



Title of Proposal - Project Sea Dragon Stage 1 Hatchery - Gunn Point

Section 1 - Summary of your proposed action

Provide a summary of your proposed action, including any consultations undertaken.

1.1 Project Industry Type

Aquaculture

1.2 Provide a detailed description of the proposed action, including all proposed activities.

This EPBC Act referral has been prepared for the Project Sea Dragon Stage 1 Hatchery (the Project) proposed to be developed at Gunn Point in the Northern Territory. The Stage 1 Hatchery is a component of a larger project, Project Sea Dragon. Project Sea Dragon is a large, fully integrated, prawn aquaculture project located in northern Australia. Project Sea Dragon will be delivered as an integrated production system, providing reliable, long-term, high quality and large scale production of Black Tiger prawns (*Penaeus monodon*). Project Sea Dragon focuses on sustainable land use and integrated design practices to maintain surrounding river and coastal environments and support adjacent agricultural land uses.

For the reasons outlined in Sections 1.15 and 1.16, this referral relates only to the Project Sea Dragon Stage 1 Hatchery.

The Stage 1 Hatchery has the sole purpose of producing post-larval prawns for the Stage 1 Legume Grow-out Facility, located at Legume Station over 800 km from the proposed Project site. The Stage 1 Hatchery involves:

- the breeding, spawning, and rearing of larval prawns until they are 15 days into the post-larval stage within the Stage 1 Hatchery module;
- the supply, storage, use and discharge of seawater and freshwater;
- the generation of power;
- the construction and operation of ancillary infrastructure such as waste management facilities, sewerage systems, road infrastructure, managers accommodation and site administration.

Figure 1 illustrates the proposed layout of the Stage 1 Hatchery on the Project site.

Breeding, Spawning and Rearing of Larval Prawns: Hatchery Module

To supply 1,120 ha of ponds at the Stage 1 Legume Grow-out Facility, the Stage 1 Hatchery module will require 700 male and 700 female broodstock prawns per week from the Project Sea Dragon Broodstock Maturation Centre in Point Ceylon. These broodstock will be high health, Specific Pathogen Free, of superior pedigree, mature and in breeding condition.

Within the Stage 1 Hatchery module there will be three buildings in which broodstock, spawning and hatching take place. Within each of these buildings there will be 20 tanks for holding the broodstock. The broodstock will be held in these tanks until they are ready to spawn, at which time they will be transferred to the spawning tanks. Once they have completed spawning, the broodstock will be transferred back to the broodstock tanks. Eggs produced during spawning will be harvested and transferred to the hatching tanks where they are hatched.



Nauplii (the first larval stage after hatching) harvested from the hatching tanks will be transferred to the larval rearing buildings. The Stage 1 Hatchery module will contain four buildings designated for larval rearing. Each larval rearing building will contain 20 parabolic tanks. The prawn larvae will be grown out in the larval rearing tanks for 24-25 days at which time they will be at the post larval stage (i.e. 15 days into the post-larval stage) and ready for transfer to the Grow-out Facility on Legune Station. The Stage 1 Hatchery will produce up to 16.2 million post larvae per week.

Algae provide an important food source for the larval prawns. Algae will be produced in the two algal laboratories and two grow-out rooms within the Stage 1 Hatchery module. Algae will be grown in batch culture, typically in an enriched seawater media. Algae are fed to the prawns at the earliest stage of their development. The common brine shrimp, *Artemia*, are also used in the early stage diet of prawns. *Artemia* are cultured from cysts which are obtained commercially. Two specific *Artemia* rooms are included in the design of the Stage 1 Hatchery module.

Water Supply, Storage, Use and Discharge

The Stage 1 Hatchery utilises both seawater and freshwater in the production of post-larval prawns.

Seawater will be sourced from offshore and piped to the Hatchery via seawater intake pipelines. The pipes will be buried by horizontal directional drilling methods under the fore dune and beach for as far as possible into the intertidal zone. After this point, the pipes will then be laid on the seabed using fleximat concrete anchors. At the seaward end of the pipes, an inlet structure will be anchored via a driven pile. It will be fitted with a maximum of 100 mm aperture mesh screen to limit the intake of marine debris and fauna. In times of pumping, the velocity of seawater intake at the mesh screen will be less than 0.25m/sec. The routine replacement and/or cleaning of these intake screens of biofouling is the only maintenance activity requiring repeated access to the pipe's seaward termination point. The seawater will be extracted by pumping ashore and will be delivered to three seawater storage ponds, which will be sized to hold enough seawater for at least five days of normal operations. The seawater pump will typically only operate from mid to high tide daily. The average daily intake of seawater during operations is 954 kL.

Freshwater will be supplied by Northern Territory Power and Water Corporation (PWC) and sourced from the existing bore supplying water to Gunn Point (bore number RN 26138). The maximum daily requirement for freshwater during operations is 44.25 kL.

Wastewater discharged from the Hatchery module will be stored in three settlement ponds for a minimum of 60 hours prior to being discharged to the receiving environment. This will allow the discharge water to settle and solids to separate. Discharge water will be pumped from the settlement ponds via a closed high density polyethylene (HDPE) pipe. The discharge pipeline will be constructed as described above for the intake pipelines. Water will be discharged directly into Shoal Bay at approximately 2 km offshore. The discharge point has been strategically located to minimise the impact on the receiving environment and, for biosecurity reasons, minimise recirculation of discharge water in the sea water intake pipe. The average daily discharge rate of wastewater during operations is 954 kL.

Power Demand and Generation

Power demand for operation of the Stage 1 Hatchery is in the order of 0.5 to 1.5 MW (i.e. 0.6 to



1.8 MVA, using a power factor of 0.83). Power will be generated on-site using two standalone diesel generating sets with fuel storage. Each generating set will be containerised in a self-bunded and sound attenuating enclosure with connection points for fuel, coolant, and lubricants. Onsite fuel storage volume will be approximately 5 to 7 days of consumption, with the site proposing to store 100 kL of diesel fuel.

Ancillary Infrastructure and Activities

Ancillary infrastructure associated with the Hatchery includes a small waste transfer station, an incinerator for the disposal of waste prawns, internal access roads, managers accommodation, site administration, a car park, storage facilities, workshops, and sewerage systems comprising of wastewater treatment plants (i.e. septic tanks).

The proposed incinerator for waste prawns is a small dual chamber system. Waste will be burnt in the primary chamber and hot gases and emissions are burnt in the secondary chamber. An incinerator with a burn rate of 50 kg/hr is proposed in order to dispose of waste prawns. The potential incineration task is approximately 140 kg each week. Given an incinerator burn load of 50 kg/hour, and a maximum load capacity of 17 kg, this equates to approximately 8 loads per week, or approximately 3 hours of operation.

1.3 What is the extent and location of your proposed action? Use the polygon tool on the map below to mark the location of your proposed action.

Area	Point	Latitude	Longitude
Project Site	1	-12.274777718126	131.044336408
Project Site	2	-12.274693849577	131.044336408
Project Site	3	-12.275784138626	131.02519616447
Project Site	4	-12.275197060468	131.02545365654
Project Site	5	-12.273939031437	131.02605447135
Project Site	6	-12.268068149845	130.99884614311
Project Site	7	-12.274022900226	131.02614030204
Project Site	8	-12.272764865587	131.02691277824
Project Site	9	-12.271506824938	131.02777108512
Project Site	10	-12.271003606996	131.02880105339
Project Site	11	-12.270248778281	131.03026017509
Project Site	12	-12.269493947403	131.03163346611
Project Site	13	-12.269410077172	131.03214845024
Project Site	14	-12.269158466319	131.03300675712
Project Site	15	-12.268822984807	131.03532418571
Project Site	16	-12.269074595981	131.0428772863
Project Site	17	-12.26798427916	131.04296311698
Project Site	18	-12.26798427916	131.04399308525
Project Site	19	-12.274777718126	131.044336408



1.5 Provide a brief physical description of the property on which the proposed action will take place and the location of the proposed action (e.g. proximity to major towns, or for off-shore actions, shortest distance to mainland).

Location

As illustrated in Figure 2, the Stage 1 Hatchery is proposed to be located on the Gunn Peninsula in the Northern Territory, within the Litchfield Municipality on Parcel Number 2626. It is located approximately 70 km by road from Darwin and 40 km from Howard Springs, a rural suburb occupied by 5,132 people (ABS 2016). The adjacent marine environment to the Project site is Shoal Bay. Hope Inlet, at the mouth of the Howard River, lies approximately 6 km to the south.

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 15 dwellings that are occupied variously throughout the year. No other communities are located within close proximity to the proposed Project area.

Geology and Soils

The geology of the Project area and surrounds is described by the 1:100,000 Koolpinyah Geological Map Sheet. Basement geology on the Gunn Peninsula consists of deeply weathered and eroded rocks from the Early Proterozoic (represented by the Partridge Group), and the Lower Cretaceous rocks of the Bathurst Island Formation. The Project area is underlain by tertiary soils and laterite overlying Wangarlu Mudstone which in turn overlies the Koolpinyah Dolomite.

Generally, the tertiary soils and laterite underlying the Project area are a competent mix of silt, sand and gravel. Soils on the lateritic plain in the eastern portion of the Project area consist of relatively deep red or yellow massive earths while soils on the slopes towards the western portion of the Project area consist of more shallow gravelly earths. Both soil types are moderately to rapidly draining.

Topography Elevations across the Project site range from approximately 27 m above sea level to sea level.

The main topographic feature in the vicinity of the Project area is the Koolpinyah surface. The Koolpinyah surface is a level to gently undulating plateau approximately 25 m above sea level which drains internally to the east of Gunn Point Road and west towards the coast (Willing et al. 1991).



The Project area is located on the western edge of the Koolpinyah surface which gradually slopes down towards the coastal sand plain. Slopes in the vicinity of Project area range generally between 0-4%, with short sections of terrain up to and greater than 8%.

Areas of erosion are observable most notably along exposed vehicle tracks. Shallow incised gullies are also present on slopes, particularly in the western portion of the Project area (Astrebla Ecological Services 2017).

Vegetation Communities

As illustrated in Figure 3, nine vegetation communities occur on the Project site. No threatened ecological communities or species listed under the EPBC Act were predicted to occur within the Project site, and none were identified during field surveys.

Approximately 60% of the Project site is dominated by one community, *Eucalyptus tetradonta* woodland to low woodland on the lateritic plain. Eighteen percent of the site is occupied by deciduous mixed species low woodland. The next most common vegetation community (approximately 11%) on the Project site is low woodland dominated by *Eucalyptus tectifica* and *C. polysciada*. The remaining six communities present each comprise less than 3% of the site. *M. viridiflora* low open forest dominates a broad drainage line and shallow depression in the south east of the Project site, and woodland of *Corymbia polycarpa* and *Erythrophleum chlorostachys* occupies the fringe of a closed depression wetland located just off the south east corner. The remainder of the site is comprised of four communities that occupy the narrow coastal sand plain. Two vegetation communities, monsoon vine thicket and mangrove low closed forest, which occur in a mosaic together on the coastal sand plain, are considered to be sensitive vegetation types under the Land Clearing Guidelines (DNREAS 2010).

Terrestrial Fauna Habitat

As described above, the site is dominated by sclerophyll woodland and open forest. *Eucalyptus tetradonta* is a dominant element of the tree canopy throughout the eastern two-thirds of the site. Both density and height of the tree canopy varies considerably. Generally, a higher abundance of taller and older trees were noted from the eastern third of the site, with woodland throughout other parts of the site characterised by a more open tree canopy and generally a lower height class. Understorey is relatively sparse in regard to shrubs and small trees (e.g. *Terminalia carpentariae* and *Pandanus spiralis*), though in parts, it is characterised by notable stands of the cycad *Cycas armstrongii*.

Eucalyptus tetradonta woodland and open forest supported a comparatively higher density of hollow-bearing trees (live trees and stags) than other vegetation communities. Within the *E. tetradonta* woodland and open forest, a higher density of hollow-bearing trees were observed within the eastern part of the site. Generally, ground timber (including hollow logs) and termitaria were present, whereas these habitat resources were sparse to absent within other parts of the



site (western half and north-western parts). Woodland understorey was also variable, and thought to be linked to changes in topography and the frequency of fire.

Sclerophyll woodland and open forest dominates the erosional plain of the east, with low woodland, shrubland, vine thicket, and grassland present on the slopes and flats to the west of the eroding edge of the plain.

The western parts of the site support distinctly different fauna habitat characteristics in comparison to the woodland / open forest habitats dominating the eastern areas. Here low woodland occurs, either dominated by paperbarks (*Melaleuca viridiflora*) or bloodwoods (*Corymbia polysciada*). The tree canopy is comparatively lower than that observed within the eastern parts of the site (median height <10m versus 15-20m). Ground timber (including hollow logs) and termitaria were present, though sparsely distributed and typically absent within low paperbark woodland, vine thicket, and grassland/sedgeland communities on sandier soils within the western-most third of the site. The habitat in the western part of the site is considered highly degraded, largely as a result of heavy disturbance by recreational users.

Along the western edge of the site, a low dune and swale variously supports mangroves and dry vine thicket communities. These elements intertwine and form a relatively narrow timbered band. During field work, the sandy beach exposed at high tide was approximately 60 m in width, and flats exposed at low tide were approximately 100-150m in width.

Marine and Intertidal Habitat

Shoal Bay differs from most other bays in the Top End in that no large rivers (or freshwater coastal floodplains) are associated with it (DNREAS 2017). Extensive mud and sand flats are the major feature of Shoal Bay, with much of the bay exposed at low tide (DNREAS 2017). This is supported by the benthic habitat mapping undertaken to support the Ichthys Gas Field Development Project, which indicated that the sediments of Shoal Bay are predominantly sand and mud, with the inferred habitat being classified as "soft-bottom benthos; sediment", with no macrobiota or reef communities present.

In regard to the marine and intertidal habitats of the Shoal Bay Site of Conservation Significance, DNREAS (2017) notes the following: "the Shoal Bay site lacks extensive sandy beaches and as a result, it is likely to be only used infrequently by marine turtles for nesting; no seabird breeding colonies are known from the Shoal Bay site; the Shoal Bay site lacks a large area of freshwater wetland and supports relatively low numbers of waterbirds; sand and mud flats in Shoal Bay are an important feeding and roosting area for migratory shorebirds during their non-breeding season; parts of the Shoal Bay site are degraded due to heavy disturbance by recreational users; urbanisation is impacting on the Shoal Bay site, with local swamps being drained for urban development and further developments are proposed as Darwin continues to expand; other management concerns include exotic plants and animals, frequent fires, and uncontrolled recreational use of the area."



Land Use

Since around 1907 the primary use of the greater Gunn Peninsula has been for grazing. A prison farm was established to the north-east of the proposed Project site in 1972 and functioned till 1995 when it was closed. Historically the Project site itself has had low levels of activity, with current use for recreational fishing, hunting and camping.

However, field assessments revealed that the coastal sand plain area is heavily utilised by visitors for camping, beach fishing, and trail-bike riding, and, consequently, showed signs of heavy human use including abundant litter, ranging from plastic and bottles to large sheets of corrugated iron; open (unburied) latrine sites; evidence of soil compaction; and occurrences of impromptu clearing. In addition, weeds, which were not present over most of the site (where present they were restricted to the immediate edge of tracks), were abundant on the coastal sand plain, and it was considered possible that fire frequency is increased (this latter impact affects the entire site, not just the coastal sand plain). Increased weeds and fire frequency were considered possibly attributable to heavy human use.

1.6 What is the size of the proposed action area development footprint (or work area) including disturbance footprint and avoidance footprint (if relevant)?

28.93 ha

1.7 Is the proposed action a street address or lot?

Lot

1.7.2 Describe the lot number and title.Portion Number 2626

1.8 Primary Jurisdiction.

Northern Territory

1.9 Has the person proposing to take the action received any Australian Government grant funding to undertake this project?

No

1.10 Is the proposed action subject to local government planning approval?

No

1.11 Provide an estimated start and estimated end date for the proposed action.

Start date 04/2019



End date 06/2048

1.12 Provide details of the context, planning framework and State and/or Local government requirements.

Commonwealth Government Requirements

Project Sea Dragon has been accorded 'Major Project Facilitation' through the Commonwealth Department of Infrastructure and Regional Development.

An analysis of the applicability of Commonwealth regulation to the Project has been undertaken and the results are presented below.

Customs Act 1901 – import permits and quarantine permits

For development of the Project the proponent proposes to source feed from national and international sources. Feed from overseas will be imported in accordance with an import license or permit. The proponent currently holds an import permit for feed under the *Customs Act* for its existing aquaculture facilities. No additional import permits are required to be obtained for the Stage 1 Hatchery.

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) - approval under the Act

This EPBC Act referral has been submitted to the Commonwealth Government Department of Environment and Energy to assist in determining whether assessment under the EPBC Act is required for the Stage 1 Hatchery.

Based on the information presented in this referral, the proponent concludes that the Project will not result in significant impacts to matters of national environmental significance (MNES), and hence will not require approval under the EPBC Act.

Migration Act 1958 - Temporary Skill Shortage (TSS) visa

The proponent has not yet determined if foreign workers are required for the Stage 1 Hatchery.

The proponent is aware of the requirements of this Act and will ensure any utilisation of foreign workers, in the event that they are required, would be in accordance with the requirements of this Act.



Native Title Act – Indigenous Land Use Agreement

The Native Title Act is suppressed under current tenure and there is no current native title claim over the proposed Project area. Should a native title claim be lodged, and be successful, the proponent will endeavour to enter into an Indigenous Land Use Agreement with the claimants.

Northern Territory Government Requirements

Project Sea Dragon has also been accorded 'Major Project Status' through the Northern Territory Department of the Chief Minister. An analysis of the applicability of Northern Territory regulation to the Project has been undertaken and the results are presented below.

Bushfires Act - Fire Management Plan

A fire management plan will be prepared to detail measures to prevent and manage bushfires in and surrounding the Project site.

Control of Roads Act – Permits on Northern Territory roads and road reserves

All Northern Territory road upgrades will be undertaken by the Northern Territory Government, therefore, it is the responsibility of the Department to ensure that all permits under the Act are obtained prior to the commencement of works.

Environmental Assessment Act (EA Act) - Approval under the Act

A Notice of Intent has been prepared for the Northern Territory Environment Protection Agency (NT EPA) to assist in determining whether assessment under the Northern Territory EA Act is required for the Stage 1 Hatchery. The Notice of Intent is provided as Attachment 1 to this referral.

Fisheries Act - Aquaculture Licence

An Aquaculture Licence is required to be obtained for the Project.

It is the proponent's expectation that environmental management of the site will be through an Environmental Management Plan as part of the Aquaculture Licence process, noting that particular aspects of environmental management (e.g weeds, bushfires, waste management



and wastewater) will be addressed under separate licences and permits.

Food Act - Food business registration

A temporary construction camp may be established on site.

The camp's kitchen will be registered with the Northern Territory Department of Health, in accordance with the requirements of the Act.

Heritage Act - Approval to carry out work on, disturb or salvage heritage places or objects declared or protected under the Act

An email has been received from the Heritage Branch of the Northern Territory Government identifying the location of recorded Aboriginal archaeological sites on Portion 2626. The Project has been designed to avoid impacts on these sites and no heritage place or object is anticipated to be impacted by the Project, therefore approval under the Act is not required.

Marine Act - Approval for the erection of structures below the high water mark or for attaching structures to the sea floor

The seawater intake pipelines and the discharge pipeline will be anchored to the seafloor below the high tide water mark. Accordingly, the proponent will apply for approval under the Act.

Northern Territory Aboriginal Sacred Sites Act - Aboriginal Areas Protection Authority (authority certificate)

An authority certificate under the Act was issued to Project Sea Dragon Pty Ltd for a commercial prawn Hatchery on 3820 Gunn Point Road, Koolpinyah by the Aboriginal Areas Protection Authority on 2 May 2017.

The proponent understands that, based on recent Project design modifications, an amendment to the authority certificate is required.

Planning Act - Development Consent (also known as a Development Permit under the Act) and Development Consent to Clear Native Vegetation

Under the Northern Territory *Planning Act*, Development Consent is required to be obtained to



enable both the subdivision of Parcel 2626, and development and operation of the Project. Development applications in the Northern Territory are assessed by the Development Consent Authority. Project Sea Dragon has prepared and submitted a development application for Development Consent in accordance with the requirements of the Planning Act and the Northern Territory Planning Scheme. An application for subdivision of Portion 2626 has also been prepared and submitted, on behalf of the Northern Territory Land Corporation.

The clearing of native vegetation will be addressed as part of the Development Consent process and in accordance with the requirements of the Northern Territory Planning Scheme.

Public and Environmental Health Act - Wastewater Works Design Approval

The proponent will apply for a waste water works design approval for the design and installation of the site's wastewater system, required to service administration buildings and managers accommodation areas.

Soil Conservation and Land Utilisation Act 1969 – Compliance with the requirements of the Act

The proponent has included provisions for erosion and sediment control in the Project's Environmental Management Plan (see Attachment 7 to this referral). The proponent has also been advised that an Erosion and Sediment Control Plan will be added as a standard condition of the Development Consent.

Territory Parks and Wildlife Conservation Act (TPWC Act) - Permit to take or interfere with wildlife

The Project will involve the removal of the vulnerable *Cycas armstrongii*. Approval to take *Cycas armstrongii*, in accordance with the requirements of the TPWC Act, will be addressed through the Development Consent process.

Waste Management and Pollution Control Act - Environment Protection Approval (EPA) and Environment Protection Licence (EPL)

The proponent anticipates that an EPA and EPL will be required for the construction and operation of an incinerator and a small waste transfer station to manage recyclable, household and aquaculture waste.



Water Act - Waste Discharge Licence and Surface Water Extraction Licence

The proponent expects a Waste Discharge Licence will be required and will apply for the licence accordingly.

The proposed extraction location water is best described as tidal water within the meaning of the Act, being located within a marine tidal environment. On this basis the proponent anticipates that a Surface Water Extraction Licence is not required for the Stage 1 Hatchery.

Weeds Management Act - Compliance with the requirements of the Act

The proponent has been advised that a Weed Management Plan will be added as a note or a standard condition of the Development Consent.

1.13 Describe any public consultation that has been, is being or will be undertaken, including with Indigenous stakeholders.

Project Sea Dragon has been discussed with the public across a range of media and through a variety of channels since 2015. In terms of the methodology employed to understand the potential social impacts of the proposed Stage 1 Hatchery at Gunn Point, 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. This consultation process commenced in April 2017 and is ongoing. 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, and has included consultation with private landholders, private businesses, Indigenous groups, Traditional Owners of the region, recreational organisations, politicians and environment groups.

1.14 Describe any environmental impact assessments that have been or will be carried out under Commonwealth, State or Territory legislation including relevant impacts of the project.

An environmental impact assessment has been undertaken as part of the development of this EPBC Act referral and the Notice of Intent submitted to the NT EPA.

The primary potential impacts of the Project were considered to be associated with the clearing of vegetation for the development of infrastructure and services, the construction of intake and discharge pipelines and with the discharge of wastewater from the Stage 1 Hatchery module to the marine environment.



The environmental impact assessment considered these impacts and a range of other potential impacts of the Project, including impacts associated with increased noise, increased traffic movements, restrictions on access to the area, and the operation of a small power facility and incinerator. The assessment focused on the potential impacts of Project construction and operation on geology and soils, acid sulfate soils, the marine environment, groundwater, terrestrial flora and vegetation, terrestrial and marine fauna, significant sites or features, cultural heritage, the socio-economic environment, matters of national environmental significance and climate change.

A brief description of the environmental impact assessment is presented below, and the full Notice of Intent and relevant technical reports are appended to this referral as Attachment 1.

Geology and Soils

The clearing of vegetation within the Project footprint is the main potential impact on geology and soils. The majority of land on the Project site, however, will remain vegetated, with the only clearing outside of the building footprints being that required for compliance with the Northern Territory Bushfire Management Act.

Given the relatively small area of the area to be cleared (28.93 ha), clearing will not be staged. Construction is scheduled to take place from April 2019 to February 2020. Land clearing will occur at the beginning of this period and it is expected that the buildings will be constructed by the end of the dry season, with internal fit out occurring through the wet up until February 2020. 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).

Potential impacts associated with the clearing of vegetation on geology and soils have been identified as: soils cleared of vegetation are likely to be prone to soil erosion caused by rainfall; clearing at inappropriate times can exacerbate the effects of soil erosion; vehicles and machinery operating outside the areas to be cleared have the potential to exacerbate the potential for erosion; and, soils left without vegetative cover during the dry season are likely to be prone to wind erosion.

To mitigate the impact of vegetation clearing on geology and soils, an Erosion and Sediment



Control Plan has been developed and is included in the Project's Environmental Management Plan (see Attachment 7).

Acid Sulfate Soils

Should acid sulfate soils (ASS) be encountered and disturbed, this can result in oxidation and generation of acid leachate, which can acidify runoff or groundwater leachate, affecting receiving waters. Acid leachate can also affect infrastructure particularly concrete structures, such as footings and culverts.

Given the soil types across the site, only the deeper borehole located in the vicinity of the intake structure was assessed for ASS (although the profile comprised sands over mudstones).

Soil samples were sent to a NATA laboratory and analysed for pH_f, pH_{fox} and the chromium acid sulfate soil suite, which incorporates sulfur and acid trail analysis, including Chromium Reducible Sulfur (CRS, also denoted S_{Cr}), acidity and acid neutralising capacity.

The pH results indicate no potential acid sulfate soils (PASS) in the soils, based on the lack of reaction between pH_f and pH_{fox} and the low or negligible CRS results. They do indicate significant existing acidity, as evidenced by a pH-KCL result of 3.7 – 3.8 and total acidity for soils below 1.5m depth. Some retained acidity, which can indicate Actual ASS (AASS), was identified, however the results were low, and were more likely to indicate either an influence in the region (but not in the borehole itself), or natural mineral source rather than existing PASS or AASS in the soils encountered.

Pre-construction testing for acid sulfate soils will be undertaken in areas indicated on the ASS risk map (see Acid Sulfate Soil Management Strategy in EMP – see Attachment 7). Noting that the following may require adjustment to match the existing acidity of natural (non ASS) soils, after consultation with a soil specialist, any ASS found will be managed as follows:

- Acid sulfate soils are to be avoided, and groundwater level not lowered in their vicinity, or the neutralising capacity of any exposed acid sulfate soil (after treatment) must exceed the existing plus potential acidity of the soil, with a Factor of Safety of 1.5, and
- Acid Neutralising Capacity, whether naturally available or added, must be sufficiently fine to



counteract oxidation and acid generation, as outlined in Dear et al (2014)

- Any placement of ASS is to be in a place such that future exposure of the material to oxidising conditions is prevented, unless the material is validated as having been neutralised

- If ASS neutralisation treatment is required:

1. A laboratory test of the material is to be conducted in accordance with the Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines (Dear et al, 2014)

2. An assessment of the bulk density of the soil will be required to determine the rate of lime addition required in kg CaCO₃/m³ of soil (from kg CaCO₃/t soil)

3. A subsequent determination of the liming rate per m² to allow determination of lime addition required in kg CaCO₃/m² (or other measure such as acre or hectare as appropriate). A factor shall be applied to the liming rate depending on the equivalent CaCO₃ of the neutralising agent used. This shall be applied by calculating 100/%CaCO₃ equivalent and multiplying this factor by the liming rate / tonne of soil (or m³ of soil) to achieve the required rate in CaCO₃.

4. Spreading of lime (preferably fine agricultural lime – ‘aglime’) at a rate exceeding that identified above per tonne soil to be disturbed or removed and ploughing or ripping of spread lime into soil ensuring that lime is distributed throughout the topsoil layer. This management is valid for shallow excavations / stripping affecting at most the top 700mm only (without intercepting groundwater and with a 500 mm safety factor to the limit of investigation).

- Some management may be required to ensure acidic runoff does not occur into receiving waters from any such stockpiles. This will be undertaken in accordance with Dear et al (2014).

Noise

A detailed noise assessment for the Project was undertaken by GHD to assess the noise generated during the operation of the Project from the diesel generators at the power facility (GHD 2017). Noise modelling was undertaken using sound propagation software CadnaA. The noise model was used to gain an understanding of predicted noise levels at sensitive and industrial receptors, and to determine how far the power facility should be from these areas to minimise potential noise impacts.

Based on the NSW Industrial Noise Policy 2000, which classifies intrusive noise as being noise that intrudes above the background level by more than 5 decibels, the noise criteria adopted for assessing the impact on sensitive receptors was 35 dB(A). For industrial receptors, such as the site administration, access control point and warehouse, the recommended acceptable noise level when in use is 70 dB(A).



The results of the noise modelling show that a distance of 470 m would be needed from the power facility to sensitive receptors to meet the adopted noise criteria of 35 dB(A) (GHD 2017). As there are no sensitive receptors within 470 m of the power facility, no impacts from noise emissions on sensitive receptors are expected.

Noise impacts on industrial receptors are not expected outside 50 m from the power facility (GHD 2017). The closest industrial receptor is the site administration, access control point and warehouse which is approximately 150 m to the north-east. Therefore, no impacts from noise emissions on industrial receptors are expected.

Air Quality

A detailed air quality assessment for the Project was undertaken by GHD to assess air emissions resulting from the operation of the power facility and the incinerator (GHD 2017).

The most significant air pollutant generated by the power facility, based on the ratio of its emission rate to impact assessment criteria, will be nitrogen dioxide (NO₂) released as oxides of nitrogen (NO_x) from on-site diesel generation units. For the power facility the results of the worst-case air quality modelling show that the predicted NO₂ levels will meet the recommended criteria set out in the National Environment Protection (Ambient Air Quality) Measure (Air NEPM) at a distance of 100 m from the power facility (GHD 2017). This distance is below the minimum distance required to meet the noise requirements of the facility of 470 m. As such, no additional mitigation is required.

The proposed incinerator is a small facility and will operate for a limited number of hours during the day, a few days a week. With such a low mass throughput, a risk assessment approach has identified very low risk to the environment. Furthermore, in accordance with the NT EPA Guideline for Disposal of Waste by Incineration the incinerator will be located greater than 500 m from any sensitive receptors such as the manager's accommodation. As such the operation of the incinerator will not have a significant impact on the environment or any sensitive receptors.

Marine Environment (coastal features, oceanographic conditions and water quality)

An extensive literature review was conducted to document the existing coastal environment



within Shoal Bay and Hope Inlet. A physical data collection program was also undertaken which included the deployment of water level, and salinity data loggers. It also included the collection of bathymetric level data and sediment and water quality samples to assist in characterising the physical coastal environment, and background water quality concentrations. Water quality data collected in the Darwin Harbour region by the Department of Environment and Natural Resources since 1987 (Wrigley et al. 1990) was also used to characterise the background water quality in the marine environment adjacent to the Project.

The data collected was used to support the development and calibration of numerical models of the study area, which were used to simulate the transport, dilution and dispersion of the proposed discharge at Gunn Point and surrounding waters.

Coastal Features and Processes

In terms of coastal features and processes, the impact assessment identified that the coastal features at Gunn Point that could be potentially impacted by the proposed facility are in the vicinity of the intake and discharge pipe location. Both the intake and outfall pipes will be buried under the dune and out through the intertidal zone via horizontal directional drilling methods. Offshore they will be placed on the seabed. There is potential that the pipe 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 be some visual disturbance due to the construction in an area with a low level of development. The presence of the pipes in this area could impede navigation of recreational vessels in the area.

Bathymetry and Geomorphology

Placement of the intake pipe on the bed will result in minor and localised changes to the bathymetry in deeper water due to scour and deposition. More significant, but still relatively minor changes could be observed in the intertidal region where sediments are more mobile. Discharge flows have the potential to cause scour of the bed, however it is unlikely due to the low flow rate.

Sediment Transport and Coastal Processes

As noted above, placement of the intake pipe on the sea bed may cause localised bathymetric changes. Within the intertidal zone where small waves may be impacted by the pipe some minor changes to the coastline could occur.



Oceanographic Conditions

The macro tidal environment within Shoal Bay means that the potential changes to tidal water levels and currents associated with the intake or discharge are extremely low. The tidal prism (i.e. the volume of water which is exchanged during each tide) in the vicinity of Gunn Point north of Hope Inlet is of the order of $4 \times 10^7 \text{ m}^3$ during a spring tide and $4 \times 10^6 \text{ m}^3$ during a neap tide. During a single tide, the intake pipe will remove approximately 500 m^3 of water from Gunn Point (over approximately 12 hours) at the ultimate development state. This represents 0.001% of the tidal prism during a spring tide and 0.01% during a neap tide and is thus unlikely to have any impact on tidal water levels or currents.

High tidal currents will necessitate the armouring of the intake pipe to the bed to prevent damage through movement. Rock armouring along the pipeline, or concrete braces will be considered.

Water Quality

Water Quality Objectives (WQOs) exist for Darwin Harbour. The Darwin Harbour WQOs recommend the water quality that supports the maintenance of the ecosystem, and are designated under Part 7 of the Northern Territory *Water Act* as a local guideline level in accordance with the National Water Quality Management Strategy (NWSMS) and Australia and New Zealand Environment and Conservation Council (ANZECC) guidelines (DENR 2016).

Shoal Bay is categorised as part of Darwin Harbour and as such the WQO's for Darwin Harbour apply to the waters to be affected by the Project. Different WQOs exist for upper estuary, mid estuary and outer estuary areas of Darwin Harbour and delineation of these zones is made through the use of residence times and a flushing index derived from the Darwin harbour hydrodynamic model. An analysis of residence times was undertaken by Water Technology using a numerical model system. The results indicate the water to be affected by the Project are a mix of mid and outer estuary zones. From this assessment, delineation between mid and outer estuary was created for purposes of defining the water quality objectives, and therefore assessing potential impacts from the proposed facility.

Background concentrations of nutrients and chlorophyll a were derived from local water quality monitoring undertaken by both the proponent and the Department of Environment and Natural Resources. This has revealed that the background mid-estuary chlorophyll a concentration is above the Darwin Harbour WQO. Given the Darwin Harbour WQO is assigned to the full



harbour system, it is proposed that the WQO objective for chlorophyll a be adjusted at this location, and an interim site specific guideline for this parameter be derived for the purposes of the assessment of this Project. In accordance with the approach for low risk trigger values set out in Section 3.3.2.4 and 3.3.3.2 of the Australian and New Zealand Guidelines for fresh and marine water quality (ANZECC & ARMCANZ 2000), the approach taken has been to use the 80th percentile of the results of the local monitoring to derive an interim site specific guideline for mid estuary chlorophyll a.

Following determination of the relevant WQOs and the background concentrations, tracer concentration time series from the numerical models were converted to nutrient concentration by applying the discharge median licence condition for total nitrogen, total phosphorus and chlorophyll a, and adding the background value for each of these parameters. These results were then compared to the relevant WQO's.

The modelling shows that the proposed Water Quality Objectives are not predicted to be exceeded for any site assessed, therefore significant impacts as a result of the discharge are not expected to occur.

The full results of the water quality modelling are presented in Attachment 4 to this referral. Specifically, Figures 5-3 to 5-8 of Attachment 4 show the results of water quality modelling box and whisker plots, including a comparison to the proposed WQOs.

Ground Water

In the Gunn Peninsula area there are two separate groundwater aquifers; a shallow unconfined aquifer in the lateritic subsoil layer and a deep aquifer confined to weathered dolomite. The location of recharge areas has received limited investigation however Jolly (1984) and Yin Foo (2004) identified a low recharge area to the south of Koolpinyah Station homestead, which is located to the south east of the Project site.

Given that all seawater intake and discharge ponds will be lined with a High Density Polyethylene (HDPE) membrane to prevent any seepage to groundwater, no impacts from the construction and operation of the Project on groundwater are anticipated. HDPE liners are essentially impermeable and commonly used in wide ranging containment applications including potable water storage, animal waste containment, landfills and canal linings. Additionally, all seawater intake and discharge water pipelines will be closed HDPE pipes and there is no potential for interaction with groundwater. All other water use on the site will be contained in



tanks within the Hatchery module buildings.

Freshwater for the site will be supplied by an external party. Northern Territory Power and Water Corporation (PWC) will supply freshwater from the existing bore supplying water to Gunn Point. PWC has confirmed that there is sufficient freshwater capacity to supply the Hatchery and has agreed to provide a service connection for the required freshwater volumes.

Terrestrial Vegetation and Threatened Flora

Astrebla Ecological Services was engaged to undertake desktop assessments and field surveys to inform the terrestrial vegetation and flora impact assessment for the Project. Prior to the field assessment, a desktop assessment was undertaken to gain an understanding of the ecological values of the Gunn Point area and associated landscape, including vegetation communities and threatened species that could be present.

Three site visits were undertaken, an initial site reconnaissance on 7th of April 2017, a six day site survey from July 2-7, 2017, and another single day survey on 7 September, 2017. The objectives of the field survey were: to map vegetation communities present on the site; to survey for the presence of threatened species and their supporting habitats, and to conduct population surveys if present; and to identify weeds present on the site.

For each species identified within the databases and predictive models for the Gunn Point area, an assessment of the likelihood of site occurrence was then undertaken. The conclusion in regard to site occurrence for each species was based on the known ecological requirements of the species, presence of local records, and the presence and condition of suitable potentially habitat resources on the site.

Field surveys of the site determined that none of the vegetation communities present are listed threatened ecological communities under the EPBC Act. Approximately 45% of the clearing area occurs within *Eucalyptus tetrodonta* woodland to low woodland on the lateritic plain (Astrebla Ecological Services 2017). This community is one of the most common in the Northern Territory with over 1.2 million hectares mapped by Wilson et al. (1990) (Department of Natural Resources, Environment and the Arts 2004). The other two vegetation communities to be cleared by the Project are *Eucalyptus tectifica* and *Corymbia polysciada* low woodland/open woodland on gentle run-off slopes and deciduous mixed species low woodland/open woodland on lower run-off slopes. The combined total area of these two communities within the footprint is less than 0.7% of the vegetation community that occurs within the Litchfield Shire area. The



clearing of these vegetation communities has been minimised to the greatest extent practicable and is not considered a significant impact or loss of biodiversity values.

Only one flora species listed under the EPBC Act was returned from the search of the Commonwealth EPBC Protected Matters Search Tool (see Attachment 6), *Stylidium ensatum* which is listed as Endangered under the EPBC Act. The assessment of likelihood of site occurrence, which is presented in Table 2.4.1 of Section 2 of this referral, determined that this species is unlikely to occur within the Project site. There are no peaty/sandy soils on the site that stay damp well into the dry season and it was not observed during the field surveys. Additionally, a 2016 survey by the Northern Territory Herbarium of the Litchfield local government area, including numerous sites in suitable habitat in Tree Point Conservation Area and vicinity, did not find this species (Green & Cuff 2016).

The desktop and field assessments revealed that one threatened flora species listed as Vulnerable under the Northern Territory, TPWC Act does occur on site - *Cycas armstrongii*. *Cycas armstrongii* is a common species on site, with population densities between 800 per hectare to 1,000 per hectare in the eastern half of the site. It is less common in the western half of the site. Avoidance of habitat for *Cycas armstrongii* was a key consideration in planning the site layout. Habitat for this species was avoided to the greatest extent practicable. 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 *C. armstrongii*. Operation of the facility is unlikely to pose any threat to this 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 this species, 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 *Cycas armstrongii* within the site. *Cycas Armstrongii* is not a listed species under the EPBC Act.

Based on the desktop and field surveys an additional four threatened species listed under the TPWC Act are considered possible to occur on site - *Typhonium praetermissum*, the Melville Island Desmodium (*Desmodium tiwiense*), *Operculina turpethum* and *Pittosporum moluccanum*. None of these species are listed threatened species under the EPBC Act.

Suitable habitat is present on site for *Typhonium praetermissum*, and populations have been located in the Gunn Point area. Green and Cuff (2016) have mapped a corridor of potential habitat for this species through the middle of the Project site. It was not observed during the field survey, but it is noted that the season was not correct for surveys for this species.



Construction of the Project will result in the removal of 0.12 ha of habitat for this species. This represents 0.01% of potential habitat for the species available on the Project site and as such is not considered to be significant. Operation of the facility is unlikely to pose any threat to this 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 this species, when compared with the current situation, for the same reasons as those described above for *Cycas Armstrongii*. Targeted surveys for the species will be conducted in late December which is the optimal survey time for the species.

Suitable habitat is present and common on site for *Desmodium tiwiense*, and is contiguous with habitat for a previous record from within 2 km. However, the species was not observed during the field survey (but an earlier fire had burnt out suitable habitat). Potential habitat for this species is considered to be *Eucalyptus tetrodonta* woodland to low woodland on the lateritic plain, which is also habitat for *Cycas armstrongii*. As mentioned above, minimisation of impacts to those parts of the site with higher densities of *Cycas armstrongii* was a key consideration in planning the site layout. Construction of the Project will result in the removal of 12.84 ha of habitat for this species. This is not considered to be significant given habitat for this species is widespread across the region, and the area to be cleared is less than 0.1% of the extent of potential habitat for the species that occurs within the Litchfield Shire area. Operation of the facility is unlikely to pose any threat to this 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 this species, when compared with the current situation, for the same reasons as those described above for *Cycas armstrongii*. Targeted surveys for this species will be conducted prior to commencement of construction.

Operculina turpethum was collected on the coastal sand dune immediately adjacent to the Project site in 2000. Potential habitat for this species exists along the coastal sand dune as well as the vine thicket/mangrove mosaic community. It was not observed during the field survey however an earlier fire had burnt out beach dune where it had been previously recorded. If it were to be present, it would not be affected by the Project, as there will be no impacts to the coastal sand dune and/or the vine thicket/mangrove mosaic community.

Suitable areas of habitat for *Pittosporum moluccanum* in the vine thicket on stabilised coastal sand dunes are present on site, and the species has been found twice within 2 km of the Project site, both to the north and south. However, it was not observed during the field survey and if it were present on site, it will not be affected, as there will be no impacts to the vine thicket/mangrove mosaic community where it occurs.

Upon finalisation of detailed design, and once the exact numbers of *Cycas armstrongii*, and, if



found to be present within the footprint, *Typhonium praetermissum*, and the Melville Island Desmodium (*Desmodium tiwiense*), required to be removed are known, an application for a permit to take or interfere with wildlife under the TPWC Act, will be sought.

Terrestrial Fauna Habitat

Flora and fauna surveys were undertaken to determine the areas of the site with comparatively lower values for threatened and non-threatened fauna. The results revealed that the western third of the site supports comparatively lower values, and as such development has been concentrated into this area of the site as much as possible to ensure impacts on fauna species are minimised.

Field surveys also indicate that the site has been subject to degrading processes, particularly as result of the past fire regime. There is also widespread evidence of invasive plants and feral animals, and the impacts of uncontrolled recreational uses, which have impacted of the quality of fauna habitat on the site. These impacts are more evident in the western third of the site.

The Project will involve the clearing 28.93 ha of vegetation while the remainder of the vegetation on the site (101.07 ha) will be retained. The area of vegetation proposed to be cleared is considered to be conservative as it includes a 25 m buffer around all infrastructure to allow for flexibility in the detailed design stage. It is highly likely that not all of the area within the 25 m buffer will be required to be cleared and as such the clearing area is likely to be smaller than 28.93 ha.

In addition, the vegetation to be cleared is widespread in the local area and is not considered to represent unique, or critical habitat for any threatened species that may utilise the site. This, combined with the small extent of the proposed development footprint, the proposed location of the footprint elements, and the nature of the operations indicates that, with the incorporation of the management practices, there will be no significant impact to fauna habitat values on, or adjacent to the site.

Marine Habitat

The area of marine habitat to be impacted by the Project is relatively small, comprising only the intake and outfall pipelines. This area is classified as "soft-bottom benthos; sediment", with no macrobiota or reef communities present and does not contain any unique habitat values, being well represented locally and affecting only a very small proportion of Shoal Bay. As such there is



not considered to be any potential for the pipelines to significantly impact upon marine habitat in Shoal Bay.

The quality of the water to be affected by the discharge from the proposed Project will be well within the Water Quality Objectives for Darwin Harbour, and as such, by definition, will not pose a significant risk to the environmental values of the receiving waters.

Threatened Fauna (terrestrial, avifauna and marine)

A Fauna Habitat Assessment was undertaken to support the Notice of Intent for the NT EPA and this EPBC Act Referral. This involved both desktop assessments and a two day terrestrial habitat assessment of the site and surrounds on 11 and 12 July 2017.

In addition to the EPBC Act protected matters search tool, the following search tools, databases and information sources were also searched for records of threatened and migratory species listed under the EPBC Act:

- Atlas of Living Australia search (search encompassed the area within 15 km of the centre of the site)
- NT NRM Infonet
- NR Maps
- Fauna records for the Shoal Bay
- Site of Conservation Significance #8
- Previous fauna surveys undertaken in the Project area and surrounds, including: EcoOz (2001) Flora and fauna survey and preliminary environmental assessment, Sunrise Gas Project, Gunn Peninsula, Northern Territory; Department of Infrastructure Planning and Environment Glyde Point Flora and Fauna Survey (GHD 2005); URS (2003) Proposed Glyde Point Industrial Estate Marine Habitats Survey; and waterbird and shorebird record data sets relevant to the Shoal Bay area from the Parks and Wildlife Commission of the Northern Territory Technical Reports 73 and 76 (Chatto, 2003 and 2006).

For each species identified within the databases and predictive models for the Gunn Point area, an assessment of the likelihood of site occurrence was 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.

For listed threatened and migratory species under the EPBC Act, the impact assessment involved application of the Australian Governments Significant Impact Guidelines 1.1 – Matters of National Environmental Significance (DoE 2013). The results of this assessment are presented below in Section 2 of this referral.

Table 2.4.1 of this referral lists 40 listed threatened species that were returned from the search of the Commonwealth EPBC Protected Matters Search Tool, and explains why there is unlikely to be a significant impact on any listed threatened species as a result of the proposed action.

Table 2.5.1 of this referral lists 51 migratory species that were returned from the search of the Commonwealth EPBC Protected Matters Search Tool, and explains why there is unlikely to be a significant impact on any migratory species as a result of the proposed action.

The results of the impact assessment for threatened fauna listed under the Northern Territory, TPWC Act are presented in Section 13 of the Notice of Intent, which is Attachment 1 of this referral.

Significant Sites or Features

A desktop assessment was undertaken to identify significant sites or features within, or in close proximity to the Project area, and to evaluate the likely environmental impacts on these values. The results of this assessment are presented below.

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. Therefore, National Parks will not be directly or indirectly impacted by the Project.

There are no Commonwealth marine areas 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. Therefore, Commonwealth marine areas or reserves will not be directly or indirectly impacted by the Project.

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. Therefore, World Heritage Properties or National Heritage Places will not be directly or indirectly impacted by the Project.

There are no Ramsar Wetlands within the proposed Project area or surrounds. The nearest Ramsar Wetland is located over 100 km away in Kakadu National Park. Therefore, Ramsar Wetlands will not be directly or indirectly impacted by the Project.

There are no public or private reserves in the vicinity of the Project area. Therefore, public or private reserves will not be directly or indirectly impacted by the Project.

Areas to the immediate north and south of the Project site are zoned for conservation under the Northern Territory Planning Scheme, and a very small area located in the south-west corner of the Project site is also zoned for conservation. However, 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 that identifies areas intended for future rezoning and development. Areas zoned as conservation will not be directly or indirectly impacted by the Project. Additionally, the Project will be assessed against relevant provisions of the Northern Territory Planning Scheme as part of the development consent and subdivision process.

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 area is not within any area mapped as a Priority Environmental Management Area. Therefore, Priority Environmental Management Areas will not be directly or indirectly impacted by the Project.

The Tree Point Conservation Area is located immediately to the south of the Project area. It 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. 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.



The Tree Point Conservation Area 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 Conservation Area will be demarcated as a no go area. In addition, appropriate buffers between the Project and the Conservation Area have been maintained in accordance with Northern Territory Planning Scheme Land Clearing Guidelines (DNREAS 2010) and the NT EPA Guideline for Disposal of Waste by Incineration (NT EPA 2013). Any potential indirect impacts to the Tree Point Conservation Area from stormwater runoff from the Project, or uncontrolled discharges (e.g. overtopping of ponds), have been mitigated through Project design and there is not expected to be any significant impact to the Conservation Area.

The Shoal Bay Coastal Reserve is located adjacent to the Tree Point Conservation Area, approximately 1.5 km to the south-east of the Project area. 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. Given the distance between the Reserve and the Project, the Project will not result in any direct or indirect impacts to the Shoal Bay Conservation Reserve.

The Project is located within the Shoal Bay Site of Conservation Significance which is noted for its extensive tidal flats that provide important feeding and roosting area for migratory shorebirds in their non-breeding season. It is also noted for its areas of rainforest or monsoon vine thicket as well as its high number of threatened species. 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 a small degraded area of monsoon vine thicket on the Project site and measures will be taken to avoid and minimise impacts to any threatened flora and fauna which may occur on site.

The Project will not result in an increase in any of the risks to Shoal Bay Site of Conservation Significance identified by the Northern Territory Government (urbanisation and drainage of wetlands, uncontrolled recreational use, weed incursion, presence of feral animals and increased fire regime and intensity). Conversely, 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 on the condition of the Project site and the values of the Shoal Bay Site of Conservation Significance. Consequently, the Project will not have a significant impact on the identified values of the Shoal Bay Site of Conservation Significance.



Cultural heritage

An archaeological assessment, including a desktop assessment and field survey, was undertaken by Ellengowan Enterprises for the Project. 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. 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.

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.

Taking into account previous studies, the Northern Territory Heritage database and field assessments, there are no recorded Indigenous or non-Indigenous sites in the Project footprint (Jung 2017). Therefore, no impacts are anticipated to sacred sites or archaeological sites or places.

Socio-economic environment

As described in Section 1.13 above the proponent has undertaken a targeted consultation process for the Project. It is clear from these meetings and interviews that the general Gunn Point area is considered important to people from Darwin and Howard Springs because of its opportunity for recreations and camping in particular. Discussions also revealed mixed views in relation to the current management and behaviours of users.

The Stage 1 Hatchery has been designed to maintain beach access and the prevailing uses of the land in the vicinity of the site. Access to the beach will not be impeded by the proposal and the final engineering design will take into account the use of the beach and will ensure 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.

'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.

When operational the Stage 1 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 consequential impact on the area immediately surrounding the site from the workforce.

The visual impact of the intake and discharge pipelines will be minimised by extending the buried section of pipeline as far offshore as possible. The proponent is seeking approval from the Director of the Marine Department, Department of Infrastructure, Planning and Logistics to construct the seawater intake and discharge pipelines for the Project. The proponent has also requested advice regarding the marking requirements for the intake and discharge pipelines and the need for any navigational aids.

Climate Change

The potential climate change effects that could impact the coastal environment of the Project area are sea level rise and tropical cyclone intensity and frequency.



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, land based facilities and water quality and circulation.

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, at this location, the pipe will be secured to the bed. Changes to the shoreline at the discharge point could result in more significant, but still relatively minor, 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.

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.

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.

1.15 Is this action part of a staged development (or a component of a larger project)?

Yes

1.15.1 Provide information about the larger action and details of any interdependency between the stages/components and the larger action.

The Stage 1 Hatchery is a component of a larger project, Project Sea Dragon, which also comprises: the Stage 1 Legume Grow-out Facility, and associated onsite and offsite infrastructure, located on Legume Station in the north-west Northern Territory; the Core Breeding Centre and Broodstock Maturation Centre, to be located at Bynoe Harbour to the west of Darwin; a processing plant to be located near Kununurra WA; export facilities proposed to be located at either Wyndham in WA or Darwin in the Northern Territory; a quarantine, founder stock facility and back-up breeding centre located at Exmouth in WA. Each of these components is critical for the successful delivery of Project Sea Dragon.

The Hatchery has the sole purpose of providing post-larval prawns for the proposed grow-out



centre at Legune Station, located over 800 km away by road. Whilst at full-scale the Legune Grow-out Facility will require four Hatchery modules to support operations, this EPBC Act referral is for the first Hatchery module (Stage 1), which is required to support Stage 1 of the Legune Grow-out Facility. The locations of, and timing for, future Hatchery modules (expansions) has not been determined and will be dependent upon future approvals for future stages of the Legune Grow-out Facility. Optimising biosecurity means that geographical separation of Hatchery modules is desirable, and as such, the location of the future modules will also be determined with biosecurity as a key consideration.

1.16 Is the proposed action related to other actions or proposals in the region?

Yes

1.16.1 Identify the nature/scope and location of the related action (Including under the relevant legislation).

Approvals for the related actions outlined in Section 1.15 above have been sought separate to approval for the Stage 1 Hatchery. This is due to: differing land tenures; the different geographic location of infrastructure required for each facility, and their distance from each other; the different environmental impacts associated with each of the facilities and infrastructure, the need for tailored assessment and the fact that some facilities are in place; the required timing for commissioning of some of the facilities is very different - assuming the Legune Grow-out Facility is ready to receive post-larvae prawns by December 2018, the facilities at Bynoe Harbour need to be commissioned by September 2017, whereas the Hatchery does not need to be commissioned until September 2018; and the different governmental jurisdictions for each of the project elements.

The relevant regulatory approvals for each component of Project Sea Dragon are described below.

Quarantine, Founder Stock Facility and Back-up Breeding Centre – Exmouth Western Australia

The Quarantine, Founder Stock Facility and Back-up Breeding Centre already exists and was commissioned with first wild stock intake on 23 September 2016. It is located at Exmouth W.A. and was previously a barramundi farm for Marine Farms Ltd.

Core Breeding Centre and Broodstock Maturation Centre – Point Ceylon Northern Territory



A Notice of Intent for the Core Breeding Centre and Broodstock Maturation Centre was submitted to the NT EPA on 19 February 2016 for consideration under the Northern Territory EA Act. On 19 August 2016, following a number of further information requests, the NT EPA decided that the Project required assessment under the *EA Act* at the level of an EIS. An EIS for the Core Breeding Centre and Broodstock Maturation Centre was completed, with the Northern Territory Government producing Assessment Report 81 on 27 March 2017. The Assessment Report stated that 'the NT EPA considers that the Project can be managed in a manner that is highly likely to meet the NT EPA's objectives and avoids significant or unacceptable environmental impacts. The NT EPA makes 6 recommendations as an outcome of the EIA of the Project'.

The Core Breeding Centre and Broodstock Maturation Centre was also referred to the Australian Government under the EPBC Act on 27 May 2016 (ref EPBC 2016/7713). The Commonwealth Minister for the Environment and Energy determined that the proposed action was not a controlled action on 13 September 2016. No further assessment or approval under the EPBC Act was required.

The proponent is currently in the process of applying for secondary approvals for the Core Breeding Centre and Broodstock Maturation Centre.

Stage 1 Legune Grow-out Facility – Legune Station Northern Territory

A Notice of Intent for the Stage 1 Legune Grow-out Facility was submitted to the NT EPA on 15 July 2015 for consideration under the Northern Territory EA Act. On 14 September 2015, the NT EPA decided that the Project required assessment under the EA Act at the level of an EIS.

The Stage 1 Legune Grow-out Facility was also referred to the Australian Government under the EPBC Act on 20 July 2015 (ref EPBC 2015/7527). On 31 August 2015, a delegate of the Commonwealth Minister for the Environment decided that the proposed action was a controlled action and, as such, required assessment and approval under the EPBC Act. The controlling provisions included the likely significant impact on listed threatened species and communities (sections 18 & 18A) and listed migratory species (sections 20 & 20A).

The Stage 1 Legune Grow-out Facility was assessed under the Northern Territory *EA Act* and the Commonwealth EPBC Act under the bilateral agreement between the Northern Territory and Commonwealth Governments.



In March 2017 the NT EPA released Assessment Report 80 stating that 'the NT EPA considers that the Project can be managed in a manner that is highly likely to meet the NT EPA's objectives and avoids significant or unacceptable environmental impacts. The NT EPA makes 13 recommendations as an outcome of the EIA of the Project'. On 10 May 2017, approval was granted by the Commonwealth Government for the Stage 1 Legume Grow-out Facility subject to 16 conditions.

The proponent is currently in the process of applying for secondary approvals for the Stage 1 Legume Grow-out Facility.

Processing Plant – Kununurra, Western Australia

The processing plant, proposed to be located at Kununurra, is currently vacant land that was previously cleared for agricultural purposes. Development approval is currently being sought for the facility in accordance with the requirements of the local government planning scheme.

Export Facilities – location to be determined

Export facilities to be utilised will comprise existing facilities. Therefore, no approvals will be required to be sought for the use of the existing facilities.



Section 2 - Matters of National Environmental Significance

Describe the affected area and the likely impacts of the proposal, emphasising the relevant matters protected by the EPBC Act. Refer to relevant maps as appropriate. The [interactive map tool](#) can help determine whether matters of national environmental significance or other matters protected by the EPBC Act are likely to occur in your area of interest. Consideration of likely impacts should include both direct and indirect impacts.

Your assessment of likely impacts should consider whether a bioregional plan is relevant to your proposal. The following resources can assist you in your assessment of likely impacts:

- [Profiles of relevant species/communities](#) (where available), that will assist in the identification of whether there is likely to be a significant impact on them if the proposal proceeds;
- [Significant Impact Guidelines 1.1 – Matters of National Environmental Significance](#);
- [Significant Impact Guideline 1.2 – Actions on, or impacting upon, Commonwealth land and Actions by Commonwealth Agencies](#).

2.1 Is the proposed action likely to have ANY direct or indirect impact on the values of any World Heritage properties?

No

2.2 Is the proposed action likely to have ANY direct or indirect impact on the values of any National Heritage places?

No

2.3 Is the proposed action likely to have ANY direct or indirect impact on the ecological character of a Ramsar wetland?

No

2.4 Is the proposed action likely to have ANY direct or indirect impact on the members of any listed species or any threatened ecological community, or their habitat?

Yes

2.4.1 Impact table

Species	Impact
Summary	The assessment of significance presented



Species	Impact
	below reveals that there will not be any significant impact to any species. This table lists 40 listed threatened species that were returned from the search of the Commonwealth EPBC Protected Matters Search Tool, and explains why there is unlikely to be a significant impact on any listed threatened species as a result of the proposed action.
Flora <i>Stylidium ensatum</i> - endangered	<i>Stylidium ensatum</i> preferred habitat is poorly drained grassy flats with damp peaty or heavy clay soils, which stay damp well into the dry season (TSSC 2016). Poorly drained sandy soils have also been associated with this species (Green & Cuff 2016). No peaty/clay soils that stay damp well into the dry season are present on site (although there may be suitable habitat in areas of wetland along but outside of the southern boundary of the site). It was not observed during the field survey and a 2016 survey by the Northern Territory Herbarium of the Litchfield local government area, including numerous sites in suitable habitat in Tree Point Conservation Area and vicinity, did not find this species (Green & Cuff 2016). Therefore there is unlikely to be a significant impact to this species as it is unlikely to occur in the Project area.
Marine Mammals Blue Whale (<i>Balaenoptera musculus</i>) – endangered, migratory	There are no records of this species within 20 km of the Project area. This species is ocean-going and spends most of its time far from land. In the Northern Territory, it is known from two beach-washed specimens, at Cape Hotham in 1980 (Chatto and Warnecke, 2000), and at Port Essington in August 2003 (R. Chatto pers. comm. for PSD CBC/BMC EIS). The Project area is not mapped as a biologically important area for this species (DoEE 2017b). As no suitable habitat exists in the Project area and this species has no records that overlap with the Project area, this species is unlikely to occur in the Project area and as such, would not be significantly affected by the proposed action.
Humpback Whale (<i>Megaptera novaeangliae</i>) – vulnerable, migratory	There are no records of this species within 20 km of the Project area. This species is ocean-going and spends most of its time far from land.



Species	Impact
	<p>In the Northern Territory, it is known from one beach-washed specimen on the Napier Peninsula, north-eastern Arnhem Land, in 1981 (Chatto and Warnecke, 2000). Recent records suggest a more regular southward migration each year around October along the western NT coast (R. Chatto pers.comm.): this has included two individuals (mother and calf) seen off Casuarina and the Peron Islands, September- October 2002 (R. Chatto pers. comm. for PSD CBC/BMC EIS). The Project area is not mapped as a biologically important area for this species (DoEE 2017b). As no suitable habitat exists in the Project area and this species has no records that overlap with the Project area, this species is unlikely to occur in the Project area and as such, would not be significantly affected by the proposed action.</p>
Sharks and Sawfish Great White Shark (<i>Carcharodon carcharias</i>) – vulnerable	<p>There are no records within 15 km of the Project area. This species has been sighted in all coastal areas except for the Northern Territory, and is not likely to occur within the Project area. The Project area is not mapped as a biologically important area for this species (DoEE 2017a). Therefore there is unlikely to be a significant impact to this species as it is unlikely to occur in the Project area.</p>
Whale Shark (<i>Rhincodon typus</i>) – vulnerable	<p>This species may occasionally be present near Shoal Bay but is highly unlikely to occur in the vicinity of the intake or outfall pipelines, preferring deeper oceanic waters. The Project area is not mapped as a biologically important area for this species (DoEE 2017b). Therefore there is unlikely to be a significant impact to this species as it is unlikely to occur in the Project area.</p>
Northern River Shark (<i>Glyphis garricki</i>) – endangered Spear-tooth Shark (<i>Glyphis glyphis</i>) – critically endangered	<p>Northern River Shark and Spear-tooth Shark The modelled distributions for these species indicate that they may occur in the vicinity of the Project and there is potentially suitable habitat, but no records of this species were returned from the searches of databases of species previously recorded in a 5 km radius of the Project area (see methods in Section 13 of the attached Notice of Intent – Attachment 1). As</p>



Species	Impact
	<p>such, they were ranked as possibly occurring in the vicinity of the Project. The area to be affected by the Project would not represent critical habitat for either of these species. Key threatening processes to these species include commercial and recreational fishing activities. The proposed action will not increase these activities. No significant impacts to either of these species as a result of the proposed action are anticipated. See the assessment of the potential for significant impacts as a result of the proposed action in relation to sawfish, which is also relevant for the northern river shark and the speartooth shark.</p>
Dwarf Sawfish (<i>Pristis clavata</i>) – vulnerable Freshwater Sawfish (<i>Pristis pristis</i>) – vulnerable Green Sawfish (<i>Pristis zijsron</i>) - vulnerable	<p>Dwarf Sawfish, Freshwater Sawfish and Green Sawfish Both the dwarf sawfish and green sawfish have been previously recorded in Buffalo Creek, which drains into the western side of Shoal Bay. The dwarf sawfish was ranked as likely to occur in the vicinity of the Project, although the area to be affected by the proposed action would not constitute critical habitat for this species. The green sawfish was ranked as possible to occur, as it has a preference for habitats with muddy substrate and is thought to be largely restricted to the inshore coastal fringe, with a strong association with mangroves and adjacent mudflats – these habitats are not present in the vicinity of the area to be affected by the proposed action. The freshwater sawfish has similar habitat requirements to the dwarf sawfish species so it was also assessed as likely to occur, although it has not been recorded from the surrounding area. The main threatening processes for sawfish in Australia are fishing (targeted and incidental capture) and habitat degradation (Cavanagh et al. 2003). The proposed action will not increase these activities. It should be noted that the records from Buffalo Creek were from an area where the existing water quality is known to be poor due to discharge into Buffalo Creek from the Leanyer Sanderson Wastewater Treatment Plant. The MNES significant impact guidelines (DoE 2013) state that an action is likely to have a significant impact on a critically</p>



Species	Impact
	<p>endangered, endangered or vulnerable species if there is a real chance or possibility that it will:</p> <ul style="list-style-type: none">-Lead to a long-term decrease in the size of a population (Critically Endangered and Endangered species)/lead to a long-term decrease in the size of an important population (Vulnerable species) -Reduce the area of occupancy of the species (Critically Endangered and Endangered species)/ reduce the area of occupancy of an important population (Vulnerable species) -Fragment an existing population into two or more populations (Critically Endangered and Endangered)/ fragment an existing important population into two or more populations (Vulnerable)-Adversely affect habitat critical to the survival of a species -Disrupt the breeding cycle of a population (Critically Endangered and Endangered)/ disrupt the breeding cycle of an important population (Vulnerable) -Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline -Result in invasive species that are harmful to a species becoming established in the threatened species' habitat -Introduce disease that may cause the species to decline, or -Interfere with the recovery of the species. An explanation of the potential impacts to the marine environment is given in Section 2.6, below. In summary however, there are not expected to be any significant impacts to any threatened marine species, or their habitat, as a result of the proposed action. The species of shark and sawfish that may occur in the vicinity of the proposed action are wide ranging, transient or migratory animals that would not be confined to one area. The marine habitat to be directly affected by the Project is restricted to a small (relative to the range of these species) footprint of seabed over which the intake or outlet pipelines will be placed. There is no unique, or critical habitat for these species within the footprint of the pipelines or surrounds. Construction impacts will be relatively minor and short-lived. During operations, changes to



Species	Impact
	water quality as a result of the Project would not exceed the trigger levels for aquatic ecosystem health within the Darwin Harbour Water Quality Objectives (see Attachment 4 - Stage 1 Hatchery Coastal Environment and Impact Assessment report prepared by Water Technology), hence will not affect ecosystem health. Mitigation measures including a screen on the intake pipe, and a low velocity of intake, have been put in place to ensure that entrainment or impingement of sawfish and sharks does not occur. As such, the potential impacts of the proposed action will not lead to a long term decrease in the size of any population or a reduction in the area of occupancy of any species of sawfish or shark that may occur in the area. Nor will there be any fragmentation of any sawfish or shark populations. The area to be affected by the proposed action does not constitute critical habitat for any shark or sawfish species and there will not be modification, destruction, removal, isolation or a decrease in habitat such that any sawfish or shark species would decline. The proposed action will not result in the introduction of a disease or an introduced species that could affect any threatened marine species or its habitat. The proposed action will not affect the recovery of any threatened marine species.
Terrestrial Reptiles Plains Death Adder (<i>Acanthophis hawkei</i>) - vulnerable	Suitable habitat for this species consists of flat, treeless, cracking-soil riverine floodplains. This habitat is not present on site. No records of this species were returned from the searches of the information sources (which covered areas up to 15 km from the site). As such the species is unlikely to occur on site and there will not be significant impacts to this species as a result of the proposed action.
Marine Reptiles Leatherback Turtle (<i>Dermochelys coriacea</i>) – endangered Loggerhead Turtle (<i>Caretta caretta</i>) – endangered Green Turtle (<i>Chelonia mydas</i>) – vulnerable Hawksbill Turtle (<i>Eretmochelys imbricata</i>) – vulnerable Olive Ridley Turtle (<i>Lepidochelys olivacea</i>) – endangered Flatback Turtle (<i>Natator depressus</i>) – vulnerable	Leatherback turtle The leatherback turtle spends much of its time in the open ocean, mainly venturing close to shore during the nesting season. There are very few nesting records for the leatherback turtle in the Northern Territory, and none from near the Project area (the closest being Point Danger on the Coberg Peninsula, more than 200 km



Species	Impact
	<p>away). As such this species would be unlikely to occur near the intake and outfall pipelines and so there will be no potential for significant impacts to this species as a result of the proposed action. Loggerhead, green, hawksbill, olive ridley and flatback turtles The loggerhead, green, hawksbill, olive ridley and flatback turtles have all been previously recorded as part of surveys within the local surrounding area, and potentially suitable habitat is present for these species in the vicinity of the footprint for the intake and discharge pipelines. None of these species are known to nest in Shoal Bay, and Shoal Bay is not mapped as a Biologically Important Area for any of these species except for flatback turtles, for which Shoal Bay is mapped as Inter-nesting Habitat. The nearest known nesting beach for this species is Casuarina Beach which is located around 18 km from the Project footprint. Potential threats to marine turtles are: effects of climate change on habitat, resources, and biology/life history; ingestion of, and entanglement in, marine debris; biological effects of anthropogenic sources of chemicals and sediment; hunting and fishing bycatch; terrestrial predation upon eggs and hatchlings; light pollution; habitat modification due to coastal development, dredging and trawling; boat strike; marine noise; recreational activities; diseases and pathogens. The proposed action will not result in a contribution to any of these threats to a magnitude that would constitute a significant impact to any marine turtle species. There will be some localised disturbances during construction of the pipelines in the form of increased sediment, noise and boat traffic. These potential impacts are assessed below in Section 2.6, but in summary, these impacts will be localised and short-lived and are not expected to cause any significant impacts to any turtle species. During operations, there is potential for light spill to the marine environment, but as is explained in Section 2.6, with the implementation of the proposed mitigation measures it is considered unlikely</p>



Species	Impact
	<p>that effects from light spill into the marine environment would cause any significant impact to any marine turtle species. During operations, there is also the potential to impinge or entrain marine species, however, mitigation measures including a screen on the intake pipe, and a low velocity of intake, have been put in place to ensure that this does not occur (see Section 2.6). Changes to water quality in the receiving environment as a result of the Project will not exceed the trigger levels for aquatic ecosystem health within the Darwin Harbour Water Quality Objectives (see Section 2.6), hence would not cause a risk to marine turtles. Given the above, with reference to the MNES significant impact guidelines (DoE 2013), there is not considered to be a real chance or possibility that the proposed action will:</p> <ul style="list-style-type: none">-Lead to a long-term decrease in the size of a population of marine turtles (Critically Endangered and Endangered species)/lead to a long-term decrease in the size of an important population of marine turtles (Vulnerable species)-Reduce the area of occupancy of a population of marine turtles (Critically Endangered and Endangered species)/ reduce the area of occupancy of an important population of marine turtles (Vulnerable species)-Fragment an existing population of marine turtles into two or more populations (Critically Endangered and Endangered)/ fragment an existing important population of marine turtles into two or more populations (Vulnerable)-Adversely affect habitat critical to the survival of a species of marine turtles-Disrupt the breeding cycle of a population of marine turtles (Critically Endangered and Endangered)/ disrupt the breeding cycle of an important population of marine turtles (Vulnerable)-Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that a Critically Endangered, Endangered or Vulnerable species of marine turtle is likely to decline-Result in invasive species that are harmful to a Critically Endangered, Endangered or Vulnerable species of marine turtle becoming



Species	Impact
	established in the threatened species' habitat -Introduce disease that may cause a Critically Endangered, Endangered or Vulnerable species of marine turtle to decline, or -Interfere with the recovery of a species of a Critically Endangered, Endangered or Vulnerable species of marine turtle.
Shorebirds and waterbirds Australian Painted Snipe (<i>Rostratula australis</i>) - vulnerable Red Knot (<i>Calidris canutus</i>) – endangered, migratory Curlew Sandpiper (<i>Calidris ferruginea</i>) – critically endangered, migratory Great Knot (<i>Calidris tenuirostris</i>) – critically endangered, migratory Greater Sand Plover (<i>Charadrius leschenaultii</i>) – vulnerable, migratory Lesser Sand Plover (<i>Charadrius mongolus</i>) – endangered, migratory Bar-tailed Godwit (<i>baueri</i>) (<i>Limosa lapponica baueri</i>) – vulnerable, migratory Northern Siberian Bar-tailed Godwit (<i>Limosa lapponica menzbieri</i>) – critically endangered, migratory Eastern Curlew (<i>Numenius madagascariensis</i>) - critically endangered, migratory	There is no suitable habitat on the site or surrounds for the waterbird, the Australian Painted Snipe, hence there is not possibility of a significant impact to this species. However all of the other species (all shorebirds) listed here are either considered likely or possible to occur. Observations during the field investigations indicated that there was a paucity of shorebirds using the intertidal flats along the beach, thought possibly due to a lower bio-productivity of the intertidal flats (that is, a low abundance of invertebrates associated with coarser sandy substrates), and/or the manifest effects of regular human disturbance (people, dogs, and of-road vehicles). Searches of beach and claypan habitats did not reveal evidence of any high-tide roosts. Regardless, 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 within levels considered acceptable under the Darwin Harbour Water Quality Objectives (see Section 2.6). As such there will not be any significant impact to feeding resources or habitat for migratory shorebirds in Shoal Bay. As such, with reference to the MNES significant impact guidelines (DoE 2013), there is not considered to be a real chance or possibility that the proposed action will: -Lead to a long-term decrease in the size of a population of a shorebird species (Critically Endangered and Endangered species)/lead to a long-term decrease in the size of an important population of a shorebird species (Vulnerable species) -Reduce the area of occupancy of a population of a shorebird species (Critically Endangered



Species	Impact
	and Endangered species)/ reduce the area of occupancy of an important population of a shorebird species (Vulnerable species) -Fragment an existing population of a shorebird species into two or more populations (Critically Endangered and Endangered)/ fragment an existing important population of a shorebird species into two or more populations (Vulnerable) -Adversely affect habitat critical to the survival of a Critically Endangered, Endangered or Vulnerable shorebird species -Disrupt the breeding cycle of a population of a shorebird species (Critically Endangered and Endangered)/ disrupt the breeding cycle of an important population of a shorebird species (Vulnerable) -Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that a Critically Endangered, Endangered or Vulnerable shorebird species is likely to decline -Result in invasive species that are harmful to a Critically Endangered, Endangered or Vulnerable species of shorebird becoming established in the threatened species' habitat -Introduce disease that may cause a Critically Endangered, Endangered or Vulnerable species of shorebird to decline, or -Interfere with the recovery of a species of Critically Endangered, Endangered or Vulnerable species of shorebird.
Other Birds Alligator Rivers Yellow Chat (<i>Epthianura crocea tunneyi</i>) - Endangered Gouldian Finch (<i>Erythrura gouldiae</i>) – Endangered Red Goshawk (<i>Erythrotriorchis radiatus</i>) - Vulnerable Partridge Pigeon (<i>Geophaps smithii smithii</i>) - Vulnerable Masked Owl (<i>Tyto novaehollandiae kimberli</i>) - Vulnerable	Alligator Rivers Yellow Chat This subspecies is restricted to a small geographic area which comprises floodplains between the Adelaide River and the East Alligator River. Within this area it is known from only a small number of sites. The Project footprint is not situated between the Adelaide and East Alligator River. Most records of the subspecies derive from tall grasslands and samphire shrublands (on coastal saltpans) associated with floodplain depressions and channels, and concentrating around wetter areas at the end of the dry season. This type of habitat does not occur on the Project site. No records of this species were returned from the searches of the information sources (which covered areas up to 15 km from the site). The species would not occur on the



Species	Impact
	<p>Project site hence there is no potential for the proposed action to significantly impact upon it.</p> <p>Gouldian Finch This species undergoes regular seasonal shifts in habitat, from breeding areas in hill woodland in the dry season to adjacent lowlands throughout much of the wet season - in response to seasonal changes in food availability. Known breeding habitat in the Northern Territory and WA is characterised by rocky hills with hollow-bearing <i>Eucalyptus brevifolia</i>, <i>E. tintinnans</i> or <i>Corymbia dichromophloia</i>, and within two to four kilometres of small waterholes or springs that persist throughout the dry season. These habitat features are not present on the Project site. No records of this species were returned from the searches of the information sources (which covered areas up to 15 km from the site). This species would not occur on the Project site hence there is no potential for the proposed action to create a significant impact to it.</p> <p>Red Goshawk, Partridge Pigeon and Masked Owl The site contains remnant habitat conditions for these species and resources for these species are available. All three species have been previously recorded within 15 km of the Project site.</p> <p>Red goshawk: The red goshawk maintains a very large home range (e.g. >120km²) across open forest and woodland, and favouring such habitats associated with river systems. There are no river systems on or in close proximity to the Project site.</p> <p>Very tall Eucalyptus tetradonta trees are a favoured nest site, and nesting typically occurs within 1 km of a watercourse or wetland (Garnett & Crowley 2000). Very tall trees are not present within the majority of the area to be cleared to facilitate the Project footprint, which was preferentially situated, wherever possible, in the more degraded areas of the overall Project site. Therefore whilst <i>Eucalyptus tetradonta</i> is a dominant element of the tree canopy throughout the eastern two-thirds of the site, generally, a higher abundance of taller and older trees were noted from the eastern third of the site, with woodland</p>



Species	Impact
	<p>throughout other parts of the site characterised by a more open tree canopy and generally a lower height class (see Section 3.1). The majority of the footprint is situated in the western third of the site, and so largely avoids these areas with a comparatively higher habitat value. As such the area to be cleared is unlikely to represent favoured habitat (being removed from proximity to river systems) or important breeding habitat for this species. The red goshawk may forage over the Project site, but the removal of 29 ha of habitat that would largely be considered marginal for this species would not result in a decrease in the size of an important population, reduce the area of occupancy of an important population, fragment an important population into two or more populations, or disrupt the breeding cycle of an important population. It will not affect any critical habitat, nor will it affect any habitat such that the species is likely to decline, or interfere with the recovery of this species in any way. Furthermore, there is no mechanism by which the proposed action would introduce invasive species that are harmful to red goshawk or disease that may cause red goshawk to decline. As such, the proposed action would not have a significant impact upon red goshawk.</p> <p>Partridge pigeon: As a ground-nesting species (nesting during the dry season and preferentially selecting sites within relatively dense grass), it is vulnerable to a variety of threats, including invasive animal and fire. As is detailed in Section 3.7, there are a number of threatening processes currently operating on site, particularly in the western third of the site where the majority of the Project footprint will be situated. The uncontrolled recreational use, increased frequency of fire, and presence of weeds and invasive animals, particularly evident in the western third of the site, will have reduced the habitat value of the site for this species. The majority of the Project infrastructure was preferentially sited in areas of degraded habitat in the western third of the site (see Figure 1) to minimise impacts to flora and</p>



Species	Impact
	<p>fauna values of the site. Furthermore, 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). Operation of the facility is unlikely to pose any threat to this 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 partridge pigeon, when compared with the current situation. The removal of 29 ha of habitat that would largely be considered marginal for this species would not result in a decrease in the size of an important population, reduce the area of occupancy of an important population, fragment an important population into two or more populations, or disrupt the breeding cycle of an important population. It will not affect any critical habitat, nor will it affect any habitat such that the species is likely to decline, or interfere with the recovery of this species in any way. Furthermore, there is no mechanism by which the proposed action would introduce invasive species that are harmful to partridge pigeon or disease that may cause partridge pigeon to decline. As such, the proposed action would not have a significant impact upon partridge pigeon.</p> <p>Masked Owl: This species typically roosts (and nests) in tree hollows. The reasons for its decline are not known, though probable causes include fire regimes which reduce the availability of large trees and hollows, and declines in small and medium-sized mammals. A higher abundance of taller and older trees, with tree hollows, were noted from the eastern third of the site, with woodland throughout other parts of the site characterised by a more open tree canopy and generally a lower height class (see Section 3.1). <i>Eucalyptus tetradonta</i> is a dominant element of the tree canopy throughout the eastern two-thirds of the site and this community was found to support a comparatively higher density of hollow-bearing trees (live trees and stags) than</p>



Species	Impact
	<p>other vegetation communities present on and around the site. Within this <i>E. tetradonta</i> woodland and open forest, a higher density of hollow-bearing trees were observed within the eastern part of the site. The majority of the footprint is situated in the western third of the site, and so largely avoids these areas with a comparatively higher habitat value for masked owl. As such the area to be cleared to be cleared is unlikely to represent favoured habitat or important breeding habitat for this species. As is detailed in Section 3.7, there are a number of threatening processes currently operating on site, particularly in the western third of the site where the majority of the Project footprint will be situated. The uncontrolled recreational use, increased frequency of fire, and presence of weeds and invasive animals, particularly evident in the western third of the site, will have reduced the habitat value of the site for this species. The majority of the Project infrastructure was preferentially sited in areas of degraded habitat in the western third of the site (see Figure 1) to minimise impacts to flora and fauna values of the site. Furthermore, 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). Operation of the facility is unlikely to pose any threat to this 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 masked owl, when compared with the current situation. The removal of 29 ha of habitat that would largely be considered marginal for the northern quoll would not result in a decrease in the size of an important population, reduce the area of occupancy of an important population, fragment an important population into two or more populations, or disrupt the breeding cycle of an important population. It will not affect any critical habitat, nor will it affect any habitat such that the species is likely to decline, or interfere with</p>



Species	Impact
	the recovery of this species in any way. Furthermore, there is no mechanism by which the proposed action would introduce invasive species that are harmful to masked owl or disease that may cause masked owl to decline. As such, the proposed action would not have a significant impact upon masked owl.
Terrestrial Mammals Fawn Antechinus (Antechinus bellus) - Vulnerable Brush-tailed Rabbit-rat (Conilurus penicillatus) – Vulnerable Water Mouse (Xeromys myoides) – Vulnerable Nabarlek (Petrogale concinna canescens) –Endangered Northern Quoll (Dasyurus hallucatus) - Endangered Black-footed Tree-rat (Kimberley and mainland Northern Territory) (Mesembriomys gouldii gouldii) –Endangered Northern Brush-tailed Phascogale (Phascogale pirata) –Vulnerable	Fawn antechinus Although suitable habitat is present on site, there is considered to be a negligible probability of occurrence by this species due to the highly degraded conditions and resources. The species is known from forests with a relatively dense shrubby understorey, which is absent from the Project site due to the frequent fires that have been occurring on site. Recognised threats (i.e. inappropriate fire regimes) and potential threats (exotic invasive grasses; cane toads (Rhinella marinus); and disease from introduced species such as black rats (Rattus rattus) and feral cats are present and on-going. No records of this species were returned from the searches of the information sources (which covered areas up to 15 km from the site). As such the species is unlikely to be present, and there is no potential to cause a significant impact to this species as a result of the proposed action. Brush-tailed Rabbit-rat Although suitable habitat is present on site, there is considered to be a negligible probability of occurrence by this species due to the highly degraded conditions and resources. The species is known from open forests and woodlands which have not been exposed to recent severe fires. Recognised threats (i.e. high frequency of extensive and intensive fires) and potential threats (exotic invasive weeds; competition with introduced rodents such as black rats (Rattus rattus) are present and on-going. No records of this species were returned from the searches of the information sources (which covered areas up to 15 km from the site). As such the species is unlikely to be present, and there is no potential to cause a significant impact to this species as a result of the proposed action. Water Mouse This species inhabits intertidal flats within mangrove



Species	Impact
	<p>wetlands and adjacent supralittoral habitats (e.g. sedge swamps and saline grasslands). Suitable habitat for this species is not present on the site or surrounds. No records of this species were returned from the searches of the information sources (which covered areas up to 15 km from the site). As such the species is unlikely to be present, and there is no potential to cause a significant impact to this species as a result of the proposed action. Nabarlek This species is restricted to the monsoonal tropics where it has been recorded from a series of isolated rocky sites from the Daly River in the west to the East Alligator River area. It inhabits rugged rocky areas, typically dominated by sandstones but occasionally by granites. Suitable habitat for this species is not present on the site or surrounds. No records of this species were returned from the searches of the information sources (which covered areas up to 15 km from the site). As such the species is unlikely to be present, and there is no potential to cause a significant impact to this species as a result of the proposed action. Northern Quoll, Black-footed Tree-rat, Northern Brush-tailed Phascogale The site contains remnant habitat conditions for these species and resources for these species are available. Both Northern Quoll and Black-footed Tree-rat have been previously recorded within 15 km of the Project site, but no records of Northern Brush-tailed Phascogale were returned from the searches of the information sources (which covered areas up to 15 km from the site). Habitat for the Northern Quoll is rocky areas with tall open coastal eucalypt forests. Prime habitat is associated with sandstone escarpments. Decline in the Northern Territory has been linked to several threatening processes, including impacts of feral cats and cane toads, disease, and/or changed fire regimes. There are no rocky outcrop areas on site, and the potential on site habitat is considered degraded by the ongoing threatening processes, particularly the exacerbated fire regimes and the likely presence of cane toads feral cats (see</p>



Species	Impact
	<p>Section 3.7). The ongoing threatening processes are particularly evident in the western third of the site, where the majority of the Project footprint will be situated. The majority of the Project infrastructure was preferentially sited in areas of degraded habitat in the western third of the site (see Figure 1) to minimise impacts to flora and fauna values of the site. Furthermore, 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). Operation of the facility is unlikely to pose any threat to this species. In fact, the weed, pest and fire management regimes that will be implemented as part of the Project will likely have a positive impact upon habitat for northern quoll, when compared with the current situation. The removal of 29 ha of habitat that would largely be considered marginal for this species would not result in a decrease in the size of a population, reduce the area of occupancy of a population, fragment a population into two or more populations, or disrupt the breeding cycle of an population. It will not affect any critical habitat, nor will it affect any habitat such that the species is likely to decline, or interfere with the recovery of this species in any way. Furthermore, there is no mechanism by which the proposed action would introduce invasive species that are harmful to northern quoll or disease that may cause northern quoll to decline. As such, the proposed action would not have a significant impact upon northern quoll. Both Black-footed Tree-rat and Northern Brush-tailed Phascogale occur mostly in open forests and woodlands dominated by <i>Eucalyptus miniata</i> and/or <i>E. tetrodonta</i>. Black-footed Tree-rat particularly are known from where these forests have a relatively dense shrubby understorey (as opposed to habitat subjected to frequent fires). The Black-footed Tree-rat shelters in tree hollows and fallen logs, and the Northern Brush-tailed Phascogale also shelters</p>



Species	Impact
	<p>in tree hollows. Threats to both of these species are inappropriate fire regimes; predation by feral cats or wild dogs; habitat loss and fragmentation; and habitat change due to exotic invasive grasses. Black-footed Tree-rat is also susceptible to poisoning by cane toads. As detailed in Section 3.7, there are a number of threatening processes currently operating on site, particularly in the western third of the site where the majority of the Project footprint will be situated. Uncontrolled recreational use, increased frequency of fire, and presence of weeds and invasive animals, particularly evident in the western third of the site, will have reduced the habitat value of the site for these species. The majority of the Project infrastructure was preferentially sited in areas of degraded habitat in the western third of the site (see Figure 1) to minimise impacts to flora and fauna values of the site. Furthermore, 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). Operation of the facility is unlikely to pose any threat to 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. The removal of 29 ha of habitat that would largely be considered marginal for these species would not result in a decrease in the size of a population of Black-footed Tree-rat, or an important population of Northern Brush-tailed Phascogale; reduce the area of occupancy of a population of Black-footed Tree-rat, or an important population of Northern Brush-tailed Phascogale; fragment a population of Black-footed Tree-rat, or an important population of Northern Brush-tailed Phascogale into two or more populations; or disrupt the breeding cycle of a population of Black-footed Tree-rat, or an important population of Northern Brush-tailed Phascogale. It will not affect any</p>



Species	Impact
Bats Ghost Bat (<i>Macroderma gigas</i>) - Vulnerable Bare-rumped Sheath-tailed Bat (<i>Saccolaimus saccolaimus nudicluniatus</i>) - Vulnerable	<p>critical habitat for either of these species, nor will it affect any habitat such that either species is likely to decline, or interfere with the recovery of these species in any way. Furthermore, there is no mechanism by which the proposed action would introduce invasive species that are harmful to either species or disease that may cause either species to decline. As such, the proposed action would not have a significant impact upon Black-footed Tree-rat, or Northern Brush-tailed Phascogale.</p> <p>Ghost Bat Distribution of this species is influenced by the availability of cavernous roosts, including caves, rock crevices and disused mines. Suitable habitat for this species is not present on the site or surrounds. No records of this species were returned from the searches of the information sources (which covered areas up to 15 km from the site). As such the species is unlikely to be present, and there is no potential to cause a significant impact to this species as a result of the proposed action. Bare-rumped Sheath-tailed Bat The site contains remnant habitat conditions and resources for this species are available. No records of this species were returned from the searches of the information sources (which covered areas up to 15 km from the site). Records derive from tall open eucalypt forest of <i>Eucalyptus tetrodonta</i> and <i>E. miniata</i>, <i>Pandanus</i> woodland fringing the South Alligator River, and in grassy beach dunes with <i>Melaleuca</i> and <i>Acacia</i> adjacent to open eucalypt forest. Roosting ecology is poorly known. All confirmed roosting records are from deep tree hollows in, mostly large trees, being <i>Eucalyptus platyphylla</i> (reported as <i>E. alba</i>), <i>E. miniata</i> and <i>E. tetrodonta</i>. Hollows in these tree species have also been used as maternity roosts. Such roosts are susceptible to damage by termites and by fire. A higher abundance of taller and older trees, with tree hollows, were noted from the eastern third of the site, with woodland throughout other parts of the site characterised by a more open tree canopy and generally a lower height class (see Section 3.1).</p>



Species	Impact
	<p>Eucalyptus tetradonta is a dominant element of the tree canopy throughout the eastern two-thirds of the site and this community was found to support a comparatively higher density of hollow-bearing trees (live trees and stags) than other vegetation communities present on and around the site. As mentioned earlier, within this E. tetradonta woodland and open forest, a higher density of hollow-bearing trees were observed within the eastern third of the site. The majority of the footprint is situated in the western third of the site, and so avoids these areas with a comparatively higher habitat value for bare-rumped sheath-tailed bat. As such, the area to be cleared largely avoids potential habitat for this species. As is detailed in Section 3.7, there are a number of threatening processes currently operating on site, particularly in the western third of the site where the majority of the Project footprint will be situated. The uncontrolled recreational use, increased frequency of fire, and presence of weeds and invasive animals, particularly evident in the western third of the site, will have reduced the habitat value of the site for this species. The majority of the Project infrastructure was preferentially sited in areas of degraded habitat in the western third of the site (see Figure 1) to minimise impacts to flora and fauna values of the site. Furthermore, 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). Operation of the facility is unlikely to pose any threat to this 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 bare-rumped sheath-tailed bat, when compared with the current situation. The removal of 29 ha of habitat that would largely be considered marginal for this species would not result in a decrease in the size of an important population, reduce the area of occupancy of an important</p>



Species	Impact
	population, fragment an important population into two or more populations, or disrupt the breeding cycle of an important population. It will not affect any critical habitat, nor will it affect any habitat such that the species is likely to decline, or interfere with the recovery of this species in any way. Furthermore, there is no mechanism by which the proposed action would introduce invasive species that are harmful to bare-rumped sheath-tailed bat, or disease that may cause bare-rumped sheath-tailed bat to decline. As such, the proposed action would not have a significant impact upon bare-rumped sheath-tailed bat.

2.4.2 Do you consider this impact to be significant?

No

2.5 Is the proposed action likely to have ANY direct or indirect impact on the members of any listed migratory species, or their habitat?

Yes

2.5.1 Impact table

Species	Impact
Summary	The assessment of significance reveals that there will not be any significant impact to any migratory species listed under the EPBC Act. This table lists 51 migratory species that were returned from the search of the Commonwealth EPBC Protected Matters Search Tool, and explains why there is unlikely to be a significant impact on any migratory species as a result of the proposed action. Note that an additional eight species are both threatened and migratory and these are addressed in Table 2.4.1, above.
Fish, Marine Mammals and Marine Reptiles Narrow Sawfish, Knifetooth Sawfish (Anoxypristis cuspidata) Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray (Manta	An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will: -substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological



Species	Impact
alfredi) (Manta alfredi) Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray (Manta birostris) Salt-water Crocodile, Estuarine Crocodile (Crocodylus porosus) Bryde's Whale (Balaenoptera edeni) Dugong (Dugong dugon) Irrawaddy Dolphin (Orcaella brevirostris) Killer Whale, Orca (Orcinus orca) Indo-Pacific Humpback Dolphin (Sousa chinensis) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) (Tursiops aduncus [Arafura/Timor Sea populations])	cycles), destroy or isolate an area of important habitat for a migratory species -result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or -seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species. The proposed action will not fragment, destroy or isolate any habitat for any of these species. There will be a very minor increase in nutrients at the discharge location (see Section 2.6), but the nutrient levels will not exceed the trigger values for aquatic ecosystem health outlined in the Darwin Harbour Water Quality Objectives, hence the water quality will be within levels considered acceptable for ecological health and would not constitute a significant impact to any of these species. As is detailed in Section 2.6, the proposed action will not result in invasive species harmful to any migratory fish, mammal or reptile species becoming established. The proposed action would not cause any serious disruption to the lifecycle of any of these species.
Terrestrial Birds Oriental Reed-Warbler (Acrocephalus orientalis) Fork-tailed Swift (Apus pacificus) Red-rumped Swallow (Cecropis daurica) Oriental Cuckoo, Horsfield's Cuckoo (Cuculus optatus) Barn Swallow (Hirundo rustica) Rainbow Bee-eater (Merops ornatus) Grey Wagtail (Motacilla cinerea) Yellow Wagtail (Motacilla flava) Rufous Fantail (Rhipidura rufifrons)	An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will: -substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species -result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or -seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species. The proposed action will not substantially modify, destroy or isolate an area of important habitat for any migratory bird species that might use the terrestrial habitat to be affected by the proposed action. The Project site does not contain any unique, or critical habitat for any of



Species	Impact
	<p>these species. The majority of the habitat to be cleared is considered degraded, relative to that which occurs in other parts of the Project site and in areas adjacent to the site. The proposed action will only remove 29 hectares of vegetated area, comprising three vegetation communities. For each of these communities, the removal equates to less than 0.7% of that within the Litchfield Shire area. All of the migratory species likely to occur on site are, by nature, wide-ranging and are likely to be able to move away from construction impacts and avail themselves of habitat in adjacent areas. There are no mechanisms by which operation of the facility could substantially modify, destroy or isolate an area of habitat important 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. There are no mechanisms by which an invasive species harmful to any of these terrestrial bird species would become established, and the Project site is not important habitat for any of the migratory species that could occur there. The proposed action would not cause any serious disruption to the lifecycle of any of these species.</p>
<p>Shorebirds and Waterbirds Common Sandpiper (<i>Actitis hypoleucos</i>) Common Noddy (<i>Anous stolidus</i>) Ruddy Turnstone (<i>Arenaria interpres</i>) Sharp-tailed Sandpiper (<i>Calidris acuminata</i>) Sanderling (<i>Calidris alba</i>) Pectoral Sandpiper (<i>Calidris melanotos</i>) Red-necked Stint (<i>Calidris ruficollis</i>) Long-toed Stint (<i>Calidris subminuta</i>) Little Ringed Plover (<i>Charadrius dubius</i>) Oriental Plover, Oriental Dotterel (<i>Charadrius veredus</i>) Lesser Frigatebird, Least Frigatebird (<i>Fregata ariel</i>) Great Frigatebird, Greater Frigatebird (<i>Fregata minor</i>) Swinhoe's Snipe (<i>Gallinago megala</i>) Pin-tailed Snipe (<i>Gallinago stenura</i>) Oriental Pratincole (<i>Glareola maldivarum</i>) Grey-tailed Tattler (<i>Tringa brevipes</i>) Wandering Tattler (<i>Tringa incana</i>) Broad-billed Sandpiper (<i>Limicola falcinellus</i>) Asian Dowitcher (<i>Limnodromus semipalmatus</i>)</p>	<p>An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will: -substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species -result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or -seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species. The proposed action will not substantially fragment, destroy or isolate any habitat for these species. The placing of the pipelines will result in a very minor reduction in the availability of feeding</p>



Species	Impact
Black-tailed Godwit (<i>Limosa limosa</i>) Little Curlew, Little Whimbrel (<i>Numenius minutus</i>) Whimbrel (<i>Numenius phaeopus</i>) Osprey (<i>Pandion haliaetus</i>) Pacific Golden Plover (<i>Pluvialis fulva</i>) Grey Plover (<i>Pluvialis squatarola</i>) Little Tern (<i>Sterna albifrons</i>) Roseate Tern (<i>Sterna dougalli</i>) Common Tern (<i>Sterna hirundo</i>) Wood Sandpiper (<i>Tringa glareola</i>) Common Greenshank, Greenshank (<i>Tringa nebularia</i>) Marsh Sandpiper, Little Greenshank (<i>Tringa stagnatilis</i>) Terek Sandpiper (<i>Xenus cinereus</i>)	habitat which is ubiquitous throughout Shoal Bay. There will also be a very minor increase in nutrients at the discharge location (see Section 2.6), but the nutrient levels will not exceed the trigger values for aquatic ecosystems health outlined in the Darwin Harbour Water Quality Objectives, hence the water quality will be within levels considered acceptable for ecological health and would not constitute a significant impact to the feeding resources for any of these species. The proposed action will not result in invasive species harmful to any migratory bird species becoming established. The proposed action would not cause any serious disruption to the lifecycle of any of these species.

2.5.2 Do you consider this impact to be significant?

No

2.6 Is the proposed action to be undertaken in a marine environment (outside Commonwealth marine areas)?

Yes

2.6.1 Is the proposed action likely to have ANY direct or indirect impact on the Commonwealth marine environment?

No

2.6.2 Describe the nature and extent of the likely impact on the whole of the environment.

The intake and outfall to the surrounding marine waters will be located so as to be viable during all tidal conditions. Both the seawater intake and discharge pipelines will be laid directly on the seabed. Imagery of the seabed in the vicinity of the seawater intake and discharge pipelines indicates that, like most of Shoal Bay, the substrate is sandy and no coral or seagrass beds are present.

During operation of the facilities, waste water will be discharged from the discharge pipeline in deep water at approximately 2 km offshore. Hydrodynamic modelling of the discharge waters



has shown that the proposed Water Quality Objectives are not predicted to be exceeded at any site assessed; therefore significant impacts on the marine environment as a result of the operation of the facility are not expected to occur.

With respect to the potential impacts of the aspects of the action that will occur in the marine environment, the potential impacts of construction and operation of the facility to conservation significant fish and marine turtle species are:

- changes in water quality during construction (elevated turbidity);
- entrainment or impingement in the intake pipe;
- changes in water quality as a result of the discharge of the aquaculture water;
- spills or leaks of hydrocarbons during construction;
- changes to the marine ecology as a result of escape of prawn stock;
- changes to the marine ecology through the spread of disease;
- Increased noise during construction and operation;
- light spill to the marine environment (marine turtles only).

These are addressed below.

Changes in water quality during construction

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.

The 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 to the area following cessation of disturbances; this is supported by evidence collected under the Ichthys nearshore environmental monitoring program (Cardno 2015) for a large scale dredging and pile driving program in the Darwin region - this project was of a much larger scale than that proposed for this Project. Monitoring results found no indication that dredging activities (which would elevate turbidity far more than the activities proposed for the construction of the marine infrastructure as part of this Project) affected turtle distribution or population sizes (Cardno 2015). Furthermore, the aquatic flora and fauna present in the environment surrounding the Project area would be habituated to periods of high turbidity that



occur naturally in Shoal Bay. As such it is considered highly unlikely that any of the conservation significant marine species that may possibly occur in Shoal Bay would be significantly impacted by any localised spikes in turbidity as a result of construction activities.

Entrainment or impingement in the intake pipe

The proposed seawater intake may entrain or impinge aquatic fauna, including fishes and invertebrates. Entrainment is the voluntary or involuntary movement of aquatic organisms small enough to pass through the particular size and shape of intake screens, while impingement is the involuntary retention of aquatic organisms on the screen. Entrainment and impingement can cause mortality or injury to aquatic fauna, with egg and larval stages most susceptible.

Involuntary entrainment and impingement of aquatic fauna may occur when the velocity at which water drawn into the seawater intake pump station exceeds the swimming capability of the species. Published data suggests most fish can swim against currents of 0.4 m/s and all fish can swim against currents of 0.1 m/s (Boys et al. 2012; and see also Section 3.19.18 of PSD 2016).

While there is limited data available on the swimming abilities of most threatened species potentially occurring within the vicinity of the intake, juveniles of these species are relatively large (e.g. sawfish pups > 65 cm and river shark > 50 cm) and therefore are likely to have a relatively strong swimming ability. Flatback turtle hatchlings (approximately 6 cm at emergence) can have a swimming speed of >1 m/s, but generally only for short periods of time and they require periodic oxygen replenishment (Salmon et al. 2010). Turtle hatchlings however are unlikely to be in the vicinity of the intake given they generally disperse seaward following emergence from nesting beaches (Hamann et al. 2011).

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. In times of pumping, the velocity of seawater intake at the mesh screen will be less than 0.25 m/sec - suggesting that most fish will be able to swim away from this area (i.e. the velocity at the screen is less than the 0.4 m/s velocity that most fish can swim against). Calculations undertaken reveal that 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 sawfish, river sharks and marine turtles.

Also of note is that the seawater intake pump will only operate between mid to high tide daily meaning that there will be a large proportion of each day when no fauna will be exposed to any entrainment and impingement risks.

Consequently, with the velocities described and the inclusion of the screen over the intake point as described above, there are not expected to be any significant impacts to conservation significant fish and marine turtle species as a result of the operation of the intake pumps.



Changes in water quality as a result of the discharge of the aquaculture water

The aquaculture water will be discharged proportional to the intake of water (i.e. an average of 954 kl/day). The discharged water will have elevated nutrients, derived from the feeding of the prawns, relative to the intake water. As such, nutrients and algae (which is a food source) will leave the facility in the form of uneaten prawn feed residues and prawn excreta (faeces and moults).

The increased nutrients and algae in the discharge water may impact upon the aquatic ecology of the receiving environment through increasing primary production, denitrification, zooplankton and juvenile fish feeding biomass near the discharge. However, the increase will be relatively small and at the point of discharge the water will be well within the range considered acceptable under the Water Quality Guidelines for Darwin Harbour (see Attachment 4 for full details), so none of these potential increases are likely to lead to significant impacts to any conservation significant fish species. It should also be noted that the closest records of any these species to the proposed discharge are from areas of Buffalo Creek where the existing water quality is known to be poor due to discharge from the Leanyer Sanderson Wastewater Treatment Plant.

There will be no release of any elements that do not occur naturally in the local environment i.e. no anti-parasitic or anti-fouling agents will be released. Whilst it is proposed to use hydrogen peroxide to disinfect the water prior to discharge, hydrogen peroxide occurs naturally in the environment, and is not considered to pose a significant risk to environmental values at levels below 0.7 mg/L (Schmidt et al., 2006). Concentrations of H₂O₂ will be measured at the point of release and water will not be released until levels under 0.7 mg/L are achieved.

Spills or leaks of hydrocarbons during construction

Spills or leaks of hydrocarbons or other contaminants such as chemicals from construction vessels or vehicles are considered a very low risk and will be controlled via operational procedures and environmental management plans required to detect and respond to any unplanned accidental releases to ameliorate impact to the environment.

Additionally, a hazardous materials management strategy (as detailed in the attached Environmental Management Plan) will be 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.

Light spill to the marine environment

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.

The environmental risks are considered to be as low as reasonably practicable as the lighting will be short lived during construction, and managed to the requirements for occupational safety regulations. Construction will occur during daylight hours only, but it is likely that some construction lighting will be required across the Project site 24 hours a day 7 days a week to manage safety on site.

Outdoor operational lighting will be minimal, designed to be 'turtle friendly' by being low profile (i.e. mounted as low to ground as possible, on fencing or buildings, not pole mounted), directed away from the marine environment, or shielded where that is not possible, and on timers or sensors. The Hatchery buildings will have minimal wall mounted lighting to aid in navigation at night which are switched by light sensor or manually. Detailed design (at which time the specific lighting details will be documented) will consider the best available turtle friendly low wattage lighting that is practical for safety (for example, red or amber LEDs, which are best for turtles, may not be considered practical from a workplace health and safety perspective). The managers' houses will have decks with lighting on manual switches. However, the manager's houses will be 300 m and 1,000 m from the beach and vegetation will be retained between the houses and the beach.

Importantly, it is not proposed to clear any of the monsoon vine thicket or any other beach vegetation, nor any other vegetation types between the building footprints and the beach. The retention of this vegetation will act as a screen between light sources from the facility and the beach. As such, potential impacts associated with light disturbance to marine turtle species are considered to be minimal.

Changes to the marine ecology as a result of escape of prawn stock

The likelihood of accidental escape of prawns from the Stage 1 Hatchery is negligible. To ensure the accidental escape of prawns from the Hatchery into the surrounding environment is further diminished, filters will be placed over all outlets to the settlement ponds prior to release.

It should be noted that regardless of the extremely low probability of escape, the consequence of prawn escapes is insignificant; the species are local (that is the founder stock will be sourced from the local populations), found across waters in the Top End and they will be of known health status (Specific Pathogen Free) and of high health.

Changes to the marine ecology through the spread of disease



Domesticated Prawn Stock

There are a number of potential diseases that have the potential to spread from domesticated prawn stock to aquatic fauna in the estuarine environment. However, these diseases are all endemic and exist in the wild prawn populations of Darwin Harbour. Outbreaks of exotic diseases are not considered a risk given Australia's geographic isolation and restrictions on the importation of prawns and prawn products.

An assessment of the potential risk that these endemic diseases pose to the wild prawn populations of the receiving waters for PSD was undertaken by Panaquatic Health Solutions Pty Ltd (Panaquatic) and is included in Attachment 5. Panaquatic conclude that the risk of diseases being spread from prawn stock to aquatic fauna in the marine environment was very low given:

- The Stage 1 Hatchery will be stocked with post-larvae that are bred from Specific Pathogen Free (SPF) prawn stock. SPF prawns are a domesticated and selectively bred population of prawns that have been screened for a suite of known pathogens. Consequently, if the prawns in the Stage 1 Hatchery are free of disease in the first place, there is no risk of the disease being released to the external environment.- A biosecurity plan has been developed for the Project to minimise the potential for the introduction and spread of diseases through pathways such as the movement of staff and equipment. This includes development of biosecurity zones and restricting movements of people and equipment between these zones.- A health monitoring and surveillance program will be implemented as part of the biosecurity plan to rapidly identify any disease, should such a disease be introduced to the Stage 1 Hatchery. If a disease is identified, immediate steps will be taken to contain the disease to the tank in which it has been identified.

In addition, in the unlikely event that a disease was transmitted to the external environment, the following steps would need to occur in order for that disease to spread to a wild prawn population and/or other aquatic fauna:

1. Wild prawns or aquatic fauna that are susceptible to the disease must be present in the receiving environment.
2. The disease must persist long enough in the environment to come into contact with the susceptible animals.
3. Susceptible animals must be exposed to sufficient quantities of the disease so that they become infected and develop the disease.
4. The diseased animals must then shed sufficient quantities of the disease to infect other wild prawns.

Based on the number of steps required in order for a disease to be transmitted and the likelihood of each of these steps occurring, the risk of a disease from the grow-out facility impacting on a wild prawns and/or other aquatic fauna is concluded to be very low.

Altered Water Quality Conditions



Altered nutrient and turbidity water quality conditions in the estuarine environment has the potential to detrimentally affect the health of aquatic vertebrate fauna (Brodie et al. 2014, Palmer and Peterson 2014). Diseases such as fibropapillomatosis in turtles and pox-like fungal infections of dolphins have been related to poor water quality conditions. Increased sediment or nutrient loads may increase exposure of species to biotoxins bound to sediments or associated with nutrients or indirectly alter dietary and habitat quality affecting foraging and reproductive success (Santos et al. 2010, Van Houtan et al. 2010, Bearzi et.al 2009).

As detailed in Attachment 4, the modelling indicates that the Project discharge will disperse quickly in the receiving environment and the Water Quality Objectives for aquatic ecosystem protection for Darwin Harbour will not be exceeded. Given this, and that the habitat to be affected is both widespread in the surrounding areas and is not unique or critical for any species, hence is unlikely to be preferentially utilised over surrounding areas, it is unlikely that the discharge of waste water will lead to detrimental health impacts to any marine vertebrate population.

Increased noise during construction and operation

Underwater noise and vibration are likely to occur during construction of the intake and outfall pipelines, particularly during pile driving works which are required for parts of the marine infrastructure. The construction vessel(s) will also generate through-hull noise associated with engine and propulsion systems, and propeller tip vortex cavitation noise. The vessel(s) are expected to produce similar noise emissions to other marine vessels that frequent Shoal Bay (e.g. recreational vessels, etc.). Operational noise may also occur from the operation of the pump systems for the intake and outfall pipelines and during routine maintenance procedures such as pigging (cleaning) the pipelines, however, again, these are expected to be no louder than noise emissions from recreational vessels that frequent Shoal Bay.

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 be localised and temporary with aquatic fauna expected to resume normal behavioural patterns in the waters surrounding the Project within a short time-frame. This is supported by the findings of the Ichthys nearshore environmental monitoring program (Brooks and Pollock 2015). Construction activities for that project included pile driving, albeit on a much larger scale than what is required for this Project.

2.6.3 Do you consider this impact to be significant?

No

2.7 Is the proposed action to be taken on or near Commonwealth land?



No

2.8 Is the proposed action taking place in the Great Barrier Reef Marine Park?

No

2.9 Is the proposed action likely to have ANY direct or indirect impact on a water resource related to coal/gas/mining?

No

2.10 Is the proposed action a nuclear action?

No

2.11 Is the proposed action to be taken by the Commonwealth agency?

No

2.12 Is the proposed action to be undertaken in a Commonwealth Heritage Place Overseas?

No

2.13 Is the proposed action likely to have ANY direct or indirect impact on a water resource related to coal/gas/mining?

No



Section 3 - Description of the project area

Provide a description of the project area and the affected area, including information about the following features (where relevant to the project area and/or affected area, and to the extent not otherwise addressed in Section 2).

3.1 Describe the flora and fauna relevant to the project area.

Vegetation Communities

A description of the vegetation communities of the site is provided in Section 3.3 below.

Flora of Conservation Significance

As previously described only one species of conservation significance was identified on site during field surveys. This species is not a listed threatened species under the EPBC Act.

Based on the desktop and field surveys an additional four species are considered possible to occur on site - *Typhonium praetermissum*, the Melville Island Desmodium (*Desmodium tiwiense*), *Operculina turpethum* and *Pittosporum moluccanum*. Targeted surveys for these species will be conducted prior to the commencement of construction, and at the optimal time for detection. None of these species are listed threatened species under the EPBC Act.

Weeds

In general, weeds are restricted to the areas being utilised by the public for recreation, largely in the western third of the Project site (Astrebla Ecological Services 2017). Outside of these areas exotic species were almost completely absent, with the exception of hyptis (*Hyptis suaveolens*) and gamba grass (*Andropogon gayanus*). Impacts from weeds are most notable on the foredune and swale area where perennial mission grass (*Cenchrus polystachyios*), Mossman River grass (*Cenchrus echinatus*) and spiny-headed sida (*Sida acuta*) are all prevalent. Low densities of hyptis are also present in low woodland on the run-off slopes. All weeds found on site are declared Class B and C weeds in the Northern Territory, these are: Gamba grass (*Andropogon gayanus*); Goat's head burr (*Acanthospermum hispidulum*); Hyptis (*Hyptis suaveolens*); Mossman River grass (*Cenchrus echinatus*); Perennial mission grass (*Cenchrus polystachyios*) and Spiny-headed sida (*Sida acuta*) and Flannel weed (*Sida cordifolia*).

Terrestrial Habitat



The site is dominated sclerophyll woodland and open forest. *Eucalyptus tetradonta* is a dominant element of the tree canopy throughout the eastern two-thirds of the site. Both density and height of the tree canopy varies considerably. Generally, a higher abundance of taller and older trees were noted from the eastern third of the site, with woodland throughout other parts of the site characterised by a more open tree canopy and generally a lower height class. Understorey is relatively sparse in regard to shrubs and small trees (e.g. *Terminalia carpentariae* and *Pandanus spiralis*), though in parts, it is characterised by notable stands of the cycad *Cycas armstrongii*.

Eucalyptus tetradonta woodland and open forest supported a comparatively higher density of hollow-bearing trees (live trees and stags) than other vegetation communities. Within the *E. tetradonta* woodland and open forest, a higher density of hollow-bearing trees were observed within the eastern part of the site. Generally, ground timber (including hollow logs) and termitaria were present, whereas these habitat resources were sparse to absent within other parts of the site

(western half and north-western parts). Woodland understorey was also variable, and thought to be linked to changes in topography and the frequency of fire.

Sclerophyll woodland and open forest dominates the erosional plain of the east, with low woodland, shrubland, vine thicket, and grassland present on the slopes and flats to the west of the eroding edge of the plain.

The western parts of the site support distinctly different fauna habitat characteristics in comparison to the woodland / open forest habitats dominating the eastern areas. Here low woodland occurs, either dominated by paperbarks (*Melaleuca viridiflora*) or bloodwoods (*Corymbia polysciada*). The tree canopy is comparatively lower than that observed within the eastern parts of the site (median height <10m versus 15-20m). Ground timber (including hollow logs) and termitaria were present, though sparsely distributed and typically absent within low paperbark woodland, vine thicket, and grassland/sedgeland communities on sandier soils within the western-most third of the site.

Along the western edge of the site, a low dune and swale variously supports mangroves and dry vine thicket communities. These elements intertwine and form a relatively narrow timbered band. During field work, the sandy beach exposed at high tide was approximately 60 m in width, and flats exposed a low tide were approximately 100-150m in width.

Threatened Fauna

Threatened EPBC Act listed fauna of relevance to the Project area are described in Section 2 of this referral and for Northern Territory listed species, in the Attached Notice of Intent (Attachment 1).



Pest Animals

GHD (2005) and EcoOz (2001) recorded a number of introduced fauna species in the area surrounding the Project including the black rat (*Rattus rattus*), house mouse (*Mus musculus*), feral pig (*Sus scrofa*), horse (*Equus caballus*), cattle (*Bos taurus*) and Asian water buffalo (*Bubalus bubalis*).

During the recent fauna assessment undertaken to support this EPBC Act referral the occurrence of feral pigs was evident across the site. Habitats associated with depressions in the south-west and the paperbark wetland within the south-east exhibited recent evidence of pig damage. There was also evidence of Asian water buffalo within the Gunn Point area.

At a larger scale, the following pest species were returned from grid cells within which the Northern Territory NRM search was undertaken (i.e. the search area lies within a number of grid cells but the results returned are from the search area plus the full extent of the grid cell within which the search area occurs) - as such the following records may relate to areas outside of the Project site and immediate surrounds: Cane Toad (*Rhinella marina*), Asian House Gecko (*Hemidactylus frenatus*), Flower-pot Blind Snake (*Ramphotyphlops braminus*), Rock Dove (*Columba livia*), Barbary Dove (*Streptopelia roseogrisea*) Common Starling (*Sturnus vulgaris*), House Sparrow (*Passer domesticus*), Eurasian Tree Sparrow (*Passer montanus*), House Mouse (*Mus musculus*), Black Rat (*Rattus rattus*) and Cat (*Felis catus*).

3.2 Describe the hydrology relevant to the project area (including water flows).

There are no permanent waterbodies 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 2010) direct impacts to these drainage areas and wetlands have been avoided and required buffer distances have been maintained. Therefore, the Project is not expected to result in any direct or indirect impacts to hydrology.

3.3 Describe the soil and vegetation characteristics relevant to the project area.

Geology and Soils

The geology of the Project area and surrounds is described by the 1:100,000 Koolpinyah Geological Map Sheet. Basement geology on the Gunn Peninsula consists of deeply weathered and eroded rocks from the Early Proterozoic (represented by the Partridge Group), and the Lower Cretaceous rocks of the Bathurst Island Formation.

The Project area is underlain by tertiary soils and laterite overlying Wangarlu Mudstone which in



turn overlies the Koolpinyah Dolomite. Generally, the tertiary soils and laterite underlying the Project area are a competent mix of silt, sand and gravel. Soils on the lateritic plain in the eastern portion of the Project area consist of relatively deep red or yellow massive earths while soils on the slopes towards the western portion of the Project area consist of more shallow gravelly earths. Both soil types are moderately to rapidly draining.

Vegetation Communities

Nine vegetation communities occur on the Project site. No threatened ecological communities or species listed under the EPBC Act were predicted to occur within the Project site, and none were observed (Astrebla Ecological Services 2017).

Approximately 60% of the Project site is dominated by one community, *Eucalyptus tetradonta* woodland to low woodland on the lateritic plain. This community also contains the highest concentration of the only threatened species found during the survey, the cycad *Cycas armstrongii*, listed as Vulnerable under the Northern Territory, TPWC Act.

Eighteen percent of the site is occupied by deciduous mixed species low woodland. This community occurs on lower run-off slopes, and occupies most of the ground between the Koolpinyah plateau and the coastal plain. It is characterised by a mixture of sclerophyllous and non-sclerophyllous species including *Melaleuca viridiflora*, *Corymbia polysciada*, *Gardenia megasperma*, *Xanthostemon paradoxus*, *Terminalia ferdinandiana* and, in places, *Lophostemon lactifluus*. It contains a population of *C. armstrongii*, but in much lower densities than those found in *E. tetradonta* woodland.

The next most common vegetation community (approximately 11%) on the Project site is low woodland dominated by *Eucalyptus tectifica* and *C. polysciada*. It occupies the run-off slope formed by the eroding Koolpinyah plateau, and occurs slightly down slope of the *E. tetradonta* woodland which dominates that surface. This community also contains *C. armstrongii*, but as with mixed deciduous species woodland, the population density is relatively low.

The remaining six communities present each comprise less than 3% of the site. *M. viridiflora* low open forest dominates a broad drainage line and shallow depression in the south east of the Project site, and woodland of *Corymbia polycarpa* and *Erythrophleum chlorostachys* occupies the fringe of a closed depression wetland located just off the south east corner. The remainder of the site is comprised of four communities that occupy the narrow coastal sand plain. None of these communities contain *C. armstrongii* populations. However, two vegetation communities,



monsoon vine thicket and mangrove low closed forest, which occur in a mosaic together on the coastal sand plain, are considered to be sensitive vegetation types under the Land Clearing Guidelines (Department of Natural Resources, Environment, the Arts and Sport 2010).

3.4 Describe any outstanding natural features and/or any other important or unique values relevant to the project area.

The Tree Point Conservation Area is located immediately to the south and south west of the Project area. The Tree Point Conservation Area protects a coastal area on the Tree Point Peninsula and a large area of mangrove habitat associated with tidal creek. 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.

Directly to the east of the Tree Point Conservation Area is the Shoal Bay Coastal Reserve. 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. The Reserve is located over 1.5 km to the south of the proposed Project infrastructure.

The proposed Gunn Point site is located in the Shoal Bay Site of Conservation Significance. 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.

The Project will not result in direct or indirect impacts to the identified values of the Tree Point Conservation Area, the Shoal Bay Coastal Reserve or the Shoal Bay Site of Conservation Significance.



3.5 Describe the status of native vegetation relevant to the project area.

As previously described vegetation present across the Project area is common to the Litchfield Shire and no communities present are listed threatened ecological communities under the EPBC Act.

However, two vegetation communities, monsoon vine thicket and mangrove low closed forest, which occur in a mosaic together on the coastal sand plain, are considered to be sensitive vegetation types under the Land Clearing Guidelines (Department of Natural Resources, Environment, the Arts and Sport 2010). These communities are outside of the Project footprint and will not be affected by the proposed action.

In general, all communities except those on the coastal sand plain were considered to be in an intact, essentially unmodified ecological condition, using the VAST assessment framework (Astrebla Ecological Services 2017).

3.6 Describe the gradient (or depth range if action is to be taken in a marine area) relevant to the project area.

Elevations across the Project site range from approximately 27 m above sea level to sea level.

The main topographic feature in the vicinity of the Project area is the Koolpinyah surface. The Koolpinyah surface is a level to gently undulating plateau approximately 25 m above sea level which drains internally to the east of Gunn Point Road and west towards the coast (Willing et al. 1991). The Project area is located on the western edge of the Koolpinyah surface which gradually slopes down towards the coastal sand plain. Slopes in the vicinity of Project area range generally between 0-4%, with short sections of terrain up to and greater than 8%.

Areas of erosion are observable most notably along exposed vehicle tracks. Shallow incised gullies are also present on slopes, particularly in the western portion of the Project area (Astrebla Ecological Services 2017).

3.7 Describe the current condition of the environment relevant to the project area.

As described below there is evidence of a variety of impacts to the environmental values on the site.



Uncontrolled recreational uses – There is ample evidence that the beach and beach dune habitats within the Project site itself are well used for recreational camping and four-wheel driving. Clearings for campsites and access tracks are prevalent throughout the dunes. Discarded rubbish is common. Beach driving appears to be common during both high and low tide conditions.

Fire – Evidence of the effects of fire was widespread across the site. There are indications that fire is more frequent and hotter within the western parts of the site (e.g. signs of old fire scars high up on trunks of canopy trees, and the paucity of ground timber and tree stags which would be habitat for terrestrial fauna). The impact of a recent fire was evident across the northern part of the site and much of the eastern half of the site. Evidence indicates that the fire was of higher intensity within the north. It is considered quite possible that fires may more often emanate from unattended / poorly managed fires associated with camping along the beach and foredune areas.

Invasive weeds – Small occurrences of Gamba grass (*Andropogon gayanus*) has been detected on the site and within the Gunn Point area. Gamba grass is a serious invasive weed with the capacity to dominate the natural ground cover and significantly increase fire intensity, which in turn can reduce habitat values of woodland/open forest for a wide variety of fauna.

Invasive animals – Evidence of the occurrence of feral pigs was apparent across the site. Habitats associated with depressions in the south-west and the paperbark wetland within the south-east exhibited recent evidence of pig damage. There was also evidence of Buffalos (*Bubalus bubalis*) within the Gunn Point area.

3.8 Describe any Commonwealth Heritage Places or other places recognised as having heritage values relevant to the project area.

There are no Commonwealth Heritage Places located in the vicinity of the Project area. The nearest Commonwealth Heritage Place is located over 100 km away at the Mount Bundey Military Training Area.

3.9 Describe any Indigenous heritage values relevant to the project area.

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).

Sacred Sites

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

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 Northern Territory Land Clearing Guidelines and the Northern Territory Guideline for Disposal of Waste by Incineration and the air and noise modelling) and an amendment to the Authority Certificate is currently being sought to accommodate these changes.

Archaeological Sites

Ground surface visibility was generally good over the Project site at the time of the field survey 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. 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.

3.10 Describe the tenure of the action area (e.g. freehold, leasehold) relevant to the project area.

The Project site is owned by the Northern Territory Government, through the Northern Territory Land Corporation. The Northern Territory Land Corporation was issued Crown Lease Perpetual No. 311 over Northern Territory Portion 2626 in 1984 (Calnan 2006).

3.11 Describe any existing or any proposed uses relevant to the project area.

Since around 1907 the primary use of the greater Gunn Peninsula has been for grazing. A prison farm was established to the north-east of the proposed Project site in 1972 and functioned till 1995 when it was closed. Historically the Project site itself has had low levels of activity, with current use for recreational fishing, hunting and camping.



The greater Gunn Peninsula, and in particular Glyde Point, to the north of the proposed Project site, has been the subject of numerous investigations and studies since the 1980s, including feasibility studies; siting studies; concept design for a port; concept design for an industrial estate and associated infrastructure to support the gas industry; concept design of a proposed residential development (Murrumujuk township); and environmental studies to support approval applications and to identify potential environmental constraints.

In 2002 Glyde Point was zoned for development and was identified by the Northern Territory Government as the location for a major gas-related industrial estate. The proposed industrial estate was to cover an area of 4,212 ha of which approximately 1,572 ha would be reclaimed land. The industrial estate would include a port consisting of a 4.9 km long, 17 m deep access channel, an 875 m by 500 m, 17 m deep turning basin and a composite wharf. It was also proposed to develop a residential estate and district centre at Murrumujuk which would house a population of approximately 16,000 people.

However, in 2007, Glyde Point was rezoned by the then Chief Minister, Claire Martin, to Public Open Space for the purpose of conservation and recreation, prohibiting industrial development. Current Northern Territory Government Policy precludes the development of Glyde Point as a future gas industry development.



Section 4 - Measures to avoid or reduce impacts

Provide a description of measures that will be implemented to avoid, reduce, manage or offset any relevant impacts of the action. Include, if appropriate, any relevant reports or technical advice relating to the feasibility and effectiveness of the proposed measures.

Examples of relevant measures to avoid or reduce impacts may include the timing of works, avoidance of important habitat, specific design measures, or adoption of specific work practices.

4.1 Describe the measures you will undertake to avoid or reduce impact from your proposed action.

As detailed below, the proponent has sought to avoid, minimise and mitigate impacts of the Project through both the site selection process and through Project design and operation.

Site Selection Process

The proponent spent considerable time investigating suitable sites for the development of the Hatchery. To determine the optimal location, a multi-criteria analysis was applied to sites across the northern Australian coast. Attributes considered in the analysis included land tenure, land area, elevation, access to fresh water and seawater, access to mains power, logistics and workforce, existing infrastructure, surrounding land and marine uses, and biosecurity separation from other Project Sea Dragon facilities. One of the more critical attributes for the Hatchery is the access to, and availability of, seawater that maintains a relatively uniform salinity (i.e. has minimal interaction with freshwater inflows).

This multi-criteria analysis produced a number of sites which were shortlisted for further investigation including sites at Charles Point, Gunn Point and Dundee Beach in the Northern Territory, and a site at Cygnet Bay in Western Australia. As part of these investigations the Charles Point site was identified as a high priority location for the development of the Hatchery. However, the site at Charles Point was subject to the Kenbi Land Claim which was settled on the 21 June 2016. Following the settlement of the land claim, discussions were held with the Traditional Owners of the area regarding the potential development of the Hatchery on the Charles Point site. Through these discussions it became apparent that the Traditional Owners could not contemplate such a development on the site at this time. Therefore, the Charles Point site was ruled out on this basis.

Consequently, further analysis of the environmental, social, and cultural heritage constraints was undertaken for the Gunn Point, Dundee Beach North, Dundee Beach South and Cygnet Bay sites. As a result of this analysis: Dundee Beach North was ruled out on the basis that the landowner would not grant access to the site, and up to 80% of the site contains sensitive



vegetation communities; Dundee Beach South was ruled out as only a limited area of the site would be made available by the landholder, a large area of the site contains sensitive vegetation communities and an important nesting area for Flatback Turtles is located immediately to the south of the site; and Cygnet Bay was ruled out due to the potential implications associated with developing and operating project components within a Native Title Determination Area.

Consequently, the Gunn Point site was identified as the site that had the least potential to impact on environmental, social and cultural heritage values, and was ranked as the most optimal location for the Stage 1 Hatchery.

Gunn Point Design Process

To avoid and minimise potential environmental, social and cultural heritage impacts, extensive analysis has been undertaken to determine the optimum layout and design of the Stage 1 Hatchery on the Gunn Point site. Avoidance and mitigation measures focused on minimising potential impacts associated with vegetation clearance, the intake and discharge of water, and the operation of infrastructure such as the power station and the incinerator.

Vegetation Clearance

In accordance with the Northern Territory Planning Scheme Land Clearing Guidelines (DNREAS 2010): the results of vegetation and flora field surveys were used to inform the layout of the facilities to avoid direct impacts to sensitive vegetation communities and limit development in areas with higher densities of *Cycas armstrongii*; vegetation buffers and corridors have been maintained to maximise connectivity, and avoid impacts to wildlife movement; direct impacts to drainage areas and wetlands have been avoided and required buffer distances have been maintained; and where possible, slopes greater than 2% have been avoided, and whilst it is not possible to avoid slopes greater than 2% entirely, an Erosion and Sediment Control Plan will be implemented to mitigate the risk of erosion during vegetation clearance works.

Water Intake and Discharge

To minimise the potential impact of discharge waters on the receiving environment, as well as the risk of recirculation through the intake pipe, a feasibility assessment of the intake and discharge locations was undertaken (Water Technology 2017).

The feasibility assessment involved numerical modelling of the discharge waters using over 20 different configurations of the intake and discharge points, and accounting for seasonal and inter-annual variation. Based on this extensive analysis the final locations selected represent



the optimal configuration to minimise water quality impacts (i.e. there are only minimal increases in nutrient concentrations due the location of the discharge point in deep water) and to minimise intake recirculation (which is not desirable from an operational perspective).

Air Quality and Noise

Modelling undertaken by GHD (2017) found that a buffer of 100 m is required between the power station/incinerator and sensitive receptors to meet the requirements for air quality. The modelling also showed that a buffer of 470 m is required to meet the requirements for noise. These results were incorporated into the design process for the Stage 1 Hatchery and a buffer distance of 500 m has been maintained between sensitive receptors (e.g. staff accommodation, protected areas) and the power station/waste transfer station. This also satisfies the requirements for buffer distances outlined in the NT EPA Guideline for Disposal of Waste by Incineration (NT EPA 2013).

Proposed Mitigation Measures

Geology and Soils

An Erosion and Sediment Control Plan has been developed and is included in the Project's Environmental Management Plan (see Attachment 7).

Acid Sulfate Soils

Pre-construction testing for acid sulfate soils will be undertaken in areas indicated on the ASS risk map (see Acid Sulfate Soil Management Strategy in EMP – see Attachment 7). Noting that the following may require adjustment to match the existing acidity of natural (non ASS) soils, after consultation with a soil specialist, any ASS found will be managed as follows:

- Acid sulfate soils are to be avoided, and groundwater level not lowered in their vicinity, or the neutralising capacity of any exposed acid sulfate soil (after treatment) must exceed the existing plus potential acidity of the soil, with a Factor of Safety of 1.5, and
- Acid Neutralising Capacity, whether naturally available or added, must be sufficiently fine to counteract oxidation and acid generation, as outlined in Dear et al (2014)
- Any placement of ASS is to be in a place such that future exposure of the material to oxidising conditions is prevented, unless the material is validated as having been neutralised
- If ASS neutralisation treatment is required:



1. A laboratory test of the material is to be conducted in accordance with the Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines (Dear et al, 2014)
 2. An assessment of the bulk density of the soil will be required to determine the rate of lime addition required in kg CaCO₃/m³ of soil (from kg CaCO₃/t soil)
 3. A subsequent determination of the liming rate per m² to allow determination of lime addition required in kg CaCO₃/m² (or other measure such as acre or hectare as appropriate). A factor shall be applied to the liming rate depending on the equivalent CaCO₃ of the neutralising agent used. This shall be applied by calculating 100/%CaCO₃ equivalent and multiplying this factor by the liming rate / tonne of soil (or m³ of soil) to achieve the required rate in CaCO₃.
 4. Spreading of lime (preferably fine agricultural lime – ‘aglime’) at a rate exceeding that identified above per tonne soil to be disturbed or removed and ploughing or ripping of spread lime into soil ensuring that lime is distributed throughout the topsoil layer. This management is valid for shallow excavations / stripping affecting at most the top 700mm only (without intercepting groundwater and with a 500 mm safety factor to the limit of investigation).
- Some management may be required to ensure acidic runoff does not occur into receiving waters from any such stockpiles. This will be undertaken in accordance with Dear et al (2014).

Noise

There are no expected impacts from noise during the operation of the facility, and therefore no mitigation measures are required. However, the power facility will likely have certain sides of the containers where noise emissions would be higher. 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.

Air Quality

Although there are predicted to be no impacts to air quality as a result of worst-case air quality modelling and no mitigation is required, the following mitigation and design requirements will be implemented for the incinerator: exhaust will be three metres higher than the top of any building within 100 m of the incinerator; 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.

Coastal Features and Processes



The following measures have been undertaken to ensure the potential impacts of the Project on the coastal values around Gunn Point are minimised:

- detailed design of the pipe bedding will ensure adequate scour protection is provided
- the visual impact of the pipe across the intertidal bank will be minimised to as low as practicable by using directional drilling as the method of construction for the intake and outfall pipes. This will be utilised under the dunes and beach, and will extend as far as possible into the marine environment.
- directional drilling as a method of pipeline construction under the dunes will minimise impacts to coastal vegetation
- navigational markers will be installed to notify boaters of the potential hazard of the pipeline.

Bathymetry and Geomorphology

The following actions will ensure there is minimal impact of the Project on the bathymetry around Gunn Point: ensure adequate scour protection is provided in the design of the pipe bedding and construction; mitigate the potential for scour across the discharge point by ensuring appropriate scour protection is considered during the detailed design phase.

Sediment Transport and Coastal Processes

The intake and discharge pipes will be constructed via directional drilling and will be buried underneath the dunes and across the intertidal zone. To minimise impacts to sediment transport and coastal processes, these will be buried as far offshore as possible.

Oceanographic Conditions

Removal and discharge of seawater through the intake / discharge pipes is unlikely to result in any changes to the hydrodynamic conditions. Design of adequate anchoring of the pipes will be undertaken to ensure that they are stable.

Water Quality

The impacts of the discharge have been minimised through selecting a location for the discharge that was optimal in terms of reduction of environmental impacts. The modelling demonstrates that significant impacts as a result of the discharge are not expected to occur. As such no further mitigation is needed, however, as detailed engineering design of the discharge structure itself has not been completed for the Project at this time, the opportunity exists to



provide further reductions in nutrient concentrations within the receiving environmental system via a discharge diffuser. This will be considered during detailed design and the discharge process will be engineered to maximise the dilution as it enters the water column.

Vegetation Clearance

Upon finalisation of detailed design and vegetation clearing approval, as part of the Construction EMP site specific Vegetation Clearing Plans will be developed, with the extent of clearing and 'no go' areas clearly defined. Clearing activities will avoid damage to the roots, trunks and canopy of adjacent retained vegetation and the boundaries of clearing and 'no go' areas will be clearly pegged/flagged on the ground prior to clearing starting. Training for all personnel will include information on identifying these marked areas.

No lay down areas or materials storage will be located within areas of retained vegetation.

Given the relatively small area to be cleared, clearing will not be staged. Construction is scheduled to take place from April 2019 to February 2020. Land clearing would occur at the beginning of this period 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. 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). This will minimise the likelihood of erosion related impacts to vegetation adjacent to the footprint that will be retained. Cleared areas will be stabilised as much as practicable prior to wet season rains. The EMP makes provision for erosion and sediment control.

Threatened Flora Species

Avoidance of habitat for *Cycas armstrongii* was a key consideration in planning the site layout. Siting of infrastructure in areas mapped as having higher densities of this species was avoided, as much as practicable. Upon finalisation of detailed design, and once the exact numbers of *Cycas armstrongii* required to be removed are known, an application for a permit to take or interfere with wildlife under the TPWC Act, 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 for landscaping. Seafarms are engaging with the LDC regarding this.

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 found to be present within the footprint, *Typhonium praetermissum*, and the Melville Island Desmodium (*Desmodium tiwiense*), an application for a permit to take or interfere with wildlife under the *Territory Parks and Wildlife Act*, 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.



Weed Management

Prior to the commencement of construction activities, a Weed Management Plan (WMP) for the construction and operation stages of the Project will be developed and implemented. The control of gamba grass and perennial mission grass will be a focus of this WMP, including ensuring that vehicle movements to and from site do not spread these weeds further.

This plan will include vehicle and plant wash down procedures for the construction phase, and a requirement for all contractors bringing vehicles/plant onto site to complete Weed Declaration Forms, in which they formally declare that all required weed hygiene measures have been taken and that their vehicles/plant are free of weed material (in particular, weed seeds).

During construction, weed monitoring will be conducted to ensure that high risk weeds have not been introduced.

During the operational stage, weed monitoring will be undertaken within the Project footprint, particularly service corridors subject to road traffic, on an annual basis.

Terrestrial Fauna and Avifauna

Flora and fauna surveys were undertaken to determine the areas of the site with comparatively lower values for threatened and non-threatened fauna. The results revealed that the western third of the site supports comparatively lower values, and as such development has been concentrated into this area of the site to ensure impacts on fauna species are minimised. To further minimise impacts to terrestrial fauna, the measures described below will be undertaken.

- A Weed Management Plan will be implemented prior to construction. The control of gamba grass and perennial mission grass will be a focus of this WMP.
- A fauna spotter will be present on site during clearing activities. If conservation significant fauna are identified within the Project footprint, mitigation measures, including relocation of the fauna if appropriate, will be developed in consultation with the Northern Territory Government.
- Formulation of bushfire management practices (as required under the Bushfire Act 2009) will also take into account measures to optimise burns in a way that least impacts habitat.
- A Fauna Management Plan will be developed to provide for the protection of fauna during construction and operation of the facility.
- The boundary of the site will be fenced with standard rural cattle fencing to exclude feral animals.

In regards to rodents and feral cats the Fauna Management Plan will include: an on-going,



rodent baiting program around built facilities; Measures to minimise available food sources for introduced rodents around buildings; and an on-going cat baiting program around built facilities using proprietary baits such as Curiosity® with the toxin PAPP (para-aminopropiophenone).

Marine Fauna

Hydrodynamic numerical modelling has shown that during operation, the impact of the discharge on the receiving waters of Shoal Bay will be minimal.

The mitigation measures specified above for coastal features and processes and water quality are also relevant to marine fauna. In addition to those measures, the actions outlined below will be considered to alleviate the potential impact of the Project on threatened marine fauna and their habitat in Shoal Bay.

- The intake pipes will be screened to avoid entrapment or entrainment.
- The proponent will ensure the implementation of vessel speed limits in the construction zone and implementation of a marine megafauna observation zone (150 m) and a marine megafauna exclusion zone (50 m).
- 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: light fixtures that are mounted low down, shielded and aligned to direct light onto the target area only; turn lights on only when they are needed; directional, achieving no spill to the marine environment; automated controls (e.g. timers and motion detectors) to be used as appropriate to minimise lighting; designing ground-level path lighting for use where practicable; and construction vessels used to be certified as free of marine fouling.

Tree Point Conservation Area

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.

Cultural Heritage

Despite there being no anticipated impacts to sacred sites or archaeological sites or places, a protocol for unexpected finds is included in the Project's Environmental Management Plan. 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.

Socio-economic 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.

Climate Change

The risk posed by climate change to intake and discharge infrastructure can be 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.

Design of the intake pipe and bedding should also consider the potential for increased wave conditions into the future. Where the pipes are buried, they should 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 included in the detailed design of the Project facilities.

4.2 For matters protected by the EPBC Act that may be affected by the proposed action, describe the proposed environmental outcomes to be achieved.

As demonstrated throughout this referral, the proponent is committed to avoiding, minimising and mitigating impacts on the environment, including matters protected under the EPBC Act.

The only EPBC Act matters that could potentially be affected by the Project are listed threatened species and listed migratory species.

The proponent has demonstrated that any potential impacts on these matters have been avoided and mitigated through Project design and through commitments to environmental management, such as the implementation of vessel speed limits in the construction zone and implementation of a marine megafauna observation zone (150 m) and a marine megafauna exclusion zone (50 m).

As presented in Section 2, potential impacts to listed threatened species and migratory species were assessed against the Australian Government's Significant Impact Guidelines 1.1 – Matters of National Environmental Significance (DoE 2013). This assessment demonstrates that the Project will not result in significant impacts to listed threatened species and migratory species protected under the EPBC Act.

Therefore the development of the Project is consistent with the objectives of the EPBC Act, in that it provides for the protection of the environment, especially matters of national environmental significance.

Notwithstanding the above the proponent is committed to achieving the following objectives through the construction and operation of the Project:

- To protect benthic communities and habitats so that biological diversity and ecological integrity



are maintained.

- To maintain the geophysical processes that shape coastal morphology so that the environmental values of the coast are protected.
- To maintain the quality of water, sediment and biota so that environmental values are protected.
- To protect marine fauna so that biological diversity and ecological integrity are maintained.
- To protect flora and vegetation so that biological diversity and ecological integrity are maintained.
- To maintain the variety and integrity of distinctive physical landforms so that environmental values are protected.
- To protect subterranean fauna so that biological diversity and ecological integrity are maintained.
- To maintain the quality of land and soils so that environmental values are protected.
- To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.
- To maintain the hydrological regimes of groundwater and surface water so that environmental values are protected.
- To maintain the quality of groundwater and surface water so that environmental values are protected.
- To maintain air quality and minimise emissions so that environmental values are protected.
- To protect social surroundings from significant harm.
- To protect human health from significant harm.



Section 5 – Conclusion on the likelihood of significant impacts

A checkbox tick identifies each of the matters of National Environmental Significance you identified in section 2 of this application as likely to be a significant impact.

Review the matters you have identified below. If a matter ticked below has been incorrectly identified you will need to return to Section 2 to edit.

5.1.1 World Heritage Properties

No

5.1.2 National Heritage Places

No

5.1.3 Wetlands of International Importance (declared Ramsar Wetlands)

No

5.1.4 Listed threatened species or any threatened ecological community

No

5.1.5 Listed migratory species

No

5.1.6 Commonwealth marine environment

No

5.1.7 Protection of the environment from actions involving Commonwealth land

No

5.1.8 Great Barrier Reef Marine Park

No

5.1.9 A water resource, in relation to coal/gas/mining

No



5.1.10 Protection of the environment from nuclear actions

No

5.1.11 Protection of the environment from Commonwealth actions

No

5.1.12 Commonwealth Heritage places overseas

No

5.2 If no significant matters are identified, provide the key reasons why you think the proposed action is not likely to have a significant impact on a matter protected under the EPBC Act and therefore not a controlled action.

As presented in this referral, the Project will not result in a significant impact on any matter protected under the EPBC Act.

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. Therefore, World Heritage Properties or National Heritage Places will not be directly or indirectly impacted by the Project.

There are no Ramsar Wetlands of international importance within the proposed Project area or surrounds. The nearest Ramsar Wetland is located over 100 km away in Kakadu National Park. Therefore, Ramsar Wetlands will not be directly or indirectly impacted by the Project.

There are no threatened ecological communities present on the Project site.

Table 2.4.1 of this referral lists 37 listed threatened species that were returned from the search of the Commonwealth EPBC Protected Matters Search Tool, and explains why there is unlikely to be a significant impact on any listed threatened species as a result of the proposed action.

Table 2.5.1 of this referral lists 51 migratory species that were returned from the search of the Commonwealth EPBC Protected Matters Search Tool, and explains why there is unlikely to be a



significant impact on any listed migratory species as a result of the proposed action.

There are no Commonwealth marine areas 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. Therefore, Commonwealth marine areas or reserves will not be directly or indirectly impacted by the Project.

The Project is not proposed to be undertaken on Commonwealth land, and will not impact directly or indirectly on Commonwealth land.

The proposed action will not be undertaken within the Great Barrier Reef Marine Park, and will not impact directly or indirectly on the Great Barrier Reef Marine Park.

The Project is not a nuclear action.

The Project is not a coal seam gas development or large coal mining development.



Section 6 – Environmental record of the person proposing to take the action

Provide details of any proceedings under Commonwealth, State or Territory law against the person proposing to take the action that pertain to the protection of the environment or the conservation and sustainable use of natural resources.

6.1 Does the person taking the action have a satisfactory record of responsible environmental management? Please explain in further detail.

Seafarms is an ASX listed company holding separate subsidiary companies each operating in emerging, non-conventional commodities areas: aquaculture, carbon and environmental offsets. The companies are Seafarms Operations Limited, and CO2 Australia Limited. Project Sea Dragon Pty Ltd is a subsidiary of Seafarms Operations Limited.

Seafarms is currently the largest producer of farmed prawns – growing, processing and distributing the well-known Crystal Bay Prawns® premium brand. Seafarms has 148 ponds covering 160 hectares, across three locations throughout north Queensland. Seafarms is committed to sustainability and believe that farmed seafood is the most sustainable way to provide seafood to the world. Crystal Bay Prawns are produced using environmentally sustainable culture processes, state of the art processing facilities and support services. Seafarms believes that protection of the environment is a primary corporate responsibility. Therefore, all the Seafarms business activities reflect these beliefs and Seafarms strive to constantly:

- adopt best management practices to conduct operations in an environmentally responsible manner
- implement sound environmental management practices to minimise the impacts due to our business operations
- comply with all relevant environmental regulations
- minimise resource consumption and waste generation by efficient use of resources
- protect all natural ecosystems in our area
- conduct necessary programmes to enhance environmental awareness among our employees.

Seafarms and its subsidiary companies have never been subject to prosecution for environmental breaches and have a strong record of environmental management across a diverse portfolio of aquaculture, carbon and environmental projects.



6.2 Provide details of any past or present proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against either (a) the person proposing to take the action or, (b) if a permit has been applied for in relation to the action – the person making the application.

No past or present proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources has been taken against the person proposing to take the action and/or the person making the application.

6.3 If it is a corporation undertaking the action will the action be taken in accordance with the corporation's environmental policy and framework?

Yes

6.3.1 If the person taking the action is a corporation, please provide details of the corporation's environmental policy and planning framework.

See attached Environmental Management System and Environmental Management Plan (Attachment 7)

6.4 Has the person taking the action previously referred an action under the EPBC Act, or been responsible for undertaking an action referred under the EPBC Act?

Yes

6.4.1 EPBC Act No and/or Name of Proposal.

Project Sea Dragon Stage 1 Legume Grow-out Facility (EPBC Act No: 2015/7527)

Project Sea Dragon Core Breeding Centre and Broodstock Maturation Centre (EPBC Act No: 2016/7713)



Section 7 – Information sources

You are required to provide the references used in preparing the referral including the reliability of the source.

7.1 List references used in preparing the referral (please provide the reference source reliability and any uncertainties of source).

Reference Source	Reliability	Uncertainties
Astrebla Ecological Services (2017) Project Sea Dragon Gunn Point Hatchery Flora Survey Report.	High	All reports are peer reviewed, published literature or government reports
Australian Bureau of Statistics 2016 Census QuickStats. http://www.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/SSC70129 . Accessed 20 October 2017.	High	All reports are peer reviewed, published literature or government reports
Bearzi, M Rapoport, S, Chau, J and Saylan, C 2009, Skin lesions and physical deformities of coastal and offshore common bottlenose dolphins (<i>Tursiops truncatus</i>) in Santa Monica Bay and adjacent areas, California. <i>Ambio</i> 38: 66-71.	High	All reports are peer reviewed, published literature or government reports
Brodie, J., Ariel, E., Thomas, C., O'Brien, D. and Berry, K. (2014), Links between water quality and marine turtle health. TropWATER Report 14/05, James Cook University.	High	All reports are peer reviewed, published literature or government reports
Brooks, L. and Pollock, K. (2015) The Darwin dolphin monitoring program: Abundance, apparent survival, movements and habitat use of Humpback, Bottlenose and Snubfin dolphins in the Darwin area. Prepared for INPEX.	High	All reports are peer reviewed, published literature or government reports
Calnan, T. (2006). An assessment of the conservation	High	All reports are peer reviewed, published literature or



Reference Source	Reliability	Uncertainties
values of the Gunn Peninsula/Vernon Islands area and the impacts of the proposed Glyde Point heavy industry and residential estate. Prepared for ECNT and AMCS, Darwin.		government reports
Cardno (2015) Turtle and Dugong Monitoring Post-dredging Report – Ichthys Nearshore Environmental Monitoring Program. Prepared for INPEX. Boys, C, Baumgartner, L., Rampano, B, Robinson, W, Alexander, T, Reilly, G, Roswell, M, Fowler, T and Lowry, M (2012) Development of fish screening criteria for water diversions in the Murray-Darling Basin. NSW Department of Primary Industries, Port Stephens Fisheries Institute, Nelson Bay, NSW.	High	All reports are peer reviewed, published literature or government reports
Cavanagh, RD, Kyne, PM, Fowler, SL, Music, JA, and Bennett, MB (eds) 2003, 'The conservation status of Australia Chondrichthyans', Report to the IUCN park specialist group Australia and Oceania Regional Red List workshop, University of Queensland, Brisbane.	High	All reports are peer reviewed, published literature or government reports
Chatto, R. (2003). The Distribution and Status of Shorebirds around the Coast and Coastal Wetlands of the Northern Territory. Technical Report 73. Parks and Wildlife Commission of the Northern Territory, Palmerston.	High	All reports are peer reviewed, published literature or government reports
Chatto, R. (2006). The Distribution and Status of Waterbirds around the Coast and Coastal Wetlands of the Northern Territory. Technical	High	All reports are peer reviewed, published literature or government reports



Reference Source	Reliability	Uncertainties
Report 76. Parks and Wildlife Commission of the Northern Territory, Palmerston.		
Chatto, R. and Warnecke, R.M. High (2000). Records of cetacean strandings in the Northern Territory of Australia. The Beagle 16: 163-175.		All reports are peer reviewed, published literature or government reports
Dear, S-E., Ahern, C. R., O'Brien, L. E., Dobos, S. K., McElnea, A. E., Moore, N. G. and Watling, K. M., (2014), Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines. Department of Science, Information Technology, Innovation and the Arts, Queensland Government.	High	All reports are peer reviewed, published literature or government reports
Department of Environment and Natural Resources (2009) Towards the Development of a Water Quality Protection Plan for the Darwin Harbour Region, Phase 1 Report.	High	All reports are peer reviewed, published literature or government reports
Department of Environment and Natural Resources (2016) Darwin Harbour Region 2016 Report Card, Water Quality Supplement. Department of Environment and Natural Resources.	High	All reports are peer reviewed, published literature or government reports
Department of Natural Resources, Environment and the Arts (2004) Darwin Coastal Bioregion Conservation Values and Environmental Resources, Department of Natural Resources, Environment and the Arts, Palmerston, Northern Territory .	High	All reports are peer reviewed, published literature or government reports
Department of Natural Resources, Environment and the Arts (2017) Sites of Conservation Significance. Shoal Bay. Department of	High	All reports are peer reviewed, published literature or government reports



Reference Source	Reliability	Uncertainties
Natural Resources, Environment, the Arts and Sports, Darwin, Northern Territory. Available online at: http://www.territorystories.nt.gov.au/bitstream/handle/10070/254289/08_shoal.pdf?sequence=1&isAllowed=y . Accessed 30 August 2017.		
Department of Natural Resources, Environment, the Arts and Sport, 2010, Land Clearing Guidelines, Department of Natural Resources, Environment, the Arts and Sport, Darwin.	High	All reports are peer reviewed, published literature or government reports
Department of the Environment (2013) Matters of National Environmental Significance Significant impact guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999 http://www.environment.gov.au/system/files/resources/42f84df4-720b-4dcf-b262-48679a3aba58/files/nesc-guidelines_1.pdf	High	All reports are peer reviewed, published literature or government reports
Department of the Environment and Energy (2017a) National Conservation Values Atlas. Species Profile and Threats Database. Carcharodon carcharias — White Shark, Great White Shark http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64470	High	All reports are peer reviewed, published literature or government reports
Department of the Environment and Energy (2017b) National Conservation Values Atlas. http://www.environment.gov.au/web-gis-framework/apps/ncva/ncva.jsf . Accessed 01 September 2017.	High	All reports are peer reviewed, published literature or government reports
EcoOz (2001) Flora and Fauna Survey and Preliminary	High	All reports are peer reviewed, published literature or



Reference Source	Reliability	Uncertainties
Environmental Assessment, Sunrise Gas Project, Gunn Peninsula, Northern Territory. For Woodside Petroleum.		government reports
Garnett, S. & Crowley, G. (2000). The Action Plan for Australian Birds 2000. Available from: http://www.environment.gov.au/node/34417 . Accessed 15 October 2017.	High	All reports are peer reviewed, published literature or government reports
GHD (2005) Department of Infrastructure Planning and Environment Glyde Point Flora and Fauna Survey.	High	All reports are peer reviewed, published literature or government reports
GHD (2017) Gunn Point Air Quality and Noise Assessment. Prepared for CO2 Australia Limited.	High	All reports are peer reviewed, published literature or government reports
Green, C. and Cuff, N. 2016. Threatened Species Distribution in the Greater Darwin Region. Typhonium praetermissum. Mapped Distribution. Department of Land Resource Management, Northern Territory. Available from https://nt.gov.au/environment/native-plants/threatened-plants . Accessed 24 July 2017.	High	All reports are peer reviewed, published literature or government reports
Green, C. and Cuff, N., 2016a, Threatened Species Distribution in the Greater Darwin Region. Stylidium ensatum. Mapped Distribution. Department of Land Resource Management, Northern Territory. Available from https://nt.gov.au/environment/native-plants/threatened-plants . Accessed July 2017	High	All reports are peer reviewed, published literature or government reports
Jolly, P. (1985). Report No 211985 Gunn Point Peninsula Investigation of Groundwater Resources 1984, Water Resources Division, Department of Mines and	High	All reports are peer reviewed, published literature or government reports



Reference Source	Reliability	Uncertainties
Energy.		
Jung, S. (2017) Archeological Survey Report – Sea Dragon Hatchery, Gunn Point. Prepared for CO2 Australia Limited.	High	All reports are peer reviewed, published literature or government reports
Northern Territory Environment Protection Authority (2013) Guidelines for the Disposal of Waste by Incineration. November 2013. Available online: https://ntepa.nt.gov.au/_data/assets/pdf_file/0009/284679/guideline_pollution_incinerator.pdf . Accessed 13 July 2017.	High	All reports are peer reviewed, published literature or government reports
Palmer, C and Peterson A (2014). First report of a lacaziosis-like disease (LLD) observed in the Australian snubfin dolphin (<i>Orcaella heinsohni</i>) in Darwin Harbour, Northern Territory, Australia. Northern Territory Naturalist 25:3–6.	High	All reports are peer reviewed, published literature or government reports
Project Sea Dragon. 2016. Project Sea Dragon Stage 1 Legume Grow-out Facility Supplementary Environmental Impact Assessment. Available online: https://ntepa.nt.gov.au/_data/assets/pdf_file/0003/407766/supplement_eis_sea_dragon_legume_growout.pdf . Accessed 15 September 2017.	High	All reports are peer reviewed, published literature or government reports
Salmon, M., Hamann, M. and Wyneken, J. (2010) 'The development of early diving behaviour by juvenile flatback sea turtles (<i>Natator depressus</i>)'. Chelonian Conservation and Biology 9, 8-17.	High	All reports are peer reviewed, published literature or government reports
Santos, R., et al. (2010), Relationship between fibropapillomatosis and	High	All reports are peer reviewed, published literature or government reports



Reference Source	Reliability	Uncertainties
environmental quality: a case study with <i>Chelonia mydas</i> off Brazil. Diseases of Aquatic Organisms 89: 87-95		
Schmidt, L. J., Gaikowski, M.P and Gingerich, W.H. (2006) Environmental Assessment for the Use of Hydrogen Peroxide in Aquaculture for Treating External Fungal and Bacterial Diseases of Cultured Fish and Fish Eggs, US Geological Survey. Available online: https://www.fda.gov/downloads/AnimalVeterinary/DevelopmentApprovalProcess/EnvironmentalAssessments/UCM072399.pdf Accessed 18 September	High	All reports are peer reviewed, published literature or government reports
Threatened Species Scientific Committee, 2016, Approved Conservation Advice for <i>Stylidium ensatum</i> . Canberra, Department of the Environment. Online pdf available from http://www.environment.gov.au/biodiversity/threatened/species/pubs/86366-conservation-advice-05052016.pdf . Accessed 24 July, 2017.	High	All reports are peer reviewed, published literature or government reports
URS (2003) Proposed Glyde Point Industrial Estate Marine Habitats Survey.	High	All reports are peer reviewed, published literature or government reports
Van Houtan, K., Hargrove, S.K. Balaz, G.H. (2010), Land use, macroalgae, and a tumor-forming disease in marine turtles. PLoS ONE. 5, e12900.	High	All reports are peer reviewed, published literature or government reports
Water Technology Pty Ltd 2017 Project Sea Dragon Gunn Point Breeding Centre Coastal Environment and Impact Assessment, A report prepared for Seafarms Group Limited.	High	All reports are peer reviewed, published literature or government reports
Western Australia Environmental Protection Authority (2010). Environmental	High	All reports are peer reviewed, published literature or government reports



Reference Source	Reliability	Uncertainties
Assessment Guidelines. No.5 Environmental Assessment Guideline for Protecting Marine Turtles from Light Impacts. Available from: http://www.epa.wa.gov.au/sites/default/files/Policies_and_Guidance/EAG%20%20Lights%20Turtle%2011110.pdf . Accessed 13 July 2017.		
Willing and Partners and Dames and Moore (1991). Murrumbidgee Trunk Drainage Study, Final Report, for Department of Transport and Works, Roads Division, Northern Territory.	High	All reports are peer reviewed, published literature or government reports
Wilson, B. A., Brocklehurst, J. S., Clark, M. J. and Dickinson, K. J. M (1990) Vegetation Survey of the Northern Territory, Australia, Technical Report #49, Northern Territory Conservation Commission, Darwin.	High	All reports are peer reviewed, published literature or government reports
Wrigley T.J., Cumberland D.A., and Townsend S.A. (1990). Ambient Water Quality of Darwin Harbour Report 71/90, Water Resources Division, Power and Water Authority.	High	All reports are peer reviewed, published literature or government reports
Yin Foo, D. (2004). Modelling of the McMinns/Howard East Groundwater System. Department of Natural Resources, Environment and the Arts, Northern Territory. Report 26/20040.	High	All reports are peer reviewed, published literature or government reports



Section 8 – Proposed alternatives

You are required to complete this section if you have any feasible alternatives to taking the proposed action (including not taking the action) that were considered but not proposed.

8.1 Select the relevant alternatives related to your proposed action.

8.27 Do you have another alternative?



Section 9 – Contacts, signatures and declarations

Where applicable, you must provide the contact details of each of the following entities: Person Proposing the Action; Proposed Designated Proponent and; Person Preparing the Referral. You will also be required to provide signed declarations from each of the identified entities.

9.0 Is the person proposing to take the action an Organisation or an Individual?

Organisation

9.2 Organisation

9.2.1 Job Title

~~Executive Director~~ Managing Director

9.2.2 First Name

Chris

9.2.3 Last Name

Mitchell

9.2.4 E-mail

chris.mitchell@seafarms.com.au

9.2.5 Postal Address

31/47 Joseph Street

31
Blackburn North VIC 3130
Australia

9.2.6 ABN/ACN

ACN

604936192 - PROJECT SEA DRAGON PTY LTD

9.2.7 Organisation Telephone



(08) 9321 4111

9.2.8 Organisation E-mail

info@seafarms.com.au

9.2.9 I qualify for exemption from fees under section 520(4C)(e)(v) of the EPBC Act because I am:

Not applicable

Small Business Declaration

I have read the Department of the Environment and Energy's guidance in the online form concerning the definition of a small a business entity and confirm that I qualify for a small business exemption.

Signature:..... Date:


9.2.9.2 I would like to apply for a waiver of full or partial fees under Schedule 1, 5.21A of the EPBC Regulations

No

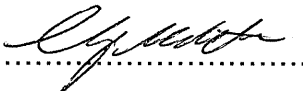
9.2.9.3 Under sub regulation 5.21A(5), you must include information about the applicant (if not you) the grounds on which the waiver is sought and the reasons why it should be made

Person proposing the action - Declaration

I, CHRISTOPHER DAVID MITCHELL, declare that to the best of my knowledge the information I have given on, or attached to the EPBC Act Referral is complete, current and correct. I understand that giving false or misleading information is a serious offence. I declare that I am not taking the action on behalf of or for the benefit of any other person or entity.

Signature:  Date: 30/10/12

I, CHRISTOPHER DAVID MITCHELL the person proposing the action, consent to the designation of PROJECT SEA DRAGON PTY LTD as the proponent of the purposes of the action describe in this EPBC Act Referral.

Signature:  Date: 30/10/12



9.3 Is the Proposed Designated Proponent an Organisation or Individual?

Organisation

9.5 Organisation

9.5.1 Job Title

~~Executive Director~~ Managing Director

9.5.2 First Name

Chris

9.5.3 Last Name

Mitchell

9.5.4 E-mail

chris.mitchell@seafarms.com.au

9.5.5 Postal Address

P.O Box 7312

Cloisters Square
Perth WA 6850
Australia

9.5.6 ABN/ACN

ACN

604936192 - PROJECT SEA DRAGON PTY LTD

9.5.7 Organisation Telephone

(08) 9321 4111

9.5.8 Organisation E-mail

info@seafarms.com.au

Proposed designated proponent - Declaration



I, CHRISTOPHER DAVID MITCHELL, the proposed designated proponent, consent to the designation of myself as the proponent for the purposes of the action described in this EPBC Act Referral.

Signature: *Chris Mitchell* Date: 30/10/17

9.6 Is the Referring Party an Organisation or Individual?

Organisation

9.8 Organisation

9.8.1 Job Title

~~Executive Director~~ Managing Director

9.8.2 First Name

Chris

9.8.3 Last Name

Mitchell

9.8.4 E-mail

chris.mitchell@seafarms.com.au

9.8.5 Postal Address

P.O. Box 7312

Cloisters Square
Perth WA 6850
Australia

9.8.6 ABN/ACN

ACN

604936192 - PROJECT SEA DRAGON PTY LTD

9.8.7 Organisation Telephone

(08) 9321 4111




9.8.8 Organisation E-mail

info@seafarms.com.au

Referring Party - Declaration

I, CHRISTOPHER DAVID MITCHELL, I declare that to the best of my knowledge the information I have given on, or attached to this EPBC Act Referral is complete, current and correct. I understand that giving false or misleading information is a serious offence.

Signature:  Date: 30/10/22



Appendix A - Attachments

The following attachments have been supplied with this EPBC Act Referral:

1. area_of_monsoon_vine_thicket_to_the_west_of_the_site.jpg
2. attachment_1_notice_of_intent_hatchery_no_appendices_part_1.pdf
3. attachment_1_notice_of_intent_hatchery_no_appendices_part_2.pdf
4. attachment_1_notice_of_intent_hatchery_no_appendices_part_3.pdf
5. attachment_1_notice_of_intent_hatchery_no_appendices_part_4.pdf
6. attachment_2_gunnpntflora_final_part_1.pdf
7. attachment_2_gunnpntflora_final_part_2.pdf
8. attachment_2_gunnpntflora_final_part_3.pdf
9. attachment_2_gunnpntflora_final_part_4.pdf
10. attachment_2_gunnpntflora_final_part_5.pdf
11. attachment_2_gunnpntflora_final_part_6.pdf
12. attachment_3_gunnpntfauna_final.pdf
13. attachment_4_-_water_technology_report_part_1.pdf
14. attachment_4_-_water_technology_report_part_2.pdf
15. attachment_4_-_water_technology_report_part_3.pdf
16. attachment_5_-_panaquatic_report.pdf
17. attachment_6_-_pmst_search_results.pdf
18. attachment_7_-_en-03-mp-em4001c_gunn_point_emp_part_2.pdf
19. attachment_7_-_en-mn-em4001g_ems_manual.pdf
20. attachment_7_-_n-03-mp-em4001c_gunn_point_emp_part_1.pdf
21. camping_along_beach_dunes.jpg
22. cycas_armstrongii_on_site.jpg
23. figure_1_developmentfootprint.pdf
24. figure_2_regionalcontext.pdf
25. figure_3_vegetationcommunities.pdf
26. floorplan-stageonesitelayoutplan_geo171013_full.shp.kmz
27. vegetation_in_the_approximate_location_of_the_hatchery_module.jpg
28. view_along_the_beach_facing_south.jpg