seafarms

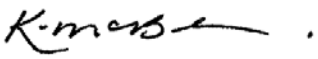
Project Sea Dragon - Stage 1 Legune Grow-out Facility

Notice of Intent for Aquaculture Operations

July 2015

Approvals

Rev	Date	Description	By	Checked	Approved
A	30/06/2015	Draft for internal review	KM	NM	NM
0	13/07/2015	Final	KM	NM	NM

	NAME	POSITION	SIGNATURE
ORIGINATORS	NM	Environmental Manager	
	KM	Senior Consultant	
	MF	Consultant	
CHECKER	NM	Environmental Manager	
APPROVER	CM	Executive Director	

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Abbreviations and Acronyms

AAPA	Aboriginal Areas Protection Authority
AOA	Access and Option Agreement
BBC	Back-up Breeding Centre
BMC	Broodstock Maturation Centre
CBC	Core Breeding Centre
EIA	Environmental Impact Assessment
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPBC PMST	EPBC Act Protected Matters Search Tool
EPZ	Environmental Protection Zone
FTE	Full Time Equivalents
ICN	Industry Capability Network
IFRP	Internal farm recycling ponds
IPP	Independent power producer
LNG	Liquefied natural gas
MDC	Main discharge canal
MFC	Main feeder canal
NOI	Notice of Intent
NT	Northern Territory
NT EPA	Northern Territory Environment Protection Authority
PASS	Potential acid-sulphate soils.
PL's	Post larvae
PSD	Project Sea Dragon
Seafarms	Seafarms Group Limited
Stage 1 Legune Grow-out Facility	Stage 1 of Project Sea Dragon at the Grow-out Facility to be situated on Legune Station
WA	Western Australia
WWTP	Waste Water Treatment Plant

1 Introduction

Project Sea Dragon Pty Ltd, a wholly owned subsidiary of Seafarms Group Limited (Seafarms) (ASX: SFG), proposes to develop Project Sea Dragon, a large, fully integrated, prawn aquaculture project located in northern Australia.

The project will be delivered as an integrated production system, providing reliable, long-term, high quality and large scale production of Black Tiger prawns (*Penaeus monodon*). The project focuses on sustainable land use and integrated design practices to maintain surrounding river and coastal environments and support adjacent agricultural land uses. Project Sea Dragon is a large project with a long development timeline (approximately 7 years) between first operations and full scale operations.

This Notice of Intent (NOI) is for construction and operation of Stage 1 of Project Sea Dragon at the Grow-out Facility to be situated on Legune Station (herein referred to as the Stage 1 Legune Grow-out Facility). Legune Station is located in the north-western Northern Territory. The Stage 1 Legune Grow-out Facility will comprise approximately 1,080 ha of prawn farming capacity, plus associated infrastructure onsite.

The Stage 1 Legune Grow-out Facility is part of a larger project including other ancillary aspects of Stage 1 to be located in Darwin, Exmouth, Kununurra and Wyndham; and future proposed stages to reach full scale operations. However, these aspects of the larger project are not considered part of this application for geographical and operational (timing) reasons. These facilities will be subject to separate environmental approval processes as required, and development application approvals as required.

This NOI has been prepared based on consultation with the Northern Territory Environment Protection Authority (NT EPA) and review of the 'Draft Guideline for the Preparation of a Notice of Intent' and the 'Guide to writing a "Notice of Intent for Aquaculture" in the Northern Territory'. It includes:

- an overview of project particulars including details of the project proponent, key timeframes, locality, land use history and applicable regulations
- a detailed project description
- a description of development related to the project that is not the subject of this NOI
- a description of the existing environment including:
  - the natural environment
  - significant sites or features
  - cultural heritage environment
  - social and economic environment
- a description of the potential impacts arising from the proposed development
- an outline of the measures to avoid and reduce impacts
- an overview of the likelihood of significant impacts on matters of national environmental significance protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- a conclusion on whether the proposal is likely to have a significant impact on the environment
- a brief overview of the local and regional benefits of the project.

2 Project Details

2.1 Project Proponent

This application is made by Project Sea Dragon Pty Ltd, a wholly owned subsidiary of Seafarms. Project Sea Dragon Pty Ltd company details are outlined in **Table 1.1.** Details for the primary contact person for this application are provided in **Table 1.2**.

Seafarms is an Australian agri-food company which operates, builds and invests in sustainable aquaculture production platforms producing high-quality seafood. Seafarms is currently Australia's largest producer of farmed prawns – growing, processing and distributing the well-known Crystal Bay Prawns® premium brand. Seafarms has existing operations in Cardwell and Ingham, Queensland, and is a major supplier of prawns to Coles and Woolworths on the East Coast. The company is one of Australia's largest prawn aquaculture enterprises.

Table 1.1 Project Sea Dragon Pty Ltd Details

Required Information	Details
ACN	604 936 192
Street Address	Level 11, 225 St Georges Terrace, Perth WA 6000 Australia
Postal Address	P.O. Box 7312 Cloisters Square, Perth WA 6850 Australia
Phone	+61 8 9321 4117
Fax	+61 8 9321 4411
Website	www.Project Sea Dragon.com.au

Table 1.2 Primary Contact Details

Required Information	Details
Name	Chris Mitchell
Title	Executive Director – Seafarms Group Limited
Postal Address	Unit 6 Ground Floor 31-47 Joseph St Blackburn North VIC 3130
Phone	03 9928 5111
Fax	03 9928 5199
Email	Chris.Mitchell@co2australia.com.au

2.2 Timeframes

The Stage 1 Legune Grow-out Facility will be developed in three steps, which include:

- a final feasibility study, including environmental impact studies, to:
  - de-risk the development feasibility
  - secure statutory approvals
  - engage with funding partners and secure project finance
  - identify and secure suitable land for each of the support infrastructure facilities
  - finalise the development schedule and Project Execution Plan
- an execution phase for the engineering, procurement, construction and commissioning phase of the capital works.
- an operations ramp-up phase, to commence the breeding program and start stocking the farms.

Pending receipt of the relevant Approvals, Project Sea Dragon Pty Ltd expects to make a final investment decision on Stage 1 Legune Grow-out Facility in mid-2016, and Financial Close in the 4th quarter of 2016. Construction of the first 1,080 ha of ponds is anticipated to begin soon after during the dry season in mid- 2017; with the first stocking of farms expected in late 2018 (calendar years).

Financial modelling on the project to date has assumed a nominal 25 year operating life. However, there is nothing in the proposed assets, facilities design, breeding program and operating plan which would prevent the business from continuing for a significantly longer period.

2.3 Locality

The Stage 1 Legune Grow-out Facility is proposed to be located at Legune Station in the Northern Territory. Legune Station comprises NT Portion 798 and Portion 3222 in the Victoria River District. Legune Station is currently used for cattle grazing under a pastoral lease. The pastoral lease has an area of approximately 189,000 ha and the land is located near the western border of the Northern Territory. Road access to the site is from Western Australia. The nearest town, including police, fire and emergency services is Kununurra (106 km by road). The nearest port is Wyndham (212 km by road). The project is located wholly within the Victoria Daly Local Government Area. The location of the site is shown in **Figure 1.1**. The location is described in latitude and longitude in **Table 1.3**.

Table 1.3 Latitude and Longitude

	Latitude			Longitude		
Location	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
1	-14	58	35.422	129	24	53.784
2	-14	59	54.069	129	25	16.8
3	-15	1	16.405	129	25	17.216
4	-15	3	19.929	129	24	56.157
5	-15	3	19.927	129	23	55.849
6	-15	9	27.405	129	23	56.598
7	-15	13	10.791	129	27	40.112
8	-15	14	49.124	129	24	7.994
9	-15	14	46.582	129	21	22.736
10	-15	15	21.24	129	20	5.741
11	-15	17	42.46	129	18	34.948
12	-15	23	3.758	129	15	11.773
13	-15	23	3.013	129	15	8.535
14	-15	18	44.546	129	17	28.937
15	-15	15	43.175	129	15	47.512
16	-15	14	57.456	129	16	15.604
17	-15	12	33.661	129	20	19.859
18	-15	12	23.564	129	20	29.236
19	-15	12	22.779	129	22	22.873
20	-15	11	29.479	129	23	3.536
21	-15	3	19.908	129	23	2.823
22	-15	3	19.85	129	20	27.277
23	-14	59	36.391	129	18	57.767
24	-14	58	56.302	129	19	35.619
25	-14	57	18.608	129	23	58.088

2.4 Land Use History

Legune Station has historically been used for cattle grazing under a pastoral lease and was originally an outstation of the Victoria River Downs Station. The improvements on the land include dwellings and farm sheds,

cattle yards, stock watering points, paddocks and fencing, and a 50,000 megalitre freshwater dam constructed on Forsyth Creek that is used for irrigation of pasture during the dry season. Current pastoral operations are illustrated in **Figure 1.2**.

2.5 Regulation

The Stage 1 Legune Grow-out Facility will be subject to Commonwealth and Northern Territory jurisdiction. Approvals, permits and licences under Commonwealth and Northern Territory legislation will be required as described below. To reduce the duplication in regulation, Project Sea Dragon Pty Ltd is anticipating that the project will be assessed in accordance with the Bilateral Agreement between the Commonwealth of Australia and the Northern Territory of Australia (11 December 2014).

2.5.1 Commonwealth Legislative Requirements

The Stage 1 Legune Grow-out Facility will require approval under the EPBC Act due to the potential for impact on matters of national environmental significance. Other relevant Commonwealth Government legislation and permits which may apply include:

- *Australian Maritime Safety Authority Act 1990*
- *Marine Safety (Domestic Commercial Vessel) National Law Act 2012*
- *Native Title Act 1993*
- *Commonwealth Quarantine Act 1908*
- *Export Control Act 1982*

2.5.2 Northern Territory Legislative Requirements

Project Sea Dragon has been accorded 'Major Project Status' through the Department of Chief Minister.

This NOI has been prepared for the NT EPA. The NOI represents an initial statement of advice to the Northern Territory Government and is intended to initiate the environmental assessment process. It is anticipated that the Stage 1 Legune Grow-out Facility will be assessed by the NT EPA via an Environmental Impact Assessment (EIA) process in accordance with the *Environmental Assessment Act* and the subordinate Environmental Assessment Administrative Procedures.

The Stage 1 Legune Grow-out Facility is located on a pastoral lease. Under the *Northern Territory Pastoral Land Act* pastoral leases are intended primarily for pastoral purposes, but also allow for other activities to be established to improve economic viability. An application will be made under section 86 of the *Northern Territory Pastoral Land Act* for a non-pastoral use permit which will allow the use of part of the pastoral lease for non-pastoral purposes (i.e. aquaculture).

The Stage 1 Legune Grow-out Facility is also located on land that is unzoned. Unzoned land is not subject to land use controls under the NT *Planning Act*. The exception to this is the subdivision of land that is controlled by the *Pastoral Land Act* to facilitate a non-pastoral land use which requires development consent under the *Planning Act.* The subdivision of Legune Station is not proposed as part of the project and therefore the *Planning Act* does not apply to the project.

Other Northern Territory legislative consents and licenses which may be required include:

- a sacred sites clearance from the Aboriginal Areas Protection Authority (AAPA) under the *Northern Territory Aboriginal Sacred Sites Act*
- a waste discharge licence pursuant to section 74 of the *NT Water Act*
- a licence to take or use surface water pursuant to section 45 of the *NT Water Act*
- an aquaculture licence in accordance with the *NT Fisheries Act 1988*, Fisheries Regulations and subordinate legislation.
- a permit for the clearing of native vegetation for non-pastoral use in accordance with the *NT Pastoral Land Act*
- an environmental protection licence under the *NT Waste Management and Pollution Control Act.*

Relevant Northern Territory government legislation which may apply includes:

- *Bushfires Act*
- *Control of Roads Act*
- *Heritage Act*
- *Food Act*
- *Parks and Wildlife Conservation Act*
- *Pastoral Lands Act*
- *Public and Environmental Health Act*
- *National Environment Protection Council (Northern Territory) Act*
- *Soil Conservation and Land Utilisation Act*
- *Waste Management and Pollution Control Act*
- *Weed Management Act*
- *Work Health and Safety Act*

2.5.3 Local Government Legislative Requirements

The proposed action is located within the Victoria Daly Regional Council Local Government Area. No local government consents or licences are anticipated to be required for the development of the Stage 1 Legune Grow-out Facility.

Figure 1.1 Project Sea Dragon Stage 1 Legune Grow-out Facility Context

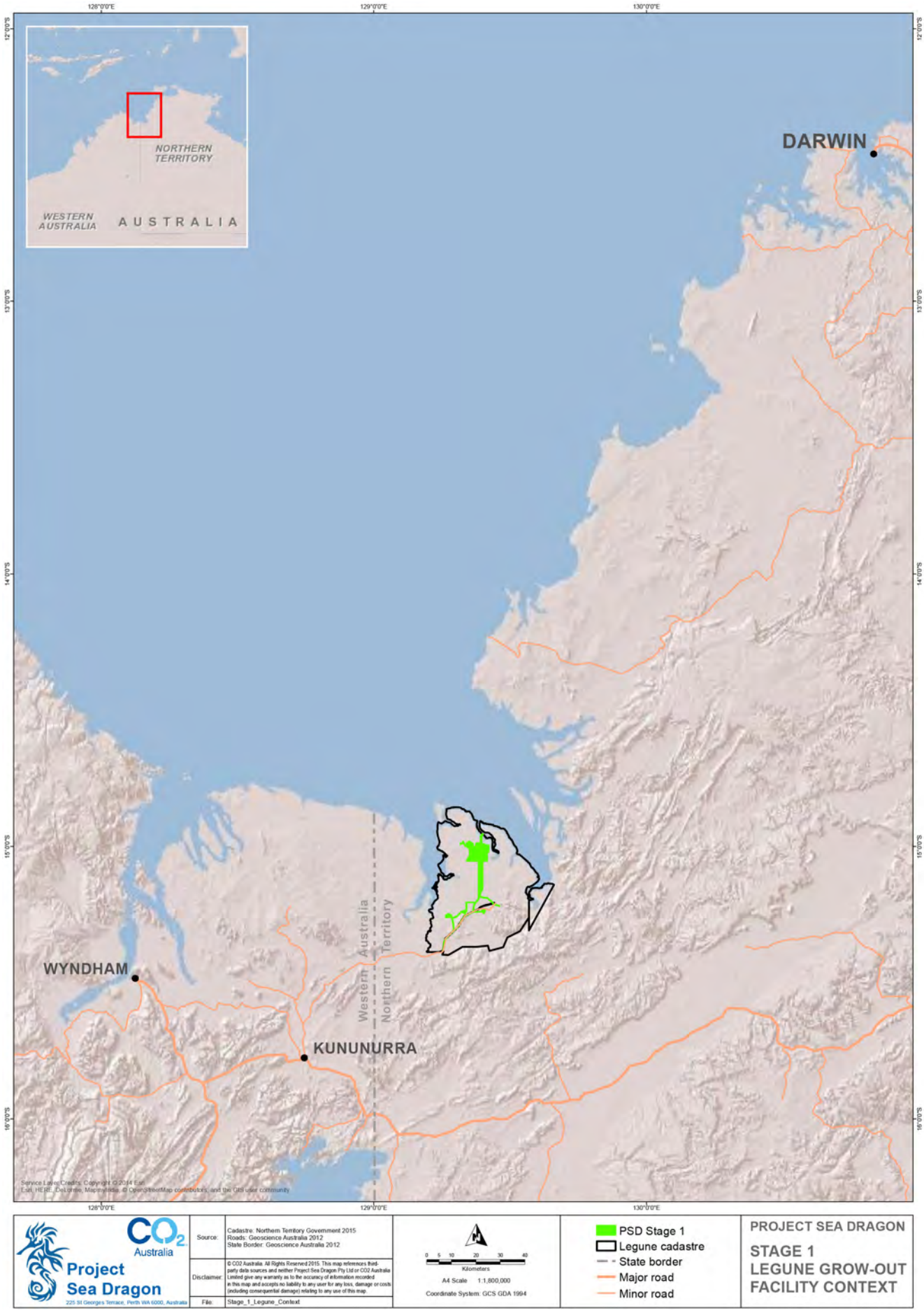
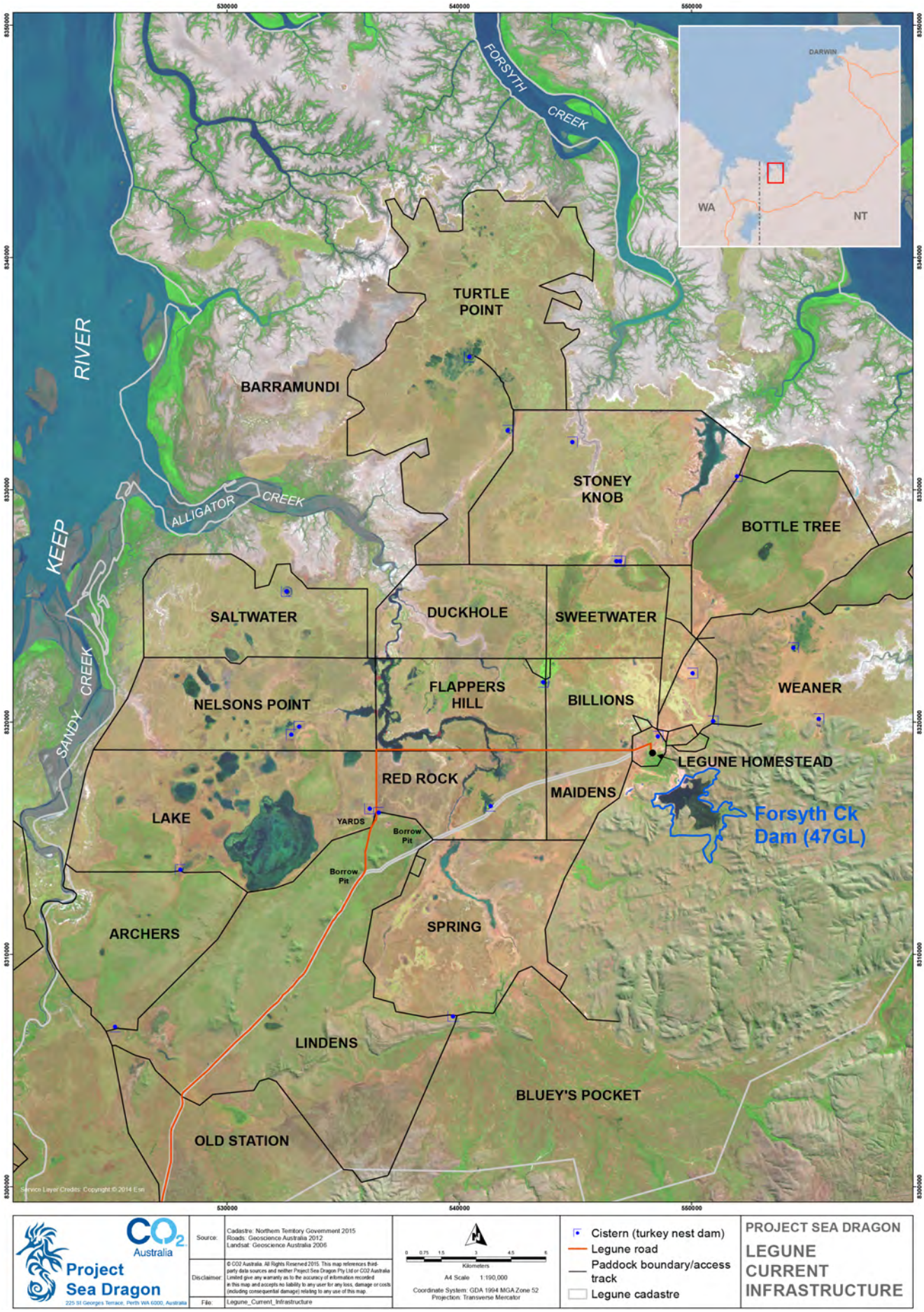


Figure 1.2 Legune Station – current pastoral operation



3 Project Description

3.1 Overview

The Stage 1 Legune Grow-out Facility involves prawn production on 1,080 ha of land-based ponds, producing nominally 12,000 tonnes per annum of prawns. Development of the Stage 1 Legune Grow-out Facility will include the following:

- three farms with a total productive area of 1,080 ha
- internal farm recycling ponds (IFRP) of 324 ha
- an intake structure and pump station at Forsyth Creek suitable for operating seawater intake pumps
- an intake settlement basin
- a main feeder canal (MFC) for the delivery of seawater
- a freshwater feed channel to deliver freshwater to each farm
- a main discharge canal (MDC)
- an environmental protection zone and constructed wetlands (EPZ)
- a power plant footprint and installation of an initial power generation capacity to meet 12 MW of peak demand at the Grow-out Facility
- a barge landing in Forsyth Creek as temporary works for construction
- diesel and LNG supply and storage infrastructure (suitable for Stage 1 generation) to the power generation facility
- diesel supply and storage for light and heavy vehicles
- a central village at Legune (refer to section **3.2.11**), and distributed on-farm accommodation.

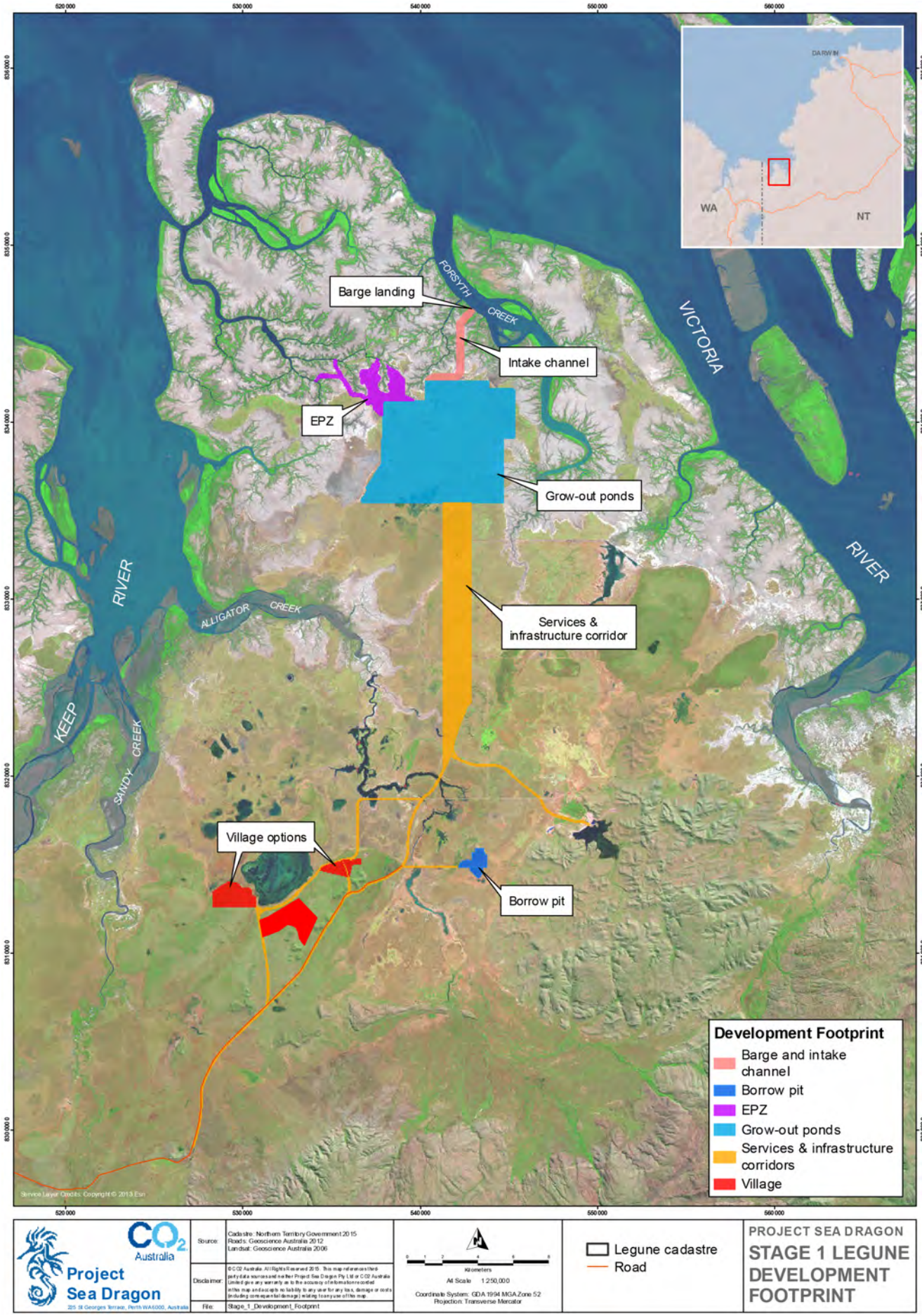
The Stage 1 Legune Grow-out Facility project elements are depicted in **Figure 1.3**. The total footprint for the Stage 1 Legune Grow-out Facility is approximately 8,567 ha as outlined in **Table 1.4**. Detailed descriptions of each component of the Stage 1 Legune Grow-out Facility, including operational matters, are provided below.

Table 1.4 Stage 1 Legune Grow-out Facility Footprint (ha)

Project Component	Area of Footprint (ha)
Grow-out ponds and associated bunds and channels (includes farms of 1,080 ha and IFRP of 324 ha)	4,751
Barge and intake channel	232
Environmental protection zone	485
Accommodation village (3 options - each 106 ha)*	106
Power station, including photovoltaic (PV) solar arrays	164
Quarry, borrow pits	140
Service corridors	2,689
Total	**8,567**

*Each 106 ha potential accommodation village site will be assessed as part of the EIS, however, only one site will ultimately be developed.

Figure 1.3 Project Sea Dragon Stage 1 Legune Grow-out Facility Development Footprint



3.2 Project Components

3.2.1 Grow-Out Facility

Project Sea Dragon has identified land on Legune Station in the Victoria River District, as being the most suitable for the Grow-out Facility.

All of the project elements to be situated on Legune Station are collectively referred to as the “Grow-out Facility”. The Grow-out Facility includes the Grow-out Centre as well as the EPZs and the entire ancillary infrastructure to support the Grow-out Centre (e.g. roads, canals and channels, power plant and accommodation facilities).

A significant proportion of the site is floodplain which is fed by annual rainfall and by two creeks. The siting, design and operation of the grow-out facilities will respond to the environmental features associated with the floodplain and surrounds.

For Stage 1 the grow-out ponds will occupy about 1,080 ha of the floodplain. A further 7,593 ha of largely contiguous area will be required for the barge and intake channel, EPZs, biosecurity buffer zones, water storage, water access canals, accommodation village, power station, quarry, borrow pits and service corridors.

These requirements amount to approximately 4.5% of the area of the current pastoral lease. Although some of the pastoral areas will be displaced by the project’s footprint, the stocking rate will be adjusted accordingly, and the remaining land on the station will continue to support a viable pastoral operation.

3.2.2 Grow-Out Centre

The grow-out operations occur within the Grow-out Centre, which will be laid out as three farms. Each farm has 36 grow-out ponds of 10 ha each in area for a total 360 ha of grow-out ponds per farm. In addition to grow-out pond area, each 360 ha farm includes a further IFRP designated for recycling of pond water as an environmental management strategy, equating to 108 ha per farm, or approximately 30% of grow-out pond area.

A pump station and pipes will deliver estuarine saltwater to a settlement pond. Seawater will then be pumped into a MFC which will deliver seawater to the farms. Seawater at each farm will be filtered and then distributed to ponds via channels within the farm. Freshwater will be piped to each farm and mixed at this point to achieve the desired salinity.

The settlement pond is expected to accumulate fine sediments and require occasional cleaning by suction dredging. The settlement pond will be designed to have separate chambers or sub-ponds to allow the cleaning to occur without interrupting seawater pumping operations. Recovered sediment will be delivered to approved reclamation areas.

3.2.3 Pond Design

Ponds will be designed to be 10 ha in area, approximately 316 m x 316 m and 1.5 m deep each. Ponds are to be unlined and formed from cut/fill of floodplain soils, with the surrounding earthen berm built to be capable of handling vehicle traffic year-round.

An allowance will of an additional 0.7 m be made in the berm height to allow for freeboard to accommodate wet season storms and water balance.

The ponds will be aerated at selected times to enhance animal growth.

Ponds will be emptied during harvest of the prawn crop, with water diverted through the farm’s environmental treatment systems and recirculated. The timing of harvests will be staggered across the ponds and farms, allowing for:

- the target prawn size per market demand
- ‘smoothing’ of the workforce demand
- the peak design capacity of the processing plant and transport chain

Ponds will be left fallow after a harvest when drying out is possible. Once dry the ponds will be tilled, cleaned of any solid wastes and contoured, ready for re-filling and preparation for re-stocking (refer to section **6.3.2.1**).

Solid wastes from the centre mound in the dried-out pond will essentially comprise fine sediments and nutrient rich biological matter. This material will either be ploughed into the pond or stockpiled, dried and taken to approved reclamation areas for beneficial use, such as in the control of pastoral areas erosion.

3.2.4 Farming Process

Prawns will be delivered from a hatchery as small post-larvae (<0.1 gram) and grown out to market size (22-45 grams). This growth period will vary from 90-175 days. At desired size, prawns will be harvested and sent to the processing plant for processing and packaging.

3.2.4.1 Feed

Prawns will be fed a specific diet three to four times a day during grow-out, according to prawn size, maturity and feeding pattern preferences.

Feed will be propelled into the pond using motor-driven blowers. Feed is one of the major costs of production, and feed consumption by the prawns is measured at each feed, while prawn growth rates are monitored regularly. This feed management helps the farm minimise feed wastage and maintain good feed conversion ratios.

The feed used comply with the requirements of the Seafarms Ethical Sourcing Manual and will be either Australian Quarantine Inspection Service (AQIS) approved, or have been produced by a manufacturer that operates in compliance with the requirements of quality standard AS/NZS ISO 9001:2008, or the international equivalent ISO 9001:2008.

3.2.4.2 Water Management

Water inputs to the farm are from two primary sources, estuarine and fresh water. Incident rainfall and local flood-lifting will provide a secondary input. Estuarine water will be pumped into the intake settlement pond during periods of high tide, to minimise the sediment load and to reduce electricity demand and hence environmental impact associated with pumping.

Fresh water will be required to manage salinity fluctuations in the ponds, and help reduce estuarine water turnover and discharge. Fresh water will be delivered from the existing dam via channel, and then reticulated individually to farms by pipeline.

A preliminary probabilistic water balance model (GoldSim) has been run for the Full Scale project considering:

- seasonal effects of rainfall and evaporation which cause fluctuations in salinity
- production life cycle and salinity limits as they affect prawn development and production
- changes in salinity in ponds resulting from mode of operation, incident rainfall and evaporation
- freshwater storage and reliability.

Water flows within the system can be characterised by **Figure 1.4**.

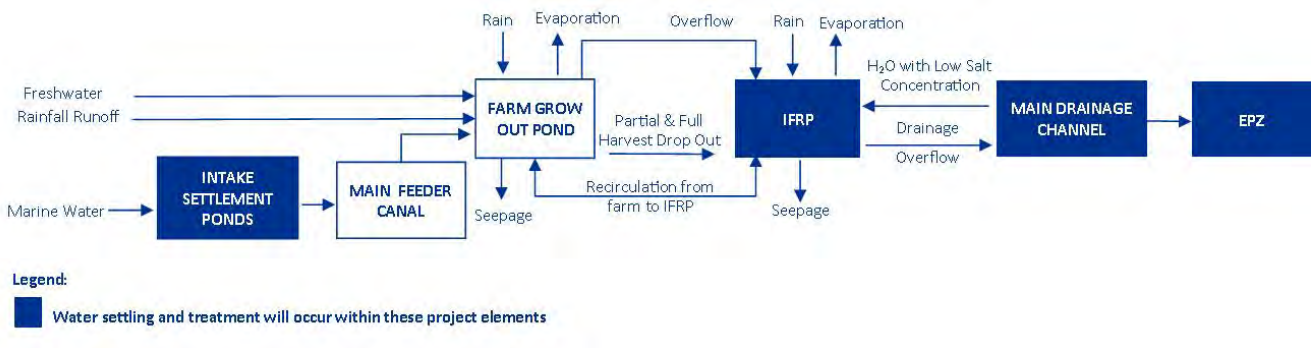


Figure 1.4 Schematic Representation of water flow in the Grow-out Centre

Pond and IFRP seepage is expected to be negligible, as these structures will be built in surface clay materials.

Water exchanges in ponds will be variable. Protocols will be based upon minimising water exchanges, however the pumping capacity and channel capacity must be designed for maximum likely requirements, which are:

- All of farm to be filled within seven days; i.e., ~ 8 m^3/sec required into farm; ~ 1.7 m^3/sec required into each pond.
- Pond fills will be based on end of channel fill. Six ponds in any sector need to be filled at the same time (i.e. the furthest from the inlet). ~ 1.7 m^3/sec required into each pond.
- Normal pond exchanges based on partial harvest refill requirements. 6 x 30% x 12 hours into each sector, ~ 1 m^3/sec required into each pond.
- Water from MFC will be supplied via gravity through drum/disc filters – 8 x 1 m^3/sec capacity filters. Filters can be removed after initial fill and utilised either on the next farm or on the recirculation system.
- Water from IFRP (recycled) will be supplied via gravity through drum/disc filters – 8 x 1 m^3/sec capacity filters. Filters can be removed or installed based on water demand and utilised either on the next farm or on the intake system.

Each farm will include an IFRP for storage, settling, treatment and return of water to the farm feed channel for re-use.

The IFRP will be the size of an area equivalent to 30% of farm ponded area. IFRP depth will be less than 2.5 m to ensure that the IFRP base is not excavated into any potential acid-sulphate soils (PASS).

The IFRP will be set at an elevation, nominally one meter lower than the ponds, to maximise the ability to harvest ponds without restrictions, whilst also allowing for high rainfall events. The IFRP will be designed with splitter dykes to maximise the residence time and maximise the settlement of suspended solids.

Each recirculation pump station will be sized to handle water for re-use at a rate of 11 per cent of total farm volume per day.

Any excess water will be discharged to the outfall channels (MDC). The MDC will be routed to the wetland treatment areas (EPZ) The EPZ will slow the discharge to the selected receiving water body, to provide nutrient stripping which will aid mangrove growth additional to that achieved in the IFRPs.

Depending on the amount of suspended sediments in the system it is expected that the IFRPs may require sediment removal every few years, either by tracked equipment in the dry, or by suction dredging methods in the wet. Any sediment recovered from these activities will be taken to approved reclaim zones within the property. After curing for sufficient time it may be returned to the pond walls as topsoil to encourage vegetation growth and reduce erosion or alternatively used in other beneficial ways such as soil enhancement in the marginal pasture areas or as inclusion in future pond walls.

3.2.5 Water Requirements

While prawns require saline water, necessitating the use of estuarine water intake, freshwater input is an important aspect of project design allowing an emphasis on biosecurity, recirculation of water and reducing discharges and nutrient loads to the environment. A water balance model has been developed which takes into account farm operations and expected seasonal conditions to generate water demands. Based on the preliminary salinity and water modelling undertaken the expected required freshwater and estuarine water volumes for the Stage 1 Legune Grow-out Facility have been estimated as:

- 15 gigalitres of freshwater, and
- 42-45 gigalitres of marine water.

The site has sufficient freshwater capture and storage to support Stage 1 in the current Forsyth Creek dam, which holds 42-45 gigalitres. This structure was forecast to fill approximately seven out of every ten years. Anecdotal evidence suggests that it has filled seven times since it was completed in 2006, and in the years that it did not completely fill, it was close to filling. Under current practice by the existing owners of Legune Station the dam has been emptied each year in the dry season to extend the pasture through flood irrigation. Accordingly, for Stage 1 no additional fresh water capture will be sought or required.

3.2.6 Internal Farm Recycling Ponds and Environmental Protection Zones

The EPZ will provide a buffer between the regular daily discharge for the farms and the tidal fluctuations in the receiving body of water. These movements of water are shown in **Figure 1.4.**

The project will employ two main strategies to minimise the impact of tail-waters on the wider receiving environment. These are:

- high levels of re-use/recirculation of water within the growing system (IFRPs)
- use of EPZ, which include settlement areas.

These strategies as combined within the proposed design represent world's best practice for a 'green-water' prawn production system.

The recirculation of water within each farm, as specified in the Basis of Design, will have a daily capacity of 11% of total pond water volume. This approach is designed to achieve two environmental outcomes. The first is to reduce the overall requirement for water within the production system; noting that most water loss is through evaporation and freshwater is used to replenish this evaporative loss. The second is to manage nutrients as a part of the microbiology of the ponds.

Settlement ponds are widely used in the aquaculture industry, primarily to reduce total suspended solids. Preliminary sampling undertaken for this project suggests relatively high naturally occurring Total Suspended Solids (TSS) in the surrounding estuarine environment so that incoming water will need to be managed to reduce the TSS load. Settlement ponds will be located within the EPZ's. With the settlement ponds in place the impact to the wider receiving environment from TSS is expected to be minimal.

The proposed EPZ's are intended to settle and bioremediate water prior to release. Since it is anticipated that immediately upon release from the settlement ponds, the water will have nutrient (nitrogen and phosphorous) levels somewhat elevated above background, the design incorporates the use of planted mangroves and other suitable plants to biologically strip and recirculate nutrients. This biological approach has been demonstrated in a variety of contexts.

The wider receiving environment has significant mixing and assimilative capacity for nutrients. Thus again two outcomes are anticipated from this approach:

- an increase in the mangrove habitat, intended to reduce and stabilise existing scouring
- minimal impact of the activity on the wider receiving environment.

3.2.7 Power Requirements

Grow-out ponds will be aerated, and water circulated, to maintain dissolved oxygen levels in the water above critical thresholds. Aeration will be the biggest power user in Grow-out Facility. The Grow-out Facility will require installed power of circa 9 kW/Ha, which translates to an on-property requirement for installed capacity of 10-12 MW at Stage 1, preferably powered by gas rather than diesel. Power demand and consumption requirements for the Legune Grow-Out Facility at Stage 1 are estimated to be:

- 12 megawatts peak capacity
- 76, 000 Megawatt hours per annum consumption.

Power for the project will be provided by the proponent or by an independent power producer (IPP). For the Grow-out area the power generation will comprise:

- multiple dual fuelled engines running nominally 30% diesel and 70% LNG
- solar PV generation without battery storage, for daily reduction of LNG and diesel consumption.

Project Sea Dragon is well placed to seek LNG supplies for Stage 1 of the project, whereby LNG will be trucked to the site if the roads have been developed for all-season access in time for Stage 1 production.

An onsite storage tank would likely be installed, to receive LNG pumped out of road iso-tankers or the barge mounted tankers. LNG may also be trucked to wherever the processing plant is located. Surplus cold energy from the liquefaction process would provide a basis for the cold stores and ice-making plant.

The project is situated in the Bonaparte gas basin, and is on and adjacent to current exploration leases. At later stages of expansion there is a realistic prospect that the power station could be fed by onshore gas wells and the LNG transport discontinued.

3.2.8 Access and Traffic

On the property, link roads and farm roads will be constructed to provide links within and between farms. Link roads (between farms and key infrastructure) will be sealed where all-weather access is required for highway trucks and high axle load vehicles. Other roads will be unsealed, unless specifically justified. Farm roads will be constructed on the trafficable bunds forming the ponds, channels and environmental treatment areas.

It will be necessary to upgrade the Legune main road (also known as Weaber Plain/Cave Spring Rd) and to build culverts and bridges. This is necessary for the initial construction phase to provide all season access to Legune ahead of the bulk of the farm development works, as well as during operations for the transport of:

- harvest to the Kununurra processing plant
- feed to Legune
- energy supplies
- staff for the Grow-out Facility.

Indicative freight volumes at Stage 1 scale are shown in **Table 1.5**.

Table 1.5 Indicative Weekly Road Freight Demand at Stage 1

Tonnes per Week	Commodity	Origin to Destination
400	Feed	Wyndham or Darwin to Legune
300	Fossil fuel	Wyndham or Darwin to Legune
270	Harvested prawns, plus brine slurry	Legune to Kununurra
300	Frozen prawns	Kununurra to Wyndham

3.2.9 Port/Barge Facilities

3.2.9.1 Barge

A barge landing could be constructed on Forsyth Creek as part of the Stage 1 Legune Grow-out Facility, and hence will be assessed. Barging operations may be utilised during construction, and possibly during operation. If LNG supplies are available for Stage 1, iso-tankers could be barged into Legune from Darwin also.

3.2.9.2 Port

The Port of Wyndham will be utilised for feed transport, product transport and possibly energy supplies. The Port of Wyndham is the only established port in the region, unless all feed, energy and product is transported by road via Kununurra to and from Darwin.

3.2.10 Processing Plant

The processing plant will be capable of processing 45 tonnes of prawns per day. It is proposed to be located in an appropriately zoned location in the Kununurra environs.

3.2.11 Accommodation

3.2.11.1 Manpower Design

The operating phase workforce for Stage 1 Legune Grow-out Facility (3 farms) is expected to be domiciled thus:

- Legune on-farms: Farm Manager only

- Legune central village: 100 staff plus contractors.

The Legune central village shall be designed to cater for:

- operations staff
- any ongoing construction workforce
- contractors and service providers.

The Kununurra accommodation facilities shall be designed to cater for:

- some FIFO operations staff
- any ongoing construction workforce for the processing plant
- contractors and service providers.

3.2.11.2 Workforce Source

It is Seafarms intent to preference local employment wherever possible and to put in training programs to assist with this aim. Seafarms will also seek to maximise local indigenous employment.

The Grow-Out Centre workforce is expected to come from a mixture of sources, including:

- permanent staff, relocated to Legune, with village and on-farm accommodation
- local indigenous
- local directly employed staff, accommodated in the Legune village or on-farm
- local contractors, accommodated in the Legune village
- fly-in/fly out staff and contractors.

If required, other options will be pursued.

3.2.11.3 Central Village Design

A central village will be constructed to accommodate employees and contractors working in the central facilities and transport system, i.e., those not domiciled on-farm or at Kununurra. The facilities will be designed to minimise staff turnover. The village will comprise:

- ensuite portable accommodation
- central mess
- wet mess
- central toilet block near mess hall
- village admin unit
- laundries
- recreational facilities
- water treatment plant for potable water supplies.
- wastewater treatment plant
- vehicle parking.

Some houses may be provided for selected senior staff that elect to bring families. The central mess shall be designed to be the emergency response centre and location where staff will be moved to in the event of cyclones and/or flooding.

3.2.11.4 Farm Accommodation Design

One three bedroom house will be constructed for each pair of farms, to accommodate the farm manager. Bunkhouse accommodation will be provided for up to 8 over-night/short stay farm staff when not staying at the central village.

Potable water supplies to each pair of farms shall be developed by treatment of farm water delivered from Forsyth Creek dam.

Sewage from the farm facilities shall be treated by packaged plant, and disposed of by periodic truck pump-out back to the treatment plant at the Central Village.

Whilst the accommodation buildings shall be cyclone rated, in the event of cyclones on-farm staff will be required to move to the cyclone shelter at the Central Village.

3.2.12 Site Security

In consideration of biosecurity requirements, the site will be fenced with access subject to strict quarantine measures and designed with local crustaceans, crocodiles, cattle and non-approved human movement in mind.

Biosecurity will be a critical feature of the development and a fully detailed and rigorous biosecurity system will be put in place. Biosecurity infrastructure and protocols will ensure that the risks of transfer of genetic material (into and out of the site) are mitigated. In addition, farms are separated by buffer zones, for internal biosecurity purposes.

The project site will be divided into a series of biosecurity zones, designed to provide an escalating and manageable distinction between risk areas and to manage internal and external biosecurity. Staff will be segregated to designated zones of the facility. A biosecurity pass will be required to travel between zones.

External visitors will require site manager approval, and accompanied by a staff member during site visits. Visitors will be informed via induction about the need for biosecurity, biosecurity zones and standard operating procedures. Visitors will be required to wear the appropriate uniform and boots specific to the zone that they are visiting.

3.3 Project De-commissioning

Whilst there is a limit to the potential for growth of operations at Legune Station due to available freshwater and flat land, at Full Scale Project Sea Dragon elements at Legune Station should continue to be a viable business indefinitely. As such, there is no decommissioning plan as there is no known end date to the business.

3.4 Alternatives

For the Stage 1 Legune Grow-out Facility it will be necessary to upgrade the Legune main road to highway standard, to handle the transport of:

- harvest to the Kununurra processing plant
- feed to Legune
- energy supplies
- staff for the Grow-out Facility.

It is fully intended that the road upgrade will occur in time for commencement of the Stage 1 Legune Grow-out Facility. However, there are contingency plans for an expanded accommodation village and the processing plant to be built at Legune in the event that unforeseen circumstances preclude the finalisation of the road in time for Stage 1 commencement.

In this scenario all major transport of construction materials to Legune could be achieved via barging operations. During operations processed product could also be barged directly to Darwin or Wyndham. Feed could be barged into Legune in bulka bags or containers, from Darwin. If LNG supplies are available for Stage 1, iso-tankers could be barged into Legune from Darwin also.

3.5 Related Development

The Stage 1 Legune Grow-out Facility is a component of a larger project which also comprises:

- a Processing Plant – proposed to be located near Kununurra in Western Australia (WA) if it is not located on Legune Station
- Breeding Program and Hatchery Sites – proposed to be located in the Darwin (NT) environs
- Quarantine, Founder Stock Facility and Back-up Breeding Centre – proposed to be located at Exmouth (WA)
- Export Facilities – proposed to be located at either or both Wyndham and Darwin, and
- Full Scale development (over 7 stages) of the Grow-out Facility on Legune (up to 10,000 ha) including associated onsite and offsite infrastructure.

Approvals for the Processing Plant (if located in Kununurra), Breeding Program and Hatchery Sites, Quarantine, Founder Stock and Back-up Breeding Centre, Export Facilities and subsequent stages of development will be sought separate to this NOI. This is due to:

- the geographical location of offsite facilities and infrastructure required for Stage 1 development and their distance from Legune
- the anticipated relatively minimal impact environmental impacts associated with these other facilities
- the current uncertainty surrounding the exact location of offsite facilities and infrastructure
- the different governmental jurisdictions to other project elements.

Further details of project staging, Stage 1 development (including development in addition to Stage 1 Legune Grow-out Facility), Full Scale development and descriptions of the larger project components are provided below.

3.5.1 Project Staging

Project Sea Dragon is a large-scale, integrated, land-based aquaculture project in northern Australia with the potential at final stage to produce >100,000 tonnes per annum of Black Tiger Prawns generating an export revenue of AUD $1.6 B per annum. However the project will be developed progressively over several stages and it is intended to use Stage 1 of the project to test and refine environmental performance to inform future stages, as well as seek solutions to future water requirements.

There are a number of benefits to staging the development of the project including the learnings obtained from each incremental stage. By committing to Stage 1 (1,080 ha of ponds) Project Sea Dragon Pty Ltd will be in a position to monitor impacts and collect vital data to shape the design and implementation of subsequent stages of expansion. Therefore, the expansion of Project Sea Dragon to Full Scale will be determined by the company as Stage 1 progresses and is subject to:

- the success of Stage 1 operations, and the learnings therefrom, including environmental management
- further statutory approvals
- project cash-flow
- capital funding.

3.5.2 Stage 1

Stage 1 will be located over several sites as described below:

- Grow-out Facility (the subject of this NOI) – proposed to be located at Legune Station (NT)
- Breeding Program and Hatchery Sites – proposed to be located in the Darwin (NT) environs
- Quarantine, Founder Stock Facility and Back-up Breeding Centre – proposed to be located at Exmouth (WA)
- a Processing Plant – proposed to be located near Kununurra in Western Australia (WA), or possibly on Legune Station, and
- Export Facilities – proposed to be located at either or both Wyndham and Darwin.

If located in Kununurra, it is intended that the Processing Plant will be located within land zoned for purpose. The sites for the breeding program facilities near Darwin are yet to be confirmed, but sites that are already permitted for aquaculture are being investigated. The Founder Stock Facility and Back-up Breeding Centre is intended to be located within the existing “Marine Farms” facility at Exmouth and is already owned by Seafarms. The Export Facilities are also intended to be located within already existing facilities. As such, it is anticipated that there will be relatively minor environmental concerns associated with these aspects of Stage 1. Given this, and as the different project elements will be located far away from the operations at Legune Station, this NOI is for the Stage 1 works associated with the Grow-Out Facility at Legune Station only.

3.5.3 Full Scale Expansion of Project Sea Dragon

The Full Scale expansion of Project Sea Dragon is dependent on a number of factors, including the success of Stage 1 operations. At Full Scale the project will include facilities at Legune and across the Darwin, Kununurra, Wyndham and Exmouth environs as described below.

At Legune:

- 27 farms with a total productive area of 9,720 ha
- internal farm recycling ponds of 2,916 ha
- 10 seawater intake pumps, distributed in 2 seawater intake structures (Forsyth Creek and Sandy Creek)
- intake settlement basins
- Main Feeder Canals for the delivery of seawater
- an expanded environmental protection zone and constructed marine wetlands
- an additional dam for freshwater storage and added delivery channel
- Main Discharge Canals
- power generation plant (hybrid) and switchyard to meet peak demand of 90 MW at the Grow-out Facility
- Gas storage infrastructure for Full Scale power generation requirements, or alternatively a local gas wellfield
- diesel storage for all fleet vehicles
- an expanded central village at Legune, and distributed on-farm accommodation

At Darwin:

- a Hatchery able to supply up to 100 million post larvae (PL's) per week
- a Core Breeding Centre
- a Broodstock Maturation Centre

At Kununurra:

- a Feed Mill with total capacity of 200,000 tonnes per year
- a processing plant with a capacity of 400 tonnes per day
- a village for accommodating non-local workforce
- a power plant to supply the processing plant and Feed Mill
- township accommodation, with an emphasis on residential housing integrated with the existing community

At Wyndham:

- a container park for refrigerated reefer containers
- bulk storage sheds for WA grain and imported ingredients for prawn feed

At Exmouth:

- Initial Quarantine and Founder Stock Centre
- a Backup Breeding Centre

3.5.4 Description of Larger Project Elements – Stage 1 and Full Scale

The development of the Stage 1 Legune Grow-out Facility is dependent on the development of a Quarantine and Founder Stock Facility (which will later become the Back-up Breeding Centre), as well as Breeding Program and Hatchery. Export of the product will take place from either or both Wyndham and Darwin. The upgrade of the Legune main road would ensure that the processing plant (and in future stages, a Feed Mill manufacturing prawn feed) would be located at Kununurra, however, should this not occur in time for the proposed commencement of Stage 1, there is a contingency plan to build a processing plant on Legune and utilise barging of product to Darwin. The intermediate expansion steps between Stage 1 and Full Scale have not been defined here in this document.

Descriptions of each component of the larger project outside of the Legune Grow-out Facility as they apply to both Stage 1 and Full Scale development are provided below. **Figure 1.5** illustrates the Full Scale project scope and **Figure 1.6** indicates the location of the main components of Project Sea Dragon.

Figure 1.5 Full Project Sea Dragon project schematic and scope

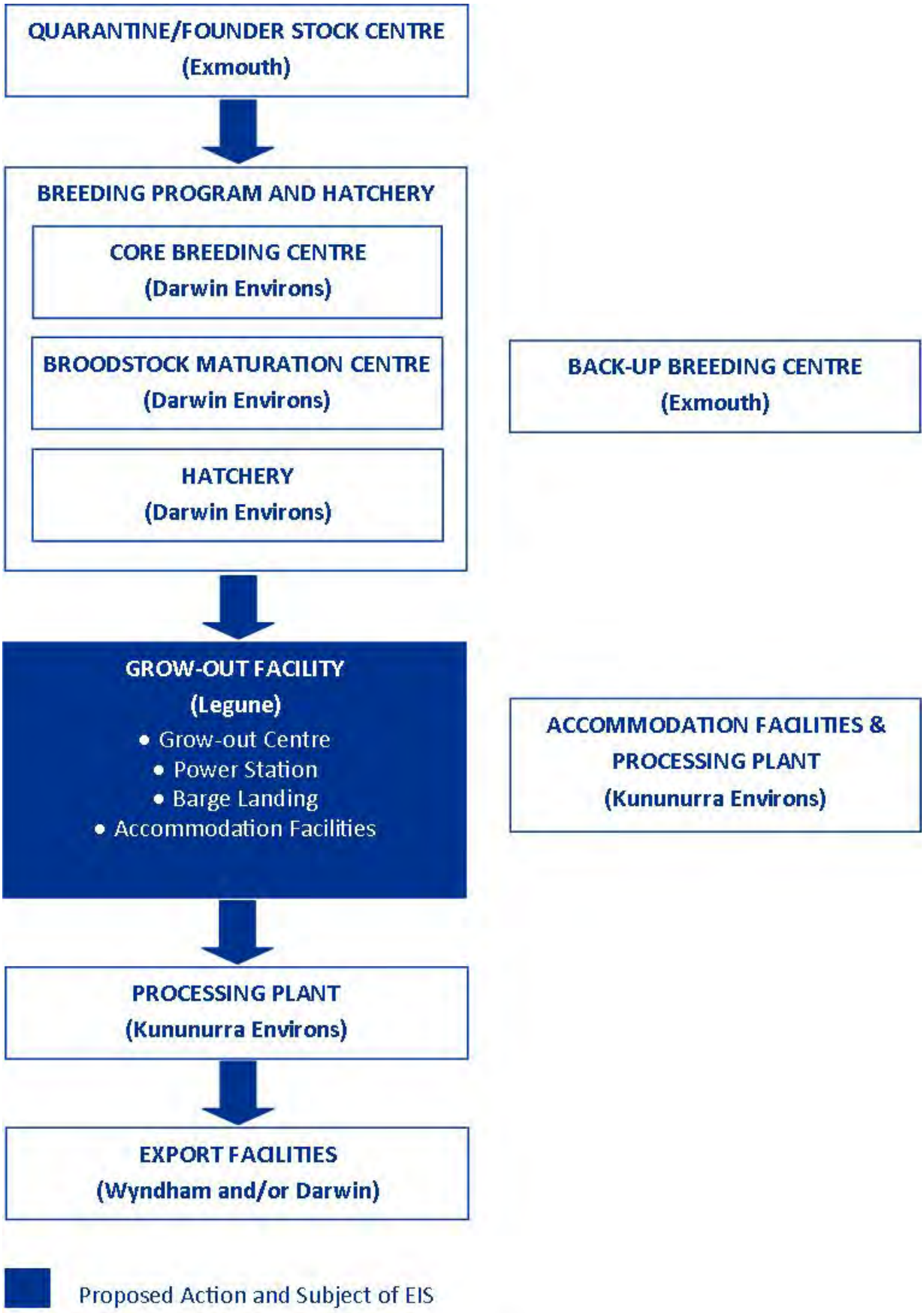
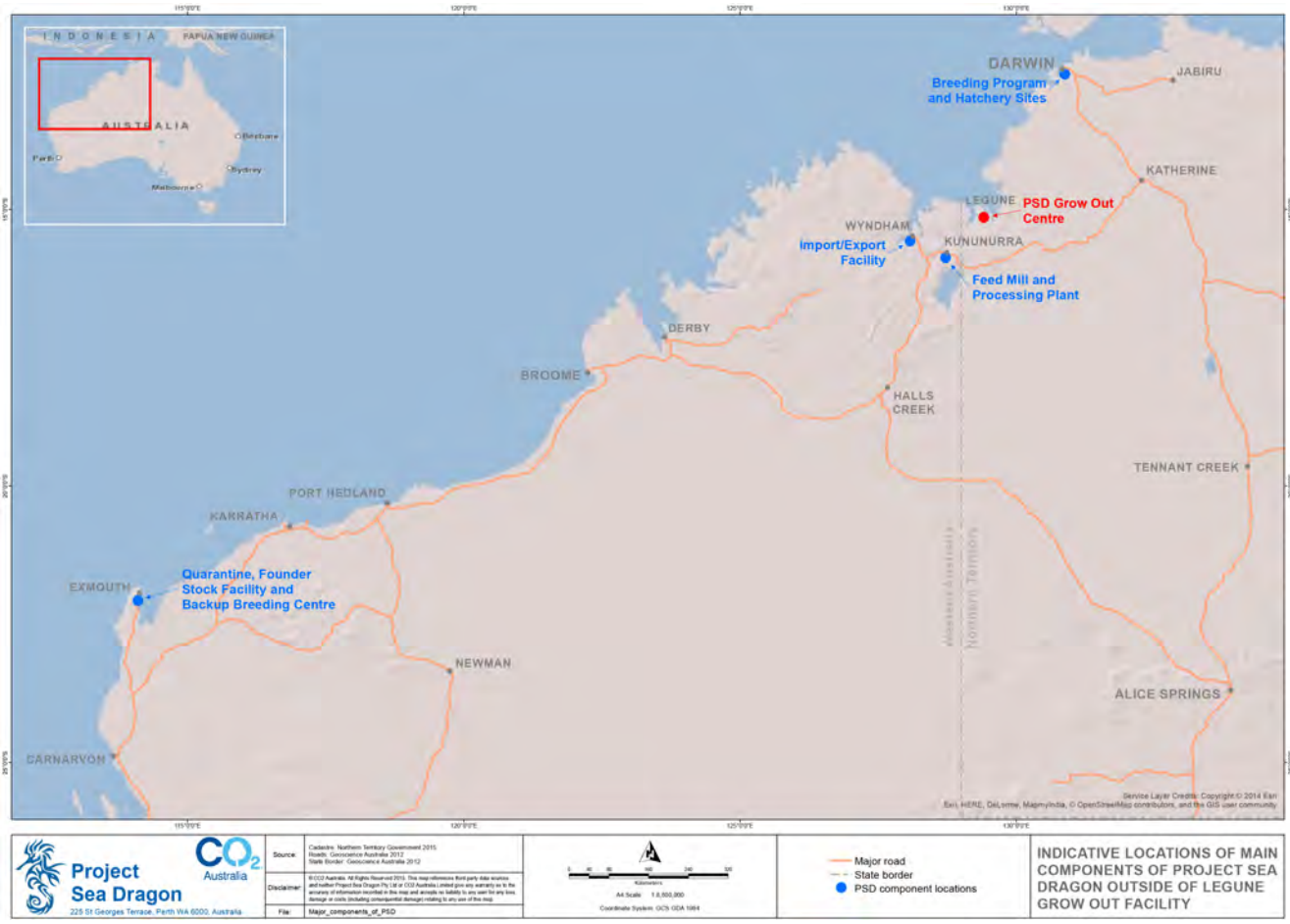


Figure 1.6 Indicative locations of main components of Project Sea Dragon



3.5.4.1 Quarantine and Founder Stock Facility

Investigations have confirmed that the development of a population of founder animals will require recruitment from the wild at sustainable levels. To stock the Founder Stock Centre, there will be between two and four collections of wild catch taken per annum, with the aim of collecting 150 pairs of animals in each collection (that is, the total wild catch per annum will be up to 1200 individuals only). The catch will be conducted using licenced operators. As the founder population is established, the project will reduce requirements for wild caught individuals. Ultimately there will be negligible if any wild caught individuals in the population. A thorough investigation of disease status in wild and domesticated Black Tiger prawn populations has narrowed likely target populations to those from the Northern Territory and Western Australia.

Establishment of a domesticated population of animals free of specific pathogens (SPF), particularly notifiable diseases is feasible, provided Project Sea Dragon uses quarantine facilities within a high biosecurity environment.

A Quarantine and Founder Stock Centre is needed to house the wild caught stock and commence the breeding cycle. The requirement is to screen two generations with disease screening at regular intervals in the life cycle in order to produce Specific Pathogen Free prawns stocks prior to delivery to the Breeding Program facilities.

The Quarantine and Founder Stock Facility will be located at a physically different site to the Breeding Program and Hatchery facilities (described below). The facility is assumed to be built at Seafarm's Exmouth Founder Stock Centre.

Once a domesticated Black Tiger prawn population is achieved, the facility will continue to operate at the Back-up Breeding Centre (described below).

3.5.4.2 Breeding Program and Hatchery

Project Sea Dragon includes a series of Breeding Program facilities (Core Breeding Centre, Back-up Breeding Centre and Broodstock Maturation Centre).

Given the requirements for full-strength salinity seawater, the Breeding Program facilities are likely to be located within the environs of Darwin.

Other company functions to be located in Darwin include central management and planning, procurement and administration, R&D and central laboratory. These may not be co-located with breeding program facilities due to biosecurity requirements.

Core Breeding Centre

The Core Breeding Centre (CBC) will be used for the development, production and selection of high performing prawn stock. This facility will be fully biosecure and managed in accordance with the requirements of the PSD Biosecurity Manual, which meets national and international biosecurity standards. The facility will comprise an appropriate mix of hatchery operations; individual family rearing tanks and grow-out raceways.

The CBC is assumed to be built in the Darwin environs, at a separate location to the other Breeding Program facilities having:

- clean, full strength salinity, stable and secure water supply
- mains power
- a 'normalised' workforce
- existing support and service industries
- proximity to learning centres for training purposes.

Broodstock Maturation

The top individuals within the top families will be used to produce commercial broodstock and in order to meet the broodstock supply objectives a Broodstock Maturation Centre (BMC) will facilitate the required multiplication. This facility will be responsible for the production of commercial numbers of spawners and the focus of the operation (including design) will be to provide spawners that have high levels of performance in the commercial hatchery while carrying the improved traits from the breeding program.

This facility will be physically separate from the CBC but will be in a logistically favourable location to support broodstock supply to the commercial hatchery. The BMC will be fully biosecure and managed in accordance with the requirements of the PSD Biosecurity Manual.

As for the CBC, the BMC is assumed to be built in the Darwin environs, at a separate location to the other Breeding Program facilities.

Hatchery

The Project Sea Dragon hatchery (Hatchery) requires approximately 150,000 broodstock prawns, or around 3,000 per week, from the BMC. These broodstock will be high health, Specific Pathogen Free, of superior pedigree, on-grown to maturity and in breeding condition.

The hatchery will produce approximately 100 million post-larvae (PLs) per week based on a 12 month per annum production cycle, running continuously with rolling dry-outs.

The Hatchery is assumed to be built in the Darwin environs, at a separate location to the other Breeding Program facilities.

3.5.4.3 Transport to the Legune Grow-out Facility

The PL's will be trucked to the Legune Grow-out Facility by SGL or contracted transport units.

3.5.4.4 Back-up Breeding Centre

A back-up facility to the CBC is required (Back-up Breeding Centre or BBC) to retain in a secure environment a population of domesticated and improved stock as a risk-mitigation measure against the catastrophic loss of animals at the CBC. The BBC will be used for the rearing of selected individuals (representative genetic stock) sourced from the CBC.

This facility will be fully biosecure and managed in accordance with the requirements of the PSD Biosecurity Manual, and meeting national and international biosecurity standards. The facility will be located at a physically

different site to the CBC or other Project Sea Dragon facilities. The BBC is assumed to be built at Seafarm's Exmouth Founder Stock Centre.

The BBC will therefore hold a small number of individuals from each family to enable rapid replacement of genetic stock in the event of losses at the CBC.

3.5.4.5 Feed Mill

During Stage 1, formulated feed will be bought from local and international suppliers. Therefore no Feed Mill is required. As the project develops sufficient scale the economics will swing in favour of dedicated a Feed Mill that combines imported and locally grown ingredients into formulated feed. The feed requirement at Full Scale is in the vicinity of 200,000 tonnes per annum.

The Feed Mill would ideally be built at a short distance to the north of Kununurra, possibly co-located with the Processing Plant. The Feed Mill is likely to be developed in 50,000t capacity staged modules to the ultimate 200,000t capacity (for 10,000 ha Grow-out farm capacity). The exact locations of the Processing Plant and Feed Mill will depend on land zoning and availability, the power solution, and the options for workforce accommodation in the town.

3.5.4.6 Processing Plant

At the processing plant prawns will be cleaned, graded, packed, frozen and palletised for transport in refrigerated containers to port.

Harvested prawns will be transported to the processing plant in ice slurry. A key parameter for processing is being able to deliver harvested prawns to the processing plant within a short time, typically 1 to 2 hours, to ensure that processing is achieved within 4-6 hours.

To minimise the long-term dependence of the workforce on accommodation and victualling being provided by Seafarms in a company-run on-site village, Project Sea Dragon would benefit from domiciling as much of the workforce at Kununurra as possible. To ensure that the product is processed in less than 4-6 hours after harvest, it is desirable to build the Processing Plant within a two hour trucking distance from the Legune Grow-out Facility, and within a 30 minute drive or less for the workforce from the Kununurra residential areas. This will allow a 'normalised' outcome for residential living. There may be some requirement for the company to provide bussing for some of the workforce.

The processing plant will be sized and located as follows:

- Stage 1: capable of processing 45 tonnes of prawns per day. The processing plant site for Stage 1 of the project will be sited at Kununurra.
- Full Scale: capable of processing 400 tonnes per day. Located to the north of Kununurra.

4 Existing Environment

4.1 Natural environment

4.1.1 Climate

Legune Station is located in a region that experiences two distinct seasons. The wet season is typified by high temperatures and humidity, and significant rainfall events, with most rain falling between November and April. The dry season, extending between May and September, is characterised by low humidity and temperatures, and very little rain. The closest long-term weather station to Legune is Timber Creek (15º 39.0'S, 130.4808E) located 135 km south east of Legune. Temperature and rainfall statistics from the Timber Creek weather station are presented in **Table 1.6**, **Table 1.7** and **Figure 1.7** (Bureau of Meteorology 2015).

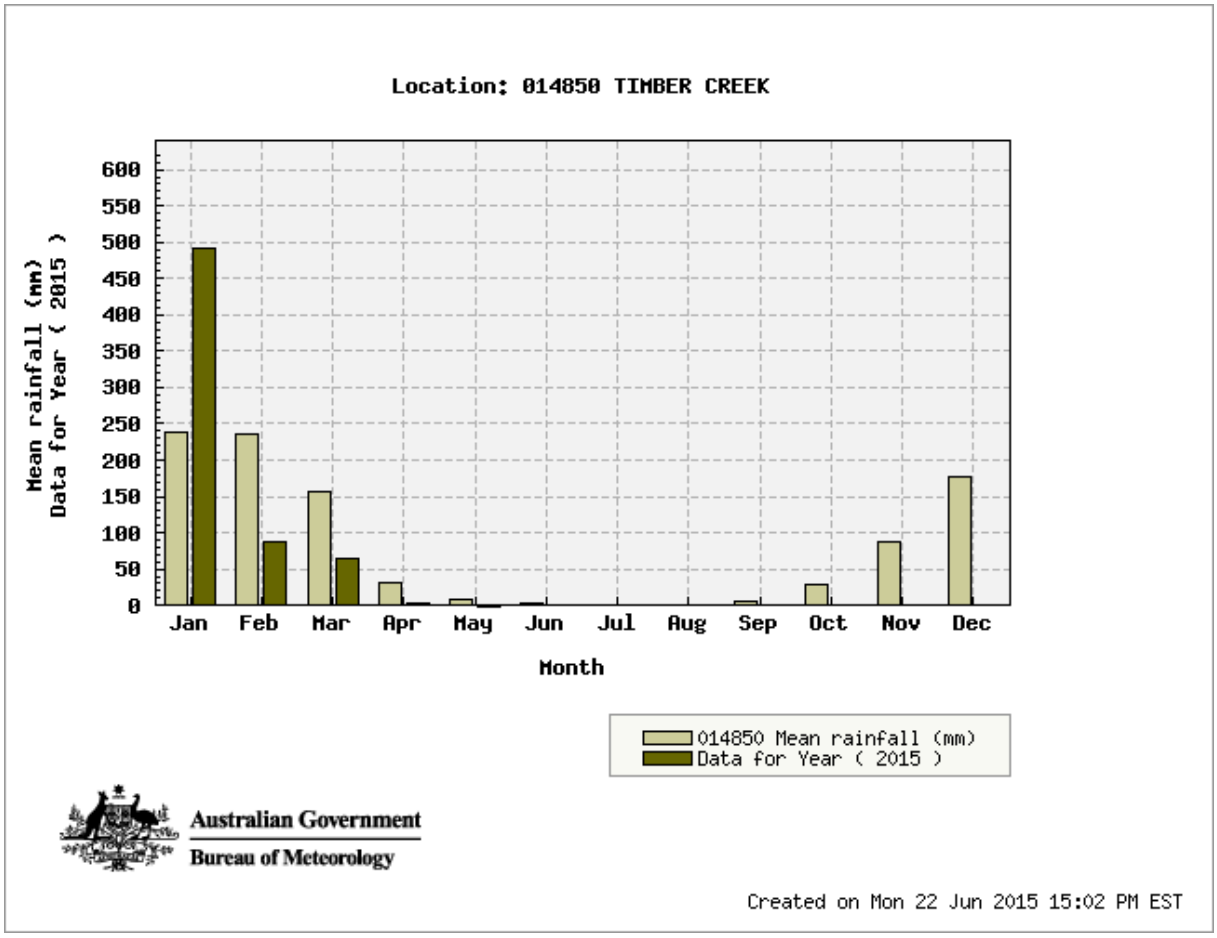
Table 1.6 Timber Creek Climate Statistics

Statistic	Annual Values	Years of Record
Mean max temperature (deg C)	34.9	34
Highest temperature (deg C)	43.7	34
Lowest max temperature (deg C)	16.9	34
Mean min temperature (deg C)	21.1	34
Lowest temperature (deg C)	3.8	34
Highest min temperature (deg C)	33.0	34
Mean rainfall (mm)	978.0	34
Highest rainfall (mm)	1,453.1	34

Table 1.7 Timber Creek mean rainfall (mm) for years 1981 to 2015

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
237.7	236.3	157.5	31.6	7.3	2.5	1.8	0.5	5.3	28.1	87.5	177.1

Figure 1.7 Timber Creek mean rainfall (mm) for years 1981 to 2015 and current data for 2015



4.1.2 Geology, Geomorphology and Soils

The proposed footprint for Stage 1 Legune Grow-out Facility is located on the Auvergne and Port Keats geological sheets as illustrated in **Figure 1.8**. The northern part of Legune Station comprises tidal flats (referred to below as the coastal plain) bordering the Victoria and Keep Rivers. These areas are subject to tidal inundation and consist of poorly drained clays and mud. The majority of the project footprint is located south of the tidal flats in the coastal floodplains (above the areas of tidal inundation) and comprises poorly drained black soils derived from the underlying carbonates or volcanics. These coastal floodplains, or estuarine-deltaic plains, are seasonally flooded and inundated for 3 to 6 months a year. Desiccation cracks and gilgais form on these soils as they dry after the wet season (Dunster *et al.,* 2000). Quaternary coastal alluvium, sheetwash and sheetflood deposits are scattered throughout this area. Other project elements lie to the south-west of the coastal floodplains, within the lateritic plains and rises associated with deeply weathered profiles (laterite) including sand sheets and other depositional products. Within these lateritic plains calcareous sandstone, quartzic dolarinite and leached carbonite rocks of the Burt Range Formation are present.

At the finer scale, the project footprint of Stage 1 Legune Grow-out Facility can be described as being primarily located on a four-tiered series of plains directly on the coast between the mouths of the Keep and Victoria Rivers. Each plain has its own characteristic soils, formation history and vegetation communities. These plains are described below, in increasing order of elevation, from sea level.

The largest of these plains is the coastal plain, which extends from just below sea level to approximately five metres elevation and occupies approximately 60, 000 ha in the general project area. It is formed from Holocene (recent) marine sediments (Dunster *et al.,* 2000), and is actively extending, cutting into the plain above it, the estuarine-deltaic plain. It is characterised by numerous incipient drainage lines usually arranged in a trellis pattern and lined by mangrove low closed forest, dissecting vast areas of bare clay pan and sparsely to densely vegetated samphire forblands. Approximately 690 ha of the project footprint, comprising the Environmental Protection Zone (~480 ha) and the barge and intake channel (~210 ha), are located on the coastal plain.

The estuarine deltaic plain extends from approximately five to ten metres elevation, and is characterised by dark cracking clays. It extends into the coastal plain in a rough delta and was formed in the Cainozoic from river sediments deposited by the Victoria and Keep Rivers (Dunster *et al.,* 2000; Paterson, 1970). The estuarine-deltaic plain is the site of the majority of proposed infrastructure for the Stage 1 Legune Grow-out Facility.

Next in the tiered series of plains is the flood out plain, which occurs in two relatively small areas (approximately 10, 000 ha) between 10 and 20 m elevation. The smallest flood out plain in the project area is located at the point where Forsyth Creek emerges from the ranges (now dammed). The main area of the flood out plain is located in the far south of the proposed project area, where it is traversed by approximately five kilometres of the Kununurra-Legune access road.

This land form comprises a flood plain formed when a tributary of Sandy Creek emerges from the ranges to the south and disgorges onto the estuarine-deltaic plain. Floodwaters fan out and lose energy as they do so, depositing primarily gravel and sand in a fan (because this alluvium covers the plain it disgorges onto, it can also be termed a covered plain). A characteristic of this flood plain is a broad, divergent, multi-channelled and interrupted drainage pattern formed by the deposition of large amounts of alluvium, which persists for some distance downstream, before a single channel pattern reasserts itself. This multi-channelled, interrupted drainage patterns results in the formation of numerous seasonally inundated swamps and flats (Twidale and Campbell, 2005).

Present between 10 and 30 m elevation, the coastal erosion plain is characterised by sandy soils and an undulating surface, punctuated by sandstone rises and low hills, and an absence of defined drainage channels (channels are present but are generally incipient, rapidly mobile and poorly defined). In the vicinity of the Red Rock dam, the coastal erosional plain is represented by rolling sandstone rises to 30 m elevation.

4.1.3 Topography

The elevation across the Stage 1 Legune Grow-out Facility project footprint ranges from just below sea level to approximately 30 metres above sea level.

4.1.4 Surface Water

Alligator Creek, located to the west of the project footprint, has its catchment in the south of the property and runs north west across the floodplain on the western (Keep River) side.

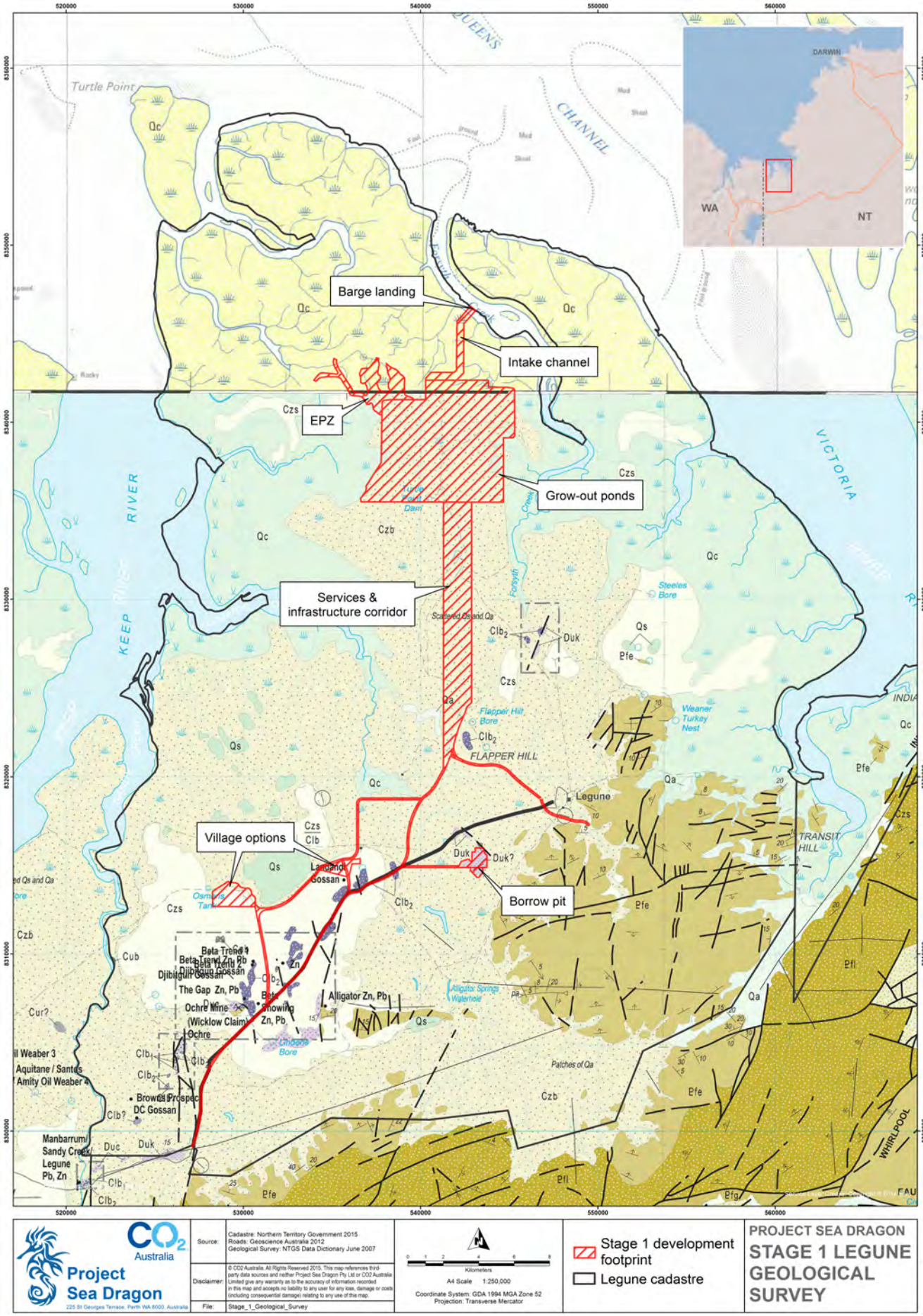
Forsyth Creek, located to the east of the project footprint, has its catchment in the south of the property and runs north across the floodplain on the eastern (Victoria River) side. The creek has a large dam (47,000 ML capacity) on it that is used to extend dry season pasture growth to about 10,000 ha of floodplain via flood irrigation.

Both major creeks are known to have large stream flows on an annual basis, predominantly during the wet, continuing for several months into the dry season. The commissioning of the dam on Forsyth Creek has been found to limit wet season flooding and natural erosion across the eastern area of the floodplain.

4.1.5 Groundwater

The floodplain is subject to annual inundation by wet season rainfall and stream flow from the two main streams that flow onto the floodplain. Additionally, the floodplain is subject to periodic seawater inundation at peak tide events. These factors, combined with the very low relief of the landscape, proximity to the sea and low height above sea level, contribute to a very shallow groundwater table that is saline at depth. For this reason, livestock are watered from large turkey nest dams.

Figure 1.8 Auvergne and Port Keats Geological Sheets – Legune Station



4.1.6 Vegetation and Flora

4.1.6.1 Desktop Studies

A search of the EPBC Act Protected Matters Search Tool (EPBC PMST) and the Northern Territory InfoNet database revealed that no Threatened Ecological Communities are predicted to occur within the Stage 1 Legune Grow-out Facility or surrounds. However, three flora species listed as Vulnerable under the *Northern Territory Parks and Wildlife Conservation Act 2006* were returned from Northern Territory InfoNet database search. One of these, Craven's native hibiscus (*Hibiscus cravenii*) is also listed as Vulnerable under the EPBC Act. The other two species are a ground orchid (*Zeuxine oblonga*), and a platysace, (*Platysace saxatilis*).

4.1.6.2 Field Surveys

Dedicated flora and vegetation surveys undertaken from 1 May 2015 to 10 May 2015, earlier preliminary flora and vegetation assessments as part of the site selection process, and an earlier study of part of the study site (Freeland, 2004) did not locate any of the three threatened flora species predicted to potentially occur on site, and habitat assessments for these species revealed that none of them are likely to occur on site due to a lack of suitable specific habitat requirements and an unsuitable fire regime. **Table 1.8** provides a brief description of the vegetation communities in and around the Stage 1 Legune Grow-out Facility footprint and are derived from the field assessments undertaken between 1 and 10 May 2015.

Table 1.8 Vegetation of the Legune Coastal Floodplain and the Hinterland

NVIS* Level II Vegetation Communities	Surveyed Community Description (NVIS* Level V)	Area (ha)	Condition	Comment
Legune Coastal Floodplain				
Coastal plain: level plain 0-5 m elevation formed from recent deposition of marine sediments, characterised by incipient, trellised drainage lines				
Sparse samphire shrubland	*Suaeda arbusculoides, Tecticornia australasica, T. indica* samphire forbland	41,004	Intact	Includes extensive areas of bare salt pan;
Closed forest/mid-closed forest/low closed forest	*Avicennia marina, Excoecaria agallocha, Ceriops* sp. mangrove low closed forest	18,313	Intact	
Estuarine-deltaic plain: level to gently undulating plain 5-10 m elevation, characterised by cracking clay soils				
Tussock grassland	*Ophiuros exaltatus, Cyperus scariosus, Imperata cylindrica* tall closed tussock grassland	19,252	Intact	Part of an estuarine-deltaic plain grassland mosaic.
Tussock grassland	*Xerochloa imberbis, Sporobolus virginicus, Imperata cylindrica* tussock grassland	18,120	Intact	
Woodland/open woodland	*Melaleuca dealbata, Terminalia platyphylla, Melaleuca leucadendra* low open woodland/woodland	4,586	Modified	Part of an estuarine-deltaic plain woodland mosaic
Sedgeland	*Cyperus scariosus, Schoenoplectus praelongatus, Caldesia oligococca* open sedgeland/tall open forbland	3,999	Intact	Ephemeral wetland
Freshwater lake/lagoon/aquatic plants	*Schoenoplectus littoralis, S. laevis, Oryza australiensis* closed to open sedgeland	2,309	Modified	More or less permanent wetland
Woodland/open woodland	*Corymbia bella, Melaleuca dealbata* woodland/open woodland	747	Modified	Part of an estuarine-deltaic plain woodland mosaic
Woodland/open woodland	*Terminalia platyphylla, Melaleuca dealbata* low open woodland	333	Modified	
Open forest	*Melaleuca leucadendra, Barringtonia acutangula, Pandanus spiralis* fringing open forest/ low open forest	63	Modified	Fringes Forsyth Creek and playas on the edge of the coastal erosional plain
Vine thicket	*Ficus virens, Cochlospermum fraseri, Adansonia gregorii* monsoon vine thicket	22	Modified	A minor component restricted to rocky

NVIS* Level II Vegetation Communities	Surveyed Community Description (NVIS* Level V)	Area (ha)	Condition	Comment
				rises
Hinterland (areas behind the Legune Coastal Floodplain)				
Coastal erosional plain: gently undulating to rolling plain 10-30 m elevation, with steep low hills (to 50 m), characterised by pale to red sandy soils				
Open forest/ woodland/ open woodland	*Eucalyptus tetrodonta*, *E. miniata, E. tectifica* woodland	11,259	Intact or Transformed	Where *Hyptis suaveolens* dominates the ground layer, condition is assessed to be transformed from its natural state, otherwise condition is intact
Woodland/open woodland	*Corymbia bella, C. polycarpa, C. greeniana,* woodland/open woodland	2,573	Modified	
Woodland/open woodland	*Corymbia bella, C. polycarpa, Grevillea pteridofolia* low woodland/low open woodland	226	Modified	
Shrubland	*Calytrix exstipulata, Melaleuca sericea, M. minutifolia* tall mixed species shrubland on rocky rises	177	Modified	Restricted to rocky rises
Flood out plain: gently undulating plain at the foot of ranges 18-22 m elevation, characterised by flood out fans and divergent, interrupted drainage channels				
Low woodland	*Melaleuca viridiflora, M. minutifolia, M. sericea* low woodland	659	Intact	
Sedgeland	*Eleocharis sundaica, Fimbristylis microcarya, Oryza australiensis* closed sedgeland	193	Intact	Ephemeral wetland

* NVIS = National Vegetation Information System (ESCAVI 2003)

4.1.6.3 Weeds

The following plants designated as Class B weeds under the *Northern Territory Weeds Management Act 2001* were observed during the May 1 – May 10 vegetation and flora surveys.

Class B declared weeds were:

- *Azadirachta indica* Neem
- *Hyptis suaveolens* Hyptis
- *Parkinsonia aculeata* Parkinsonia
- *Senna obtusifolia* Sicklepod
- *Sida acuta* Spinyhead sida
- *Sida cordifolia* Flannel weed
- *Sida rhombifolia* Paddy's Lucerne

Caltropis procera is also common but it is only declared in Northern Territory where it occurs south of 16°30' S (Legune is 15°23' S).

No Class A weeds were observed. It should also be noted that in the Northern Territory, all Class A and B weeds are also Class C weeds. No additional Class C weeds were observed.

4.1.7 Fauna

A search of the EPBC PMST and the Northern Territory InfoNet database revealed 59 threatened and/or migratory species that may occur around, or relate to Legune Station and surrounds. Of these, 41 are listed under either the Commonwealth EPBC Act or the *Territory Parks and Wildlife Conservation Act 2006*. The remaining 18 species are listed as migratory under the EPBC Act. Some of the threatened species are also listed as migratory under the EPBC Act. The details are provided in **Table 1.9** below.

It should be recognised that the EPBC PMST predicts which species protected under the auspices of that Act may occur or relate to a site based on bioclimatic modelling. As such, the species returned from the EPBC PMST searches have not necessarily been recorded from the site, and may not be likely to occur on the site. **Table 1.9** provides an assessment of the likelihood of occurrence of the 59 species predicted to occur on, or relate to, Legune Station and surrounds.

Table 1.9 Threatened and migratory fauna species of Legune Coastal Floodplain and marine surrounds

Scientific Name	Common Name	EPBC Act Status	TPWC Act Status	Likelihood of Occurrence
Snails				
Mesodontrachia desmonda	Desmond's Land Snail		Critically Endangered	Site surrounds: Would not occur Site: Would not occur
Birds				
Apus pacificus	Fork-tailed Swift	Marine Migratory		Site surrounds: Possible Site: Possible
Ardea alba	Great Egret, White Egret	Marine Migratory - CAMBA, JAMBA		Site surrounds: Known Site: Known
Ardea ibis	Cattle Egret	Marine Migratory - CAMBA, JAMBA		Site surrounds: Known Site: Known
Calidris canutus	Red Knot	Marine; Migratory Species (Bonn, CAMBA, JAMBA, ROKAMBA	Vulnerable	Site surrounds: Possible Site: Would not occur
Calidris ferruginea	Curlew Sandpiper	Critically Endangered; Marine; Migratory(Bonn, CAMBA, JAMBA, ROKAMBA)	Vulnerable	Site surrounds: Known Site: Unlikely
Calidris tenuirostris	Great Knot	Marine; Migratory(Bonn, CAMBA, JAMBA, ROKAMBA)	Vulnerable	Site surrounds: Known Site: Would not occur
Charadrius mongolus	Lesser Sand Plover	Marine Migratory - Bonn, CAMBA, JAMBA, ROKAMBA	Vulnerable	Site surrounds: Known Site: Would not occur
Charadrius leschenaultia	Greater Sand Plover	Marine Migratory - Bonn, CAMBA, JAMBA, ROKAMBA	Vulnerable	Site surrounds: Known Site: Would not occur
Charadrius veredus	Oriental Plover, Oriental Dotterel	Marine Migratory - Bonn, JAMBA, ROKAMBA		Site surrounds: Possible Site: Would not occur
Erythrotriorchis radiatus	Red Goshawk	Vulnerable	Vulnerable	Site surrounds: Possible Site: Unlikely
Erythrura gouldiae	Gouldian Finch	Endangered	Vulnerable	Site surrounds: Possible Site: Highly Unlikely
Falco hypoleucos	Grey Falcon		Vulnerable	Site surrounds: Possible Site: Unlikely
Falcunculus frontatus whitei	Crested Shrike-tit (northern), Northern Shrike-tit	Vulnerable		Site surrounds: Possible Site: Highly Unlikely
Geophaps smithii	Partridge Pigeon	Vulnerable	Vulnerable	Site surrounds: Possible Site: Highly Unlikely

Scientific Name	Common Name	EPBC Act Status	TPWC Act Status	Likelihood of Occurrence
Glareola maldivarum	Oriental Pratincole	Marine Migratory - CAMBA, JAMBA, ROKAMBA		Site surrounds: Known Site: Possible
Haliaeetus leucogaster	White-bellied Sea-Eagle	Marine Migratory - CAMBA		Site surrounds: Known Site: Known
Hirundo rustica	Barn Swallow	Marine Migratory - CAMBA, JAMBA, ROKAMBA		Site surrounds: Possible Site: Possible
Limosa lapponica	Bar-tailed Godwit	Marine; Migratory(Bonn, CAMBA, JAMBA, ROKAMBA)	Vulnerable	Site surrounds: Known Site: Highly Unlikely
Malurus coronatus coronatus	Purple-crowned Fairy-wren (western)	Vulnerable	Vulnerable	Site surrounds: Possible Site: Highly Unlikely
Merops ornatus	Rainbow Bee-eater	Marine Migratory - JAMBA		Site surrounds: Known Site: Known
Numenius madagascariensis	Eastern Curlew	Critically Endangered; Marine; Migratory(Bonn, CAMBA, JAMBA, ROKAMBA)	Vulnerable	Site surrounds: Possible Site: Highly Unlikely
Pandion cristatus	Eastern Osprey	Marine Migratory - Bonn		Site surrounds: Known Site: Highly Unlikely
Pezoporus occidentalis	Night Parrot	Endangered	Critically Endangered	Site surrounds: Would not occur Site: Would not occur
Rostratula australis	Australian Painted Snipe	Endangered; Marine Migratory – CAMBA*	Vulnerable[#]	Site surrounds: Possible Site: Highly Unlikely
Sterna albifrons	Little Tern	Marine Migratory		Site surrounds: Possible Site: Would not occur
Tyto novaehollandiae kimberli	Masked Owl (northern)	Vulnerable	Vulnerable	Site surrounds: Possible Site: Would not occur
Terrestrial Mammals				
Conilurus penicillatus	Brush-tailed Rabbit-rat, Brush-tailed Tree-rat,Pakooma	Vulnerable	Endangered	Site surrounds: Would not occur Site: Would not occur
Dasyurus hallucatus	Northern Quoll	Endangered	Critically Endangered	Site surrounds: Possible Site: Would not occur
Rattus tunneyi	Pale Field-rat		Vulnerable	Site surrounds: Possible Site: Possible
Saccolaimus saccolaimus nudicluniatus	Bare-rumped Sheathtail Bat	Critically Endangered		Site surrounds: Possible Site: Possible
Xeromys myoides	Water Mouse, False Water Rat, Yirrkoo	Vulnerable		Site surrounds: Possible Site: Would not occur
Marine Mammals				
Balaenoptera edeni	Bryde's Whale	Cetacean Migratory - Bonn		Site surrounds: Species or species habitat may occur within area
Balaenoptera musculus	Blue Whale	Endangered; Cetacean Migratory		Site surrounds: Would not occur Site: Would not occur
Dugong dugon	Dugong	Marine Migratory – Bonn		Site surrounds: Species or species habitat may occur within area

Scientific Name	Common Name	EPBC Act Status	TPWC Act Status	Likelihood of Occurrence
Megaptera novaeangliae	Humpback Whale	Vulnerable; Cetacean Migratory - Bonn		Site surrounds: Species or species habitat likely to occur within area
Orcaella brevirostris	Irrawaddy Dolphin	Cetacean Migratory - Bonn		Site surrounds: Species or species habitat may occur within area
Orcinus orca	Killer Whale, Orca	Cetacean Migratory - Bonn		Site surrounds: Species or species habitat may occur within area
Sousa chinensis	Indo-Pacific Humpback Dolphin	Cetacean Migratory - Bonn		Site surrounds: Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations)	Spotted Bottlenose Dolphin (Arafura/Timor Sea populations)	Cetacean Migratory - Bonn		Site surrounds: Species or species habitat likely to occur within area
Terrestrial Reptiles				
Acanthophis hawkei	Plains Death Adder	Vulnerable	Vulnerable	Site surrounds: Possible Site: Possible
VRD Ctenotus rimacola camptris	Blacksoil Ctenotus		Vulnerable	Site surrounds: Known to occur Site: Possible
Varanus mertensi	Mertens` Water Monitor		Vulnerable	Site surrounds: Known to occur Site: Possible
Varanus mitchelli	Mitchell`s Water Monitor		Vulnerable	Site surrounds: Possible Site: Possible
Varanus panoptes	Yellow-spotted Monitor		Vulnerable	Site surrounds: Known to occur Site: Possible
Marine Reptiles				
Caretta caretta	Loggerhead Turtle	Endangered	Vulnerable	Site surrounds: Foraging, feeding or related behaviour likely to occur within area
Chelonia mydas	Green Turtle	Vulnerable		Site surrounds: Foraging, feeding or related behaviour known to occur within area
Crocodylus porosus	Salt-water Crocodile, Estuarine Crocodile	Marine Migratory – Bonn		Site surrounds: Known Site: Possible
Dermochelys coriacea	Leatherback Turtle, Leathery Turtle, Luth	Endangered; Marine Migratory – Bonn	Critically Endangered	Site surrounds: Foraging, feeding or related behaviour likely to occur within area
Eretmochelys imbricata	Hawksbill Turtle	Vulnerable; Marine Migratory – Bonn	Vulnerable	Site surrounds: Foraging, feeding or related behaviour likely to occur within area
Lepidochelys olivacea	Olive Ridley Turtle, Pacific Ridley Turtle	Endangered	Vulnerable	Site surrounds: Foraging, feeding or related behaviour known to occur within area
Natator depressus	Flatback Turtle	Vulnerable; Marine Migratory – Bonn		Site surrounds: Foraging, feeding or related behaviour known to occur within area
Sharks				
Carcharodon carcharias	Great White Shark	Vulnerable; Migratory – Bonn		Site surrounds: Species or species habitat may occur within area
Glyphis garricki	Northern River Shark, New Guinea River Shark	Endangered	Endangered	Site surrounds: May possibly occur. Not recorded despite targeted surveys in the lower Keep River (WRM 2014).

Scientific Name	Common Name	EPBC Act Status	TPWC Act Status	Likelihood of Occurrence
Manta birostris	Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray	Migratory – Bonn		Site surrounds: Species or species habitat may occur within area
Pristis clavata	Dwarf Sawfish, Queensland Sawfish	Vulnerable	Vulnerable	Site surrounds: Known to occur. Recorded by WRM 2014 in the Keep River estuary.
Pristis pristis	Largetooth Sawfish, Freshwater Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish	Vulnerable		Site surrounds: Known to occur. Recorded by WRM 2014 in the Keep River estuary.
Pristis zijsron	Green Sawfish, Dindagubba, Narrowsnout Sawfish	Vulnerable	Vulnerable	Site surrounds: Known to occur. Recorded by WRM 2014 in the upper Keep River estuary.
Rhincodon typus	Whale Shark	Vulnerable; Migratory – Bonn		Site surrounds: Species or species habitat may occur within area

Site surrounds are defined as the Legune Coastal Floodplain site of conservation significance and surrounding waters
*As a migratory species this species is listed as *Rostratula benghalensis* (sensu lato). Under the *Territory Parks and Wildlife Conservation Act 2006* this species is listed as *Rostratula benghalensis australis*

4.2 Significant Sites or Features

4.2.1 National Parks

The closest National Park is the Keep River National Park located along the NT/WA border around 80 km to the south-west of the proposed Stage 1 Legune Grow-out Facility footprint. A proposed extension to the Keep River National Park would extend the National Park to around 30 km south of the centre of the proposed project footprint. There are no anticipated impacts to the Keep River National Park or its proposed extension.

4.2.2 Conservation Reserves

The Spirit Hills Wilderness Conservation Area, which falls within the proposed extension to the Keep River National Park is located around 30 km to the south of the proposed Stage 1 Legune Grow-out Facility.

4.2.3 Marine Parks or Reserves

The closest instance of the Commonwealth Marine area occurs around 50 km north-west of the centre of the project footprint. The boundaries between the North and North-west Commonwealth Marine Regions occurs to the north-west of the Legune area.

4.2.4 Legune Coastal Floodplain Site of Conservation Significance

The entire Stage 1 Legune Grow-out Facility project footprint is situated within the Legune Coastal Floodplain Site of Conservation Significance. Legune Coastal Floodplain Site of Conservation Significance and proposed Stage 1 Legune Grow-out Facility

4.2.5 Legune Wetlands

The Legune Wetlands are situated on Legune Station. Legune Wetlands are recognised as a Nationally Important Wetland. The Legune Wetlands are listed as containing the following wetland types:

- seasonal/intermittent freshwater lakes (>8 ha), floodplain lakes
- ponds, including farm ponds, stock ponds, small tanks
- shrub swamps; shrub-dominated freshwater marsh, shrub carr, alder thicket on inorganic soils
- seasonal/intermittent freshwater ponds and marshes on inorganic soils; includes sloughs, potholes; seasonally flooded meadows, sedge marshes.

Legune Wetlands are considered nationally important because they are considered to meet the following criteria:

- they are a good example of a wetland type occurring within a biogeographic region in Australia
- they are a wetland which plays an important ecological or hydrological role in the natural functioning of a major wetland system/complex
- they are a wetland which is important as the habitat for animal taxa at a vulnerable stage in their life cycles, or provides a refuge when adverse conditions such as drought prevail.

The proposed services corridor and one of the proposed roads intersect the Legune Wetlands.

4.2.6 World Heritage Properties and National Heritage Places

There are no World Heritage Properties within the referral area, or within the same catchment as the referral area. The nearest World Heritage Property is located over 250 km south-west of the referral area.

There are no National Heritage Places within or near the project area. The nearest National Heritage Place is The West Kimberley, located around 130 km west of the proposed project.

4.2.7 Public or Private Reserves

There are no public or private reserves within or near the project area.

4.2.8 Conservation Zones under a Planning Scheme

The project falls within the Victoria Daly Regional Council area. The area is not designated as a conservation zone.

4.2.9 Significant Natural Land Features

The Legune area contains seasonal/intermittent freshwater lakes and ponds, and swamps, floodplain lakes and ponded pastures.

4.2.10 Proximity to the Northern Territory Coastline

The nature of the proposed operation requires close proximity to the coastal environment. By necessity, the intake and outfall to marine waters will be located so as to be viable during all tidal conditions. The grow-out ponds will be set back at least 100 m from the high tide level and will be bunded so as to be protected from higher than average tides as a result of extreme weather events.

4.2.11 Relation to Storm Surge Zones

The project area is not mapped as a storm surge zone.

4.3 Cultural Heritage Environment

The cultural heritage environment of an area includes the following:

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

4.3.1 Non-indigenous Heritage

Non-indigenous heritage relates to the places or objects associated with the European settlement of the area. No non-indigenous heritage sites are listed on the Commonwealth Heritage Database or on the NT Heritage Register as occurring on Legune (Earth Sea Heritage Surveys 2013).

4.3.2 Aboriginal Heritage

A search of the register at the AAPA has shown a number of registered and recorded sacred sites protected under the *NT Aboriginal Sacred Sites Ac*t on Legune (Earth Sea Heritage Surveys 2013). Consultation with AAPA has commenced and an application for an Authority Certificate for the proposed project area has been submitted. Works will not commence until an Authority Certificate has been issued.

The NT archaeological database also lists ten Aboriginal archaeological sites and artefacts on Legune (Earth Sea Heritage Surveys 2013). These sites were identified as a result of two archaeological surveys undertaken in the south-west corner of the property. Large areas of Legune however have not been subjected to archaeological survey and as such the NT archaeological database may not record all Aboriginal sites and artefacts present in the area.

Previous archaeological surveys in the areas surrounding Legune have identified a correlation between land system and Aboriginal archaeological site distribution (Gregory and Sutton 1997). Earth Sea Heritage Surveys (2013) developed an archaeological predicative model for Legune based on land systems mapping. This model can be used to assess the likelihood of finding Aboriginal archaeological sites on each land system present on Legune.

The majority of the project footprint is located on the Legune and Carpentaria land systems. These areas comprise of tidal mudflats and seasonally inundated coastal floodplains with poorly drained clayey soils. The Legune and Carpentaria land systems are considered to be unlikely to host Aboriginal archaeological sites, although shell middens and mounds are possible around the margins of these areas (Earth Sea Heritage Surveys 2013).

Some of the project infrastructure including roads, quarries and accommodation village will be situated on the Cockatoo land system. There is a very high likelihood of archaeological sites occurring in the Cockatoo land system. Sites are most likely to be located on sandstone outcrops in this land system may include rock art and artefact scatters (Earth Sea Heritage Surveys 2013).

4.4 Social and Economic

The project area is located on a pastoral lease which is currently used for pastoral purposes (i.e. grazing). The project area is remote with the nearest population centre being the town of Kununurra in Western Australia, approximately 106 km to the south-west. The closest population centre to the project in the Northern Territory is Timber Creek, approximately 135 km to the south-east.

The town of Kununurra is located in the Shire of Wyndham – East Kimberly and is the major commercial centre for the region. The town was created in the early 1960s to service the development of the Ord River Irrigation Scheme and has experienced steady population growth since its establishment.

The Shire of Wyndham – East Kimberly has an estimated permanent population of approximately 8,500 people (Australian Bureau of Statistics 2012). The majority of the population is based in the towns of Kununurra and

Wyndham with the remaining inhabitants scattered through several Aboriginal communities, pastoral stations and mining camps. The population of the shire can increase by over 25% with the arrival of tourists during the dry season.

Aboriginal people comprise of about 35% of the total population of the area (Australian Bureau of Statistics 2011). The traditional owners of the project area will be identified and consulted to ensure the traditional uses and activities of the area are taken into consideration.

Dominant industries in the region are agriculture including pastoral industries and irrigated agricultural operations, mining, tourism and fishing. The labour force participation rate in the region is 67%, which similar to Australia as a whole (65%) (Australian Bureau of Statistics 2011). Unemployment, however is much higher within the Aboriginal population (8%) than non-Aboriginal people (4%).

5 Potential Impacts

5.1 Natural Environment

The proponent spent considerable time studying suitable sites for the project across northern Australia (the site selection process is described in detail in **Section 6.1**, below). Site selection considered avoidance of sites with significant populations of threatened species, sites of archaeological, heritage or Aboriginal significance, Ramsar wetlands, breeding colonies, known critical habitat, mangroves, intertidal zones, acid sulfate soils, vegetation clearance and Great Barrier Reef and inshore reefs. Of all the sites considered, Legune Station is the most modified, and is considered to have the least potential impact from this type of development.

Native vegetation has previously been cleared over approximately 80 years as a pastoral lease from the coastal plains of the property and levee banks and operational dams have been installed in a number of locations to maintain the improved pasture species sown into the fenced paddocks network. A major flood irrigation dam has also been built on Legune to improve the productivity of the coastal plains during the drier parts of the year and to improve cattle production. As such, the site is highly modified, however, despite this, it is recognised that Legune Station and its surrounds, as well as the adjoining marine environment, provide a number of important environmental values for a number of fauna species, particularly waterbirds and shorebirds.

The potential impacts associated with the development and operation of the Stage 1 Legune Grow-out Facility are discussed below, and are broken into potential direct, and potential indirect, impacts. Direct impacts relate to the construction and operation of the Stage 1 Legune Grow-out Facility within the proposed project footprint. Indirect impacts are defined as those potential impacts that derive from construction and operation within the footprint, but are not confined to the project footprint.

5.1.1 Potential direct impacts

The Stage 1 Legune Grow-out Facility is comprised of both linear project elements (services corridor, roads), several small non-linear footprints for discrete pieces of infrastructure (quarry, accommodation village, power station), and the larger non-linear footprints comprising the grow-out centre and EPZs.

The majority of the proposed Stage 1 Legune Grow-out Facility footprint lies on the estuarine deltaic plain as described in **Section 4.1.2**, and the majority of the vegetation within the footprint is broadly mapped as 'tussock grassland' under the National Vegetation Information System (ESCAVI, 2003). The proposed Stage 1 Legune Grow-out Facility footprint takes up around 12% of the extent of this vegetation type within the Legune Coastal Floodplain Site of Conservation Significance.

At a finer scale, within the project footprint, these tussock grasslands are largely comprised of two major communities, both roughly equal in extent. Northern rice grass dominates grassland primarily in areas of higher salinity, whereas canegrass (*Ophiuros exaltatus*) and/or Australian wild rice (*Oryza australiensis*) dominates grassland located in areas with a lower soil salinity, and those areas subject to extended periods of inundation (particularly the latter species) (Wilson *et al*. 1991). Together, these grasslands form a mosaic that also includes an ephemeral wetland community described as mixed species open sedgeland/tall open forbland, occurring on playas (shallow closed depressions) and land with frequent gilgai microrelief. This community is more prevalent in the northern section of the estuarine deltaic plain, in the vicinity of the proposed grow out centre, and is a seasonal wetland only – it appears to dry out rapidly in the dry season when rainfall decreases dramatically. Dominant species include *Cyperus scariosus, Caldesia oligococca, Atriplex elachophylla, Schoenoplectus lateriflorus* and *S. praelongatus*, and *Panicum trachyrhachis*. Shrubs or tall forbs that dominate in the wet season include *Ammannia multiflora* and *Ludwigia perennis*. This community is located in low lying sections of the estuarine deltaic plain that become inundated during the wet season (i.e. from rainfall and local overland flow, not from stream input).

The modification of these areas will result in a loss of habitat and associated resources for resident and migratory fauna. Given the widespread nature of these habitat types within the surrounding areas, it is considered unlikely to constitute a significant impact to any species. However, a large number of studies are proposed to fully assess the impacts to resident and migratory fauna species.

5.1.2 Potential indirect impacts

The main potential indirect impacts of the proposed project primarily derive from the discharges from the operations to the marine environment. These will comprise elevated Nitrogen and Phosphorus and, whilst not considered to constitute a direct threat to any vertebrate species, have the potential to modify existing resources in the marine environment.

5.2 Significant Sites or Features

5.2.1 Legune Coastal Floodplain Site of Conservation Significance

The entire Stage 1 Legune Grow-out Facility project footprint is situated within the Legune Coastal Floodplain Site of Conservation Significance. The proposed project footprint comprises 5.68% of the Legune Coastal Floodplain Site of Conservation Significance.

5.2.2 Legune Wetlands

The proposed Stage 1 Legune Grow-out Facility services corridor and one of the roads intersect the Legune Wetlands. The area of impact comprises 305.21 ha, which equates to 2.97% of the Legune Wetlands. However, this may be an overestimation as the infrastructure within the services corridor is unlikely to take up the whole of the corridor. It should also be noted that the design of the Grow-out Facility is at concept level only at this stage, and there is some potential to vary the location of some infrastructure.

5.3 Cultural Heritage Environment

The site selection for the Stage 1 Legune Grow-out Facility has taken into consideration potential impacts on sites of Aboriginal and non-indigenous heritage. The majority of the project area has been located on land which has low archaeological potential and impacts on known heritage sites will be avoided and/or minimised where possible. Additionally, consultation has and will continue to be undertaken with the Traditional Aboriginal Owners to ensure any impacts to cultural heritage from the development of the project are avoided and/or minimised.

5.4 Social and Economic Environment

For Stage 1 the project will create significant local employment with over 100 staff and contractors employed at Legune and additional workforce required in the vicinity of Kununurra. As described in Section 3.2.11.2 the intention is to maximise local and indigenous employment.

5.5 Air Quality

Energy generation at the power station is the predominant source of emissions to air. The power station is likely to be configured as a hybrid generation with solar PV's and dual-fuelled Rankin Cycle engines and will be located sufficiently away from the Legune village. While diesel/LNG and solar generation will supply energy for the project, it is anticipated that diesel will be the main energy source during construction. Consequently, there is the potential for localised emissions and impacts on air quality from fossil fuelled gensets and earthmoving equipment. The EIA investigations will explore the extent of solar power to minimise impacts on air quality.

6 Measures to Avoid or Reduce Impacts

Project Sea Dragon Pty Ltd is committed to avoiding impacts on matters of significance to the greatest extent practical. For unavoidable impacts, mitigation measures will be implemented to reduce the extent and significance of the impact. Potential impacts of the project have and will be avoided, minimised and mitigated through:

- Site selection
- Engineering and operations design
- Environmental management
- Indigenous engagement

In the event that significant residual impacts remain, following implementation of avoidance and mitigation measures, appropriate offsets will be delivered in accordance with the EPBC Act Environmental Offsets Policy. Details of any offsets required for impacts on matters of significance will be outlined in the EIA report.

6.1 Site Selection

The proponent spent considerable time studying suitable sites for the project across northern Australia. To determine the optimal location for the project, a formal multi-criteria analysis, using site suitability criteria based on initial investigations by CSIRO and further developed by Seafarms, was applied across the northern Australian coast. Biophysical, environmental, economic, commercial and socio-political attributes were used to define the criteria used in the analysis, which produced a limited number of ranked properties as being suitable. Attributes considered included land tenure, land area (suitable for 10,000 ha), elevation (terrain), topography, temperature, rainfall, evaporation, biosecurity risk, land use, water holding soils, available fresh-water, available marine water, assimilative capacity, feasible logistics and workforce, location away from industrial processes & contamination and relative proximity to port. Site selection also considered avoidance of sites with significant populations of threatened species, sites of archaeological, heritage or Aboriginal significance, Ramsar wetlands, breeding colonies, known critical habitat, mangroves, intertidal zones, acid sulfate soils, vegetation clearance and Great Barrier Reef and inshore reefs.

Based on this analysis, Legune Station in the Northern Territory is the number-one ranked site. The Legune property is the most modified, and considered to have the least impact from this type of development, of all the candidate sites assessed by Seafarms for large-scale prawn grow-out.

Native vegetation has previously been cleared from the coastal plains of the property and levee banks and operational dams have been installed in a number of locations to maintain the improved pasture species sown into the fenced paddocks network. A major flood irrigation dam has also been built on Legune to improve the productivity of the coastal plains during the drier parts of the year and to improve cattle production. The site is highly modified, has existing access to ample fresh water, and is away from significant mangrove areas.

In CSIRO's opinion, "…Legune Station has one of the highest levels of economic and environmental attributes required for the sustainable development of large-scale land-based marine aquaculture in northern Australia."

6.2 Engineering and Operations Design

Impacts of the construction and operation of the project will be minimised by adhering to the following guidelines:

- minimum footprint
- minimum earthworks movement
- no dredging
- avoidance of PASS
- water balance and recycling to minimise discharges
- flood management
- hydrocarbons management

- stormwater, erosion and sedimentation control
- nutrient stripping, including by wetlands enhancement
- outfall controls
- avoidance of established bird breeding sites
- community engagement
- Indigenous Land Use Agreement incorporating employment opportunities
- employment and training
- dust control methods
- traffic management
- construction management – OH&S, IR, environmental management
- operations management - re-use, recycling, chemicals controls, waste disposal practices
- breeding efficiency – the genetic improvements from the domestication program mean that prawns grow faster and require less feed over time
- feed formulation – best practice for minimising marine ingredients (fish meal, fish oil)
- best proven renewable energy component to the power generation demand.

6.3 Environmental Management

6.3.1 Environmental Management Plan

As part of the EIA an Environmental Management Plan will be developed. This will cover both the construction phase and the Stage 1 operations. The Environmental Management Plan will address controls, nutrient stripping, maximum possible water recirculation, wet season flood avoidance and minimization of environmental discharge for all the facilities. Ongoing monitoring will be performed to inform approvals for possible future expansion of the project.

6.3.2 Waste Management

6.3.2.1 Farms

The solid waste streams from grow out operations are predominantly centre mound spoil from the aquaculture ponds, and sediment accumulation in the sediment ponds and treatment areas.

Pond and IFRP water contains nutrient metabolites. The project will manage excess water through use of settlement ponds that remove nitrogen from the water column, and constructed wetlands that further reduce nutrient load entering the receiving environment.

Centre mound spoil in the aquaculture ponds is the combination of faeces, uneaten feed and dead prawns that are deposited in the centre of the pond as a result of the forced water circulation. The pond spoil is either ploughed back into the base of the pond during dry out or is removed from the grow out ponds by truck and excavator after harvest and stockpiled in a bunded area. Planned beneficial uses of this material include:

- after curing for sufficient time it may be returned to the pond walls as topsoil to encourage vegetation growth
- soil enhancement in the marginal pasture areas
- fill for control of erosion zones at the extremities of the pastoral areas.

6.3.2.2 Stormwater

Stormwater produces stream flows which in the pastoral environment carry turbid water to the sea. The project will manage storm water through:

- Controlled releases, for excess rainfall on the ponds, IFRP's and channels, via the MDC and downstream wetlands treatment areas.
- Farms by-pass for the normal overland stormwater drainage. This will be managed through the farms design by keeping the natural drainage paths as much as possible.

Any upstream new dam will also be designed to ensure adequate environmental flows are maintained.

It should be noted that the area is a natural floodplain, and as such the design has been laid out in a manner to ensure the storm and floodwater passes through unimpeded as much as practicable. The natural drainage has already been highly modified as a result of construction of bunds on the property to facilitate the ponded pastures currently used as part of pastoral operations.

6.3.2.3 Sewerage and Industrial Liquid Wastes

Sewage from the Legune central facilities will be treated on site with a permanent approved waste water treatment plant (WWTP).

Sewage emanating from workforce accommodation on each pair of farms will be treated by installing a type-approved package sewage treatment units in accordance with the Building Regulations administered by the NT Dept of Lands, Planning and the Environment, or alternatively transferred to the Legune central WWTP by vacuum sewerage truck.

Liquid wastes at Legune central facilities will be subject to oily water separation, if necessary, and then directed to the respective treatment systems.

6.3.2.4 Other Solid Wastes

Solid wastes arising from the Legune site will be minimised by the transport of bulk materials wherever possible.

Packaging waste will mainly comprise cartons and plastic materials. These will be baled for removal to the closest Shire of Wyndham-East Kimberley recycling depots. Other trash will be collected in receptacles and removed by licensed contractors for disposal at approved sites.

6.3.3 Dust, Noise and Odour Emission Control

6.3.3.1 Construction

The propensity for dust generation from the earthworks required for building the farms and channels is low, owing to the high moisture content of the clay soils being worked. Where drying occurs sufficient to create fugitive dust, water carts will be employed to mitigate and condition the soils when necessary.

Construction noise at the farm sites will be consistent with any large earthmoving project, except that the project economics will require some of the construction works to be 20 hours/day in the dry season. As the area is remote from any residential areas noise impacts are expected to be minimal.

6.3.3.2 Operations

Dust, noise and odour emissions for the Legune Grow-out Facility are expected to be insignificant, as will those for the Legune central facilities.

6.3.4 Effluent Treatment

The project will generate two main streams of effluent:

- from the processing plant in Kununurra
- from the accommodation villages

The current assumptions for the project operating in the Northern Territory are that:

- the project will be required to meet the conditions and conformance with the Australian and New Zealand Guidelines for Fresh and Marine Water Quality, (as per ANZECC 2000)
- Guidelines on Mixing Zones (NT EPA 2013) will be followed
- site-specific conditions will be taken into account.

Consistent with the above considerations, the project design criteria is nonetheless to maximise recirculation of water within all the production systems (grow-out farms, processing plant and feed Mill) and to minimise discharge.

For the processing is to treat and recycle process water as much as possible. For the accommodation in Kununurra will be on the town sewage treatment scheme. At the Legune accommodation village there will be wastewater treatment and leach drain disposal.

6.4 Indigenous Engagement

Project Sea Dragon wishes to develop a positive relationship with the Traditional Owners and their representatives as well as the wider community. The area of proposed works on Legune Station has had Native Title Determination. Project Sea Dragon is seeking to discuss and negotiate an Indigenous Land Use Agreement with Traditional Owners, gain their support for the project and establish and maintain sustainable legacy benefit to them. Discussions with the broader indigenous community are planned and such discussions will encompass opportunities the Project may bring.

The design and layouts for the Stage 1 Grow-out Facility and supporting infrastructure have been developed to avoid and protect the registered sacred sites and recorded sacred sites that the company has been able to identify to date. The project proponent did commission an early desk-top investigation as part of its early studies (Earth Sea Heritage Surveys, 2013). As outlined in Section 4.3.2 the proponent has submitted applications to the Aboriginal Areas Protection Authority and will seek further advice and will consult with custodians to determine any further constrains that may apply to the proposed project areas. The applications for clearance cover all proposed ground disturbing works, including those incorporated in the environmental baseline work and any temporary works needed in the Feasibility Study.

7 Matters of National Environmental Significance

A referral will be submitted to the Australian Government to obtain a decision on whether the proposed action (Stage 1 Legune Grow-out Facility) will need formal assessment and approval under EPBC Act.

Table 1.10 below summarises the matters of national environmental significance that may occur in, or may relate to, Legune Station. These values are derived from a search of the EPBC PMST with a buffer of 20 km applied to the Stage 1 Legune Grow-out Facility footprint area, and searches of the NT NRMInfo database.

The listed threatened and migratory species are described in **Table 1.9** above.

Table 1.10 Matters of national environmental significance that may occur in, or may relate to, Legune Station

Matter of National Environmental Significance	
World Heritage Properties	none
National Heritage Places	none
Wetlands of International Importance	none
Great Barrier Reef Marine Park	none
Commonwealth Marine Area	none
Listed Threatened Ecological Communities	none
Listed Threatened Species	29 – see **Table 1.9**
Listed Migratory Species	36 – see **Table 1.9**

8 Conclusion on the Likelihood of Significant Impacts

Whilst the proposed Stage 1 Legune Grow-out Facility will reduce and/or modify habitat and other resources available to some of the threatened and or migratory species that utilise the site, in the context of the availability of the resources at the local and regional scale, it is considered highly unlikely that the proposed project will constitute a significant impact to any threatened or migratory species. A range of studies are proposed to comprehensively assess impacts to these species.

9 Local and Regional Benefits

9.1 Cooperation with Government

At scale Project Sea Dragon will make a significant contribution to Regional Development, Northern Territory GDP, export earnings, taxation revenue, commercial activity and employment.

In order to achieve this opportunity for Seafarms and the Northern Territory, Seafarms will work closely with the Northern Territory Government to ensure that collaborative processes are established with all stakeholders to underpin proactive information sharing to support the timely approvals of licences and other government requirements. These will be outlined in the Project Development Agreement to be agreed with the NTG.

Given the remoteness of the main project elements on Legune Station and the transport logistics required throughout the PSD operation across WA and the NT, Seafarms will work with the NT, WA and Commonwealth Government to ensure that appropriate public economic and social infrastructure to support the project's construction and ongoing operations and broader regional development is available.

Seafarms will seek to maximise employment opportunities for local residents at its range of sites and will ensure the development and implementation of a targeted indigenous employment strategy. Seafarms will work closely with the Northern Territory Government to ensure that government training assistance aligns with the qualifications required for the jobs being created by PSD.

9.2 Employment and Training

The project will generate significant employment for the region and flow-on benefits to local businesses by using the NT Industry Capability Network (ICN) as a gateway to maximise opportunities for NT business, service providers and training and education institutions. The development is of a large scale and will, at Full Scale, require a workforce of some 1600 to 1700 FTE, of whom approximately 600 will be employed at Legune and a further 700 in the vicinity of Kununurra. This scale of net employment increase in the region will increase training, employment and business opportunities for local individuals and businesses, and will also encourage net migration to the region and an expansion of business and service offerings.

A significant number of the proposed jobs will provide opportunities for the local and regional indigenous population.

Many of the skilled employment opportunities (breeding and hatchery operations) are expected to be located in the environs of Darwin. Further jobs in management, administration and logistics are also to be located in Darwin.

There are a number of well-developed training providers in Darwin and Kununurra that will be able to participate in the project development and in the ongoing operations phase. A significant opportunity is the ongoing Research and Development work that will arise from the breeding program and other productivity initiatives. Seafarms will seek to enter into a formal arrangement with Charles Darwin University to progress this Research and Development opportunity.

9.3 Power Generation

The large requirement for power is in excess of the surplus hydroelectric power generation capacity of the Lake Argyle Dam, and remoteness makes transmission costs prohibitive to Legune. The project, once operating at full scale, will require the commissioning of generator capacity in the vicinity of 90MW at Legune and ultimately up to 20MW near Kununurra with feed mill and processing plant. The power plants will require skilled operators resident in the region.

The plant at Legune will be remote from Kununurra and considered a standalone operation. The plant near Kununurra, while capable of operating standalone, may have the potential to link into the Kununurra grid, subject to commercial arrangements.

A further benefit to the region would be realised if onshore gas wells are developed for the long term energy supply.

9.4 Statement of Economic Benefits

Project Sea Dragon will have a significant positive impact on the Northern Territory economy during both construction and operational phases. The CAPEX required to establish the project at Full Scale is $1.45 billion.

During the construction phase, Project Sea Dragon will create 200 to 300 jobs. Many of these jobs will be based at Legune Station and surrounding areas. At Full Scale the project will employ 1,600 to 1,700 people. The project will create significant employment and commercial opportunities for indigenous people. Seafarms has had constructive discussions with Indigenous Business Australia who confirmed there would be significant opportunities for indigenous businesses.

Significant upgrades to public infrastructure in the region will also be required including roads, bridges and culverts, housing, energy developments and general infrastructure to support logistics and supply chains. These upgrades to public infrastructure will facilitate further investment and employment in the region.

Project Sea Dragon satisfies all of the objectives outlined in the Northern Territory Government's 'Framing the Future Strategic Plan' and supports the Government in achieving its goals for the Territory. The project aligns with Objective 1 of the Plan for creating a Positive Economy, which is:

- an economy built on strong trade, cultural and tourism relationships and that leverages new investment to improve food, energy and resource security for the Territory and our partners.
- advance the development of Northern Australia: lead the development of Northern Australia, working with the Queensland, Western Australian and Australian governments and other organisations to fast track key projects and policies.
- strengthen the Territory's role as the gateway between Australia and Asia: develop the Northern Territory as an investment destination and a supplier of quality goods and services.

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