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EXECUTIVE SUMMARY

Guthalungra Prawn Farm – Environmental Impact Statement

1.0 PROPONENT

Pacific Reef Fisheries (Bowen) Pty Ltd
Lot 1
Trent Road
Ayr Qld 4807

1.1 Designated Proponent

Nick Mitris
Director

2.0 PROJECT OBJECTIVES

2.1 Production Objectives:

The Guthalungra prawn farm will produce black tiger prawns, *Penaeus monodon*. At full operational capacity approximately 260 ha of production ponds will be farmed. Production at Guthalungra will commence in 2005 at around 550 tonnes per annum. Annual production will rise to around 900 tonnes in 2006, 1300 tonnes in 2007 and full production will be reached in 2008 at over 1600 tonnes.

2.2 Business Objectives

The Guthalungra project will assist Pacific Reef to achieve its Business Vision by:

- Maximising returns in domestic markets by vertically integrating to take control of the entire supply chain;
- Surpassing ESD expectations;
- Establishing the benchmark for production and water management in the dry tropics of North Queensland;
- Being recognised as industry leaders in quality; and
- Maintaining a highly competent workforce.

The Guthalungra Prawn Farm will be a profitable operation; complementing the already profitable Pacific Reef prawn farm located at Alva Beach, Ayr. At full production, the combined output from the Alva Beach and Guthalungra facilities will be over 2000 tonnes of black tiger prawns. Around 88 Full Time Equivalent positions will be created at Guthalungra alone.

The Guthalungra farm will make a substantial contributional to economic and social well being of the region by:

- Creating wealth in the region;
- Stimulating the growth of support industries in the region;
- Enhancing the critical mass of aquaculture activity in the area in order to improve local aquaculture business efficiencies;
- Helping develop an industry that will cement the social fabric of the region;
- Optimising the use of the region's physical, social and infrastructural resources; and
- Working to Environmentally Sustainable Development principles.

2.3 Objectives of the EIS

The purpose of this Environmental Impact Statement (EIS) is to examine the potential environmental, economic and social effects of the proposed development, and to formulate appropriate environmental management plans to minimise adverse impacts and to enhance community benefit.

3.0 THE LOCATION OF THE PROJECT

As shown in Figure 1-2 in Section 1 the proposed site is near the coastal North Queensland town of Guthalungra which lies approximately:

- 40 kilometres north of Bowen;
- 60 kilometres south of Home Hill, and;
- 175 kilometres south of Townsville.

The land is situated at the end of Watts Road and Coventry Road. Coventry Road joins the Bruce Highway at Guthalungra. The proposed area for development includes Lot 370 K124643 and Lot 8 SB294, Parish of Curlewis, County of Salisbury. Figure 1-3 to Figure 1-7 show details of the location of the proposed development site.

4.0 PROJECT BACKGROUND

The Guthalungra site was identified as having potential for a large scale prawn farm after an extensive search for properties along the length of the Queensland coastline. The site has many attributes that make it an excellent candidate for the establishment of a black tiger prawn farm. These include:

- Suitable climate for producing pawns;
- Freehold land owned by Pacific Reef;
- The land has been cleared previously and is presently used for grazing;
- Supportive State government, local council and community;
- Close to the regional centre of Bowen;
- Excellent local infrastructure;
- The physical characteristics (slope, soil types) of the site are ideal;
- The skills of the local workforce are well suited to the operation;
- Availability of good quality seawater;
- Situated in a relatively low recreational and commercial resource use area.

Undoubtedly, the coastal region in the vicinity of the proposed farm is significant, both from a cultural and environmental perspective. In addressing these important issues there is an opportunity for close collaboration between the Traditional Owners and Pacific Reef in the development of the project. The environmental impacts of the project are considered to be small when considered in context of the principles of Economically Sustainable Development (ESD). Impacts will be seasonal and reversible, and acceptable given the social and economic benefits that will accrue.

5.0 INDUSTRY AND REGIONAL DEVELOPMENT

There are a number of Federal, State and Local government initiatives and legislative changes that have been taken into consideration in the preparation of the EIS. All tiers of Government have made a commitment to support the development of sustainable aquaculture. There are many initiatives intended to facilitate the growth of aquaculture nationally and specifically in Bowen Shire. The Guthalungra proposal is consistent with the objectives of these goals.

There are also Federal and State initiatives underway that are aimed at protecting the valuable natural resources of the State. The findings of this EIS indicate that the development is consistent with the objectives of these initiatives, provided an ESD approach to assessment is adopted.

Clearly, the Guthalungra proposal will have an environmental impact. At a state level the coastal management planning process, and at a Federal/State level the implementation of the Reef Water Quality Protection Plan, take into account that aquaculture development will have an environmental impact. This impact is most likely to take the form of low concentration nutrient discharge. The Guthalungra proposal is no exception.

This EIS has determined that the impact from Guthalungra will not result in “significant adverse impacts on the coastal resource” which complies with the State Coastal Management Plan – Queensland Coastal Policy.

An objective of the Reef Water Quality Protection Plan is to reduce nutrient run-off from catchments such as the Don River Catchment by around 30%. However there is a commitment by both State and Federal Government to “undertake economic and socio-economic studies of the industries associated with the Reef including the values of these industries and an assessment of the benefits and costs of specific actions that are proposed” (Hon. Peter Beattie MP, Aug 2002). This being the case it is anticipated that the assessment of the Guthalungra proposal will be balanced and a “triple bottom line” approach taking full account of the principles of ESD and risk analysis adopted. Therefore the additional nutrient discharged from Guthalungra prawn farm should be considered acceptable in relation to the level of impact and the benefits that will accrue from the project.

6.0 CURRENT STATUS OF THE PROJECT

To date, no development has taken place at the proposed site. Under the provisions of the State Development and Public Works Organisation Act 1971, (SDPWO Act) the Coordinator-General has declared the Guthalungra Aquaculture project for Pacific Reef Fisheries to be a significant project for which an EIS is required.

The Commonwealth Minister for the Environment has decided that the proposed action is a “controlled action” under the provisions of the Environment Protection and Biodiversity Conservation Act 1999 (the EPBC Act), affecting matters of national environmental significance.

Part 5 of the State Development and Public Works Organisation Regulation 1999 (SWDPO) provides a process for an accredited assessment process where the project has been declared a significant project. Accordingly, this EIS will be carried out in accordance with the provisions of Part 4 of the SDPWO Act and Part 5 of the SDPWO Regulation to address both State and Commonwealth issues.

Impact assessment is a process through which information is provided to Local, State and Commonwealth government decision-makers. In this process, a proponent provides appropriate levels of information to approval agencies and the general public about the nature of a development proposal, its potential impacts, and the way in which the proposal will be managed in order to reduce those impacts. An assessment of the proposal, including any relevant recommendations, is then made available to the decision makers. The objectives for impact assessment are:

- To inform decision makers about the potential impacts of a proposal on the surrounding natural, social and economic environment;
- To develop strategies to ensure that, where possible, effects on natural, social and economic values are acceptable; and
- To provide opportunities for effective input to the assessment process.

The impact assessment process in Queensland is designed to achieve these objectives by ensuring that decision makers are provided with information which is comprehensible, of appropriate scope, and which is based on consultation with all interested parties. Impact assessment influences the design of the project and identifies management or monitoring conditions that can form part of the approval process.

7.0 THE CONSEQUENCES OF NOT PROCEEDING WITH THE PROJECT

The Guthalungra proposal will have significant economic and social impact on Bowen Shire. The consequences of not proceeding with the project is a significant opportunity loss. The project is extremely important for the region. At full production, the Guthalungra proposal will:

- Increase the total GVP of agriculture in the Shire by almost 15%;
- Employ equivalent to 10% of the Shire's agricultural labour force;
- Have an annual turnover equivalent to the value of the cattle grazing industry in the Shire;
- Increase personal household incomes in the Shire by up to $4.4 million per annum;
- Occupy an area equivalent to 0.04% of the area zoned for rural grazing in the Shire;
- Generate direct and flow-on business turnover in the region of $43 million per annum;
- Create 88 Full Time Equivalent positions directly on the farm and a further 20 elsewhere in the region; and
- Cost around $36 million to construct, with many of the goods and services to be sourced locally.

In more general terms, Bowen Shire has experienced some decline in population and economy in recent years. Although the Guthalungra proposal will not reverse the broader trends currently impacting on the Shire such as aging populations, net migration or the adverse economic pressures on traditional rural industries, it will help to stabilise the workforce and counter some of the negative trends encountered by the Shire.

8.0 DESCRIPTION OF THE PROJECT

The elements of the farm will include:

- Two hundred and fifty nine prawn grow-out ponds, each approximately 1ha in area;
- A seawater storage pond approximately 11.3 ha in area, with a maximum of 370 mega litres (ML) storage capacity;
- A treatment area of approximately 50 ha consisting of sedimentation and settlement ponds;
- Intake and discharge pipelines to Abbot Bay, each approximately 4 km long;
- A freshwater storage pond and water treatment system
- A seafood processing facility, and;
- Support infrastructure including feed storage, workshops, general storage and accommodation.

Important aspects of the proposed layout unique to this development include:

- Piped ocean intake and discharge;
- Configuration of the layout to provide three independent production areas within the overall farm development, each with its own water supply, drainage, exchange water treatment and re-use facilities;
- Treatment systems incorporating primary sedimentation areas that will allow removal of sediment during the season, discharging to settlement ponds for further sedimentation and biological treatment;
- The facility to increase the operating depth in the sedimentation areas and settlement ponds from 2.0 m to 3.0 m when required to accommodate short-term increases in hydraulic or nutrient loads, and;
- A design that will facilitate integration of new technologies, if appropriate in the future.

The farm will operate as three independent farms in one. The three production areas will be the following sizes:

- Production Area 1: 91 ha;
- Production Area 2: 112 ha;
- Production Area 3: 56 ha.

This arrangement will have the following benefits:

- It will reduce the size of each farm entity to a level where it can be effectively managed. Logistics associated with stocking, feed management and staffing suggests that an upper limit of about 100 ha of growout ponds per operating entity is desirable to maximise operating efficiency;
- It will allow for each production area to operate independently of water supply and exchange systems. This will provide production area managers with full control over water quality management, and hence control over the performance of their farm area;
  It will reduce the risk of disease by limiting the ability for disease to spread across the farm by water transfer.

9.0 DESCRIPTION OF THE EXISTING ENVIRONMENT

9.1.1 Site Location

The proposed site, as shown in **Figure 9-1** is located approximately 6km north east of the North Queensland town of Guthalungra which lies approximately 40 kilometres north west of Bowen, 60 kilometres south east of Home Hill, and 175 kilometres south of Townsville.

Figure 9-1 Proposed Pacific Reef Prawn Farm Site Location near Guthalungra, Queensland

More detailed plans showing the footprint of the proposed development are shown in Appendix B.

9.2 Physical Aspects of the Site

Topography and Terrestrial Morphology

The site on which the main production ponds, administration/processing, and water treatment areas are to be located can be characterised as undulating coastal plain comprised of sedimentary clays and sandy silty clays. The natural gradient is typically around 6% from the north west to the south east, with natural surface levels of approximately 8.0m at the highest point on the property. The site is traversed by several shallow depression systems.

The seawater supply and intake pipeline route traverses an area of coastal saltpan immediately to the east of the main site. Along Coventry Road it follows an ancient coastal dune ridge. From Coventry road to the coast the pipeline route crosses an inter-dunal depression system, before traversing the primary and secondary coastal dunes of Abbot Bay.

Coastal Geomorphology

It is estimated that there is a 30 year cycle of accretion and erosion along the Abbot Bay northern coastline. In the vicinity of the proposed seawater pump station and seawater pipelines it is estimated that erosion will occur at a rate of 0.9 m/yr for the next few years, then recover at about 1.5 m/yr over the next few decades.

Geotechnical Characteristics

Geotechnical investigations indicate that the production pond/treatment areas are underlain by clays and sandy silty clays more than 3.0m deep. Given the alluvial nature of the deposits, it is likely that interbedded clay lenses will exist at various locations across the main production area site, although the extent of these is expected to be limited.

Acid Sulphate Soils

The site is largely free of PASS. PASS is present across lower lying areas of the saltpan and wetland areas that exist along parts of the pipeline route. On the basis of the above findings an ASSMP has been prepared to enable appropriate management of PASS during construction.

Storm Surge

The main site is several kilometres from Abbot Bay, and is not expected to be impacted by storm surge, other than as a consequence of elevated tide levels under extreme events. Analysis of storm surge levels for Abbot Bay indicates that the main production area site is not at significant risk from such levels.

The site of the seawater intake pump station and intake/disposal pipelines will be subject to the effects of extreme storm surge events.

Regional Flooding

Hydrologic and hydraulic modelling of the lower Elliot River floodplain indicates that much of the land immediately adjacent to the river is prone to flooding, even under relatively small flood events. Flood mapping for the 1:20 year and 1:100 year floods indicates that parts of the footprint area of the proposed development would be inundated during these events.

The depths of inundation however, are typically not great, with a 1:20 year flood level just east of Coventry Road of approximately 3.4 m, and a level of 4.3 m for the 1 in 100 year event. Lower lying parts of the site west of Coventry Road immediately adjacent to the mud flats would also be inundated.

Groundwater Quantities and Levels

Geophysical survey of the site was undertaken, consisting of EM34 mapping of the area to be used for grow out ponds, water storage and settlement ponds. The survey indicated that conductivities ranged from 40 mS/m (400 EC) to 225 mS/m (2250 EC) although the results had been influenced by soil saturation from recent heavy rain.

Depth to groundwater varied from 7.5 m at the higher southern boundary of the site (Bore 1) to 1.0 m near the saltpan (Bore 6). Increases in watertable levels were noted in several bores after initial intersection of the aquifer, suggesting confined aquifer systems. Groundwater salinity was similar to that of seawater, with an average salinity across all bores of 32 500 mg/L. Subsequent levelling of the bores and analysis of regional groundwater information showed that groundwater levels at the time of sampling graded from east to west, and was approximately 2.0 m AHD at the south-west end of the site, reducing to 0.4 m near the salt pan at Coventry Road.

In addition to this, anecdotal evidence suggests that localised shallow freshwater perched aquifer systems are present in the area, as evidenced by several bores in the area, typically near the Elliot River. These bores draw from the shallow alluvial aquifers and are of limited extent.

9.3 Terrestrial Ecology

Vegetation Communities: Main Development Area

The vegetation within the main development area is predominantly remnant eucalypt open woodland with large areas of cleared or modified vegetation also occurring. Clearing of original vegetation was apparently undertaken to facilitate cattle grazing which has been the main land use for many years. A number of tree stumps are evident throughout the area however these are most likely to have resulted from post cutting rather than timber getting, as the mature trees on the property do not attain large girth sizes.

The open nature of the eucalypt communities is most likely similar to the natural density of the vegetation and reflects the difficult growing conditions of the site, particularly the heavy textured alluvium that occurs across most of the site, and pronounced seasonal fluctuation in rainfall and soil moisture. Overlaid on these natural conditions are the effects of sustained grazing pressure over many years, including suppression of recruitment of juvenile trees through trampling and grazing, and compaction and erosion of the ground surface leading to mortality of mature trees from root damage.

The ground cover vegetation is indicative of significant disturbance in terms of both structural and species composition. Two introduced grasses *Bothriochloa pertusa* (Indian bluegrass) and *Digitaria ciliaris* (summer grass) dominate the ground cover across the majority of the main development area with a small number of native grasses also present.

The woody weeds *Acacia nilotica* (prickly acacia) and *Zizyphus mauritianus* (chinese apple) are widespread in the otherwise treeless areas and within the eucalypt community occurring on lighter textured alluvium in the eastern part of the area.

Vegetation Communities: Proposed Pipeline Route

The proposed pipeline route traverses inter-tidal and coastal areas supporting a wide range of vegetation types. Sparsely vegetated hypersaline flats are crossed to the north of the main development area before the route joins the weedy vegetation adjacent to Cape Upstart Road and then turns eastward towards the coastline of Abbot Bay. The natural vegetation of the saltpan area is salt couch and samphire flats subject to occasional tidal inundation.

A large expanse of freshwater/brackish wetlands is traversed between this point and the beach dunes. The vegetation of the coastal dunes is dominated by eucalypt and Melaleuca woodlands associated with the ridge/swale sequence. A grassy ephemeral wetland is traversed before the foredune vegetation is reached. The vegetation of the dunes and beach is regarded as remnant and there has been little anthropogenic or grazing related disturbance of the ground surface or natural vegetation, although there are significant infestations of ground cover and woody weeds.

Regional Ecosystems and Biodiversity Status

- No endangered Regional Ecosystems have been mapped for the study area or adjacent areas, and none were encountered during the EES survey. Two of concern Regional Ecosystems occur within the study area:
- RE 11.3.13 [Grevillea striata open woodland] is mapped for the main development area and adjacent areas, and the EES survey confirmed the presence of this RE although it is not as widely distributed as suggested by the EPA RE mapping; and
- RE 11.2.2 [Ipomoea pes-caprae and Spinifex sericeus grassland ± Casuarina equisetifolia] occurs at the seaward extent of the proposed pipeline route where the pipeline enters Abbot Bay.

Another of concern Regional Ecosystem, 11.2.3 [low microphyll rainforest] is mapped by the EPA for the pipeline route; however, the EES survey suggests that this vegetation has been incorrectly mapped and is more closely attributable to RE 11.2.5 [Corymbia tessellaris on beach ridges]. This Regional Ecosystem is not of concern.

9.4 Marine Environment

Abbot Bay and Marine Park Bioregions

The Great Barrier Reef Marine Park Authority, through the classification phase of the Representative Areas Program, has mapped the biological and physical diversity of the GBR World Heritage Area (GBRMPA, 2001).

Bioregions (based on animal and plant assemblages and landform features) have been identified within the GBRWHA to identify and protect representative examples of all habitats and communities (GBRMPA, 2001).

As such, the development site is adjacent to one non-reef bioregion and one reef bioregion:

- Non-reef bioregion NA3: Abbot Bay is representative of the High Nutrients Coastal Strip (NA3) bioregion (terrigenous mud and high levels of nutrients from the adjoining land. Seagrass in sheltered sites only. Good turtle and dugong feeding habitat. Wet tropical influence for much of the coast);

- Reef bioregion RF2: Camp Island is representative of the Central Open Lagoon Reef (RF2) bioregion (region dominated by episodic Burdekin flood plumes. Sea floor deeper and lagoon significantly wider, with more tidal movement than RF1. Few reefs and islands).

Abbot Bay Seagrass and Coral Distribution

Broad-scale seagrass surveys in 1987 by the Queensland Department of Primary Industries (Queensland Fisheries Service - Northern Fisheries Centre) identified seagrass meadows in Abbot Bay. This study identified 35.4 km^2 or 3500 ha of seagrass meadows in Abbot Bay, comprising seven species (Lee Long *et al*., 1993). As tropical seagrass meadows are subject to natural temporal changes, varying seasonally and between years (Mellors *et al*., 1993), the seagrass meadows may have changed in the fifteen years since the QDPI survey.

However, a follow-up survey of seagrass in Upstart Bay (the adjacent northerly bay to Abbot Bay) undertaken 10 years later by the DPI Northern Fisheries Research Centre (Coles, pers. comm.) found that seagrass density and location was similar to their previous survey and there had been little change over this time period.

A marine resources survey of Abbot Bay was undertaken in December 2002. An area of approximately 15km^2 was surveyed around the proposed intake and outfall pipes and found approximately 1000 ha of seagrass in their survey. Approximately 100 ha of this seagrass were surveyed previously by Coles *et al*. (1992). Three species of seagrass (*Halophila ovalis, Halophila spinulosa* and *Halodule uninervis*) were recorded. *Halodule uninervis* could further be described as either thin or wide leaved. *Halophila ovalis* and *Halophila spinulosa* were the most common species, being found in 59% and 54% of samples, respectively. Dugong feeding trails were noted at two sites.

Fringing reefs around Camp Island in Abbot Bay were surveyed. Coral bleaching events in 1998 and 2001, and crown-of-thorn starfish outbreaks in 2001 were reported by the caretaker of Camp Island. The effects of these events were evident in areas surveyed by divers identified by recent dead coral, covered in algae.

9.5 Cultural, Social and Economic Characteristics

9.5.1 Cultural

A full description is provided in the Cultural Heritage Assessment Report (confidential document).

9.5.2 Social

The study area for the purpose of the social impact assessment is defined as the local government area of Bowen. It is anticipated that the benefits associated with construction and operation of the Guthalungra prawn farm are likely to centre on Bowen Shire with some impact on Burdekin and Whitsunday Shires.

Since the 1860's the potential of Bowen Shire for development has been widely recognised. Apart from its large well protected harbour and its climate and coal resources, it has substantial areas suitable for agricultural and horticultural development and access to water resources. In spite of these natural attributes, the Shire has never fulfilled its promise.

Whilst agriculture has remained a major employer, the combination of limited rainfall and poor commodity growth have restricted the industry's opportunity for growth. An already difficult position was exacerbated by the recent closure (1998) of the meat works at Merinda, with the resultant lay-off of some 400 people.

The towns' tourism industry remains relatively static and is substantially confined to a fairly narrow, low cost and declining market.

Coal mining, power generation, and meat processing, horticulture, fishing and railways historically dominated industry within the Bowen shire. Over time the economic significance of these industries has changed dramatically. Whilst still significant industries to Queensland, the coal mining, power generation and railway support industries no longer employ significant quantities of people which has reduced their economic importance to Bowen shire.

The Bowen Shire is experiencing a net reduction in population and is facing many of the issues being confronted by many rural communities reliant on commodity agricultural products. The Shire has experienced considerable growth in the horticulture sector to the point where further expansion is unlikely being constrained by the lack of water.

Demographics (ABS 2001 Census)

Around 70% of the Shire population lives in Bowen, 15% in Collinsville and the rest in other regions of the shire. There has been a 4.9% drop in the Shire population since 1996, the average age has increased from 33 in 1991 to 40 in 2001, and proportion of the population over 65 years of age has risen by about 4%. In addition the proportion of women in the shire has increased. These findings are consistent with a trend towards an aging population, however the neighbouring shires of Whitsunday and Thuringawa, and Queensland as a whole continue to sustain strong population growth.

The number of people of aboriginal origin has risen by around 2% since 1991. There are a higher number of couple families without children in Bowen Shire compared with Queensland as a whole; this could be a reflection of the greater number of older families whose children have left home.

The Shire population has fewer qualifications than the State population, however of those that are qualified a greater proportion has a skilled vocational qualification, particularly in field of engineering. Of the persons employed in the Bowen Shire around 26% are employed in the "labourer & related worker" category compared with 9.8% State wide.

Community Services and Infrastructure

Community infrastructure in the Shire is centred on Bowen and the surrounding rural communities rely on Bowen for the provision of some higher order services. The regional centres of Mackay and Townsville provide the services of district offices of government departments. In particular, social services to the region are provided through Mackay and medical and health services through Townsville.

Unusually for a rural community the incidence of home ownership is lower in Bowen shire than the State. The proportion of people renting housing is similar to the state average however the incidence of dwellings such as cabins and caravans is significantly higher (15% compared with 4% in the State). This is likely to be a result of the seasonal nature of the agricultural sector and the transient nature of the labour force.

Bowen Shire is adequately serviced with educational and childcare facilities, health and social services, and leisure and recreational facilities.

9.5.3 Economic

Agriculture and Horticulture

Horticulture in the region has grown dramatically in recent years. The value of fruit and vegetables has grown from $85 million in 1992 to around $230 million in 2000. Most of the crop is concentrated around Bowen with around 10% produced at Gumlu. Further expansion of the industry appears limited due to the lack of fresh water.

Cattle grazing makes up the rest of the agricultural production in the Shire at around $30 million per annum. It is unlikely that the grazing sector will expand. It should be noted that around 95% of land in the shire has been zoned rural grazing in the local planning scheme.

Seafood

Sixty two boats were registered at the port of Bowen in 1996/97, and the gross value of production around $ 5.2 million. Despite the substantial restructuring of the trawl and line fishery, three processing operations are still located in Bowen and local processors estimate that Bowen is currently the centre of a $10 million fishing industry.

Mines

Two mines are located in Bowen. The mines are located at Collinsville and Newlands and supply high quality coking and thermal coals to both domestic and export clients.

In 2000/01 an estimated 15 million tonnes of coal will be produced in the shire, with 10.8 million tonnes being shipped to export clients via the Port of Abbot Point.

Bowen also has a coking plant that produces coke for MIM smelter operations in Mount Isa and other areas.

Power Station

The Queensland State Government shut down the Collinsville Power Station in 1988, it was then sold in the mid 90's. The refurbishment by the new owners was completed in 1998 and a contract with the Collinsville coal mine will see it supplied with coal for the next 14 years. The refurbishment has meant that the station is largely automated and requires a staff of around 32 to operate.

Tourism

The major existing markets for Bowen are cited as the "grey market" and Backpackers, and to a lesser degree residential markets in adjoining regions. Backpackers visit the area to obtain seasonal work and visit the tourist centre of the Whitsundays and more northerly parts of Queensland.

9.6 Regional Values

Like rural communities elsewhere in Queensland the values of the inhabitants of Bowen are largely determined by the primary industries that have maintained the basis for the majority of employment and economy in the region over many years. The social structure, values, and aspirations of the region will be driven by this agronomic dominance.

The changing profitability of the primary sector and in particular commodity production such as sugar and beef, which are subject to the volatility and competition of the global market, has had an impact on the confidence of individuals in the future economy of the region. Also, a series of development proposals have not materialised, this appears to have influenced attitudes regarding the future prospects of the region.

9.7 Community Perceptions

The community is aware of aquaculture and its potential. Unfortunately the aquaculture ventures currently established locally have had a chequered history and have created a level of caution. Despite this, residents appear supportive of aquaculture that will contribute to the economy of the region without adversely impacting on the environment or the recreational values of the region.

10.0 PROJECT DESCRIPTION: DESIGN, CONSTRUCTION AND OPERATIONAL CONSIDERATIONS

10.1 Design & Construction

a) Roads and Site Access

Based on the current and projected turning volumes and AUSTROADS Part 5 – Guide to Traffic Engineering Practice – Intersections at Grade, the Bruce Highway and Coventry Road intersection will not need any remedial works associated with the proposed development. The intersection has already been designed for the surrounding land uses and 100kph speed limit.

The traffic impacts of the proposed development on the State Controlled Road Network are negligible. The intersection will not require remedial works as it has already been designed in accordance with Austroads Part 5 – Intersections at Grade. The intersection would operate with significant spare capacity in the future. The intersection has adequate sight distances and safety should not be an issue. No pavement works will be required based upon Equivalent Standard Axles calculations.

Road works proposed as part of the project include upgrade of the existing road from Guthalungra to the site, construction of on farm roads and access tracks, and construction of an access track from Coventry Road to the water intake pump station.

An access track will be constructed from Coventry Road to the water intake pumping station. The track will be located alongside the pipeline route, and will provide access to the pumping station for construction purposes, for periodic daily inspection, and for annual maintenance.

b) Grown out Pond Construction

Roads and Site Access

All storage ponds, grow out ponds, drains, and water treatment ponds will be constructed using clay material won from the site.

Geotechnical investigation indicates that ample clay material suitable for pond construction exists across the site. The investigation indicated there is approximately 4.3 million to 5.9 million cubic meters of soil at the site suitable for pond construction. Permeability testing of remoulded samples indicated the soils have good water retaining characteristics, with permeabilities ranging from 1 x 10-9 m/s to 3 x 10-11 m/s.

All ponds and storages will be lined with a 0.5m thick compacted clay layer to control seepage. All storages will be lined with rip-rap to minimise soil erosion and maximise water quality.

On-site seawater supply channels will be plastic lined to avoid erosion of inner banks.

c) Freshwater Storage and Treatment

An existing dam on a depression that runs through the site east of Coventry Road will be used to store water for potable supply. The approximate capacity of this dam is 20 000 – 25 000 kL. Storage of all other potable and fresh raw water supplies will be via self-contained concrete or polyethylene storage tanks adjacent to the processing area. It is proposed that water sourced from the dam be treated via sand pressure filtration and disinfection by chlorination.

d) Wastewater Treatment

The administration/processing/workshop areas will generate two types of wastewater:

- Processing wastewater, which will be saline;
- Domestic wastewater.

e) Processing Wastewater

The processing facility will generate 130 – 150 kL/d of water from the cooking and chilling process, and from wash down and cleaning. The waste stream will be saline, and will have high levels of suspended solids and dissolved organics from the cooking process. There is also a risk that this waste stream could be a vector for disease propagation and transmission.

The proposed treatment strategy consists of:

- Collection and flow balancing tanks;
- Primary static screening (wedgewire slot 0.5mm) to remove larger particulate material;
- Secondary screening using cartridge filtration to remove particulate material down to 0.1mm;
- Disinfection by chlorination;
- De-chlorination via natural volatilisation and aeration in an de-chlorination lagoon
- Discharge to Settlement Pond 1.

f) Domestic Wastewater

Domestic wastewater will be produced from the ablution facilities associated with the administration office and processing workers facilities. The laboratories will also produce small amounts of grey water, and the three residences will produce domestic effluent. It has been assumed:

- An effluent production rate of 200L/EP per day is appropriate;
- Day-visit staff produce 0.2 EP of effluent.

The estimated maximum daily sewage production rate is 30.8 EP (6.16 kL/d), and annual production is estimated to be 1 740 kL.

g) The strategy for treating and disposing of this effluent will be to:

- Reticulate sewage and grey water to septic tanks located close to the source. Separate septic tanks will be constructed for each of the domestic residences, and for the administration building/ablutions facilities;
- Overflows from the septic tanks will be reticulated to a central effluent storage, which will overflow to an aerobic sand filter;
- Water will be pumped from the aerobic sand filter to a wet weather storage with approximately 420 kL capacity. This will be equivalent to 60 days average effluent production. This storage will be in the form of elevated plastic or concrete tanks;
- Water will be pumped from the wet weather storage tanks and irrigated on site. Several potential irrigation areas exist. Irrigation will be via sub-surface dripper, supplying native trees.

The treated water storage tank will be sized to provide “wet weather” storage. If longer periods occur when irrigation is not possible, treated water from this tank will be carted to Bowen for disposal to the municipal treatment facility.

h) Design and Operation of the Prawn Farm Water Discharge Treatment Facilities

- The proposed average daily water exchange over the growing season for the Guthalungra prawn farm will be 2.7%. Maximum daily discharges up to 200 ML/d from the farm will occur in February and March every year.
- Prior to discharge, discharge waters will be treated in three primary sedimentation areas. The primary sedimentation ponds consist of two cells and will be 3 m deep under normal operating conditions, with 1.0 m freeboard. Each cell will provide a hydraulic retention time of approximately 8 hours under peak exchange conditions. Only one cell will be used at any one time, allowing for the other cell to be dried, and sediment removed.
- Three settlement pond areas, sized to provide a hydraulic retention time of 48 hours under peak exchange conditions. Treatment areas will be 2.0 m deep under normal operating conditions, with 1.0 m freeboard.
- Improved feeding regimes, recirculation and bioremediation will all be adapted throughout the operation of the farm to further decrease discharge loadings from the farm.

- Total Nitrogen loads of between 36 and 61 tonnes are predicted to be discharged per annum. This is comparable to daily loads of 0.5 to 0.8kg/ha/day. Total Phosphorus loads of between 3.6 and 6.1 tonnes are predicted to be discharged per annum. Total Suspended Solids loads are predicted to be 2980 – 5410 tonnes per annum; comparable to a daily load of between 11.5 to 34 kg/ha/d.
- The composition of the Total Nitrogen component on a daily basis should be 25% refractory Dissolved Organic Nitrogen, 25% bio-available ammonia and 50% organic matter, predominately algal matter. The bulk of the Total Suspended Load will be algal material.

i) Pipeline Structures and Route

The main components of the water supply and disposal systems will be:

- A seawater intake system consisting of a 1200 mm nominal diameter ocean intake pipeline extending approximately 350 m offshore, a wet-well submersible pump station located on the back of the primary dune, and a 5040 m long rising main pipeline, 1000 mm nominal diameter, discharging to an on-farm seawater storage. The design capacity of the pumping system will be 180 ML/d.
- An 11.3 ha seawater storage with a maximum storage depth of 4.0 m, and a freeboard of 1.0 m, and an active storage capacity of 370 ML.
- Plastic-lined supply channels servicing each pond, with water pumped from the seawater storage. Two re-lift pumps will be located on two of the main supply channels.
- The seawater supply pump station will essentially be a below ground structure. The only above ground infrastructure will be a cabinet for power and control switching, a gantry for maintenance purposes and an on-ground transformer.
- The rising main will consist of buried 1 000 mm diameter HDPE pipeline. From the intake pump station, the pipeline route will follow an existing unmade road reserve to Coventry Road. Along Coventry Road the pipeline will be located on the western side of the existing road. The pipeline will cross an area of saltpan immediately north of the proposed farm. The route in this area was selected to minimise the amount of pipeline installation required across saltpan, given the risks and potential problems associated with such construction.
- The pipeline will be partially buried in Abbot Bay. As a minimum, anchor blocks will be used to ensure pipeline stability. The anchor blocks will be located every 5 -10 m along the pipelines. Anchor blocks will only be used seaward of Ch (Chainage) 5200, which is about the low water mark.
- Provision has been made for periodic cleaning of the intake pipeline and pump station via “pigging (running a cleaning device within the pipeline).

Disposal Pump Station and Pipeline

Water will be pumped from the proposed farm to Abbot Bay via a pump station near the north east end of the Seawater Storage and rising main that follows the same route as the intake pipeline. The main features of this system are:

- The discharge pump station and pipeline will have a design capacity of 200 ML/d, in accordance with the peak discharge estimate for the farm.

- The pump station will consist of a 3-pump submersible pump arrangement, similar to that proposed for the intake system. The pump-well will be a concrete caisson type construction approximately with a floor level of –2.0m AHD. The pump and pipe system will include the same provisions for pigging as the intake system.
- The discharge pipeline will consist of a single line of 1 000 mm diameter HDPE, and will be laid adjacent to the water intake pipeline. It will extend approximately 500 m offshore.
- The pipeline will generally follow the natural topography. In the intertidal zone, cover over the pipe will be increased to 2.0m to minimise the risk of pipe exposure under extreme conditions.
- The final 100m of discharge pipeline will serve as a diffuser.

The ocean pipeline construction sequence will involve:

- Excavation of the trench along the full pipeline ocean route. The trench will be slightly over excavated to allow some incidental filling during the construction period.
- Whilst trench excavation is occurring, the pipeline will be welded on shore. This will be done with the pipe aligned along the land based pipeline route (i.e. perpendicular to the shoreline).
- The pipeline will be progressively towed out to sea. Pre fabricated anchor blocks will be fixed to the pipe at the shoreline as the pipeline is towed out. The pipeline will be sealed and will float.
- When positioned over the trench, the pipeline will be sunk by controlled release of air.
- Minor re alignment of the pipeline or adjustment of bedding level will be undertaken to position the pipeline in the trench.
- Backfilling of the trench will occur relatively quickly via natural sand movement.

The above process is a proven technique for ocean pipeline installation in Australia.

- The pipeline on land will be constructed during the dry season to ensure ground conditions are optimal. It is expected that conventional excavation and laying techniques will be possible over the full length of the pipeline except in some sections across the mud flats. In such conditions a temporary working platform will be constructed using imported clay soil, underlain with geo-fabric to provide stability. This platform will be removed following construction.
- Pipe cover in this section of the pipelines will be reduced to 0.3m, and any Acid Sulphate Soils will be handled in accordance with the Acid Sulphate Soils Management Plan.
- The pipeline will traverse several environmentally sensitive areas. A number of detailed measures are proposed to mitigate these impacts during pipeline construction and operation.

10.2 Prawn Farm Operation

a) Species Farmed

The Guthalungra prawn farm has been designed and will be constructed to grow penaeid prawns particularly black tiger prawns, *Penaeus monodon*.

b) Operational Parameters

The following table outlines the operational parameters of the farm:

Table 1

Operational Parameters	
Stocking Density	28 prawns per m^2
Food Conversion Ratio	1.7
Survival Rate	80%
Productivity	~ 6 tonnes per ha
Average body weight at harvest	Approx 28.5g

c) Production Estimates

The following table outline the estimated production from the farm:

Table 2

	04/05	05/06	06/07	07/08
Ha of pond production	91	147	203	260
Total Yield (tonnes)	581	938	1296	1660
Total feed used (tonnes)	1045	1690	2330	2990

d) Management Procedures to Maintain Stock Health

The most up-to-date management practices and procedures will be implemented at Guthalungra to ensure the farmed prawns experience minimal stress; so that the risk of disease outbreak will be reduced. Also, the water quality of the operation will be closely managed. The following list highlights some of the activities that will be undertaken to ensure that the stock remains healthy:

- Adequate pond water exchange to maintain appropriate physico-chemical parameters;
- Adequate levels of aeration;
- Monitoring of pond water quality and substrate conditions will be undertaken;
- Monitoring of growth rates, feed conversion, specific growth rates undertaken regularly;
- Strict regulation of pond biomass and feeding rate;
- Extensive training program for staff particularly in water quality control, stock handling and response procedures;
- Low stocking rates;
- Screening of stock for diseases;
- Purchase of disease free post larvae;
- Feed rates capped, and feeding optimised through monitoring;
- Comprehensive health management plan. Records of all introductions and disposals of prawns, including their source and destination, will be maintained;
- Health monitoring will be undertaken on a regular basis;
- Records of all disease outbreaks and parasite infections will be maintained;
- Screens in position to prevent escape stock;
- Facility in place to isolate individual ponds or sections of the operation.

11.0 THE ADVERSE AND BENEFICIAL IMPACTS OF THE PROJECT

11.1 Construction Impacts and Mitigation

The principal environmental impacts of the project during construction are expected to be:

- Impact on the wetland and dune system between Coventry Road and Abbot Bay, across which the pipeline route will traverse, and
- Localised impacts on the marine environment during construction of the ocean pipelines.

Other risks and possible impacts, such as surface water runoff quality, acid sulphate soils, flora and fauna impacts are considered to be either readily managed, or not significant in the local or regional context.

Supply/Disposal Pipeline Construction Impacts
The pipeline will be laid in the winter months during the dry season. Construction of the pipeline will only occur over a one/two month period. Migratory birds will not be impacted by construction works, as they do not arrive in Australia until the wet season. The pipeline route through the wetland areas will be rehabilitated post construction.

The pipeline will only be partially buried to reduce the amount of disturbance during construction. The access track will be designed to maintain water flow across the wetland, unlike the two bunds presently constructed across the wetland.

A number of design options have been considered for the access track, based on the need to minimise environmental impacts. These have included low-level causeways, alternative means of access via sea or air, or overland via amphibious vehicles. A low-level gravelled access track is proposed, incorporating cross-drainage culverts to maintain surface flow characteristics. Part of the track formation will incorporate the rising main pipelines, as discussed above.

Where the track crosses lower lying depressions that become regularly inundated, subgrade will be excavated 4 m wide and to a depth of 1 000 mm, and backfilled with rock to provide a more stable carriageway. Where soft sub grade conditions are encountered, the rock will be underlain with geofabric. A low level causeway will be constructed to provide year-round access. The causeway will include cross-drainage to maintain the hydrological characteristics of the area. Figure 1 shows the type of cross-section proposed for much of the access causeway.

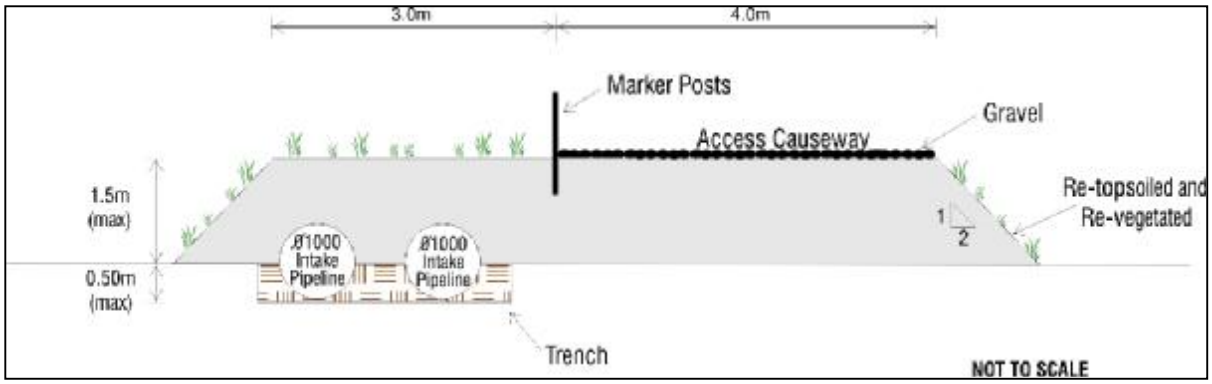

Figure 1
Station Access Causeway Cross-section

The track will vary in height up to 1.5m above natural surface, and will be fully re-topsoiled and revegetated.

In sections where the track is located on higher ground, the track will consist of little more than a cleared pathway that has been graded to provide a cross sectional profile that drains and can be maintained. No re grading of the longitudinal profile will be undertaken, and no placement of gravel or other surfacing material will be carried out.

The frontal dune will be re-established, stabilized and revegetated after construction. An area of seagrass is likely to be loss during construction. After stabilization of the seabed it is expected that the local seagrass species will recolonise the previously disturbed area. Noise and dust will meet the required environmental standards during construction.

It is anticipated that the construction of the submerged ocean pipeline will result in the loss of a small area of seagrass. This will only be in the direct path of the pipeline and therefore losses will be minimal. The cutter-suction technique used to bury the pipe will deposit sand to the beach where it will be redistributed through natural tidal processes.

Appropriate mitigation measures such as silt curtains will be utilised to minimise sediment impacts adjacent to the pipeline. The pipeline is relatively shallow and therefore the extracted material will be mainly sand however it may be appropriate to bund and dewater the material in association with additional near shore silt curtains. Monitoring and response plans will be prepared.

11.2 Operational Impacts and Mitigation

Main Development Area

None of the habitat areas occurring within the main development area are of particular ecological significance given their disturbed condition and abundance elsewhere in the study region. The wetlands occurring within the main development area (farm dams, hypersaline flats) are of limited spatial extent and are not expected to be of particular ecological significance, particularly given their abundance elsewhere in the study region.

Proposed Pipeline Route

Two ecologically significant areas occur along the eastern section of the pipeline route:

- The band of habitat types occurring on the dune complex fringing Abbot Bay; and
- The freshwater wetlands established on marine deposits.

The band of habitat types occurring on the dune complex fringing Abbot Bay provide a diversity of habitat opportunities for fauna including shrubby woodland, Melaleuca wetland, grassy ephemeral wetland, and foredune vegetation. While these vegetation types are not uncommon in the study region, the tract traversed by the pipeline route extends for a considerable distance northwards to Cape Upstart with little disturbance, and is of considerable extent. This corridor of dunal habitats also links the terrestrial habitats of Cape Upstart with the riparian vegetation of the Elliot River, and the small National Park patch located to the north of Lot 370. These habitats are of local significance.

The freshwater wetlands established on marine deposits are not remnant habitat features but provide extensive foraging habitat for migratory waders. Migratory shorebirds/waders such as godwits, sandpipers, plovers, snipes and egrets utilise the saltmarsh and wetland areas the proposed pipeline route will traverse. This wetland is identified as Southern Upstart Bay wetland (QLD009) listed on the directory of important wetlands in Australia (Environment Australia, 2002a).

These birds arrive in the north of Australia in September-October and return to their Siberian breeding grounds in April-May to breed. These wetlands extend for some 7km to the north where they merge with tidal wetlands adjacent to the Cape Upstart National Park, and also link up with the mangrove habitats of the Elliot River 2.5 km to the south.

Impacts on Native Flora and Fauna Habitats

Rare or Threatened Flora

No rare or threatened flora are definitely known to occur in the study area; however, three species are at least moderately likely to occur. No rare or threatened flora are anticipated to be significantly effected by the proposal. This is because only very small areas of potential habitat for these species will be disturbed by the development, and extensive areas of similar habitat occur locally and regionally.

None of the rare or threatened terrestrial fauna species known or likely to occur in the study area are anticipated to be significantly effected by the proposal since:

- For the majority of the species, potential habitat immediately adjacent to the main development area and proposed pipeline will not be effected; and
- In instances where potential habitat will be disturbed, only relatively small areas of habitat will be involved, and extensive areas of similar habitat occur locally and regionally.

The local impact on the Bare-rumped sheath-tail bat *(Saccolaimus saccolaimus)* (if present) may be significant, as a result of the removal of scattered poplar gums *(Eucalyptus platyphylla)* that occur over the majority of Lot 8. This tree is favoured as a roosting site by the species. However, the EPA RE mapping shows that RE's containing poplar gum (11.3.9 and 11.3.35) are widely distributed in the surrounding area and the viability of the regional population of the species is unlikely to be significantly effected.

Migratory and Wetland Fauna

The conservation of migratory waterbirds is closely linked to the management of wetlands (Asia-Pacific Migratory Waterbird Conservation Committee, 2001). The key elements of the Asia-Pacific Migratory Waterbird Conservation Strategy: 2001-2005 is for the conservation of migratory waterbirds and their habitats. The following elements of the strategy apply to this prawn farm development:

- A network of sites that are internationally important for migratory waterbirds are required to be effectively managed; and
- There is a requirement for the raised awareness of the presence of waterbirds and their link to wetland values and functions throughout the region and at all levels.

These elements have been considered as part of the design of the prawn farm and pipeline. Since migratory birds have been identified to occur within and adjacent to the development, construction time of the pipeline will be occur when migratory birds numbers are lowest, construction time will be limited to 12-16 weeks, the ecological footprint is small and rehabilitation of any disturbance will be undertaken.

A total of five (5) migratory, wetland or marine terrestrial fauna species listed under the EPBC Act are known to utilise the study area. An additional twenty-three (23) species are at least moderately likely to occur in the study area. Twelve (12) of these species are listed on both the Japan-Australia Migratory Bird Agreement (JAMBA) and the China-Australia Migratory Bird Agreement (CAMBA), another three (3) are JAMBA only listed, and an extra seven (7) are CAMBA only listed.

None of these species are anticipated to be significantly affected by the proposal since:

- For the majority of the species, potential habitat immediately adjacent to the main development area and proposed pipeline route will not be affected;
- In instances where potential habitat will be disturbed, only relatively small areas of habitat will be disturbed by the development, and extensive areas of similar habitat occur locally and regionally.

Impacts on Seagrass in Abbot Bay

Modelling of the discharge to Abbot Bay was undertaken by the CRC for Reef Research. A daily discharge volume of 200mL/d was modelled and represents the maximum discharge volumes in February and March from the farm. On average, the daily discharge flows during the grow out season will be 100 ML/d.

The area of impact on sensitive environments, in this instance, seagrasses in Abbot Bay was determined where concentrations of total nitrogen were greater than 150 µg/L, total phosphorus concentrations were greater than 24 µg/L and Chlorophyll a concentrations were greater than 2 µg/L. The area of impact determined was less than 5 % of the total estimated area of seagrass in the bay.

Noise

Noise predictions indicate that construction works are not likely to generate significant acoustic impacts at nearby sensitive receiver locations, providing the recommended daytime working hours are adhered to. Construction works, may however, be audible for part of the works.

A noise model for the operation of the proposed Guthalungra Prawn farm was established to estimate the likely noise levels during general farming activities and during the post-harvest maintenance activities. The predicted noise levels showed that operation of the proposed facility is not likely to generate noticeable noise levels at the nearest sensitive receiver, located approximately 2000 m east of the proposed processing area and the nearest pond.

The project is expected to comply with the day and evening operational noise level objective of 40 dB(A) and the night-time noise level objective of 33 dB(A) at the nearest sensitive receiver.

Light Levels

Light levels will be designed to meet the Australian Standards AS – 4282-1997 for the ''Control of Obtrusive Effects of Outdoor Lighting".

Risk of Disease Outbreaks to Wild Populations

The potential for the transfer of endemic or exotic diseases is considered low. A suite of measures will be put in place to prevent the escape of cultured stock. The Import Risk analysis being undertaken by Biosecurity Australia assessed the risk of transfer of exotic disease to endemic stocks through prawn farms as low. Also, given that the diseases encountered on the farm are known to be present in wild populations, then the risk to the wild population is considered low.

Impacts on World Heritage Values

The development site is located adjacent to, and will discharge into, the Great Barrier Reef World Heritage Area (GBRWHA). The Great Barrier Reef World Heritage Area is the largest World Heritage Area in the world and one of just a few that meet all four natural World Heritage criteria:

Table 3

Criterion (i)	An example of a major stage in the earth's evolutionary history
Criterion (ii)	An outstanding example of geological processes, biological evolution and people's interaction with their natural environment.
Criterion (iii)	A place with unique, rare and superlative natural phenomena.
Criterion (iv)	A place that provides habitats for rare and endangered species of plants and animals.

Within the Great Barrier Reef World Heritage Area (GBRWHA) particular emphasis is placed on the conservation of threatened species such as dugong, marine turtles, dolphins and whales. About 98% of the World Heritage Property is within the Great Barrier Reef Marine Park, the remainder being Queensland waters and islands. The Great Barrier Reef Marine Park was declared in 1975 with the purpose of preserving the area's outstanding biodiversity whilst providing for its reasonable use.

The prawn farm site and the adjacent area meets Criterion (ii), (iii), and (iv) as identified in Table 4 below.

Table 4
World Heritage Values of the Proposed Site

Criterion	World Heritage Values
Criterion (ii)	The diversity of fauna and flora including: Marine reptiles; Marine mammals; Terrestrial vertebrate fauna; and Feeding grounds for international migratory seabirds and sea turtles.
Criterion (iii)	Superlative natural phenomena including: Migrating whales, dolphins, dugong, whales sharks, sea turtles, seabirds and concentrations of large fish.
Criterion (iv)	Habitats for species of conservation significance including: Seagrass beds; Mangroves; and Species of plants and animals of conservation significance.

Even though Abbot Bay meets these criteria and contains high conservation value, other areas in the Great Barrier Reef World Heritage Area (eg. Upstart Bay), have greater significance in relation to the World Heritage criteria. In particular, Upstart Bay has significant populations of Dugong and extensive seagrass meadows as it is protected from major climatic events by Cape Upstart, whereas Abbot Bay is coastal and highly dynamic and provides less protection for seagrass habitat.

The major risk to these values is the loss of seagrass and the associated ecological impact e.g. loss of grazing grounds for dugongs and turtles. The loss of seagrass is predicted to be less than 5 % of the estimated seagrass area within Abbot Bay. The loss of this seagrass is not expected to impact significantly on the grazing patterns of dugongs and turtles.

11.3 Cultural Impacts

Refer to the Cultural Heritage Assessment Report (Confidential Document).

11.4 Social Impacts

It is highly likely that the Guthalungra prawn farm will help to improve the economic base and the social stability of the shire. Prawn farming will remain a labour hungry, high-tech rural activity that depends on local goods and services for successful operation.

Population

The resident population of Bowen Shire may increase by around 140 individuals as a result direct employment at Guthalungra. An increase in the population of this magnitude over four to five years is unlikely to put undue pressure on the infrastructure and services of Bowen Shire. However it will positively contribute to a reduction in the ongoing decline of the Shire population.

The Guthalungra prawn farm may help to slow the trend towards an older overall population in Bowen however the impacts will be slight and transient as this is an overriding global trend.

Cultural Heritage

The impacts on Cultural Heritage and the strategies to address the issues raised by the proposal are addressed in the Cultural Heritage Report (confidential document).

Pacific Reef is currently negotiating a Memorandum of Understanding and Cultural Heritage Management Plan with the Traditional Owners of the area in which the prawn farm is to be located. It is envisaged that a proportion of the Pacific Reef workforce will consist of people of aboriginal origin and these may include existing residents and individuals currently located outside the Shire.

Education Status

It will be essential for the senior staff at Guthalungra to be suitably qualified. For this reason it is likely that the number residents with graduate and post graduate qualifications will increase in the Shire. Pacific Reef is implementing a training program at its existing prawn operation at Ayr in preparation for the establishment of Guthalungra. The training is linked to the National Seafood Industry Training Package and staff members will obtain vocational qualifications to diploma level. Therefore is may be assumed that the number of residents in the Bowen Shire with vocational qualifications will increase.

Services and Infrastructure

Bowen Shire is well serviced with social services and regional infrastructure is commensurate with the size of the population. Higher order services are available in the region if not in the Shire itself. It is not envisaged that the Guthalungra prawn farm will put additional pressure on local services or infrastructure. However the stabilisation in population and workforce may mean that service provisions does not contract with in the Shire.

Housing

It is estimated that up to 55 positions on the farm (or 50% of the workforce) will be filled by people currently living outside the Bowen Shire. Assuming that each new employee requires accommodation in the Shire, and that most of the staff will live in or around Bowen then around 10 new households per year will be established in Bowen over the development phase of the project. Again this is unlikely to put undue pressure on housing in the Shire.

11.5 Economic Impacts

Contribution of the Guthalungra Prawn Farm to the Gross State Product.

Table 5

Estimated Economic Impact of the Guthalungra Prawn Farm Development on the Queensland Economy

Sector	Value Added/Gross State Product[a]		Employment (Fte)[b]		H'hold income[c]	
	$m	%	Jobs	%	$m	%
Guthalungra Prawn Farm Direct	11.00	67%	88	75%	2.80	64%
Finance, Property $ Business Services	1.52	9%	7	6%	0.47	11%
Trade	0.70	6%	8	7%	0.70	9%
Food Manufacturing	0.50	5%	4	3%	0.50	5%
Government Admin						2%
Electricity Supply	0.30	2%			0.30	
Road Transport			1	1%		
Other Industries	1.30	11%	9	8%	1.30	10%
Total	**16.34**	**100**	**118**	**100**	**4.39**	**100**
Total /Direct	1.49		1.34		1.57	

a: output less the value of goods and services consumed in the production process, other than depreciation of fixed assets. Percentages taken from OESR Queensland Treasury 2001. Direct prawn farm values from Guthalungra Prawn Farm Business Plan 2003.

b & c: Percentages taken from OESR Queensland Treasury 2001. Direct prawn farm values from Guthalungra Prawn Farm Business Plan 2003.

The direct business turnover (output) generated by the Guthalungra is estimated at $29 million. Flow-ons to other sectors may add another $14.3 million to regional business income (total $43.3 million). The sectors most likely to be affected include manufacturing, trade, business and property services and finance sectors. It is anticipated that for each dollar of sales generated by the Guthalungra prawn farm there will be a total of $1.50 of business income earned by businesses throughout the state; $1.0 by Pacific Reef and $0.5 in other sectors of the economy.

Gross state product or direct value added generated by the Guthalungra is expected to be around $11 million. Associated with this will be a flow on value added in other sectors of the economy of almost $5.3 million. Again, for each $1.00 of gross state product directly generated by the Guthalungra farm is likely to result in $0.5 ($1.5 total) in gross state product generated in other sectors of the State economy.

The Guthalungra prawn farm will be responsible for the direct employment of around 88 people (FTE'S). Flow on business activity from the operation (at full operation) may generate a further 30 jobs to give a total of around 118. For each job directly generated at the Guthalungra prawn farm there may an additional 0.34 jobs (1.34 jobs total) created.

It has been estimated that personal income of $2.8 million will be earned by Guthalungra employees and a further $1.6 million by wage and salary earners in other sectors or aquaculture businesses. For each $1.00 of household income generated directly by the Pacific Reef Guthalungra prawn farm, an additional $0.6 (1.6 total) will be generated in other sectors of the State economy.

Impacts on the Regional Economy

Historically, aquaculture industries have been noted for the relatively high income earned by employees compared with traditional agriculture industries. Bowen is no different to many small rural towns in that it is heavily reliant on one or a small number of industries, combined with a set of other fundamental activities that provide basic services and infrastructure to those industries. They lack the diversity and complexity of larger economic units.

Aquaculture has the potential to develop rapidly and, through its relatively large requirement of labour and material input, has shown the potential to increase the complexity and diversity of local economies. It is anticipated that the demand from Guthalungra for local labour, goods and services will help to offset the contraction of other local industry and help to alleviate the range of economic and social pressures associates with declining regional economies.

Guthalungra will provide a catalyst for further investment in aquaculture in the region and will have an impact on the character of the local economy. Prawn farms need juvenile stock, feed, and other material inputs such as labour, energy and services. It is anticipated that much of the expenditure form Guthalungra will go to persons and companies located in the region. Of the estimated $36 million construction costs, the majority will be spent locally.

12.0 ELEMENTS OF THE ENVIRONMENTAL MANAGEMENT PLAN

A detailed set of Environmental Management Plans have been designed to manage both construction and operational impacts. During construction, of particular importance is the management of Acid Sulphate Soils, the construction and rehabilitation of the road across the saltpan and the wetland, the laying of the pipeline across the frontal dune and dredging for laying the pipeline in Abbot Bay. After construction, ongoing monitoring of the effect of discharge on sea grass beds and wetland hydrology and ecology will be undertaken.

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