

# **13 SIGNIFICANT SITES OR FEATURES**

#### 13.1 EXISTING ENVIRONMENT

#### 13.1.1 National Parks

There are no National Parks within the proposed Project area or surrounds. The nearest National Park is Djukbinj National Park, approximately 28 km to the east of the Project area (Figure 64).

#### 13.1.2 Conservation Reserves

#### 13.1.2.1 Tree Point Conservation Reserve

The Tree Point Conservation Reserve is located immediately to the south of the Project area (Figure 64). The Tree Point Conservation Reserve protects a coastal area on the Tree Point Peninsula and a large area of mangrove habitat associated with tidal creek that runs back in towards the Shoal Bay Coastal Reserve (refer to Section 13.1.2.2). The Conservation Area is fringed by coastal vine thicket and a swampy floodplain, which hosts a number of bird species at various times of the year.

#### 13.1.2.2 Shoal Bay Coastal Reserve

The Shoal Bay Coastal Reserve is located adjacent to the Tree Point Conservation Reserve, approximately 1.5 km to the south-east of the Project area (Figure 64). The Shoal Bay Coastal Reserve protects a large coastal area consisting of tidal sand and mud-flats. It also contains a large area of Eucalypt woodland and large areas of saline swamp with areas that are inundated during the wet season.

#### 13.1.3 Marine Parks or Reserves

There are no Commonwealth or Northern Territory marine parks or reserves located in the vicinity of the Project area. The nearest Commonwealth marine area is located over 100 km from the proposed Project area. The nearest Commonwealth marine reserve is located over 300 km from the proposed Project area.

#### 13.1.4 World Heritage Properties and National Heritage Places

There are no World Heritage Properties or National Heritage Places located in the vicinity of the Project area. The nearest World Heritage Property and National Heritage Place is Kakadu National Park which is located over 100 km to the east of the Project area.

#### 13.1.5 Public or Private Reserves

There are no public or private reserves in the vicinity of the Project area.

#### 13.1.6 Conservation Zones under a Planning Scheme

Areas to the immediate north and south of the Project site are zoned for conservation under the Northern Territory Planning Scheme (Figure 65). As illustrated in Figure 65, a very small area located in the south-west corner of the Project site is zoned for Conservation. The primary purpose of Conservation zoning, as stated in Section 5.22 of the Planning Scheme, is to conserve and protect the flora, fauna and character of natural areas. The Planning Scheme also states that 'development is to be sensitive to the natural features and habitats of the zone and be so sited and operated as to have minimal impact on the environment'. No Project infrastructure or services area proposed to be located in areas zoned as Conservation. The Project will not impact, directly or indirectly, on areas zoned for Conservation.

As discussed in the Section 2.4, the majority of the Project area, and all areas identified for Project infrastructure and services, is zoned for future development which is an interim zone which identifies areas that are intended for future rezoning and development.





Inate System: GDA 1994 MGA Zone 52

Date: 25/10/

Sites of Conservation Significance

#### FIGURE 64 SIGNIFICANT SITES AND FEATURES





FIGURE 65 CONSERVATION ZONING



#### **13.1.7** Priority Environmental Management Areas

Priority Environmental Management Areas are mapped under the Litchfield Subregional Land Use Plan. These are areas where development should give priority to the natural environment and where there may be a need for assessment of potential environmental impacts. The Project footprint is not within any area mapped as a Priority Environmental Management Area (Figure 66).

#### 13.1.8 Significant Natural Land Features

The proposed Hatchery site is located in the Shoal Bay Site of Conservation Significance (Figure 64). The Shoal Bay Site of Conservation Significance comprises the lower reaches of the Howard River and other small tidal creeks that empty into Hope Inlet and the Shoal Bay. The Shoal Bay Site of Conservation Significance differs from most other bays in the Top End in that no large rivers (or freshwater coastal floodplains) are associated with it. Extensive mud and sand flats are the major feature of Shoal Bay, with much of the bay exposed at low tide.

The extensive tidal flats in Shoal Bay provide an important feeding and roosting area for migratory shorebirds in their non-breeding season. Up to 5,000 waterbirds are known to aggregate on small freshwater wetlands inland of the tidal flats late in the dry season as more extensive coastal floodplains dry out across the Top End. Numerous patches of rainforest occur around the margin of the tidal flats. A high number of threatened species are reported from the Shoal Bay area, including three plants, ten vertebrates and one invertebrate.

#### 13.1.9 Proximity to the Northern Territory Coastline

The nature of the proposed Project requires close proximity to the coastal environment. The intake and outfall infrastructure are connected to the surrounding marine waters and will be located so as to be viable during all tidal conditions.

The intake and discharge pipes will be buried under the intertidal zone to ensure beach access and the ability to drive along the beach remains unhampered. An assessment of the potential visual and navigational impacts as a result of the construction of the intake and discharge pipelines is included in Section 15.3.1.1.

# 13.2 POTENTIAL IMPACTS

#### 13.2.1 Conservation Reserves

#### 13.2.1.1 Tree Point Conservation Area

The Tree Point Conservation Area is located adjacent to the Project site and will not be directly impacted by the construction or operation of the facility. The boundary between the Project site and the Tree Point Conservation Area will be fenced and the Tree Point Conservation Area will be demarcated as a no go area.

There are no anticipated indirect impacts from the Project on noise levels or air quality in the Tree Point Conservation Area. In accordance with the NT EPA Guideline for Disposal of Waste by Incineration a 500 m buffer has been applied between the incinerator and the Tree Point Conservation Area. Furthermore, noise modelling indicates that noise levels at the Tree Point Conservation Area would be well below the criteria required by the NSW Industrial Noise Policy 2000 which has been used in the absence of any NT guidance (Section 7.3).

Potential indirect impacts to the Tree Point Conservation Area could result from stormwater runoff from the Project or uncontrolled discharges (e.g. overtopping of ponds). The natural surface water drainage of the Project site flows into the Tree Point Conservation Area and as such stormwater runoff or uncontrolled discharges could potentially impact the Tree Point Conservation Area. Measures to manage and mitigate these potential impacts are detailed in Section 13.3.1.





FIGURE 66 PRIORITY ENVIRONMENTAL MANAGEMENT AREAS



#### 13.2.1.2 Shoal Bay Coastal Reserve

The Shoal Bay Coastal Reserve is located approximately 1.5 km to the south of the Project area. Given the intervening distance, the Project will not result in any direct or indirect impacts to the Shoal Bay Conservation Reserve.

#### 13.2.2 Shoal Bay Site of Conservation Significance

The Project is located within the Shoal Bay Site of Conservation Significance. As described in Section 13.1.7, the Shoal Bay Site of Conservation Significance is noted for its extensive tidal flats that provide important feeding and roosting area for migratory shorebirds in their non-breeding season. It also noted for its areas of rainforest or monsoon vine thicket occur as well as its high number of threatened species.

The Project will not have a significant impact on the identified values of the Shoal Bay Site of Conservation Significance. As detailed in Section 12.3.3.5.2, the Project will have minimal impacts to the intertidal zone and the nutrients contained in the aquaculture water to be discharged in to the marine environment will be within levels considered acceptable under the Darwin Harbour Water Quality Objectives. As such there will not be any significant impact to feeding resources or habitat for migratory shorebirds in Shoal Bay. The Project has also been designed to avoid an area of monsoon vine thicket adjacent to the Project and measures will be taken to avoid and minimise impacts to threatened flora and fauna which may occur on site (Section 12.4.1).

In listing the Shoal Bay Area as a site of conservation significance, the Northern Territory Government has identified a number of key risks to the values of the Shoal Bay Site of Conservation Significance. These include:

- urbanisation and drainage of wetlands
- uncontrolled recreational use of the area
- weed incursion, in particular exotic pasture grasses
- presence of feral animals
- increased fire regime and intensity.

The Project will not result in an increase in any of the risks identified above. The Project is not an urban development and in terms of impact on the land footprint is relatively small (28.93 ha) and of low intensity. Furthermore, the Project has been designed to avoid wetland and drainage areas and stormwater runoff will be managed (as detailed in Section 3.5.6) to ensure that there is no indirect impacts to Shoal Bay.

It should be noted that the Project site currently shows signs of degradation as a result of heavy human use including abundant litter; open (unburied) latrine sites; evidence of soil compaction; and occurrences of impromptu clearing. There is evidence of increased fire regimes as well outbreaks of weeds and exotic pasture grasses on the site. It is highly likely that the weed and fire management regimes that will be implemented as part of the Project will likely have a positive impact the condition of the Project site and, in turn, the values of the Shoal Bay Site of Conservation Significance.

# 13.3 MEASURES TO AVOID OR REDUCE IMPACTS

#### 13.3.1 Tree Point Conservation Area

As detailed in Section 3.5.6, the following measures are proposed to mitigate and manage any potential indirect impacts to the Tree Point Conservation Area from stormwater runoff from the Project or uncontrolled discharges (e.g. overtopping of ponds):



- Seawater storage ponds and discharge settlement ponds have been designed to cater for an 100 ARI event.
- The Project has been minimised to the greatest extent practicable and will not result in large hardstand areas.
- Vegetation surrounding the facility will be retained to manage stormwater runoff as well as provide a buffer between the Project facilities and the Tree Point Conservation Area.
- Run-off from the hatchery and infrastructure pads will be collected with piped and open drains which will direct the water to flat areas for infiltration and erosion control.



# 14 CULTURAL HERITAGE

# 14.1 METHODS

An archaeological assessment, including a desktop assessment and field survey was undertaken by Ellengowan Enterprises for the Project and is included as Appendix H. In addition, an application for an Authority Certificate was applied for and subsequently granted by the Aboriginal Areas Protection Authority (AAPA) for the works associated with construction of the Stage 1 Hatchery.

A summary of the desktop assessment and field survey methods employed as part of the archaeological assessment is provided in Sections 14.1.1 to 14.1.2.

#### 14.1.1 Desktop Assessment

The desktop assessment involved a search of the Northern Territory Heritage Register database as well as a literature review of previous archaeological surveys conducted at Gunn Point.

#### 14.1.2 Field Survey

A three day field survey was conducted on the 11, 13 and 14 September 2017. The field survey involved a systematic survey method with eight transects set at approximately 100 metre intervals, running east to west across the larger Project site. The survey was conducted on foot with some vehicular observations made along existing tracks around and through the survey area.

## 14.2 EXISTING ENVIRONMENT

The cultural heritage environment of an area includes the following:

- Aboriginal sacred sites and archaeological sites and artefacts
- Macassan archaeological sites and artefacts
- Non-indigenous heritage sites or artefacts.

#### 14.2.1 Aboriginal Heritage

The Larrakia, Tiwi and Wulna people are the indigenous users of the Gunn Peninsula. The Jampalampi Tiwi group claim traditional right to Tree Point, to the south of the proposed Stage 1 Hatchery site and have freehold tenure there as well as the Tree Point (Durduga) Community.

Gunn Peninsula falls within Larrakia land, with acknowledged Wulna and Tiwi interest in the area. The greater Gunn Peninsula is used by Larrakia people for hunting, teaching and ceremonial purposes. The Larrakia acknowledge that the neighbouring Tiwi and Wulna people also have customary use of the area (Calnan, 2006). The Tiwi have both sacred sites and an ongoing presence at the Tree Point (Durduga) Community on the Peninsula. Wulna people continue to use the areas around the Adelaide River floodplains for hunting, teaching and ceremonial purposes (Calnan, 2006).

#### 14.2.1.1 Sacred Sites

An application for an Authority Certificate was applied for and subsequently granted by the Aboriginal Areas Protection Authority (AAPA) for an earlier layout of the Stage 1 Hatchery. Subsequently Project layout has been amended to accommodate environmental constraints (i.e. avoidance of high densities of *Cycas armstrongii*, compliance with buffer requirements under the NT Land Clearing Guidelines and the NT Guideline for Disposal of Waste by Incineration and the air and noise modelling) and an amendment to the Authority Certificate will be sought to accommodate these changes.



There is one registered sacred site to the north of the Project site, which will not be impacted by the Project.

#### 14.2.1.2 Archaeological Sites

Ground surface visibility was generally good over the Project site at the time of the field survey, with visibility ranging from 10% in some areas of regrowth vegetation to 75% in areas that had been recently burnt by a fire. Despite this, no Indigenous archaeological sites were identified on the Project site during the field survey. This is likely due to the lack of permanent water sources in the Project area, which is a key determinate in locating archaeological sites.

Three shell midden sites have been previously recorded on the coastal dunes adjacent to the Project site (Figure 67). An attempt was made to locate the two closest sites to the Project (Shoal Bay 1 and Shoal Bay 3) as part of the field survey. The Shoal Bay 1 site was located and assessed as having low archaeological significance. The Shoal Bay 3 site however, could not be located and appears to have been destroyed by a beach access track.

#### 14.2.2 Macassan Heritage

Macassan heritage relates to evidence from visits by Macassan people who sailed from present day Indonesia from the early 1700s to the early 1900s, often to harvest sea cucumbers (otherwise known as trepang). There are no known recorded instances of Macassan archaeological sites or artefacts in, or in proximity to, the Project area. Furthermore, the Shoal Bay area is not conducive for trepang and no Macassan sites have ever been recorded from the area.

#### 14.2.3 Non-indigenous Heritage

Non-indigenous heritage relates to the places or objects associated with the European activities in the area.

Three aircraft wrecks, two of which were shot down during the first Japanese air raid on Darwin, are recorded on the NT Heritage Register as occurring in the Gunn Point area. The location of the wreck sites of these aircraft have never been formerly recorded as it was unknown where on Gunn Point they had crashed. No trace of any of these wrecks was found in the survey area.

A brick and terracotta culvert was found on the southern boundary of the Project site. This site is outside of the Project footprint and will not be impacted.

#### 14.3 POTENTIAL IMPACTS

Taking into account previous studies and the NT Heritage database and investigations associated with this proposal, there are no recorded Indigenous or non-Indigenous sites in the Project footprint. Therefore, no impacts are anticipated to sacred sites or archaeological sites or places. Expressed as a risk-based statement, there is negligible risk of a significant impact on cultural heritage values.

#### 14.4 MEASURES TO AVOID OR REDUCE IMPACTS

Despite there being no anticipated impacts to sacred sites or archaeological sites or places, a protocol for unexpected finds is included in the EMP (Appendix B). Early discussions with custodians in relation to having a cultural monitor on-site during ground disturbing activities have taken place, consistent with correspondence from the Aboriginal Areas Protection Authority.





FIGURE 67 CULTURAL HERITAGE SITES



# 15 SOCIO-ECONOMIC

# 15.1 BACKGROUND

This Notice of Intent provides the information to consider whether the development is likely to have a significant environmental impact as per the *Environmental Assessment Act* which states:

"that each matter affecting the environment which is, in the opinion of the NT EPA, a matter which could reasonably be considered to be capable of having a significant effect on the environment".

Within this, the Act defines 'environment' very broadly:

"environment means all aspects of the surroundings of man including the physical, biological, economic, cultural and social aspects".

Thus this section of the NOI examines the economic and social aspects of the proposal. Relevant cultural aspects are addressed in Section 14.

The Stage 1 Hatchery is part of Project Sea Dragon, which has been accorded Major Project Status by both the Commonwealth and the Northern Territory Governments. From a functional and enterprise perspective the hatchery cannot be separated from the wider Project in that the infrastructure to be established at Gunn Point is an integral and non-discretionary component of the production system. It is non-substitutable insofar as:

- there are no other prawn hatcheries in Australia that have the capability or capacity to supply the numbers of post-larvae required for Project Sea Dragon;
- post-larvae cannot be imported into Australian because of quarantine laws;
- there are no plausible alternative sites that are suitable for a hatchery that meet the development timeframes for Project Sea Dragon and adequately conform to the strict biosecurity requirements of the Project (see Section 4 for a shortened summary of a number of alternative sites that were investigated).

Therefore this section of the NOI considers the socio-economic aspects of the Project both narrowly and more broadly.

The state of the Northern Territory economy provides the broadest socio-economic context for the proposed action. The most recent 'State of the States' report (CommSec, July 2017) notes that while the NT fares well on some economic indicators it has the lowest annual population growth in Australia, and on indicators such as housing finance and home starts the Territory lags behind other jurisdictions.

#### 15.2 EXISTING ENVIRONMENT

#### 15.2.1 Consultation and Public Information

Project Sea Dragon has been discussed with the public across a range of media and through a variety of channels for more than two years. Figure 68 shows the media exposure of the Project across Australia and Figure 69 shows the potential reach of this exposure.

Until recently Seafarms was unable to identify a feasible site for the construction of a hatchery.

One feature of the approval processes for Project Sea Dragon, is that each of the proposed infrastructure and facility elements are very different from each other. The facility at Exmouth, WA, is extremely small-scale and is being undertaken at a site that had already been licenced. The facilities at Bynoe Harbour are significantly



larger than the Exmouth facility and are within completely different legal, political, environmental and social context. The Grow-out Facility planned for Legune is dissimilar to the previously mentioned sites. Again, the Stage 1 Hatchery proposed for Gunn Point is dissimilar from these other facilities and sites. For example, in comparison the CBC and BMC at Bynoe Harbour, which is the closest facility to the Hatchery:

- 📕 the Stage 1 Hatchery facilities are of smaller scaler scale than the Bynoe Harbour facilities;
- the approvals pathway is different: formal approval by the Development Consent Authority was not required at Bynoe Harbour;
- the culture process is more limited (that is, confined to the spawning, hatching, pre-larval and early postlarval stages of the prawn life-cycle).

On this basis the proponent has pursued tailored community consultation strategies for each component of Project Sea Dragon that take into account the nature and scale of the proposed development at each location, the unique circumstances at each site, and the nature of the local community at each site.

While 'consistency' leading to a 'one-size-fits-all' approach to consultation, may be superficially desirable, it has been more powerful for the proponent to not only learn from experience, but also to not assume that because one approach or decision was made in one place that was relevant to a particular facility or development, the same consultation approach should be pursued elsewhere.

In terms of the methodology employed to understand the potential social impacts, the proponent has undertaken a series of targeted one-on-one meetings and interviews to gain an understanding of the social context for the proposal. It is clear that the general Gunn Point area is considered important to people from Darwin and Howard Springs because of its opportunity for camping in particular. Our discussions also reveal mixed views in relation to current management and behaviours of users.



# FIGURE 68 MEDIA EXPOSURE OF PROJECT SEA DRAGON AS TRACKED THROUGH MELTWATER (FIGURE SUPPLIED BY TRUE NORTH STRATEGIC COMMUNICATIONS)





# FIGURE 69 REACH ASSOCIATED WITH MEDIA EXPOSURE OF PROJECT SEA DRAGON (FIGURE SUPPLIED BY TRUE NORTH STRATEGIC COMMUNICATIONS)

#### 15.2.2 Litchfield Shire

TARIE 34

The proposed Stage 1 Hatchery is in the Shire of Litchfield which, according to the 2016 census data has a population of 23, 855 people, of whom nearly 10% are Aboriginal or Torres Strait Islanders. Table 34 and Table 35 summarise the major demographic and social features of Litchfield Shire.

Industry statistics for Litchfield from the 2016 Census were not available at the time of writing this NOI, however at the 2011 Census the biggest industry in the Northern Territory, and biggest industry in the Litchfield Shire by the number of persons employed was Public Administration and Safety, followed by Construction and Retail Trade. 304 people in Litchfield Shire were working in agriculture, forestry and fishing at the 2011 census. Thus the 28 additional jobs at the hatchery represent about a 7% increase in employment within this industry sector for the Shire.

LITCHFIFLD SHIRE, NT - POPULATION ESTIMATES (2016 CENSUS ABS \$A3)

	Litchfield Shire		NT	
Land area	308 306 ha		135 222 699	
Pop. Density/ha	0.08/ha		0.00	
Working age population (15-64 years)	17 529	74.5% of resident population	162 987 (66.3% of population)	
Largest age bracket	2 217 (45-49 years)		21 707 (25-29 years)	
Tertiary qualification	2 451 (Census 2011)		6 679 (Census 2011) 8 054 (Census 2016)	
No qualification	6 182 (Census 2011)		38 573 (Census 2011) -	
Unemployment rate	2.39% (March 2017		3.5% (March 2017)	
Resident population	23, 528	~10% of NT population	228, 833	
Male	14, 009	59.5%	118, 570	



	Litchfield Shire	NT	
Female	9, 520	40.5%	110, 266
Median age	37		32
Aboriginal/TSI people	2, 321	9.9% of Litchfield population	58, 248
Male	1, 542	66.3%	29, 129
Female	783	33.7%	29, 118
Median age	29		25

TABLE 35

LITCHFIELD SHIRE - PRIVATE DWELLINGS DATA - (2016 CENSUS ABS SA3)

	Litchfield	NT	National
Total private dwellings	8309	89 959	9 901 496
Average people per household	2.8	2.9	2.6
Median weekly personal income *	\$1 092	\$871	\$662
Median weekly household income	\$2 219	\$1 983	\$1 438
Median weekly rent	\$400	\$315	\$335
Median monthly mortgage repayments	\$2,400	\$2 167	\$1 755

#### 15.2.3 Social Values associated with the Gunn Point Area

Project Sea Dragon has undertaken a range of consultations with stakeholders in relation to the overall proposal. The proponent has submitted to the NT EPA a confidential (in order to protect privacy) register of consultations. The consultation approach has been to identify key stakeholders on either a representative or individual basis.

The proposed site is an area that is sparsely populated; with few landholders in the Gunn Point/Glyde point area. The land surrounding the proposed site is mostly held by the Northern Territory Land Corporation on the basis that it will be developed in future. The planning context for the site is outlined in Section 2.4 of this NOI and in the attached Development Consent Application (Appendix J). The relevance of this from a social impact perspective is to note that there are no 'near neighbours' or properties abutting the site in which any residential impacts will be felt.

The key social values associated with the vicinity of the site are described below.

#### 15.2.4 Durduga Tree Point Aboriginal Association

The Durduga Tree Point Aboriginal Association holds freehold land (informally the 'Tree Point Community') (242.5 ha as Portion 3104) approximately 3 km south of the proposed Stage 1 Hatchery site. This land parcel hosts a small community consisting of fewer than 10 dwellings that are occupied variously throughout the year.



Custodians were formally consulted by the Aboriginal Areas Protection Authority in granting a Clearance Certificate for the Stage 1 Hatchery site. Other discussions between the Custodians and the Proponent alerted Project Sea Dragon to an easement owned by the community. The proposal described in this NOI is the result of amending the original Stage 1 Hatchery concept designs to avoid any impact on the easement and the water supply to this community.

The proponent's consultations also revealed community concern in relation to the level and nature of current recreational activities in the vicinity of the community. There is some concern that the 'quiet enjoyment' and rights of the owners are not always respected by visitors to the area.

#### 15.2.5 Future Town of Murumujuk

The future town of Murumujuk is to the immediate north of the proposed Stage 1 Hatchery site. This proposal does not compromise this future proposed use.

#### 15.2.6 Tree Point Conservation Reserve and Shoal Bay Coastal Reserve

The Tree Point Conservation Reserve of 960 ha lies is at the southern boundary of the proposed development. Further south and beyond Potion 6166 (vacant crown land) lies the Shoal Bay Coastal Reserve. This proposal does not compromise either of these uses.

A draft Statement of Management Intent for the Tree Point Conservation Reserve notes that the values of the reserve are natural values that include a large mangrove habitat with a tidal creek that runs back in towards the Shoal Bay Coastal Reserve, a coastal monsoon vine forest that occurs along the beach, and a land-locked swamp that provides habitat for various coastal bird species.

Recreational values consist of the ability of visitors to enjoy activities such as walking along the beach, birdwatching, beach fishing and picnicking. Visitor facilities consist of small areas set aside for picnicking on the edge of the beach. Visitors can also observe variety of seabirds, and the swamps often host striking birds such as the Brolga and the Jabiru.

Recreational fishing also occurs within Shoal Bay. The only physical intersection between the Project and Shoal Bay are the inlet and outlet pipes as depicted in Figure 5. The aquaculture water used in the facility will both be taken from, and discharged into Shoal Bay.

In addition to the values formally identified, the proponent is also aware that informal camping takes place either in the reserve, within the proposed development, between the proposed development and the beach as well as up and down the beach, and to the immediate north of the proposed Stage 1 Hatchery site.

Other consultations have revealed that vehicle-based recreational activities not noted in official documents also occur, mainly on the beach itself. These include four wheel-driving along the beach, ATV recreational activities and other forms of motorised recreation.

#### 15.2.7 Economic Existing Environment

The aquaculture industry has been identified as a key opportunity for northern Australia, and Project Sea Dragon has been awarded Major Project Status by the Australian, Western Australian and Northern Territory governments because it has the potential to generate significant economic and employment opportunities for the Northern Territory and East Kimberley. At full scale, Project Sea Dragon is expected to create an export industry worth an estimated US \$1.7 billion. In addition the Project also represents a contribution to the diversification of northern Australia's economy, which is frequently subject to the cyclical fluctuations of commodity markets.



As outlined in Section 15.1 above, ascribing an economic value to the Stage 1 Hatchery separate from the greater Project is theoretical given there is no prawn aquaculture industry in the Territory. However, it is possible to construct a model in which the hatchery is considered as a stand-alone enterprise providing post-larvae to a vibrant Northern Australian prawn grow-out industry.

Key parameters for such a model are shown in the following two tables. It is important to note that the tables show the values associated with the hatchery as proposed within this NOI. Based on a number of broad assumptions in relation to price, the revenues from the hatchery are guesstimated to be A\$16.6 M per annum.

## FIGURE 70 KEY OPERATING ASSUMPTIONS

Key Operating Assumption	
Operating weeks	52 per year
Production per week	20 million
Annual production	1, 040 million
Market	50% export

## FIGURE 71 PRODUCTION INPUTS

Production Input		
Electricity	Usage per week (MWh)	45
Labour	FTE	28
Broodstock	Number per week	1500
Feed costs	Dry feed per million PLs	A\$ 800
	Wet feed per million PLs	A\$ 140
	Artemia	A\$ 1, 360

The operating assumption of 50% of the PLs being for export does not represent what is planned for this facility, but has been assumed to demonstrate the economic capacity of the facility and what would be required should it be a standalone enterprise. This analysis shows that Project Sea Dragon would not proceed without these hatchery facilities. This is for three reasons:

- there are no other prawn hatcheries in Australia that have the capability or capacity to supply the numbers of post-larvae required for Project Sea Dragon;
- **P** post-larvae cannot be imported into Australia because of quarantine laws
- the economic case for the Project would be impaired to the extent that it would not be investable.

It could be argued therefore that the potential of a \$1.7 billion industry is contingent upon the proponent being able to secure the site for this purpose.

#### 15.2.8 Summary

From a socio-economic perspective this development is low-impact/high value. There are minimal social risks and genuine potential social net benefits arising from the action.

Under the operating legislation, the key question to be resolved by the EPA in determining whether the information contained within this NOI leads to further Assessment under the *Environmental Assessment Act* 



*2013* is whether there is a significant impact on the social or cultural environment in the vicinity of the proposed facility or more broadly within the NT.

Figure 72 below provides a model for interpreting the requirements in relation to the Act, taking into account not only the legislation, but also accounts for those actions which would not be considered for investment by the private sector, but are in effect social investments normally undertaken by governments. Application of this model indicates that the proposed development can be assessed as having 'no significant' socio-economic impact requiring assessment beyond what is required under the Development Consent process under the NT *Planning Act*.

This NOI also needs to be considered in the context of the broader approvals framework for the proposed action. In this case, and in contrast to the other Project Sea Dragon developments proposed at Bynoe Harbour and at Legune, Development Consent by the Development Consent Authority is required at this site for the proposed action. Under the *Planning Act* this involves a formal public consultation process. Thus there is a material difference in process between this development and those at Legune and Bynoe Harbour that means public interest and consultation will occur. This assessment does not reveal any significant impact that would trigger significant impacts in relation to the 'human environment'.

The evidence provided here forms the basis to conclude that there is negligible (if any) negative social impact across the greater Darwin area in the event that the proposal proceeds. However, there is the potential of a negative social impact (or net social loss) if it does not proceed.

Net economic benefits Net social costs (negative benefits or risks) <mark>Assessment required</mark>	Net economic benefits (e.g profits, income jobs) Meets Assessment Act for no significant impact <b>No further assessment required</b>
Net social cost or risk	Net social benefit
Negative social costs (social risks) Economic costs Proposal should not proceed (No action)	Substantial economic costs or payments yielding significant social benefits Assessment required or Government and social programs assessed through Cabinet

# **Economic benefits or profits**

# **Economic costs or losses**



# FIGURE 72 QUALITATIVE SOCIO-ECONOMIC ASSESSMENT MODEL FOR DETERMINING SIGNIFICANCE FOR PURPOSES OF *ENVIRONMENTAL ASSESSMENT ACT*

## 15.3 POTENTIAL IMPACTS

#### 15.3.1 Potential Social Impacts

The Stage 1 Hatchery has been designed to take into account beach access and the prevailing uses of the land both on, and in the vicinity of, the site. Access to the beach will not be impeded by the proposal and the final engineering design is to construct the intake and outfall pipelines using horizontal directional drilling, meaning that the pipelines will be buried and that both access and the beach itself, are protected.

At a maximum, the direct social impact will be to exclude visitors from the 130.5 ha site. On the basis that recreational opportunities are potentially available across any of Portion 2626 this reduces the available area for camping and other recreation from 2,697.37 hectares to 2,566.87 hectares. This reduction is insignificant in the total amount of land available in the Gunn Point/Glyde Point area, especially considering that existing reserves have been excluded from the analysis.

Discharge of the aquaculture water into Shoal Bay will have no impact upon recreational fishing or visual amenity. The quality of the water to be affected by the discharge from the Project will remain within levels considered acceptable under the Darwin Harbour Water Quality Guidelines (see Section 9.3.3).

'Uncontrolled recreational use' of the Shoal Bay Site of Conservation Significance is identified as a management issue and parts of the site are considered 'degraded' due to 'heavy disturbance' by recreational users (see the Statement on the Shoal Bay Site of Conservation Significance at:

http://www.territorystories.nt.gov.au/bitstream/handle/10070/254289/08\_shoal.pdf?sequence=1&isAllowed= y).

The proposed development provides for two managers' houses and for two dorm-style beds. This reflects the intention for the Stage 1 Hatchery to be staffed mostly by employees commuting between the Stage 1 Hatchery and Howard Springs or Palmerston. The managers' residences ensure proper oversight and management of the site on a 24 hour per day 52 week per year basis. The configuration also provides sufficient redundancy for security and safety. The dorm accommodation provides for safety of staff to assist in the management of fatigue (if required). This level of residency will have minimal social impact on existing use of the area, if there is any impact it is likely to be positive (although also insignificant) in that there will be people present who can assist in the event of emergencies.

Anecdotally, recreational activities have resulted in injuries in the area. A permanently staffed facility may provide a contact point that can assist in the case of emergency.

The hatchery and associated infrastructure has been designed to enable access to the beach and camping around the facility to occur uninterrupted. The design approach to recreational impact, with the exception of the site itself, is avoidance of impact.

When operational the hatchery will employ about 28 FTE and will be self-contained, meaning that it will not require surrounding infrastructure or facilities other than the existing water supply from the PWC borefield. Thus there will be no automatic consequential impact on the area immediately surrounding the site from the workforce.

Section 3.6 of this NOI describes the number of vehicle movements anticipated during construction and operation of the facility.



#### 15.3.1.1 Visual and Navigational Impacts

The visual and navigational impacts as a result of the construction of the intake and discharge pipelines are anticipated to be low. The intake and discharge pipelines consist of three HDPE pipes (two intake and one discharge pipeline), each with an overall diameter of 250 mm. The pipelines will be buried by horizontal directional drilling methods under the fore dune and beach to ensure that beach access and the ability to drive along the beach to remain unhampered.

The buried section of pipelines will be extended as far offshore as possible to minimise the visual impact. Figure 73 shows the proposed alignment for the intake pipes overlaid on both the approximate Mean Low Water Spring (MLWS) extent, Mean Low Water Neap (MLWN) and Mean Sea Level. MLWS gives the average "lowest" low tide, while Mean Low Water Neap gives the average "highest" low tide, hence together they show the typical range that may be exposed at any low tide (under average meteorological conditions).

There may be some impacts to the boat navigation in the vicinity of the pipelines. The proponent is seeking advice from the Director of the Marine Department (Department of Infrastructure, Planning) regarding the marking requirements for the intake and discharge pipelines and the need for any navigational aids in the marine environment.



M \Jobs\3800-3899\3894\_Sea\_Dragon\_Coastal\_Study\Spatial\ESRI\Mxds\3894-25\3894-25\_Model\_discharges\_Feas02\_v3\_Intake mxd

# FIGURE 73 EXTENT OF PIPELINE VISIBLE AT MEAN LOW WATER SPRING, MEAN LOW WATER NEAP AND MEAN SEA LEVEL

#### 15.3.2 Potential Economic Impacts

Environmental assessments typically use a methodology of comparing either 'no action' or a 'baseline' against the predicted 'effects,' 'impacts', 'consequences' or 'risks' arising from or associated with the proposed action.



Table 36 provides an assessment of the socio-economic consequences of the Stage 1 Hatchery at Gunn Point not proceeding (that is the 'no action' case) compared with the impacts associated with the proposal going ahead.

It summarises the local impacts associated with the Stage 1 Hatchery, but also provides the wider spill-over socio-economic impacts in the context of the other Project Sea Dragon facilities, which are intrinsically linked to the Hatchery component of the Project. This is a conservative assessment in relation to social and economic benefits that can be captured. There are other benefits that cannot be captured in this type of assessment, for example, the breeding program facilities for Project Sea Dragon (collectively the Founder Stock Centre, the Core Breeding Centre, the Brood Stock Maturation Centre and the Hatcheries) require the deployment of the best of prawn aquaculture science and technology - increasingly, a science and technology focus on prawn genetics and breeding, biosecurity and prawn health allied to facilities with high economic value offers the prospect for Darwin to establish itself as an innovation centre for aquaculture.

# TABLE 36SOCIO-ECONOMIC CONSEQUENCES OF THE 'NO ACTION' VS 'PROJECTPROCEEDS' SCENARIOS

Socio-economic Indicator	No action – Proposal does not p	roceed	Proposal proceeds	
	Impact within Litchfield Shire	Indirect and wider impacts	Impact within Litchfield Shire	Indirect and wider impacts
Employment and jobs	Opportunity cost of approx. 28 FTE jobs not created Otherwise no impact	Up to 400 construction and 300 operations jobs (ongoing) will be foregone; no additional employment at Bynoe Harbour; Seafarms does not establish head office functions in Darwin	Approx. 28 Full- time equivalent jobs at hatchery within commuting distance of Howard Springs. Darwin construction estimated to provide 70 jobs over 3 years	The overall employment impact is to create an average of 444 jobs over 3 years construction years and 334 ongoing jobs across all sites. Assuming a growth and development pathway, this leads to approx. 1500 direct FTE jobs.
Investment	Opportunity cost of the economic impact of the investment. Otherwise no change	Loss of \$400+ million in investment across northern Australia for Stage 1 of PSD. Ultimate potential loss of US\$1.5B for all stages of Project.	Direct investment of \$A60 million; ancillary investment of \$A40 million to upgrade Gunn Pt road to a two-lane sealed standard to the entrance of the Project site at Gunn Point (Chief Minister media release, 1st Sep 2017)	The overall economic benefits of Stage 1 of Project Sea Dragon were reported in the Stage 1 Legune Grow-out Facility EIS, which is available on the NT EPA website.
Residential amenity	Continued degradation of residential amenity	No change	Hatchery provides additional communications	Residential amenity of Native Title Holders at Legune will be improved via ILUA



Socio-economic Indicator	No action – Proposal does not proceed		Proposal proceeds	
Residential services (Tree Point)	No change	None	No signficant impact	No significant impact
Recreation - camping	Continued informal and unregulated use of site	Not relevant – no impact	No impact on recreational values other than a small displacement effect to other parts of Gunn Point	Not relevant – no impact
Recreation – beach access	No change	Not relevant – no impact	No significant impact - beach access will not be impacted	Not relevant – no impact
Recreation - fishing	No change	Not relevant – no impact	Area may be more easily accessible for fishers due to infrastructure upgrade	No impact
Recreation - bird watching	No change	Not relevant – no impact	No impact – birds will not be disturbed, there are no significant birdwatching areas nearby that would be excluded from	No indirect impact

#### 15.3.3 Workforce

There will be a positive social impact in the form of job creation. To staff the Stage 1 Hatchery a workforce of 28 is required. The workforce is expected to come from a mix of sources, including:

V directly employed staff, self-accommodated in the local area and/or accommodated nearby, and

Iocal contractors, self-accommodated in the local area and/or accommodated nearby.

Employee numbers and positions at the Hatchery during Stage 1 are presented in Table 37.

TABLE 37       FULL TIME EMPLOYEES AT THE STAGE 1 HATCHERY			
Position	Stage 1		
Hatchery Manager	1		
Unit Manager	1		
Aquaculture Technician	7		
Transit Technicians	2		
Junior Technicians	4		
Electro Mechanical Technicians	1		



Position	Stage 1
Aquaculture Worker	9
Administrator	1
Truck Operators	2
Total	28

# 15.4 MEASURES TO AVOID OR REDUCE IMPACTS

The primary social value of the Project area is associated with the recreational use of the site. The Project site has been minimised to the smallest extent possible and access will only be restricted to the immediate Project site (approximately 130 ha). This area is insignificant given the total amount of land that is publically accessible in the greater Gunn Point/Glyde Point area.

Access to the beach will not be impacted by the Project. The pipelines will be buried by horizontal directional drilling methods under the foredune and beach to ensure that beach access and the ability to drive along the beach to remain unhampered. The road easement to the Tree Point Conservation Area will also be retained.

The intake and discharge of the aquaculture water will have no impact on aquatic ecosystem health. Therefore no impacts on recreational fishing or visual amenity.

There may be some minor impacts to boat navigation in the vicinity of the pipelines. The proponent is seeking advice from the Director of the Marine Department (Department of Infrastructure, Planning) regarding the marking requirements for the intake and discharge pipelines and the need for any navigational aids.



# 16 CLIMATE CHANGE

## 16.1 METHODS

To assess the potential impact of climate change on the coastal environment and the coastal infrastructure proposed as part of the Project, a risk assessment methodology was adopted. The main steps of the risk assessment process are as follows:

- identification of the relevant threats associated with climate change to the coastal environment
- determination of the aspects of the development that could potentially be exposes to these threats
- assessment of the overall risk of this exposure.

## 16.2 POTENTIAL CLIMATE CHANGE EFFECTS OF RELEVANCE

The potential climate change effects that could impact the physical processes operating on the coastal environment of the Project area are:

- 📕 sea level rise
- tropical cyclone intensity and frequency.

#### 16.2.1 Sea Level Rise

Global average sea level rose by approximately 0.17 m during the 20th Century. The average global rate of sea level rise between 1950 and 2000 was  $1.8 \pm 0.3$  mm/year. The tidal gauge in Darwin Harbour to the west of the proposed facility is one of the National Tide Centre's array of sixteen high accuracy sea level measurement stations. The net relative sea level trend since installation in June 1992 is 7.6 mm/year at Darwin (BoM 2017). The Intergovernmental Panel on Climate Change (IPCC) is the authoritative source on projections of future sea-level rise due to climate change. Table 38 displays the sea level rise projections relative to late 20th century mean sea levels for the A1F1 high emission scenario.

TABLE 38	IPCC 2014 PROJECTED SEA LEVEL RISE				
Scenario	ario 2030 2070 2100				
IPCC	0.18 m	0.42 m	0.82 m		

The main impacts associated with increase in mean sea level at Gunn Point are considered to be:

shoreline recession

increase in storm tide elevations.

#### 16.2.2 Tropical Cyclone Intensity and Frequency

There is considerable debate regarding the projected impact of climate change on tropical cyclones. The Engineers Australia Guidelines for Responding to the Effects of Climate Change in Coastal and Ocean Engineering suggests that whilst there is "no evidence that (globally) tropical cyclones are getting stronger, or are becoming more frequent or producing greater rainfall", there is the opportunity that peak winds during a tropical cyclone may increase by 11% by the year 2100, and that rainfall associated with a tropical cyclone may increase by 20% by 2100 (Engineers Australia 2012).



The spatial and seasonal distribution of cyclone occurrence is expected to remain approximately similar to present whilst the frequency of tropical cyclone formation may actually decline under climate change.

The main potential impacts associated with increases in tropical cyclone intensity are considered the following;

- higher maximum wind speeds generating larger waves and associated wave set-up on the coastline
- higher maximum wind speeds and lower central pressures generating large storm surges.

A storm tide assessment by Systems Engineering Australia (2010) considered the effects of sea level rise and increasing winds. The predicted storm tides for a number of return periods and horizons at Gunn Point are summarised relative to existing conditions in Table 39. Table 39 shows increases in predicted storm tide elevations at Gunn Point of 0.8 m through to 1.5 m by 2100. This increase is comprised of 0.8 m of mean sea level rise and an additional meteorologically induced component of 0.1 m for the 100-year ARI event, and 0.7 m for the 500 year event.

TABLE 39     PREDICTED STORM TIDE LEVELS					
	Return Period (Average Recurrence Interval, ARI)				
	50	100	500	1,000	10,000
Gunn Point					
2010	3.5 m AHD	3.7 m AHD	4.2 m AHD	4.7 m AHD	6.3 m AHD
2050	3.8 m AHD	4.1 m AHD	5.0 m AHD	5.6 m AHD	7.4 m AHD
2100	4.3 m AHD	4.6 m AHD	5.7 m AHD	6.2 m AHD	7.9 m AHD

## 16.3 POTENTIAL IMPACTS

The main components of the Project and the coastal environment, that are considered to be exposed to the impacts of sea level rise and tropical cyclone intensity and frequency are the:

- intake and discharge infrastructure
- Iand based facilities
- water quality and circulation.

#### 16.3.1 Intake and Discharge Infrastructure

The intake and discharge infrastructure are vulnerable to potential changes to the shoreline through increased inundation, or coastal erosion due to increases in mean sea level, storm tides and wave action. Higher wave energy could result in deeper water during storm events which may impact the bed more than present conditions.

The consequences of changes to the shoreline are likely to be minimal at the intake pipe location as the pipe will be secured by piles to the bed. Changes to the shoreline at the discharge point could result in more significant consequences, and could include redesign and relocation costs and inconvenience.

Increased wave energy on the bed could lead to increase scour and movement of the intake pipeline, potentially causing damage to the pipe and loss of production.



#### 16.3.2 Land Based Facilities

Facilities associated with the Project adjacent to or near the existing shoreline could potentially be exposed to threats associated with shoreline recession. The proposed location of the facility is approximately 150 m landward of the existing vegetation line.

The elevation of the development is above the predicted storm tide levels thus the inundation threat is low.

#### 16.3.3 Water Quality and Circulation

As sea levels rise, there will be greater water exchange occurring and a net effect of more flushing, which should see lower concentrations of the discharge waters within the Gunn Point region.

## 16.4 MEASURES TO AVOID OR REDUCE IMPACTS

The risk posed by climate change to intake and discharge infrastructure has been accommodated by designing intake and discharge facilities setback from the present-day coastline to allow for any changes as a result of increased inundation to 2100.

Detailed design of the intake and outfall pipes and bedding will consider the potential for increased wave conditions into the future. Where the pipes are buried, they will be deep enough such that they do not become exposed during erosion events.

The likely extent of erosion caused by shoreline recession by 2100 will be considered in the detailed design of the Project facilities.



# 17 ENVIRONMENTAL MANAGEMENT PLAN

To ensure that the appropriate environmental management practices are implemented, Seafarms has developed a draft Environmental Management Plan for the construction and operational stages of the Project. The draft EMP clearly describes the management activities, mitigation and control measures that will be adopted to minimise environmental impacts and enhance the benefits of the Project. It includes those management activities, mitigation and control measures detailed in this Notice of Intent as well as those arising from the final detailed design and construction and operational requirements. As well as the commitment given above, it is worth noting that as part of the Aquaculture Licence application the proponent is required to produce an Environmental Management Plan to a standard acceptable by the Northern Territory EPA.

Environmental matters for which management activities, mitigation and control measures have been developed include (but are not limited to):

- erosion and sediment control
- Iand and soils
- acid sulfate soil
- vegetation management
- weeds and pests
- 🗾 fauna
- surface water
- 📕 groundwater management
- 📕 waste management
- noise and air quality
- effluent management
- 📕 hazardous materials
- 📕 bushfire management
- traffic and transport
- 📕 social matter
- cultural heritage
- biting insects

During construction, the contractor will be responsible for the implementation of construction environmental management plans, which will also need to take into account any conditions under which the Project may be approved. During operation, Seafarms will be responsible for the implementation of the operational environmental management plans, which also will take into account any conditions of Project approval. The mitigation, management and control measures for each of the above are described in the EMP.



# 18 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

Table 40 summarises the Matters of National Environmental Significance (MNES) that may occur in, or may relate to, the Project area and surrounds. These values were derived from a search of the EPBC Act protected matters search tool with a buffer of 20 km applied to the Project area for fauna species, and 5 km applied to the Project area for flora species.

TABLE 40 MNES THAT MAY OCCUR OR MAY RELATE TO THE STAGE 1 HATCHERY			
Matter of National Environmental Significance	Could the MNES occur within the Project Area or surrounds?		
World Heritage properties	No		
National Heritage places	No		
Ramsar Wetlands of International Importance	No		
Great Barrier Reef Marine Park	No		
Commonwealth Marine Area	No		
Listed threatened ecological communities	No		
Listed threatened species	Potentially - 40 threatened species		
Listed migratory species	Potentially - 51 migratory species		

As presented in Table 40, the protected matters search indicates that the only MNES that could potentially be affected by the Project are listed threatened species and listed migratory species.

In terms of threatened and migratory species, it should be recognised that the EPBC Act protected matters search tool predicts which species protected under the auspices of the EPBC Act may occur or relate to a site based on bioclimatic modelling. As such, the species returned from the EPBC protected matters search tool searches have not necessarily been recorded from the site, and may not be likely to occur on the site.

Table 41 lists the threatened species which were returned from the protected matters search tool. It also indicates which of these species are listed under the NT TPWC Act. Species that are both migratory and threatened under the EPBC Act are included in Table 41. Of the listed threatened species that could possibly occur within the Project area or surrounds:

- one is a flora species
- two are marine mammals
- 📕 seven are sharks and sawfish
- one is a terrestrial reptile
- six are marine reptiles
- nine are shorebirds and waterbirds
- 📕 five are other birds



seven are terrestrial mammals

two are bats.

Table 42 lists the migratory species which were returned from the protected matters search tool. None of these migratory species are listed under the NT TPWC Act. Of the listed migratory species that could possibly occur within the Project area or surrounds:

- 10 are either fish, marine mammals or marine reptiles
- nine are terrestrial birds
- 32 are shorebirds and waterbirds

An assessment has been undertaken to determine whether the Project is likely to result in a significant impact on any of the species listed in Table 41 and Table 42. This involved desktop assessments, a two day terrestrial habitat survey of the site and surrounds on 11 and 12 July 2017 for fauna values, and a six day site survey for vegetation and threatened flora between 2-7 July 2017. For each species identified within the databases and predictive models for the Gunn Point area, an assessment of the likelihood of site occurrence was also undertaken. The conclusion in regard to site occurrence for each species was based on the known ecological requirements, presence of local records, and the presence and condition of suitable potentially habitat resources on the site. Finally, the impact assessment involved application of the Australian Governments Significant Impact Guidelines 1.1 – Matters of National Environmental Significance (DoE 2013).

Based on this assessment a referral has been submitted to the Australian Government to obtain a decision on whether the Project will need formal assessment and approval under EPBC Act (Appendix I). The referral concludes that, the Project will not result in a significant impact on a matter protected under the EPBC Act, and therefore the Project is not expected to be determined a controlled action.

#### TABLE 41THREATENED SPECIES LISTED UNDER THE EPBC ACT

Species	EPBC Act Status	TPWC Act Status	
Flora			
Stylidium ensatum	Endangered	Endangered	
Marine Mammals			
Blue Whale ( <i>Balaenoptera musculus</i> )	Endangered, Migratory	-	
Humpack Whale ( <i>Megaptera</i> novaeangliae)	Vulnerable, Migratory	-	
Sharks and Sawfish			
Great White Shark ( <i>Carcharodon carcharias</i> )	Vulnerable	-	
Whale Shark (Rhincodon typus)	Vulnerable	-	
Northern River Shark ( <i>Glyphis</i> garricki)	Endangered	Endangered	
Speartooth Shark (Glyphis glyphis)	Critically Endangered	Vulnerable	



Species	EPBC Act Status	TPWC Act Status	
Dwarf Sawfish (Pristis clavata)	Vulnerable	Vulnerable	
Freshwater Sawfish (Pristis pristis)	Vulnerable	Vulnerable	
Green Sawfish (Pristis zijsron)	Vulnerable	Vulnerable	
Terrestrial Reptiles			
Plains Death Adder ( <i>Acanthophis</i> <i>hawkei</i> )	Vulnerable	Vulnerable	
Marine Reptiles			
Leatherback Turtle ( <i>Dermochelys coriacea</i> )	Endangered	Critically Endangered	
Loggerhead Turtle (Caretta caretta)	Endangered	Vulnerable	
Green Turtle (Chelonia mydas)	Vulnerable	-	
Hawksbill Turtle ( <i>Eretmochelys</i> <i>imbricata</i> )	Vulnerable	Vulnerable	
Olive Ridley Turtle ( <i>Lepidochelys</i> olivacea)	Endangered	Vulnerable	
Flatback Turtle (Natator depressus)	Vulnerable	-	
Shorebirds and Waterbirds			
Australian Painted Snipe ( <i>Rostratula australis</i> )	Vulnerable	Vulnerable	
Red Knot (Calidris canutus)	Endangered, Migratory	Vulnerable	
Curlew Sandpiper ( <i>Calidris ferruginea</i> )	Critically Endangered, Migratory	Vulnerable	
Great Knot (Calidris tenuirostris)	Critically Endangered, Migratory	Vulnerable	
Greater Sand Plover ( <i>Charadrius</i> <i>leschenaultii</i> )	Vulnerable, Migratory	Vulnerable	
Lesser Sand Plover ( <i>Charadrius mongolus</i> )	Endangered, Migratory	Vulnerable	
Bar-tailed Godwit (baueri) ( <i>Limosa</i> <i>lapponica baueri</i> )	Vulnerable, Migratory	Vulnerable	
Northern Siberian Bar-tailed Godwit ( <i>Limosa lapponica menzbieri</i> )	Critically Endangered, Migratory	Vulnerable	
Eastern Curlew (Numenius madagascariensis)	Critically Endangered, Migratory	Vulnerable	
Other Birds		·	



Species	EPBC Act Status         TPWC Act Status		
Alligator Rivers Yellow Chat (Epthianura crocea tunneyi)	Endangered	Endangered	
Gouldian Finch (Erythrura gouldiae)	Endangered Vulnerable		
Red Goshawk ( <i>Erythrotriorchis</i> radiatus)	Vulnerable Vulnerable		
Partridge Pigeon ( <i>Geophaps smithii</i> smithii)	Vulnerable	Vulnerable	
Masked Owl (Tyto novaehollandiae kimberli)	Vulnerable	Vulnerable	
Terrestrial Mammals			
Fawn Antechinus ( <i>Antechinus bellus</i> )	Vulnerable	Endangered	
Brush-tailed Rabbit-rat ( <i>Conilurus penicillatus</i> )	Vulnerable	Endangered	
Water Mouse (Xeromys myoides)	Vulnerable	-	
Nabarlek (Petrogale concinna canescens)	Endangered	Vulnerable	
Northern Quoll ( <i>Dasyurus hallucatus</i> )	Endangered	Critically Endangered	
Black-footed Tree-rat (Kimberley and mainland Northern Territory) (Mesembriomys gouldii gouldii)	Endangered	Vulnerable	
Northern Brush-tailed Phascogale ( <i>Phascogale pirata</i> )	Vulnerable	Endangered	
Bats			
Ghost Bat (Macroderma gigas)	Vulnerable	Near Threatened	
Bare-rumped Sheath-tailed Bat (Saccolaimus saccolaimus nudicluniatus)	Vulnerable	-	

# TABLE 42 MIGRATORY SPECIES LISTED UNDER THE EPBC ACT

Species	EPBC Act Status	TPWC Act Status	
Fish, Marine Mammals and Marine Reptiles			
Narrow Sawfish, Knifetooth Sawfish (Anoxypristis cuspidata)	Migratory	-	
Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince	Migratory	-	



Species	EPBC Act Status	TPWC Act Status
Alfred's Ray, Resident Manta Ray ( <i>Manta alfredi</i> )		
Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray ( <i>Manta birostris</i> )	Migratory	-
Salt-water Crocodile, Estuarine Crocodile ( <i>Crocodylus porosus</i> )	Migratory	-
Bryde's Whale (Balaenoptera edeni)	Migratory	-
Dugong (Dugong dugon)	Migratory	-
Irrawaddy Dolphin ( <i>Orcaella</i> brevirostris)	Migratory	-
Killer Whale, Orca (Orcinus orca)	Migratory	-
Indo-Pacific Humpback Dolphin (Sousa chinensis)	Migratory	-
Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) ( <i>Tursiops aduncus</i> [Arafura/Timor Sea populations])	Migratory	-
Terrestrial Birds		
Oriental Reed-Warbler (Acrocephalus orientalis)	Migratory	-
Fork-tailed Swift (Apus pacificus)	Migratory	-
Red-rumped Swallow ( <i>Cecropis</i> daurica)	Migratory	-
Oriental Cuckoo, Horsfield's Cuckoo ( <i>Cuculus optatus</i> )	Migratory	-
Barn Swallow (Hirundo rustica)	Migratory	-
Rainbow Bee-eater ( <i>Merops</i> ornatus)	Migratory	-
Grey Wagtail (Motacilla cinerea)	Migratory	-
Yellow Wagtail ( <i>Motacilla flava</i> )	Migratory	-
Rufous Fantail (Rhipidura rufifrons)	Migratory	-
Shorebirds and Waterbirds		
Common Sandpiper ( <i>Actitis hypoleucos</i> )	Migratory	-



Species	EPBC Act Status	TPWC Act Status
Common Noddy (Anous stolidus)	Migratory	-
Ruddy Turnstone ( <i>Arenaria</i> interpres)	Migratory	-
Sharp-tailed Sandpiper ( <i>Calidris acuminata</i> )	Migratory	-
Sanderling (Calidris alba)	Migratory	-
Pectoral Sandpiper ( <i>Calidris melanotos</i> )	Migratory	-
Red-necked Stint (Calidris ruficollis)	Migratory	-
Long-toed Stint (Calidris subminuta)	Migratory	-
Little Ringed Plover ( <i>Charadrius dubius</i> )	Migratory	-
Oriental Plover, Oriental Dotterel (Charadrius veredus)	Migratory	-
Lesser Frigatebird, Least Frigatebird (Fregata ariel)	Migratory	-
Great Frigatebird, Greater Frigatebird ( <i>Fregata minor</i> )	Migratory	-
Swinhoe's Snipe (Gallinago megala)	Migratory	-
Pin-tailed Snipe (Gallinago stenura)	Migratory	-
Oriental Pratincole ( <i>Glareola maldivarum</i> )	Migratory	-
Grey-tailed Tattler (Tringa brevipes)	Migratory	-
Wandering Tattler (Tringa incana)	Migratory	-
Broad-billed Sandpiper ( <i>Limicola falcinellus</i> )	Migratory	-
Asian Dowitcher ( <i>Limnodromus</i> semipalmatus)	Migratory	-
Black-tailed Godwit (Limosa limosa)	Migratory	-
Little Curlew, Little Whimbrel ( <i>Numenius minutus</i> )	Migratory	-
Whimbrel (Numenius phaeopus)	Migratory	-
Osprey (Pandion haliaetus)	Migratory	-
Pacific Golden Plover ( <i>Pluvialis fulva</i> )	Migratory	-



Species	EPBC Act Status	TPWC Act Status
Grey Plover (Pluvialis squatarola)	Migratory	-
Little Tern (Sterna albifrons)	Migratory	-
Roseate Tern (Sterna dougalli)	Migratory	-
Common Tern (Sterna hirundo)	Migratory	-
Wood Sandpiper (Tringa glareola)	Migratory	-
Common Greenshank, Greenshank (Tringa nebularia)	Migratory	-
Marsh Sandpiper, Little Greenshank (Tringa stagnatilis)	Migratory	-
Terek Sandpiper (Xenus cinereus)	Migratory	-



# 19 RISK ASSESSMENT

The risk assessment provides a framework for identifying components of the Project with the potential to result in environmental impacts and highlights where specific control strategies are required to minimise the likelihood and consequence of identified risks. Environmental impacts include impacts to environmental, cultural and socio-economic aspects. Health and safety impacts are not considered in this risk assessment but will be dealt with in the Health and Safety Plan.

# 19.1 METHOD

The methodology employed in the following risk assessment is based on a standard semi-quantitative risk assessment consistent with AS/NZS ISO 31000:2009 'Risk Management – Principles and Guidelines'. The risk assessment process is shown in Figure 74.



#### FIGURE 74 RISK ASSESSMENT PROCESS

#### 19.1.1 Context Establishment

The context of the environmental risks was determined by the environmental setting of the Project and the Project design. A detailed description of the environment in which the Project is located is provided Section 5 to Section 15 and a description of the construction and operational methods is provided in the Project Description in Section 3.

#### 19.1.2 Risk Identification

The risk identification process involved the identification of risks to environmental values arising from Project. For the purposes of this risk assessment, the environmental values were referred to as 'consequence aspects', and broadly categorised as:



- general ecological values
- threatened and migratory species
- historic and cultural heritage
- 📕 amenity
- 🗾 land
- marine and estuarine waters
- 📕 freshwater
- 📕 groundwater
- air quality
- 📕 social
- 📕 economic
- traffic and transport

Risks were systematically identified taking into consideration the full range of Project activities during each phase of the Project (i.e. construction and operations) in relation the consequence aspects listed above.

#### 19.1.3 Risk Analysis

Once all the potential risks had been identified, initial risk ratings were assessed by assigning a level of consequence in accordance with consequence criteria for the Project (Table 43) and a level of likelihood in accordance with likelihood descriptors (Table 44). The initial risk rating considered the consequence and likelihood of the event occurring without any control measures in place. Following risk treatment (i.e. the implementation of control strategies) the consequence and likelihood of the event occurring was reassessed.

Consequence criteria (Table 43) were developed for each of the consequence aspects list in Section 19.1.2 and ranged on a scale of magnitude from 'very low' to 'very high'. Magnitude was considered as a function of the size of the impact, the spatial area affected and expected recovery time.

The level of likelihoods (Table 44) were determined based upon the probability of occurrence, within the context of reasonable timeframes and frequencies given the nature of the anticipated Project life.



Consequence aspect	Consequences				
	Very Low	Low	Moderate	High	Very High
General Ecological Values	Insignificant or imperceptible effects.	Minor local resource and/or habitat modification and/or local short-term decrease in abundance of some species with no lasting effect on local population.	Moderate local resource and/or habitat modification and/or local long-term decrease in abundance of some species resulting in some permanent change to community structure.	Moderate resource and/or habitat modification and/or regional decrease in abundance of some species resulting in some changes to community structure.	Substantial regional resource and/or habitat modification and/or loss of numerous species resulting in the dominance of only a few species.
Threatened and Migratory Species	Minor local habitat modification and/or lifecycle disruption for a listed species No discernible decrease in size of populations of	Moderate local habitat modification and/or lifecycle disruption for a listed species. Minor local decrease in size of populations of	Substantial local habitat modification and/or lifecycle disruption for a listed species. Moderate lasting decrease in size of populations of	Moderate widespread habitat modification and/or lifecycle disruption for a listed species. Substantial local decrease in size of populations of	Substantial widespread habitat modification and/or lifecycle disruption for a listed species. Moderate or substantial widespread decrease in
	conservation significant fauna species.	species of conservation significance.	conservation significant species.	conservation significant species.	size of populations of conservation significant species.
Historic and Cultural Heritage	Insignificant impact to site or item of cultural significance.	Reparable minor impact to site or item of cultural significance.	Reparable major damage to site or item of cultural significance.	Irreparable minor damage to site or item of cultural significance.	Irreparable major damage to sites of cultural significance or sacred value.


Consequence aspect	Consequences												
	Very Low	Low	Moderate	High	Very High								
Amenity	Visual: Changes to landscape as a result of the Project are barely noticeable from key vantage points, publicly accessible areas and areas of significance. Noise: Negligible noise level increase at closest affected receiver	Visual: Changes to landscape as a result of the Project are visible only from nearby key vantage points, publicly accessible areas and areas of significance, and only occupy a small proportion of the viewshed. Noise: Marginal noise level increase at closest affected receiver	Visual: Changes to landscape as a result of the Project are visible from most key vantage points, publicly accessible areas and areas of significance, and only occupy a small proportion of the viewshed. Noise: Moderate noise level increase at closest affected receiver	Visual: Changes to landscape as a result of the Project are visible, occupy a large proportion of the viewshed and may intrude upon the visual amenity of key vantage points, publicly accessible areas and areas of significance across a variety of landscape. Noise: Appreciable noise level increase at closest affected receiver.	Visual: Changes to landscape as a result of the Project are clearly visible, numerous, continuous and widespread and are likely to be viewed from a number of key vantage points, publicly accessible areas and areas of significance across the landscape. Noise: Significant noise level increase at closest affected receiver.								



Consequence aspect	Consequences	Consequences												
	Very Low	Low	Moderate	High	Very High									
Land	Impacts are localised and confined to near surface soils and are short-term. Easily rectified with no long term impacts.	Localised and medium- term reversible impact. May take up to 1 year to remediate.	Major localised impact or widespread lower impact. Remediation may take months to years.	Impact most likely affecting large areas and/or deep soil profiles leaving long term residual damage. Requires long- term recovery. May take years for full remediation to a point suitable for beneficial uses commensurate with current land uses.	Impact most likely affecting large areas and/or deep soil profiles leaving major residual damage. Requires long- term recovery. May take decades to achieve full remediation to a point suitable for beneficial uses commensurate with current land uses.									



Consequence aspect	Consequences												
	Very Low	Low	Moderate	High	Very High								
Marine Waters	Quality: Minimal near source (at point of discharge) eutrophication, or other water quality change with no significant loss of quality. Quantity: Short term minor change in quantity. Seabed changes: Insignificant change in bathymetry as a direct result of Project activities.	Quality: Local short-term eutrophication or other water quality change above approved Water Quality Objectives. Quantity: Long term minor change in quantity. Seabed changes: Near- source and minor changes in bathymetry as a result of Project activities.	Quality: Local long-term eutrophication or other water quality change above approved Water Quality Objectives. Short term local changes to water quality as a result of discharge or spillage of chemical or toxicants. Quantity: Moderate change in quantity. Seabed changes: Local and minor changes in bathymetry as a result of Project activities.	Quality: Widespread long- term eutrophication or other water quality change above approved Water Quality Objectives. Short term widespread changes to water quality as a result of discharge or spillage of chemical or toxicants Quantity: Short term major or long term moderate changes in quantity. Seabed changes: Local and substantial changes in bathymetry as a result of Project activities.	Quality: Long term widespread changes to water quality as a result of discharge or spillage of chemical or toxicants Quantity: Long term major changes in quantity. Seabed changes: Widespread and substantial changes in bathymetry as a result of Project activities.								



Consequence aspect	Consequences											
	Very Low	Low	Moderate	High	Very High							
Wetlands and Drainage Areas	Quality: Minimal contamination or change with no significant loss of quality. Hydrology: Insignificant alteration of existing hydrology.	Quality: Localised minor short term reduction in water quality. Local contamination or change that can be immediately remediated. Hydrology: Localised minor changes to existing hydrology.	Quality: Localised, minor long term; or widespread, minor short term; reduction in water quality. Remediation may take weeks. Hydrology: Localised major or widespread minor changes to existing hydrology.	Quality: Localised, major long term; or widespread, major short term; reduction in water quality. Remediation may take months. Hydrology: Widespread major changes to existing hydrology.	Quality: Widespread major long term reduction in water quality. Remediation may take years. Hydrology: Major changes to existing hydrology on a catchment level.							
Air Quality	No measurable air quality impacts or exceedance of air quality standards	Near source, short-term, and approaching exceedance of air quality standards	Near source, minor, long- term, or widespread minor short term or minor exceedance of air quality standards	Widespread, major, short- term exceedance of air quality standards	Regional long term change in air quality or exceedance of air quality standards							



Consequence aspect	Consequences	Consequences												
	Very Low	Low	Moderate	High	Very High									
Social	Social: Short term actual or perceived social impact with no lasting repercussions Access: Short term restrictions on access to the Project area only	Short term social impact which can be mitigated, repaired or offset in the short term (<1-2 years) Access: Permanent restrictions on access to the Project area only	Social or cultural decline which can be mitigated, repaired or offset in the short-medium term (1-5 years) Access: Short term restrictions on access which affect areas beyond the Project area	Social or cultural decline which cannot be mitigated, repaired or offset in the short-medium term (1-5 years) Access: Permanent restrictions on access which affect areas beyond the Project area	Irreversible social or cultural decline which cannot be mitigated, repaired or offset (or, in the case of community safety, could result in death) Access: Permanent restrictions on access at the regional scale									



TABLE 44   LIKELIHOOD CLASSIFICATION												
	Likelihood											
	Rare	Unlikely	Possible	Likely	Almost Certain							
Frequency Interval (multiple events)	1/100 years	1/10 – 1/100 years	1/year – 1/10 years	2/years – 1/year	>2/year							
Probability (single events)	<0.1%	0.1%-1%	1%-10%	10%-25%	>25%							

#### 19.1.4 Risk Evaluation

Once the consequence criteria and level of likelihood had been assigned to each identified risk, the overall risk level was evaluated by using the risk matrix provided in Table 45.

TABLE 45       RISK ASSESSMENT CLASSIFICATION MATRIX											
Likelihood	Consequences										
	1 – Very Low	2 – Low	3 – Moderate	4 – High	5 – Very High						
5 – Almost Certain	Medium	Medium	High	Extreme	Extreme						
4 - Likely	Medium	Medium	Medium	High	Extreme						
3 – Possible	Low	Medium	Medium	Medium	High						
2 – Unlikely	Very Low	Low	Medium	Medium	Medium						
1 – Rare	Very Low	Low	Low	Medium	Medium						

A brief description of each overall possible risk classification is provided below.

#### Extreme

A ranking of very high represents an unacceptable risk, which is usually critical in nature in terms of consequences (e.g. extensive and long term environmental damage) and is considered possible to almost certain to occur. Such risks significantly exceed the risk acceptance threshold and require comprehensive control measures, and additional urgent and immediate attention towards the identification and implementation of measures necessary to reduce the level of risk.

#### High

High risks typically relate to significant to critical consequences (e.g. a major amount of environmental damage) that are rated as possible to almost certain to occur. These are also likely to exceed the risk acceptance threshold, and although proactive control measures are usually planned or implemented, a very close monitoring regime and additional actions towards achieving further risk reduction is required.

#### Medium



As suggested by the classification, medium level risks span a group of risk combinations varying from relatively low consequence / high likelihood to mid-level consequence / likelihood to relatively high consequence / low likelihood scenarios. These risks are likely to require active monitoring as they are effectively positioned on the risk acceptance threshold.

#### Low

Low risks are below the risk acceptance threshold and although they may require additional monitoring in certain cases, are not considered to require active management. In general such risks represent relatively low likelihood, and low to mid-level consequence scenarios.

#### Very Low

Very Low risks are below the risk acceptance threshold and would, at the most, require additional monitoring and in many cases would not require active management. These risks can include unlikely to rare events with minor consequences, and in essence relate to situations around very low probabilities of relatively minor impacts occurring.

#### 19.1.5 Risk Treatment

Control measures were developed to further reduce the risk. The risk was then reassessed using the processes outlined in Sections 19.1.3 and 19.1.4 to confirm the effectiveness of these control measures. This second rating is known as the residual risk rating and was used as the final risk rating.

The control measures have been used in the development of the Environmental Management Plan and will be implemented in the construction and operation of the Project.

#### 19.2 RISK REGISTER

A risk register was established to document the findings of the risk assessment process. The risk register contains details of the source of impact, the potential consequences and control measures that will be implemented as part of the Project.

The risk register for Project construction is presented in Table 46, while the risk register for operations is presented in Table 47. The two tables combined constitute the risk register for the Project.

Source of Impact	Consequence	Risk	Initial	Risk Rat	ing	Control Strategies	Residu	al Risk F
	Aspect		Likelihood	Consequence	Risk Level		Likelihood	Consequence
Site establishment, vegetation	General Ecological Values	Clearing of vegetation results in the change or loss of habitat/biodiversity values for terrestrial flora and fauna.	5	2	М	Avoidance of sensitive vegetation and habitats was a key design criteria and the disturbance footprint was sited within lowest value habitat areas to minimise impacts to terrestrial ecological values as	5	1
clearing and earthworks.		Clearing of vegetation and/or earthworks results in the mortality or injury of terrestrial fauna or avifauna species.	5	2	М	<ul> <li>much as practicable.</li> <li>Minimise vegetation clearance to the smallest extent possible.</li> <li>Clearly mark out limits of clearing and individuals to retain.</li> <li>Avoid land clearing during the wet season.</li> <li>Adhere to buffer widths recommended by the NT Land Clearing Guidelines where possible, with regard to riparian vegetation in drainage lines.</li> <li>Install structures that would capture sediment downstream of development.</li> <li>Rehabilitate/stabilise cleared land as soon as possible after works have been completed.</li> <li>Develop and implement a vegetation management plan which include areas not to be cleared (no-go areas) and make all workers aware of them through environmental management plan and site work briefings.</li> </ul>	5	1
	Threatened and Migratory Species	Clearing of vegetation results in the change or loss of habitat/biodiversity values for threatened and migratory fauna.	3	1	L	<ul> <li>Develop and implement fauna management plan including procedures for managing vegetation clearing operations and any direct fauna impacts (injuries, entrapments etc).</li> <li>Controlled burns and/or vegetation mulched for re-use where practicable.</li> </ul>	3	1
		Clearing of vegetation results in the mortality or injury of threatened flora species.	5	3	Н	<ul> <li>Avoidance of the eastern part of the site where <i>Cycas armstrongii</i> are in higher densities was a key criteria in planning the layout of the Project infrastructure. This area also correspond to habitat for <i>Desmodium tiwiense</i>.</li> <li>Avoidance of monsoon vine thicket/mangrove mosaic, which provides habitat for <i>Pittosporum moluccanum</i> and <i>Operculina turpethum</i>, was a key criteria in the planning the layout and construction methodology for the site.</li> </ul>	3	1



lating	Evaluation Rationale
Risk Level	
M	<ul> <li>In the initial (unmitigated) risk rating we have assessed the likelihood of habitat loss as certain, simply because clearing will occur.</li> <li>The majority of areas to be cleared (in the western third of the site) are considered of poorer habitat quality than the eastern portion of the site, having been degraded as a result of uncontrolled recreational activities (evidence of weeds, increased fire regime and litter).</li> <li>The dominant community is <i>Eucalyptus</i> totard on the site of the sit</li></ul>
	<i>tetradonta</i> woodland which comprises 44% of the clearing footprint. This community is widespread and common in the NT with over 1.2 million hectares mapped by Wilson et. al. 1990. The clearing represents 0.01% of the area of <i>Eucalyptus tetradonta</i> woodland in the Litchfield Shire area.
L	The majority of areas to be cleared (in the western third of the site) are considered of poorer habitat quality than the eastern portion of the site, having been degraded as a result of uncontrolled recreational activities (evidence of weeds and feral animals, increased fire regime and human interference such as clearing and litter).
L	<ul> <li>Cycas armstrongii are common onsite with population densities in the eastern half of the site in between 800 - 1,000 individuals per hectare. It is much less common in the western half of the site where the majority of the Project infrastructure is located.</li> <li>With mitigation in place there will be only minor local habitat modification and with transplant/translocation it is possible that there will be no loss of individuals</li> </ul>

Source of Impact	Consequence	Risk	Initial I	Initial Risk Rating		Control Strategies	Residual Risk Rating			Evaluation Rationale
	Aspect		Likelihood	Consequence	Risk Level	Targeted surveys for threatened species (other than Cycas	Likelihood	Consequence	Risk Level	The monsoon vine thicket is highly dependent of the second sec
						<ul> <li>Application for a permit to take or interfere with wildlife under the Territory Parks and Wildlife Act 2006 will be sought where required.</li> </ul>				degraded being disturbed as a result of camping and recreation
		Clearing of vegetation and/or earthworks results in the mortality or injury of threatened or migratory terrestrial fauna or avifauna species.	2	2	L	Avoidance of areas of higher value habitat for threatened and migratory fauna (i.e. the eastern portion of the site).	2	1	VL	<ul> <li>As demonstrated, the unmitigated likelihood of threatened species being present is low and any disturbance would not have population-scale impacts.</li> <li>Threatened species that are considered to have potential to occur on the site are likely to be limited to the <i>Eucalyptus tetradonta</i> woodland of which only 12.84 ha is within the clearing footprint.</li> <li>Furthermore, The majority of areas to be cleared (in the western third of the site) are considered of poorer habitat quality than those in the eastern portion of the site, having been degraded as a result of uncontrolled recreational activities (evidence of weeds and feral animals, increased fire regime and human interference such as clearing and litter). The likelihood of threatened species being present in this marginal habitat is reduced.</li> </ul>
	Historic and Cultural Heritage	Damage to or destruction of sacred sites or heritage items during vegetation clearing and/or earthworks.	2	3	Μ	<ul> <li>Directional drilling to be undertaken under the coastal dune areas, to avoid potential impacts to burial sites, should they occur.</li> <li>Archaeological survey has been undertaken. No Indigenous or non-Indigenous items or sites of heritage significance were identified in or in proximity to the Project footprint.</li> <li>An AAPA certificate (reference no. 2016/1206) has been obtained for the Project and the Project will be constructed and operated in accordance with the conditions of the certificate.</li> <li>A cultural monitor to be present in the event that any human remains are disturbed</li> <li>The EMP includes protocols to be enacted in the event of unexpected finds.</li> </ul>	1	3	L	Discussions with custodians suggest that any 'damage' is, from a cultural perspective, likely to be 'reparable' provided that appropriate cultural protocols are observed if any human remains found. It is considered highly unlikely that human remains would be encountered given that directional drilling will be employed under the coastal dunes where burials are more likely to be present.



Source of Impact Consequence Risk		Initial	Risk Rat	ing	Control Strategies		ial Risk R	ating	Evaluation Rationale	
	Aspect Marine Waters	Clearing of vegetation leads to increased erosion and runoff resulting in release of	c Likelihood	Consequence	A Risk Level	<ul> <li>Land clearing would commence at the beginning of April 2019 and it is expected that the buildings would be constructed by the end of</li> </ul>	Likelihood	Consequence	A Risk Level	Site does not drain directly into marine environment.
		sediments and/or organic matter to marine waters impacting water quality.				the dry season, with internal fit out occurring through the wet up until February 2020.				Works will not change overland flows to cause water to run-off into Shoal Bay
	Wetlands and Drainage Areas	Clearing of vegetation leads to increased erosion and runoff resulting in release of sediments and/or organic matter to wetlands impacting water quality.	4	2	М	<ul> <li>Clearing in April or May is considered one of the optimal times to undertake clearing, as soils are moist (reducing the chance of wind erosion) but without a high likelihood of rain (reducing the chance of erosion as a result of rainfall).</li> <li>Minimise vegetation clearance to the smallest extent possible.</li> <li>Clearly mark out limits of clearing and individuals to retain.</li> <li>Avoid land clearing during the wet season.</li> <li>Adhere to buffer widths recommended by the NT Land Clearing Guidelines where possible, with regard to riparian vegetation in drainage lines.</li> <li>Install structures that would capture sediment downstream of development.</li> <li>Rehabilitate/stabilise cleared land as soon as possible after works have been completed.</li> <li>Develop and implement vegetation management plans which include areas not to be cleared (no-go areas) and make all workers aware of them through environmental management plan and site work briefings.</li> <li>Adhere to Erosion Sediment Control Plan as likely condition procedent to Down and the procedent control plan as likely condition</li> </ul>	2	2	L	Meeting the requirements of NT legislation and regulations explicitly addresses this risk.
	Land	Encountering contaminated sites (e.g. cattle dips and landfills) during vegetation clearing or earthworks requiring clean up or remediation to make safe.	2	2	L	The EMP includes protocols to be enacted in the event of unexpected finds, including unexploded ordinances.	2	2	L	<ul> <li>As the Project site has not been previously used for purposes other than grazing, it is considered unlikely to have any contaminated soils.</li> <li>However, it is acknowledged that there is a possibility of uncovering items from World War II, including unexploded ordinance, and it is possible there may be some contamination from World War II materials such as fuel spills from aircraft that crashed in the area.</li> </ul>
		Clearing of vegetation leads to increased erosion.	4	3	M	Land clearing would commence at the beginning of April 2019 and it is expected that the buildings would be constructed by the end of	2	2	L	



Source of Impact	Consequence	Risk	Initial Risk Rating		ing	Control Strategies	Residual Risk Rating			Evaluation Rationale
	Aspect		Likelihood	Consequence	Risk Level		Likelihood	consequence	Risk Level	
Introduction or spread of weeds/pest animals during construction activities (e.g. site establishment, earthworks, movement of heavy machinery).	General Ecological Values Threatened and Migratory Species Wetlands and Drainage Areas	The introduction or spread of weeds/pest animals results in the change or loss of habitat/biodiversity values for terrestrial flora and fauna. The introduction or spread of weeds/pest animals results in the change or loss of habitat/biodiversity values for threatened flora and threatened and migratory fauna. The introduction or spread of weeds results in hydrological or water quality changes.	3	2	M	<ul> <li>the dry season, with internal fit out occurring through the wet up until February 2020.</li> <li>Clearing in April or May is considered one of the optimal times to undertake clearing, as soils are moist (reducing the chance of wind erosion) but without a high likelihood of rain (reducing the chance of erosion as a result of rainfall).</li> <li>Minimise vegetation clearance to the smallest extent possible.</li> <li>Clearly mark out limits of clearing and individuals to retain.</li> <li>Avoid land clearing during the wet season.</li> <li>Install structures that would capture sediment downstream of development.</li> <li>Rehabilitate/stabilise cleared land as soon as possible after works have been completed.</li> <li>A erosion and sediment control plan is included in the EMP.</li> <li>The EMP includes a Weed Management Plan which includes commitments to undertake pre-construction mapping and regular weed inspections during construction.</li> <li>The EMP includes a Fauna Management Plan which details pest animal eradication and management strategies that will be implemented for construction.</li> <li>Environmental inductions for workforce to include identification of problem weeds.</li> <li>Vehicle and equipment wash-down procedures on-site.</li> <li>Implement weed control notification and location recording for weed identified on site.</li> <li>Weed control monitoring and management practices.</li> <li>Ensure fire management plan applies to construction and takes into consideration weed impacts following burn offs.</li> <li>Manage putrescible waste to control feral and pest animal ingress.</li> </ul>	2	2	L	<ul> <li>With mitigation measures in place it is unlikely that any weeds/pest animals will be introduced or spread as a result of Project construction activities do not directly interact with wetlands. There is no reason for any construction personnel to enter any wetland areas. Wetlands will be flagged as no go areas in the construction EMP. As vehicles will be washed down and clearing and earthworks will be undertaken during the dry season there is limited possibility for spread of weeds from construction vehicles via overland flow movement. Therefore the risk of weeds being introduced or spread into these areas is highly unlikely.</li> </ul>
Generation and dispersion of dust emissions from site establishment, vegetation	Air Quality General Ecological Values	Dust emissions result in a reduction of air quality at potentially sensitive receptors. Dust emissions result in increased levels of dust deposition on surrounding flora resulting in smothering of vegetation and habitat degradation.	2	2	M	Land clearing would commence at the beginning of April 2019 and it is expected that the buildings would be constructed by the end of the dry season, with internal fit out occurring through the wet up until February 2020.	1	1 3	VL L	<ul> <li>There are no nearby sensitive receptors. The nearest sensitive receptor is the Tree Point community, 3 km to the south of the Project.</li> <li>There are no sites of cultural significance in proximity to the Project.</li> </ul>



Source of Impact	Consequence	Risk	Initial Risk Rating		ing	Control Strategies		al Risk R
	Aspect		Likelihood	Consequence	Risk Level		Likelihood	Consequence
clearing, earthworks.	Threatened and Migratory Species Historic and Cultural Heritage	Dust emissions result in increased levels of dust deposition on surrounding threatened flora resulting in smothering of vegetation and habitat degradation. Dust impacts on sites of cultural significance.	3	3	VL	<ul> <li>Clearing in April or May is considered one of the optimal times to undertake clearing, as soils are moist therefore reducing the chance of wind erosion and dust generation.</li> <li>Standard dust suppression measures will be implemented including limiting vegetation clearing and revegetating exposed areas and watering of unsealed road and construction surfaces, if necessary.</li> </ul>	1	3
Noise generation and vibration impacts from site	General Ecological Values	Increased noise levels results in the disturbance of terrestrial fauna and avifauna.	3	2	М	<ul> <li>Standard noise mitigation measures will be implemented as part of the EMP.</li> <li>Short duration of impact (i.e. land clearing would commence at the</li> </ul>	3	2
establishment, vegetation clearing, earthworks and the movement of heavy machinery.	Threatened and Migratory Species	Increased noise levels results in the disturbance of threatened and migratory fauna and avifauna.	2	2	L	beginning of April 2019 and it is expected that the buildings would be constructed by the end of the dry season). Clearing would be the noisiest activity and this will only take place in April and May.	2	2
	Amenity	Increased noise levels at sensitive receptors.	2	2	L	<ul> <li>Minimisation of clearing impacts to the greatest extent practicable. Only 29 ha will be required to be cleared.</li> <li>Disturbance footprint was sited as much as possible within the lowest value habitat areas to minimise impacts to terrestrial ecological values as much as practicable.</li> <li>No construction activities will occur at night.</li> </ul>	2	1
Construction of seawater intake and discharge pipelines	Marine Waters	Construction of seawater intake and discharge pipelines leads to a change in marine water quality, namely an increase in turbidity as a result of disturbance of the sea bed.	5	2	Μ	<ul> <li>The intake and discharge pipeline will be directionally drilled as far as practicable.</li> <li>Outside of the directionally drilled area the pipeline will be anchored to the seafloor with fleximats and concrete blocks (i.e. does not require drilling) hence comparatively less sediment movement.</li> </ul>	5	1
	General Ecological Values	Construction of seawater intake and discharge pipelines results in changes in water quality which in turn causes a change of habitat/biodiversity values for flora and fauna.	2	1	L		2	1



ating	Evaluation Rationale
Risk Level	
L	
VL	
М	
L	
L	<ul> <li>There are no nearby sensitive receptors. The nearest sensitive receptor is the Tree Point community, 3 km to the south of the Project.</li> <li>The mitigated consequence level has reduced because of the control strategies of not constructing at night and undertaking the noisiest activity (i.e. clearing) over a short period time.</li> </ul>
Μ	<ul> <li>The marine environment in Shoal Bay is naturally turbid at times. Marine flora and fauna are habituated to these conditions.</li> <li>Turbidity to be created as a result of the construction of pipelines would be within</li> </ul>
L	<ul><li>the range of that occurring naturally.</li><li>Area to be disturbed is small relative to the scale of Shoal Bay.</li></ul>
	<ul> <li>Disturbance will be localised, short term and temporary in nature.</li> <li>Species that may be influenced by elevated turbidity are highly mobile and are expected to move away from disturbance areas such that they are not detrimentally affected. They are also expected to return</li> </ul>

Source of Impact	Consequence Risk		Initial I	Risk Rati	ing	Control Strategies	Residu	al Risk R
	Aspect		Likelihood	Consequence	Risk Level		Likelihood	Consequence
	Threatened and	Noise and vibration during the construction	3	1	L	Directional drilling and the laying of fleximat and concrete blocks is	2	1
	Migratory Species	of seawater intake and discharge pipelines results in disturbance to threatened and migratory marine megafauna.				<ul> <li>likely to have less potential to create disturbance to marine species than pile driving.</li> <li>Pile driving activities will only be undertaken for the construction of the seawater intake location.</li> </ul>		
Disturbance of ASS during	Land	Disturbance of ASS leads to acidification of soils and/or continued leachate generation.	3	2	М	The EMP includes an ASS management plan which will be implemented during construction.	2	1
earthworks.	Wetlands and Drainage Areas	Disturbance of ASS results in the generation of acid leachate which acidifies runoff and leads to changes in water quality in wetlands.	2	2	L	<ul> <li>Disturbance and oxidation of ASS will be avoided or if ASS is disturbed, it will be ensured that there is sufficient neutralising capacity to permanently avoid oxidation (adding lime if necessary).</li> <li>ASS risk map will be produced prior to construction.</li> <li>Pre-construction testing for ASS in all areas indicated as high risk on ASS risk map.</li> <li>If found, treatment of ASS will be in accordance with Dear et. al. (2014)</li> </ul>	1	2
Spills or leaks of contaminants such as fuel, oils, chemicals or	Land	Spills of contaminants result in contamination of soils.	3	2	М	<ul> <li>Fuel, oil, chemical and liquid waste to be stored in bunded and appropriately contained areas.</li> <li>Fuel and chemical transfer points to be bunded.</li> </ul>	2	1
chemicals or liquid waste.	Wetlands and Drainage Areas	Contaminants enter surrounding waterways and lead to changes in water quality in wetlands and drainage areas.	2	2	L	<ul> <li>Spin Kits and spin management controls utilised at all storage and transfer points.</li> <li>All waste will be disposed appropriately offsite.</li> <li>Training and incident/notification procedures to be adopted.</li> </ul>	1	2



ating	Evaluation Rationale
Risk Level	to the area following cessation of
	disturbances.
L	<ul> <li>Short duration of impact.</li> <li>Any threatened and migratory species in the vicinity of the seawater intake are likely to temporarily vacate or avoid the area following the commencement of disturbing works.</li> </ul>
	Threatened and migratory species are expected to resume normal behavioural patterns following the cessation of the piling works.
	Vessel(s) used in construction of the intake and discharge pipelines are expected to produce similar noise emissions to other marine vessels that frequent Shoal Bay (e.g. recreational vessels, etc.).
L	Considered to be little likelihood of encountering ASS across much of the Project site
VL	Some residual acidity in soils was considered likely to be derived from regional or natural mineral sources rather than ASS/PASS.
L	With mitigation and management measures in place spills are unlikely and procedures are in place to rectify them immediately.
VL	No construction work will be undertaken in close proximity to freshwater environments.
	Construction will occur in the dry season when there is limited standing water in wetland and drainage areas.

Source of Impact	act Consequence Risk		Initial Risk Rating			Control Strategies	Residual Risk	
	Aspect		Likelihood	Consequence	Risk Level		Likelihood	Consequence
Landscape changes from the construction of the Project.	Amenity	Changes to the landscape impact on the visual amenity of the area.	5	2	М	<ul> <li>Buildings are lowset and vegetation will be retained between buildings.</li> <li>Footprint has been minimised to the lowest extent practicable.</li> <li>Retention of dune vegetation will screen the terrestrial components of the Project from beach users.</li> </ul>	5	2
Increased traffic movements	Social	Increased traffic movements lead to an increase in vehicle incidents.	3	5	Н	<ul> <li>Establish, implement and monitor a Driver Safety and Fatigue Management Policy for all employees and contractors. Among other things the policy will include measures to ensure that:         <ul> <li>Drivers will adhere to site speed limits and road rules.</li> <li>Personnel operating vehicles will not be under the influence of alcohol or other drugs.</li> <li>Personnel will be appropriately licenced.</li> </ul> </li> <li>Vehicle inspection checks and services required to be undertaken at regular (appropriate) intervals.</li> <li>All Project personnel to complete a site and safety induction prior to commencement of work.</li> </ul>	2	5
	Air Quality	Increased traffic results in increased dust emissions from unsealed roads.	5	1	М	Unsealed internal roads will be watered to reduce dust emissions.	5	1
	Land	Increased traffic results in soil compaction, rutting and soil erosion outside of designated traffic areas.	3	1	L	<ul> <li>Vehicles to stay on defined ingress and egress points.</li> <li>Vehicles to adhere to site speed limits and road rules.</li> <li>No go areas to be included in the construction EMP.</li> </ul>	2	1



Rating	Evaluation Rationale
Risk Level	
	With mitigation and management measures in place spills are unlikely and procedures are in place to rectify them immediately.
Μ	The terrestrial component of the development is unlikely to be noticed and will have a minimal visual impact. The buildings are lowset and will be screened by surrounding vegetation.
Μ	<ul> <li>The NT Government has committed to construct, or procure, the construction of works required to upgrade the Gunn Point Road and Murrumujuk Drive to Territory Rural Standard. This will ensure that access to the site is of an appropriate standard and capacity to accommodate the needs of the Project. This may be completed prior to construction commencing.</li> <li>With the implementation of the mitigation measures the likelihood of vehicle incidents is reduced.</li> </ul>
М	<ul> <li>The NT Government has committed to construct, or procure, the construction of works required to upgrade the Gunn Point Road and Murrumujuk Drive to Territory Rural Standard. This will ensure that access to the site is of an appropriate standard and capacity to accommodate the needs of the Project. This may be completed prior to construction commencing.</li> <li>There are no sensitive receptors in close proximity the road easement.</li> </ul>
L	

Source of Impact	Consequence	Risk	Initial	Risk Rat	ing	Control Strategies		ual Risk R
	Aspect		Likelihood	Consequence	Risk Level		Likelihood	Consequence
	General Ecological Values	Increased traffic results in the mortality or injury of terrestrial fauna or avifauna species.	3	2	Μ	<ul> <li>Roads will be clearly signposted and designed to minimise potential for roadkill.</li> <li>The EMP contains a fauna management plana which includes</li> </ul>	2	2
	Threatened and Migratory Species	Increased traffic results in the mortality or injury of threatened or migratory terrestrial fauna or avifauna species.	2	1	L	<ul> <li>procedures for managing traffic incidents involving fauna.</li> <li>Vehicles to stay on defined ingress and egress points.</li> <li>Vehicles to adhere to site speed limits and road rules.</li> <li>No go areas to be included in the construction EMP.</li> <li>Disturbance footprint was sited within lowest value habitat areas to minimise impacts to terrestrial ecological values as much as practicable.</li> </ul>	1	1
Access restrictions	Social	Construction of the Project results in restrictions to areas that were previously publically accessible.	5	2	Μ	The Project area has been minimised to the greatest practicable.	5	2
	Social	Construction of the intake and discharge pipelines results in restriction to beach access.	5	1	Μ	Where possible detours will be in place during construction of the pipelines.	5	1



ating	Evaluation Rationale
Risk Level	
L	
VL	
Μ	Access will only be restricted to the Project site (approximately 130 ha). This area is insignificant given the total amount of land available in the Gunn Point/Glyde Point area for recreational activities and camping.
Μ	The intake and discharge pipelines will be constructed via horizontal directional drilling methods. This will likely require temporary restrictions on beach access during activities where public safety is of concern.

Source of Impact	Consequence	Risk	Initial	Risk Rat	ing	Control Strategies	Resid	ual Risk	Rating	Evaluation Rationale	
	Aspect		ikelihood	Consequence	Risk Level		ikelihood	Consequence	isk Level		
Intake and discharge pipelines	Marine Waters	Presence of intake and discharge pipelines results in localised bathymetry and current changes.	4	1	м	<ul> <li>Adequate scour protection will be provided in the design of the intake and discharge pipe bedding and construction.</li> <li>The pipeline will be buried (via horizontal directional drilling methods) for as far offshore as possible.</li> </ul>	3	1	L		
	General Ecological Values	Presence of intake and discharge pipeline results in changes to habitat/biodiversity values for marine flora and fauna.	2	1	VL		2	1	VL	<ul> <li>Benthic habitat in the vicinity of the pipeline consists of mud and sand flats.</li> <li>These habitats are widespread throughout</li> </ul>	
	Threatened and Migratory Species	Presence of intake and discharge pipeline results in changes to habitat/biodiversity values for threatened and migratory species.	1	1	VL		1	1	VL	<ul> <li>the Shoal Bay and Darwin Harbour area and are not considered unique or critical to the survival of any threatened or migratory marine fauna.</li> <li>The area to be affected is very small relative to Shoal Bay as a whole.</li> </ul>	
	Amenity	The visibility of the intake and discharge pipelines results in changes to the visual amenity of the area.	5	3	Н	Directional drilling of the pipeline will be undertaken under the dunes and beach and as far into the intertidal zone as possible, to minimise the visual impact.	3	2	М	The pipes are relatively small with each of the three pipes being 250 mm in overall diameter.	
	Social	The presence of the intake and discharge pipeline results in change in boating access along pipeline easements.	5	2	М	<ul> <li>Directional drilling of the pipeline will be undertaken and the buried section of the pipeline will be extended as far offshore as possible.</li> <li>Navigational markers will be installed to notify boaters of the location of the intake and discharge pipelines.</li> </ul>	5	2	Μ	The pipes are relatively small with each of the three pipes being 250 mm in overall diameter. As such, navigation will only be affected in a very small area of Shoal Bay.	
Intake of seawater	General Ecological Values	Entrainment or impingement in intake structures results in mortality or injury of aquatic fauna.	4	2	Μ	<ul> <li>The intake point will be fitted with a screen covered with mesh sized at 100 mm or less to limit the potential to intake marine fauna.</li> <li>The seawater intake pump will only operate between mid to high</li> </ul>		2	М	The velocity of seawater intake at the mesh screen will be less than 0.25 m/s - most fish will be able to swim away from this (i.e. the	
	Threatened and Migratory Species	Entrainment or impingement of threatened and migratory aquatic fauna in intake structures.	3	2	М	tide daily. As such, there will be a large proportion of each day when no fauna will be exposed to any entrainment and impingement risks.	2	2	L	<ul> <li>velocity at the screen is less than the 0.4 m/s velocity that most fish can swim against).</li> <li>Within one metre of the mesh screen, the intake velocity will drop to less than 1 m/sec - which is within the swimming ability of all fish (Boys et al. 2012), and the speed of currents within Shoal Bay during spring tides. As such, there is a considered to be a negligible potential to impinge or entrain threatened or migratory fauna.</li> <li>Furthermore, turtle hatchlings are unlikely</li> </ul>	



Source of Impact	urce of Impact Consequence Risk		Initial F	Risk Rati	ing	Control Strategies	Residu	al Risk I
	Aspect		Likelihood	Consequence	Risk Level		Likelihood	Consequence
Discharge of wastewater	Marine Waters	Elevated levels of nutrients in discharge water results in a change in water quality above the Darwin Harbour Water Quality Objectives	2	2	L	<ul> <li>Water quality modelling was undertaken to determine the most optimal location of the discharge point to minimise water quality impacts.</li> <li>Location of discharge point in deeper waters to aid dilution.</li> </ul>	1	1
		Discharge water results in scour and/or changes to the bathymetry of receiving waters.	3	2	М	<ul> <li>Appropriate scour protection will be considered during detailed design.</li> <li>Water will be discharged at a low flow rate.</li> </ul>	2	1
	General Ecological Values	Elevated levels of nutrients in discharge water results in changes in water quality which in turn causes a change of habitat/biodiversity values for flora and fauna.	2	2	L	<ul> <li>Water quality modelling was undertaken to determine the most optimal location of the discharge point to minimise water quality impacts.</li> <li>Location of discharge point in deeper waters to aid dilution.</li> </ul>	1	1
	Threatened and Migratory Species	Elevated levels of nutrients in waste water results in changes in water quality which in turn causes a change of habitat/biodiversity values for threatened and migratory aquatic and avifauna fauna.	2	1	VL		1	1
Uncontrolled discharges	Wetlands and Drainage Areas	Uncontrolled discharges (e.g. through the overtopping of ponds) lead to changes in water quality in wetlands and/or drainage areas.	4	2	М	<ul> <li>The seawater storage and discharge settlement ponds have been designed with a 500 mm freeboard to cater for a 100 ARI event, assuming no active controls.</li> <li>Operations personnel would actively manage the ponds and all other water retaining structures to ensure that any overtopping risk is minimised using weather forecasting, instrumentation, alarms and water level controls.</li> </ul>	2	2
Escape of prawn stock from hatchery	General Ecological Values	The escape of prawn stock from the hatchery leads to changes in aquatic ecology or exotic disease outbreaks.	1	4	Μ	<ul> <li>The facility has been expressly designed to be secure and to have within it Specific Pathogen Free Stock</li> <li>There are major national and NT protocols that come into force in the event of a detection of an exotic disease outbreak. As shown in Queensland, it is possible through early notification and aggressive action, for exotic pathogens to attenuate, thus returning an environment to a pre-outbreak status</li> </ul>	1	3



Rating	Evaluation Rationale
Risk Level	
	generally disperse seaward following emergence from nesting beaches, and the nearest nesting beach is 18 km away.
VL	The water to be affected by the discharge will be well within the range considered acceptable under the Water Quality Guidelines for Darwin Harbour.
VL	<ul> <li>Bathymetry of the marine environment is naturally extremely dynamic.</li> <li>The low flow rate of discharge is unlikely to have an impact on bathymetric and sediment transport processes in comparison to the natural tidal currents.</li> </ul>
VL	At the point of discharge the water will be within the range considered acceptable under the Water Quality Guidelines Aquatic Ecosystem Protection for Darwin Harbour and as such, by definition, will not pose a significant risk to the marine flora and fauna.
L	To overflow the 500 mm freeboard, there would need to be a rainfall event that exceeded 500 m in a 24 hour period, which has never yet occurred in the Darwin region
L	The grow-out facility will be stocked with black tiger prawns ( <i>Penaeus monodon</i> ) which are native to the area. The founder stock which will be used to establish the breeding program for the Project will be sourced from wild populations of black tiger prawns from the waters around the Northern Territory and Western Australia.

Source of Impact	Consequence	Risk	Initial R	Risk Rati	ing	Control Strategies		al Risk
	Aspect		Likelihood	Consequence	Risk Level		Likelihood	Consequence
Lighting	Threatened and Migratory Species	Lighting used for operations alters foraging and breeding activities of threatened and migratory marine fauna.	2	2		<ul> <li>Only low intensity lighting will be required for security and safe access.</li> <li>The majority of operational buildings will be closed with no windows and so light spill from the operations at night is expected to minimal.</li> <li>Vegetation along the coastal dunes will be retained and will act as a screen between the marine environment and the facilities.</li> <li>Notwithstanding that only minimal lighting is required for the construction and operation of the Project, in accordance with the Environmental Assessment Guideline for Protecting Marine Turtles from Light Impacts (WAEPA 2010), the proponent will limit lighting to only that which is essential. Lighting will be installed low in the vertical plane and will use the lowest intensity practicable. Detailed design will consider the following:         <ul> <li>light fixtures that are mounted low down, shielded and aligned to direct light onto the target area only</li> <li>turn lights on only when they are needed</li> <li>directional, achieving no spill to the marine environment</li> <li>Automated controls (e.g. timers and motion detectors) to be used as appropriate to minimise lighting</li> <li>Designing ground-level path lighting for use where practicable.</li> </ul> </li> </ul>	2	1
Power generation	Amenity	Increased noise levels at sensitive receptors.	3	2	Μ	<ul> <li>The power facility has been located 500 m from the nearest sensitive receptor based on the results of noise modelling.</li> <li>The power facility containers will, where practicable, be orientated in the direction where the loudest noise sources face away from any residential or other noise sensitive receptors.</li> </ul>	1	1
	Air quality	Reduction of air quality at potentially sensitive receptors.	3	2	Μ	The power facility has been located 500 m from the nearest sensitive receptor based on the results of noise modelling.	1	1



k Rating		Evaluation Rationale
	Risk Level	Thus any disease they might carry would be endemic to the wild population, from which they were originally sourced.
	VL	Given that turtles do not nest within the Project area or adjacent habitats (the nearest nesting beach is located around 18 km from the Project area), and that vegetation between the facility and the marine environment will be retained, it is unlikely the artificial light will interfere with the breeding success and population longevity of marine turtles.
	VL	Noise modelling show that noise levels meet the noise criteria of 35 dB(A) at distance of 470 m from the power facility. As there are no sensitive receptors within 470 m of the power facility, no impacts from noise emissions on sensitive receptors are expected.
	VL	The results of the worst-case air quality modelling show that the predicted NO <sub>2</sub> levels will meet the criteria at a distance of 100 m from the power facility. There are no sensitive receptors within 100 m of the power facility and therefore there are no

Source of Impact	Consequence	Risk	Initial I	Risk Rat	ing	Control Strategies	Residu	al Risk R
	Aspect		Likelihood	Consequence	Risk Level		Likelihood	Consequence
Operation of the incinerator	Air quality	Reduction of air quality at potentially sensitive receptors.	3	2	М	<ul> <li>The incinerator was located 500 metres from any sensitive receptor in accordance with the NT EPA Guideline for Disposal of Waste by Incineration.</li> <li>Exhaust will be three metres higher than the top of any building within 100 m of the incinerator.</li> <li>Exhaust efflux velocity will be 10 m/s or more during all operational hours of waste incineration.</li> <li>Once operational, a stack test be undertaken to confirm emission limits comply with requirements of the NT EPA Guideline for Disposal of Waste by Incineration.</li> </ul>	1	1
Spills or leaks of contaminants	Land	Spills of contaminants result in contamination of soils.	3	2	М	Fuel, oil, chemical and liquid waste to be stored in bunded and appropriately contained areas.	2	1
such as fuel, oils, chemicals or liquid waste.	Wetlands and Drainage Areas	Contaminants enter wetlands and leads to changes in water quality.	2	2	L	<ul> <li>Fuel and chemical transfer points to be bunded.</li> <li>Spill kits and spill management controls utilised at all storage and transfer points.</li> <li>All waste will be disposed appropriately offsite.</li> <li>Training and incident/notification procedures to be adopted.</li> </ul>	1	2
Introduction or spread of weeds/pest animals during	General Ecological Values	The introduction or spread of weeds/pest animals results in the change or loss of habitat/biodiversity values for terrestrial flora and fauna.	3	2	М	<ul> <li>The EMP includes a Weed Management Plan which includes commitments to undertake regular weed inspections during operations.</li> <li>The EMP includes a Fauna Management Plan which details pest</li> </ul>	2	2
operations	Threatened and Migratory Species	The introduction or spread of weeds/pest animals results in the change or loss of habitat/biodiversity values for threatened flora and threatened and migratory fauna.	3	2	М	<ul> <li>animal eradication and management strategies that will be implemented for operations.</li> <li>Environmental inductions for workforce to include identification of problem weeds.</li> </ul>	2	2
	Wetlands and Drainage Areas	The introduction or spread of weeds results in hydrological or water quality changes.	2	3	М	<ul> <li>Vehicle and equipment wash-down procedures on-site.</li> <li>Implement weed control notification and location recording for weed identified on site.</li> <li>Weed control monitoring and management practices.</li> <li>Ensure fire management plan applies to construction and takes into consideration weed impacts following burn offs.</li> <li>Manage putrescible waste to control feral and pest animal ingress.</li> </ul>	1	2



Rating	Evaluation Rationale
Risk Level	
	impacts from noise emissions on sensitive receptors
VL	<ul> <li>The proposed incinerator is a small facility and will operate for a limited number of hours during the day, a few days a week.</li> <li>With the implementation of mitigation and management measures, there will be no reduction in air quality at any sensitive receptors.</li> </ul>
VL VL	With mitigation and management measures in place spills are unlikely and procedures are in place to rectify them immediately.
L	With mitigation measures in place it is unlikely that any weeds/pest animals will be introduced or spread as a result of Project operations.
L	The weed and fire management regimes that will be implemented as part of the Project will likely have a positive impact upon flora and vegetation, when compared with the current situation.
L	

Source of Impact	Consequence	Risk	Initial Risk Rating		ing	Control Strategies		Residual Risk Rating		Evaluation Rationale	
	Aspect		Likelihood	Consequence	Risk Level		Likelihood	Consequence	Risk Level		
Access restrictions	Social	Operation of the Project results in restrictions to areas that were previously publically accessible.	5	2	М	<ul> <li>Directional drilling to be undertaken under the coastal dune and intertidal areas so as not to impede to access to or along the beach.</li> <li>Navigational markers will be installed to notify boaters of the intake and discharge pipelines.</li> </ul>	5	2	Μ	<ul> <li>Access will only be restricted to the Project site (approximately 130 ha). This area is insignificant given the total amount of land that is publically accessible in the Gunn Point/Glyde Point area.</li> <li>Dune vegetation will be retained as will all other vegetation outside of the building footprint.</li> <li>The intake and discharge pipelines are relatively small with each of the three pipes being 250 mm in overall diameter. As such, navigation will only be affected in a very small area of Shoal Bay.</li> </ul>	
Changes to the landscape	Amenity	Changes to the landscape impact on the visual amenity of the area.	5	3	н	<ul> <li>Project footprint has been minimised to the smallest extent practicable.</li> <li>Surrounding vegetation will be been retained.</li> <li>Horizontal directional drilling will be used to construct the pipelines</li> </ul>	3	2	Μ	Directional drilling will ensure the pipelines are buried under the dunes, the beach, and for as far into the intertidal zone as possible. This will minimise visual impact of the development in the more visually sensitive area of the project footprint, namely the beach and near-shore intertidal zone.	
Increased traffic movements	Social	Increased traffic movements lead to an increase in vehicle incidents.	3	5	Η	<ul> <li>The NT Government has committed to construct, or procure, the construction of works required to upgrade the Gunn Point Road and Murrumujuk Drive to Territory Rural Standard. This will ensure that access to the site is of an appropriate standard and capacity to accommodate the needs of the Project.</li> <li>Vehicles to adhere to site speed limits and road rules.</li> <li>Personnel operating vehicles must not be under the influence of alcohol or other drugs.</li> <li>Personnel will be appropriately licenced.</li> <li>Vehicle inspection checks and services required to be undertaken at regular (appropriate) intervals.</li> <li>All Project personnel to complete a site and safety induction prior to commencement of work.</li> </ul>	2	5	М		
	General Ecological Values	Increased traffic movements as a result of the Project results in the mortality or injury of terrestrial fauna or avifauna.	3	2	Μ	Roads will be clearly signposted and designed to minimise potential for roadkill.	2	2	L	•	



Source of Impact	Consequence	Risk		Initial Risk Rating		Control Strategies		Residual Risk Rating		Evaluation Rationale
	Aspect		Likelihood	Consequence	Risk Level		Likelihood	Consequence	Risk Level	
	Threatened and Migratory Species	Increased traffic movements as a result of the Project results in the mortality or injury of threatened or migratory terrestrial fauna or avifauna species.	2	1	L	The EMP contains a fauna management plan which includes procedures for managing traffic incidents involving fauna.	1	1	VL	





## 19.3 RISK ASSESSMENT RESULTS

The environmental risk assessment identified 35 construction related risks and 27 operational risks.

The majority of residual risks identified and assessed for construction had a low risk rating (19 - Figure 75) while the majority of risk assessed for operations had a very low risk rating (13 - Figure 76).

There were no risks identified and assessed during construction or operations that had an extreme risk rating. Two construction related risks and three operational risks were initially rated as high. These risks were associated with:

- potential impacts threatened flora species, most notably Cycas armstrongii, as a result of vegetation clearing
- changes in the visual amenity of the area
- an increase in vehicle incidents as a result of increased traffic movements.

Through the application of controls measures however, these risks were able to be reduced. As such there are no residual risks with a high risk rating.



## FIGURE 75 SUMMARY OF CONSTRUCTION RISK RATINGS





## FIGURE 76 SUMMARY OF OPERATIONAL RISK RATINGS

## 19.4 MITIGATION AND MONITORING

There were no risks identified and assessed during construction or operations that had an extreme or high risk rating. All residual risks were either rated medium, low or very low. These risks are considered able to be successfully managed and mitigated through inclusion of the identified control measures into the EMP procedures (Appendix B).

Ongoing monitoring and management will be undertaken to test the effectiveness of the nominated controls, audit their implementation and identify other measures or different approaches that may be required to achieve and maintain acceptable risk levels. Measures to do so are outlined in the EMP for the Project.



# 20 CONCLUSION ON THE LIKELIHOOD OF SIGNIFICANT IMPACTS

## 20.1 ENVIRONMENTAL OBJECTIVES

In the absence of significant impact assessment guidelines in the Northern Territory, and based upon advice from the NT EPA, the assessment of significance of the Project's environmental impacts has been based upon the WA EPA environmental impact assessment framework, which is summarised in the document, Statement of Environmental Principles, Factors and Objectives (EPA 2016).

As outlined in the document, the WA EPA uses environmental principles, factors and associated objectives as the basis for assessing whether a Project's impact on the environment is significant. The WA EPA framework identifies 14 environmental factors which may be impacted by an aspect of a Project. For each environmental factor there is an environmental objective. These objectives are used to make judgements as to whether the environmental impact of a Project is significant.

Table 48 below outlines how the Project satisfies each objective for the relevant environmental factors.



TABLE 48   ENVIRONMENTA	AL FACTORS AND OBJECTIVES
Objective	Assessment of Likelihood of Significant Impacts
Sea	
Benthic Communities and Habitats To protect benthic communities and habitats so that biological diversity and ecological integrity are maintained.	Section 12.2.3 and Figure 60 explain that the marine habitat to be directly affected is sand and mud and does not provide any unique values, being well represented throughout Shoal Bay. Construction impacts will be localised, short term and temporary in nature and would not create any long term impact on benthic communities or habitats. The quality of the water to be affected by the operation of the proposed project will remain within the levels set out in the Darwin Harbour WQOs for the maintenance and protection of aquatic ecosystems (see Section 9.3.3). Hence there will be no significant impacts to benthic habitat or communities due to changes in water quality.
<b>Coastal Processes</b> To maintain the geophysical processes that shape coastal morphology so that the environmental values of the coast are protected.	The coastal processes at Gunn Point that could be potentially impacted by the proposed facility are in the vicinity of the intake and discharge pipe location. To minimise impacts to the dunes, beach and intertidal zone, the intake and outfall pipes will be buried under the dune and out through the intertidal zone for as far as possible, via directional drilling. Offshore, past this point, they will be placed on the seabed. There is potential that the pipes could interrupt sediment transport within the intertidal zone. This could lead to a change in the configuration of the intertidal flats as material accumulates on either side of the pipe, and a net loss of material is experienced away from the pipe. There may also be minor and localised changes to the bathymetry in deeper water due to scour and deposition. Discharge flows have the potential to cause scour of the bed, however it is unlikely due to the low flow rate. Hence, there may be some minor and localised changes to coastal morphology. However, directional drilling to bury the pipes will minimise the potential impacts to the beach and intertidal zone. Beyond that, where directional drilling is no longer possible, detailed design of the pipe bedding will ensure that adequate scour protection is provide. As such, there may be minor changes to coastal processes around the pipelines, but they are unlikely to be changes to an extent that cause a significant impact to coastal values.
Marine Environmental Quality	Construction
To maintain the quality of water, sediment and biota so that environmental values are protected.	During construction of the intake and outfall pipelines there is the potential for the construction activities to create minor elevations in turbidity through disturbance of the sea bed. However, the area to be disturbed is small relative to the scale of Shoal Bay, and the disturbance will be localised, short term and temporary in nature.



Assessment of Likelihood of Significant impacts	
Spills or leaks of hydrocarbons or other contaminants such as chemicals from construction vessels or vehicles are considered a version of the second	ery d to cant
Additionally, a hazardous materials management strategy (as detailed in the Environmental Management Plan in Appendix B) with the implemented as part of the Project. This contains procedures and protocols for the transport, storage, use and disposal of hydrocarbons and other chemical as well as response procedures in the event of a spill or leak.	ill
Operation	
Available water quality information, consisting of data collected to date to support this Project, and data sourced from monitorin by DENR in locations in Shoal Bay and Hope Inlet, have been used to quantify the existing water quality of the waters to be affec by the proposed Project.	ng ted
The Water Quality Objectives for Darwin Harbour apply to the waters to be affected by the proposed Project. Analysis of the flushing times of these areas has revealed that these waters are a mix of mid-estuary and outer-estuary zones, and hence differed Water Quality Objectives apply for the different zones. Outer Estuary objectives can be applied to areas offshore from Gunn Poin and Shoal Bay. Mid estuary objectives can be applied to some of the sites upstream in the tidal creeks and rivers that drain into Hope Inlet (Figure 33).	ent nt
Detailed and conservative numerical modelling has shown that the discharge of 954 kL/day from the facility, at a conservative licence condition of 2 mg/L TN, 0.4 mg/L TP and 20 $\mu$ g/L chlorophyll $\alpha$ (noting that the quality of the discharge is expected to be better than these levels) will not cause any exceedance of the Water Quality Objectives for Darwin Harbour for the sites categor as outer estuary.	ised
For the sites categorised as mid estuary, there will be no exceedance of the Water Quality Objectives for Darwin Harbour for TN TP. However, for chlorophyll $\alpha$ , the background levels were found to naturally exceed the WQO for mid estuary in Darwin Harbou (being 2.1 µg/L whilst the WQO is 2 µg/L). As such the WQO is not applicable and, a more appropriate site specific WQO is proposed, being 3.4 µg/L, which is the 80th percentile of the results of the local monitoring used to derive the background levels When this WQO is applied, there is no exceedance of the levels of chlorophyll $\alpha$ in any site categorised as mid estuary.	or our s.
In the case of Darwin Harbour the most stringent water quality criterion is the environmental Beneficial Use category because the intent of environmental beneficial use is to maintain the health of aquatic ecosystems, and a water body that meets an	ne



Objective	Assessment of Likelihood of Significant Impacts
	environmental beneficial use will in almost all circumstances also meet the requirements for all other beneficial uses. The assessment undertaken to support this NOI has revealed that the quality of the water to be affected by the operation of the proposed project will remain within the levels set out in the Darwin Harbour WQOs for the maintenance and protection of aquatic ecosystems. Hence, by definition, there will be no significant impact to the water quality of Shoal Bay or Hope Inlet as a result of the Project.
Marine Fauna	The marine habitat to be affected by the Project is restricted to footprint of seabed over which the intake and outlet pipelines will
To protect marine fauna so that	be placed. The habitat is sand and mud and does not provide any unique values, being well represented throughout Shoal Bay.
biological diversity and ecological integrity are maintained.	Marine fauna of conservation significance listed under the TPWC Act and or the EPBC Act are considered likely or possible to occur in the waters surrounding the Project. These species are all transient or migratory animals that will not be confined to one area. The ability of conservation significant marine fauna to transit through the project area is not likely to be affected by the minor loss of ubiquitous habitat as a result of the placement of the intake and outfall pipes. The potential impacts to marine fauna as a result of the Project, and the proposed design solutions and mitigation measures, are as
	follows.
	Changes in water quality as a result of construction activities, or discharge of the aquaculture water
	As detailed in response to the 'Marine Environmental Quality' factor above, there are not expected to be any significant impacts to water quality as a result of construction of the proposed pipelines. Management measures to mitigate the risk of leaks or spills are included in the Project EMP.
	As described above, the water to be affected by the operation of the proposed project will remain within the levels set out in the Darwin Harbour WQOs for the maintenance and protection of aquatic ecosystems. Hence, there will be no significant impact to any marine species as a result of a reduction in the water quality of Shoal Bay or Hope Inlet.
	Entrainment or impingement of species in intake pipes during operation
	The intake point will be fitted with a screen covered with mesh sized at 100 mm or less to exclude marine fauna. The intake velocity has been designed to be less than 0.25 m/sec at the mesh screen and less than 1 m/sec within one meter of the mesh screen - all fish are able to swim against this velocity, and this is less than the speed of currents in Shoal Bay during spring tides (see Section 12.3.3.2.2). As such there is negligible potential to impinge fish and turtles, and hence highly unlikely to be a significant impact to any species as a result of entrainment or impingement.



Objective	Assessment of Likelihood of Significant Impacts							
	Localised short-term noise and vibration disturbance during construction							
	<ul> <li>The most likely impact resulting from underwater noise emitted during the construction and operation of the Project are changes in the behaviour of aquatic fauna. Aquatic fauna in the vicinity of the pipelines may vacate or avoid the area following commencement of underwater works such as pile driving. Any behavioural change caused by noise from the project is likely to localised and temporary with aquatic fauna expected to resume normal behavioural patterns in the waters surrounding the project within a short time-frame (see Section 12.3.3.2.7). As such, no significant impacts to any species as a result of noise or vibration are expected.</li> </ul>							
	Construction and operational lighting has the potential to affect marine turtles by altering use of visual cues for orientation, navigation or other purposes. However, given that turtles do not nest within the project area or adjacent habitats (the nearest nesting beach is located around 18 km from the project area), it is unlikely the artificial light will interfere with the breeding success and population longevity of marine turtles. A vegetated buffer will be retained between the facility and the beach. Lighting will be limited to only that which is essential and will be designed in accordance with the Environmental Assessment Guideline for Protecting Marine Turtles from Light Impacts (WAEPA 2010) (see Section 12.3.3.2.8).							
	Introduction or spread of marine pests.							
	To ensure the accidental escape of prawns from the Stage 1 Hatchery does not occur the outlets on the tanks are screened. The likelihood of accidental escape of prawns from these facilities is considered negligible. Furthermore, the assessment of the risk of a disease from the grow-out facility impacting on a wild prawns and/or other aquatic fauna concluded that the risk is very low (see Section 12.3.3.2.5 and Section 12.3.3.2.6).							
	The potential to significantly impact upon species with distributions or habitat requirements that overlap with the project footprint							
	was assessed in accordance with EPBC Act Significant Impact Guidelines 1.1 (DoE 2013). Based on the assessment provided in the							
	significant marine fauna.							
Land								



Objective	Assessment of Likelihood of Significant Impacts
Flora and Vegetation To protect flora and vegetation so that biological diversity and ecological integrity are maintained.	The Project will involve the clearing a maximum of 28.93 ha of vegetation while the remainder of the vegetation on the site (101.07 ha) will be retained. The vegetation communities to be cleared are well represented in the Litchfield Shire area, and the clearing represents less than 1% of the extent of each vegetation type within the shire. As described in Section 12.2.2, the site has been subject to degrading processes, particularly as result of the past fire regime, uncontrolled recreational use, and invasive pest and weed species. This is more pronounced in the western third of the site, closer to the beach. As such, the majority of the Project infrastructure was preferentially sited in areas of degraded habitat in the western third of the site to minimise impacts to flora and vegetation values. It is not considered that the removal of 28.93 ha of vegetation communities that are well represented in the local area, and are largely degraded, would have a significant impact upon local biological diversity and ecological integrity. The vulnerable cycad <i>Cycas armstrongii</i> is a common species on site, with population densities of between 800 to 1,000 cycads per hectare in the eastern half of the site. They are less common in the western half of the site, and avoidance of those parts of the site with higher densities of this species was a key consideration in planning the site layout (see Figure 59). However, to comply with the air quality and noise separation requirements for the incinerator and the generators, these facilities were required to be located in areas with comparatively higher densities of <i>C. armstrongii</i> . Upon finalisation of detailed design, and once the exact numbers of <i>Cycas armstrongii</i> required to be removed are known, an application for a permit to take or interfere with wildlife under the <i>Territory Parks and Wildlife Act 2006</i> , will be sought. The preferred option is to engage the services of the Larrakia Development Corporation (LDC) to salvage cycads from the site for sale to developers
	Targeted surveys for the other threatened species with the potential to be present (whose detection may have been compromised by fires prior to the flora surveys) are proposed prior to commencement of construction. If <i>Typhonium praetermissum</i> , and the Melville Island Desmodium ( <i>Desmodium tiwiense</i> ) are found to be present within the footprint, an application for a permit to take or interfere with wildlife under the <i>Territory Parks and Wildlife Act 2006</i> , will be sought. Both species are likely to be able to be translocated and this would be investigated further if the species are found to be present within the footprint. Operation of the facility is unlikely to pose any significant threat to any vegetation community or threatened species. In fact, the weed and fire management regimes that will be implemented as part of the Project will likely have a positive impact upon flora and vegetation, when compared with the current situation. Currently, the site shows evidence of increased fire regimes (likely as a result of inappropriate recreational use) and also has outbreaks of weeds that increase the fuel load, such as Gamba Grass and Perennial Mission Grass. Management of fire and these weeds will have a positive effect on vegetation communities and <i>Cycas</i>



Objective	Assessment of Likelihood of Significant Impacts
	armstrongii, or any other threatened species that may occur within the site. As such, construction and operation of the proposed Project is considered unlikely to have a significant impact upon flora or vegetation.
Landforms	The Project will not result in any significant impacts to landforms or land units.
To maintain the variety and integrity of distinctive physical landforms so that environmental values are protected.	The majority of land on the Project site, will remain vegetated, with the only clearing outside of the building footprints being that required for compliance with the NT <i>Bushfire Management Act</i> . Clearing will occur in April or May, and this is considered one of the optimal times to undertake clearing, as soils are moist (reducing the chance of wind erosion) but without a high likelihood of rain (reducing the chance of erosion as a result of rainfall). Due to the nature of the soils there is considered to be little likelihood of encountering acid sulfate soils across much of the Project site. An ASS risk map will be prepared and management of any ASS found will be in accordance with Dear et. al. (2014).
Terrestrial Environmental Quality	Refer to response to the 'Landform' factor above.
To maintain the quality of land and soils so that environmental values are protected.	
<b>Terrestrial Fauna</b> To protect terrestrial fauna so that	Sixteen species of conservation significant terrestrial fauna listed under the TPWC Act (2006) are known, or considered likely or possible to occur in and around the project site. They are:
biological diversity and ecological	One insect
integrity are maintained.	One terrestrial reptile
	Twelve species of bird – nine that are considered shorebirds (i.e. using resources predominantly found in the intertidal environment) and three terrestrial birds (i.e. using resources predominantly found within the terrestrial environment).
	Four species of mammal.
	Terrestrial species
	The terrestrial habitat to be cleared to facilitate the project is not considered to be unique or critical habitat for any of these species. As described in Section 12.2.2, the site has been subject to degrading processes, particularly as result of the past fire regime, uncontrolled recreational use, and invasive pest and weed species. This is more pronounced in the western third of the site, closer to the beach.



Objective	Assessment of Likelihood of Significant Impacts
	The habitats in the eastern parts of the site (i.e. outside of the main part of the project footprint) were found to have more resources for fauna species than the western parts of the project site. As such, the majority of the Project infrastructure was preferentially sited in areas of degraded habitat in the western third of the site to minimise impacts to flora and fauna values. The clearing will be restricted to those areas required to be cleared to facilitate the Project footprint only (i.e. only the footprint of the infrastructure and the required firebreaks will be cleared – the rest of the site will remain vegetated). The areas to be cleared for the project infrastructure are unlikely to be important habitat for any of threatened fauna species that may utilise the site and the removal of 29 ha of habitat that would largely be considered marginal for these species is unlikely to result in a significant impact to any threatened species.
	Loss of habitat resources (e.g. tree hollows) and conditions as a result of inappropriate fire regimes, habitat degradation due to exotic invasive grasses and/or feral animals, and human interference, are regarded a key threats to the conservation significant fauna that may potentially use the site. The proposed action will not exacerbate any of these threatening processes. Operation of the facility is unlikely to pose any threat to any of these species. In fact, the weed and fire management regimes that will be implemented as part of the project will likely have a positive impact upon habitat for these species, when compared with the current situation.
	Shorebirds
	The Project will have a minimal impact upon the intertidal zone and impacts will be restricted to those required for construction of the intake and outfall pipelines. The nutrients contained in the aquaculture water to be discharged in to the marine environment will be well within levels considered acceptable under the Darwin Harbour Water Quality Objectives (see Section 9.3.3). As such there will not be any significant impact to feeding resources or habitat for migratory shorebirds in Shoal Bay.
	Summary
	The assessments undertaken to support this NOI have revealed that there is unlikely to be a significant impact to terrestrial threatened species as a result of the proposed Project.
	In terms of Commonwealth matters, an assessment of the potential impacts to terrestrial species listed under the Commonwealth EPBC Act was undertaken in accordance with the MNES significant impact guidelines (DoE 2013). The assessment revealed that there is not considered to be a real chance or possibility that the project will result in a significant impact upon any threatened or migratory species listed under the EPBC Act.



Objective	Assessment of Likelihood of Significant Impacts
Water	
<b>Hydrological Processes</b> To maintain the hydrological regimes of groundwater and surface water so that environmental values are protected.	There are no permanent water bodies on the Project site. Broad shallow drainage lines and localised depressions are present in the south west of the Project site. A closed depression wetland is located just outside of the boundary of the Project site in the south east corner. In accordance with the Northern Territory Planning Scheme Land Clearing Guidelines (DNREAS 2010b) direct impacts to these drainage areas and wetlands have been avoided and required buffer distances have been maintained. There will be no impacts to groundwater as seawater intake and discharge ponds will be lined with a HDPE membrane to prevent any seepage to groundwater. Therefore, the Project is not expected to result in any direct or indirect impacts to hydrology or groundwater.
Inland Waters Environmental Quality To maintain the quality of groundwater and surface water so that environmental values are protected.	Refer to response to the 'Hydrological Processes' factor above.
Air	
Air Quality To maintain air quality and minimise emissions so that environmental values are protected.	The site will contain an incinerator and power station consisting of two CAT32 diesel generators, packaged in containers. Results of the worst-case air quality modelling show that the predicted NO <sub>2</sub> levels will meet the emissions criteria at a distance of 100 m from the power facility. As the minimum distance required to meet the noise requirements of the facility is 470 m, the power station is situated 500 m from the nearest sensitive receptor, hence is located in excess of the separation distance required . As such, no additional mitigation is required. The following mitigation and design requirements have been implemented for the incinerator: The incinerator will be located 500 metres from any sensitive receptor (which, in this instance is the nearest area where people
	may be sleeping, and the Tree Point Conservation Area) in accordance with the NT EPA Guideline for Disposal of Waste by Incineration Evaluate will be three metres higher than the top of any building within 100 m of the incinerator.



Objective	Assessment of Likelihood of Significant Impacts
	Exhaust efflux velocity will be 10 m/s or more during all operational hours of waste incineration
	Once operational, a stack test be undertaken to confirm emission limits comply with requirements of the NT EPA Guideline for Disposal of Waste by Incineration.
People	
Social Surroundings To protect social surroundings from significant harm.	There are no anticipated impacts to cultural heritage values. In the unlikely event of a finding, a protocol for unexpected finds is included in the EMP (Appendix B) (See Section 14.4).
	There are no anticipated impacts to sites of conservation significance. Whilst the site abuts the Tree Point Conservation Area, the following measures have been put in place to protect it from potential impacts as a result of the proposed Project:
	Seawater storage ponds and discharge settlement ponds have been designed to cater for an 100 ARI event to minimise the risk of uncontrolled discharges ort stormwater runoff into the Tree Point Conservation Area,
	Vegetation surrounding the facility will be retained to manage stormwater runoff as well as provide a buffer between the Project facilities and the Tree Point Conservation Area.
	In accordance with the NT EPA Guideline for Disposal of Waste by Incineration, the recommended buffer of 500 m between the incinerator and the Tree Point Conservation Area (a sensitive receptor) has been adhered to
	There are no anticipated significant impacts to the Shoal Bay Site of Conservation Significance as a result of the construction or operation of the facility (see Coastal Processes, Marine Environmental Quality and Marine Fauna factors earlier in this table).
	There may be some minor visual impacts as a result of construction of the facility. These will be short lived and temporary. During operations the pipelines may be visible at some stages of the tide (see Figure 73). The pipes, however, are relatively small in size
	(overall diameter of 250 mm) and the visual impacts will be minimised to as low as possible by burying the pipeline for as far as possible using directional drilling as the method of construction.
	Noise impacts are expected to be minor and to only exceed guidelines for sleep criteria for a distance of 470 m from the only source of significant noise, which is the power generation facility. As such the nearest residence (one of the on-site managers houses) has been located 500m from the power generation facility. Noise impacts on industrial receptors are not expected outside 50 m from the facility. The closest industrial receptor is the site administration, access control point and warehouse which is approximately 150 m to the north-east.



Objective	Assessment of Likelihood of Significant Impacts
	Therefore, the Project is not expected to result in significant impacts to social surroundings.



## 20.2 CONCLUSION OF LIKELIHOOD OF SIGNIFICANT IMPACTS

As detailed in in this NOI, the construction and operation of the proposed facility may cause localised impacts to water quality, marine species, and terrestrial species. However, with the implementation of the control, management and mitigation measures described, none of these potential impacts are considered likely to be significant in nature, as described in Table 48.

In terms of Commonwealth matters, an assessment of the potential impacts to species listed under the Commonwealth EPBC Act was undertaken in accordance with the MNES significant impact guidelines (DoE 2013). The assessment revealed that there is not considered to be a real chance or possibility that the Project will result in a significant impact upon any threatened or migratory species listed under the EPBC Act.



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### APPENDIX A PROJECT SEA DRAGON ENVIRONMENTAL MANAGEMENT SYSTEM



## APPENDIX B DRAFT ENVIRONMENTAL MANAGEMENT PLAN



### APPENDIX C STAGE 1 HATCHERY COASTAL ENVIRONMENT AND IMPACT ASSESSMENT (WATER TECHNOLOGY 2017)



### APPENDIX D GUNN POINT HATCHERY FLORA SURVEY REPORT (ASTREBLA ECOLOGICAL SERVICES 2017)



# APPENDIX E FAUNA HABITAT ASSESSMENT (AUSTECOLOGY 2017)



# APPENDIX F BIOSECURITY ASSESSMENT (PANAQUATIC 2016)



APPENDIX G GUNN POINT AIR QUALITY AND NOISE ASSESSMENT (GHD 2017)



APPENDIX H ARCHAEOLOGICAL SURVEY REPORT (ELLENGOWAN ENTERPRISES 2017)



## APPENDIX I EPBC ACT REFERRAL



### APPENDIX J DEVELOPMENT CONSENT AND SUBDIVISION APPLICATIONS