Onslow Seawater Desalination Plant

Section 38 Referral Supporting Document

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O2 MARINE

Important Note

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Transmission Register

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Executive Summary

The Water Corporation propose to construct a Seawater Desalination Plant (SDP) ('the Proposal') in the town of Onslow, Western Australia. This Proposal will establish a reliable drinking water supply to the town, which is currently supplied from the Cane River borefield. Seawater intake and brine wastewater release will occur in Beadon Bay, approximately 1 km seaward from the shoreline. The desalination processing facility is to be located at Lot 551, 552 and or 553 Beadon Creek Road, Onslow. The SDP plant will supply fresh water to the town of Onslow, and will supplement the existing supply from the Cane River borefield.

The Proposal will involve the installation of permanent subtidal infrastructure in Beadon Bay (intake head, brine diffusers and transport pipes), a land-based processing plant, and piping to the existing town storage tanks.

The Proposal is considered to pose a moderate risk to four of the Environmental Protection Authority's (EPA's) environmental factors: Marine Environmental Quality, Marine Fauna, Flora and Vegetation and Social Surrounds. The actual and potential impacts of the Proposal on each of these factors have been investigated and the significance of the impacts evaluated. A summary of the predicted outcomes for each key environmental factor is provided below in accordance with the EPA's mitigation hierarchy (Avoid, Minimise, Rehabilitate).

Marine Environment Quality

The SDP operations will involve the release of brine wastewater. This product will contain higher salinity concentrations, and lower dissolved oxygen levels, compared to the natural waters of Beadon Bay. Construction activities pose a minor risk to marine environmental quality through temporary increased total suspended sediments (TSS) and the potential for unplanned hydrocarbon spills.

A summary of the proposed mitigation and environment protection outcomes is summarised below:

- **Avoid:**
  - To avoid the potential release of toxic chemicals to the marine environment, all chemicals used in the SDP water treatment process will be removed from the brine prior to discharge.
  - Hydrodynamic modelling (Baird 2020) was undertaken to select an appropriate site where the required number of dilutions could be achieved within a designated Low Ecological Protection Area (LEPA).
- **Minimise:**

  Construction
  - Construction activities to place/secure subtidal infrastructure will be restricted to the approved Development Area Footprint (DAF).
  - All construction activities (vessels and construction plant) will have approved hydrocarbon spill response procedures in place as part of the Proposal Construction Environmental Management Plan (CEMP).

Operation

- Brine diffuser design will be optimised to maximise dilution with the receiving waters.
- A LEPA is proposed to be designated as a 50 m buffer surrounding the final outfall location. Modelling has demonstrated that the required dilutions can be achieved within the LEPA to achieve a High level of ecological protection (LEP) at the Low/High LEP boundary.

An Operational Marine Environmental Monitoring & Management Plan (OMEMMP) will be developed and implemented to monitor and manage water quality. In relation to the Proposal, the Proponent considers that the EPA's objective for marine environmental quality has been met.

Marine Fauna

As stated above the proposal involves construction in the marine environment and discharge of brine wastewater. Both of these key activities have the potential to impact on marine fauna. However, through siting of the proposed infrastructure and management of impacts to marine environmental quality, any impacts to marine fauna are likely to be minor, temporary and / or localised to within the proposed LEPA. Therefore, in relation to the Proposal, the Proponent considers that the EPA's objective for Marine Fauna has been met.

Flora and Vegetation

The SDP facilities and pipeline corridors will require the clearing of 8 ha of native vegetation. Construction activities also have the potential to spread invasive flora species to natural vegetation habitats. Therefore, Proposal construction activities have potential to impact the biological diversity and ecological integrity of local vegetation habitats.

A summary of the proposed mitigation and environment protection outcomes is summarised below:

- **Avoid:**
  - Detailed flora surveys (Biota 2020) identified a locally significant vegetation community (i.e. *Tecticornia* over *Sporobolus* – T1) as occurring in the southern portion of the DAF. This vegetation community will be entirely avoided in the siting of the facility.
  - No clearing of vegetation will occur without applicable clearing permits, nor will clearing outside the approved DAF be permitted.
- **Minimise:**
  - A Construction Environmental Management Plan (CEMP) will be developed and implemented to manage and minimise construction impacts on vegetation communities during construction.
  - All clearing is to expected to be authorised under Water Corporation's state-wide Clearing Permit CPS 185/8 as clearing is not expected to be at variance with any of the ten clearing principles. An Environmental Assessment Report will be prepared in support of the proposed clearing for the Proposal and will include a full environmental impact assessment including assessment against the clearing principles.

In addition, it is expected that with appropriate management through an approved CEMP, construction activities are not expected to have significant impact on the biological diversity and ecological integrity of local vegetation communities. In respect of the proposed design and management of the Proposal, the Proponent considers that the EPA's objective for flora and vegetation has been met.

Social Surrounds

The proposed development has potential to directly impact one registered Aboriginal Heritage site ('Jinta 2', 6620). Ten registered Aboriginal Heritage sites have been identified nearby in the Onslow region. Construction activities may temporarily impact the local social surroundings regarding noise, dust and road works. A summary of the proposed mitigation and environment protection outcomes is summarised below:

- **Avoid:**
  - A small section of the proposed DAF (water supply pipeline and connection point to existing storage tanks) is located within the north-west corner of the registered Aboriginal Heritage Site 'Jinta 2' – 6620. Construction within this small area is largely unavoidable due to the location of essential existing infrastructure (water storage tanks). It should be noted that established infrastructure (Onslow Road, Onslow Airport, water storage tanks and laydown yards) already exist within the footprint of 'Jinta 2'.
- **Minimise:**
  - Potential impacts on registered site 'Jinta 2' and surrounding registered sites will be minimised through consultation with local Onslow Native Title Body - The Buurabalayji Thalanyji Aboriginal Corporation (BTAC) and the Shire of Ashburton (SoA). Consultation through meetings, community workshops and information notifications will be ongoing throughout the planning and construction of the Proposal.
  - With guidance and recommendation from the BTAC and the SoA, a CEMP will be developed to manage and minimise impacts on social surroundings by:
    - reducing construction footprints where practicable to avoid unnecessary impact on heritage areas
    - clearly demarking restricted access boundaries and areas of heritage importance
    - managing construction activity times and equipment operation to reduce noise, light and emission impacts where possible
    - providing adequate and safe traffic control where required.
  - Implementing dust management when required.

With early, ongoing stakeholder consultation and proper management through an approved CEMP, it is expected that Proposal construction and operation will not have significant impact on the social surrounds on the community of Onslow, including Aboriginal Heritage sites. In relation to the Proposal, the Proponent considers that the EPA's objective for Social Surrounds has been met.

Holistic Impact Assessment

Overall actual and potential impacts of the Proposal on the environment are considered not to represent a significant environmental risk on the basis that:

- The EP Act principles and relevant EPA guidance documents have been considered in investigating and evaluating potential impacts of the Proposal on the EPA's environmental factors.
- A comprehensive set of monitoring and management measures have been developed to further mitigate and avoid potential impacts of the Proposal on the EPA's environmental factors.
- The proponent has committed to open and transparent reporting of environmental performance throughout the Proposal construction phase.
- Evaluation of impacts against all relevant environmental factors, including other environmental factors determined that the EPA's objectives would be met.

Other environmental factors that have been considered but not deemed as a significant potential impact and are discussed below in **Section 1.**

Acronyms and Abbreviations

Acronyms/Abbreviation	Description
ALA	Atlas of Living Australia
AH Act	*Aboriginal Heritage Act 1972*
ANSIA	Ashburton North Strategic Industrial Area
ARRP Act	*Agriculture and Related Resources Protection Act 1976*
ASS	Acid Sulfate Soils
ASSMP	Acid Sulfate Soils Management Plan
BAM Act	*Biosecurity and Agriculture Management Act 2007*
BC Act	*Biodiversity Conservation Act 2016*
BCH	Benthic Communities and Habitats
BIA	Biologically Important Area
BPPH	Benthic Primary Producer Habitat
BTAC	Buurabalayji Thalanyji Aboriginal Corporation
CEMP	Construction Environmental Management Plan
DAF	Development Area Footprint
DAWE	Department of Agriculture, Water and Environment
DBCA	Department of Biodiversity, Conservation and Attractions
DMMA	Dredge Material Management Area
DPIRD	Department of Primary Industries and Regional Development
DoT	Department of Transport
DSD	Department of State Development
DPIRD	Department of Primary Industries and Regional Development
DWER	Department of Water and Environment Regulation
EIS	Environmental Impact Statement
EP Act	*Environmental Protection Act 1986*
EPA	Environmental Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPO	Environmental Protection Outcome
EQMF	Environmental Quality Management Framework
EQO	Environmental Quality Objective
EQP	Environmental Quality Plan
ERMP	Environmental Review and Management Program
EV	Environmental Value
EVNT	Endangered, Vulnerable and Near Threatened
Ha	hectares
HDD	Horizontal Directional Drilling
IBRA	Interim Biogeographic Regionalisation for Australia
IUCN	International Union for Conservation of Nature and Natural Resources
km	Kilometre

Acronyms/Abbreviation	Description
kL	Kilo Litre
LA Act	*Land Administration Act 1997*
LAU	Local Assessment Unit
LEPA	Low Ecological Protection Area
LEP	Level of Ecological Protection
LIA	Light Industrial Area
LNG	Liquified Natural Gas
OMEMMP	Operational Marine Environmental Monitoring & Management Plan
MEQ	Marine Environmental Quality
MH Act	*Marine & Harbours Act 1981*
ML	Mega Litre
MNES	Matters of National Environmental Significance
MOF	Materials Offloading Facility
MT	Management Target
MVG	Major Vegetation Groups
MVS	Major Vegetation Sub-groups
NVIS	National Vegetation Information System
OCCI	Onslow Chamber of Commerce and Industry
OMSB	Onslow Marine Support Base
OPMF	Onslow Prawn Managed Fishery
OWIUP	Onslow Water Infrastructure Upgrade Proposal
OZCAM	Online Zoological Collections of Australian Museums
PECs	Priority Ecological Communities
PEIA	Preliminary Environmental Impact Assessment (PEIA)
PD Act	*Planning and Development Act 2005*
PMST	Protected Matters Search Tool
PPA	Pilbara Ports Authority
RiWI Act	*Rights in Water and Irrigation Act 1914*
RSD	Referral Supporting Document
SCADA	Supervisory control and data acquisition
SoA	Shire of Ashburton
SP Act	*Shipping and Pilotage Act 1967*
SPL	Species Protection Level
SSC	Suspended Sediment Concentrations
SDP	Seawater Desalination Plant
SRO	Seawater Reverse Osmosis
TC	Tropical Cyclone
TACC	Technical Advisory and Consultative Committee
TECs	Threatened ecological communities
TSS	Total Suspended Sediment
WA	Western Australia

Acronyms/Abbreviation	Description
WAFIC	Western Australian Fishing Industrial Council
WAMSI	Western Australian Marine Science Institution
WONS	Weeds of National Significance

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1. Introduction

1.1. Document Purpose & Scope

This Section 38 Referral Supporting Document (RSD) presents an Environmental Review of a Proposal to construct and operate a seawater reverse osmosis (SRO) desalination plant in the town of Onslow, WA. The purpose of this RSD is to provide supplementary information for referral of the Proposal to the Environmental Protection Authority (EPA) in accordance with Section 38 (Part IV) of the *Environmental Protection Act 1986* (EP Act).

In accordance with the requirements of the EPA's *'Instructions and Template: Environmental Review Document* (EPA 2016a)*'*, the scope of the document includes:

- a description of the Proposal, including key characteristics of the Proposal which have the potential to cause an impact on the environment (**Section 2**)
- a summary of stakeholder consultation undertaken in support of the Proposal (**Section 3**)
- an assessment of the potential significant environmental impacts of the Proposal for each of the EPA's Key Environmental Factors (**Section 4**)
- an assessment of potential minor 'other' environmental impacts of the Proposal on other relevant Environmental Factors (**Section 4**)
- identification of any offsets Proposed for the Proposal (**Section 6**)
- a holistic impact assessment summarising the potential impacts of the Proposal (**Section 7**).

1.2. Proponent

The Proponent responsible for the Proposal is the Water Corporation. Proponent details are provided in **Table 1.**

Table 1 Proponent Details.

Company Name:	Water Corporation
Australian Business Number (ABN):	28 003 434 917
Address:	629 Newcastle St, Leederville WA 6007
Key Contact (Role):	Russell Brown
Key Contact Details:	Phone: (08) 9420 2186 Email: Russell.Brown@watercorporation.com.au

1.3. Environmental Impact Assessment Process

1.3.1. *Environmental Protection Act 1986* (EP Act) (Part IV)

The Proposal is being referred to the Government of Western Australia Environmental Protection Authority (EPA) in accordance with Part IV (Section 38) of the *Environmental Protection Act 1986* (EP Act).

Environmental Factors

In September 2019, O2 Marine undertook a Preliminary Environmental Impact Assessment (PEIA) to investigate potential environmental impacts and constraints of the proposal to best inform Proposal planning and design. Specifically, the scope of the PEIA included:

- an overview of the Proposal in the context of its environmental setting
- identification of the features of conservation significance relevant to the DAF
- a broad characterisation the existing environment in the context of the EPA's environmental factors that are relevant to the Proposal
- identification of any potential impacts associated with the Proposal which may be considered to pose a threat to the EPA's objectives for each of the key environmental factors
- an evaluation of the environmental suitability of the proposed intake and outfall options, including a high-level risk assessment
- recommendations regarding design considerations and likely additional environmental studies required to inform the environmental approvals process.

The PEIA identified that the Proposal had the potential to pose a moderate risk of impacting the following environmental factors:

- Marine Environmental Quality
- Marine Fauna
- Flora and Vegetation
- Social Surrounds.

Potential impacts upon the above environmental factors were thoroughly investigated and are described within **Section 4** of this RSD.

Potential impacts on the remaining EPA environmental factors (EPA 2018) were also investigated within the PEIA and it was determined that these impacts were either not significant or not relevant. These factors were therefore considered to be 'Other Environmental Factors'. Potential impacts on the following additional environmental factors are therefore summarised within **Section 5** of this RSD:

- Benthic Communities and Habitats (BCH)
- Terrestrial Environmental Quality
- Coastal Processes
- Landforms
- Subterranean Fauna
- Terrestrial Fauna

- Hydrological Processes
- Inland Waters Environmental Quality
- Air Quality
- Human Health.

1.3.2. *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)

Based on the outcomes of environmental investigations and consultation with key stakeholders, the Proponent does not consider that the Proposal involves an action that is likely to have a significant impact upon Commonwealth Matters of National Environmental Significance (MNES) or other protected matters. Furthermore, the Proposal does not involve an action that is considered likely to have a significant impact on any Commonwealth-owned land or waters. Therefore, the Proposal is not expected to require assessment under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and referral to the Commonwealth Department of Agriculture, Water and Environment (DAWE) is not proposed.

The potential for impacts upon MNES are considered and discussed further as they relate to the relevant environmental factors (Section 4 and Section 5).

1.4. Other Approvals and Regulation

The key legislation that applies to this RSD includes, but is not limited to:

- *Environmental Protection Act 1986* (EP Act)
- *Biodiversity Conservation Act 2016* (BC Act)
- *Aboriginal Heritage Act 1972* (AH Act)
- *Land Administration Act 1997* (LA Act)
- *Marine and Harbours Act 1981* (MH Act)
- *Shipping and pilotage Act 1967* (SP Act).

The key decision-making authorities (DMAs) and the other relevant approvals for the Proposal are identified in **Table 2.**

Table 2 Other approvals and regulation

Proposed Activities	Land Tenure/access	Type of Proposal	Legislation regulating the activity	Responsible Agency
Vessel Operations	'Waters' are located within the Port of Onslow limits.	Waterway Licence with DoT	SP Act MH Act	DoT
Pipeline installation on seabed	'Seabed' is located within the Port of Onslow limits.	Seabed Licence with DoT	SP Act MH Act	DoT
Vegetation clearing	Lot 551-553 Beadon Creek Road	CPS 185/8 State-wide	EP Act (Part V)	DWER

Proposed Activities	Land Tenure/access	Type of Proposal	Legislation regulating the activity	Responsible Agency
		Vegetation Clearing Permit		

2. The Proposal

The Water Corporation propose to construct a SDP in the town of Onslow, Western Australia.

2.1. Background

Onslow is a coastal port, fishing and tourist town located about 150 km south west of Karratha in the Pilbara region of Western Australia. The town water supply comes from a Water Corporation wellfield located approximately 30 km east of Onslow along the banks of the Cane River (Tomlinson 1994).

Production from the existing Cane River Borefield to its maximum licensed amount is 550 ML per annum. Maximum daily production from the borefield is approximately 2000 kL/day. The capacity of the borefield is adequate for current water usage in Onslow of approximately 1500 kL/day. The borefield is currently in the prosses of being upgraded to improve the reliability of the borefield system and to make at least 70% of the total production capacity of the borefield available under automatic control via SCADA. The remaining 30% of the production capacity will be available through only local, manual operation of diesel engine powered pumps. Following commissioning of the proposed Onslow Desalination Plant, water supplied to Onslow will be a blend of water from the Cane River Borefield and the desalination plant. The initial operating strategy will be to continue to use water from the Cane River Borefield and to operate the desalination plant to supplement supply.

A proposal for the Onslow Water Infrastructure Upgrade Proposal (OWIUP) was referred to the EPA in March 2014 and granted a 'not-assessed, public advice given' decision in July 2014. However, in late 2018, a review of alternative source options for Onslow was initiated in response to internal concerns regarding the complexity, water quality and stakeholder risks associated with the Birdrong Aquifer.

Other water source options considered include a seawater desalination facility at Beadon Creek or Beadon Bay. From March to December 2019, Water Corporation consulted with stakeholders regarding a seawater desalination facility on Lots 551, 552 and 553 in Onslow, with the intake and outfall in either Beadon Creek or Beadon Bay. During this time, the Corporation also undertook various investigative studies and engaged two proponents through an Early Contractor Involvement process to develop concept designs to aid in the planning decision. The concept designs included an estimate of whole of life costs (capital and operating components). Following extensive investigations and presentation of concept designs, as well as wide-ranging stakeholder and community consultation, the preferred planning option was identified as a seawater desalination facility at Beadon Bay. The investigations indicated that the preferred option expected to have superior water quality and environmental performance. The technology is also well understood by Water Corporation and the wider industry.

2.2. Proposal Justification

With a trend towards a drying climate, catchments have dried out to such an extent that above average rainfall is needed, year on year, to have a major difference to the levels of the bores. For this reason, Water Corporation has updated its long-term planning to reflect a future of reduced reliance on regular bore streamflow and is looking at a range of options for the next climate independent water source. This Proposal will establish a reliable drinking water supply to the town,

which is currently supplied from the Cane River Borefield. The upgrade Proposal intends to reduce reliance on the Cane River water source, minimise operations in the borefield, and improve safety through reduced operator actions.

Onslow's town demand is forecast to exceed the Cane River Borefield's licenced allocation in 2023. An additional source of 1.5 ML/day is required to meet demand for the next 20 years. To secure Onslow's long-term water future, Water Corporation plans to construct a seawater desalination plant in Onslow. This proposal will result in the town having an additional source of drinking water that is climate independent. It will provide security of water supply for Onslow.

Supplementary reports for proposal referrals consistent with the requirements of an Environmental Review Document have been produced. Key environmental risks and information gaps were identified through a PEIA. As a result, scientific investigations were undertaken to carefully evaluate potential environmental impacts. The following further studies were then commissioned to provide information required for the referral:

- Sediment and infauna survey (**Appendix A**)
- Desalination Brine Toxicity Assessment (**Appendix B**)
- Hydrodynamic Modelling (**Appendix C**)
- Benthic habitat assessment (**Appendix F**)
- .

A Operational Marine Environmental Monitoring & Management Plan (OMEMMP) was also prepared in accordance with '*Instructions on how to prepare EP Act Part IV Environmental Management Plans*' (EPA 2020) to support the referral (**Appendix D**).

2.3. Proposal Description

This Proposal will establish a reliable drinking water supply to the town, which is currently supplied from the Cane River Borefield. The SDP plant will supply potable water to the town of Onslow and will supplement the existing supply from the Cane River Borefield. The Proposal will involve the installation of permanent subtidal infrastructure in Beadon Bay (intake head, brine diffusers and transport pipes), a land-based processing plant, and piping to the existing town storage tanks.

Consistent with the requirements outlined within the EPA's '*Instructions on how to define the key characteristics of a Proposal'* (EPA 2016b), a summary of the Proposal is provided in **Table 3** and the key Proposal characteristics, which have the potential to impact on the environment, are provided in **Table 4**. The Proposal Development Area Footprint (DAF[1]) and location are shown in **Figure 1** and **Figure 2**.

[1] It is noted that the 'Development Area Footprint' or 'DAF' is a term used by the Water Corporation to define the maximum spatial extent of the development. It does not necessarily constitute the disturbance final disturbance footprint of the development. For the purpose of this assessment, the DAF is equivalent to the EPA's term 'Development Envelope'.

Table 3 Summary of the Proposal

Proposal Title	Onslow Seawater Desalination Plant (SDP)
Proponent Name	Water Corporation
Short Description	The Proponent intends to construct and operate a SDP desalination plant to supply potable water to the town of Onslow, Western Australia. Seawater intake and brine wastewater release will occur in Beadon Bay approximately 1 km seaward from the shoreline. The desalination processing facility is to be located at Lot 551-553 Beadon Creek Road and will feed the towns existing drinking water storage tanks at Lot 880 Onslow Road.

Table 4 Key Physical and Operational Elements of the Proposal.

Element	Location	Proposed Extent
Physical Elements		
Seawater intake	Figure 1	Two options are provided for intake locations within the DAF. Both options are positioned in areas of sand substrate.
Diffuser outfall	Figure 1	Two options are provided for outfall locations within the DAF. Both options are positioned in areas of sand substrate. Outfall may be positioned near to the seawater intake.
Intake/outfall pipeline	Figure 1	Location of pipeline is indicative only and position may vary within the designated DAF. Specifically, the pipeline take-off point will be optimised in the facility design and may occur anywhere within Lots 551-553. Pipeline will extend up to 1 km offshore to either of the seawater intake/outfall options.
Desalination plant	Figure 1	Lot 551-553 Beadon Creek Rd, Onslow. Land clearing within Lot 551-553 of up to 3.5 ha.
Storage supply pipeline	Figure 1	Within existing access track behind coastal dune out to storage tank facility.
Operational Elements		
Seawater intake	Figure 1	Flow rate up to 4.44 ML/day.
Brine release	Figure 1	Flow rate up to 2.44 ML/day discharged of brine to Beadon Bay. Discharge may be either constant or intermittent. A Low Ecological Protection Area (LEPA) is proposed to be established as a 50m buffer surrounding the brine outfall diffuser in Beadon Bay.

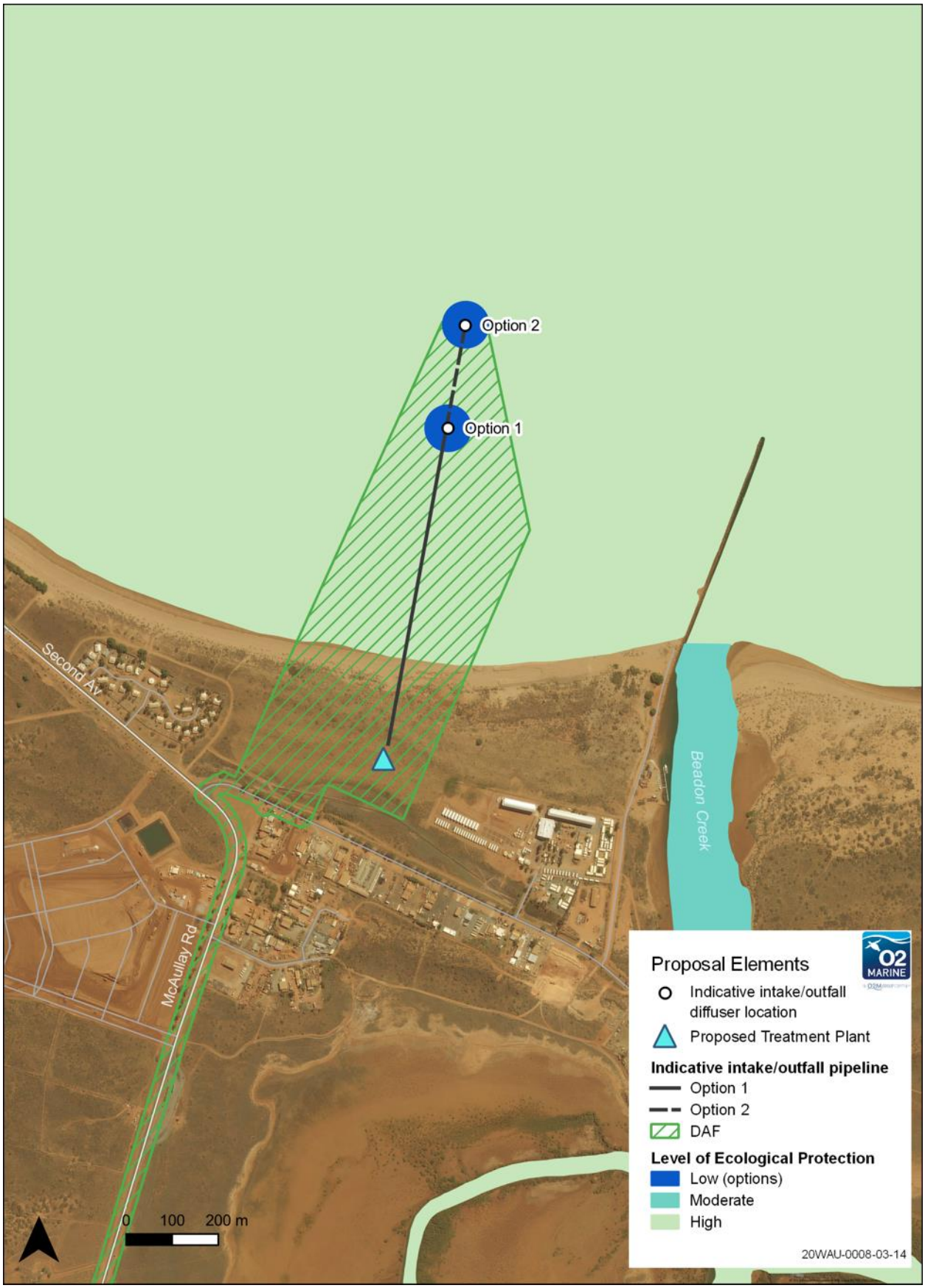

Figure 1 Location of key Proposal elements.

2.4. Local and Regional Context

2.4.1. Locality

The Proposal is situated within and adjacent to the town of Onslow, in the Pilbara region of WA and within the Shire of Ashburton (SoA) jurisdiction (**Figure 2**). The area around Onslow is the traditional home to the Thalanyji People.

The township of Onslow was originally founded in 1883 and gazetted in 1885, as a port at the mouth of the Ashburton River, which was developed as a commercial marine industry with basic shipping activities to support inland wool-growing and gold mining, which continued to be major industries for 80 years. Cattle farming has since replaced sheep running as the predominant inland agricultural enterprise.

In the early settlement days, Onslow became a home port for pearling luggers, which operated in the nearby Exmouth Gulf. Due to repeated cyclone damage and the flooding/silting of the Ashburton River, the townsite was moved in 1925 to its current location, 18 km northeast of Old Onslow, to take advantage of the deeper waters of Beadon Creek. Since then, the port function has developed to support growth in the fishing and resource sectors and more recently the exploitation of offshore oil and gas reserves.

Figure 2 **Proposal location local and regional context**

2.4.2. Other Regional Developments

The township of Onslow is ideally located to service offshore locations including the Mackerel Islands, Barrow Island (Gorgon LNG Plant), Exmouth Gulf, and the Carnarvon Basin (oil and gas reserves) as well as in-land mines including Rio Tinto's Mesa A site and Pannawonica. However, the broader Proposal Area is largely undeveloped, except for:

- the Onslow Marine Support Base Salt solar salt field, encompassing a large area of salt flats surrounding the Beadon Creek tidal embayment to Coolgra Point
- the Roller oilfield in shallow coastal waters to the west of Onslow
- the Liquified Natural Gas (LNG) plants, Wheatstone (Chevron) and Macedon (BHP) located approximately 12 km southwest of Onslow, within the Ashburton North Strategic Industrial Area (ANSIA)
- the Port of Ashburton: a multiuser port providing support for the Macedon and Wheatstone Proposals LNG developments and other planned industrial activities in the area
- offshore loadout facilities for the Onslow Salt Facility, located to the west of Onslow in the Port of Onslow. The Port of Ashburton and the Port of Onslow share a common port boundary
- the Onslow airport, owned and operated by the SoA, and located approximately 3 km south of the Onslow town site. The airport underwent significant upgrades in 2015 to cater for the construction of the Macedon and Wheatstone Proposals.

2.4.3. Environmental Assets

Other than protected or conservation significant species which may occur in the DAF, there are no State or Commonwealth listed environmental assets located near the Proposal.

3. Stakeholder Engagement

Consultation has occurred with government agencies; the Shire of Ashburton; landowners and occupiers, including Discovery Parks and Bind Bindi Aboriginal Community; the Native Title holder; marine stakeholders, including WA Fishing Industry Council and RecFishWest; local salt producer Onslow Salt; and Onslow Chamber of Commerce and Industry.

Face-to-face and written consultation has occurred regarding a possible seawater desalination plant with intake and outfall at Beadon Bay in Onslow. Feedback from this consultation has influenced and informed the location of the proposed infrastructure, as well as aspects of the design, including the method and nature of chemical disposal.

The scope and level of engagement is to commit to providing ongoing information about the project and to consult with the intent to minimise the impacts of the proposed desalination plant on the community. Engagement has and will continue to focus on using feedback to mitigate impacts; raise broad community support and awareness for the project to support approvals; and to provide a solid foundation for the future operation and maintenance of the asset

A summary of engagement and stakeholder feedback follows in **Table 6**.

3.1. Key Stakeholders

3.1.1. State Government Agencies and Regulators

Briefings and project updates have been provided to the Department of Jobs, Tourism, Science and Innovation (JTSI); the Department of Primary Industries and Regional Development (DPIRD); the Department of Transport (DoT); the Department of Planning, Lands and Heritage (DPLH); Development WA (formerly LandCorp) and the Department of Water and Environmental Regulation (DWER).

3.1.2. Local Government

Briefings have been held with Shire of Ashburton, including the Shire President and Councillors, Chief Executive Officer and relevant officers, regarding a potential desalination plant within Lots 551, 552 and 553 with an intake and outfall in Beadon Bay. Consultation with the Shire of Ashburton has indicated that it is supportive of the proposal.

3.1.3. Traditional Owners

Water Corporation has consulted with Buurabalayji Thalanyji Aboriginal Corporation (BTAC) as the registered Native Title Body of the prescribed body corporate for the Thalanyji People, the native title holders of the proposed site of the desalination plant. An archaeological survey and ethnographic survey were completed by BTAC over the development area footprint in July 2019. In November 2020, Water Corporation provided the new BTAC Chief Executive Officer and Board of Directors with a full briefing on the proposal. Consultation has indicated that BTAC is comfortable with the proposal.

3.1.4. Bindi Bindi Aboriginal Community

Bindi Bindi Aboriginal Community (Bindi Bindi) is located on lot 655. Bindi Bindi is over 100 metres away from boundary of lot 551, the closest of the lots being considered as a possible location for the proposed seawater desalination plant, and over 300 metres away from the boundary of lot 553. Water Corporation briefed Bindi Bindi on a proposed seawater desalination plant in Onslow in August 2019. In October 2020, a fact sheet about the project was provided to employment agency REFAP, which has committed to liaise with the community on the proposal with a view to maximising employment opportunities for the residents of Bindi Bindi. Water Corporation presented to members of Bindi Bindi at a REFAP-hosted NAIDOC Week event in November 2020 and will continue to consult with and inform Bindi Bindi as the project progresses. Water Corporation will address impacts on Bindi Bindi, such as noise, visual amenity and environmental impacts through the location and design of the infrastructure, as well as on-going consultation. Feedback has indicated that Bindi Bindi is comfortable with the proposal.

3.1.5. Discovery Parks Onslow

Discovery Parks Onslow provides accommodation services and is located approximately 100 metres from the boundary of lot 553, which is the closest lot being considered as a possible location of the proposed seawater desalination plant. Water Corporation has briefed and provided a written notification to the Onslow-based management and has provided written notification to the corporate administration of Discovery Parks. Water Corporation will continue to provide updates as the project progresses. Discovery Parks has mentioned noise from the proposed desalination plant as a potential issue and Water Corporation will address this through effective noise control engineering. It should be noted that Water Corporation already has noise attenuation requirements within its design standards and these will be adhered to, and, where required, exceeded, to minimise the noise impact on Discovery Parks and its customers. A representative from Discovery Parks contacted Water Corporation for a project update and raised no objections to the proposal.

3.1.6. Onslow Salt

Onslow Salt is a local salt producer and major employer within Onslow. The location of the infrastructure was deliberately moved further away from Onslow Salt's operations near the Creek and into the Bay to address its concerns about possible impacts to its operations. Water Corporation has also responded to Onslow Salt's feedback about chemicals in the Bay and has informed it that the plant is being designed such that food-grade phosphate is the only added chemical to be discharged into the Bay. Water Corporation has provided Onslow Salt with a letter addressing its concerns, and an independent consultant's report regarding the insignificant levels of phosphate in the brine discharge. Water Corporation subsequently met with site-based personnel at Onslow Salt on 23 October 2020 and is awaiting further feedback from Onslow Salt. Onslow Salt has indicated that the additional information provided has addressed its initial concerns.

3.1.7. Marine Stakeholders

Water Corporation has briefed the commercial and recreational fishing sector and the Department of Transport about the proposed infrastructure in Beadon Bay. The location of the intake and outfall pipes in Beadon Bay removes the proposed infrastructure from the Beadon Creek harbour channel.

Written notifications have also been provided to local mariners. Water Corporation will continue to inform and consult with marine stakeholders, including the provision of detailed information on the potential impacts to marine fauna, as the project progresses. No objections to the proposed infrastructure have been received so far.

3.1.8. General Community

Water Corporation has presented at two Onslow Community Forums, attended by representatives from the Shire, industry stakeholders and the general community. In August 2019, Forum attendees were informed that Water Corporation is investigating new water source options for Onslow, including a desalination plant at Beadon Creek or Beadon Bay. In August 2020, the community was informed that Water Corporation is proceeding with planning and consultation for a seawater desalination plant with intake and outfall at Beadon Bay.

To ensure that information on the proposal has been provided to all members of the Onslow community, a project fact sheet on the proposal was distributed to every post office box in Onslow in October 2020. Feedback on the proposal was requested by 4 December 2020.

Water Corporation received five responses to the fact sheet. Four of the respondents stated that the land proposed for the desalination plant could be better utilised for future tourism development in Onslow. They queried what other locations had been considered for the proposed infrastructure. One of the respondents asked about noise from the proposed infrastructure.

Water Corporation offered face-to-face meetings to everyone who provided feedback to better understand community concern and to provide further information. Two members of the community accepted a meeting request. Water Corporation explained that while other locations had been considered, the location within lots 551, 552 and 553 places the plant close to a water source, which will result in the most efficient design and provide value on capital and operational expenditure. Should the plant be located significantly further inland from the water source, additional infrastructure, such as a pump station, would be required on the coast. Locating the plant significantly further away from the Bay would likely make a seawater desalination plant impractical.

As a result of the feedback received, Water Corporation is now considering moving the infrastructure to one side of the lots and setting it back from the beach, which will maximise the land available for future development by other parties, as well as reducing the impact on visual amenity. Water Corporation is committed to consulting with stakeholders and the general community about reducing impacts to visual amenity. As part of this consultation, Water Corporation plans to canvass the community about the potential for showcasing the proposed Onslow seawater desalination plant as an educational and tourism landmark.

3.2. Stakeholder Engagement Process

Stakeholder engagement commenced early in the planning process with a focus on allowing opportunities for genuine community consultation and collaboration as various water source options were considered (**Table 5**). The purpose of engagement has been to use stakeholder and community

feedback to mitigate impacts of the proposed infrastructure; raise awareness within the community; foster community advocacy for the project; and to support project approvals.

Table 5 Stakeholder engagement process

Issue for Engagement	Level of Engagement	Timing	Decision scope for the community
1. Raise awareness of the proposal and ask for stakeholder and community feedback	Inform/consult	ongoing	Mitigate impacts of the SDP i.e. location, design local opportunity, water quality, lowest environmental impact
2. Support necessary project approvals and permits	Inform/consult	February 2020 – March 2022	Prerequisites to Works, environmental, key stakeholder briefings, heritage, environmental and social
3. Foster community advocacy for the project	Inform/consult	February 2020 – ongoing	Identify opportunities to promote Water Corporation activities
4. Engage with community for visual amenity as well as community offerings	Consult/engage	2021 – ongoing	Fencing (Indigenous local artist) landscaping (visual buffer), building design and community offerings e.g. beach shelters
5. Manage community impacts during construction	Inform/consult	2022 – 2024	Signage, construction notifications, key stakeholder updates

Water Corporation has sought to engage on major issues through in-person briefings where possible, with written updates provided to support a timely flow of information to stakeholders.

Stakeholders have been informed that Water Corporation is pursuing plans to construct the Onslow Seawater Desalination Plant to be located on Lot 551, 552 and/ or 553 with intake and outfall in Beadon Bay. Information provided has included the potential impacts of the infrastructure on the community and environment.

Written communication about the proposal was distributed to stakeholders in October 2020 with feedback and Water Corporation has sought to incorporate feedback into the design to mitigate impacts wherever possible.

Further consultation is planned with stakeholders when investigative work has been completed and a design concept is available for comment. Consultation will remain ongoing as the project progresses.

3.3. Outcomes

Following comprehensive stakeholder consultation as well as extensive investigations and evaluation of concept designs, the preferred planning option was identified as a seawater desalination facility at Beadon Bay.

The investigations indicated that the preferred option will have better water quality and environmental performance, which will benefit all stakeholders.

Early consultation has informed the location of the proposed infrastructure, as well as aspects of the design, including the method of chemical disposal.

Local salt producer Onslow Salt raised concerns about the impact of a seawater desalination plant on its salt production facilities. To diminish the impact of the seawater desalination plant, the proposed infrastructure has been deliberately moved further away from Onslow Salt's facilities. Chemicals will be disposed of separately, apart from food-grade phosphate, which fall within naturally occurring levels in Beadon Bay. Water Corporation has responded to Onslow Salt's concerns in writing and has provided an independent report about phosphate and this stakeholder is satisfied that is initial concerns have been addressed. Water Corporation will continue to consult with Onslow Salt as the project progresses.

As a result of community feedback on the proposal, Water Corporation is considering moving the infrastructure to one side of the lots to minimise impacts to visual amenity and maximise the area available for future development. It has also committed to consultation with stakeholders and the community on reducing visual impacts of the infrastructure when an engineering design is available in mid-2021. This will involve establishing a community consultation group comprised of stakeholders and interested members of the community. Water Corporation will consult with the community regarding showcasing the infrastructure as an educational tourism attraction for the town. A three-dimensional model of the proposed infrastructure will be made publicly available and updates will continue to be widely provided as the proposal progresses.

3.3.1. Stakeholder Consultation Matrix

Table 6 Stakeholder consultation outcome matrix

Date	Stakeholder	Purpose of Engagement/ Questions/Comments/Issues Raised	Outcome
18 January 2021	Discovery Parks	Phone call from Discovery Parks Regional Manager requesting a schedule update. Suggested that Discovery Parks provided accommodation for construction workers. Water Corporation to discuss accommodation requirements with Discovery Parks when appropriate.	N/A

Date	Stakeholder	Purpose of Engagement/ Questions/Comments/Issues Raised	Outcome
12 January 2021	WA Fishing Industry Council	Provide an approvals update. Ask WA Fishing Industry Council to review marine impact information provided on website.	N/A
12 January 2021	Onslow Salt	Phone call following up from 21 October 2020 letter.	Concerns raised have been addressed in the information provided. No further feedback provided at this time.
2 December 2020	Shire of Ashburton	Provided summary of the proposal to town planner. Commented that there will be concerns if the plant is expanded beyond its current footprint to provide water for the Ashburton North Strategic Industrial Area (ANSIA).	There will be some water available for industrial consumption provided by this project.
13 November 2020	Bindi Bindi Aboriginal Community	Presentation to community about the proposal. 1. What are the noise implications? 2. The current water doesn't taste very good. What will the taste of the water be like?	1. The project will conform to the Environmental Protection (Noise) Regulations 1997. Adherence to requirements will be monitored at key milestones during the project. 2. The water should taste better. The current water source is quite a hard water and with blending from the new source, the taste of the water should improve.
12 November 2020	Thalanyji (BTAC) Board of Directors	Presentation to Board of Directors about the proposal. 1. What are the noise implications? 2. What is the approximate size of the plant? 3. What will be the impact on local fauna?	1. The project will conform to the Environmental Protection (Noise) Regulations 1997. Adherence to requirements will be monitored at key milestones during the project. 2. Unable to provide details about the exact size and what it will look like, as currently we are undertaking engineering design. At this stage, we expect the plant to fit within lot 553. 3. All the CIP chemicals will be removed from the

Date	Stakeholder	Purpose of Engagement/ Questions/Comments/Issues Raised	Outcome
			waste stream. Ecotoxicology reports have been compiled and demonstrate minimal impact.
2 November 2020	Thalanyji (BTAC)	Following the emergence of BTAC from administration, Water Corporation provided background on the project to the new Chief Executive Officer. 1. Can you place the infrastructure near the existing Water Corporation tank site? 2. How big will it be and what will it look like?	1. The Beadon Bay shore area is Water Corporation's preferred location because it is near the source of water. Locating it at the tank site would require infrastructure such as a pumping station on the Beadon Bay shore anyway. There would be additional capital and operational costs associated with building and maintaining the raw water pipes. 2. Water Corporation is still in early consultation and design phase. When we have a design, we will consult with stakeholders and the community about visual properties of the plant. Invited Corporation to present the proposal to Thalanyji (BTAC) **B**oard of Directors and members.
27 October 2020	Department of Water and Environmental Regulation	Provided an update on the proposal and the project fact sheet.	N/A
23 October 2020	Onslow Community	Project fact sheet provided for delivery to all PO Boxes in Onslow from 26 October 2020. Feedback on the proposal was requested by 4 December 2020. Five responses were received in total. 1. Four of the five responses related to concerns about the proposed location on the beachfront and whether other locations had been considered. Responders asserted that the beach-front	Face-to-face meeting in Onslow were offered to all five people. Two meetings were accepted and were held on 23 November 2020. 1. Water Corporation has considered several locations for the proposed plant and the location on the beachfront at lot 551/552 and/or 553 is the preferred location due to

Date	Stakeholder	Purpose of Engagement/ Questions/Comments/Issues Raised	Outcome
		land would be better used for tourism purposes. 2. The fifth respondent asked about the impact of noise. At one of the meetings, the following additional questions: 3. What is the impact of desalinated water on public health? 4. What is the energy requirements of desalination? 5. Instead of building a desalination plant, what is Water Corporation doing to reduce water demand in Onslow?	its proximity to the water source. As a result of the feedback received, Water Corporation is considering locating the infrastructure to one side of the lots and setting it back further from the beachfront. This would help obscure the infrastructure from public view and maximise the land available for future tourism development. Water Corporation is committed to consulting on visual amenity of the proposed infrastructure. 2. Water Corporation will comply with Environmental Protection (Noise) Regulations 1997 and will mitigate noise at all stages of the project. 3. Water supplied will adhere to Australian Drinking Water Quality Standards. 4. Referred to information about energy requirements of desalination process on website. 5. To reduce water demand, Onslow was included in the Waterwise Towns program in 2020. Further information has been provided online to keep the community informed.
23 October 2020	Onslow Salt Pty Ltd	Provided an in-person presentation to operations personnel from the independent consultant on the dispersion of phosphate into the Bay	Comfortable with the presentation and will consider the findings before providing further response.
23 October 2020	Bindi Bindi Aboriginal Community	Provided fact sheet to REFAP for liaison with Aboriginal Community and discussion about Water Corporation providing a barbecue and presentation in November 2020 in Onslow during NAIDOC Week.	No issues raised.

Date	Stakeholder	Purpose of Engagement/ Questions/Comments/Issues Raised	Outcome
23 October 2020	Thalanyji (BTAC)	Provided a project update and queried the location and whether heritage approval had been obtained.	Water Corporation has previously sought feedback on the location. Heritage approval has been obtained from BTAC. Water Corporation has requested a meeting with BTAC on 29 October 2020 to discuss the project in more detail.
21 October 2020	Onslow Salt Pty Ltd	Provided formal response to October 2019 letter regarding brine discharge confirming that CIP chemicals will be removed from brine discharge and phosphate levels will be insignificant compared with naturally occurring background levels in Beadon Bay. Provided independent consultant report. Provided project proposal fact sheet.	Confirmed that it will review the letter and respond to Water Corporation.
21 October 2020	WA Fishing Industry Council and licenced commercial fishers, Pearl Producers Association of Australia and Marine Tourism Association of WA	Provided project proposal fact sheet Could you please provide further information on marine impacts?	Further information about marine impacts has been made available online.
21 October 2020	RecFishWest and Ashburton Anglers	Provided project proposal fact sheet	N/A
21 October 2020	Shire of Ashburton	Provided project proposal fact sheet	N/A
21 October 2020	Marine stakeholders – Bhagwan Marine, Agility, Mackerel Island Tours	Provided project proposal fact sheet	N/A
21 October 2020	Department of Transport	Provided project proposal fact sheet	N/A
21 October 2020	Maritime Construction	Provided project proposal fact sheet	N/A

Date	Stakeholder	Purpose of Engagement/ Questions/Comments/Issues Raised	Outcome
21 October 2020	Onslow Marine Supply Base	Provided project proposal fact sheet	N/A
21 October 2020	Main Roads	Provided project proposal fact sheet	N/A
21 October 2020	Department of Mines, Industry and Regional Development	Provided project proposal fact sheet	N/A
21 October 2020	Discovery Parks, Onslow	Provided project proposal fact sheet	N/A
21 October 2020	Department of Planning, Lands and Heritage	Provided project proposal fact sheet. DPLH responded that DPLH is awaiting further information on the proposal, such as whether an easement and tenure grant is required. DPLH will conduct due diligence, including seeking statutory approvals and comment from impacted stakeholders.	Provide further information to DPLH when appropriate.
21 October 2020	Aboriginal Lands Trust	Provided project proposal fact sheet	N/A
21 October 2020	Development WA	Provided project proposal fact sheet	N/A
11 August 2020	Bindi Bindi Aboriginal Corporation	Pre-arranged meeting to provide community with project update. Low attendance.	Repeat engagement to ensure consultation has occurred.
11 August 2020	Discovery Parks Onslow	Provided a project update that we are pursuing a proposed desalination plant with intake/outfall at Beadon Bay, with the plant located on at lots 551,552 and 553. Will the noise impact the accommodation?	Noise mitigation strategies will be used throughout construction and operation. Engineering design will be used to minimise noise to nearby occupiers. Water Corporation will continue to consult throughout project.
11 August 2020	Onslow Salt Pty Ltd	Provided a project update to operations personnel that we are pursuing a proposed desalination plant with intake/outfall at Beadon Bay, with the plant located on at lots 551,552 and 553. Concerned about phosphate and chemicals will impact salt operations.	Water Corporation will provide an independent consultant report regarding phosphate dispersion with a letter addressing issues raised.

Date	Stakeholder	Purpose of Engagement/ Questions/Comments/Issues Raised	Outcome
10 August 2020	Shire of Ashburton Community Forum	Provided a project update presentation that we are pursuing a proposed desalination plant with intake/outfall at Beadon Bay, with the plant located on at lots 551, 552 and 553. The presentation was attended by Shire of Ashburton officers, Councillors and local industry representatives and members of the community.	Community seemed comfortable with proposal and no material objections were raised.
15 July 2020	Local recreational fisher through Ashburton Anglers	19 June 2020 email with queries about the proposed desalination plant in Onslow 1. Can an overview map be made available? 2. Will plant access road impact local access to the area? 3. Will public access be restricted around the inlet and outlet pipes, beach areas and ocean area? 4. Are there other possible locations for the plant? 5. Is there a lighting strategy (turtle breeding)? 6. Will the inlet/outlet pipes affect green sawfish travel paths? 7. Will employment be residentially based?	1. We are still in early stages of design and engagement. A map will be shared when it is available. 2. The plant access road will not impact access to the area. 3. The public will have access to the beach and ocean area, except for a permanent exclusion area around the inlet/outlet pipes due to snagging and navigational hazards. 4. A water treatment plant was going to be located further inland however there were water quality, processing and land access issues. Beadon Creek investigated and discounted due to other human activity in the Creek and proximity to environmentally sensitive mangroves. Current option has better water quality and can be designed to mitigate environmental impacts. 5. Plant is not expected to cause a significant increase to artificial lighting. Closest known turtle nesting area is more than 11 km north of proposed site. 6. Not likely to impact green sawfish utilisation of Beadon Bay. 7. Principal contractor will be encouraged to use local labour force. We will continue to liaise with Chamber of Commerce. Construction is likely to take 12 months. When in operation, one to two people will be required to run the plant.

Date	Stakeholder	Purpose of Engagement/ Questions/Comments/Issues Raised	Outcome
			No further queries or comments were received.
30 June 2020	Onslow Salt Pty Ltd	Requested a copy of April 2020 presentation and letter formally responding to October 2019 letter.	Provided a copy of presentation and informed it that Water Corporation is awaiting independent consultant report to attach to response letter.
17 June 2020	Ashburton Anglers and RecFishWest	Phone call into Ashburton Anglers fortnightly club meeting to speak with them about proposal. No concerns raised.	None
16 June 2020	Shire of Ashburton	Webex meeting with Shire officers to provide update on proposal and consult on planned pipeline route. What is the status of consultation with Onslow Salt? For the pipeline consideration must be given to other planned infrastructure.	None
3 June 2020	DJTSI and Chevron	1. How will Water Corporation limit noise from the proposed desalination plant once it is operational, particularly disturbance to neighbours such as Discovery Park, which provides accommodation, including for shift workers? 2. Pathway for Ministers' endorsement for the change in scope of the project (from previous Birdrong Project to current Beadon Bay Desalination Plant). 3. Water Corporation to provide updated Project Implementation Plan for DJTSI's review and comment.	1. Water Corporation has noise standards which are included in the contract specifications for contractors. 2. DJTSI to advise of approvals pathway. 3. Water Corporation provided updated Project Implementation Plan.
21 May 2020	Onslow Salt Pty Ltd	Videoconference meeting with Executive. Informed Onslow Salt that we are pursuing a Beadon Bay desalination plant. Explained how we are reducing impacts on their operations by deliberately moving the plant further	Water Corporation to provide a letter addressing impacts of proposal and a copy of the independent consultant's report.

Date	Stakeholder	Purpose of Engagement/ Questions/Comments/Issues Raised	Outcome
		away from their operations and into Beadon Bay. Indicated that they are more comfortable with the plant further away from operations. Requested proposal in writing and a copy of the independent consultant's report on phosphate.	
16 May 2020	WA Fishing Industry Council	Provided brief to WAFIC.	
11 May 2020	Shire of Ashburton	Project updates to Councillors via video conference. Provided an update that we are pursuing a proposed desalination plant at Beadon Bay, located on lots 551, 552 and/ 553. New Shire CEO requires further information about previous consultation.	Meeting held with Shire CEO on 12 May 2020 to brief further on project, including historical consultation. Shire CEO Is comfortable with the project.
15 November 2019	Shire of Ashburton MLA Member for North West Central	Two seawater desalination plant options for intake and outfall are being investigated – Beadon Creek and Beadon Bay. Decision on our preferred option will be made following further stakeholder consultation and environmental studies. Early consultation with marine stakeholders underway. Actual location of plant still to be determined. Site options include Beadon Creek industrial area and coastal location along Beadon Creek Road. No concerns raised by Shire regarding Beadon Bay seawater intake and outfall pipelines.	N/A

Date	Stakeholder	Purpose of Engagement/ Questions/Comments/Issues Raised	Outcome
		MLA queried the proposed desalination plant site location, given it's a coastal site and the minimal remaining developable land in that area, believing it was better utilised for other purposes. Shire responded that the land is unlikely to be used for any other purpose. Anticipate announcing our preferred option early in the new year. Once we have a preferred option, broader consultation will commence.	
12 November 2019	Department of Transport	Request for feedback regarding Beadon Creek intake option.	
12 November 2019	WA Fishing Industry Council – Pearlers Association and commercial fisheries	Request for feedback on seawater desalination plant at either Beadon Bay or Beadon Creek. One response received from commercial fisher noting that the water quality is poor in the Bay.	Responded that we are undertaking water quality monitoring.
12 November 2019	RecFishWest and Ashburton Anglers	Request for feedback on seawater desalination plant at either Beadon Bay or Beadon Creek. No feedback was received.	N/A
10 October 2019	Onslow Salt Pty Ltd	Requested written response to concerns raised about potential impact on Onslow Salt's operations from nutrients and toxins from discharge into Beadon Creek.	Water Corporation to gather more information to respond comprehensively.
23 September 2019	Bindi Bindi Aboriginal Community (REFAP)	Following the August 2019 community presentation, Bindi Bindi community is comfortable with the project as they are more concerned about reliability of Cane River Borefield and support having the additional water supply.	N/A

Date	Stakeholder	Purpose of Engagement/ Questions/Comments/Issues Raised	Outcome
17 September 2019	Onslow Salt Pty Ltd	Onslow Salt requested feedback on the brine discharge and pipeline dewatering	Feedback on brine discharge expected early October 2019.
5 September 2019	RecFishWest	Initial briefing of peak body representing recreational fishers in WA. Consultation with members in Onslow will be required.	Water Corporation to consult directly with members.
19 August 2019	Bindi Bindi Aboriginal Community	Presented to the community using A1 posters to give a comprehensive overview of the development area footprint of the project. Provided overview of project and described two options with a focus on Beadon Creek SDP. Poster has been left at REFAP office as a prompt for further discussion. Response was that fishing in the Cree area is critical to the local community who rely on it for food security. Questions posed were: 1. Why do we need so much water? 2. Will the facility be fenced? 3. What happens to the salt concentrate discharge? 4. Will the salt affect the Creek environment? 5. What monitoring will be done to ensure the Creek environment stays OK? 6. Will the ecosystem be affected by the discharge? 7. Will there be a noise issue from the plant and what can be done about that? 8. What will happen to the Cane River Borefield? 9. What do the Water Corporation plan to do with buildings at Cane River that are no longer used?	1. It was explained to cater for future demands for the town of Onslow. The current draw for Onslow is about 1.5ML per day. The Cane River bore fields deliver 1.9ML per day so when combined with the new desalination plant capacity of 1.5ML per day will ensure a secure supply of water for Onslow's future. 2. Yes, the facility will be fenced, and it may have some screening for aesthetics and noise attenuation purposes (this was asked acknowledging the curious nature of children). 3. It was explained that the extraction would occur on the incoming tide and the discharge on the outgoing tide to dissolve. 4. WC needed to meet stringent environmental requirements to ensure that the ecosystem would not be impacted by the desalination process. 5. WC would comply with the regulatory requirements of ongoing monitoring of the environment and ecosystem in the surrounding area. This would be continued on an ongoing basis. 6. Video was played showing a Perth Desalination Plant discharge pipe and how the marine ecosystem

Date	Stakeholder	Purpose of Engagement/ Questions/Comments/Issues Raised	Outcome
			has not been compromised by its presence but has attracted marine life and growth of marine organisms around and on the pipework. It was also conveyed that studies of existing desalination plants have indicated that the surrounding ecosystem is not adversely affected. 7. WC needs to comply with regulatory requirements to ensure that any noise issues are mitigated to minimise and/or eliminate noise concerns. 8. Cane River Borefield will be retained as a long-term source for the Onslow WS as it is a cheap source of water. 9. Could not confirm what was going to happen to the buildings. Attendees advised that if they have any questions or concerns, they can talk to REFAP representative who will liaise with Water Corporation.
30 July 2019	Onslow Chamber of Commerce and Industry	Presented on the proposal at the proposed Onslow Chamber of Commerce and Industry. 1. What are the employment opportunities? 2. Why are you locating the plant on lots 551,552 and/ or 553? Stated preference for the availability of those lots for other development.	1. Undertook to keep the Onslow Chamber of Commerce and Industry updated on the project any employment opportunities. 2. Explained the advantages of having the plant near to the source of water – more efficient design, better operational and environmental performance.
30 July 2019	LandCorp	Provided project briefing to new Regional Manager. Preferred WC to use a different lot.	Explained why the alternative lot is not WC's preferred location.
25 July 2019	Thalanyji (BTAC)	Ethnographic Survey conducted	
24 July 2019	Thalanyji (BTAC)	Archaeological Survey conducted	N/A

Date	Stakeholder	Purpose of Engagement/ Questions/Comments/Issues Raised	Outcome
23 July 2019	LandCorp	Letter seeking feedback on lot 551,552 and 553. Letter acknowledged and passed on to colleagues.	N/A
17 July 2019	LandCorp	Provided a high-level update on future source plans for Onslow	N/A
14 July 2019	Department of Primary Industries and Regional Development (Fisheries)	Discussed Beadon Creek Option, roles and responsibilities of DPIRD in Onslow and Beadon Creek Option Source Risk Assessment.	Need to check compliance with birling controls, prepare a data request and provide a DAF to DPIRD. Follow up consultation with DPIRD.
3 July 2019	Thalanyji (BTAC)	A letter seeking feedback on Lot 551.	No response received.
2 July 2019	Department of Planning, Lands and Heritage	Sent letter seeking feedback on Lot 551, 552 and 553	N/A
2 July 2019	Agility	Undertook site tour for the Catchment Risk Assessment	N/A
27 June 2019	Land Corp	Regular briefing. No specific feedback on Lots provided.	N/A
27 June 2019	Agility	Sent letter seeking feedback on Lot 551	N/A
27 June 2019	Onslow Marine Supply Base	Sent letter seeking feedback on Lot 551	N/A
26 June 2019	Discovery Parks Onslow	Sent letter seeking feedback on Lot 551	N/A
26 June 2019	Department of Transport	Sent letter seeking feedback on Lot 551	N/A
26 June 2019	Onslow Chamber of Commerce and Industry	Sent letter seeking feedback on Lot 551	N/A
25 June 2019	Shire of Ashburton	Provided feedback on Lot 551. Construction would have to be raised to avoid flooding and corrosion.	Water Corporation to note.

Date	Stakeholder	Purpose of Engagement/ Questions/Comments/Issues Raised	Outcome
24 June 2019	Shire of Ashburton	Planning approval process regarding Lot 551 and requirement to consult with Bindi Bindi	Water Corporation will consult with Bindi Bindi.
14 May 2019	Department of Transport	Requested more information on water quality monitoring.	Water Corporation provided water quality information.
14 May 2019	Onslow Salt Pty Ltd	Requesting more information from water quality requirements. Reiterated concerns about a desalination plant in Beadon Creek.	Provided list of water quality requirements and committed to re-engage in response to their concerns.
13 May 2019	Department of Primary Industries and Regional Development	Requested more information on the water quality monitoring.	Water Corporation provided the requested information.
13 March 2019	Onslow Salt Pty Ltd	Purity of its salt is highly valued by its customers and any traces of antiscalant or other chemicals would be a concern.	Water Corporation to arrange meeting with Onslow Salt Executive to better understand its concerns and how they can be mitigated.
13 March 2019	Thalanyji	Sent an activity notice in relation to water quality monitoring in Beadon Creek with an invitation to a presentation on water source options being considered. No response received.	Water Corporation to re-engage to understand preferences in regard to location of infrastructure early.
13 March 2019	Department of Transport	Provided more detail on the conceptual location of infrastructure within Beadon Creek in relation to the Seawater Desalination Plant.	N/A
11 March 2019	Shire of Ashburton Community Forum	Presented to the community regarding Water Corporation looking into alternative options for next major source. Presentation was well received.	N/A
11 March 2019	Shire of Ashburton	Provided more detail on the future water options Water Corporation was progressing. Comfortable with seawater desalination plant over other options.	N/A

Date	Stakeholder	Purpose of Engagement/ Questions/Comments/Issues Raised	Outcome
11 March 2019	Agility	Background provided on Water Corporation's planning process for seawater desalination at Onslow Interested in location and depth of facilities installed in Beadon Creek should the SDP option proceed. Advised that the turning bay for vessel turning in Beadon Creek is a potential source of suspended solids (i.e. turbidity).	N/A

4. Environmental Principles and Factors

4.1. Principles

A summary of how the EP Act principles have been considered in relation to the Proposal is presented in **Table 7.**

Table 7 EP act Principles

Principle	Consideration
1. The precautionary principle *Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.* *In application of this precautionary principle, decisions should be guided by:* *a) Careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and* b) *An assessment of the risk-weighted consequences of various options.*	Several Proposal design options were considered during the pre-feasibility stage. Environmental constraints, stakeholder considerations, social/community impacts and other factors have influenced the current proposal, which aims to have minimal impacts across all these factors. Key environmental risks and information gaps were identified through a Preliminary Environmental Impact Assessment (PEIA). As a result, scientific investigations such as a baseline water quality program, benthic habitat survey, vegetation survey and contaminate site assessment were undertaken to carefully evaluate potential environmental impacts.
2. The principle of intergenerational equity *The present generation should ensure that the health, diversity and productivity of the environment is maintained and enhanced for the benefit of future generations.*	The Proponent considered that the identified potential impacts of the Proposal can be adequately managed to avoid significant harm to the health, diversity and productivity of the environment, and is not considered to negatively impact future generations. The Proposal will provide local employment, enhance economy and most importantly provide a sustainable supply of potable drinking water to the Onslow Community, and therefore considered an integral service for future generations.
3. The principle of the conservation of biological diversity and ecological integrity *Conservation of biological diversity and ecological integrity should be a fundamental consideration.*	The potential impacts of the Proposal on conservation of biological diversity and ecological integrity and correlating mitigation actions are discussed for the following environmental factors: > Marine Environmental Quality (section 4.2); > Marine Fauna (Section 4.3) > Flora and Vegetation (Section 4.4); and > Social Surrounds (section 4.5).

Principle	Consideration
4. Principles relating to improved valuation, pricing and incentive mechanisms *i. Environmental factors should be included in the valuation of assets and services.* *ii. The polluter pays principles – those who generate pollution and waste should bear the cost of containment, avoidance and abatement.* *iii. The users of goods and services should pay prices based on the full life-cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste.* *Environmental goals, having been established, should be pursued in the most cost-effective way, by establishing incentive structure, including market mechanisms, which enable those best placed to maximise benefits and/or minimise costs to develop their own solution and responses to environmental problems.*	Environmental factors played a key part of Proposal design and location. Preliminary design options included the intake and diffuser locations within Beadon Creek, however, identified constraints around impacts to upper creek environments related to brine dilution deficiencies, and potential impacts to the nearby Onslow Salt operations deemed this option as environmentally unfeasible. The current option of intake and diffuser locations in Beadon Bay is not necessarily the most economical option but ensures dilution efficiencies regarding protection of Marine Environmental Quality are optimised. The proponent is responsible for managing the release of brine into the marine environment in a manner that will maintain environmental values of marine water, sediment and biota. The Proponent is committed to implementing all monitoring and management requirements stipulated in the OMEMMP. No significant pollution or waste is expected from the Proposal.
5. The principle of waste minimisation *All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment.*	Proposed mitigation, monitoring and management strategies to minimise waste discharge to the environment are described within the OMEMMP (Appendix D). General site waste management will be addressed within a Proposal CEMP.

4.2. Marine Environmental Quality

4.2.1. EPA Objective

The EPA's objective for the factor 'Marine Environmental Quality' (MEQ) is:

'To maintain the quality of water, sediment and biota so that environmental values are maintained'.

4.2.2. Policy and Guidance

The following EPA policies and guidance have been considered in evaluating potential impacts on this factor:

- *Environmental Factor Guideline: Marine Environmental Quality.* (EPA 2016c)
- *Technical Guidance. Protecting the Quality of Western Australia's Marine Environment*. (EPA 2016d).

4.2.3. Receiving Environment

Studies that have background information on MEQ relevant to the proposal area are included in **Table 8**.

Table 8 Marine Environmental Quality Studies Relevant to the Proposal.

Author (Date)	Study
Baird (2020)	Onslow SDP Hydrodynamic Modelling Report. Prepared for Water Corporation.
BMT Oceanica (2014)	BMT Oceanica (2014). Beadon Creek Maritime Facility Capital Dredging Environmental Impact Assessment. Prepared for the Department of Transport.
Chevron (2010)	Wheatstone Project Draft Environmental Impact Statement/ Environmental Review and Management Programme, Technical Appendix Q5 Sediment Quality Assessment Wheatstone Dredging Program, Western Australia.
O2 Marine (2020a)	Onslow SDP Project – Baseline Marine Water Quality Investigation
O2 Marine (2020b)	Onslow SDP Project – Sediment and Infauna Investigation
O2 Marine (2020c)	Onslow SDP Project – Benthic Communities and Habitat Investigation
O2 Marine (2020d)	Onslow SDP Project – Desalination Brine Toxicity Assessment
MScience (2013)	Wheatstone LNG Development: Water Quality Around the Proposed Nearshore Outfall. Unpublished Report to Chevron Australia by MScience Pty Ltd, MSA188R1, Perth, WA

Author (Date)	Study
MScience (2009)	Wheatstone LNG Development: Baseline Water Quality Assessment Report November 2009. Unpublished Report to URS Corporation by MScience Pty Ltd, MSA134R3, Perth, WA

Environmental Quality Management Framework

In accordance with guidance provided in EPA (2016d), five Environmental Values (EVs) are generally applied throughout WA coastal waters. Each of these EV's have been considered in regard to potential impacts from the Onslow SDP Proposal in **Table 9**.

Table 9 Relevant Marine Environmental Values

Environmental Value	Environmental Quality Objective	Local Consideration
Ecosystem Health	**EQO1**: Maintenance of ecosystem integrity. The 'Ecosystem Health' category can be split into four Levels of Ecological Protection (LEPs), being Maximum, High, Moderate and Low. However, the following sub-objectives are applicable to the Proposal Area (refer **Figure 3**) > High: very low level of contaminates and no detectable change from natural variation; > Moderate: elevated levels of contamination, moderate changes from natural variation.	Construction activities have potential to impact physico-chemical characteristics through turbidity generation, and toxicant levels (commission testing and hydrocarbon spills from construction vessel/plant). The release of brine wastewater has potential to alter physico-chemical characteristics and toxicant levels (water and sediment) of Beadon Bay, Beadon Creek and the upper tributaries of Beadon Creek.
Recreation & Aesthetics	**EQO2**: Water quality is safe for primary contact recreation (e.g. swimming and diving). **EQO3**: Water quality is safe for secondary contact recreation (e.g. fishing and boating). **EQO4**: Aesthetic values of the marine environment are protected.	Neither construction or operational activities are expected to have significant impact on the recreation or aesthetic values within Beadon Bay or Beadon Creek.
Fishing and Aquaculture	**EQO5**: Seafood (caught) is of a quality safe for human consumption.	Neither construction or operational activities are expected to have significant impact on safe eating quality of fish caught within Beadon Bay or Beadon Creek.
Cultural & Spiritual	**EQO6**: Cultural and spiritual values of the marine environment are protected.	There are no registered Aboriginal Heritage sites within the predicted

Environmental Value	Environmental Quality Objective	Local Consideration
		marine impact area of the Proposal. However, consultation with BTIA will be undertaken to recognise the importance of the mythological water serpent *Warnamankura* (Refer Section 3).
Industrial Water Supply	**EQO7**: Water quality is suitable for industrial use.	There is a low risk that SDP operations may impact waters within Beadon Creek utilised by Onslow Salt.

The *Pilbara Coastal Water Quality Consultation Outcomes: Environmental Values and Environmental Quality Objectives* (DoE 2006) identifies the receiving environment potentially impacted by the Onslow SDP proposal as High LEP within Beadon Bay and Moderate LEP within Beadon Creek. The existing LEPs of the Onslow region are presented in **Figure 3**, with areas applicable to the proposal including:

- High LEP: Beadon Bay and the upper tributaries of Beadon Creek
- Moderate LEP: Beadon Creek, adjacent to the Beadon Creek Maritime Facility.

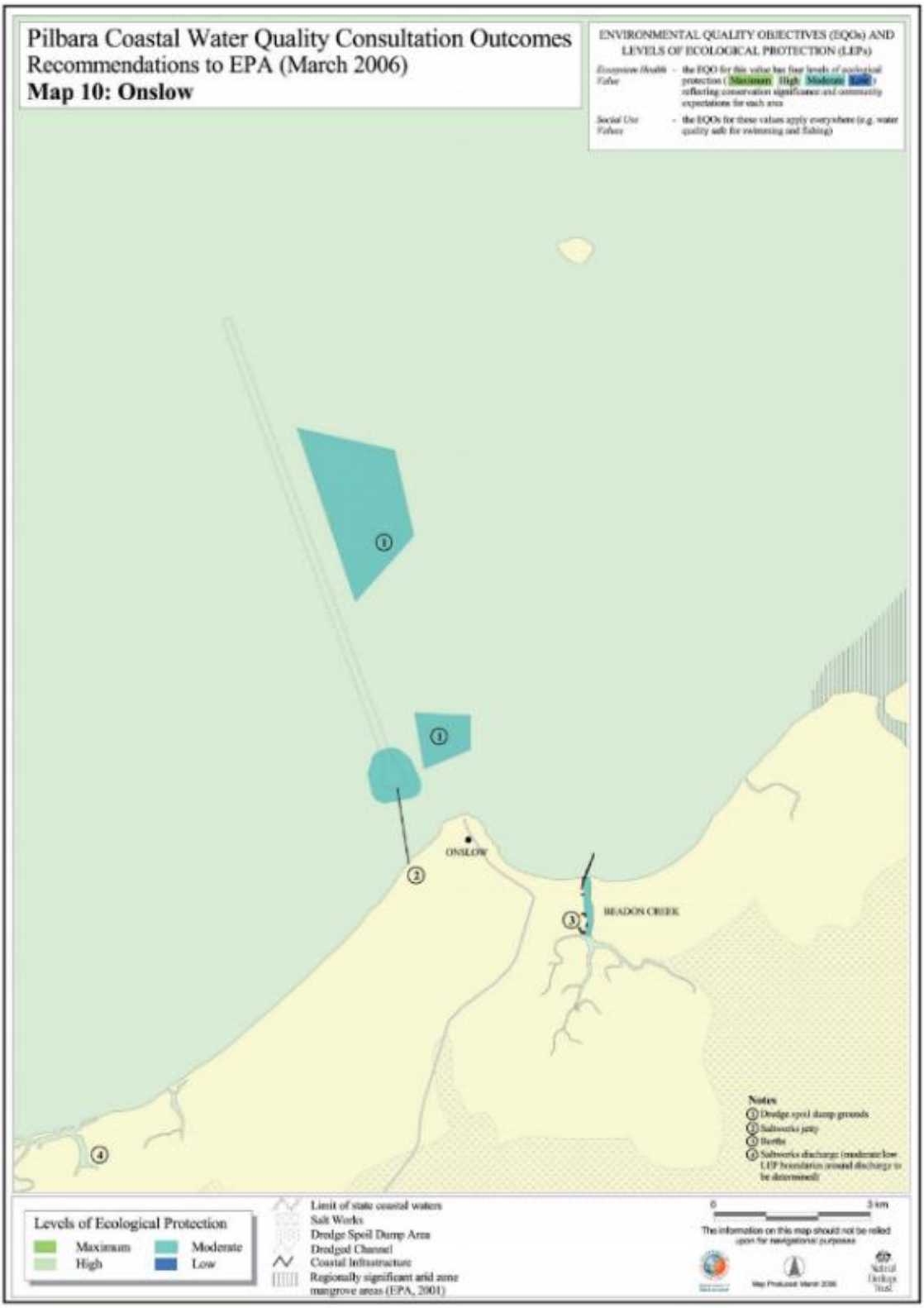

Figure 3 Onslow levels of ecological protection (DoE 2006)

Marine Water Quality

Baseline water quality monitoring of nearshore waters in Beadon Bay and Beadon Creek has been undertaken by O2 Marine since June 2019 and is planned to be completed in June 2021. This program includes in-situ monitoring of physical parameters and a 4-month intensive water sampling program completed between May to August 2019. Historic water quality data has also been collected in the nearshore Onslow Region as part of the Wheatstone Project (MScience 2013).

Physico-chemical Parameters

When the in-situ monitoring program began (May 2019), the proposed intake/diffuser site was located within Beadon Creek. A creek sensor (Site A) and one (1) 'bay' site (Site C) were monitored from May 2019 up to September 2019 when design criteria changed, and the preferred location of the intake/diffuser was shifted into Beadon Bay. Site C data was analysed and deemed representative of Beadon Bay conditions (during flood tide sampling periods) and therefore this data was included in the full baseline data and complimented the new Beadon Bay site (Site D). A second Beadon Bay site (Site E) was introduced as an option for a nearshore intake/diffuser option. All monitored sites and time periods are included in **Table 10** and **Figure 4** below.

A summary of monthly baseline physico-chemical data collected in Beadon Bay is included below in **Table 10**. These results reflect the typical seasonal patterns experienced in the Pilbara, with hot, wet and windy summer periods (December through to March), and slightly cooler, calmer periods experienced from April through to September. Baseline data shows water temperatures increase with the increasing atmospheric temperature during summer with Beadon Bay recording a maximum median temperature of 29.19°C, this is consistent with of nearshore studies in the Pilbara, recording maximum water temperatures of approximately 30°C (Pearce et al. 2003). Dominant westerly winds during the summer months contribute to elevated turbidity levels, particularly in shallow, nearshore waters where re-suspension of fine sediments occurs. Heavy rainfall and tropical cyclone events are also common during the summer period, with these events being a significant driver for elevated turbidity in nearshore environments due to run off from creek systems into the ocean (e.g. Ashburton River). Tropical Cyclone Damian passed over Karratha (approximately 200 km NE of Onslow) on the 8th February 2020. Whilst Onslow did not experience direct impacts from rainfall or runoff, the increased wind and ocean movement did result in a notable elevation in the median turbidity levels for the month of February **(Table 10).** Baseline salinity data shows relatively uniform concentrations between June 2019 and August 2020 with monthly median concentrations ranging from 37.47 ppt (October) to 38.45 ppt (March).

These baseline data are consistent with findings from previous studies in the Onslow region, where MScience (2009) found that marine waters around Onslow are characterised by relatively turbid inshore/nearshore waters that are subject to strong tidal flows. The shallow inshore bathymetry combined with climatic and meteorological factors such as seasonal winds, rainfall and tropical cyclones have strong influence over turbidity, salinity and temperature in the marine waters around Onslow (Chevron 2010).

Table 10 Monthly median baseline water quality data collected in Beadon Bay (June 2019 – July 2020).

		Parameter				
	Season	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (%)	pH	Turbidity (NTU)
Dry	May	24.18	37.25	95.90	8.69	9.17
	June	21.98	37.69	79.66	8.20	4.45
	July	20.82	37.54	80.12	8.31	4.30
	August	20.25	37.42	93.71	8.34	4.63
	September	23.40	37.59	90.09	8.35	2.25
	October	24.18	37.47	96.30	8.22	4.91
Wet	November	26.47	37.54	93.15	8.21	5.87
	December	28.35	37.50	93.30	8.22	4.69
	January	28.76	37.59	88.79	8.08	6.90
	February	27.39	37.61	83.68	8.25	11.56
	March	29.19	38.45	88.53	8.42	4.24
	April	28.39	38.09	94.05	8.92	7.67

Figure 4 **Beadon Bay monitoring site locations**

Toxicants

In addition to the 24-month in-situ phsyico-chemical monitoring, an intensive water sampling program was undertaken in Beadon Bay and Beadon Creek between May and August 2019. The tested parameters were largely selected to inform design criteria for the proposed desalination plant and included a suite of pesticides, hydrocarbons, dissolved metals, nutrients, algae, and microbiology. The sampling regime was aimed at identifying differing water characteristics between spring/neap cycles and ebb and flood tides within these cycles.

Key findings of the four-month sampling program are detailed in O2 Marine (2020a) and summarised below:

- All pesticide results (98 analytes) were equal to or below the laboratory Limit of Reporting (LoR) for the duration of the sampling program.
- All industrial hydrocarbons, TPH and PAH results were below the laboratory LoR for the duration of the sampling program.
- Dissolved metal concentrations for Al, Bo, Ba, St, Mg and Fe were all low (either below LoR, or marginally above). MScience (2013) found that dissolved metals were also low, with the majority of results below the 99% or 90% species protection level. Zinc was recorded in concentrations that exceeded the guideline value for 99% species protection (High LEP), but not the 90% (Moderate LEP) (MScience, 2013).
- Nutrient levels (total nitrogen, total phosphorus, ammonia and NOx) were consistently recorded in concentrations marginally above the recommended guidelines specified in ANZG (2018) for north-west waters of Western Australia. This observation is consistent with MScience (2013) sample results where nitrogen-based water quality parameters (total nitrogen, nitrates + nitrites) were above the recommended guidelines specified in ANZECC & ARMCANZ (2000). This indicates that the recommended nutrient guidelines in ANZG (2018) are not suitable for application to the nearshore waters of Onslow and locally derived guideline values should be developed.
- Microbiology concentrations were low throughout the sampling program. The majority of results were below LoRs, with maximum concentrations of Heterotrophic Plate Count, E.Coli and Enterococci 65 cfu/ml, 58 cfu/100 ml and 10 cfu/100 ml, respectively. These results are consistent with MScience (2013), where total coliforms measured were well below guideline values for recreational water use.
- Algal results indicate Bacillariophyceae and Dinophyceae were consistently present throughout the sampling program. Bacillariophyceae dominated samples with variable concentrations (maximum 608,900 cells/L, minimum 7500 cells/L), while Dinophyceae were recorded in lower concentrations (maximum 7200 cells/L, minimum 100 cells/L). Low concentrations of Euglenophyceae and Dictyochophyceae were intermittently recorded during the sampling program.

Overall, these results indicate that the water quality guidelines for 99% and 90% species protection for all elements, except possibly Zn, are suitable for application to the waters around Onslow, with these findings consistent with previous nearshore water quality studies (MScience 2013).

Marine Sediment Quality

Beadon Bay Sediment and Infauna Survey, March 2020.

A sediment and infauna investigation was undertaken in Beadon Bay by O2 Marine in March 2020 (Appendix A). The objective of the survey was to determine baseline sediment characteristics (including particle size and concentrations of potential contaminants) and detail the composition of infauna communities that inhabit marine sediments at the proposal site. Ten sample locations within the potential area of impact are shown in **Figure 5**.

Sediment particle size results indicate that fine sand made up at least 50% of all samples, with higher proportions recorded at nearshore sites WC7 – WC 10. The deeper sites (WC1 – WC6) closer to the intake/diffuser location had a higher proportion of clays and silts.

Nutrient levels were generally low and comparable to previous sediment studies conducted within Beadon Bay (O2 Marine 2017b).

Laboratory results indicate that sediments are uncontaminated, with all hydrocarbon and organotin concentrations below the LoRs for both primary and secondary laboratories. This is consistent with previous sediment studies within and just offshore form Beadon Creek, where no discernible anthropogenic enrichment of contaminants in sediments were identified (DEC 2006). As part of the Onslow Marine Supply Base (OMSB) environmental investigations, O2 Marine (2017) also concluded that sediments within the capital dredge channel were sandy, clean and uncontaminated and were considered suitable for onshore disposal.

Metal concentrations were generally low and comparable to previous background investigations in the Pilbara region (DEC 2006) although aluminium, copper, iron and vanadium concentrations were slightly higher at deeper sites (WC1 – WC6). These elevations are likely attributable to the strong positive relationship with the <63-µm particle fraction (Stoddart and Welsh 2019). Arsenic concentrations were elevated above the ANZG (2018) Screening Level across all sample locations during the March 2020 sediment investigation. These levels are consistent with both DEC (2006) and O2 Marine (2017b) investigations.

The Default Guideline Values (DGVs) for toxicants in sediment in ANZG (2018) are typically used to derive EQGs as recommended in EPA (2016) for the EV ‘Ecosystem Health’. However, based on sediment results from the March 2020 survey, some ANZG (2018) guideline values were not deemed appropriate as EQG for the Onslow area (e.g. arsenic). Therefore, where guidelines are not provided, or in cases where background levels have been found to be naturally elevated, it is recommended that EQG values be derived using the natural background concentrations as defined in DEC (2006). It is recommended that the following EQG values be derived for:

- Maximum LEP areas using the 80th percentile of background concentrations
- High/Moderate LEP areas using the median of natural background concentrations multiplied by a factor of 2
- Low LEP areas using the median of natural background concentrations multiplied by factor of 3.

Infauna analysis indicated that there was no statistical difference in species richness or species diversity among sites. All sites presented with very high to complete evenness, which indicates that individual counts are distributed evenly among the different species. When considering the sites grouped into four locations (proposed intake/diffuser; proposed pipeline; west of pipeline and east of the pipeline) there was no statistical difference between the four locations. Overall, the survey area presented with very low faunal abundances with composition deemed heterogeneous (Appendix A).

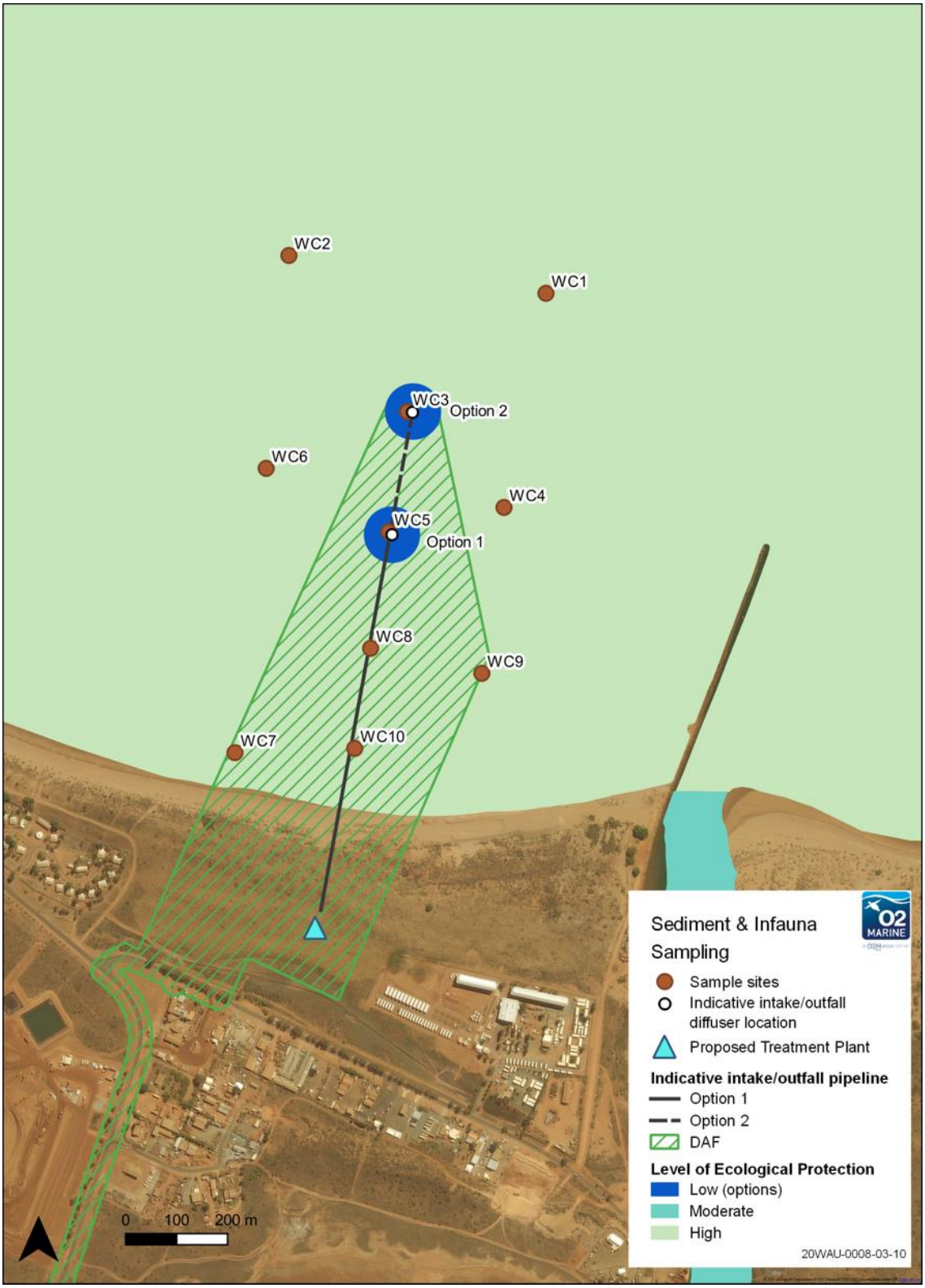

Figure 5 Sediment and infauna sampling locations, Beadon Bay, March 2020.

4.2.4. Potential Impacts

Potential impacts to water, sediment and biota quality may occur through construction and operational activities from the SDP desalination proposal. These impacts to MEQ may have flow on effects to other factors, including BCH and Marine Fauna.

Construction Impacts

The two main construction activities involving the marine environment include the placement and securing of the intake/diffuser and installation of the pipeline infrastructure. The proposed placement method for the pipeline is expected Horizontal Directional Drilling (HDD) but this is subject to geophysical and geotechnical investigations to confirm suitability. The disturbance during HDD is minimal with steps being made to mitigate localised disturbance of sediments. Placement of the intake/diffuser structures will cause localised sediment disturbance in area of approximately 400 m^2.

A summary of the potential impacts to MEQ are outlined in **Table 11**. Cause-effect pathways related to construction activities are shown in **Table 12**, this illustrates how direct impacts on MEQ can indirectly impact other environmental factors.

Table 11 Potential construction impacts to MEQ.

Potential Impacts	Context
Elevated turbidity/TSS	HDD activities and placement of infrastructure will cause direct impacts on water quality through temporary elevations in turbidity/TSS (altered physico-chemical characteristics).
Toxicity (hydrocarbon spills)	Marine construction activities include the use of vessels presenting potential risks due to unplanned hydrocarbons spills and waste generation.

Note – direct impacts on BCH from construction and operational activities are discussed under the Benthic Communities and Habitats factor in Section 5.

Table 12 Cause-effect pathways on MEQ associated with SDP marine construction activities.

Construction Activity	Infrastructure Installation		Commissioning Testing
Cause	Sediment disturbance	Vessel hydrocarbon Spill	Flushing of pipelines
Primary Impact (Marine Environmental Quality)	Elevated turbidity/TSS	Toxicity (water and sediments)	
Secondary Impact (BCH and Marine Fauna)	Stressor effects to BCH and Marine Fauna	Toxicity effects to BCH and or Marine Fauna	

Note – direct impacts on marine fauna and BCH from construction and operational activities are discussed in Section 4.3 and Section 5, respectively.

Operational Impacts

The SDP desalination process produces a liquid concentrate (brine) that will be discharged into Beadon Bay. The highest salinity value recorded at Site A is equivalent to approx. 39.5 psu. If the RO is run nominally 50% recovery, the salinity upper limit for the brine may get close to 80 psu (doubling the background salinity level) at times.

The average temperature differential between the ambient receiving waters and brine effluent produced at other Water Corporation desalination plants (namely, Perth SDP and Southern SDP) is about +2°C. Included in the brine will be trace concentrations of antiscalant; all other chemicals used during the desalination process at the Onslow SDP will be removed from the waste stream and treated/disposed of on land.

Table 13 identifies the potential direct impacts to MEQ from operational activities of the Onslow SDP proposal. **Table 14** indicates possible cause-effect pathways that may result in indirect impacts to other environmental factors such (BCH and Marine Fauna).

Risks associated with operational activities on MEQ and other environmental factors have been assessed via ecotoxicity testing on targeted local species to determine required dilution ratios for species protection (O2 Marine 2020d; **Appendix B**), and also through a high-resolution three-dimensional numerical model (Baird 2020;) to assess mixing and dispersion characteristics around the outfall. The outcomes of these studies are discussed further in **Section 4.2.5**.

Table 13 Potential operational impacts to MEQ.

Potential Impacts	Context
Altered Physico-chemical Properties (salinity, temperature and dissolved oxygen)	Brine discharge may lead to an altered physico-chemical state (water salinity and water temperature) in localised areas around the diffuser. These direct impacts to water quality may have indirect stress impacts or mortality on BCH and marina fauna that utilise the area directly surrounding the diffuser. Density differences between natural waters and brine water may cause stratification. This may result in reduced dissolved oxygen (DO) concentrations leading to stress or mortality of benthic habitats and sessile organisms.
Toxicity (chemicals)	Chemicals used in plant operations have the potential to result in localised toxicity around the diffuser, reducing water and sediment quality, and indirectly impacting nearby BCH and organisms.

Table 14 Cause-effect pathways on MEQ associated with SDP marine operations.

Operational Activity	Discharge into Beadon Bay			
Cause	Discharge of saline brine			Discharge of antiscalant
Primary Impact (Marine Environmental Quality)	Increased water salinity	Increased water temperature	Reduced dissolved oxygen (stratification)	Increased toxicants (water and sediment)
Secondary Impact (BCH and Marine Fauna)	Stressor effects to BCH and Marine Fauna			Toxicity effects to BCH and Marine Fauna

4.2.5. Assessment of Impacts

DoE (2006) established EVs and EQOs for state waters from Exmouth to Cape Keraudren. These values and objectives are recommended as the basis of an environmental quality management framework for the region to help manage and protect the marine environment from the effects of waste inputs and pollution (DoE 2006).

Construction Phase Impacts

HDD drilling, Installation of Subtidal Infrastructure: Increase Turbidity (reduced light)

This construction activity will result in localised increases to turbidity due to sediment re-suspension. Sediment quality investigations (O2 Marine 2020b) suggest that the proposed disturbance area

consists of uncontaminated sediments largely comprised of 'fine sands', with deeper areas (beyond the -2.5 m isobath) containing a slightly higher proportion of clay and silts. Due to the small volume of sediment disturbance (~400 m^2) and the short duration of the activity, turbid plumes generated will be localised and temporary and thus not have significant impact on water quality within Beadon Bay.

The potential localised increase in turbidity is further discussed and assessed in the context of the extent, duration and severity of the potential impact on BCH and marine fauna in discussed in Other Environmental Factors or Matters in **Section 5**.

Increases in turbidity have also been considered in relation to compromising EQO7 for protection of the EV 'Industrial water supply' at the Onslow Salt seawater intake which requires turbidity <10 NTU to be maintained in the upper reaches of the eastern tributary of Beadon Creek. No adverse impact to water quality (specifically turbidity levels) at the upper creek intake location is anticipated due to the spatial distance from the source point as well as the relative low intensity and duration of the turbidity generating activities during construction.

Overall, given the naturally turbid waters of the Proposal area, any localised increases in turbidity are expected to be of limited duration and any resultant effects on the environment are expected to be negligible.

Operational Phase Impacts

As described in **Table 4**, the EQO for 'maintenance of ecosystem integrity' has four different LEPs, each representing a different level of ecosystem protection. These LEPs are applied to ensure that the general integrity and function of the ecosystem is maintained, whilst still allowing for multiple uses (some with localised effects). The EV for Ecosystem Health recognises that there are areas (such as around outlets, ports and harbours) where a high level of ecosystem protection cannot be maintained. As such these areas are generally assigned either a moderate or low level of ecological protection, each of which has specific limits of acceptable change (**Table 4**). This is important in the context of this document and the OMEMMP included in **Appendix D**, which includes strategies to manage the expected reduction in environmental quality immediately adjacent to the SDP diffuser as a low LEP area in accordance with EPA (2016b), which states:

'A low level of ecological protection should only be considered around a wastewater discharge where the need can be technically justified. They should be as small as possible and linked to the zone of initial dilution where reasonably practicable to do so, usually extending no more than 70 m from the diffuser. These areas should be located within moderate ecological protection areas where available.'

As such, during the operational phase of the proposal, MEQ will be managed to meet a Low LEP immediately around the proposed diffuser location (70 m radius) and to meet a High LEP beyond this distance. Proposed LEPs are identified in **Figure 3**.

Brine Discharge Impacts

Ecotoxicity testing of prototype desalination brine effluent for the SDP Proposal was undertaken on a suite of representative species for the proposed Proposal site by Intertek, a NATA certified laboratory. The results of ecotoxicity testing were used to create a Species Sensitivity Distribution (SSD) in accordance with ANZG (2018) guidelines. This SSD was used to statistically derive guideline concentrations of brine in seawater for different species protection levels (SPLs). These guideline concentrations were used to predict the number of dilutions required to meet the different levels of ecological protection.

Species selected for testing were determined to be locally relevant for the statistical assessment of SPLs for the Proposal. These species were:

- Milky oyster *Saccostrea echinata*
- Sea anemone *Aiptasia pulchella*
- Barramundi *Lates calcarifer*
- Diatom *Nitzschia closterium*
- Sea urchin (*Echinometra mathaei*)

Methods used for each species are outlined in **Table 15**. Intertek advised that some test species used in ecotoxicity tests done for the Southern SDP were applicable and relevant to the Onslow assessment, and therefore these tests were included to improve statistical derivation of SPLs (O2 Marine 2020d). The additional species included were microalgae (*T. Isochrysis galbana)* and Yellowtail Kingfish (*Seriola lalandi*).

Table 15 Analytical tests, temperature, acute or chronic tests and test protocols for SSDP brine samples submitted on 1 April 2020 (Intertek 2020).

Test Performed	Temperature	Acute/Chronic	Test Protocols
72-hr marine algal growth test using *Nitzschia closterium*	22°C	Chronic	ESA SOP 110 (ESA 2016), based on Stauber et al. (1994)
Sea Urchin Larval Development *Echinometra mathaei*	25±1°C	Chronic	APHA and ASTM protocols
48-hr larval development test using the Milky oyster *Saccostrea echinata*[1]	29±1°C	Sub-chronic	ESA SOP 106 (ESA 2016), based on APHA (1998) and Krassoi (1995)
8-day Sea anemone pedal lacerate development test using *Aiptasia pulchella*	25±1°C	Chronic	ESA SOP 128 (ESA 2014), based on Howe et al. (2014)
7-day fish imbalance and biomass toxicity test using barramundi *Lates calcarifer*[1]	25±2°C	Chronic	ESA SOP 122 (ESA 2017), based on USEPA (2002)

All samples were serially diluted (5 x) with FSW to achieve the test concentrations of 3.1, 6.3, 12.5, 25, 50 and 100%. The six test results conducted during the targeted analysis, combined with two test results recorded from a previous test (microalgae *T. Isochrysis galbana* and Yellowtail Kingfish

Seriola lalandi) on brine samples collected from the same facility, resulted in eight tests of seven species that belong to five groups (i.e. algae, fish, echinoderm, mollusc, cnidaria) used to develop the SSD.

The toxicity test results are presented in several ways. The concentration at which no observed effects (no observed effect concentration, NOEC) is generally used as the most conservative measure of toxicity in that it is the lowest concentration at which no test organisms are affected. The lowest observed effects concentration (LOEC) is the concentration where the first statistically detectable toxicity is observed. The concentration that causes one or more specified effects in 50% of the test organisms in the prescribed test duration (EC_{50}) or which inhibits growth or reproduction of 50% of the test organisms in the prescribed test duration (IC_{50}) are statistically calculated. Similarly, IC/EC_{10} values are statistically calculated as the concentration that causes one or more specified effects/detectable inhibition in 10% of the test organism (O2 Marine 2020d). Results of the ecotoxicity testing of the brine effluent on seven species used for this assessment is presented in **Table 16.**

Table 16 Ecotoxicity results for the proportion (%) of SSDP brine samples resulting in the NOEC, LOEC, 50% and 10% EC/IC.

Test	NOEC (%)	LOEC (%)	EC_{50}/IC_{50} (%)	EC_{10}/IC_{10} (%)
Microalgal growth inhibition bioassay: *T. Isochrysis galbana**	25	50	>100	46.4
Fish larvae development bioassays: Kingfish *Seriola lalandi**	25	50	41.9	25.7
Microalgae Growth using *Nitzschia closterium*	3.1	6.3	46.6	21.3
Sea Urchin Development using *Echinometra mathaei*	<3.1	3.1	17.2	13.0
48-hr larval development test using the Milky oyster *Saccostrea echinata*	6.3	12.5	14.5	8.3
8-day Sea anemone pedal lacerate development test using *Aiptasia pulchella*	12.5	25	17.5	13
7-day fish imbalance toxicity test using barramundi *Lates calcarifer*	25	50	35.4	32.6
7-day fish biomass toxicity test using barramundi *Lates calcarifer*	12.5	25	35.8	22.6

These toxicity results were used to develop an SSD from the Burrlioz 2.0 Software. All IC_{10} values in **Table 16** were used to determine the percentage of species affected by the discharge of desalination brine with variable dilutions. The output of these results is shown in **Figure 6**.

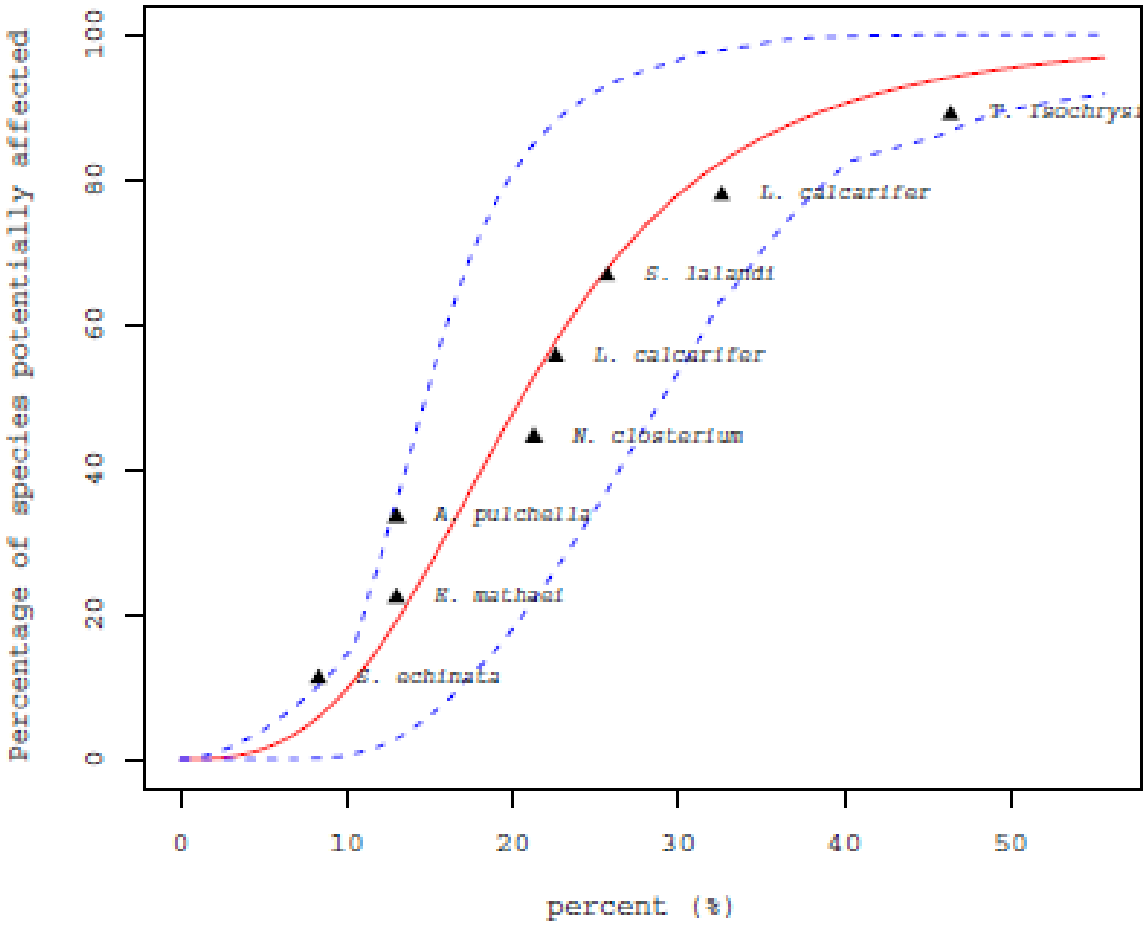

Figure 6 **Burrlioz 2.0 SSD based on the chronic test results from the analysed brine effluent and the 95% confidence interval.**

Guideline concentrations for a range of species protection levels (80%, 90%, 95% & 99%) are statistically derived and presented **Table 17**. These results indicate that to achieve 80% protection of species at the Proposal site, a brine concentration of 13% should be reached on release from the outfall requiring a dilution of 1:8. In line with EPA (2016d), an 80% SPL is acceptable in a Low Level of Environmental Protection (LEP) area, which has been allocated as a 50 m radius buffer around the diffuser in the EQP for the Proposal (O2 Marine 2019d). The area greater than 50 m from the outfall is afforded a High LEP and 99% species protection, indicating a brine concentration of 4.4% and a dilution of 1:23 must be achieved at the Low/High LEP boundary.

Table 17 **Recommended guideline values (±95%CI) and corresponding dilutions for concentration of the analysed brine effluent for each species protection level and LEP**

Species Protection Level	LEP	Estimated dilutions	Guideline	Lower 95% CI	Upper 95% CI
99%	High	23	4.4%	1.8%	12%
95%	-	13	7.8%	5.3%	15%
90%	Moderate	10	10%	7.7%	19%
80%	Low	8	13%	9.0%	23%

During the Operational phase of the MEQ, the ecotoxicology concentrations for 80% and 99% SPLs were estimated to require 1:8, and 1:23 dilutions, respectively. These dilutions need to be achieved at the following locations:

- 8 dilutions within the Low LEP area
- 23 dilutions on the Low/High LEP boundary (Maximum distance not more than 70 m from the outfall diffuser).

As part of the studies for the Proposal, hydrodynamic modelling at two discharge locations was undertaken in Beadon Bay (Baird 2020). For each location, the brine discharge was modelled under two discharge regimes (constant discharge and intermittent release) during ebb tides only. The model outcomes show that there is a pronounced area around the outfall where the plume is concentrated on the seabed and there is significant stratification, but at a relatively short distance from the outfall the water column becomes well mixed. Analysis of plume recirculation effects showed that there was minimal recirculation around the outfall location for the modelled options.

The model results have been analysed to inform the OMEMMP. The model results across the 4-week dry season simulation were used to calculate dilution contours around the outfall that represent the modelled 5th percentile dilution level (i.e. 95th percent salinity level) from the 3D model results near the seabed. The dilutions achieved from the model were compared against the designated level of ecological protection (LEP) at the Low / High LEP boundary designated (for evaluation purposes) at 70 m from the outfall. All four modelled cases were shown to meet the environmental criteria, with the constant discharge cases showing higher rates of dilution (better outcomes) and a smaller overall plume footprint compared with the intermittent release cases. **Figure 7** to **Figure 10** outline the modelled dilution contours around the outfall location for each of the four different discharge scenarios. The modelled results show that 50 dilutions (more than double the required dilution) are achieved within a 50m radius around the outfall for each scenario.

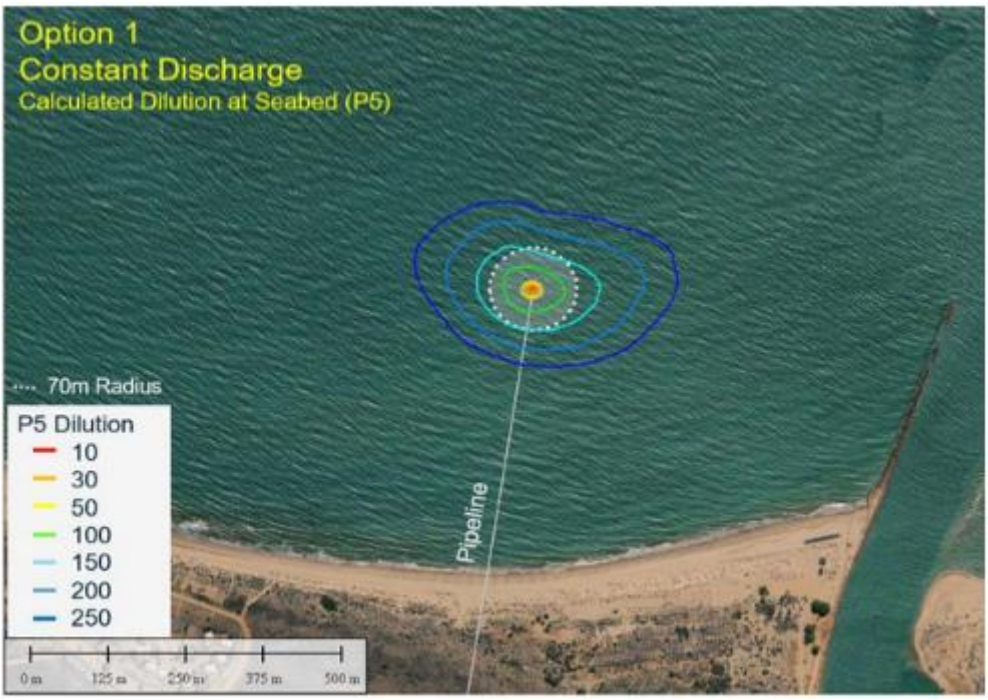

Figure 7 **Modelled dilution contours for Option 1 constant discharge. Dry season model case, dilution contours calculated as 5th percentile value over the four-week simulation period (Baird 2020).**

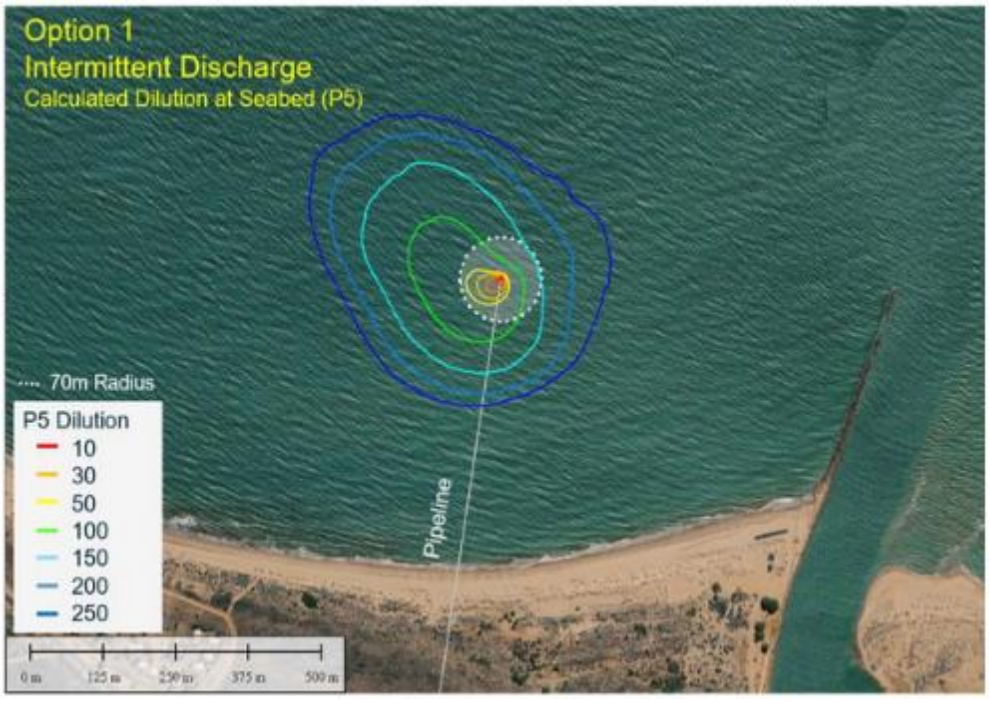

Figure 8 **Modelled dilution contours for Option 1 intermittent discharge. Dry season model case, dilution contours calculated as 5th percentile value over the four-week simulation period (Baird 2020).**

Figure 9 **Modelled dilution contours for Option 2 constant discharge. Dry season model case, dilution contours calculated as 5th percentile value over the four-week simulation period (Baird 2020).**

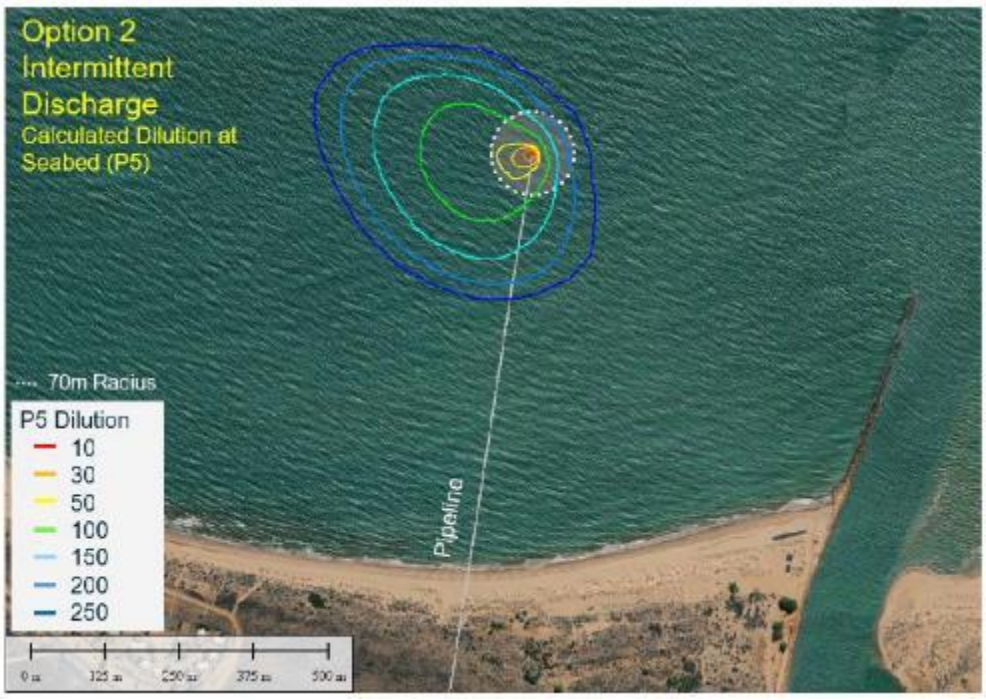

Figure 10 **Modelled dilution contours for option 2 intermittent discharge. Dry season model case, dilution contours calculated as 5th Percentile value over the four-week simulation period (Baird 2020).**

4.2.6. Mitigation

Mitigation measures proposed to minimise potential impacts on the environmental factor 'Marine Environmental Quality' are described in **Table 18** and presented in accordance with the EPA's mitigation hierarchy (Avoid, Minimise, Rehabilitate[2]).

[2] Rehabilitation measures are excluded from Table 18 as these are not expected to be required to mitigate impacts to marine environmental quality.

Table 18 Mitigation measures to minimise impacts on Marine Environmental Quality

Potential Impact	Avoidance	Minimisation	Residual Impact
Construction Phase Impacts *Construction phase impacts will be managed through the development and implementation of a CEMP. The following mitigation measures will be included in the CEMP to mitigate impacts on MEQ.*			
Elevated turbidity/TSS from trenching	> Considering significant impacts to marine water quality are expected to be avoided through design and operational management, secondary impacts to Benthic Communities and Habitats (BCH) from reduced water quality is not anticipated.	> Construction activities to place/secure subtidal infrastructure will be restricted to the approved DAF. Only localised impacts to water quality are expected (temporary elevated TSS) and are unlikely to significantly impact the naturally turbid waters of Beadon Bay.	No residual impacts are anticipated
Toxicity (hydrocarbon spills)	> Ensure all construction vessels are compliant with the International Maritime Organisation International Convention for the Prevention of Pollution from Ships (MARPOL). > Store all fuels, oils and lubricants on site to ensure that they do not pose a threat to the environment or the safety of staff and the public. > Manage vessel bunkering, chemical storage and spill response to ensure no adverse impacts to the marine environment	> All construction activities (vessels and construction plant) will have approved hydrocarbon spill response procedures in place as part of the Proposed Construction Environmental Management Plan (CEMP).	No residual impacts are anticipated
Operational Phase Impacts *Operational phase impacts will be managed through the development and implementation of an* OMEMMP*. The following key management measures will be included in the* OMEMMP *to mitigate impacts on MEQ surroundings during operation.*			
Altered physico-chemical properties	> No untreated brine wastewater will be released into the marine environment without prior testing to ensure parameters are within ANZG (2018) guidelines.	> The EPA (2016d) recommends a preference for the Low LEP to be designated no more than 70 m surrounding a proposed outfall. However, hydrodynamic modelling (barid 2020) demonstrated that the number of dilutions required	Any decline in water quality will be restricted to within the proposed LEPA, which occurs

Potential Impact	Avoidance	Minimisation	Residual Impact
(salinity, temperature and dissolved oxygen)	> Hydrodynamic modelling (Baird 2020) was undertaken to predict the dilution and extent of brine wastewater entering Beadon Bay during the Proposed operations. This study informed the proposed design options and feasibility in relation to potential impacts on the marine environment. Modelling results suggest that with adequate design and operational management, dilution ratios will be sufficient to avoid significant impact to the marine water quality environment. > Through operational management, no secondary impacts to BCH from reduced water quality are anticipated. > No impacts to the industrial water supply are anticipated due to the location of the activity and limited use of chemicals.	to achieve the relevant SPL at the Low/High LEP Boundary was easily achieved within 50 m, therefore, a Low LEP is proposed within 50 m surrounding the proposed outfall diffuser options. > A OMEMMP has been developed to monitor and manage water quality monthly during the life of the operation.	within predominantly bare sand substrate.
Toxicity (chemicals)		> Chemicals used during the desalination process will be removed from the waste stream and treated/disposed of within the Water Corp wastewater treatment plant.	No residual impacts are predicted.

4.2.7. Predicted Outcomes

A LEPA is proposed to be designated within 50 m surrounding the proposed diffuser outfall location (i.e. either option shown in **Figure 1**).

An OMEMMP has beem developed to ensure that operations can be effectively managed to so that the relevant EQOs are achieved and the associated Environmental Values are protected.

Based on the mitigation measures discussed above, and in consideration of the proposed monitoring and management strategies, the Proposal activities are not expected to pose any significant residual risks to maintaining the quality of water, sediment and biota and therefore the environmental values can be protected. In relation to the proposal, the Proponent considers that the EPA's objective for marine environmental quality has been met.

4.3. Marine Fauna

4.3.1. EPA Objective

The EPA's objective for the factor 'Marine Fauna' is:

> ***'To protect marine fauna so that biological diversity and ecological integrity are maintained.'***

4.3.2. Policy and Guidance

The following EPA policies and guidance have been considered in evaluating potential impacts on this factor:

- *Environmental Factor Guideline: Marine Fauna, EPA, Western Australia.* (EPA 2016e).

4.3.3. Receiving Environment

Studies of marine fauna that are relevant to the Proposal are identified in **Table 19**.

Table 19 Receiving Environment Studies – Marine Fauna

Author (Date)	Study
O2 Marine (2017a)	Onslow Marine Support Base Stage 2 – Ecological Site Investigation
CWR (2010)	A Description of Megafauna Distribution and Abundance in the SW Pilbara Using Aerial and Acoustic Surveys – Final Report 2010
Pendoley (2010)	Marine Turtle Beach Survey: Onslow Mainland Area and Nearby Islands 25 January – 6 February 2009
RPS (2010a)	Marine Turtles Technical Report
RPS (2010b)	Marine Mammals Technical Report
RPS (2010c)	Dugong Aerial Survey Report
URS (2010a)	Intertidal Habitats of the Onslow Coastline
URS (2010b)	Biota of subtidal habitats in the Pilbara Mangroves, with particular reference to the Ashburton Delta and Hooley Creek
URS (2010c)	Survey of Fish in Hooley Creek and North-eastern Lagoon of the Ashburton Delta
Kangas *et al.* (2006)	Development of biodiversity and habitat monitoring systems for key trawl fisheries in Western Australia
Bamford 2009	Survey for Migratory Birds in the Wheatstone LNG Project Area, November 2008 and April 2009. Wheatstone Project Draft EIS/ERMP Appendix K1.
Huisman (2008)	Marine Introductions into Western Australian Waters. Records of the Western Australian Museum 24: 323-366.

For the purposes of EIA, marine fauna are defined as: *Animals that live in the ocean or rely on the ocean for all or part of their lives.*

The marine waters within and adjacent to the Project area support a variety of fauna, several of which are listed as being of conservation significance and protected under the Commonwealth EPBC Act and/or State BC Act. Database searches of the online EPBC Act Protected Matters Search Tool (PMST) and DBCA *NatureMap* databases were conducted with a 10km buffer of the project area, along with a desktop review of relevant publications and reports, to conduct a Likelihood of Occurrence Assessment. A brief description of these species and their habitats within and adjacent to the Project Area is provided in **Appendix E**.

The list of conservation significant species with at least a moderate potential to occur in the SDP project area, with a focus on Beadon Creek, is provided in **Table 20**.

Table 20 Conservation significant marine fauna species likely to occur in the SDP Project area.

Class	Species Name	Common Name	EPBC Act Status	WC Act Status	IUCN Status
Mammal	*Dugong dugon*	Dugong	MM, Ma	OS	VU
Mammal	*Orcaella heinsohni*	Australian snubfin dolphin	M	P4	NT
Mammal	*Sousa sahulensis*	Australian humpback dolphin	M	P4	
Reptile	*Aipysurus apraefrontalis*	Short-nosed Sea snake	CE, Ma	CR	CR
Reptile	*Caretta caretta*	loggerhead turtle	E, MM, Ma	EN	EN
Reptile	*Chelonia mydas*	green turtle	V, MM, Ma	VU	EN
Reptile	*Crocodylus porosus*	salt-water crocodile	M, Ma	OS	LR/LC
Reptile	*Dermochelys coriacea*	Leatherback Turtle, Leathery Turtle, Luth	E, MM, Ma	VU	VU
Reptile	*Eretmochelys imbricata*	hawksbill turtle	V, MM, Ma	VU	CR
Reptile	*Natator depressus*	flatback turtle	V, MM, Ma	VU	DD
Shark	*Carcharodon carcharias*	White Shark, Great White Shark	V, MM	VU	VU
Shark	*Pristis clavata*	Dwarf Sawfish, Queensland Sawfish	V, MM	P1	EN
Shark	*Pristis zijsron*	green sawfish	V, M	VU	CR
Shark	*Rhincodon typus*	Whale Shark	V, MM	OS	VU
Shark	*Rhynchobatus australiae*	White spotted Guitarfish	-	-	VU

- EPBC Act (species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*): Ex = Extinct, CE = Critically Endangered, E = Endangered, V = Vulnerable, M = Migratory, MM = Migratory Marine, MT = Migratory Terrestrial, MW = Migratory Wetlands, Ma = Listed Marine
- WC Act (species listed under the Western Australian *Wildlife Conservation Act 1950*):
    - Threatened Species: EX = Presumed Extinct, CR = Critically Endangered, EN = Endangered, VU = Vulnerable, IA = Migratory birds protected under an International Agreement, CD = Conservation Dependent, OS = Other Specially Protected
    - Priority Species: P1 = Priority 1, P2 = Priority 2, P3 = Priority 3, P4 = Priority 4
- IUCN (species listed under the International Union for Conservation of Nature (IUCN) Red List of Threatened Species): EX = Extinct, EW = Extinct in the Wild, CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened, LC = Least Concern , LR = lower Risk, DD = Data Deficient

Mammals

Listed threatened marine mammals from the database searches include the humpback whale (*Megaptera novaeangliae*), dugong (*Dugong dugon*), Australian snubfin dolphin (*Orcaella heinsohni*) and Australian humpback dolphin (*Sousa sahulensis*). All threatened species are also listed as migratory. A further three whale species and six dolphin species are listed as migratory and/or marine under the EPBC Act (O2 Marine 2017a).

Humpback Whale

Humpback whales migrate annually from Antarctic feeding grounds to the Kimberley coast for calving during the winter. The humpback whales predominantly occur further offshore. The southern migration is the period when they are closest to shore at an average of 36 km although have been recorded in waters less than 10 m deep during the latter part of the migration (September to November). Other whales recorded in the region are believed to only transit through oceanic waters well offshore from the shallow waters of the Proposal Area (CWR, 2010; RPS 2010b).

Dugong

Exmouth Gulf and Ningaloo Reef to the south of Onslow are recognised biologically important Dugong (*Dugong dugon)* habitats, each with about 1,000 individuals (Grech 2012). Some Dugong populations migration may be driven by food availability (Gales 2004) possibly by water temperature (Sheppard et al. 2006). Dugongs are known to feed on and have strong associations with seagrass communities. During 26 aerial surveys completed 2009-2010, a total of 169 dugongs were recorded (CWR 2010). Individuals were sighted in all but six of the of the 26 flights. RPS (2010c) estimated population in the Onslow region at 287 individuals. Numbers may be highest during June to September; however, it is also considered that at least some Dugongs are resident in the area year-round (CWR 2010). There were higher densities of dugongs observed in an area east of Coolgra Point (CRW 2010; RPS 2010c).

Dolphins

The Australian humpback dolphin and Indo-Pacific bottlenose dolphin (*Tursiops aduncus*) are likely to be the most abundant dolphin species in the proposal area inside the 20 m isobath. The Australian snubfin dolphin has also previously been recorded in the region but is presumed to be an occasional visitor from the Kimberley region. These dolphin species occur throughout the region likely to be present in shallow and nearshore waters of the Onslow region at any time. Other species of dolphin most likely occur further offshore from the proposal depths (CWR 2010; RPS 2010b).

Reptiles

Listed threatened reptiles from the database searches include five turtle species, the short-nosed sea snake (*Aipysurus apraefrontalis*) and the salt-water crocodile (*Crocodylus porosus*). Only the short-nosed sea snake is not also listed as migratory. A further 13 sea snake species are listed marine under the EPBC Act (O2 Marine 2017a).

Salt-water Crocodile

A salt-water crocodile (*Crocodylus porosus*) was anecdotably observed in Beadon Creek in 2012, however, no further sightings have been reported. It is further noted, that the DAF is outside of the typical range of the salt-water crocodile and does not include any particular habitat preferences of this species.

Turtles

Green turtles (*Chelonia mydas*) and flatback turtles (*Natator depressus*) are known to occur in the Onslow region during all sensitive life-history phases (mating, nesting and inter-nesting) and may be present all year round. Loggerhead turtles (*Caretta caretta*) and hawksbill turtles (*Eremochelys imbicata*) are less abundant and their distribution in the Onslow region is unclear. Leatherback (*Dermochelys coriacea*) and olive ridley turtles (*Lepidochelys olivacea*) have not been previously recorded in the Onslow region, nor are they known to nest in the Pilbara. The Pilbara is known to be used for nesting by four species of turtles. Nesting activity is generally greater on the islands than on the mainland. The flatback, green, hawksbill and loggerhead turtle rookeries in the Pilbara are considered significant to the populations of these species throughout north-west Australia. Peak nesting periods vary slightly between species, as do preferred nesting and foraging habitats (RPS, 2010a).

There is very little nesting activity on the mainland beaches between Locker Point and Onslow. A snapshot survey of turtle nesting activity was undertaken in February 2009 (Pendoley, 2010). Flatback turtles were predominantly found nesting on nearshore islands with smaller aggregations on the mainland and the south coast of Thevenard Island. Green turtles were found to nest predominantly on outer islands such as Bessieres, Serrurier and the north and west coasts of Thevenard Island. Only one hawksbill nest was documented during the survey period at Bessieres Island and no loggerhead turtle nesting was found in the Onslow region. On the mainland, low density flatback turtle nesting was observed on a beach adjacent to the Ashburton delta approximately 4 km west of Ashburton North. A secondary survey of this beach in December 2009 by RPS (2010a) suggests that approximately 20 to 35 flatback turtles attempt to nest each night at the peak of the flatback turtle season, and that five to nine of these turtles were successful (RPS 2010a). Most of the turtle's nest towards the eastern end of the beach. This survey also recorded fresh flatback turtle nesting tracks on Ashburton Island (RPS 2010a).

Previous surveys have indicated that 'low level' flatback turtle nesting may occur elsewhere on the mainland. At Onslow's Sunset Beach (known as "back beach") area, two nests were recorded during a survey undertaken by AECOM (Pendoley 2010) and a similarly low level of flatback turtle nesting has also been recorded between Beadon Point and Coolgra Point (RPS 2010a). The nesting activity observed on the mainland beaches in both studies was very low density with large sections of beach apparently not used. The results of the surveys indicate that most marine turtle nesting that occurs on mainland beaches in the Onslow region is by flatback turtles at the Ashburton River delta beach, approximately 4.5 km west of Ashburton North. The level of flatback turtle nesting along mainland

beaches is not regionally or even locally significant and none of the mainland beaches surveyed are considered to support locally or regionally significant breeding colonies (Pendoley 2010).

The most abundant turtles in the area are typically Green turtles observed around the islands (CWR 2010, RPS 2010a). These turtles are likely to be residents at their foraging grounds. Foraging Green turtles are likely to be found in seagrass and algal habitats near the Onslow region, and may utilise mangrove habitats (Pendoley 2010). A boat-based survey found 104 turtles from 92 transects covering 28 km^2 of the sea surface within the Onslow region. Highest turtle densities (82.7%) were observed at shallow offshore reefs, suggesting this habitat is important compared with adjacent inter-reef habitat characterised by unconsolidated sediment (RPS 2010a). Very few loggerhead (3) and flatback (2) turtles were recorded during the boat-based foraging survey, 69 (66%) green turtles were recorded and 30 turtles could not be identified. Aerial surveys during mid-May 2009 to April 2010 counted 2,152 turtles and these were predominantly located inside the 50 m depth contour (CWR 2010), but species could not be distinguished from the air. Turtle numbers sighted during flights varied from 3 to 261 over all surveys with no obvious temporal pattern, and likely influenced by sea state conditions for observations.

An aerial survey for dugongs undertaken of the Onslow region and Exmouth Gulf in August 2010 also recorded incidental observations of sea turtles. A total of 170 individual turtles were recorded within the Onslow region, compared to 134 individual turtles from Exmouth Gulf (RPS 2010). Very few turtles were observed close to the coast (<5 km) in the Onslow region, with the mean distance recorded at 22 km from the mainland. Turtles were commonly observed near reefs, both fringing and submerged, with mention of large aggregations around habitats fringing Thevenard Island (RPS 2010c).

Adult green turtles can migrate thousands of kilometres between foraging areas and breeding areas (RPS 2010a). The average migration distance of green turtles nesting at the GBR is approximately 400 km. Within their foraging habitats green turtles are typically sedentary. During the inter-nesting period, green turtles appear to remain within shallow nearshore waters (<20 m) (RPS, 2010e).

A satellite tagging study of six flatback turtles from Ashburton Island found that these turtles typically remain nearshore between Ashburton River and Coolgra Point (i.e. approximately 35 km) during the inter-nesting period (RPS 2010e). No preference for any area was observed along this coast during this time. The benthic habitats within this stretch of coastal sea (i.e. soft sediments with sparse macroalgae and filter feeders) are widespread. The mean re-nesting interval for tagged flatback turtles was 15 days. Two of the six turtles from Ashburton Island were recorded also nesting at nearby islands (i.e. Direction Island, Thevenard Island) during the same season, indicating nesting site fidelity is not exclusive. The mean dive depth during the inter-nesting period was 10 m and maximum dive depth 20 m which correspond with the bathymetry of their location. All six turtles undertook post-nesting circular movements for a short period (i.e. 3-20 days), typically remaining in the nearshore area before commencing post-nesting migration. Three tagged flatback turtles were tracked following a similar pathway to other flatback turtles from Barrow Island, Roebuck Bay and Cemetery Beach, (and observed in green and hawksbill turtles), towards the Kimberley region.

These three turtles displayed the behavioural characteristic of milling around the mouth of rivers, which were proposed to take advantage of food sources that flush out of the river systems. The other three tagged flatback turtles remained in the Pilbara region migrating between 73 and 291 km north-east to the Dampier Archipelago and Barrow Island between depths from 20 m to 100 m (RPS 2010e).

Flatback turtles make long reproductive migrations (RPS 2010a). Satellite tracking of flatback turtles from Barrow Island suggest that these turtles migrate along the north coast from the Pilbara and into the Kimberley region on the conclusion of the nesting season. However, some individuals remain in the Pilbara during the inter-nesting period (RPS 2010a).

Sea Snakes

Sea snakes are not well researched in the Pilbara, but they have been reported in a trawl net study in the Onslow Region and Exmouth Gulf (Kangas et al. 2006). Five species were recorded including the Critically Endangered short-nosed sea snake (*Aipysurus apraefrontalis*) and listed marine species dubois' sea snake (*Aipysurus duboisii*), olive sea snake (*Aipysurus laevis*), olive-headed sea snake (*Disteira major*) and stoke's sea snake (*Disteira stokesii*).

Sharks and Rays

Listed threatened elasmobranchs from the database searches include two sawfish species, the whale shark (*Rhincodon typus*), white shark (*Carcharodon carcharias*) and whitespotted guitarfish (*Rhynchobatus australiae*). Of these species, the whitespotted guitarfish is the only species not listed as migratory. One sawfish species and two species of Manta Ray are also listed as Migratory under the EPBC Act.

Sawfish

Northern Australia boasts four of the world's five sawfish species, and each is listed as either *Critically Endangered* or *Endangered* at the international level (IUCN Red List), with each having a population trend that is decreasing (Dulvy et al. 2016). Three species of sawfish are known from the Onslow area, including the green sawfish (*Pristis zijsron*), freshwater sawfish (*Pristis pristis*) and the narrow sawfish (*Anoxypristis cuspidata*). The dwarf sawfish's (*Pristis clavata*) may also occur in the Onslow region. Freshwater Sawfish are essentially diadromous, with pups born in the estuary, where they migrate to freshwaters until they mature and eventually enter marine waters (Morgan et al. 2012). Data on Green Sawfish are limited, but in the Onslow area, they are known to be pupped near the Ashburton River mouth, where they have a high site fidelity for at least 3 to 6 months. Older juveniles utilise the Ashburton River estuary and nearby mangrove creeks, before moving offshore to mature at a length of about 3 m (Morgan et al. 2015).

There has been no targeted sampling for sawfish in Beadon Creek. However, a recently removed Green Sawfish rostrum was found at Beadon Creek, suggesting that the individual was captured there. Based on the results of the acoustic study, it is also suggested that the mouth of Beadon Creek is likely to be visited by larger (1+ year old) individual Green Sawfish on a regular basis,

particularly during periods of high freshwater discharge, when Green Sawfish leave and are absent from the Ashburton River mouth (Morgan et al. 2012). There is some ontogenetic depth partitioning of Green Sawfish in the Onslow region (Four Mile Creek, Hooley Creek, Ashburton delta), with neonates occupying the extreme shallows, and deeper habitats utilised with increasing size.

Other Sharks & Rays

Shovelnose rays (*Rhynchobatus australiae*) are listed as IUCN *Vulnerable* and were captured in trawl nets from three surveys of Exmouth Gulf and Onslow (Kangas et al. 2006). This species inhabits inshore waters, occurring on soft bottoms near reefs (Fishes of Australia 2019) and has moderate potential to occur in Beadon Creek.

The whale shark was spotted during aerial surveys of the region approximately 30-50 km offshore of Onslow (CWR 2010).

White sharks have been spotted feeding on whale carcasses in the region although the distribution is typically further south (O2 Marine 2017a).

Manta rays have been frequently sighted and are known to be sparsely distributed in depths further offshore of 50-150 m (CWR 2010).

Scaly Fishes & Crustaceans

Database searches found 29 listed marine species from the order Sygnathiformes which includes the family Sygnathidae (seahorses, pipefishes, pipehorses and seadragons) and the genus *Solenostomus* (ghost pipefishes) (O2 Marine 2017a). Four species of seahorse were captured in the trawl net from three surveys of Exmouth Gulf and Onslow between March and November 2004 with diverse preferences for suitable BCH ranging from soft bottom debris, algal rubble reefs, seagrass beds and coral reefs (Kangas et al. 2006).

Juveniles of many marine species utilise nearshore areas such as Beadon Bay and mangrove areas like in Beadon Creek as habitat. This includes many species of prawn, such as the commercially important Banana Prawn (*Penaeus merguiensis*). Post-larvae of this species settle in the upper reaches of small creek systems and the success of juvenile populations emigrating from the creeks correlates positively with rainfall during the wet season (Vance et al. 1998).

In general, the nearshore area of the Onslow region contains a low to moderate abundance of fish, with species richness typically ranging from low close nearshore to high further offshore (O2 Marine 2017a). Marine species within the nearshore area are predominantly tropical and are short lived with high productivity, resulting in life-history traits of high fecundity and high productivity and high input into reproduction during their relatively short life spans. Most species are locally and regionally widespread with dominant species comprising a high proportion (i.e. ~80-90%) of marine fauna present. Dominant fishes typically recorded are those known to inhabit muddy/sediment (trawling grounds) habitats which include ponyfish, goatfish, flathead or crabs and prawns, and the mantis shrimp. However, some dominant fish also suit reef and weed habitat (Kangas et al. 2006).

Commercial Fisheries

Commercial fisheries possibly occurring in the proposal area include (O2 Marine 2017a):

- Onslow Prawn Trawl Managed Fishery (OPMF)
- Sea Cucumber (Beche de Mer) Fishery
- Marine Aquarium Fish Managed Fishery
- Pearl Oyster Managed Fishery (Zone 1)
- Pilbara Line Fishery
- Pilbara Developmental Crab Fishery
- Specimen Shell Managed Fishery
- Western Skipjack Tuna Fishery
- Southern Bluefin Tuna Fishery
- Western Tuna and Billfish Fishery.

Consultation with commercial fishers was undertaken through WAFIC and the outcomes are presented in **Section 3.3**.

Invasive Marine Species

No introduced marine species listed as species of concern on the National Introduced Marine Pests Coordination Group have been recorded in the Onslow region (Huisman et al. 2008). One introduced species, the barnacle *Megabalanus tintinnabulum* has been recorded in Onslow (Huisman et al. 2008). This species is not considered a pest and has been recorded at several other WA ports.

4.3.4. Potential Impacts

Potential impacts to marine fauna may occur through construction and operational activities from the SDP desalination proposal.

Construction Phase Impacts

During the construction phase of the Proposal, the following activities and resulting impacts have the potential to adversely affect the Marine Fauna in the vicinity of the proposed DAF:

1. Disturbance/removal of marine fauna habitat through construction activities.
2. Disturbance of fauna arising form additional light sources associated with construction activities.
3. Disturbance of fauna arising from additional noise sources associated with construction activities.

Operational Phase Impacts

The following post-construction or operational phase impacts have the potential to adversely impact on marine fauna in the vicinity of the proposed DAF.

4. Artificial light emissions from SDP facility causing disturbance to marine fauna.
5. Physical entrainment of marine fauna at seawater intake.
6. Reduction in water quality (i.e. localised changes in water temperature, salinity and dissolved oxygen) within the proposed LEPA.

4.3.5. Assessment of Impacts

Construction Phase Impacts

Disturbance/removal of marine fauna habitat through construction activities (1).

The area of subtidal BCH to be disturbed during construction of the SDP facility represents a narrow corridor of predominantly bare sand with occasional sparse cover of macroalgae and filter feeders. This habitat is widespread throughout the region and as such any localised impacts are unlikely to result in any substantial changes to the abundance and diversity of the fish and invertebrate communities of the Onslow region.

No critical habitats for conservation significant marine fauna are present within or adjacent to the DAF, therefore no impacts to conservation significant species are predicted as a result of habitat loss.

Disturbance of fauna arising from additional light sources associated with construction activities (2).

Light pollution is defined as excessive or obtrusive artificial light, which itself is distinct from natural light in five main ways: source, scattering, reflection, directivity and direction. DSEWPAC (2012) classifies turtles as “Concern” in relation to the vulnerability of these animals to artificial lighting, dugongs, sawfish and finfish are classified as “less concern”.

The proposed SDP DAF is in the immediate vicinity of town of Onslow, and the existing working Onslow Port, including the Beadon Creek Maritime Facility and OMSB. As such numerous artificial light sources are already present in and around the proposed DAF. The beach which occurs within the DAF has not previously been known to represent existing critical habitat for nesting turtles.

Any artificial lighting present during construction is expected to be lost within the existing light sources already present in the construction area.

Disturbance of fauna arising from additional noise sources associated with construction activities (3).

Anthropogenic noise poses a threat to some marine fauna species because it may mask sounds that are vital for their essential activities and behaviours, modify behaviour through attraction and avoidance to sound or cause temporary or permanent physical injury (DSWEPaC 2012). Humpback whales, dolphins and turtles are classified as “potential concern” in relation to the vulnerability of the animals to underwater noise, and dugong are classified as “less concern”.

Underwater noise may pose a potential disturbance to marine fauna during installation of the intake/outfall pipeline. Water Corporation has a preference for HDD installation of the intake / outfall pipeline which in studies for similar facilities has been predicted to result in peak sound pressures of between 135 and 190 db in the immediate vicinity of the activities (Water Corporation 2019). This assessment concluded that constant noise at these levels is not sufficient to cause injury to marine fauna but may cause behavioural responses in the form of avoidance of approximately a 300 m radius (Water Corporation 2019). However, this impact will be localised and temporary and the noise generated will be substantially less than a conventional cut and cover construction methodology

Furthermore, the shallow nature of the marine environment in the vicinity of the disturbance area will substantially limit propagation of underwater noise into the offshore areas that are known to be important habitat areas for humpback whales, dolphins, dugong and turtles.

If trenching or cut and cover is required for pipeline installation then it is noted that this activity is likely to be at the lower end of the noise spectrum with regards to emitted sound pressure levels in aquatic environments (CEDA 2011). The source sound pressure of underwater noise from a CSD ranges from 172 to 185 dB re 1 µPa, with peak intensity between 100 and 500 Hz (CEDA 2011). The sensitive auditory ranges of marine fauna species compared with the predicted noise frequencies from dredging indicate that the frequencies are at the lower end of hearing sensitivity for toothed whales and sirenians, and within the hearing range for baleen whales, turtles, sharks, bony fish and prawns.

It is likely that in the case of either installation option, soft start procedures are likely to be sufficient to mitigate any impacts to marine fauna.

Operational Phase Impacts

Artificial light emissions from SDP facility causing disturbance to marine fauna (4).

For marine turtles, light pollution along, or adjacent to, nesting beaches or rookeries may cause alterations to critical nocturnal behaviours, particularly the selection of nesting sites and the passage of emerging turtle hatchlings from the beach to the sea. Potential impacts include a decrease in nesting success, beach avoidance by nesting females and disorientation resulting in increased mortality.

As previously stated, there are already numerous artificial light sources present in and around the proposed DAF and the beaches in this area are not known to support nesting turtles. Nevertheless, lighting for the facility will consider design recommendations provided in the Environmental Assessment Guideline for Protecting Marine Turtles from Light Impacts (EPA, 2010).

It is further noted that the Wheatstone Project established 1.5 km distance from turtle nesting beaches as the area within which light emissions would need to be managed (Chevron, 2016). The known nearest turtle nesting beach to the proposed activities occurs on Direction Island, approximately 10 km north of the nearest point of the DAF. Two nests have been previously recorded between Beadon Point and Coolgra Point although this low level of nesting would not be regarded

as a turtle nesting beach (RPS, 2010a). The locations of those nests were unable to be determined although there is a high probability that these nests were located east of Beadon Creek along this 15 km stretch of beach.

Overall, the impact of artificial light emissions from the SDP facility based on the potential light spill and glow reaching significant turtle habitats and/or nesting beaches and rookeries is expected to be negligible.

Physical impingement / entrainment of marine fauna at seawater intake (5).

Physical impingement and/or entrainment of marine fauna is possible at the proposed seawater intake. However, after design and construction of several desalination plants across Western Australia, Water Corporation have adopted best-practice design principles for engineering of the SDP intake. Consistent with the design of other Water Corporation facilities, the intake will be engineered so that:

- the screen approach velocity is minimised to allow 33% occlusion by marine growth and ultimate velocity of 0.15 m/s to allow small fish to escape
- the intake is located ~2 m above the seabed to reduce potential for demersal species to enter.

Whilst best efforts are made to prevent impingement or entrainment of larger marine species, marine larvae are at particular risk of entrainment as they are passive particles in the water column and typically of a size that can pass through intake screens (Water Corporation 2019). However, the waters surrounding the proposed intake are not known to support any spawning aggregations and any entrainment of larval species within the proposed intake is considered to be negligible in the context of the surrounding waters.

Reduction in water quality (i.e. localised changes in water temperature, salinity and dissolved oxygen) within the proposed LEPA (6).

Increases in salinity and temperature and potentially declines in dissolved oxygen have the potential to cause stress or even death of marine fauna if they are exposed to degraded conditions for extended periods. However, given that the spatial extent of any physico-chemical water quality changes is limited to within 50 m of the proposed diffuser location, it is unlikely that any conservation significant marine fauna would be exposed to degraded water quality for sufficient period to cause any harm to either individuals or populations.

Benthic infauna in sediments within the 50 m LEPA are likely to be more negatively affected, due to their lack of behavioural (motile) ability and the fact that highest salinity, temperature and lowest dissolved oxygen is expected at the seafloor in stratified worst-case conditions. Although it is noted that the existing benthic infauna assemblages already occur in this area in abundance and diversity, indicating that conditions in this area are already marginal to support significant benthic infauna populations.

Changes to water quality are discussed further in relation to MEQ in Section 4.2

4.3.6. Mitigation

Mitigation measures proposed to minimise potential impacts on the environmental factor 'Marine Fauna' are described in **Table 21** and are presented in accordance with the EPA's mitigation hierarchy (Avoid, Minimise, Rehabilitate[3]).

[3] Rehabilitation measures are excluded from Table 24 as these are not expected to be required to mitigate impacts to marine environmental quality.

Table 21 Mitigation measures to minimise impacts on Marine Fauna

Potential Impact	Avoidance	Minimisation	Residual Impact
Construction Phase Impacts *Construction phase impacts will be managed through the development and implementation of a CEMP. The following mitigation measures will be included in the CEMP to mitigate impacts on Marine Fauna.*			
Disturbance/removal of marine fauna habitat (1).	> Siting of the facility and associated infrastructure has been done to ensure that no critical marine fauna habitats are impacted. > HDD is proposed for installation of the pipeline to mitigate potential indirect impacts associated with increased turbidity.		No residual impacts to marine fauna are predicted.
Disturbance of fauna arising from light sources during construction (2).	> Avoid night works wherever possible.	> Use of wildlife friendly lighting on construction vessels.	No residual impacts to marine fauna are predicted.
Disturbance of fauna arising from additional noise sources (3).	>	> Soft-start procedures applied to all marine construction works. > Construction crew to include at least one trained marine fauna observer.	No residual impacts to marine fauna are predicted.
Operational Phase Impacts *Operational phase impacts will be managed through implementation of the OMEMMP. The following mitigation measures will be included in the CEMP to mitigate impacts on Marine Fauna.*			
Artificial light emissions from SDP facility (4).	> Siting of facility to avoid important marine fauna habitats.	> Use of wildlife friendly lighting on the facility.	No residual impacts to marine fauna are predicted.

Potential Impact	Avoidance	Minimisation	Residual Impact
Physical impingement / entrainment of marine fauna at seawater intake (5).	> Siting of facility to avoid important marine fauna habitats.	> the screen approach velocity is minimised to allow 33% occlusion by marine growth and ultimate velocity of 0.15 m/s to allow small fish to escape. > an intake screen bar will be in place to prevent large fish from entering. > the intake is located ~2 m above the seabed to reduce potential for demersal species to enter.	
Reduction in water quality within the proposed LEPA (6).	> Siting of proposed outfall (and associated LEPA) in an area that does not constitute critical habitat for any marine fauna species and is well represented in the region.	> The EPA (2016d) recommends a preference for the Low LEP to be designated no more than 70 m surrounding a proposed outfall. However, hydrodynamic modelling (barid 2020) demonstrated that the number of dilutions required to achieve the relevant SPL at the Low/High LEP Boundary was easily achieved within 50 m, therefore, a Low LEP is proposed within 50 m surrounding the proposed outfall diffuser options. > A OMEMMP has been developed to monitor and manage water quality monthly during the life of the operation. >	Any impacts are limited to the LEPA. No impacts to important habitat areas for marine fauna.

4.3.7. Predicted Outcomes

Implementation of the Proposal in accordance with the defined mitigation and management actions will result within the following Environmental Protection Outcomes for marine fauna:

- no harm to conservation significant marine fauna species
- no loss of critical habitat for any marine fauna species
- potential temporary, localised disturbance to marine fauna species (i.e. fish, dolphins, dugong) during construction of the intake/outfall pipeline
- potential avoidance of waters surrounding the proposed outfall due to altered physico-chemical conditions in this area
- potential changes in population diversity and abundance of infauna communities within the LEPA arising from changed altered physico-chemical conditions in this area.

The combined impact of the Proposal activities and the consequent outcomes are not considered to pose any significant risks to the marine fauna and therefore marine fauna are protected from significant harm. In respect of the proposed design and management of the Proposal, the Proponent considers that the EPA's objective for marine fauna has been met.

4.4. Flora and Vegetation

4.4.1. EPA Objective

The EPA's objective for the factor 'Flora and Vegetation' is:

'To protect flora and vegetation so that biological diversity and ecological integrity are maintained.'

4.4.2. Policy and Guidance

The following EPA policies and guidance have been considered in evaluating potential impacts on this factor:

- *Environmental Factor Guideline: Flora and Vegetation* (EPA 2016g)
- *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016h).

4.4.3. Receiving Environment

Studies of flora and vegetation that are relevant to the Proposal are identified in **Table 22**.

Table 22 Receiving Environment Studies - Flora and Vegetation

Author (Date)	Study
Biota (2020)	Onslow Desalination Plant and Pipeline Flora and Fauna Survey. Prepared for Water Corporation. Leederville Western Australia.
Ecoscape (2019)	Beadon Creek Reconnaissance Flora and Fauna Survey. Prepared for Water Corporation. 4286-18R-1. North Fremantle, Western Australia.
Earth Stewardship (2017)	Onslow Marine Support Base Stage 2 – Pipeline and DMMA Botanical Surveys
O2 Marine (2017a)	Onslow Marine Support Base Stage 2 – Ecological Site Investigation
Biota (2013)	Desktop review of the proposed Onslow Micro-Siting Survey Area. Prepared for Chevron Australia.
ENV Australia (ENV) (2012)	Onslow Light Industrial Area Flora, Vegetation and Fauna Assessment. Prepared for Shire of Ashburton 11/097. ENV Australia Pty Ltd.
ENV (2011)	Onslow Townsite Strategy Flora, Vegetation and Fauna Assessment. Perth, Western Australia: ENV Australia Pty Ltd.

Biota (2020) summarised the results of past flora and vegetation surveys completed within the vicinity of the proposed DAF. The focus of the review was to identify records of TECs, PECs, and flora species of conservation significance known from the locality (Biota 2020). A list of past relevant studies is included in **Table 23.**

These surveys represent “snap-shot” assessments of the flora at a particular time, and that further species would likely be recorded with additional survey work. The species lists should therefore be taken as indicative rather than exhaustive.

Table 23 Summary of major flora and vegetation surveys completed near the proposed SDP.

Survey	Survey Details	Size of Area	No. of Native Taxa	Features of Conservation Significance / TECs and PECs / Threatened and Priority Species
Onslow Solar Salt field Annual Environmental Report (Biota 2018)	Annual Environmental Report: August 2018	23.626 ha	Not applicable	• No TECs or PECs • No Threatened flora • One Priority 3 flora species; *Stackhousia clementii*

Survey	Survey Details	Size of Area	No. of Native Taxa	Features of Conservation Significance / TECs and PECs / Threatened and Priority Species
Flora and Vegetation of the CS2 Tubridgi Wheatstone Gas Pipeline Proposal Area (Mattiske 2013)	Flora and vegetation survey: April 2013	110 km inear corridor	• 139 taxa • 80 genera • 28 families	• No TECs or PECs • No Threatened flora • One Priority 3 flora species; *Eremophila forrestii* subsp. *Viridis.*
Wheatstone Rare Flora Survey (Biota 2011)	Rare flora searches: March 2011	Greater Onslow locality.	Not applicable	• No TECs or PECs • No Threatened flora • One Priority 1 flora species; *Abutilon* sp. Onslow (F. Smith s.n. 10/9/61). • Three Priority 3 flora species: *Eleocharis papillosa, Eremophila forrestii* subsp. *viridis, Triumfetta echinata.*
A Vegetation and Flora Survey of the Wheatstone Study Area near Onslow (Biota 2010a)	Flora and vegetation survey: March & April 2009	9,794 ha	• 418 taxa • 162 genera • 58 families	• No TECs or PECs • Vegetation considered to be of high conservation significance: Inland linear sand dunes (units ID1, ID2), and Mangal vegetation (unit T2). • No Threatened flora. • One Priority 1 flora species: *Abutilon* sp. Onslow (F. Smith s.n. 10/9/61). • Four Priority 3 flora species: *Atriplex flabelliformis, Eleocharis papillosa, Eremophila forrestii*

Survey	Survey Details	Size of Area	No. of Native Taxa	Features of Conservation Significance / TECs and PECs / Threatened and Priority Species
				subsp. *viridis, Triumfetta echinata.*
Wheatstone Project Flora and Fauna Assessment Addendum (Biota 2010b)	Desktop assessment: May 2010	3,423 ha	• 422 taxa • 161 genera • 58 families	• No TECs or PECs • No Threatened flora • Four Priority 3 flora species; *Atriplex flabeliformis, Eleocharis papilosa, Ermophila forrestii* subsp. *Virdis, Triumfetta echinate.*
Wheatstone Amendment Area – Flora and Vegetation Assessment (Outback Ecology 2010)	Flora and vegetation assessment: January 2010	3,423 ha	• 96 taxa • 56 genera • 29 families	• No TECs or PECs • No Threatened flora. • One Priority 3 flora species: *Eremophila forrestii* subsp. *viridis*.
Baseline Flora and Vegetation Survey - Ashburton North Pipeline Route Option 3 (RPS Australia 2009)	Flora and vegetation survey: November 2008	100 km linear corridor	• 187 taxa • 96 genera • 37 families	• No TECs or PECs • No Threatened flora. • One Priority 3 flora species: *Triumfetta echinata.*
Wheatstone Camp and Gas Pipeline: Native Vegetation Clearing Permit Report (Biota 2009)	NVCP survey: April 2009	3,766 ha	Camp NVCP: • 145 taxa • 88 genera • 31 families Pipeline NVCP: • 218 taxa • 109 genera • 43 families	• No TECs or PECs • Vegetation considered to be of high conservation significance: Inland linear sand dunes (units ID1, ID2) • No Threatened flora. • One Priority 1 flora species: *Abutilon* sp.

Survey	Survey Details	Size of Area	No. of Native Taxa	Features of Conservation Significance / TECs and PECs / Threatened and Priority Species
				Onslow (F. Smith s.n. 10/9/61). • Three Priority 3 flora species: *Eleocharis papillosa, Eremophila forrestii* subsp*. viridis, Triumfetta echinata.*
West Pilbara Proposal Onslow Rail Route Flora and Vegetation Survey (Astron 2008)	Flora and vegetation survey: August & November 2008	150 km linear corridor	• 450 taxa • 156 genera • 51 families	• No TECs or PECs • No Threatened flora. • Two Priority 3 flora species: Atriplex flabelliformis, Eremophila forresti subsp. viridis. • One Priority 4 flora species: Goodenia nuda.
Flora & Vegetation Survey - Ashburton North Project Area (Onshore 2009)	Flora and vegetation survey: August 2008	405 ha	• 183 taxa • 118 genera • 47 families	• No TECs or PECs • Vegetation types of high conservation value: tidal flats and associated mangrove vegetation, linear dunes interspersed with claypans and broader saline drainage areas. • No Threatened flora. • Two Priority 1 flora species: *Abutilon* sp. Onslow (F. Smith s.n. 10/9/61), and *Helichrysum oligochaetum.* • One Priority 3 flora species: *Carpobrotus* sp.

Survey	Survey Details	Size of Area	No. of Native Taxa	Features of Conservation Significance / TECs and PECs / Threatened and Priority Species
				Thevenard Island (M. White 050).
Chevron Domgas Project: Onslow – Flora and Vegetation Assessment (Validus 2008)	Flora and vegetation survey: March 2008.	190 ha	• 95 taxa • 76 genera • 32 families	• No TECs or PECs • Two reservation priority ecosystems: succulent steppe (samphire) and mudflats (bare areas). No Threatened flora. • No Priority flora.
A Vegetation and Flora Survey of Additional Infrastructure Areas of the Proposed BHP Billiton Pilbara LNG Project (Biota 2007)	Flora and vegetation survey: August 2006	1,305 ha	• 242 taxa • 140 genera • 47 families	• No TECs or PECs • Vegetation considered being regionally and locally significant: samphire shrublands of saline flats (units SF. SF.2, SF.3, and SF.4), and ephemeral bare claypans (unit BCp). • No Threatened flora. • No Priority flora.
Onslow Strategic Industrial Area Flora Survey (Biota 2006)	Flora and vegetation survey: October 2005	~500 ha	• 158 taxa • 95 genera • 41 families	• No TECs or PECs • No Threatened flora. • No Priority flora.
BHP Billiton Pilbara LNG Project: Flora and Vegetation Study (Biota 2005)	Flora and Vegetation survey: June 2005	490 ha	• 158 taxa • 95 genera • 41 families	• No TECs or PECs • No Threatened flora. • No Priority flora.

Onslow SDP 2019 Reconnaissance Survey (Ecoscape 2019)

Ecoscape undertook a reconnaissance flora survey on a now outdated DAF in April 2019. Whilst the survey area was slightly different to the current DAF, some overlap areas exists and the remaining areas are within close proximity and still considered relevant to the proposal. Key findings of the 2019 survey include:

- Two Priority Ecological Communities identified within 50 km of the proposed DAF (old) area, both of which are at least 25 km from the survey area
- Seven conservation significant vascular flora taxa (two Priority 1 and five Priority 3) are known to occur within 50 km of the survey area. Two of these (*Eremophila forrestii* subsp. *viridis* and *Triumfetta echinata*) have been previously recorded from within the survey area and a further four were considered to have a possible likelihood of occurrence
- 76 vascular flora taxa:
    - none of conservation significance (i.e. no Threatened or Priority Flora species) or any other significance
    - four introduced flora, none of which are Declared Pest plants under the *Biosecurity and Agriculture Management Act 2007* or a Weed of National Significance (WONS).
- Nine vegetation types from four broad landform types (tidal mud flats/pans, non-tidal clay pans probably previously tidal but now isolated from the coast due to infrastructure, sand dunes and a low calcrete rise). None of the vegetation types were considered of conservation or other significance.

Onslow SRWO 2020 Detailed Survey (Biota 2020)

The proposed intake/diffuser and processing facility location changed in late 2019, resulting in a revised DAF. To account for this change, a single-phase detailed flora and vegetation survey specific to the updated proposed DAF was undertaken by Biota in June 2020. Key findings of this survey include:

A total of 74 native flora and seven introduced flora species were recorded from within the study area, and species diversity was as expected. No occurrence of any TECs were recorded, additionally, suitable habitat for TECs known to the Pilbara and Carnarvon bioregions is absent from the Ashburton locality. No PECs were recorded during the survey, however, one species *Whiteochloa airoiddes* has been recorded within 25 km of the study area (Thevenard Island), and also 35 km away on Airlie Island. Therefore, it is considered that this PEC has potential to be present within the study area.

Identified Vegetation Associations

Four main vegetation associations were identified during the June 2020 survey, they are shown in **Figure 11** and include:

- S1: *Spinifex* over *Ipomoea* on Primary Dune

- A1: *Acacia* over Triodia on Secondary/Tertiary Dunes
- T1: *Tecticornia* over *Sporobolus*
- CR: Cleared or Roadside vegetation

Areas devoid of vegetation were also noted, this category was made up of roads and unsealed tracks, mixed land use/buildings (ML) and ocean/beach (OB).

T1 (*Tecticornia* over *Sporobolus*) is considered to be of elevated conservation significance locally, in that is represents saltmarsh vegetation that is considered to be of high reservation priority. This unit occupied 0.71 ha of the study area. The remaining vegetation types in the study area are considered to be of lower conservation significance, being representative of the vegetation occurring in similar habitats throughout the locality (Biota 2020).

No threatened flora were recorded from the study area, and based on habitat preferences and existing distributional data, none are expected to occur. Additionally, no Priority flora species were recorded from within the study area (Biota 2020).

A total of seven introduced flora, including two naturalised taxa, were recorded, with an abundance of weed species along the roadside within the pipeline corridor. One of the species recorded, *Tamarix aphylla* (Athel Pine), is listed as a WONS and as a Declared Pest for the Shire of Ashburton under the WA *Biosecurity and Agriculture Management Act 2007* (Biota 2020).

Condition of Vegetation Units

The vegetation condition assessments were based on the ranking scale of EPA (2016h) and are shown in **Figure 12**. The rankings considered the degree of invasion by introduced flora (weeds), impact from historical and ongoing human activity, and the structural integrity of the vegetation.

Biota (2020) found that the spread of introduced flora taxa contributed to habitat deterioration and degradation, with a large proportion of the study area (37.8%) cleared and or did not receive a condition rating. Most of the remaining vegetation was either considered to be 'Very Good' to 'Good' (totalling 55%); **Table 24**.

Table 24 Extent of vegetation condition categories for June 2020 survey (Biota 2020).

Condition Ranking	Area (ha)	Proportion of Study Area (%)
Excellent	-	-
Very Good	16.66	42.7
Good	4.81	12.3
Poor	2.38	6.1
Degraded	-	-
Completely Degraded	0.05	

The main disturbance factor was weed invasion, predominantly by **Cenchrus ciliaris* (Buffel Grass), **Stylosanthes hamata* (Verano Stylo) and **Aerva javanica* (Kapok Bush). Relatively dense patches of these weed species occurred through the entirety of the study area and were present along the edges of most roads, tracks, and other cleared areas (Biota 2020).

Figure 11 Vegetation associations and sampling sites for June 2020 survey (Biota 2020).

Figure 12 Vegetation condition and introduced flora for June 2020 survey (Biota 2020)

4.4.4. Potential Impacts

The Proposal will result in a total direct loss of up to 8 ha of native vegetation and flora, all of which is located across the primary, secondary and tertiary dune system in the northern section of the DAF (**Figure 11**). The vegetation clearance area (8 ha) has been calculated based on the estimated disturbance footprint required for the proposed SDP processing facility, which is significantly less than the total allocated DAF (20.6 ha).

The pipeline route is comprised of cleared/roadside vegetation (CR) or roads and tracks. The limited vegetation along this route is no longer considered entirely natural vegetation due to clearing, colonisation of introduced species or planting of non-native species (Biota 2020). As a result, this vegetation type has not been considered in the total clearing area. (**Table 25**):

- Samphire Shrublands – Beach: 2.1 ha
- Coastal Plains: 13.4 ha
- Tidal Mudflat: 24.5 ha
- Cleared/Degraded: 4.0 ha.

Table 25 Estimated area of each vegetation association required to be cleared for SDP plant and pipeline route.

Vegetation Type	Total Area Surveyed (ha)	SDP Plant (ha)	Pipeline (ha)
Spinifex over Ipomoea on Primary Dune (S1)	3.58	0.72 (20%)	-
Acacia over Triodia on Secondary/Tertiary Dunes (A1)	16.34	7.25 (44%)	-
Tecticornia over Sporobolus (T1)	0.71	0 (0%)	-
Roadside vegetation (CR)	2	*N/A*	*N/A*
Cleared (CR)	5.54	*N/A*	*N/A*
Devoid of Vegetation (beach/roads/buildings)	10.85*	N/A	*N/A*
Total	**39.02**	**7.97**	**-**

N/A: Area does not include any natural vegetation and has not been considered in clearing area calculations.

It is noted that the SDP facility will be sited within the DAF to entirely avoid the *Tecticornia* over *Sporobolus* (T1) vegetation association.

The Proposal could also result in the indirect impacts to flora and vegetation through:

- possible introduction and/or spread of weeds to adjacent vegetation during construction activities
- increased dust on leaf surfaces during construction activities.

4.4.5. Assessment of Impacts

Native Vegetation Clearing

Proposed clearing of native vegetation will be undertaken in accordance with Water Corporation's State-wide Clearing Permit (CPS 185/8) and is not considered to represent a significant impact of flora and vegetation on the basis that:

- vegetation associations to be cleared are well represented in the region and are not considered to be regionally or locally significant
- no Threatened of Priority Ecological Communities occur within the proposed clearing area
- no threatened flora were recorded from the study area.

Indirect Impacts

Potential indirect impacts to adjacent flora and vegetation as a result of spread of weeds and/or dust generated from construction activities is considered to represent a low risk of causing environmental harm. However, through implementation of appropriate management strategies this risk is considered to be further reduced, such that the potential impacts are considered to be negligible.

4.4.6. Mitigation

Mitigation measures proposed to minimise potential impacts on the environmental factor 'Flora and Vegetation' are described in **Table 26** and are presented in accordance with the EPA's mitigation hierarchy (Avoid, Minimise, Rehabilitate[4]).

[4] Rehabilitation measures are excluded from

Table 18 as these are not expected to be required to mitigate impacts to marine environmental quality.

Table 26 Mitigation measures to minimise impacts on Flora and Vegetation

Potential Impact	Avoidance	Minimisation	Residual Impact
Construction Phase Impacts *Construction phase impacts will be managed through the development and implementation of a CEMP. The following mitigation measures will be included in the CEMP to mitigate impacts on Flora & Vegetation.*			
Direct Habitat Loss due to clearing	> Considering significant impacts to flora and fauna are minimal considering the targeted Level 1 ('Reconnaissance') survey undertaken by Ecoscape in 2019 along with database searches, did not identify any Threatened Ecological Communities (TECs) or Priority Ecological Communities (PECs) within the DAF. Seven (7) conservation significant flora species were listed as 'likely' to occur in the DAF (Ecoscape 2019), however, none of these species were identified in the DAF during the 2019 reconnaissance survey > No clearing of vegetation will occur without applicable clearing permits, nor will clearing outside the approved DAF be permitted. > No detrimental impacts to adjacent native vegetation following construction > No impact on conservation significant flora species.	> A Construction Environmental Management Plan (CEMP) will be developed and implemented to manage and minimise construction impacts on vegetation communities during the life of the operation. > Clearing will meet the principles outlined in the flora and fauna survey report and the State-Wide Clearing Permit (CPS 185/8).	No residual impacts are anticipated
Introduction and spread of weeds.	> All Proposal vehicles and plant will be screened for presence of weeds and treated according prior to entering Proposal site. > All Proposal vehicles and plan are not to access vegetated areas outside the Proposal boundary.	> A CEMP will be developed and implemented to manage and minimise construction impacts on vegetation communities during construction.	No residual impacts are anticipated
Dust generation from construction activities.	> Dust suppression will be utilised to avoid spread of construction dust (e.g. water trucks) where appropriate.	> Construction activities will be managed during high wind periods to reduce impacts. > A CEMP will be developed and implemented to manage and minimise	No residual impacts are anticipated

Potential Impact	Avoidance	Minimisation	Residual Impact
		construction impacts on vegetation communities during construction.	
Operational Phase Impacts *No Operational phase impacts on Flora and Vegetation were identified.*			

4.4.7. Predicted Outcomes

The SDP facilities and pipeline corridors will require the clearing of up to 8 ha of native vegetation. This clearing will be managed in accordance with principles outlined in the flora and fauna survey report and the Water Corporation's State-Wide Clearing Permit (CPS 185/8).

No impacts to rare flora species, TECs or PECs is predicted.

Construction activities also have the potential to spread invasive flora species to natural vegetation habitats, which have the potential to impact the biological diversity and ecological integrity of local vegetation habitats. However, with appropriate management through a CEMP, construction activities are not expected to have significant impact on the biological diversity and ecological integrity of local vegetation communities. In respect of the proposed design and management of the Proposal, the Proponent considers that the EPA's objective for flora and vegetation has been met.

4.5. Social Surrounds

4.5.1. EPA Objective

The EPA's objective for the factor 'Social Surrounds' is:

'***To protect social surrounds from significant harm***.'

The definition of 'Social Surrounds' in the EP Act encompasses the 'Environment, subject to subsection (2), means living things, their physical, biological and social surroundings, and interactions between all of these (Subsection 3(1))'. Subsection (1) includes 'mans aesthetic, cultural and economic and social surroundings to the extent that those surroundings directly affect or are affected by his physical or biological surroundings'.

The objective recognises the importance of ensuring that social surroundings are not significantly affected as a result of implementation of the proposal.

4.5.2. Policy and Guidance

The following EPA policies and guidance have been considered in evaluating potential impacts on this factor:

- *Environmental Factor Guideline: Social Surrounds* (EPA 2016h).

4.5.3. Receiving Environment

A review of existing publicly available information was conducted to identify if there are any known Natural, Historic or Aboriginal and cultural heritage sites, within the proposal area. In addition, information was collected on the economic and social surroundings of the proposal area.

Social Surrounds

Onslow is the oldest town in Ashburton Shire, supporting a population of around 857 people (Australian Bureau of Statistics 2016). The nearest residential zoning to the DAF is situated west of the northern portion of the DAF. Onslow residents utilise the marine waters and land surrounding Onslow for recreational activities including boating, fishing, snorkelling, swimming, marine fauna observing and physical exercise. The population of the town increases during the peak season (dry season) in May – September as visitors head to the region to share in these similar activities and experiences (Australian Bureau of Statistics 2016, Shire of Ashburton 2010).

Commercial operators and other industries also utilise the marine waters of Onslow for fishing and access to Beadon Creek which holds social and economic importance. Beadon Creek Harbour itself is situated to the east of the DAF, which runs north-south, flowing out into Beadon Bay. It is utilised by members of the Ashburton Anglers Fishing Club, OMSB, TAMS, Onslow Slat, Ashburton Fisheries and Fresh Fish Onslow as well as tourism operators and recreational fishers for launching and retrieving vessels.

Land based industry exists directly to the south of the northern portion of the DAF, whilst commercial accommodation is situated directly to the east of northern portion of the DAF. Other zoning adjacent the DAF includes Airport infrastructure (southern portion of the DAF) and Conservation, recreation and Nature Landscape (Northern portion of the DAF) (DPLH 2004).

Currently Beadon Creek Road is the only formal access point to and from Beadon Creek and surrounding area and therefore access to the DAF will be on shared roads. The close proximity of the DAF to different users would therefore suggests it is within hearing distance.

Aboriginal Heritage

Prior to European settlement, Onslow was primarily home to the Thalanyji people, the traditional Owners of the area. Due to the introduction of the Pastoral award in 1968 many aboriginal people from different language groups moved from their inland lands to the coastal area of Onslow. As such Onslow accommodates aboriginal people from the inland Pilbara, comprising a mix of diverse language groups.

The main language groups in town are:

- Nhuwala, Thalanyji and Burama – from the Cane and Ashburton River area (determined Traditional Landowners 18 September 2008)
- Punjima (Bunjima) and Innawonga – from the Wittenoom and Tom Price area
- Yindjibarndi – people from the Millstream area (one of the larger language groups)
- Ngarluma – from the Roebourne and Whim Creek area
- Martuthinira – traditionally from the coast around the mouth of the Fortescue River and south to the Robe River.

In recognition of the Aboriginal history in the area a review of the Department of Aboriginal Affairs Aboriginal Heritage inquiry system was conducted and identified 11 registered aboriginal heritage sites within the Onslow region. One (1) registered site, ‘Jinta 2’ (ID 6620), was identified within the DAF, whilst a further 10 registered aboriginal sites were identified adjacent the DAF within the Onslow region (**Table 27** and **Table 10**). The registered sites are regarded as culturally significant to the Traditional Owners of the land, the Thalanyji people, who hold a strong connection to land for spiritual and cultural practices and for access to food.

Table 27 Registered Aboriginal heritage sites

ID	Name	Status	Type
6620	Jinta 2.	Registered Site	Water Source
35628	Onslow Old Law Ground	Registered Site	Ceremonial, Meeting Place
6618	Dew Talu	Registered Site	Ceremonial, Water Source
6617	Burubarladji	Registered Site	Mythological
8920	Onslow 1	Registered Site	Artefacts/ Scatter, Midden/ Scatter
6575	Jinta 1 midden	Registered Site	Artefacts/ Scatter, Midden/ Scatter
6619	Jinta 1.	Registered Site	Water Source
6572	Old Racecourse Camp	Registered Site	Camp
6573	Old Racecourse Ceremonial	Registered Site	Ceremonial, Camp, Meeting Place
6574	Beadon Creek Midden	Registered Site	Artefacts/ Scatter, Midden/ Scatter, Arch Deposit,
7059	Four Mile Creek Midden	Registered Site	Midden/Scatter

European Heritage

In addition to Aboriginal heritage and cultural places, a search of the Australian Government database and the West Australian Museum online shipwreck database was conducted to identify natural and historic heritage. The search identified one (1) shipwreck within the vicinity of Beadon Creek, approximately 600 m from two options considered for the intake and outfall SDP locations, whilst a further 20 shipwrecks with exact locations provided for only 6 vessels were identified. Pre-1900 shipwrecks and archaeological sites are protected by the WA Museum, under the *Maritime Archaeology Act 1973*, while the *Underwater Cultural Heritage Act 2018* protects shipwrecks older than 75 years that rest in federal waters.

Other heritage identified in a search of the Australian Heritage Database indicates the Old Onslow Townsite, located on Old Onslow road, is heritage listed, due to its archaeological history; aesthetic historic, social and scientific and rarity cultural heritage. The most prominent ruins are the remains of the gaol, the courthouse, the police station, old Onslow Sea Jetty, part of telegraph line between town and sea, section of tram track, timber bridge, and section of bridge across marsh. However, none of the sites are located within the vicinity of the DAF.

Figure 13 Aboriginal and European heritage places in the vicinity of the DAF.

4.5.4. Potential Impacts

The section assesses the potential impact of the Proposal on the physical and biological environment within and adjacent to the DAF which may subsequently affect the aesthetic, cultural and social surroundings within the area. It discusses the design and management measures and the predicted outcome associated with construction and operation of the Proposal.

Construction Phase Impacts

During the construction phase of the Proposal, the following activities and resulting impacts have the potential to adversely affect the social surroundings in the vicinity of the proposed DAF:

1. Noise emissions from earth works machinery during clearing causing temporary disturbance to residents, visitors, commercial businesses, and other industry
2. The potential for removal or disturbance of Aboriginal heritage sites during earthworks.

Operational Phase Impacts

The following post-construction or operational phase impacts have the potential to adversely impact on social surroundings in the vicinity of the proposed DAF.

3. Noise emissions from facility (pump) operations causing temporary disturbance to residents, visitors, commercial businesses, and other industry
4. Disturbance of Aboriginal heritage sites during operations.

4.5.5. Assessment of Impacts

Construction Phase Impacts

Noise emissions resulting in disturbance of individual personnel (1)

During the construction phase of the Proposal noise emissions are expected to be generated from earth moving machinery as a result of the proposed land clearing activities. These operations are expected to result in localised and temporary noise emissions and noise management will adhere to the Environmental Protection (Noise) Regulations 1997. The nearest residential zoning is located 700 m from the DAF. Other Industry already exists adjacent to residential zoning, however further investigation is required to determine existing noise levels generated from these sources. Noise modelling would also assist in determining the extent to which noise would be emitted from machinery during construction and whether the extent of emissions would reach adjacent residential housing, as well as other industry and commercial businesses.

Targeting periods throughout the day to conduct construction activities is recommended to mitigate noise impacts to personnel. In addition, the selection of equipment used to complete the task can assist in minimising impacts.

Removal/disturbance of important Aboriginal Heritage sites (2)

During the construction phase of the Proposal, land clearing and disturbance is required. A small strip of roadside land along Onslow Road will be required for installation of the potable water pipeline. This pipeline will be located within the north east corner boundary of registered Aboriginal Heritage site ('Jinta 2', 6220). However, the pipeline disturbance will not impact the actual site. The required disturbance is considered minor, and disturbance activities short in duration. Therefore, due to the location of the disturbance and the minor level of disturbance it is not expected that these activities will impose significant threat to the cultural values of 'Jinta 2'.

Operational Phase Impacts

Noise emissions resulting in disturbance of individual personnel (3)

Once operational, the facility is expected to run 12 hrs a day for the lifetime of the Proposal. The primary source of noise will be emitted from the facility (pump) operations which will be located within the DAF. Maintenance activities during operation also have the potential to increase noise intensity. To gauge the times of the day where residents are likely to home a survey is recommended.

Disturbance of important Aboriginal Heritage sites (4)

Operational areas should be designed and constructed so that the Proposal personnel do not need to directly interact with the heritage features to conduct operational activities. Furthermore, all personnel, contractors and visitors who enter the site should undergo site inductions that include information about the heritage features. Regular audits of the aboriginal heritage features should be conducted within the DAF to monitor what impacts, if any, may be occurring. Audits should be conducted with Traditional Owners and a qualified archaeologist and inspect, monitor, and report on the condition of the sites within the Proposal Area. Quarterly heritage update meetings should also be held with Traditional Owners to discuss Proposal related activities and ongoing heritage requirements. 'Jinta 2' is an important water source site for the aboriginal people. The disruption in connection to culturally significant sites such as site 6220 within the Proposal Area may occur if access is restricted. Ten (10) additional registered Aboriginal sites have been identified nearby in the Onslow region, though do not exist within the DAF. Earthworks machinery will be used to clear terrestrial vegetation, level and compact the land to prepare a surface within Lot 551, Beadon Creek Road, where the proposed facility is to go. In addition, excavators will be engaged to place and bury pipelines in place alongside the existing dune track where possible, between the outfall/intake and Lot 551.

The design and layout for the proposal has been selected to avoid the known aboriginal heritage sites. No known cultural or aboriginal heritage sites were found within the DAF, although some sites are found in adjacent and surrounding areas (**Figure 13**). The Proponent will work with the Traditional Owners to provides access to culturally significant sites whenever practicable. It is therefore highly unlikely that significant Aboriginal cultural associations linked to the Heritage

features located within the SDP DAF, will be impacted by the Proposal and the residual risk is considered low.

Given that directional drilling will be conducted it is unlikely that the Proposal poses any risk to disturbance of any previously unrecorded shipwrecks.

4.5.6. Mitigation

Management proposed to minimise potential impacts on the environmental factor "Social Surrounds" are described in **Table 28** and presented in accordance with the EPA's mitigation Hierarchy (Avoid, Minimise, Rehabilitate[5]).

[5] Rehabilitation measures are excluded from Table 23, as these are not expected to be required to mitigate impacts to Social Surrounds.

Table 28 Mitigation measures to minimise impacts on Social Surrounds

Potential Impact	Avoidance	Minimisation	Residual Impact
Construction Phase Impacts *Construction phase impacts will be managed through the development and implementation of a CEMP. The following mitigation measures will be included in the CEMP to mitigate impacts on social surroundings during construction.*			
Noise emissions resulting in disturbance to individual personnel (1)	> N/A	> Manage construction activity times and equipment operation to reduce noise, light and emission impacts where possible; > The layout of Proposal infrastructure should be located as far as practicable from neighbouring residential housing, commercial business and other industry (internal buffering). > The time of day is an important consideration when operating machinery as quieter periods such as in the evenings are when residents in particular are returning to their homes from work or leisure activities during the day and therefore to minimise impact, certain hours should be avoided. > The selection of equipment and engineering can also assist in minimising noise emitted as well as performing the task.	> Noise during construction will primarily be due to the operation of earthmoving machinery which will be localised and temporary.
Removal/ Disturbance of important Aboriginal Heritage sites (2)	> Direct contact with Jinta 2 will be avoided through the use of boundary marking and signage. Minor disturbance within the north-	> Consultation with the local Native Title Body - The Buurabalayii Thalanyji Aboriginal Corporation (BTAC) and the Shire of Ashburton	> By including BTAC representatives and SoA members throughout all construction planning and implementation, the risks to the

Potential Impact	Avoidance	Minimisation	Residual Impact
	eastern corner of the boundary is unavoidable and will have insignificant impact when considering other industrial presence within the boundary (Onslow Road, Onslow Airport, water storage tanks and laydown yards).	(SoA) during planning and construction stages of the Proposal (meetings, workshops, information notifications); > Conduct preliminary site visit with representatives from the BTAC, the shire of Ashburton and the DPLH to identify any features or objects that require protection under the AH Act; > Walkover survey carried out by BTAC representatives and archaeologist/ anthropologist (s); > Clearly demarking restricted access boundaries and areas of heritage importance to restrict access to areas that are relatively untouched and to avoid further damage; > Provide site inductions which include cultural awareness information approved/ or delivered by the BTAC representatives.	cultural values of Aboriginal Heritage will be minimised.
Operational Phase Impacts *Construction phase impacts will be managed through the development and implementation of an OEMP. The following key management measures will be included in the OEMP to mitigate impacts on social surroundings during operation.*			
Noise emissions resulting in disturbance to individual personnel (3)	N/A	> The risk of noise impacts can be eliminated by selecting a location where practicable within the proposed site that is far from existing sensitive receivers. Should noise levels exceed the accepted levels, where individual's lives are impacted, and adequate attenuation	> During operation noise is not expected from the water transfer pipeline as they will be buried underground. > Noise during operation will be primarily from the pumping station which will be localised.

Potential Impact	Avoidance	Minimisation	Residual Impact
		by distance cannot be achieved, then engineering solutions to enhance noise-proofing of the immediate or surrounding perimeter should be developed and implemented. > Consultation with residents, commercial businesses and other industry will help to determine when to schedule activities to times that result in less noise nuisance. > Noise modelling can be quantitively measured to determine the level of noise emitted from particular sources and the extent it is emitted. Noise modelling is recommended to predict the noise levels under worst case scenarios and to determine if noise levels emitted will comply with regulation requirements. > It is recommended that the proponent undertake monitoring of noise levels at the commencement of plant operation to determine its compliance with the Regulations during operation of the SDP Plant.	
Disturbance of important aboriginal heritage sites (4)	> Direct contact with Jinta 2 will be avoided through the use of boundary marking and signage.	> Provide site inductions which include cultural awareness information approved/ or delivered by the BTAC representatives.	> No residual impacts are anticipated

4.5.7. Predicted Outcomes

Implementation of the Proposal in accordance with the defined mitigation and management actions will result within the following Environmental Protection Outcomes:

- no harm to individual people with respect to hearing or safety in general
- temporary disturbance to individuals directly adjacent construction activities
- minimal disturbance to one Aboriginal Heritage site 'Jinta 2'- 6620.

The combined impact of the Proposal activities and the consequent outcomes are not considered to pose any significant residual risks to the social surrounds and therefore social surrounds are protected from significant harm. In respect of the proposed design and management of the Proposal, the Proponent considers that the EPA's objective for social surrounds has been met.

5. Other Environmental Factors or Matters

Potential impacts to other environmental factors or matters are discussed in **Table 29**.

Table 29 Other Environmental Factors or Matters

Environmental Factor	Receiving Environment	Relevant Proposal Activities	Potential Impacts	Management, Monitoring & Mitigation	Impact Assessment
THEME: SEA					
Benthic Communities and Habitats (BCH)	Previous BCH mapping of the broader Onslow area (including Beadon Bay) has identified predominantly sandy silt habitat between LAT and the 10 m isobath. However, the Proposal Area has also been found to support areas of patchy seagrass, filter feeder, coral and macroalgal BCH communities, which are typically associated with areas of limestone covered by a sand veneer (O2 Marine 2017).	> Brine water release into Beadon Bay > Installation of pipeline and outfall/intake on seafloor	> Direct removal or disturbance of BCH > Salinity stress to BCH due to brine outfall > Temperature stress to BCH due to brine outfall > BCH stress due to reduced dissolved oxygen due to salinity stratification in the LEPA	> OMEMMP	Hydrodynamic modeling undertaken to-date indicates that dilution of brine discharge to the marine environment would be rapid and will achieve target dilutions and mixing within the proposed Low Ecological Protection Area (LEPA) (Baird 2019). Therefore, impacts to BCH as a result of the brine outfall are likely to be confined to the LEPA. Direct removal or disturbance of BCH would be limited to any intertidal or subtidal areas located directly below the intake/outfall pipeline(s) and within the proposed LEPA Based on previous local BCH studies, sandy silt is the dominant habitat type within the DAF and proposed LEPA (**Appendix F**). All outfall location options involve limited sub-surface infrastructure. Loss of small area (i.e. ~1.5 ha) of sandy silt habitat is not considered to be a significant impact. A broad BCH map

					of the marine DAF is included in **Appendix F,** which outlines no significant BCH will be impacted**.** A Marine Environmental Quality Management Plan is required to monitor and manage the brine outfall to ensure that the proposed Levels of ecological protection are achieved. ***Given the likely direct impacts, BCH is considered to be a key environmental factor at risk as a result of the Proposal. However, potential impacts to BCH are not likely to be significant. As such, the EPA's objective for this factor is considered to be met.***
Coastal Processes	To maintain the geophysical processes that shape coastal morphology so that the environmental values of the coast are protected.	> Installation of subtidal pipeline on seabed	> Altered nearshore sediment flows > Erosion of benthic sediment > Deposition of benthic sediment	> Nil	Intake/outfall locations proposed for each of the proposed options constitute negligible marine infrastructure based on pipelines installed on the seabed of Beadon Bay. ***Coastal processes are not considered to be a key environmental factor at risk as a result of this Proposal. As such, the EPA's objective for this factor is considered to be met.***

THEME: LAND					
Terrestrial Environmental Quality	To maintain the quality of land and soils so that environmental values are protected.	> Construction and earthwork activities.	> Disturbance of an existing contaminated site.	> CEMP	Beach sand and historic spoil disposal material, over beach sand within the DAF consisting of Red/brown loamy sand on dune systems. No evidence of historical contamination of the disposal site has previously been recorded. Preliminary mapping of known and Potential Acid Sulfate Soils (PASS) risk is described as low-moderate and moderate-high risk of PASS within the proposed DAF. In particular, low lying waterlogged areas and interdune swales pose the greatest risk. PASS risk can be effectively mitigated/managed through development and implementation of an appropriate CEMP. ***Potential risks to Terrestrial Environmental Quality are considered low. Risks can be managed through an appropriate and approved CEMP.***
Landforms	To maintain the variety and integrity of significant physical landforms so that environmental values are protected	> N/A	> No significant impacts anticipated	> Nil	No significant landforms exist in the vicinity of the DAF. ***Landforms are not considered to be a key environmental factor at risk as a result of the Proposal. The EPA's objective for this factor is considered to be met.***

Subterranean Fauna	To Protect subterranean fauna so that biological diversity and ecological integrity are maintained	> N/A	> No significant impacts anticipated	> Nil	The Proposal is not proposing to impact upon the subterranean environment. ***Subterranean fauna is not considered to be a key environmental factor at risk as a result of the Proposal. The EPA's objective for this factor is considered to be met.***
Terrestrial Fauna	To protect terrestrial fauna so that the biological diversity and ecological integrity are maintained	> Construction activities that may disturb/remove habitat > Construction activities that may disturb fauna behaviour (e.g. noise).	> Removal or disturbance of terrestrial fauna habitat	> CEMP	Threatened and Priority Fauna have previously been identified within DAF. However, recent reconnaissance survey by Ecoscape (2019) did not detect any fauna species of conservation significance. Other surveys in the past have identified such species of conservation significance as the Eastern Osprey, Star Finch and Rainbow Bee-eater. Nests of the Eastern Osprey were found in the past in fauna surveys of the Proposal envelope (ENV 2011), although the DAF is not noted as an area of particular importance to any of the conservation significant species. Fauna nesting, foraging and other activities may be impacted negatively by construction works, including direct removal of habitat for conservation significant species. However, as the habitat to be removed is well represented in surrounding areas it

					does not represent critical habitat for any conservation significant species. CEMP to include requirement for pre-clearance survey to be undertaken by a fauna spotter/catcher prior to constructions works commencing. ***Potential impacts to terrestrial fauna are minor and can be effectively mitigated or managed. Therefore, terrestrial fauna is not considered to be a key environmental factor at risk as a result of this Proposal. The EPA's objective for this factor is considered to be met.***
THEME: WATER					
Inland Waters	To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected	> N/A	> No significant impacts anticipated	> Nil	The Proposal is not proposing to impact upon any inland waterways. However, the Proposal requires management of surface water drainage on Lot 551-553, to ensure that surface water drainage is not inhibited. ***Inland waters are not considered to be a key environmental factor at risk as a result of the Proposal. The EPA's objective for this factor is considered to be met.***
THEME: Air					

Air Quality	To maintain air quality and minimise emissions so that environmental values are protected.	> N/A	> No significant impacts anticipated	> Nil	The Proposal is not proposing to impact upon air quality. ***Air Quality is not considered to be a key environmental factor at risk as a result of the Proposal. The EPA's objective for this factor is considered to be met.***
Greenhouse Gas Emissions	To reduce net greenhouse gas emissions in order to minimise the risk of environmental harm associated with climate change.	> Operation of the Onslow SDP	> GHG emission resulting from energy consumption of the SDP	> Minimise and manage energy consumption for the project through implementing best practices through: o Project design o Material/equipment selection o Equipment maintenance and performance testing o Energy efficient lighting and temperature control Project design and > Onslow SDP operations are not reliant on the consumption of diesel fuel. > The area of vegetation clearing is deemed insignificant	No Scope 1 GHGs are expected to be emitted as part of the Onslow SDP operations. Therefore, the emissions will be less than 100,000 tonnes of CO2-e per annum. The Onslow SDP operations estimates the following Scope 2 emission from energy consumption: (4,180MWh) x (0.63 tonnes CO2-e/MWh) = 2,633tonnes CO2-e per annum. The small amount of CO_2 emitted through construction (plant, vehicles and vessels) will have negligible impact to air quality ***Greenhouse Gas Emissions are not considered to be a key environmental factor at risk as a result of the Proposal. The EPA's objective for this factor is considered to be met.***
THEME: People					

Human Health	To protect human health from significant harm	> N/A	> No significant impacts anticipated	> Nil	***The Proposal is not expected to result in any emissions of radiation. Therefore, human health is not considered to be a key environmental factor at risk as a result of the proposal. The EPA's objective for this factor is considered to be met.***

6. Offsets

There were no significant residual impacts of the Proposal identified in this Environmental Review Document and therefore no offsets are proposed.

7. Holistic Impacts Assessment

Overall actual and potential impacts of the Proposal on the environment are not considered to represent a significant environmental risk on the basis that:

- The EP Act principles and relevant EPA guidance documents have been considered in investigating and evaluating potential impacts of the Proposal on the EPA's environmental factors.
- A comprehensive set of monitoring and management measures have been developed to further mitigate potential impacts of the Proposal on the EPA's environmental factors.
- The proponent has committed to open and transparent reporting of environmental performance throughout the Proposal construction and operational phases.
- Evaluation of impacts against all relevant environmental factors, including other environmental factors determined that the EPA's objectives were considered to be met. Specifically, for the key environmental factors the following outcomes were predicted:
    - **Marine Environmental Quality** - the combined impact of the Proposal activities, the consequent EPOs and the proposed environmental monitoring during the operational phase are not expected to pose any significant residual risks to the designated Environmental Quality Objectives. Therefore, the environmental values for MEQ are protected.
    - **Marine Fauna** - the combined impact of the Proposal activities and the consequent EPOs are not considered to pose any significant residual risks to the protection of marine fauna and therefore biological diversity and ecological integrity can be maintained.
    - **Flora and Vegetation** - the combined impact of the Proposal activities and the consequent EPOs are not considered to pose any significant residual risks to the protection of flora and vegetation and therefore biological diversity and ecological integrity can be maintained.
    - **Social Surrounds** – the minimal level of impact on social surrounds resulting from construction and operational activities can be managed through ongoing consultation with key stakeholders, and preparation of appropriate CEMP and OEMP documents. As a result the social surrounds in the vicinity of the DAF will be protected from significant harm.

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Appendix A Sediment and Infauna

Appendix B Desalination Brine Toxicity Assessment

Appendix C Hydrodynamic Modelling

Appendix D Operational Marine Environmental Monitoring & Management Plan

Appendix E Likelihood of Occurrence Assessment: Marine Fauna

An assessment was undertaken of the likelihood of occurrence for threatened species identified through the desktop review. The DAWE and DBCA do not have prescriptive likelihood of occurrence guidelines within their policies but rather clarify the scale of assessment required to determine the level of impact (e.g. level of assessment, previous record searches, and distribution maps). The below criteria have been developed with the aim of considering this scale of assessment to identify the likelihood of occurrence for threatened species:

- **Low potential to occur** – the species has not been recorded in the region (no records from desktop searches) and/or current known distribution does not encompass project area and/or suitable habitat is generally lacking from the project area.
- **Moderate potential to occur** – the species has been recorded in the region (desktop searches) however suitable habitat is generally lacking from the project area or species has not been recorded in the region (no records from desktop searches) however potentially suitable habitat occurs at the project area.
- **High potential to occur** – the species has been recorded in the region (desktop searches) and suitable habitat is present at the project area.
- **Known to occur** – the species has been recorded on-site in the recent past (i.e. last 5-10 years) and the site provides suitable habitat for it.

Codes used in the following likelihood of occurrence tables:

- EPBC Act (species listed under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999): Ex = Extinct, CE = Critically Endangered, E = Endangered, V = Vulnerable, M = Migratory, MM = Migratory Marine, MT = Migratory Terrestrial, MW = Migratory Wetlands, Ma = Listed Marine
- WC Act (species listed under the Western Australian Wildlife Conservation Act 1950):
  - Threatened Species: EX = Presumed Extinct, CR = Critically Endangered, EN = Endangered, VU = Vulnerable, IA = Migratory birds protected under an International Agreement, CD = Conservation Dependent, OS = Other Specially Protected
  - Priority Species: P1 = Priority 1, P2 = Priority 2, P3 = Priority 3, P4 = Priority 4
- IUCN (species listed under the International Union for Conservation of Nature (IUCN) Red List of Threatened Species): EX = Extinct, EW = Extinct in the Wild, CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened, LC = Least Concern

Marine Mammals

Species Name	EPBC Act Status	WC Act Status	IUCN Status	Habitat Preference	Likelihood of Occurrence
Balaenoptera musculus Blue Whale	E, MM	EN	EN	The blue whale is a cosmopolitan species, found in all oceans except the Arctic, but absent from some regional seas such as the Mediterranean, Okhotsk and Bering seas. Blue whales feed almost exclusively on krill, with a variety of species being taken by different blue whale populations. They feed both at the surface and also at depth, following the diurnal vertical migrations of their prey to at least 100 m. The migration patterns of blue whales are not well understood, but appear to be highly diverse. (Reilly et al., 2008)	**Low potential to occur** The species has not been recorded in depths of <10 m and is only located in deep waters of the continental slope
Dugong dugon Dugong	MM, Ma	OS	VU	Dugongs undertake long-distance movements, which means Australia shares populations with other neighbouring countries. In Australia, dugongs occur in the shallow coastal waters of northern Australia from the Queensland/New South Wales border in the east to Shark Bay on the Western Australian coast. They are also found in other parts of the Indian and Pacific Oceans in warm shallow seas in areas where seagrass is found.	Observed (O2 Marine) **Known to occur** The species has been recorded in the region throughout the year (desktop searches) during aerial surveys.
Eubalaena australis Southern Right Whale	E, MM	VU	LC	In Australian coastal waters, southern right whales occur along the southern coastline including Tasmania, generally as far north as Sydney (33°53'S, 151°13'E) on the east coast and Perth (31°55'S, 115°50'E) on the west coast. There are occasional occurrences further north, with the extremities of their range recorded as Hervey Bay (25°00'S, 152°50'E) and Exmouth (22°23'S, 114°07'E).	**Low potential to occur** The distribution for this species occurs significantly south of the survey area.
Megaptera novaeangliae Humpback Whale	V, MM	CD	LC	Humpback whales utilising Australian waters currently have tropical calving grounds along the mid and northern parts of the east and west coasts of Australia, and feeding grounds in the Southern Ocean. The majority of humpbacks in Australian waters migrate north to tropical calving grounds from June to August, and south to the Southern Ocean feeding areas from September to November.	Record 2014 **High potential to occur** The species has been recorded in the region (desktop searches). Typically occur further offshore (>35 km) during migratory routes, although some whales recorded in <10m during southern migration (i.e. September).
Orcaella heinsohni Australian snubfin dolphin	M	P4	NT	Stranding and museum specimen records indicate that Australian Snubfin Dolphins occur only in waters off the northern half of Australia, from approximately Broome (17° 57´ S) on the west coast to the Brisbane River (27° 32´ S) on the east coast. Aerial and boat-based surveys indicate that Australian Snubfin Dolphins occur mostly in protected shallow waters close to the coast, and close to river and creek mouths.	Record 2014 **Moderate potential to occur** Occasionally sighted in Pilbara coastal waters presumed to be an occasional visitor from the Kimberley region.
Sousa sahulensis Australian humpback dolphin	M	P4		In Australia, Indo-Pacific Humpback Dolphins are known to occur along the northern coastline, extending to Exmouth Gulf on the west coast (25° S), and the Queensland/NSW border region on the east coast (34° S) (Corkeron et al. 1997). There are few records between the Gulf of Carpentaria in the north and Exmouth Gulf in the west, this is probably due to a lack of research effort and the remoteness of the area (Bannister et al. 1996; Parra et al. 2002).	Record 2015 **High potential to occur** The species has been recorded in the region (desktop searches) and suitable habitat is present at the project area

Marine Reptiles

Species Name	EPBC Act Status	WC Act Status	IUCN Status	Habitat Preference	Likelihood of Occurrence
Aipysurus apraefrontalis Short-nosed Seasnake	CE, Ma	CR	CR	The Short-nosed Seasnake is endemic to Western Australia, and has been recorded from Exmouth Gulf, Western Australia (Storr et al. 2002) to the reefs of the Sahul Shelf, in the eastern Indian Ocean. The species prefers the reef flats or shallow waters along the outer reef edge in water depths to 10 m (Cogger 2000; Guinea 1993, 1995; McCosker 1975).	**Moderate potential to occur** The species has not been recorded in the region (desktop searches) although within the known distribution and suitable habitat is present in the project area
Caretta caretta loggerhead turtle	E, MM, Ma	EN	EN	In Australia, Loggerhead Turtles nest on open, sandy beaches. They live at or near the surface of the ocean and move with the ocean currents, choosing a wide variety of tidal and sub-tidal habitat as feeding areas and showing fidelity to both their foraging and breeding areas. (Department of the Environment, 2015)	Record 2015 **Moderate potential to occur** The species has been recorded in the region (desktop searches) although not near the Project area. Suitable habitat is present at the project area
Chelonia mydas green turtle	V, MM, Ma	VU	EN	Green Turtles nest, forage and migrate across tropical northern Australia. They usually occur between the 20°C isotherms (Marquez 1990), although individuals can stray into temperate waters (Cogger et al. 1993). In Australia, the key nesting and inter-nesting areas (where females live between laying successive clutches in the same season) occur on offshore Islands off Onslow (DEH 2005a; DEWHA 2008b).	Record 2015 **High potential to occur** The species has been recorded in the region (desktop searches) and suitable habitat is present at the project area
Dermochelys coriacea leatherback turtle	V	E	VU	The Leatherback Turtle is a pelagic feeder, found in tropical, subtropical and temperate waters throughout the world (Marquez 1990). Large body size, high metabolism, a thick adipose tissue layer and regulation of blood flow (Spotila et al.1997) allow them to utilise cold water foraging areas unlike other sea turtle species. For this reason, this species is regularly found in the high latitudes of all oceans including the South Pacific Ocean in the waters offshore from NSW, Victoria, Tasmania and Western Australia (Benson et al. 2011; Limpus & MacLachlan 1979, 1994).	**Low potential to occur** the species has not been recorded in the region (no records from desktop searches)
Eretmochelys imbricata Hawksbill Turtle	V, MM, Ma	VU	CR	Hawksbill Turtles are found in tropical, subtropical and temperate waters in all the oceans of the world. In Australia, the key nesting and inter-nesting areas (where females live between laying successive clutches in the same season) occur on offshore Islands off Onslow (DEH 2005a; DEWHA 2008b). Reefs from Cape Preston to Onslow are considered important feeding grounds.	Record 2013 **Moderate potential to occur** The species has been recorded in the region (desktop searches) although not in the Project area. Suitable habitat is present at the project area
Natator depressus flatback turtle	V, MM, Ma	VU	DD	The Flatback Turtle is found only in the tropical waters of northern Australia, Papua New Guinea and Irian Jaya (Spring 1982; Zangerl et al. 1988) and is one of only two species of sea turtle without a global distribution. On the North-West Shelf, the major rookeries are on the mid-eastern coast of Barrow Island and at Mundabullangana Station near Cape Thouin on the mainland (Prince 1994a,b). These turtles are known to occur in the Onslow region during all sensitive life-history phases (mating, nesting and inter-nesting).	Record 2015 **High Potential to Occur** The species has been recorded in the region (desktop searches) and suitable habitat is present at the project area
Crocodylus porosus Salt-water Crocodile	M, Ma	OS	LR/lc	The Salt-water Crocodile is found in Australian coastal waters, estuaries, lakes, inland swamps and marshes from Rockhampton in Queensland, throughout coastal Northern Territory to King Sound (near Broome) in Western Australia. There have been isolated records in rivers of the Pilbara region, around Derby near Broome and as far south as Carnarvon on the mid-west coast (Department of the Environment, 2017a).	Record 2014 **Moderate Potential to Occur** The species has been recorded in the region (desktop searches) although presumed to be an occasional visitor from the Kimberley region.

Sharks and Rays

Species Name	EPBC Act Status	WC Act Status	IUCN Status	Habitat Preference	Likelihood of Occurrence
Carcharias taurus Grey Nurse Shark	V	VU	VU	The Grey Nurse Shark (west coast population) has a broad inshore distribution, primarily in sub-tropical to cool temperate waters (Last & Stevens 1994). The population of Grey Nurse Shark (west coast population) is predominantly found in the south-west coastal waters of Western Australia (Environment Australia 2002a) and has been recorded as far north as the North West Shelf (Stevens 1999; Pogonoski et al. 2002).	**Low potential to occur** the species has not been recorded in the region (no records from desktop searches). Has been found to Muiron Islands although predominantly found in cooler coastal waters further south.
Carcharodon carcharias White Shark	V, MM	VU	VU	In Australia, Great White Sharks have been recorded from central Queensland around the south coast to north-west Western Australia, but may occur further north on both coasts (Bonfil et al. 2005; Bruce et al. 2006; Last & Stevens 2009; Paterson 1990). They inhabit inshore waters around rocky reefs, surf beaches and shallow coastal bays; waters on the outer continental shelf and slope; and the open ocean. These sharks most commonly live in depths above 100 m.	**Moderate potential to occur** the species has not been recorded in the region (no records from desktop searches). Has been found to Muiron Islands although predominantly found in cooler coastal waters further south.
Pristis clavata Dwarf Sawfish, Queensland Sawfish	V, MM	P1	EN	The species' Australian distribution has previously been considered to extend north from Cairns around the Cape York Peninsula in Queensland, across northern Australian waters to the Pilbara coast in Western Australia (Last & Stevens 1994; McAuley et al. 2005; Stevens et al. 2008). The Dwarf Sawfish usually inhabits shallow (2–3 m) coastal waters and estuarine habitats.	**Moderate potential to occur** the species has not been recorded in the region (no records from desktop searches). The western extent of this species range has not been fully resolved, and this species may therefore also occur
Pristis pristis (Pristis microdon) Freshwater (Largetooth) Sawfish	V, M	P3	CR	The Freshwater Sawfish may potentially occur in all large rivers of northern Australia from the Fitzroy River, Western Australia, to the western side of Cape York Peninsula, Queensland. It is mainly confined to the main channels of large rivers. Recorded within Ashburton River from the Onslow area during recent survey (pers comms Dr David Morgan).	**Low potential to occur** Predominantly found in warmer coastal waters further north and suitable habitat (large river) is not present at the project area.
Pristis zijsron Green Sawfish	V, MM	VU	CR	The green sawfish inhabit shallow coastal marine and estuarine waters of northern Australia, from about Eighty Mile Beach, Western Australia, to the Cairns region, Queensland. It has been occasionally been caught as far south as Sydney (OzFishNet, 2016). In the Onslow area, green sawfish are known to be pupped near the Ashburton River mouth and utilise the estuary and nearby mangrove creeks, before moving offshore to mature at a length of about 3 m (pers comms Dr David Morgan)	Record 2011 **High potential to occur** The species has been recorded in the region (desktop searches), Beadon Creek offers limited suitable habitat in comparison to nearby creeks. However, the species may be found moving through the project area
Rhincodon typus Whale Shark	V, MM	OS	VU	Found worldwide in tropical and subtropical oceans.(OzFishNet, 2016). Ningaloo Reef, off the Western Australian coast, is the main known aggregation site of Whale Sharks in Australian waters.	**Moderate potential to occur** the species has been recorded in deeper waters than the Project area although no records from desktop searches.
Rhynchobatus australiae Whitespotted Guitarfish	-	-	VU	Fremantle, Western Australia, around the tropical north to Crowdy Head, northern New South Wales. Elsewhere, the species occurs in the tropical, east-Indo-west Pacific. Inhabits inshore waters, occurring on soft bottoms near reefs.	**Moderate potential to occur** the species has been recorded in deeper waters than the Project area although no records from desktop searches.

Migratory/Marine Species

Class	Species	Common Name	EPBC Act Status	WC Act Status	IUCN	Record in searches
Fish	*Bulbonaricus brauni*	Braun's Pughead Pipefish, Pug-headed Pipefish	Ma			
Fish	*Campichthys tricarinatus*	Three-keel Pipefish	Ma			
Fish	*Choeroichthys brachysoma*	Pacific Short-bodied Pipefish, Short-bodied Pipefish	Ma		LC	
Fish	*Choeroichthys suillus*	Pig-snouted Pipefish	Ma			
Fish	*Doryrhamphus janssi*	Cleaner Pipefish, Janss' Pipefish	Ma		LC	
Fish	*Doryrhamphus negrosensis*	Flagtail Pipefish, Masthead Island Pipefish	Ma			
Fish	*Festucalex scalaris*	Ladder Pipefish	Ma			
Fish	*Filicampus tigris*	Tiger Pipefish	Ma			
Fish	*Halicampus brocki*	Brock's Pipefish	Ma			
Fish	*Halicampus grayi*	Mud Pipefish, Gray's Pipefish	Ma			
Fish	*Halicampus nitidus*	Glittering Pipefish	Ma			
Fish	*Halicampus spinirostris*	Spiny-snout Pipefish	Ma			
Fish	*Haliichthys taeniophorus*	Ribboned Pipehorse, Ribboned Seadragon	Ma			
Fish	*Hippichthys penicillus*	Beady Pipefish, Steep-nosed Pipefish	Ma		LC	
Fish	*Hippocampus alatus*	Winged Seahorse	Ma		DD	Y
Fish	*Hippocampus angustus*	Western Spiny Seahorse, Narrow-bellied Seahorse	Ma		DD	Y
Fish	*Hippocampus histrix*	Spiny Seahorse, Thorny Seahorse	Ma			
Fish	*Hippocampus kuda*	Spotted Seahorse, Yellow Seahorse	Ma		VU	
Fish	*Hippocampus planifrons*	Flat-face Seahorse	Ma			Y
Fish	*Hippocampus trimaculatus*	Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse	Ma		VU	
Fish	*Hippocampus zebra*	Zebra seahorse	Ma		DD	Y
Fish	*Micrognathus micronotopterus*	Tidepool Pipefish	Ma			
Fish	*Solegnathus hardwickii*	Pallid Pipehorse, Hardwick's Pipehorse	Ma		DD	
Fish	*Solegnathus lettiensis*	Gunther's Pipehorse, Indonesian Pipefish	Ma		DD	
Fish	*Solenostomus cyanopterus*	Robust Ghostpipefish, Blue-finned Ghost Pipefish,	Ma			
Fish	*Solenostomus paegnius*	Rough-snout Ghost Pipefish	Ma			
Fish	*Syngnathoides biaculeatus*	Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish	Ma		DD	

Fish	*Trachyrhamphus bicoarctatus*	Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish	Ma			
Fish	*Trachyrhamphus longirostris*	Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish	Ma			
Mammal	*Balaenoptera acutorostrata*	Minke Whale	Ma			
Mammal	*Balaenoptera edeni*	Bryde's Whale	MM		DD	
Mammal	*Delphinus delphis*	Common Dophin, Short-beaked Common Dolphin	Ma			
Mammal	*Grampus griseus*	Risso's Dolphin, Grampus	Ma			
Mammal	*Orcinus orca*	Killer Whale, Orca	MM		DD	
Mammal	*Sousa chinensis*	Indo-Pacific Humpback Dolphin	MM		NT	
Mammal	*Stenella attenuata*	Spotted Dolphin, Pantropical Spotted Dolphin	Ma			
Mammal	*Tursiops aduncus*	Spotted Bottlenose Dolphin (Arafura/Timor Sea populations)	MM		DD	
Mammal	*Tursiops truncatus s. str.*	Bottlenose Dolphin	Ma			
Reptile	*Acalyptophis peronii*	Horned Seasnake	Ma		LC	
Reptile	*Aipysurus duboisii*	Dubois' Seasnake	Ma		LC	
Reptile	*Aipysurus eydouxii*	Spine-tailed Seasnake	Ma		LC	
Reptile	*Aipysurus laevis*	Olive Seasnake	Ma		LC	Y
Reptile	*Astrotia stokesii*	Stokes' Seasnake	Ma			
Reptile	*Disteira kingii*	Spectacled Seasnake	Ma			
Reptile	*Disteira major*	Olive-headed Seasnake	Ma			
Reptile	*Emydocephalus annulatus*	Turtle-headed Seasnake	Ma		LC	
Reptile	*Ephalophis greyi*	North-western Mangrove Seasnake	Ma			
Reptile	*Hydrophis czeblukovi*	Fine-spined Seasnake	Ma		DD	
Reptile	*Hydrophis elegans*	Elegant Seasnake	Ma		LC	
Reptile	*Hydrophis ornatus*	Spotted Seasnake, Ornate Reef Seasnake	Ma			Y
Reptile	*Pelamis platurus*	Yellow-bellied Seasnake	Ma			
Shark	*Anoxypristis cuspidata*	Narrow Sawfish	M		EN	
Shark	Manta alfredi	Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray	MM		VU	Y
Shark	Manta birostris	Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray	MM		VU	Y

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Appendix F Benthic Communities and Habitat Survey Report