ASSESSMENT REPORT 48

AUSSIE PRAWNS PTY LTD

AUSSIE PRAWNS AQUACULTURE DEVELOPMENT

**(SECTION 1880 HUNDRED OF AYERS
CHANNEL ISLAND ROAD - MIDDLE ARM - DARWIN HARBOUR)**

ENVIRONMENTAL ASSESSMENT REPORT

AND

RECOMMENDATIONS

by the

**OFFICE OF ENVIRONMENT AND HERITAGE
NORTHERN TERRITORY GOVERNMENT**

May 2005

Northern Territory Government
Office of Environment and Heritage

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GLOSSARY & ABBREVIATIONS

APPL	Aussie Prawns Pty Ltd
ASS	Acid sulphate soils
CRC	Cooperative Research Centre
CNR	Conservation and Natural Resources
DBIRD	Northern Territory Department of Business, Industry and Resource Development
DCA	Development Consent Authority
DHCS	Northern Territory Department of Health and Community Services
DIPE	Northern Territory Department of Infrastructure, Planning and Environment
DPI	Department of Primary Industries (Queensland)
EMP	Environmental Management Plan
EPA	Environmental Protection Agency (Qld)
GBR	Great Barrier Reef
ha	Hectare
km	Kilometre
m	Metre
ML	Megalitre
NOI	Notice of Intent
NPI	National Pollutant Inventory
NT	Northern Territory
OEH	Office of Environment and Heritage
QLD	Queensland
PASS	Potential acid sulphate soils
PER	Public Environmental Report
WQ	Water Quality

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EXECUTIVE SUMMARY

This report assesses the environmental impacts of the proposal by Aussie Prawns Pty Ltd (the proponent), to establish an aquaculture development, at Section 1880, Hundred of Weddell (Channel Island Road, Middle Arm, Darwin Harbour). The proposal is to redevelop a disused aquaculture site, to produce up to 220 tonnes of prawns per annum. The development will consist of 42 Ha of production ponds; an existing fresh water impoundment; hatchery, packing and storage sheds; administration and workshop buildings, and associated infrastructure.

The Assessment Report reviews the revised Public Environmental Report and information, comments and advice provided by Northern Territory Government agencies. There were no comments received from the public.

Environmental assessment is the process of defining those elements of the environment which may be affected by a development proposal and of determining the significance, risk and consequences of the potential impacts of the proposal. Recommendations arising from the assessment address methods to mitigate these impacts.

Major Issues

The principal environmental issues identified by the proponent and this assessment are:

1. site design and layout;
2. land clearing and erosion control;
3. weeds and pests;
4. biting insects;
5. water management;
6. waste management and discharge; and
7. decommissioning and rehabilitation.

The potential benefits associated with the proposal include:

- significant economic growth;
- employment and training; and
- export of a premium product.

Conclusions

The Office of Environment and Heritage considers that the environmental issues associated with the proposed project have been adequately identified. Appropriate environmental management of these issues has been resolved through the assessment process and in the PER. On going monitoring and management actions for these issues will be detailed in comprehensive construction and operational Environmental Management Plans.

The final Environmental Management Plans for the construction and operational phases of the aquaculture development will be subject to satisfactory review by relevant Northern Territory Government agencies. They will be working documents for the life of the project and will require continual review in the light of operational experience and changed circumstances.

Based on its review of the Public Environmental Report and submissions from relevant Northern Territory Government agencies, the Office of Environment and Heritage considers

that the Aussie Prawns Aquaculture Development can be managed in a manner that avoids unacceptable environmental impacts, provided that the environmental commitments, safeguards and recommendations detailed in the PER, this Assessment Report and in the final Environmental Management Plans are implemented, with regular reporting and compliance auditing.

LIST OF RECOMMENDATIONS

Recommendation 1

The proponent shall ensure that the proposal is implemented in accordance with the environmental commitments and safeguards:

- **Identified in the Public Environmental Report for the development of an aquaculture facility at Section 1880 Hundred of Ayers; and**
- **Recommended in this Assessment Report (No. 48).**

Recommendation 2

In accordance with clause 14A of the Administrative Procedures of the *Environmental Assessment Act 1982* the proponent shall advise the Minister of any changes to the proposal for determination of whether or not further environmental impact assessment is required.

Recommendation 3

Prior to construction, a certified civil engineer shall review and amend, where necessary, the plans for all ponds, dams and earthen water-retaining structures to ensure their stability, water holding capability and groundwater protection. Certified plans shall be included in the Construction EMP.

Recommendation 4

As a condition of the Development Permit, the DCA should require a review of the facility prior to the expansion of the facility to each additional stage (or greater than 20 hectares of production ponds). DCA approval to proceed to the next stage should be conditional on this review satisfying the requirements of the OEH.

Recommendation 5

The performance of the waste discharge method shall be continually monitored to determine whether the initial sheet-flow method is delivering acceptable environmental outcomes. If it is determined by DIPE that the method is not performing, APPL will deploy an alternative discharge arrangement to the satisfaction of DIPE.

Recommendation 6

APPL shall incorporate a Biting Insect Management Plan into the Construction and Operation EMPs. The management plan shall be to the satisfaction of the Medical Entomology Branch (DHCS).

Recommendation 7

An Erosion and Sediment Control Plan and Dust Management Plan shall be included as a part of the Construction and Operational EMPs.

Recommendation 8

A Weed Management Plan shall be developed as part of the Construction and Operational EMPs.

Recommendation 9

An Acid Sulfate Soils Management Plan shall be developed as a part of the Construction and Operational EMPs, in consultation with DIPE.

Recommendation 10

For all discharges from the facility, a Waste Discharge Licence under the *Water Act* will be required. The Waste Discharge Licence will identify acceptable wastewater quality, and wastewater monitoring requirements for discharges. In issuing the Waste Discharge Licence, consideration of cumulative impacts and mass loadings of nutrients shall be considered.

Recommendation 11

A Waste Management Plan for general site operations, characterising all waste streams (including solid, liquid and hazardous wastes), and exploring methods for waste minimisation and recycling, shall be included in the Construction and Operational EMPs.

Recommendation 12

A Pest and Disease Management Plan shall be developed to the satisfaction of DBIRD and included in the Operational EMP.

Recommendation 13

APPL will ensure that decommissioning and rehabilitation is done in accordance with the best environmental methods and practices available at that time.

Recommendation 14

The Operational Environmental Management Plan will include an estimate on annual power consumption, a discussion on energy efficiency measures and a consideration of greenhouse offsets. Annual power consumption will be reported to the NT Greenhouse Policy Unit.

Recommendation 15

The proponent shall develop a Mangrove Monitoring Program to the satisfaction of Conservation and Natural Resources Division of DIPE, to be included within the Construction and Operational EMPs.

Recommendation 16

APPL shall assist NT Authorities in estimating emissions of listed substances for the National Pollution Inventory by providing information required to report aggregated emissions for the industry. Information needed includes:

- **annual crop production;**
- **annual stock feed (including N & P content); and**
- **annual fertiliser used (including N & P content).**

Recommendation 17

Construction shall not commence until a completed Construction Environmental Management Plan (to the satisfaction of OEH and DBIRD) that covers the construction phase of the APPL development has been submitted to OEH and DBIRD. This plan should outline the scope and scale, and layout of the first stage of development, including plans of all structures, and be updated prior to the construction of additional stages.

Recommendation 18

Operation shall not commence until a completed Operational EMP (to the satisfaction of OEH and DBIRD) for the operational phase of the APPL development has been submitted to OEH and DBIRD. This plan shall be updated for additional stages.

INTRODUCTION AND BACKGROUND

This report assesses the environmental impacts of the proposal by Aussie Prawns Pty Ltd (the proponent), to establish an aquaculture development at Section 1880, Hundred of Weddell (Channel Island Road, Middle Arm, Darwin Harbour), known as the Aussie Prawns Pty Ltd Aquaculture Development (APPL development). The proposal is to redevelop and expand a disused aquaculture facility to produce up to 220 tonnes of prawns per annum. The development will consist of 42 hectares of production ponds, a total of 20 hectares of wastewater treatment area, 46.5 hectares of fresh and saltwater storage as well as hatchery and farm support buildings. The total area of the site is 288 hectares, which includes 96 hectares of tidal flats and mangroves, and 50 hectares of unused upland area.

This Environmental Assessment Report is based on a review of the Public Environmental Report (PER) and advice from Northern Territory (NT) Government agencies. No comments were received from the public. A list of respondents to the revised PER and issues raised in their submissions are provided in Appendix I.

1.1 Environmental Assessment Process

Environmental impact assessment is based on adequately defining those elements of the environment that may be affected by a proposed development, and on evaluating the significance, risks and consequences of the potential impacts of the proposal at a local and regional level.

The Public Environmental Report (PER), submitted by the proponent provides a description of the existing environment in the area and the proposed operations, and evaluates the environmental impacts and proposed measures to minimise the expected impacts.

This Assessment Report describes the adequacy of the PER in achieving the above objectives and evaluates the undertakings and environmental safeguards proposed by the proponent to mitigate the potential impacts. Further safeguards may be recommended as appropriate.

The safeguards may be implemented at various levels within the planning framework of a project. These include, but are not limited to:

1. site selection;
2. design and layout of facilities;
3. management of construction activities;
4. processes used in operations and facilities (i.e. inputs and outputs); and
5. management of operations, processes and facilities.

The contents of this Assessment Report form the basis of advice to the Northern Territory Minister for the Environment and Heritage (the Minister) on the environmental issues associated with the project.

1.2 Environmental Impact Assessment History

This site was first considered for aquaculture in 1992. That project was not subject to assessment under the *Environmental Assessment Act*, however, the proponent was required to submit a Preliminary Environmental Report for internal assessment of that development. The farm changed ownership, and ceased operations in 2001.

The current proponent, Aussie Prawns Pty Ltd, (APPL) lodged a Notice of Intent (NOI) with the Office of Environment and Heritage (OEH) in March 2004, proposing the redevelopment of the 14 hectare aquaculture facility within the existing farm footprint, the APPL development. No formal assessment was required for that application, and an Environmental Management Plan was lodged with OEH. In September 2004 the proponent revisited their site plans, and submitted a second NOI proposing the current 42 hectare APPL development.

On 22 November 2004 the Minister for the Environment and Heritage determined that the environmental issues associated with the proposal were sufficiently significant to warrant assessment under the NT *Environmental Assessment Act 1982* at the level of a PER. Draft guidelines covering issues to be addressed in the PER were subject to public review from 8 January 2005 – 22 January 2005. Final guidelines were prepared; taking into account the comments received from the public and government agencies. The Minister issued the final guidelines and a direction to the proponent to prepare the PER on 2 February 2005.

The PER was submitted on 18 April 2005 and placed on public review for four weeks from 18 April 2005 to 16 May 2005. No comments were received from the public. Issues raised in submissions from Government departments are included at Appendix I.

2 THE PROPOSAL

The proposed APPL aquaculture development is located at Section 1880 Hundred of Ayers (Channel Island Road, Middle Arm, Darwin Harbour).

The site has a total area of 288 hectares, of which approximately 90 hectares is currently disturbed, as a disused aquaculture facility. The new proposal intends to reuse as much of the existing infrastructure as possible, and will wholly absorb the old farm footprint.

The farm, upon completion, will comprise:

- 42 production ponds, each 1 hectare in area;
- associated intake and outlet channels;
- a pump station at the jetty;
- a second lift pump station;
- a salt water dam;
- a pump station at the fresh water dam;
- two sedimentation ponds;
- a sludge drying bed; and
- a new hatchery and farm support buildings.

It is proposed that the redevelopment will be staged, with staging dependent on funding and weather conditions. The proponents intend to complete all three stages prior to the 2006 production season. The proposed staging is:

STAGE ONE:

- Establish 10-15 new production ponds including associated intake and effluent channels;
- upgrade the saltwater pump facility at the jetty;
- raise saltwater storage dam walls and install second lift pump station;
- establish one sedimentation pond;
- establish the sludge drying bed; and
- upgrade the freshwater dam spillway and establish pump station.

STAGE TWO:

- Establish a further 10-15 new production ponds including associated intake and outlet channels;
- establish the second sedimentation pond; and
- establish the new hatchery and farm support buildings.

STAGE THREE:

- Establish the remainder of the production ponds including associated intake and outlet channels.

3 ENVIRONMENTAL IMPACT ASSESSMENT

3.1 Introduction

The main purpose of this Environmental Assessment Report is to determine if the proposed project can proceed without unacceptable environmental impacts. It does this by identifying all relevant potential environmental impacts and evaluating the feasibility and likely effectiveness of environmental safeguards put forth by the proponent. Where the proposed safeguards were considered incomplete, inadequate or insufficiently clear, or for safeguards that are particularly crucial, this Assessment Report makes recommendations to complete or emphasize the safeguards and commitments made by the proponent.

The environmental acceptability of the project is based on consideration of the following, from the PER:

- Adequacy of information outlining the proposal (particularly which structures or activities are likely to impact on the environment);
- Adequacy of information on the existing environment (particularly environmental sensitivities);
- Adequacy of information on the range and extent of potential impacts; and
- Adequacy of the proposed safeguards to avoid or mitigate potential impacts.

The outcome of the environmental impact assessment for this proposal is that the NT Government believes that the project can be implemented without unacceptable environmental impacts. This outcome is dependent on the proponent implementing the environmental safeguards identified in its PER in addition to recommended measures for environmental management presented in this Environmental Assessment Report.

Because minor and non-substantial changes may be made to the design and specifications presented in the PER, some degree of flexibility is desirable and will be necessary for adapting the environmental safeguards defined in the PER and this Assessment Report. Where it can be shown that such changes are not likely to have a significant impact on the environment, an adequate level of environmental protection may still be achieved by the following recommendations, modifications to these recommendations or by conditions attached to relevant statutory approvals for these modifications.

This section contains recommendations (in **bold**), each of which are preceded by text that identifies concerns, suggestions and undertakings associated with the project. For this reason, recommendations should **not** be considered in isolation.

Subject to decisions that permit the project to proceed, the primary recommendations of this assessment are:

Recommendation 1

The proponent shall ensure that the proposal is implemented in accordance with the environmental commitments and safeguards:

- **Identified in the Public Environmental Report for the development of an aquaculture facility at Section 1880 Hundred of Ayers; and**
- **Recommended in this Assessment Report (No. 48).**

Recommendation 2

In accordance with clause 14A of the Administrative Procedures of the *Environmental Assessment Act 1982* the proponent shall advise the Minister of any changes to the proposal for determination of whether or not further environmental impact assessment is required.

Subject to these recommendations, further recommendations are made throughout this Assessment Report.

3.2 Summary of major environmental issues

The principal environmental issues raised by the proponent and through this assessment include:

1. site design and layout;
2. land clearing and erosion control;
3. weeds and pests;
4. biting insects;
5. water management;
6. waste management and discharge; and
7. decommissioning and rehabilitation.

The remainder of Section 3 deals with issues raised in the submissions to the PER and the proponent's commitments to environmental management provided within the PER. In addition, recommendations to complement or strengthen environmental management strategies and safeguards are presented.

3.3 Site Design and Layout

3.3.1 Pond Design

Given the scale of the proposed project, aspects associated with water management and public focus on such facilities, and the potential for the site to be exposed to adverse weather such as cyclones, storm surge and torrential rain, a high standard of site design and construction is imperative.

Comprehensive and appropriate pond design and construction are particularly important to ensure that the operation of the facility does not impact adjacent sensitive areas, and users of adjacent resources. As there is a wide range of local expertise within DIPE and DBIRD, the proponent is advised to liaise with these Departments to obtain relevant advice.

Recommendation 3

Prior to construction, a certified civil engineer shall review and amend, where necessary, the plans for all ponds, dams and earthen water-retaining structures to ensure their stability, water holding capability and groundwater protection. Certified plans shall be included in the Construction EMP.

3.3.2 Staging of Facility

This design issue and subsequent recommendation is heavily reliant on the consideration of wastewater quality and quantity, and the impacts of that wastewater on the receiving environment. The issues and recommendation raised in this section should be considered alongside the discussion and outcomes of Section 3.3.3 (Site Design and Layout: Method of Discharge), Section 3.6.1 (Operation Issues: Water Management) and Section 3.8.4 (General Issues: Mangroves).

The scale of the proposal is significant in terms of the area of production ponds and related infrastructure, and requires considerable financial and environmental effort to achieve. However, performance in both production goals (i.e. the tonnage of prawns produced) and environmental outcomes (primarily the quality and quantity of wastewater discharged) is dependent on climatic and market influences and may be offset by the appropriate mitigation measures (as identified in the PER). For this reason, staging of the project (as proposed by the proponent and outlined in section 2 of this report) is supported.

In order to ensure the best balance between production and environmental outcomes, it is recommended that the staging is approached formally, and reliant on demonstration of successful production and environmental performance of the facility (with respect to the nutrient loads of wastewater being discharged). To achieve this, prior to expansion to each additional stage of pond construction (or greater than 20 hectares of ponds) a review of performance should be reported to, and OEH should be satisfied with the results of the review and confident that they can be scaled up to the next stage successfully.

The review should outline how APPL has performed against both production goals and environmental management goals, and will form the basis for development approval to commence expansion to the next stage of development.

Recommendation 4

As a condition of the Development Permit, the DCA should require a review of the facility prior to the expansion of the facility to each additional stage (or greater than 20 hectares of production ponds). DCA approval to proceed to the next stage should be conditional on this review satisfying the requirements of the OEH.

3.3.3 Method of Discharge

This design issue and subsequent recommendation is interlinked to the above section (3.3.2 Staging of Facility) and also heavily reliant on the consideration of wastewater quality and quantity, and the impacts of that wastewater on the receiving environment. The issues and recommendation raised in this section should be considered alongside the discussion and outcomes of Section 3.3.2 (Site Design and Layout: Staging of Facility), Section 3.6.1 (Operation Issues: Water Management) and Section 3.8.4 (General Issues: Mangroves).

Another key outcome of this assessment, specific to site design is the proposed method of wastewater discharge. The PER has identified two options for the discharge of wastewater

from the treatment ponds. The first method is as sheet flow from a weir, over salt marsh and into the mangroves. The second method is to establish a channel on top of the mangrove mud (i.e. no excavation) to deliver wastewater directly into a mangrove creek.

Both proposed methods have advantages and disadvantages. It could be suggested that while the sheet flow method offers the advantage of less physical damage to mangroves through loss of habitat, it will have a greater impact on those mangroves (i.e. we can expect to see higher productivity, but loss of diversity amongst infauna species) through introducing high levels of nutrients. The channel method would sacrifice a strip of mangroves, but bypass the mangroves as a receiving environment for the nutrient rich wastewater, and deliver the wastewater directly into the water body. The construction of a channel on top of the mangrove mud also has the potential to create other problems related to mud waving and exposure of acid sulfate soils, depending on the physical characteristics of the mud at the site.

It could be argued that by utilising the sheet flow method, APPL is essentially receiving free additional treatment for their effluent, rather than incorporating the cost of treatment into their on-farm systems. Nevertheless, this method of wastewater discharge potentially offers a lower level of environmental disturbance, if erosion and sedimentation are managed, and nutrients are adequately assimilated as it would result in fewer nutrients in the receiving body of water. If the method performs adequately, and performance can be demonstrated through monitoring, the use of the sheet flow method is considered appropriate.

The recommendation for staging offers the opportunity for continuous monitoring, and close review to determine whether sheet flow discharge is performing within acceptable limits, prior to the expansion of the facility with the commitment by the proponent to convert to an alternative method if indicated by monitoring.

It is expected that monitoring and reporting of the performance of the discharge will form a part of the Mangrove Monitoring Program (see Recommendation 14 in Section 3.8.4 (General Issues: Mangroves)). Wastewater quality is dealt with in further detail in Section 3.6.1 (Operation Issues: Water Management).

Recommendation 5

The performance of the waste discharge method shall be continually monitored to determine whether the initial sheet-flow method is delivering acceptable environmental outcomes. If it is determined by DIPE that the method is not performing, APPL will deploy an alternative discharge arrangement to the satisfaction of DIPE.

3.4 Biting Insects

The PER included goals for the management of biting insects on site. Design features have been incorporated into conceptual plans of water holding structures to prevent the creation of nuisance biting insect breeding sites. Because of the proximity of the APPL site to known breeding habitats of biting midges and mosquitoes, the biting insect problems will not be eradicated by these management methods. Biting midges and mosquitoes will continue to be a health problem at the site throughout construction and operation.

With the health implications for staff being exposed to a work site where biting insects will exist, APPL has a responsibility to work closely with the Medical Entomology Branch (MEB) of the Department of Health and Community Services (DHCS) to put in place measures during construction and operation to ensure that health outcomes are the highest priority.

Specific comments and recommendations from MEB are listed at Appendix 1

Recommendation 6

APPL shall incorporate a Biting Insect Management Plan into the Construction and Operation EMPs. The management plan shall be to the satisfaction of the Medical Entomology Branch (DHCS).

3.5 Construction Issues

APPL intends to begin construction of Stage One immediately once all approvals have been obtained. It is envisaged that construction works will commence during the dry season 2005, and will cease prior to the wet season.

3.5.1 Land Clearing and Erosion Control

The APPL site is subject to planning controls and zones. Commitments made in the PER, and recommendations recorded in this Assessment Report cannot override the requirement for the APPL aquaculture development to meet the statutory controls of the Litchfield Area Plan, or the Clearing of Native Vegetation 2004 development provisions. Advice from the Land Clearing Branch of DIPE is that the recently legislated "Clearing of Native Vegetation Controls" are not applicable to this parcel of land, however APPL is advised to contact the Land Clearing Branch to discuss clearing methods and ensure that proposed clearing is consistent with land clearing guidelines.

APPL intends to clear 39 hectares of terrestrial vegetation and 16 hectares of intertidal vegetation to achieve the full-scale facility. Much of this vegetation is regrowth, and previously disturbed to some extent. Loss of mangrove habitat is essentially limited to clearing of regrowth in the disused facility, and is therefore not considered to have high conservation significance.

Cycads are amongst the vegetation that is proposed to be cleared from upland areas. *Cycas armstrongii* is listed as a protected species (Schedule 8, Regulation 15 of the NT *Parks and Wildlife Conservation Act 1994*). While this listing protects against collection or removal from bushland, it does not preclude development in areas with appropriate development approval.

Earthworks associated with land clearing and pond development have the potential to impact both surface and groundwater resources. Surface water resources can be contaminated through surface run-off. Groundwater will potentially be impacted by a change in the level of the water table associated with the loss of vegetation. Additionally, off-site discharge of surface drainage can cause undesirable sedimentation problems in low lying areas and waterways.

APPL has undertaken to employ proven land management procedures for land clearing and erosion control, which have been discussed in the PER, and are supported. The management procedures and methods should now be detailed in the Construction EMP for the facility.

The PER commits to implementing appropriate dust control measures, including watering, should dust levels prove to be an issue. In addition to the measures outlined in the PER, APPL should implement periodic watering of construction roads and earth materials, as this is seen as a more effective method than attempting to predict conditions when dust is likely or acting after high levels of dust are observed. Dust control measures should be included in the Construction EMP.

Recommendation 7

An Erosion and Sediment Control Plan and Dust Management Plan shall be included as a part of the Construction and Operational EMPs.

3.5.2 Introduced weeds

APPL has recognised that the potential for weeds to be spread around the Weddell/Darwin area through traffic movements is significant. APPL has recognised that the site is currently in a disturbed state. Surveying of the site identified six declared weed species. APPL has made a commitment to eradicate current weed infestations and prevent the introduction and spread of additional weeds on-site through an inspection and wash down schedule for trucks and heavy machinery entering the site during construction. The measures outlined in the PER are supported.

Recommendation 8

A Weed Management Plan shall be developed as part of the Construction and Operational EMPs.

3.5.3 Extractive Materials

APPL intends to source fill material for the construction of ponds, from on-site, where possible, from flattening batters on the higher ponds, or excavating material from around the fresh water dam.

It is important that extractive resources be utilised without creating significant disturbance and with regard to safety considerations. All extractive activities should be appropriate to the form of tenement held. As a guideline to general extractive activities:

- extractive materials should be mined to no greater than two metres unless authorised under the *Mining Management Act* based on special project circumstances or requirements;
- borrow pits, where constructed, are to be progressively rehabilitated and made stable unless alternative arrangements are formally in place between the underlying land owner and approved by the appropriate regulatory agency (Minerals and Energy Group DBIRD); and
- in the event that there is insufficient fill material available on site, any extractive material supplied to the project must be sourced from an operation that has been previously approved and authorised by the Department of Business, Industry and Resource Development (DBIRD).

3.5.4 Acid Sulfate Soils

APPL propose some earthworks in areas located below 4 m AHD, which have been identified to contain PASS material. Works are those associated with the saltwater storage dam, intake canals and sedimentation ponds. Works are predominately associated with building up pond walls using clean, non-PASS fill from upland areas. However, works to remove dead vegetation from the saltwater storage dam has the potential to expose PASS. APPL proposes management relating to timing these works for limited exposure, and the addition of a neutralising agent. While these methods are supported, further detail is required in the Construction EMP.

Recommendation 9

An Acid Sulfate Soils Management Plan shall be developed as a part of the Construction and Operational EMPs, in consultation with DIPE.

3.6 Operational Issues

Operation practices for the husbandry of prawns will include water uptake, pond maintenance, stocking, feeding, harvest and processing of the product. Water quality and run-off will therefore be issues of potential environmental impact. The waste outputs from the facility will also have the potential to impact the environment.

3.6.1 Water Management

The management of nutrients in the wastewater of this facility is fundamental to the facility's overall environmental performance, and is therefore interlinked with several issues raised throughout this report. This section should be considered with particular reference to sections 3.3 (Site Design and Layout), and Section 3.8.4 (General Issues: Mangroves).

The APPL aquaculture development is designed as a "flow-through" semi-intensive system. Saltwater is required for initial filling and daily exchange water during the production cycle. Exchange water is not required for the first 30-40 days into the production cycle, resulting in 90-120 days of water exchange per crop. Daily exchange may be up to 10 percent of pond volume, but averages 3-5%. For a fully stocked farm, with mature stock, up to 63 ML of saltwater per day may be required. Saltwater will be pumped from Castnet Creek.

Evaporation from the ponds and salinity tolerance limits of the stock necessitate the addition of freshwater to the production ponds throughout the production cycle. It is estimated that 95 ML of freshwater will be required for a September-November crop and 134 ML in total for a dry season crop. The freshwater dam has a capacity to hold 1300 ML of freshwater. While seasonal recharge of the dam may not be adequate to fill this volume, the monitoring of freshwater quantity is supported to ensure that supply is adequate for a second annual crop.

From the production ponds, wastewater enters a settlement pond for a retention time of at least 24 hours. With no aeration, and low velocity flows, these treatment ponds are expected to allow soil particles and organic matter to settle to the bottom. The CRC for Aquaculture report that total suspended solids can be reduced by up to 60%, while total nitrogen levels can be reduced by around 20% (CRC for Aquaculture 2003). By stocking the settlement ponds with marine plants, bivalves, fish and crustaceans, further reductions in nitrogen levels can be achieved. The CRC for Aquaculture suggests that reductions of up to 70% of nitrogen may be achievable (2003). The use of settlement ponds is supported, and APPL is encouraged to investigate methods of achieving the best possible discharge water quality, including through the experimentation of local flora and fauna in treatment ponds.

APPL has estimated that water discharged from the ponds will contain 0.055 mg/L of phosphorous and 1.25 mg/L nitrogen. APPL have not made a commitment to reducing this nutrient load in their wastewater, other than to install treatment ponds. Based on these calculations, APPL expect 2 kg of phosphorous in the effluent per tonne of prawns produced (Fisheries standard estimates are 15 kg P / tonne) and 45 kg nitrogen in the effluent per tonne of prawns (Fisheries standard estimates are 56 kg N / tonne). At full production of 220 tonnes of prawns per year, this would equate to 440 kg phosphorous and 9900 kg nitrogen per year in the effluent. Taking into consideration the treatment ponds, the nitrogen may be reduced by up to 1980 kg through passive settling.

The APPL aquaculture development will draw water from, and discharge wastewater into Middle Arm, Darwin Harbour. Currently there are five aquaculture facilities licensed to

discharge wastewater into this water body, with an approximate potential production area of 200 hectares. Methods of farming, species, and stocking rates vary between these facilities, as does their method and utilisation of recirculation and waste discharge regime. To date, the capacity of the Middle Arm system to assimilate the wastes from these facilities has not been fully determined. However, with the potential for such a large area of production to undertake simultaneous grow-out, caution must be undertaken by the managers of this resource.

Other discharges into the catchment such as run-off from agriculture and animal husbandry have not been quantified or recognised in the APPL PER. Similarly, resource managers lack knowledge of what other cumulative impacts exist, or how they are quantified.

Resource managers have a responsibility to proceed cautiously with approvals, and to consider cumulative effects, while developers and operators have a responsibility to ensure that environmental performance is sustainable and that production is not to the detriment of other users of receiving waters.

Recommendation 10

For all discharges from the facility, a Waste Discharge Licence under the *Water Act* will be required. The Waste Discharge Licence will identify acceptable wastewater quality, and wastewater monitoring requirements for discharges. In issuing the Waste Discharge Licence, consideration of cumulative impacts and mass loadings of nutrients shall be considered.

3.6.2 Waste Management

Pond Sludge

The PER identifies pond sludge from the production ponds as the main solid waste product that needs to be managed. Sludge is typically composed of 92-96% clay and silt matter, which has eroded from pond walls due to the action of aerators. Up to 8% of the sludge is organic matter. Once the sludge has been flushed with freshwater (to decrease salinity) and dried, it can be used as topsoil material for garden beds, rehabilitation, or repair of ponds. Taking into consideration the operation of other prawn farms in the area, the quantity of pond sludge produced is not expected to be excessive.

APPL expect that the sludge will be removed from the production and sedimentation ponds on an "as required" basis. The sludge will be transferred to drying beds for drying and desalination. All run-off from the sludge drying beds will be contained and directed back into the sedimentation ponds. The washed product will stay on site as landscaping or fill. Correct stabilisation of the material will prevent it moving off-site to cause down-stream sedimentation. The use and stabilisation of the material on site is supported. A method of monitoring the desalination and drying process to prevent leakage off site should be captured in the Operational EMP.

Sewage, Grey Water, Miscellaneous Liquid Wastes

APPL states that sewage, domestic discharge water and wash down water will pass through a seepage pit (with triple interceptor trap fitted to remove oily waste) and be disposed of via septic tanks.

The close proximity of the development to the harbour coupled with high water table requires all domestic effluent to be treated onsite by a DHCS approved alternative septic tank system. Domestic effluent will need to be treated to a minimum of secondary quality. No trade waste including wash down water will be permitted to enter the alternative septic tank system.

APPL should consult with DHCS for advice on sewage treatment.

Solid Wastes

Solid wastes will incorporate domestic wastes and production wastes. Domestic wastes will be limited as workers will not be accommodated on site. The major source of production wastes are expected to be from paper feed bags. APPL states that recycling of these bags will be investigated by the proponent. Recycling of paper feed bags is supported. APPL should consult with the Office of Environment and Heritage regarding appropriate waste disposal and general on-site waste management.

Recommendation 11

A Waste Management Plan for general site operations, characterising all waste streams (including solid, liquid and hazardous wastes), and exploring methods for waste minimisation and recycling, shall be included in the Construction and Operational EMPs.

3.6.3 Pests and Disease

APPL states in the PER, an objective to comply with regulations regarding disease control and prevent the spread of disease on and off the site. This will be achieved through quarantine and disease control procedures that are compliant with NT Fisheries requirements, and follow the Queensland DPI guidelines for on-farm health management for prawn farms (1999).

APPL shall translate these measures into a pest and disease management plan within the Operational EMP. In addition, APPL should outline measures to prevent the loss of stock from the farm (with special consideration of exotic species), and give consideration of the effect of accidental release of these exotic species into the Harbour.

Recommendation 12

A Pest and Disease Management Plan shall be developed to the satisfaction of DBIRD and included in the Operational EMP.

3.7 Decommissioning and Rehabilitation

Because at present the nature of the future surrounding land uses is unknown, development of decommissioning and rehabilitation goals is not being contemplated at this stage. It has been agreed by the proponent in the PER, however, that decommissioning and rehabilitation of the site will be the responsibility of the proponent, and all actions must be approved by the relevant authorities at the time of decommissioning. All actions must be appropriate to the surrounding land uses at the time of decommissioning and rehabilitation.

Recommendation 13

APPL will ensure that decommissioning and rehabilitation is done in accordance with the best environmental methods and practices available at that time.

3.8 General Issues

3.8.1 Noise

APPL has reported in the PER that the proposed aquaculture facility is sufficiently distant from existing residential areas that off-site construction and operation noise will not be an issue.

On site exposure to noise, however, will be significant for workers and contractors particularly during construction, but also in the immediate vicinity of the generators during the operation of the facility. APPL should liaise with NT Work Safe to ensure that appropriate Occupational Health and Safety practices are implemented.

3.8.2 Atmospheric Emissions

The information provided on greenhouse gas emissions in relation to the construction and operation of the prawn aquaculture is very limited and states emission estimates from the use of emergency diesel generators only.

No estimates have been provided from fuel consumption and associated greenhouse gas emissions from vehicle and plant use during the construction phase.

Emissions from land clearing have not been estimated. Estimations calculated by the Office of Environment & Heritage indicate greenhouse gas emissions of about 2000 t CO2-e (carbon dioxide equivalent).

It is stated that the farm will draw power from the grid. However, there is no information estimating annual power consumption.

Recommendation 14

The Operational Environmental Management Plan will include an estimate on annual power consumption, a discussion on energy efficiency measures and a consideration of greenhouse offsets. Annual power consumption will be reported to the NT Greenhouse Policy Unit.

3.8.3 Potable Water Supply

It is noted in the PER that "potable water will be required for domestic purposes and ice production". The proponent will need to further discuss with DHCS Environmental Health – Darwin Urban about the level of quality of the water supply, to ensure that it meets the requirements of the Australian Drinking Water Guidelines.

3.8.4 Mangroves

APPL has discussed mangroves with respect to existing environment and expected impacts. Impacts to mangroves are expected to be minimal but will include changes as a result of discharge of wastewater (see discussion Section 3.3 Site Design and Layout), clearing (see discussion Section 3.5.2 Land Clearing and Erosion Control) and as a consequence of interrupted/altered drainage regime as outlined below.

A change in species composition may be observed where the facility inhibits the direct influx of fresh water into the mangroves. Altered morphology of vegetation may be observed from the changed hydrodynamics relating to an increased volume of water and from modified composition in the run-off water. The changes are not expected to be significant in terms of

area of mangroves affected, and may not affect the over-all productivity of that portion of mangroves when it is considered that the fresh water drainage regime will be replace with an increase in input of production water throughout the production cycle. Any changes will be observed by a well-structured monitoring program.

APPL has submitted a Mangrove Monitoring Report (PER Appendix C) outlining a comprehensive Mangrove Monitoring Program. This program is supported, however, may require modification to adequately monitor performance of the proposed waste discharge method, (discussed in Section 3.3 Site Design and Layout) and to also satisfy the recommendations 4 and 5.

Recommendation 15

The proponent shall develop a Mangrove Monitoring Program to the satisfaction of Conservation and Natural Resources Division of DIPE, to be included within the Construction and Operational EMPs.

3.8.5 National Pollutant Inventory

The National Pollutant Inventory (NPI) is an Internet database designed to provide the community, industry and government with information on the types and amounts of certain substances being emitted to the air, land and water.

Since 1998, larger Australian facilities are required to estimate and report annually their emissions to the NPI. Estimation of emissions from smaller industry, households and everyday activities have been made by State and Territory environment authorities and listed on the database. While it is not currently a requirement for semi-intensive aquaculture facilities to report to the NPI, the information that is collected from these facilities is used to report aggregated emissions, and inform resource managers.

The main objectives of the NPI are to:

- provide information to industry and government to assist in environmental planning and management;
- satisfy community demand for accessible information on emissions to the environment; and
- promote waste minimisation, cleaner production, and energy and resource savings.

Recommendation 16

APPL shall assist NT Authorities in estimating emissions of listed substances for the National Pollution Inventory by providing information required to report aggregated emissions for the industry. Information needed includes:

- **annual crop production;**
- **annual stock feed (including N & P content); and**
- **annual fertiliser used (including N & P content).**

4 MONITORING AND ENVIRONMENTAL MANAGEMENT

4.1 Environmental Management Plans

An integral part of the environmental management of the APPL development will be the preparation and implementation of comprehensive Environmental Management Plans (EMPs)

and their effective integration into other management plans relating to construction and operation of the development.

APPL has submitted a draft EMP as a part of their PER. This will require alteration to incorporate both aspects of the project, the construction and the operation into two separate plans. Each of these plans must satisfy the requirements of OEH and DBIRD prior to the commencement of construction and operation.

The EMPs will also need to identify the construction and operational management structure and a specific contact officer and contact details, where these have not been identified within the EIS.

Recommendation 17

Construction shall not commence until a completed Construction Environmental Management Plan (to the satisfaction of OEH and DBIRD) that covers the construction phase of the APPL development has been submitted to OEH and DBIRD. This plan should outline the scope and scale, and layout of the first stage of development, including plans of all structures, and be updated prior to the construction of additional stages.

Recommendation 18

Operation shall not commence until a completed Operational EMP (to the satisfaction of OEH and DBIRD) for the operational phase of the APPL development has been submitted to OEH and DBIRD. This plan shall be updated for additional stages.

Environmental Management Plans should incorporate, but no be limited to, aspects raised in the PER, APPL draft EMP, and issues raised in this Assessment Report. The plans should be routinely reviewed by APPL, and any major amendments should be submitted to the Office of Environment and Heritage and DBIRD.

The proponent has provided a draft EMP for the construction and operation of the proposed development within the PER. The proponent also indicates that they will comply with several existing standards to develop an integrated management system encompassing quality, environment and safety.

The draft construction EMP will need to be revised to incorporate the additional measures for environmental protection and monitoring that are contained in this Assessment Report.

The operational EMP will include the matters dealt with in the Construction EMP that are also applicable to the operation of the aquaculture development, and will also include additional components relating to the operation of the facility, including:

- Documented procedures for the testing and release of water from all bunded areas;
- Operational waste management; and
- Monitoring and reporting.

The PER provides commitments to the monitoring of a number of operational issues, including dust, erosion, weeds, waste segregation/disposal, and discharge water quality. Details of these monitoring programmes should be addressed in the operational EMP and include reporting requirements.

The EMPs will be referred to relevant NT Government agencies for review prior to finalisation, after which they will become public documents. The EMPs will be the major

vehicle for implementing management and monitoring commitments made by the proponent in the revised PER and the recommendations detailed in this Assessment Report. As such, they will be working documents for the life of the proposal and will require continual review in light of operational experience and changed circumstances and in particular as the facility expands to Stages 2 and 3.

5 CONCLUSIONS

The Office of Environment and Heritage considers that the environmental issues associated with the proposed project have been adequately identified. Appropriate environmental management of these issues has been resolved through the assessment process and in the PER. On going monitoring and management actions for these issues will be detailed in comprehensive construction and operational Environmental Management Plans.

The final Environmental Management Plans for the construction and operational phases of the aquaculture development will be subject to satisfactory review by relevant Northern Territory Government agencies. They will be working documents for the life of the project and will require continual review in the light of operational experience and changed circumstances.

Based on its review of the Public Environmental Report and submissions from relevant Northern Territory Government agencies, the Office of Environment and Heritage considers that the Aussie Prawns Aquaculture Development can be managed in a manner that avoids unacceptable environmental impacts, provided that the environmental commitments, safeguards and recommendations detailed in the PER, this Assessment Report and in the final Environmental Management Plans are implemented, with regular reporting and compliance auditing.

6 REFERENCES

Australian Prawn Farmers Association, 2000. *Environmental Code of Practice for Australian Prawn Farmers.*

CRC for Aquaculture, 2003. *Inside Prawn Ponds* CSIRO Brochure.

DPI 1999. *Guidelines for On-farm Health Management for Prawn Farms* (QLD)

EPA 2000. *Discussion Paper on a Review of Queensland Marine Prawn Aquaculture Licensing Under the Environmental Protection Act* (QLD).

KBR 2004. *Notice of Intent for Aussie Prawns Pty Ltd Aquaculture Development, Section 1880, Weddell, Northern Territory*.

URS 2001. *Public Environmental Report for the Blackmore River (East) Aquaculture Project Middle Arm, Darwin Harbour Northern Territory.*

APPENDIX I

List of respondents to the revised PER and issues raised

Respondent	Comment
Medical Entomology Branch DHCS	**2.4.3 Tidal influences** The potential formation of "mud waves" should be considered when filling operations are conducted in tidal areas during the creation of the sedimentation ponds. Mud waves can create areas of ponding water suitable for mosquito breeding, which would require rectification. Any other filling practices conducted in tidal areas should also be conducted in a manner that prevents the formation of mud waves. **2.5.7 Sludge** The drying bed effluent from the bunded drying beds should be directed to the effluent canal and sedimentation ponds within 3 days of initial ponding caused by rainwater or freshwater flushing, to prevent mosquito breeding. **2.5.9 Fuel storage** Uncontaminated water held in the fuel storage bund should be directed to the stormwater system on a weekly basis, to prevent mosquito breeding. The bund may need to be fitted with drainage valves to facilitate this. **3.4 Options for effluent discharge** It is mentioned that discharge from the sedimentation ponds will be directed to the head of the nearest tidal creeks. Generally this would not create a mosquito problem if the head of the tidal creek is at an elevation of around 3m AHD or lower. The proponent should state what level in AHD the discharge points would be at. **4.6.4 Mosquitoes and Biting Insects** It should be noted that the information compiled from other surveys and reports in the vicinity of the proposed aquaculture development can only be used as a rough guide in regard to species diversity in the proposed

	development area, and cannot be relied upon to provide information on species abundance in the proposed development area. It should be noted that follow up trapping for 12 months at the Blackmore River (east) Aquaculture Project site revealed very high numbers of *Ochlerotatus vigilax*, and high numbers of *Culex annulirostris* (MEB unpublished data). This indicates that monthly trapping for 12 months is the minimum requirement needed to accurately determine mosquito populations at any one site, as different mosquito species reach peak numbers at different periods of the year. Surveys for actual and potential breeding sites would also be conducted to determine the source of any mosquito trapped. Different areas may be located closer to small, high productivity sites, which can greatly affect mosquito populations from one site to another, indicating mosquito populations at one area can not be determined from mosquito surveys conducted at another area in the general vicinity. To be more specific in regard to *Culex annulirostris* breeding sites, this species generally breeds in freshwater and coastal reed swamps, at the vegetated margins of freshwater creeks, dams and billabongs, vegetated wet season ground pools, stormwater drains and any high nutrient water such as effluent ponds. Another note to add in regards to *Culex sitiens* includes the qualification that although this species is generally considered a pest mosquito only (as previously advised by DHCS), laboratory studies have shown Cx. sitiens to be a competent vector of Ross River virus (Lee et al 1989), so it is possible that this species is a Ross River virus vector. To further clarify *Culicoides ornatus* breeding sites, dry season breeding sites for this species are generally the neap tide zone of upper tidal creeks and the *Sonneratia* foreshore. Wet season breeding sites for this species are the transitional *Ceriops* zone at the back edge of creekbank forests, and the *Rhizophora* transitional zone adjacent to the Sonneratia foreshore zone. This species is likely to be encountered in high numbers at the proposed development site. The proposed development has the potential to create breeding sites for the North Australian malaria mosquito *Anopheles farauti*. This species breeds in brackish water, generally in association with *Schoenoplectus* reeds. The effluent canal, sedimentation ponds, and any other area containing brackish water should be maintained free of *Schoenoplectus* reeds and other marginal vegetation, to prevent the creation of suitable breeding sites for this species.

	5.2.1 Impacts on the biophysical environment *Soil erosion* Any existing borrow pit areas within the development site should be rendered free draining if water is capable of ponding in the borrow pits for periods greater than 5 consecutive days. *Biting midges* It should be noted that the major potential human pest biting midge, *Culicoides ornatus*, is generally found in high numbers up to 1.5km from the mangrove margin. Major potential biting midge breeding sites affecting the proposed development site will include all upper tidal creek and *Sonneratia* foreshore mangrove areas within and adjacent to the development boundary. The entire proposed development site is likely to be subject to biting midge pest problems during most months of the year. *Culicoides ornatus* are most abundant in the dry season months, with the peak period being the months of August to November. Peak numbers generally occur in a 4-5 day period around the full and new moons, with peak biting times being the 2 hours either side of sunset and sunrise, and full moon pest problems usually being twice as large as new moon pest problems. It is mentioned in the PER document that wind action will reduce dispersal of biting midges. Wind action is unlikely to considerably reduce dispersal unless there is continuous disrupting wind in the 2 hours either side of sunset and sunrise. *Mosquitoes* The freshwater dam and sedimentation ponds can be potential sources of mosquitoes if semi-aquatic reed vegetation and other marginal vegetation become established in these water features. Annual checks should be conducted to locate and remove marginal vegetation growth. Any water holding structure should be constructed with steep sides (1:3 slope or greater), to discourage marginal vegetation growth. **6.2.7 Biting insect control** *Management measures* In addition to those biting insect management measures outlined in the Aussie Prawns Pty Ltd Aquaculture Development PER and in comments made above, further recommendations are provided below;

	• All stormwater drains and other water holding structures should be inspected annually for maintenance requirements such as vegetation and silt removal. Drains should be constructed with appropriate erosion prevention structures. • Any poorly draining area created by development activities should be rectified to prevent water ponding. • Any production pond not in operation should be maintained in a manner that prevents mosquito breeding. ie. by removing all water or by stocking the disused pond with predatory fish of mosquito larvae. • Bunded areas containing freshwater should be drained on a weekly basis, while bunded areas containing brackish water should be entirely drained every 3 days. • There is also the option of adult biting insect barrier control using the insecticide Bistar (active ingredient bifenthrin) around personnel areas. As this product can be toxic to aquatic organisms, professional application by a licensed pest controller would be advised. • Any seepage from pond walls should be rectified as soon as possible, to prevent the creation of mosquito breeding sites. • Upon cessation of operations, the development site should be rehabilitated in a manner such that no potential mosquito breeding sites remain.
Environmental Health Unit DHCS	**2.1 Site Location** What is the proximity of the development to the proposed residential subdivision of Weddell and is there any likelihood of the development having a health impact on the proposed subdivision, particularly from noise or odours? **2.2.6 Sludge Disposal Facility** It is stated that "dry sludge will be removed and used for onsite landfill, repair of pond walls or landscaping purposes". Does this mean that the dried sludge will be stockpiled onsite and how would such a stockpile be managed? In the event that there is excess sludge from the production process, how will it be managed and will it need to disposed offsite? If so then where?

	2.2.7 Buildings It is stated that "the packaging shed consists of rapid chiller units for chilling the harvested mature prawns. They are then packed in boxes and stored in cold rooms before being sent off site to market. Prawn processing (other than packing) if required, will be subcontracted to an approved offsite processing facility". The packaging shed will require approval and food premises registration by DHCS Environmental Health – Darwin Urban in accordance with the requirements of the Food Act & Building Act. **2.5.6 Wastewater Discharge** The wastewater from the production ponds is deemed to be trade waste and not sewage, therefore do not require formal DHCS approval. However, the provisions of Public Health regulations still apply and so the development, particularly the production process must not cause mosquito breeding or a public health nuisance. **2.5.8 Sewage** The close proximity of the development to the harbour coupled with high water table requires all domestic effluent to be treated onsite by a DHCS approved alternative septic tank system. Domestic effluent will need to be treated to a minimum of secondary quality. No trade waste including wash down water will be permitted to enter the alternative septic tank system. **2.7.2 Potable Water Supply** It is noted that "potable water will be required for domestic purposes and ice production". The proponent will need to further discuss with DHCS Environmental Health – Darwin Urban about the level of quality of the water supply, to ensure that it meets the requirements of the Australian Drinking Water Guidelines. **6.6.4 Deterioration of intake water quality** It is stated that "a future threat to intake water quality is posed by the proposed wastewater treatment plant that will service the Weddell community". DHCS strongly recommends that the proponent conduct a regular sampling regime of the intake water quality that focuses on bacteriological parameters. This will give the proponent baseline data that can be used as a case to ensure that the quality of the intake water is maintained and not adversely affected by upstream development.

Heritage Conservation Services DIPE	APPL has complied with the recommendations made within the Cultural Heritage Management Report for Aussie Prawns (Haycock Reach) and identified strategies necessary for the protection of the archaeological sites within the proposed project area. No further heritage issues are associated with this PER.
Greenhouse Policy Unit DIPE	The information provided on greenhouse gas emissions in relation to the construction and operation of the prawn aquaculture is very limited and states emission estimates from the use of emergency diesel generators only. No estimates have been provided from fuel consumption and associated greenhouse gas emissions from vehicle and plant use during the construction phase. Emissions from land clearing have not been estimated. Estimations calculated by the Office of Environment & Heritage indicate greenhouse gas emissions of about 2000 t CO2-e. It is stated that the farm will draw power from the grid. However, there is no information estimating annual power consumption. The Environmental Management Plan Energy also lacks energy efficiency measures. It is recommended that • an estimate on the annual power consumption is provided to this office by the proponent and that the annual power consumption be reported, eg in the annual report; • the Environmental Management Plan is upgraded to include energy efficiency measures; • consider greenhouse offsets in the development and implementation of the Environmental Management Plan..
Waste and Pollution Management DIPE	• Fresh water calculations may be optimistic. **Sludge** • Salt management may be an issue. • Leaching from landscaping and reveg works may impact ground water. • Repair of pond walls may be possible if clay is checked for dispersiveness. Dispersive clays will absorb sodium and lose structure which will limit the use of the material for clay linings.

	• Any sludge pond would need lining to protect ground water quality. **Extractive materials** • Additional fill should be checked for dispersive character is to be used for liners in pond walls/floors. **Waste water discharge** • Mass loadings to the bay from the waste water discharge should be calculated. • A hydrodynamic mixing model should be developed that determines the flushing time of Middle Arm and mass loads should be checked over the flushing period. Additionally a concentration based approach should be adopted to determine the size of the mixing zone required to dilute the waste water to background levels. The size of this mixing zone should be as small as possible and be reduced over time with treatment. The mixing zone may require the use of tidal based discharges (and hence 8-12 hour waste water storage) to allow for sufficient dilution. • 64ML/day treated by sedimentation ponds requires a large area of ponds or clarifiers with flocking agent. • There is no lagoon design submitted to assess settling rates, particle sizes or levels of treatment. **General wastes** **Options for effluent discharge** No cost-benefit is presented on any aspect of the effluent treatment systems has been presented, including: 1. zero discharge 2. partial recirculation 3. pipeline outfall to suitable mixing zone 4. discharge canal 5. sharing outfall with Golden Prawns

	Construction impacts • PASS and ASS areas will not be appropriate for any open channel flow as an effluent disposal route. Concrete "raft" structure will cause erosion and suffer acid attack. Groundwater fluctuations and tidal erosion will limit the life and usefulness of this approach. No mention of shoreline intertidal erosion effects apart form lining or suitable compaction. **Effluent discharge** *Vollenweider model:* The mass loadings used in the modelling are based on NPI data. It may be more accurate to estimate a nutrient mass loading from available water quality data in CNR WQ database records. It may be more accurate to model mass loading of whole bay when localised impacts may be restricted to Middle Arm, or the immediate area of the mixing zone. Mass loadings and water quality for the small creek being discharged to and Middle Arm in isolation may need examination as there are several other discharges of similar type including Adam Body, Phelps/Panizza. If the flushing rates of Middle Arm are similar to the rest of the bay (30 days) the build up of daily discharges needs to be modelled to determine likely effects on water quality. *Hydrodynamic Modelling:* Hydrodynamic regime described for channelled effluent to shallow edge based discharge. From the hydrodynamic modelling fig 3.3 indicates a large mixing zone for a conservative tracer of approximately 2 km in diameter – possibly so large due to shallow edge waters. The effects appeared to persist at low levels for up to 3 hours after cessation of discharge. No other point source discharges were taken into account in the model and river delivery of pollutants was also not taken into account. Given the size of the area of water affected, a mixing zone approach should possibly be used with respect to key toxicants such as ammonia and nitrate in the discharge. The mixing zone should not represent a barrier to fish passage or cause morbidity.
National Pollutant Inventory DIPE	It has recently been resolved that aquaculture facilities which involve intensive production should be included among the NPI reporting facilities. However, altering industries that need to report to the NPI cannot be

	completed until the NEPM is amended (a process that may take up to 12 months). The estimated Total N and Total P figures published in the PER are based on the Emission Estimation Technique (EET) Manual for Aquaculture which are different figures to those calculated in the PER. These are not vast differences, for example, APPL calculations indicated that total N for Prawn biomass was 20% (22% in EET Manual), Sediment 25% (14% was used from EET Manual) etc. From basic figures for estimating existing aquaculture facilities, the figure for Total N (20 000kg/year) is quite large (from total available figures the amount was 22 000kg - so one aquaculture facility is outputting a similar amount of Nitrogen to all combined aquaculture facilities in the Darwin harbour). For Total P the figure for all facilities was 6300kg cf. APPL figure of 1312kg.
Conservation and Natural Resources DIPE	**General comments** CNR supports the staging of this development. Sheet flow discharge is preferable to channel construction for discharge at least for the first stage, and dependant on monitoring of sedimentation in the mangroves and erosion at the entry point. **Land Clearing** Because there is already planning controls and zones, and despite the fact that clearing controls do not apply under the Litchfield Area Plan, the recently legislated "Clearing of Native Vegetation Controls" are not applicable to this parcel of land. **Weeds** The owner and occupier of the land must –(a) take all reasonable measures to prevent the land being infested with a declared weed; (b) take all reasonable measures to prevent a declared weed or potential weed on the land spreading to other land. **Bushfires** As per the *Bushfires Act 1996*, and new land holder would be required to ensure that a 4 metre firebreak is installed and maintained along all boundaries.
Aboriginal Areas Protection Authority	Noted that the proponent has obtained an Authority Certificate for their development.

Museum and Art Gallery of the Northern Territory	Pages 2-9, 2-22. The figure of 8% organic matter in the sludge needs to be supported by a reference. It appears to be very low. In addition, it is unclear whether these are figures for Year 1, later years or an average of all years. It does not seem to tie in with the general statements about the amount of food assimilated by aquaculture species, ie less than 30% of the protein in aquaculture feed is retained by the species farmed; the rest is either excreted or not eaten (CSIRO 1998). Page 2-13. Need to state which of the proposed farmed species, if any, do not occur here naturally; eg. Penaeus japonicus? There should be some consideration of the effect of accidental release of these exotic species into the Harbour. Pages 2-20, 2-22. It is unclear how, or with what, the wastewater effluent will be 'treated'. The authors confuse treatment prior to discharge with the fate of the nutrient-laden water after discharge. In particular, Sec. 2.5.6. Wastewater discharge. The PER is weak in its estimation of how much nutrient load will enter the environment. The proponent cannot depend upon "… biological assimilation and chemical process in the discharge creek and tidal creek mangroves" nor "mixing and dilution in estuary" – these processes need to happen on-site before discharge into the environment, surely? Biological assimilation of nutrient loads in the ponds is assumed to be "typically" done by whelks and mullets in the ponds (and there is a little more detail in Chapter 5). Page 3-2. The authors do not point out the considerable environmental advantages of a re-circulating water system, including reduction in the possibility of introducing high-nutrient waters, chemicals and diseased prawns into the Harbour. The authors mention the adoption of re-circulating system farms in Qld – presumably over concerns of nutrient laden waters to the GBR. Although Darwin Harbour is not the same environment as the GBR, problems could still occur. It is disappointing that Aussie Prawns have not followed the re-circulating water model used in Qld. Chapter 4. The description of the estuarine fauna is very general and refers to the Harbour as a whole, not the immediate environment. Apart from one survey on invertebrates (Metcalfe 2004), no site-specific information on fauna is provided. As Metcalfe and Crawford point out in Appendix C (p.2), there have been NO long-term studies on the effects on mangrove fauna and flora by outlets of prawn farms. Some of the text in the main report is lifted directly from this report without reference or acknowledgment. P5-12. Last sentence suggests that the PER involves a high level of uncertainty and experiment on the local environment.

Department of Business, Industry and Resource Development	• PER was very conservative in calculations for nutrient levels in waste water discharge, probably overestimating the likely level of waste water generated, and the amount of nutrients released. • Considers that existing freshwater supply is adequate to support the development of 42 hectares of ponds. • Supports the discharge via sheet flow to the mangroves, providing the flows are maintained below the level that causes erosion and that there is no detrimental sediment build-up in the mangroves. • It would be appropriate to evaluate impacts of each stage prior to commencing development of the following stage. • The proposal was a significant improvement over the existing facility and it was pleasing to see that the site may once again return to being productive. It was noted that in the mid to late 1990s more than 100 tonnes of barramundi were produced per annum from the farm but that sine then it had fallen into disrepair. • The further development of the aquaculture industry presents the opportunity for continued economic development, provided it is done according to the principles of Ecologically Sustainable Development. We believe that the proposal as presented by Aussie Prawns in their PER, does comply with ESD principles and we look forward to the restructuring of this farm and the economic benefits this should bring to the Northern Territory.