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5.0 ALTERNATIVES

5.1 No Project Alternative

Lost Opportunity - Social and Economic

The no project alternative option may be considered in terms of social, economic and environmental opportunity loss. The social and economic impacts of the development are detailed in Section 7.10. The direct economic loss to the region and State should the project not proceed can be estimated at around \$43 million per annum of lost business income, much of it directed to local and regional suppliers, refer Section 7.10.1. The annual output from the operation will be around \$29M (Section 7.10.5) employing around 110 staff (Section 7.10.7). The social and economic impacts of the project are further discussed in Section 7 and below. Obviously the possible adverse environmental impacts from the proposal need to be considered in light of the positive social and economic implications of the project.

Further Pacific Reef Fisheries Expansion in the Area

If the project were to go ahead, other Pacific Reef Fisheries projects in the area would also proceed e.g. the construction of a hatchery. Currently Pacific Reef Fisheries is committed to further investment in the industry and is involved in a range of research and development projects likely to benefit all aquaculture sectors. For example there is a commitment to domestication and remediation of waste research. This commitment to the industry would be lost if the project were not to proceed.

Negative Impacts on further Aquaculture Development in the Area

The Bowen Shire has identified aquaculture as having the potential to be a significant contributor to future industry growth and employment creation in the shire. As such the failure of the Guthalungra Project to proceed will severely impact on the likelihood of future projects proceeding. The Bowen Shire Development Strategy advocates the creation of a cluster of business activities that can establish expertise in the area and improve business efficiency and attract further related investment. The failure of the Guthalungra Project to proceed will severely impair the potential of Bowen Shire to establish a concentration of aquaculture businesses in the area. The economies of scale and resident skills base will not eventuate.

Impacts on Queensland Aquaculture

Despite the strong and well publicised State Government support for the development of aquaculture in Queensland, and the enormous resources poured into the development of aquaculture over the past fifteen years, growth of the industry remains relatively slow, and the current industry is substantially smaller than many assessments of its growth potential.

There have been only a small number of new prawn operations approved in Queensland in the past three years. Consequently the Guthalungra Project is being viewed with a high level of interest by industry, all levels of government; senior administrators and politicians, and the community. It is possible that investment in major new aquaculture ventures hinges on the success of the Guthalungra project.

Social Impacts

The anticipated social impact on Bowen of not developing the prawn farm reflects the continued lack of investment in the region i.e.:

- Continued stress and economic uncertainty within the community. There has been a lack of projects that have the ability to significantly assist with economic development in the Bowen region for sometime;
- The lack of confidence in investment in the area will have a cascading effect that will result in a continued reduction in the level of capital investment in new developments;
- The foregone opportunity to increase Gross State Product, personal income and employment that would be generated by the development;
- Loss of opportunity to the agricultural sector and service industries;
- Continued decline in the population and economic activity;
- Loss of opportunity to diversify the economy and skills base of the community; and
- With no restructuring towards higher growth industries, the region is likely to continue its heavy reliance on social security benefits to bolster household incomes.

5.2 Alternative Location for the Entire Project

In assessing alternative locations for the project, an assessment was made of the advantages and benefits of locating at Guthalungra as opposed to elsewhere in the State.

The entire coastline of Queensland has been assessed at various times for marine pond aquaculture. Many potential investors have travelled the state looking for sites. There are several reports that provide information on the suitability areas for aquaculture:

- Survey of Queensland Coastal Regions for Prawn Farm Development, QDPI, (1995);
- Survey of Queensland Coastal Waters for Cage Aquaculture Development, QDPI (1995); and
- Identification of Prawn Farm Opportunities in the Bowen Region, Department of State Development and Bowen Collinsville Enterprise Group Inc. (2002).

More recently, the Queensland Department of State Development have invested in producing a GIS mapping system aimed to assist in the process of identifying areas available for aquaculture development. All of these reports specifically identify Bowen Shire as having potential for large-scale aquaculture development.

5.2.1 Advantages of the Guthalungra Site

a) Climatic Conditions

The temperature in the dry tropics of Northern Queensland is ideally suited to the production of penaeid prawns. The temperature profile during the summer growing season is ideal for optimal growth (Refer to Section 6.2). There appears to be few advantages in locating farms further north in the wet tropics where the weather is warmer. The Australian prawn farming industry has identified the need to allow a fallow period during which the ponds are reconditioned prior to re-use regardless of the location. Some more northerly farms have encountered difficulties when attempting to dry-out between crops due to the high rainfall in the area.

Further south and the temperature profile is not as conducive to prawn production as there is a shorter growing season. The advantages of an extended growing season mean that there is a greater availability of fresh product over a longer period. This enables farms to optimise market prices, as buyers will pay more for fresh prawns.

b) Freehold Land Owned by Pacific Reef

Pacific Reef Fisheries purchased the land at Guthalungra with the intention of establishing the prawn farm. The assessment of the land at the time of purchase was extensive and well informed. The initial proposal for intake and discharge has changed considerably and has enhanced the attractiveness of the site for prawn aquaculture.

c) Supportive Government, Council, Community

The Bowen Shire Council and the Bowen Collinsville Enterprise Group have announced an aquaculture industry development goal of establishing a “\$100 million diversified and value added aquaculture industry employing 1000 people by 2020”. In order to achieve this the Council is undertaking a range of initiatives. The Bowen Shire Council is very supportive of the establishment of prawn farms in the region.

d) Regional Infrastructure

The site is well serviced with roads, communication and power. The site is only 2km from the national highway. This is important, as product will be transported by road to major urban centres, and feed supplies brought to the farm by road. The site is easily accessible by road and the roads to the site are well constructed.

e) Close to Centre of Population

Services, support industries and a significant centre of population are located nearby at Bowen. The village of Guthalungra has been extensively subdivided for residential development should the need for additional local housing arise.

f) Land Characteristics

The land is eminently suitable for pond construction with appropriate soils on site to construct the ponds and line ponds where necessary.

g) Rural/Agricultural Labour Force

The local workforce has many of the skills and attributes required for the operation of a prawn farm. There are a large proportion of individuals with vocational qualifications and, because agriculture has been the predominant employer in the region, the basic skills set and work ethic of the working population is well suited to prawn farming.

h) Supportive Community

A survey undertaken in the Bowen community by the Queensland Department of State Development (Community Consultation Survey of Aquaculture Developments in the Bowen Region, Deborah Wilson Consulting Services, 2001) indicates that the local population is largely supportive of the development of aquaculture industry in the region. This is borne out in the consultation undertaken during this study.

i) Access to excellent quality water

The intake water from Abbot Bay is relatively low in nutrients and suspended solids. The intake water quality used by a prawn farm has a direct bearing on the discharge quality, with better quality intake water resulting in improved quality discharge. Also, the incoming bacterial loads will be low in the intake water and will help reduce the incidence of disease on the farm.

j) Relatively Low Recreational and Commercial Use Area

Abbot Bay and the mouth of the Elliot River is a low use area (relative to many areas of coastal Queensland) without a major resident population. The development will not be visible from the Elliot River or Abbot Bay, nor will the proposal impact on user access. Therefore the development will not directly impinge on the use of the coastal resource in the region or on aesthetic values.

k) Low level Impacts

It is intended that the discharge from the site will occur via a pipe located near to the intake pipe. The pipes will be buried both onshore and offshore, and will extend offshore into Abbot Bay by about half a kilometre. The discharge pump facility will be at ground level located in the dunal system and will not be visible from the sea or residences. The pipe and pumping system will not be visible to other resource users in the region.

There is no intention of discharging into the mangrove lined estuarine area. There is no intention of discharging into the adjacent saltpan area.

The operational impact on marine plants will be low-level, seasonal and reversible, and impact during construction will be minimal. The operation of the farm and therefore the discharge period will be seasonal so the receiving environment experiences a recovery period.

The footprint of any facilities located outside of the development area (predominantly Lot 8) will be small relative to the geographic cover of the ecosystem in which they are located. When the impacts of the proposal are considered in relation to the potential risk of the development to the environment, the social and economic benefits, and the structural changes currently underway to existing rural industries in the region, then it can be argued that the proposal constitutes an acceptable alternative use of the coastal resource.

l) Cleared Land Topographically Suitable, Low Ecological Values

The area of the site to be used for ponds is ideally suited for pond aquaculture. It is gently sloping with most of the remnant vegetation being cleared the site has been heavily grazed for many years.

5.2.2 Potential Disadvantages of the Guthalungra Site

a) *Little fresh water*

The internationally accepted optimal salinity for the growout of *Penaeus monodon* is between 23 – 30 ppt. However, Pacific Reef Fisheries has been rearing in the dry tropics for a number of years and has experienced good growth and survival. Management at Pacific Reef Fisheries consider that there are some benefits from farming in higher salinity waters particularly in terms of the reduced incidence of bacterial disease. The lack of fresh water supply reduces the capacity to recirculate pond water.

b) *Distance to Water Supply*

The proposed location of the growout ponds is not directly adjacent to the water supply but located some distance away. Although this does raise the capital cost of construction and the increased power and pumping requirements are seen as a disadvantage, other positive features of the site override this. The suitability of the land, which has been earmarked for pond construction, is seen as a major advantage.

c) *Environmental and Cultural Significance*

The entire coastline of Queensland as far south as Bundaberg and north to Cape York lies within the boundaries of the Great Barrier Reef Marine Park. In addition, a number of areas of environmental importance have been identified in the vicinity of the farm. It is highly unlikely that there is a site in Queensland that will not have environmental and cultural sensitivities in close proximity. This EIS indicates that the Guthalungra development will not adversely impact on the values of adjacent environmentally or culturally sensitive areas.

Summary

On balance the advantages of the site outweigh the disadvantages of the site:

- Pacific Reef Fisheries and other farms have shown that *P.mondon* and other prawns can be very successfully grown in the Australian dry tropics;
- The ponds are located some distance from the water supply and waterways therefore does not have the amenity issues often associated with prawn farm developments;
- The site is located adjacent to important environmental and cultural areas however the impacts on these areas are not significant during construction and operation;
- Overall environmental impact will be seasonal so that some recovery from any impact is likely to occur; and
- The Traditional Owners have been, and remain, fully involved in the process and supportive of the proposal.

Alternative locations may be available within the region but will not exhibit any greater advantages.

Alternatives in the State

There are a number of considerations to take into account when locating a prawn farm, and it appears to be becoming increasingly difficult to establish aquaculture ventures. Despite the potential benefits likely to accrue from a significant aquaculture industry it is highly unlikely that there will be substantial prawn farming industry growth in the State because of:

- Increasing resistance by resource users and resource managers for prawn farms to be located adjacent to high use areas such as the mouths of rivers and creeks;
- Fewer coastal areas that do not have restricted access to aquaculture development eg. areas with environmental zoning etc;
- The majority of Queensland's population is located on the coast; it is becoming increasingly difficult to find areas away from residential or tourist development; and
- Conversely, much of Queensland is remote or has poor infrastructure and access.

5.3 Alternative Locations within the Site

5.3.1 Pond Location

The chosen design has the ponds and treatment facilities located on Lot 8. This Lot is better suited for production for a number of reasons:

- The location for the ponds has been chosen because of the proximity to intake and discharge points;
- Water flow and flood characteristics;
- Soil suitability;
- Topographic considerations;
- Access;
- Minimising environmental impacts;
- Maximise use of the space;
- The requirement to build and operate three discreet production units with integrated treatment systems;
- Minimising visual amenity; and
- Cultural Heritage considerations.

Figure 4-1 in Section 4.1 and Appendix B indicates the location of elements of the farm

5.3.2 Alternative Pond Locations

An extensive investigation of the suitability of Lot 370 for situating the production ponds has been undertaken. Apart, from the areas on the western side of the block that will be used for settlement ponds and administrative facilities the bulk of the land will not be used for development. Production ponds will not be located on Lot 370. There are a number of reasons for this:

- Distance from the rest of the farm; the bulk of the ponded area will be on Lot 8 and the area in which ponds could have been located in 370 is a considerable distance from the bulk of the operation. This is seen as increasing the relative costs of production from this area;

- The Elliot River is no longer considered an option for either intake or discharge. Initially the intention was to supply water to ponds in this area from the Elliot River or alternatively discharge from this area into the Elliot River. These proposals are no longer being considered, so the need to site ponds in this area has diminished;
- The area available is relatively small thus limiting the number of ponds that can be located in the area. The number of ponds that can be located in this area is reduced further by the requirement to locate ponds above HAT (Highest Astronomical Tide). HAT intrudes through this area through a series of shallow gullies which means that it is difficult to establish a reasonable buffer between the tidal intrusion and any proposed ponds;
- The soil characteristics of the area are not conducive to pond construction without lining material; and
- The ponds and most of the treatment area will be located on the higher ground of Lot 8. Any ponds developed on Lot 370 would require their own treatment area and discreet intake and discharge facilities;
- Areas of potential cultural sensitivity exist on Lot 370; and
- Development on Lot 370 near the banks of the Elliot River would not be compatible with the recreational use of the area.

5.3.3 Infrastructure

The location of infrastructure such as roads and utilities on the farm is dictated by the location of the ponds, the intake and discharge points, the location of the entrance to the farm, topography, and farm management requirements. The production ponds will be constructed in four stages and the operation managed in three sections; each section will constitute a separate farm unit and will have a dedicated treatment system. Facilities such as machinery storage, feed storage, workshops, and staff facilities will be shared to improve efficiencies. The design is sufficiently flexible to allow for the introduction of recirculation and bioremediation, as these techniques are refined.

The location of elements of the operation is largely dictated by the location of the ponds which have been design to achieve optimum production from the land available.

5.3.3.1 Roads

Road locations are dictated by the layout of the ponds and/or access requirements to areas of the farm that require servicing, maintenance or regular operational use.

The road required to service the pump station is located within the boundaries of a gazetted road reserve. The rationale for the pump station location and pipeline route is detailed in Section 5.4. A number of design and location alternatives were considered for the road required to service the pump station. The following issues were taken into consideration in the assessment:

The pumps at the pump station will be running continuously during the production season. The pumps will not require frequent attendance however they will need to be checked at least two times each week. The intake and discharge lines will have to be pigged (cleaned) annually, which will take two days.

The road reserve crosses nationally recognised wetlands important for migratory birds therefore the alternatives to the construction of a road across the wetland were investigated in some detail. The impacts of the pipeline route and the pump station location are discussed in more detail in Section 7.2.

Several alternatives were considered in order to gain access to the pump station across the wetland:

- No Permanent Access Route Across Wetland – Specialised Off-Road Vehicle e.g. hovercraft.

The option to gain access through a road reserve without a road or track using a vehicle that can cause minimal physical disturbance e.g. hovercraft was considered. This is not considered a practical option due to the inconvenience caused to the operation, the additional ongoing cost and the specialised equipment and training required to drive the vehicle. Also, there may be a need to get equipment out to the pump station quickly, which may not be possible on a light vehicle. Also, a vehicle such as a hovercraft may cause some disturbance of the substrate and appears to be noisier than a conventional vehicle.

Where heavy equipment is needed at the pump station quickly it may be possible to use a helicopter or landing craft and traverse the frontal dune.

- Access to the pump station via an alternative route:
 - A route along the bank of the Elliott River to the mouth then north along the beach to the pump station was considered. However it was not considered practical because of the damage that may be caused to the banks of the river and the dunal system with continued use. Also the dunal system would be very difficult to transverse without some permanent track, and a bridge would have to be constructed across Nobbies Creek; and
 - Alternatively, access may be gained by boat to a point on the beach adjacent to the pump station. This was considered impractical, as access would be highly dependent on tides and weather. The ability to carry machinery to the pump station would be limited for the reasons given above. Damage to the frontal zone would occur as a landing craft would be used and all terrain vehicles required to transport equipment from the boat to the pump station.

None of the alternatives outlined are acceptable in terms of allowing emergency access. The preferred option is to construct a low impact track across the wetland this is discussed in detail in Section 7.2.

5.3.3.2 Electricity

Electricity supply to the pump station will be buried along the pipeline route. This will remove the need for poles across the wetland.

5.3.4 Processing/Freezing

Processing is located near to the entrance of the farm and near to the administrative centre. Freezers are located next to the processing facility. There is potential for flooding in alternative low lying areas of the property and therefore there is no obvious alternative.

5.3.5 Feed Storage

Feed will be stored at a central location near the administrative centre.

5.3.6 Housing

Permanent Housing

There will be three houses located on-site. The site manager, maintenance supervisor, and caretaker/security person or processing manager will be accommodated onsite in family style housing. This housing will be located in the vicinity of the administrative facilities rather than next to the existing homestead which is adjacent to the freshwater dam in a low lying area of the property.

Temporary Housing

Initially, the construction of dormitory to house temporary staff was considered. This is not considered necessary. There is sufficient permanent and temporary housing in Bowen and the daily travelling distance of 40km is not considered unreasonable. A bus may be laid on for temporary staff during certain periods otherwise carpooling will be encouraged.

5.3.7 Staff Facilities

There will be a number of spaces made available for staff to use during break times. The form that these areas take will vary. For example a canteen will be located adjacent to the office complex and another near the processing room. Site workers will make use of the dedicated areas in the maintenance, feed and storage sheds.

5.3.8 Maintenance

There will be a single maintenance shed located near the administrative centre of the farm.

5.3.9 Office Complex

The office complex will be located within the administrative centre of the farm near to the entrance of the site and near the processing and freezers, maintenance, central storage, and central feed storage etc (Refer to Appendix B). The office complex will include a large meeting room.

5.3.10 Storage

There will be a requirement to store equipment at a central location near the administrative centre.

5.3.11 Parking

Parking will be required for up to fifty cars and will be located near the entrance of the farm adjacent to the administrative centre. Pacific Reef Fisheries will investigate running a bus from Bowen to the farm.

5.4 Alternative Locations for Intake and Discharge Structures

Several locations and their combinations were reviewed for the location of intake and discharge points. These were:

- Intake and/or discharge from the Elliot River south of the Nobbies Creek or discharge to the salt pan to the north of the ponds; and
- Intake and discharge from Abbot Bay.

The farm will pump water over a 24 hr daily cycle. Hydraulic modelling of flow conditions in the Elliot River indicated that the volume of water required for the operation of the prawn farm was not achievable. There are substantial periods when low flows exist in the Elliot River and so the quantity of water required cannot be met. Also, drawing large volumes from the Elliott River was not considered to be ecologically sustainable.

Discharge of water to either the Elliot River or across the saltpan was also considered not to be ecologically sustainable because of the large volumes involved and the potential impacts during low flow conditions.

An intake pipeline and discharge pipeline into Abbot Bay was considered to be the best economic, social and environmental alternative. A large source of good water quality is available. The pipelines will be buried and not visible to passing boats or beach visitors. The impacts of discharge on the receiving environment are likely to be sustainable.

The route by which the intake and discharge pipelines reach Abbot Bay is largely dictated by the location of the road reserves. Alternative routes would require consent from adjacent landowners to allow access. Approval has not been forthcoming to date. An Ergon right of access for power lines and an associated track exists across an adjacent property. Authority to lay the pipelines beneath this track would considerably shorten the distance from the ponds to the ocean and remove the need to construct a similar track through the road reserve 1 km to the north.

5.5 Alternative Locations for Structures to Minimise Clearing

The pipeline route to Abbot Bay has a small ecological footprint. Some marine plants in the salt pan will be removed during construction. Similarly an area in the wetland will be disturbed during construction as well as some vegetation in the dunal system. Some seagrass will be disturbed during pipeline construction.

All disturbed areas other than the seagrass will be re-vegetated with vegetation endemic to the area. The building of the pump house will require the removal of vegetation. This aspect of the project is described in more detail In Section 7.2.

5.6 Alternative Methods to Manage Water Balance in Ponds

Alternative technologies and methods for managing water balance in the ponds are discussed in Section 7.1.

5.7 Alternative Options for Design of Settlement Ponds

Discussions were held with Chris Jackson (CSIRO, Cleveland) and based upon our recent knowledge of the operation of settlement ponds, it was concluded that a pre-settling pond area prior to the settlement ponds would improve water quality treatment on the farm. Residence time within these pre-settling ponds would be in the order of 6-8 hrs. Heavier particulate material would flocculate out in these smaller pre-settling basins. It is well known in the prawn farming industry that deposition of much of the large and denser material from the prawn farm discharges occurs in the channels between the grow out ponds and the settlement ponds established by farmers.

We wish to improve on this process by capturing much of this material in a series of smaller pre-settlement ponds. Ponds are designed to be emptied regularly so that these ponds are provided in duplicate to facilitate this process. This regular emptying is to reduce the impact of feedback from the sludge layer, which can provide the release of nutrients particularly under anaerobic conditions. The sludge would be placed in a pond put aside for sludge containment.

The benefits of this process are two folds. Firstly, heavier and denser material e.g. inorganic material, bacterial and algal flocs and dead organic matter will be captured in the pre-settling ponds. Secondly, regular emptying and cleaning of these ponds will reduce the remobilization of nutrients from the sludge back in to the water column thus reducing the opportunity for increased growth of algal biomass.

5.8 No Discharge Options

The no-discharge alternative has been investigated by Oceans Institute in Hawaii for raceways. *Penaeus vanamei* have been successfully grown on a trial basis in raceways. The commercial success of these operations is still in the planning stage. A number of features are important for the successful operation of raceway operations. *P. vanamei* has successfully been domesticated and the qualities suitable for raceway mariculture have been selected. In particular the ability of the animals to live in raceway conditions has been established.

In Australia, on an experimental basis, recycling has been investigated for a *P. monodon* prawn farm in the wet tropics by the Queensland Department of Primary Industry (Robertson *et al.*, 2002). Recirculation has potential in Queensland, in particular, areas of the wet tropics. The growth of *P. monodon* is restricted by high salinities, which are likely to occur in low rainfall coastal areas with closed circuit recirculation systems. Recirculation at Guthalungra will be undertaken when the salinities and climatic conditions are acceptable.

5.9 Alternative Species

The Guthalungra Prawn farm has been designed and will be constructed for the production of black tiger prawns, *Penaeus monodon*. Pacific Reef Fisheries has an experienced management team with considerable knowledge of farming tiger prawns and has trialled banana prawns at the Ayr farm previously with limited success. Tiger prawns are considered to be more suitable for production in the dry tropics than banana prawns for the following reasons:

- Productivity - Banana prawns are grown at much lower stocking densities; around 4 tonnes per hectare per crop may be achieved. The annual production from a farm located in the wet tropics may be up to 6 tones per hectare, as continuous production is undertaken, however this is not the case in the dry tropics;
- Growing Season - Neither banana or tiger prawns can be grown continuously in the dry tropics because of the temperature profile and the desire by Pacific Reef Fisheries management to “drain-down” and fallow the ponds at the end of each season as part of their disease management and pond maintenance strategy;
- Bioremediation - Banana prawns are being trialled on a number of farms throughout Queensland as a bioremediation species and secondary crop. Initial trials have not been successful and the growth of banana prawns in discharge waters has been poor. It is envisaged that supplementary feeding would be required to sustain commercial crops; and
- Profitability - Tiger prawns return consistently high prices than banana prawns and cost less per/kg to produce.

Other species of fish or prawns are not being considered for commercial production at this stage. Milkfish may be considered for bioremediation trials.

5.10 Alternative Pond Layouts

The 260 ha of ponds will be managed as three separate farms. This is to optimize the efficiency of the farming units in terms of production, health management and for optimal water treatment efficiency. The ox bow lake area was originally set aside for up to 50 ponds. Because of cultural heritage and performance efficiency, this area would be best left in its natural state.

5.11 Alternative Management Practices

A number of alternatives to minimize and mitigate environmental impacts are discussed within the document. Two important issues are the track across the wetlands and secondly the discharge to Abbot Bay. The alternatives to the track are discussed in Section 5.3.3.1. The discharge to Abbot Bay has been minimized by introducing management practices that will lead to low pond exchange rates, minimization of Feed Conversion Ratios (FCRs) and improved on site treatment of discharge waters. Alternative methods of achieving these objectives will continue to be assessed during the detailed design phase and the construction and operation of the project.

5.12 Assessment of Alternative against Controlling Provisions

Most of the alternatives already discussed above for the project require assessment under the same controlling provisions as those required for the present design. There may be limited exceptions to this, for example, if water was not drawn from, or discharged to, Abbot Bay, or if the pump station were located on freehold land, approval under the *Beach Protection Act 1968* would not be required.

5.13 Alternative Power Supply

Alternative power supplies such as wind generators are not considered a viable alternative. Lot 8 and 370 are located around 4 km from Abbot Bay behind the shelter of the dunal system therefore wind strength is likely to have dissipated. Additionally the authors are not confident that local residents or the local community will support the construction of windmills in the vicinity of Abbot Bay.