Department of Primary Industries and Fisheries

Aquaculture policy

Management arrangements for potentially high-risk activities in the context of ecologically sustainable development (ESD) for aquaculture facilities

FAMOP001

Version 1

Dec 2004

Queensland Government
Department of Primary Industries and Fisheries

Contents

1.0 Title

The document should be cited as:

> Department of Primary Industries and Fisheries, 2004, *Management arrangements for potentially high-risk activities in the context of ecologically sustainable development (ESD) for approved aquaculture operations*, Aquaculture Policy FAMOP001.

2.0 Objectives

The objective of this policy is to assist in achieving the main purpose of the *Fisheries Act 1994* (refer to Appendix 1) to protect fisheries resources to ensure that they are used in an ecologically sustainable way for aquaculture by:

- minimising the risk of translocation of aquacultured fisheries resources into natural waterways, particularly where:
  - they are non-indigenous to the area. or
  - they have the potential to impact on the genetic diversity of wild
  - populations;
- minimising the risk of introducing disease agents into wild populations; and
- minimising the socio-economic impacts that may result from the above risks.

The Policy will achieve its objective by identifying activities that are potentially high risk, providing a process for evaluating the risks involved in translocation-related proposals, and providing risk-based management arrangements for potentially high-risk activities, to be used as a basis for:

- Assessment criteria for new applications.
- Setting reasonable and relevant conditions of approval[1].
- Auditing of aquaculture operations.
- Guiding the development of best practice within the industry.

The policy has been developed within the framework of Ecologically Sustainable Development (ESD). Requirements imposed under this policy are intended to provide a balance between development of the aquaculture industry (economic and social development) and minimising potential adverse ecological impacts through the transmission of disease and establishment of pest populations.

3.0 Background / Introduction

DPI&F has a statutory responsibility to manage the issues of disease and translocation in aquaculture operations. Fisheries and Aquaculture in Queensland are managed under the legislative framework of the *Fisheries Act 1994* and the subordinate legislation of the *Fisheries Regulation 1995.* Queensland government is committed to

[1] Refer to section 3.2 of this document regarding setting of conditions.

an Environmentally Sustainable Development (ESD) approach to the use of natural resources.

In the Queensland aquaculture industry, prawns and barramundi fish are the predominant value species in Queensland. Other important species include edible oysters, freshwater finfish and redclaw.

The potential socio-economic detriment of any aquaculture fisheries resources escaping from a facility into the wild is potentially large if disease or translocation issues must be addressed and publically funded.

3.1 Risks associated with aquaculture activities

3.1.1 *Translocation risks*

There is a risk of introducing live aquatic organisms into waters where there is no existing population (ie. introduction of non-indigenous fisheries resources). There is a potential for the displacement of native aquatic organisms by non-indigenous species. The introduced animal may compete with the native population(s) for food and habitat, predate on those native species or impact on natural environments and habitats through foraging behaviour. This may have a biological effect and consequential effects on industry (eg the affected fishery), social amenity and the environment.

Movements of aquaculture stock both from interstate / territory and between different bioregions within the state always carry a degree of risk. The major risk is of disease translocation.

Consideration should also be given to the potential for hybridisation or interbreeding between wild and farmed stocks, which may result in significant changes to the genetic pool of the natural aquatic biota. Dilution or alteration of the gene pool may leave wild stocks less competitive.

When aquaculture fisheries resources escape they may pose a significant environmental risk[2]. From a risk management perspective the unplanned escapement of any fisheries resources from an aquaculture facility into the wild is unacceptable. Containment of escaped stock in most circumstances is impossible and the potential environmental influences these animals may have are difficult to measure.

Escape of fisheries resources from aquaculture facilities can occur if the facility is not biosecure (biosecurity refers to control over the movement of all life stage of the aquacultured species). For example, escapes can occur if bund walls are overtopped during a flood event. Eggs can be transported into natural waterways if discharge pipes are not adequately screened. Some aquacultured species, such as redclaw, are capable of overland movement and can migrate into natural waterways unless a solid fence is constructed around the edges of the pond.

[2] Refer to Appendix 2 of this document regarding unlawful release of fisheries resources.

3.1.2 *Disease risks*

The potential for the introduction of disease to the aquatic environment (which is likely to result in mortality or morbidity of native biota) is a potentially significant risk.

In any aquaculture system there is always a risk that disease organisms may be present either in the stock or in the culture water. When stock is harvested there is a risk that it may contain a disease, and that if used as bait, there is a further risk that the disease could be spread to aquatic organisms occurring in the aquatic environment. In any farming system where animals are held at high densities, the risk of disease is higher than in the wild. As a result, at any point in time there is a risk that organisms which could cause disease are present in the farmed population.

The risk of disease transmission may be increased when species are introduced into an area beyond their natural range or between catchments. These animals may bring with them new disease organisms against which local species may have little or no natural resistance.

3.2 Legislative framework

Under the Integrated Development Assessment System (IDAS), fisheries development approvals including all aquaculture development may be issued under the *Integrated Planning Act 1997* (IPA). DPI&F officers will still assess applications against DPI&F policies and set conditions for aquaculture approvals issued under IPA.

Prior to the integration of development assessment processes in the *Fisheries Act 1994* into IDAS, aquaculture operations were required to be authorised under s 50 (1) of the *Fisheries Act*. Under Section 61 of the *Fisheries Act* it is appropriate to set reasonable and relevant conditions for approvals within the context of ESD.

Conditions of approval are enforceable under fisheries and IPA legislation (refer to Appendix 2).

4.0 Effective date

The policy is effective from 24 December 2004 and will be revised within 3 years or as necessary.

5.0 Application of the policy

This policy applies to all persons involved in aquaculturing fisheries resources in Queensland. This policy is to be read and applied in conjunction with the *Fisheries Act 1994*, the *Integrated Planning Act 1997*, associated Regulations, all other relevant policies of the DPI&F, and the National Competition Policy. The policy also applies to all aquaculture operations deemed as ‘Self Assessable’ unless there are unique and specific factors that justify its variation under the *Integrated Planning Act 1997*.

6.0 Relevant legislation

Queensland Fisheries Act 1994 and *Regulation 1995.*

Queensland Freshwater Management Plan 1999

Commonwealth Quarantine Act 1908

Commonwealth Quarantine Proclamation 1998

Refer also to relevant aquaculture management policies and protocols.

7.0 Consultation

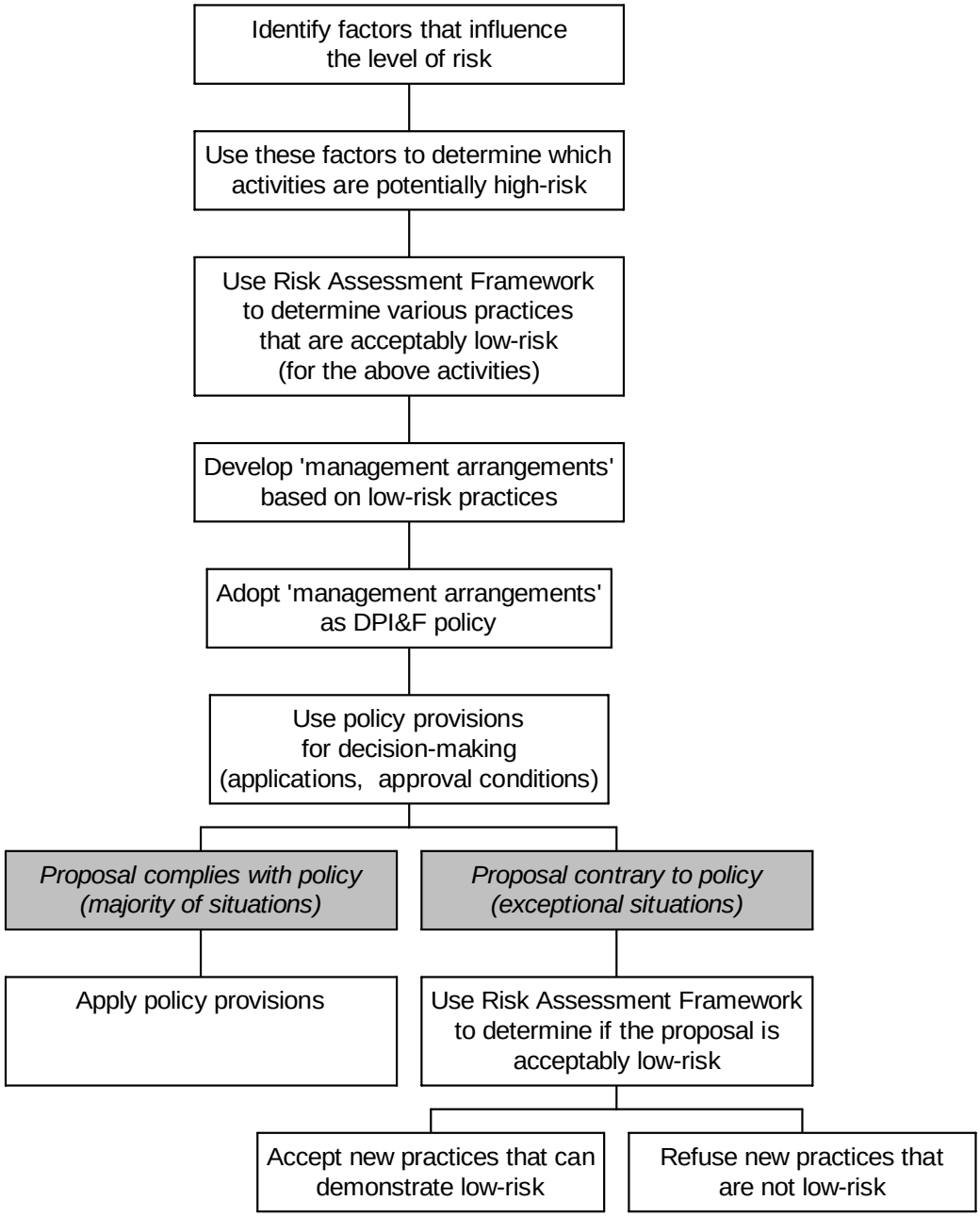
The Queensland Aquaculture Reference Group (ARG) was consulted during the development of this policy. This group comprises representatives of the aquaculture industry including the Queensland Aquaculture Industry Federation (QAIF) and State departments represented on the Aquaculture Inter-Departmental Committee (IDC).

In general the above agencies have shown support for these polices. Issues raised have been discussed in stakeholder meetings. DPI&F have considered responses received during this consultation during the development of the policy.

8.0 Policy provisions

8.1 Process for management of risks for aquaculture

DPI&F employ the following process to minimise risk of disease and translocation in aquaculture operations:



8.2 Identification of potentially high-risk activities

Risks associated with aquaculture of fisheries resources must be considered in terms of the following:

- The potential introduction of diseases into the surrounding aquatic environment.
- The potential introduction of non-indigenous aquatic organisms into the surrounding waterways.
- The potential for the displacement of native aquatic organisms by non-native species.
- The potential for significant changes to the genetic pool of the natural aquatic biota.
- The potential socio-economic impacts all the above may have.

Based on these considerations, several activities have been identified as potentially high-risk and require specific management arrangements:

- aquaculture on potentially flood-prone land;
- aquaculture of any species that are non-indigenous to the area, eg.
    - exotic ornamental fish species;
    - barramundi in inland catchments (Murray-Darling, Lake Eyre and Bulloo-Bancannia);
- use of aquacultured product for bait.

8.3 Determining management arrangements for potentially high-risk activities

The risks associated with translocation and disease in potentially high-risk aquaculture activities can be reduced by identifying the source of risk and the level of risk, and by implementing appropriate management measures.

DPI&F policy is to use a qualitative Risk Assessment framework (refer to Appendix 3) to define appropriate management arrangements for potentially high-risk activities. This framework is based on the formal risk assessment process used in the National ESD Reporting Framework, developed by the National Strategy for ESD and consistent with the Australian Standard AS/NZS 4360:1999 Risk Management, and the companion paper on Environmental Risk Management: Principles and Process HB 203:2000. (Refer to the National ESD website at www.fisheries-esd.com.)

Assessing risk is a complex process based on the scientific knowledge of the aquatic organisms including genetic distribution and disease susceptibility. Often there is little information on potential risks and it may be necessary to apply the precautionary principle until there is sufficient information on which to judge the risk.

In the absence of a scientific risk analysis to base the management arrangements on, it is necessary to qualitatively assess the probabilities and the consequences (refer to Appendix 3) of such movement on the risks of disease, translocation of nonindigenous organisms, and genetic pollution. Once the probabilities and consequences have been identified then the risk can be given a rating. It is also important to clearly document the justification for the risk rating.

Management arrangements based on risk analysis need to address the potential sources of risk and prevent practices with unacceptably high risk levels. Potential issues should be addressed as appropriate for the risk level.

8.4 Implementation of management arrangements

Management arrangements should be used as criteria for:

1. Assessment of applications. Aquaculture approvals should only be issued where the proposed activity incorporates the appropriate management measures.
2. Setting reasonable and relevant conditions of approval[3]. Reasonable and relevant Conditions should be imposed for all approvals issued, to enable the management measures to be enforced.
3. Auditing of aquaculture operations.
4. Guiding the development of best practice within the industry. Industry should be encouraged, through extension and educational information, to develop best practice in line with these management arrangements

8.5 Departure from policy

DPI&F decision-makers are required to give appropriate weight to the policy. The policy provisions are to be administered by relevant DPI&F decision-makers with discretion, having regard to the circumstances of each individual situation.

The Risk Assessment framework should be applied to determine whether the risk associated with a novel type of proposed aquaculture practice is acceptable or unacceptable.

Where a proposal involves exceptional circumstances and / or where a proposal can demonstrate an acceptably low level of risk, a departure from normal policy position may be considered. Where factors sufficient to justify departure from policy exist, those factors need to be documented by the assessing officer.

8.6 Review of management arrangements

The Risk Assessment framework should be used to review the management arrangements if new information is obtained that influences the amount of risk involved.

Similarly the Risk Assessment framework should be used to assess individual applications that have requested a variation of policy position. For example, it may be demonstrated that a new technology or operating procedure can reduce the potential impacts normally associated with a particular activity. If the risk is determined to be

[3] Refer to section 3.2 of this document regarding setting of conditions.

acceptably low according to the Risk Assessment framework, a variation of the normal policy position may be considered.

8.7 Specific management arrangements

Management arrangements have been determined for the aquaculture activities identified as potentially high-risk (Section 8.2) using the Risk Assessment framework. These management arrangements and the risk analyses on which they are based are detailed in the sections listed below:

Part 1: Management arrangements for Translocation of live aquatic organisms (transport between bioregions)

Part 2: Management arrangements for Flood prone land

Part 3: Management arrangements for Exotics

Part 4 Management arrangements for Barramundi in inland catchments

Part 5: Management arrangements Use of aquaculture product for Bait

Part 1 - Management arrangements for Translocation of live aquatic organisms (transport between bioregions)

(Policies under development. Refer to Aquaculture Health Translocation Protocols)

Part 2 - Management arrangements for Flood prone land

P2.1 Rationale

If an outbreak of a disease in a pond coincides with a flooding event, the disease organism could be transferred into the wild. However a significant consideration is that

in the event of a flood and disease event coinciding, the concentration of disease organism would be considerably diluted by the very nature of a flooding event, minimising the risk of transfer to the wild population.

The Q_{100} level is based on risk assessment. Advice from insurance companies who insure aquaculturists is that land below the 1 in 100 year flood level or Q_{100} level is considered by most insurance underwriters to be flood-prone and therefore high risk.

In the case of floods of sufficient magnitude to overtop ponds constructed on land above the Q_{100} level, the dispersal will be of such a magnitude that the impact will be negligible. Storm surges are of very low probability. Additionally, the issue of overtopping of ponds and tanks is addressed by the industry through incentive-based management. It is in the aquaculturist's best interest not to lose product during floods.

P2.2 Desired outcome

To minimise the potential of aquaculture fisheries resources escaping into the natural environment in the event of flooding and potentially impacting wild fisheries resources.

Ensure that containers used to aquaculture fisheries resources are not prone to flooding.

P2.3 Management arrangements

The following management arrangements have been developed based on the Risk Assessment (Appendix 4, Part 2) and are considered appropriate for land-based aquaculture. Standard 'Conditions of Approval' that will generally attach to aquaculture approvals are presented in Section P2.4.

In this policy, flood immunity is discussed in terms of the height of container walls relative to the Q_{100} or 1 in 100 year flood height (ie. the vertical distance between the top of the wall and the Q_{100} height), rather than the spatial location of containers relative to the Q_{100} contour (ie. the horizontal difference between containers and the Q_{100} contour). Containers may be either in-ground ponds or above-ground tanks.

This replaces the existing policy relating to Flood Levels.

P2.3.1 Flood immunity (flood clearance)

<u>Containers used to cultivate fisheries resources</u>

A. Where a wall is used for the purposes of containing water for culturing, growing or breeding aquaculture fisheries resources within a pond, tank or bund, the lowest point on the top of the wall must be higher than the vertical height of the Q_{100} (1 in 100 year) flood level.

B. Where the Q_{100} flood level recording is unavailable, siting of ponds and tanks must be no lower than the highest known or recorded flood level.

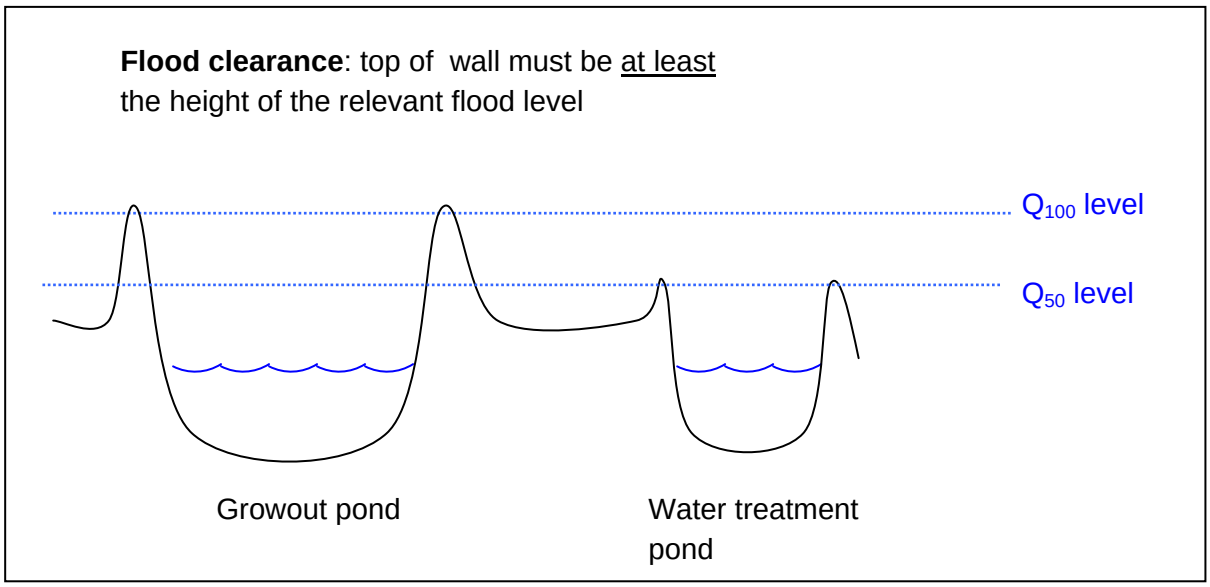
This flood clearance (Fig 2.1) must be maintained so as to prevent the escape of all aquaculture fisheries resources. If this flood clearance is compromised by heavy rain, it must be re-established as soon as practicable.

Containers used for treatment / settlement

Ponds or tanks used for the settlement and or treatment of influent or discharge water as part of the production cycle, and any associated channels, must be constructed so that the lowest point on the top of the wall is equivalent to or higher than the vertical height of the Q_{50} (1 in 50 year) flood level.

A lower level of risk is involved for treatment / settlement ponds because aquaculture approval conditions currently exclude all aquaculture organisms from these ponds. Such ponds must be dedicated for waste treatment purposes, and must not contain fisheries resources originating from the aquaculture production facility nor be used for the commercial culture/production of aquaculture fisheries resources.

Figure 2.1: Flood clearance in aquaculture ponds



Containers used for bio-remediation

DPI&F is aware that that in recent years there has been interest in the use of aquacultured species for bio-remediation of discharge water. DPI&F recognises certain risks associated with these activities. Any proposals involving culture of fisheries resources for bio-remediation within treatment / settlement ponds will require authorisation and will be subject to assessment on an individual basis.

General

The applicant(s) must supply detailed and accurate certified documentation for either the Q_{100} flood level or the Q_{50} flood level, as measured relative to the Australian Height Datum (AHD). Where the Q_{100} flood level record is unavailable, the highest known or highest recorded flood level as certified by the local Council authority will be used.

P2.3.2 Overflow protection (freeboard)

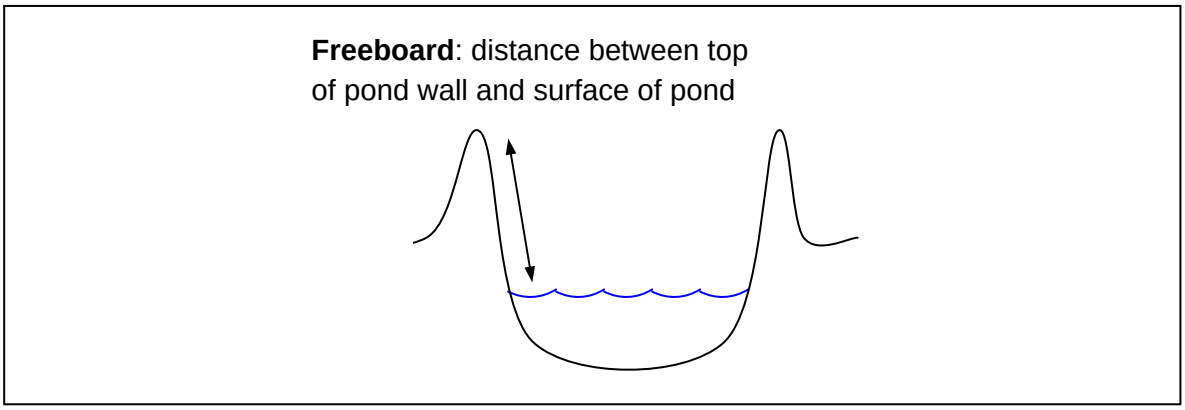
Ponds

A freeboard height (distance from the water level to the lowest point on top of the wall) that is adequate to prevent overflow must be maintained in ponds used for aquaculture (Fig 2.2). DPI&F recommends a freeboard of at least 0.5m. The freeboard must be re-established as soon as practicable after rain. Standpipes and overflow outlets positioned at the desired freeboard height are a suggested means of maintaining adequate freeboard level. The size and number of the overflow outlets should be designed with the assistance from an appropriately qualified individual who also has knowledge of rain events in the area.

Tanks

A freeboard must be maintained in tanks used for aquaculture to prevent overflow. Tanks must be constructed so as to avoid the risk of destabilisation during flood conditions.

Figure 2.2: Freeboard in aquaculture ponds



P2.3.3 Stormwater runoff protection

In addition to measures to prevent inundation by flood waters, the construction of all inground structures, including any structure or impoundment used for the collection and or treatment of wastewater, must be constructed so as to adequately prevent the ingress of stormwater runoff, for example by constructing a bund or levee wall around the structure or impoundment.

P2.3.4 Additional restrictions for certain species

Certain additional flood level restrictions apply to certain higher risk situations. Refer to the following policies for further information.

- Policy provisions for the aquaculture of exotic ornamental fish species (Part 3)
- Policy relating to the aquaculture of Barramundi in inland catchments (Murray-Darling, Lake Eyre, and Bulloo-Bancannia) (Part 4)

Where a greater level of risk minimisation is required, pond and tank siting requirements shall be at the Department's discretion. A separate risk assessment (see Section 8.3) may be required.

P2.4 Conditions specific to flooding

Conditions will attach to the Development Approval – issued under IPA. These are typical conditions that reflect the intent of the policy.

The following conditions would normally be included in any approvals issued.

Aquaculture fisheries resources must not be released into Queensland waters, other than those waters approved under this Development Approval.
The holder must be able to demonstrate control over the release of water from all ponds, tanks and drainage systems within the approved Aquaculture Area.
The holder must implement all reasonable and practicable measures to ensure that all waters (ponds, tanks, aquaria etc.) and associated plumbing, pumps etc. on the approved Aquaculture Area are secured in such a way as to prevent the escape of any specimens (eggs, juveniles or adults) into Queensland waters.
The holder must secure the Aquaculture Area to prevent the overland escape of aquacultured product by maintaining a perimeter barrier that is impervious to all size classes of the aquacultured species.

The covering letter should refer the holder to extension staff and this policy for further advice as to how these objectives can be achieved, including irrigation runoff (NB. still need discharge licence from EPA).

Part 3 - Management arrangements for Exotics

P3.1 Rationale

Species that are non-indigenous to Australia have a higher associated risk of translocation and introduction of disease.

There is a risk of introducing live aquatic organisms into waters where there is no existing population. In the worst case scenario a feral population of a pest / noxious fish could be established, having a significant impact on the natural flora and fauna of natural waters. Serious impacts on native freshwater fauna and habitat caused by the escape of exotics such as tilapia and carp and are well documented. Introduced species often have competitive advantages over native Australian species and are able to establish pest populations (eg. introduced carp, tilapia).

There is a risk that imported exotic fish species may act as hosts to disease organisms not found in indigenous fish stocks and against which indigenous species may have little or no natural resistance. The Australian Quarantine Inspection Service (AQIS) have performed a risk analysis for imported ornamental fish (AQIS, 1999, Import risk analysis on live ornamental finfish). There is a perceived high risk from a wide variety of exotic pathogens. Three cases of exotic diseases have been recorded in imported fish to date. Species of Zebra Fish (*Danio*) were found to be infected with *Edwardsiella ictaluri* which is a pathogen deemed to be exotic to Australia.

The management of domestic cultivation of exotic species is important in reducing importation of potential pathogens.

The establishment of a new exotic disease agent or feral pest fish species in an area may have a significant effect on industry (eg the affected fishery), social amenity and the environment. If non-indigenous species established in inland catchments the costs would be significant. For example, control of the spread of carp or tilapia would cost millions per year in public expenditure.

In the case of floods of sufficient magnitude to overtop ponds constructed on land above the Q_{100} level, it is considered that the dispersal will be of such a magnitude that the impact will be negligible.

The Queensland aquarium fish trade is estimated to be worth as much as $1 million (2004), with around 200 professional breeders and retailers, and tens of thousands of people who keep aquarium fish. Note that this figure is ‘farm gate’ only and does not consider related income. Aquarium fish hobbyists use an estimated 1000 species of fish, of which the majority are exotic. Most aquarium fish are currently imported. There is potential economic and social gain to be made in Queensland by encouraging a local aquarium fish breeding industry.

P3.2 Desired outcomes

To support responsible development of Queensland’s exotic freshwater ornamental fish aquaculture industry within Queensland’s framework for Ecologically Sustainable Development of aquaculture.

Biosecurity of production facilities culturing of exotic ornamentals to provide adequate safeguards and reduce the risk of transmitting potential pathogens to indigenous fish stocks.

DPI&F supports production of exotic freshwater finfish in Queensland as an alternative to imported product. Developing a domestic ornamental finfish industry provides economic opportunity for the state and reduces the risk of introducing pest fish species and diseases from imports.

P3.3 Management arrangements

The following management arrangements have been developed based on the Risk Assessment (Appendix 4, Part 3) and are considered appropriate for aquaculture of exotic species. Standard 'Conditions of Approval' that will generally attach to aquaculture approvals that include exotic species are presented in Section P3.4.

This policy refers to the culture of exotic aquarium fish species that have successfully completed Commonwealth quarantine protocols, congruent with the statutory requirements of the Fisheries Act 1994 and within an Ecologically Sustainable Development framework.

* Commonwealth legislation relating to quarantine protocols and importation of fisheries resources into Australia are outside the scope of this policy. Refer to the Australian Quarantine Inspection Service (AQIS) website at www.aqis.gov.au for more details. Note that under Commonwealth legislation exotic fish may only be imported for ornamental purposes, not for use as food.

P3.3.1 Species

DPI&F will consider applications for aquaculture of exotic species on a case-by-case basis.

In general, no issues are raised with the aquaculture of exotic fish species listed under the *Fisheries Regulation 1995* Schedule 6 'Nonindigenous Fisheries Resources'. These species are commonly aquacultured.

Species that are declared 'noxious' have considerably high risks associated with their use and such species would not generally be regarded as suitable for aquaculture. Noxious species are listed under Schedule 5A of the *Fisheries Regulation 1995*. See also the Control of Exotic Pest Fishes Strategy 2000-2005.

The Australian Government may have input into the permitting of species being introduced via the *Environment Protection and Biodiversity Conservation Act 1999*.

P3.3.2 Discharge

Culture of exotic freshwater ornamental fish in Queensland is not allowed in open or flow-through systems that allow discharge into natural waterways.

Applications for aquaculture of exotic freshwater fish in Queensland waters that allow or have a significant risk of discharge into Queensland waterways will not be approved. Only ventures that have appropriate biosecurity arrangements in place will be approved.

P3.3.3 Containers for culture of exotic species

Both tanks and in-ground ponds may be used for the culture of exotic freshwater fish species.

P3.3.4 Siting and environmental considerations

The location for each application will present a unique set of environmental circumstances for assessment. The assessment process should take into consideration surrounding environmental values and weigh potential impacts of the activity on the receiving environment.

Physical attributes of the site and surrounding area will be important in determining appropriate bio-security measures to be imposed on the farm.

Containers used for the aquaculture of exotic freshwater fish must be constructed on land that is situated above the 1:100 (Q_{100}) flood level. (Note that this is more restrictive than the normal provisions for aquaculture on flood-prone land).

P3.4 Conditions specific to culture of exotics

The Chief Executive will ordinarily impose the following conditions for Queensland aquaculture producers in addition to standard requirements imposed as part of the authorisation of native finfish aquaculture.

Conditions will attach to the Development Approval – issued under IPA. These are typical conditions that reflect the intent of the policy.

The following conditions would normally be included in any approvals issued.

Specific Conditions for Exotics

No water or organisms originating from the aquaculture of exotic species is permitted to reach Queensland waters (as defined in the *Fisheries Act 1994*), other than those waters defined in the approved aquaculture area

Specific Conditions common to Exotics & Barramundi West of the Range

All containers used to aquaculture exotic species and barramundi are to be screened to exclude vertebrate predators (eg. birds) without causing injury to such predators.
Containers used for the aquaculture of exotic species and barramundi must be constructed on land that is situated above the 1:100 (Q_{100}) flood level.
The holder must install filters with a screen to ensure that all waters leaving containers used for aquaculture of exotic species and barramundi are treated to prevent the escape of eggs, juveniles or adults.

Part 4 - Management arrangements for Barramundi in inland catchments

P4.1 Rationale

Barramundi (*Lates calcarifer*) are non-indigenous to inland catchments west of the Great Dividing Range that Queensland shares with neighbouring states, specifically the Murray-Darling, Lake Eyre and Bulloo-Bancannia catchments (refer to Figure 4.1).

Cultivation of barramundi in these areas increases the risk of transmission of disease and escape of barramundi into catchments where this species does not naturally occur, resulting in establishment of a new disease agent or feral barramundi in these catchments.

DPI&F Health officers regard barramundi nodavirus is regarded as a significant disease risk. Nodavirus may be transmitted to other barramundi and also to other freshwater species. Nodavirus is known to infect other freshwater finfish species (Anderson I G and Moody N 2004). It could have a severe impact on industry if it is spread to areas where it is not known to occur already. It is not a human health or marketability issue.

The disease status of barramundi in the eastern parts of Queensland are known. Barramundi and any associated diseases can be considered indigenous east of the Great Dividing Range.

Present knowledge of the disease risk status in the inland catchments that Queensland shares with other states is incomplete at best. Nodavirus has been recorded from farmed barramundi in Australia. It has been reported to have been contracted by freshwater fish in Australia in two natural instances (pers.com. Ian Anderson, Principal Veterinary Pathologist (Fish Disease), DPI&F) and effective transmission of the virus to native freshwater species found in these catchments has been demonstrated under laboratory conditions (pers.com. Ian Anderson, Principal Veterinary Pathologist (Fish Disease), DPI&F).

At present there is no record of nodavirus from any freshwater species in inland catchments west of the ranges. These catchments include the Murray-Darling which spans 3 states and is the most economically significant catchment in Australia. Barramundi are not reported to be present in this system. Queensland DPI&F have a duty of care to ensure that river systems outside Queensland are not subjected to disease risk. The risk of nodavirus entering natural waterways is of concern to other states including South Australia although winters in southern states are cold enough to kill barramundi (pers. comm. Mr Marty Deveney, Resource Management Officer, PIRSA Aquaculture, South Australia). Similar biosecurity measures are required in other states as part of aquaculture approval conditions.

Introduced barramundi, while not able to reproduce in these systems due to environmental constraints, is an aggressive, high order predator and may impact deleteriously on the existing ecosystem. If non-indigenous species established in inland catchments it would be likely to cost millions in impacts per year.

In the case of floods of sufficient magnitude to overtop ponds constructed on land above the Q_{100} level, it is considered that the dispersal will be of such a magnitude that the impact will be negligible.

In recognition of the potential for inter-species transmission of nodavirus a higher level of biosecurity is proposed for aquaculture of barramundi in inland catchments.

In addition to the usual consultation process, DPI&F undertook consultation on the policy for barramundi in inland catchments with the following stakeholders:

- Australian Freshwater Fishermen's Assembly Inc.
- Native Fish Australia
- Recfish Australia
- FFSAQ
- VR Fish
- Institute of Freshwater Anglers (NSW) Inc.
- QFMA (functions now fulfilled by Fisheries Resources Management, DPI&F)
- FFMAC
- QADAC (which has now evolved into QAIF)
- QDPI&F Veterinary and Scientific Staff

P4.2 Desired outcome

Ensure that the ecological integrity of the fauna in inland catchments is not compromised by the introduction of disease agents or barramundi into catchments where it does not naturally occur.

Ensure a higher level of biosecurity (over and above general biosecurity conditions) for facilities culturing barramundi in inland catchments, to minimise the risk of spreading nodavirus in recognition of the potential for inter-species transmission of nodavirus.

The DPI&F supports the aquaculture of barramundi in the Murray-Darling, Lake Eyre and Bulloo-Bancannia catchments subject to proponents satisfying the DPI&F's approval process and their continued compliance with approval requirements.

P4.3 Management arrangements

The following management arrangements have been developed based on the Risk Assessment (Appendix 4, Part 4) and are considered appropriate for aquaculture of barramundi in inland catchments that are shared with other States, namely the Murray-Darling, Lake Eyre and Bulloo-Bancannia (refer to Figure 4.1). Standard 'Conditions of Approval' that will generally attach to aquaculture approvals that include barramundi in inland catchments are presented in Section P4.4.

These management arrangements focus on the disease management and security aspects of barramundi aquaculture facilities and are to be adopted in addition to the existing standard requirements prescribed for barramundi farming.

* The policy does not discuss stocking of barramundi. Stocking of barramundi is managed through the DPI&F Stocked Impoundment Permit Scheme (SIPS) program.

The movement of all barramundi is subject to Aquaculture Translocation protocols (DPI&F) FAMPR002 and appropriate Management Plans.

P4.3.1 Use of cultured barramundi

Aquacultured barramundi may not be used for non-food purposes. DPI&F do not support use of barramundi for stocking in catchments where they are not indigenous due to the environmental impact this would involve.

P4.3.2 Source of stock

Barramundi stock must only be obtained from an approved hatchery. Hatchery production of barramundi in inland catchments is not permitted. Health testing and certification will be required as outlined in conditions of approval.

P4.3.3 Discharge

Applications for aquaculture of barramundi in open or flow through systems should not be approved for inland catchments. Barramundi in inland catchments must only be cultured in systems that allow no discharge of effluent into natural waterways.

P4.3.4 Containers for culture of barramundi

Containers used for the aquaculture of barramundi must be constructed only on land that is situated above the 1:100 (Q_{100}) flood level. (Note that this is more restrictive than the normal provisions for aquaculture on flood-prone land.)

In order to minimise the risk of disease spread between species, water used for culture of barramundi must be kept separate from water used for the culture of other species.

P4.3.5 Notification of mortalities

DPI&F must be notified in the case of mortalities as outlined in conditions of approval.

P4.4 Conditions specific to barramundi in inland catchments

Conditions will attach to the Development Approval issued under IPA. These are typical conditions that reflect the intent of the policy.

The following conditions would normally be included in any approvals issued.

Specific Conditions common to Exotics & Barramundi West of the Range

All containers used to aquaculture exotic species and barramundi are to be screened to exclude vertebrate predators (eg. birds) without causing injury to such predators.
Containers used for the aquaculture of exotic species and barramundi must be constructed on land that is situated above the 1:100 (Q_{100}) flood level.
The holder must install filters with a screen to ensure that all waters leaving containers used for aquaculture of exotic species and barramundi are treated to prevent the escape of eggs, juveniles or adults.

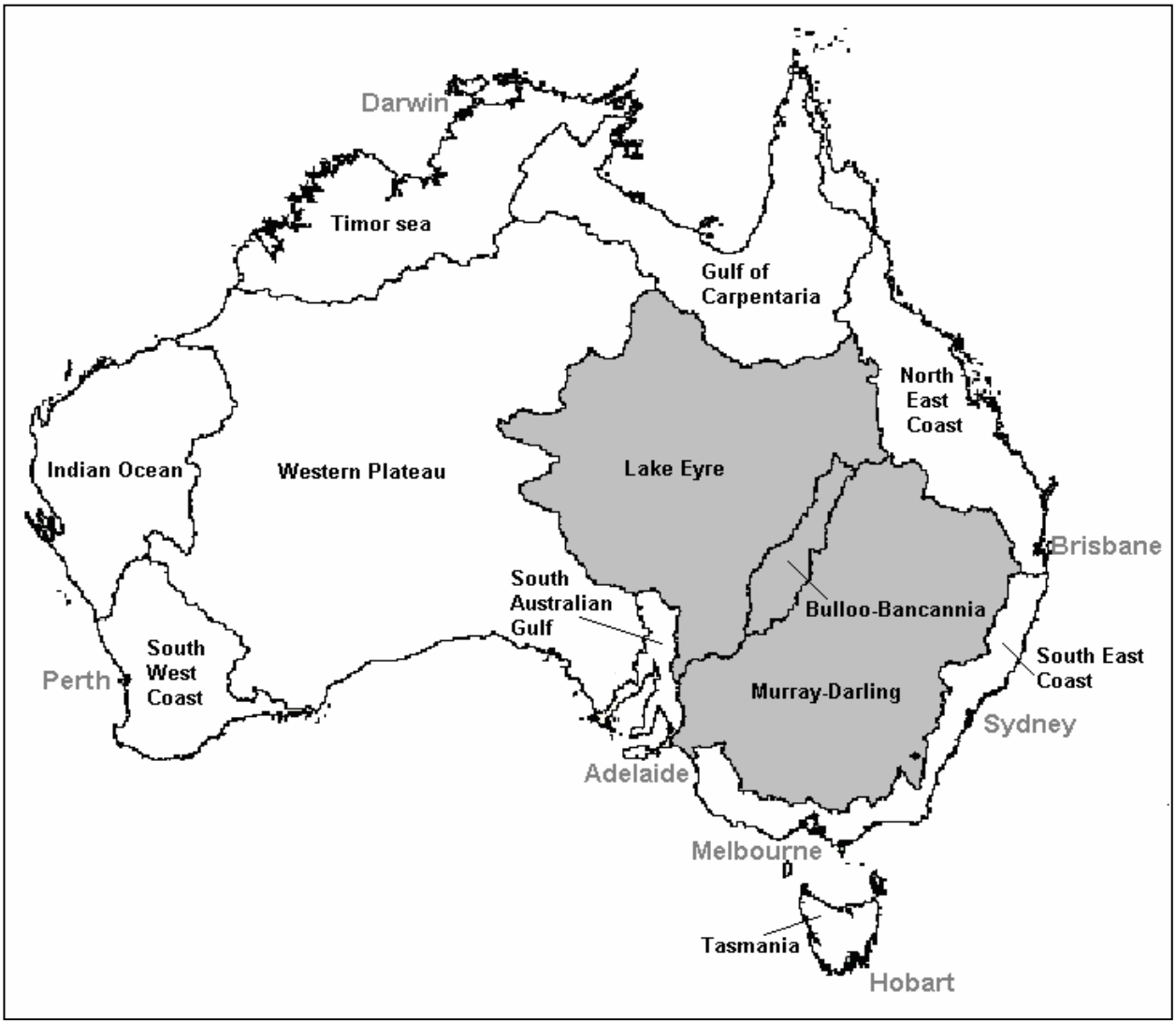
Specific Conditions for Barramundi west of the range

The movement of all barramundi is subject to the Aquaculture Translocation Policy (DPI&F) FAMPR002 and appropriate Management Plans.
No water or organisms originating from the aquaculture of barramundi is permitted to reach Queensland waters (as defined in the *Fisheries Act 1994*), other than those waters defined in the approved aquaculture area, including during transportation of aquacultured product.
Aquacultured Barramundi must not be used for non-food purposes, (eg. stocking Queensland waters or farm dams).
Water used in the culture of barramundi must be kept separate from water used to culture other species.
This Development Approval authorises the possession and aquaculture of Barramundi fingerlings, only from an approved hatchery facility, which has tested negative for nodavirus (the causative agent of viral encephalopathy and retinopathy (VER) at 21 and 42 days old.

The holder must not transport to the approved area, or possess, Barramundi eggs, larvae or fingerlings which are less than 42 days old.
Hatchery production of Barramundi, including larval rearing, is not permitted
a) The holder must obtain, from a NATA registered laboratory that is authorised to undertake such testing, a Free from Infection Pathology report which indicates the absence of lesions on all Barramundi stock, prior to transporting Barramundi fingerlings to the approved area; and b) the holder must maintain complete and accurate records of all movements of fish brought onto and taken from the approved area. Records must include: • the sources of stock obtained, • the age of specimens , • the numbers of specimens, • a signed copy of the Pathology report (infection clearance certificate) for all batches of Barramundi transported to the approved area, • the date obtained, • mortality rates, • any unusual characteristics or behaviour, • the batch number, • the destination of stock once removed from the aquaculture facility
The holder of this authority must: a) notify DPI&F immediately if fish mortalities of greater than 5% of stock in a single tank over a twenty-four (24) hour period are observed; and b) maintain a record of fish mortalities for a period of seven (7) years and make those records available to DPI&F upon request.
All Barramundi mortalities, and/or processing wastes (including filter residues), must be treated and disposed of according to the AQUAVETPLAN. Acceptable disposal methods include incineration, or burial. If buried: a) the floor of the burial pit must be one (1) metre above the water table; and b) mortalities and/or processing wastes must be covered with soil to approximately 400 millimetres, an unbroken layer of slaked lime (CaOH) added and then covered with at least one (1) metre of soil to ground level; and c) surplus soil must be heaped over the pit as overfill.

Figure 4.1 - The 13 Drainage Divisions of Australia

Showing the Murray-Darling, Lake Eyre and Bulloo-Bancannia divisions.



Adapted from “National Land and Water Resources Audit, 2000”

Part 5 - Management arrangements for Use of aquacultured product for bait

P5.1 Rationale

The use of aquaculture fisheries resources as bait has the potential to impact upon indigenous fisheries resources through disease transmission and translocation of species outside their natural range.

The principal factors to be considered are the risks of disease transmission and translocating species outside of their natural range, both of which have the potential to impact on indigenous fisheries resources.

Disease

When stock is harvested there is a risk that it may contain a disease, and that if used as bait, there is a further risk that the disease could be spread to aquatic organisms occurring in the aquatic environment.

Diseases in aquaculture from prawn (all member of the Family Penaeidae) and finfish species (including both live specimens and carcasses) are well documented (see Reference Section). Some of the diseases recorded in aquaculture facilities include:

- Gill associated virus (GAV)
- Spawner-isolated mortality virus (SMV)
- Peripheral neuropathy and retinopathy (PNR)
- Viral encephalopathy and retinopathy (VER)
- Epizootic ulcerative syndrome (EUS)
- Parvo-like virus
- QX disease

If aquaculture product is used as bait there is a risk that these identified diseases may be introduced to wild populations. Disease transmission to wild populations from finfish carcasses and members of the Family Penaeidae to wild populations may have major ecological and economic risk.

The effect of the disease on fish varies with the disease. The fish may be inedible or it may die before it reaches marketable size.

Not enough is known about the effect on wild stocks however it is expected there is a significant potential impact to pose a major ecological and economic risk of the spread of disease. As well as the known diseases, it is possible that the risks of “unknown” or exotic diseases can be amplified under aquaculture conditions and then spread to previously unexposed populations in the wild.

None of the diseases listed are directly harmful to humans if they consume the product after it has been properly prepared.

Translocation of non-indigenous species

If aquaculture product is used as live bait, there is a risk of introducing live aquatic animals into waters where there is no wild population. The introduced animal may interact with the wild fisheries resources and impact upon the natural ecosystem.

Potential socio-economic impacts

Potential socio-economic benefit of a particular aquaculture industry for bait may reflect a benefit to the individual establishing the industry or a benefit to the environment in reducing the impact of wild harvest for bait.

A well organised and functioning bait industry could help alleviate the problem of other unwitting translocations possibly occurring. For example, tilapia are now present in Boondooma dam. People arrive at Boondooma carrying live bait which may have been sourced from a tilapia infested water, such as can be found near Brisbane. Small fish such as tilapia juveniles are well known to go into bait collection traps. At the end of a fishing trip, the remaining bait may be tipped over the side into Boondooma dam, thus introducing the leftover shrimp as well as anything else collected at the other site.

P5.2 Desired outcomes

To protect aquatic animal resources from the risk of the introduction of disease or of non-endemic aquatic animals through the management of aquaculture product as bait.

Use of aquaculture product for bait in Queensland should be limited to species for which there is an acceptable level of risk.

P5.3 Management arrangements

The following management arrangements have been developed based on the Risk Assessment (Appendix 4, Part 5) and are considered appropriate for aquaculture. Standard 'Conditions of Approval' that will generally attach to aquaculture approvals are presented in Section P5.4.

*Other issues such as use of broodstock will be covered under Translocation (Part 1).

P5.3.1 General restrictions

Approvals for Queensland aquaculture producers and processors will ordinarily impose the condition that all aquaculture product (dead or alive), unless otherwise exempt, must not knowingly and intentionally be used as bait. This includes the whole organism or any part of the organism.

Only species which have an acceptably low level of risk according to the Risk Assessment will be permitted for use as bait.

In cases where knowledge of a species is limited, a precautionary approach has been adopted and a separate risk assessment (see Section 8.3) will be required.

P5.3.2 Species that may be used as bait

Species that are considered acceptably low risk that can be produced through aquaculture and sold as bait are:

Common name	Scientific name
Freshwater shrimp	*Macrobrachium australiensis*
Blood worm	*Marphysa sanguinea*
Sand wriggler worm	*Perinereis nuntia* Fam. Nereidae

To obtain authorisation to sell any other species produced through aquaculture as bait, a risk assessment will need to be undertaken by a suitably qualified professional (refer to Section 8.3). If the risk assessment meets the criteria for an Ecologically Sustainable Development, DPI&F may consider an approval for that species.

P5.4 Conditions specific to the use of aquacultured fisheries resources for bait

General aquaculture conditions state that aquaculture resources may not be used as bait. However, proponents may apply for the three exceptions in which case the general condition will be modified.

The following conditions would normally be included in any approvals issued. These are typical conditions that reflect the intent of the policy.

General:

Aquaculture fisheries resources (alive or dead) must not knowingly and intentionally be used as bait. This includes the use of whole fish and any part of the fish.

Exceptions:

Freshwater shrimp (*Macrobrachium australiensis*) may be sold as bait.
Blood worm (*Marphysa sanguinea*) may be sold as bait.
Sand wriggler worms (*Perineries nuntia*, family Nereidae) may be sold as bait.

9.0 Glossary

In this policy statement the terms listed below have the following meaning:

'AHD'

Australian Height Datum - mean sea level at it applies to 30 tide gauges around the coast of Australia. Australian Height Datum was adopted in May 1971 and is the datum to which all vertical control and determinations of elevations for mapping and surveying can be referenced in Australia. The determination used a national network of benchmarks and tide gauges, and set mean sea level as zero elevation.

'Aquaculture'

As defined in the *Fisheries Act 1994*.
Refer to the Queensland legislation website for the most current version (www.legislation.qld.gov.au).

'Aquaculture fisheries resources'

As defined in the *Fisheries Act 1994*.
Refer to the Queensland legislation website for the most current version (www.legislation.qld.gov.au).

'Bio-security'

Means protection from the risks posed by organisms to the economy, environment and people's health.

'Discharge'

Release of wastewater into natural waterways (note that standard Conditions of approval will typically prevent excess irrigation reaching waterways).

'Disease'

As defined in the *Fisheries Act 1994*.
Refer to the Queensland legislation website for the most current version (www.legislation.qld.gov.au).

'ESD'

Ecologically Sustainable Development as defined in Section 3 (4) of the *Fisheries Act 1994.*
Refer to the Queensland legislation website for the most current version (www.legislation.qld.gov.au).

'Exotic ornamental fish'

Means fish originating from anywhere outside Queensland, produced, imported for, or to be bred for the Ornamental Fish Display trade.

‘Indigenous fisheries resources’

As defined in the *Fisheries Act 1994*.
Refer to the Queensland legislation website for the most current version (www.legislation.qld.gov.au).

NB. Throughout this document, ’indigenous’ should be taken to mean indigenous to the catchment.

‘Non-indigenous fisheries resources’

As defined in the *Fisheries Act 1994*.
Refer to the Queensland legislation website for the most current version (www.legislation.qld.gov.au).

NB. Throughout this document, ’non-indigenous’ should be taken to mean nonindigenous to the catchment.

‘Open or flow through’

Means allowing release of water and / or fisheries resources to natural waterways.

‘Pond’

Earthen in-ground container.

‘Precautionary principle’

As defined in the *Fisheries Act 1994*.
Refer to the Queensland legislation website for the most current version (www.legislation.qld.gov.au).

‘Q_{50} level’

The level to which floodwaters will rise during a flood event with an average recurrence interval (ARI) of 1 in 50 years.

‘Q_{100} level’

The level to which floodwaters will rise during a flood event with an average recurrence interval (ARI) of 1 in 100 years.

‘Sell’

As defined in the *Fisheries Act 1994*.
Refer to the Queensland legislation website for the most current version (www.legislation.qld.gov.au).

‘Tank’

Above-ground container used for intensive aquaculture within an enclosed facility.

‘Translocation’

The movement of live aquatic organisms (including all stages of the organism’s life cycle and any derived viable genetic material):

- beyond its accepted distribution
- to areas which contain genetically distinct populations; or
- to areas with superior parasite or disease status

'Waterway'

As defined in the *Fisheries Act 1994*.
Refer to the Queensland legislation website for the most current version (www.legislation.qld.gov.au).

10.0 Reference material

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Bait

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Appendix 1 - Main purpose of the Fisheries Act

The main purpose of the *Fisheries Act 1994* (section 3) is to provide for the use, conservation and enhancement of the community's fisheries resources and fish habitats in a way that seeks to:

a) apply and balance the principles of ecological sustainable development; and

b) promote ecological sustainable development.

In balancing the principles, each principle is to be given the relative emphasis appropriate in the circumstances - *Fisheries Act 1994* (section 3(2)).

a) enhancing individual and community wellbeing through economic development that safeguards the wellbeing of future generations;

b) providing fairness within and between generations;

c) protecting biological diversity, ecological processes and life-support systems;

d) in making decisions, effectively integrating fairness and short and long-term economic, environmental and social considerations;

e) considering the global dimension of environmental impacts of actions and policies;

f) considering the need to maintain and enhance competition, in an environmentally sound way;

g) considering the need to develop a strong, growing and diversified economy that can enhance the capacity for environmental protection;

h) that decisions and actions should provide for broad community involvement on issues affecting them;

i) the precautionary principle.

Appendix 2 - Compliance under the Fisheries Act

Refer to the Queensland legislation website for the most current version

(www.legislation.qld.gov.au).

Condition of approval

Fisheries Regulation 1995
Schedule 1, Part 8, Section 85 'Contravening a condition of an authority'

Integrated Planning Act 1997
Chapter 4, Part 3, Section 4.3.3 'Compliance with development approval'

Biosecurity - general

Penalties may also apply in the event of escape of any aquaculture fisheries resources into Queensland waters.

Fisheries Act 1994
Part 5, Section 91 'Aquaculture fisheries resources not to be released'

Fisheries Regulation 1995
Part 8, Division 2 'Acts only an authority holder may do', Section 77 'Aquaculture'

Fisheries Regulation 1995
Part 8, Division 2 'Acts only an authority holder may do', Section 80 'Nonindigenous fisheries resources'

Fisheries Act 1994
Part 5, Section 82 'Offence to do prescribed act'

Biosecurity – noxious species

Additional restrictions are imposed for species that are declared to be 'noxious'. Noxious species are listed under Section 74 of the *Fisheries (Freshwater) Management Plan 1999.*

See also the Control of Exotic Pest Fishes Strategy 2000-2005.

Fisheries Regulation 1995
Part 8, Division 2 'Acts only an authority holder may do', Section 81 'Noxious fisheries resources'

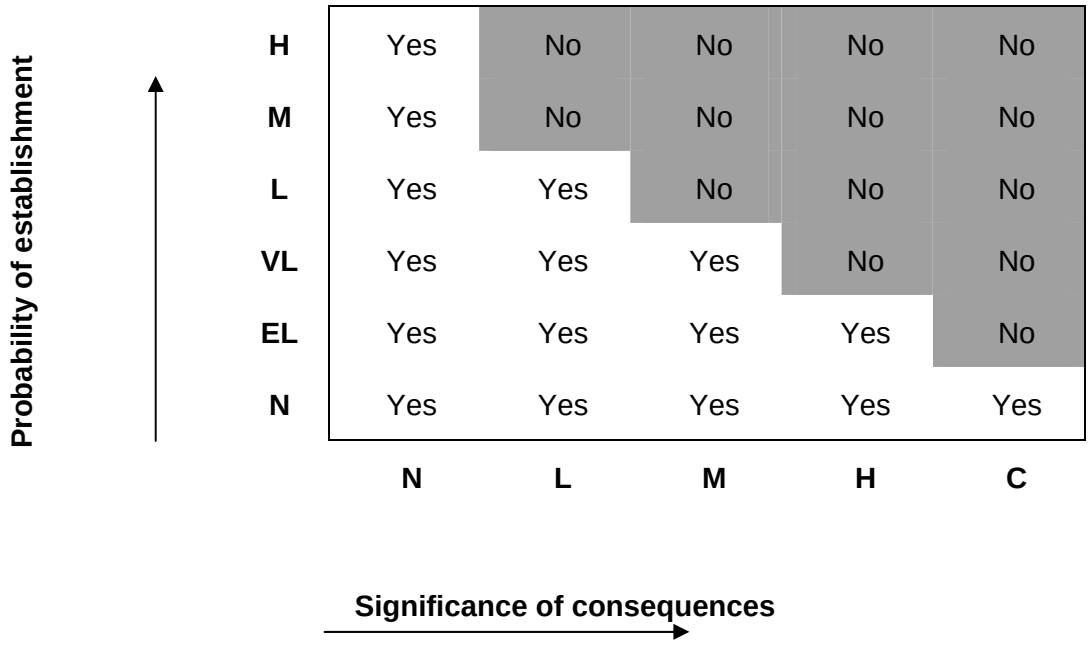
Fisheries Act 1994
Part 5, Section 93 'Recovery of costs of removing noxious fisheries resources etc'.

Disease

Fisheries Act 1994
Part 5, Section 104 'Offence to communicate disease to live fisheries resources or fish habitat'

Appendix 3 - Generic Risk Assessment framework

Risk evaluation matrix



'Yes' = the risk is acceptable and the activity can be permitted

'No' = the risk is unacceptable and the activity cannot be permitted without further risk management

Level of probability:

H=high, M=moderate, L=low, VL=very low, EL=extremely low, N=negligible

Level of significance:

C=catastrophic, H=high, M=moderate, L=low, N=negligible

Source: Adapted from Kahn et al. (1999)

Appendix 4 - Risk Assessment frameworks for specific high-risk activities

These Risk Assessments were used to develop management arrangements for specific high risk activities (refer to Section 8.7).

Part 2 - Qualitative Risk Analysis for Flood Levels in Aquaculture

Defining the probability of escape of aquaculture resources.

The probability of aquaculture fisheries resources escaping from an aquaculture operation depends on the factors shown in Table 2.1.

Table 2.1. Factors affecting the probability of aquaculture fisheries resources escaping from aquaculture facilities into natural waterways
1. The ponds and or tanks are located in flood prone area.
2. Inadequate freeboard of water levels have been maintained on each of the ponds and or tanks.
3. There are no bund/levee walls present for flood protection or those that do exist are inadequate.
4. There is inadequate screening of effluent waters from ponds and or tanks. Proximity to permanent water bodies.

Table 2.2 defines the terms used to describe the probability of such an event occurring.

Table 2.2. Terms used to describe the probability of such an event occurring	
High	Event would be expected to occur
Moderate	There is less than an even chance of the event occurring
Low	Event would be unlikely to occur
Very low	Event would occur rarely
Extremely low	Event would occur very rarely
Negligible	Chance is so small that it can be ignored in practical terms

Defining the consequences of escaped fisheries resources from an aquaculture facility.

When aquaculture fisheries resources escape they may pose a significant environmental risk. These risks may include but not be limited to:

- The potential introduction of diseases into the surrounding aquatic environment.
- The potential introduction of non-indigenous aquatic organisms into the surrounding waterways.
- The potential for the displacement of native aquatic organisms by non-native species.

- The potential for significant changes to the genetic pool of the natural aquatic biota.
- The potential socio-economic impacts all the above may have.

Table 2.3. Key factors in classifying the significance of escaped aquaculture fisheries resources
1. The biological effects on surrounding aquatic biota.
2. The short and long term effects on the environment.
3. The socio-economic effects at an enterprise/industry/national level.

From a risk management perspective the unplanned escapement of any fisheries resources from an aquaculture facility into the wild is unacceptable. Containment of escaped stock in most circumstances is impossible and the potential environmental influences these animals may have are difficult to measure. The potential for the introduction of disease to the aquatic environment that may or may not establish, however is likely to result in mortality or morbidity of native biota is also considered as a significant and unacceptable risk.

The impact or significance as a consequence of escaped aquaculture fisheries resources can be classified into one of five categories. These include catastrophic, high, moderate, low or negligible (See Table 2.4).

The categories defined in Table 2.4 lie within a continuous range of consequences. The descriptions are indicative of the expected outcomes.

Table 2.4. The categories defined are indicative of the expected outcomes	
Catastrophic	Associated with disease establishment, new genetic strains or unwanted species that would be expected to have significant irreversible environmental consequences.
High	Associated with disease introduction to the aquatic environment, not likely to establish however likely to result in mortality or morbidity of native biota. Consideration where feral populations of aquacultured product may become established and displace native biota or have some genetic influence on existing populations.
Moderate	The escape of aquaculture fisheries resources to the aquatic environment is likely to pose no effect on native populations or genetics and any introduced diseases are likely to have a less pronounced impact where they can be treated, contained or eradicated with minimal costs
Low	Associated with introduced diseases likely to be already found in wild biota, where the displacement of native biota is minimal and the genetic

	diversity is unlikely to be significant
Negligible	Associated with a facility that has no diseases, where all animals are from the same genetic structure as those of the same species found in the wild from a biogeographical structure and the economic and environmental consequences as a consequence of any escapement is negligible.

Table 2.5. Disease risk

Proposed activity	**Probability** (Y Axis – App 3)	**Significance** (X Axis – App 3)	**Risk**
Flood prone areas Less than Q_{100}	High	Low	Unacceptable
Not Flood prone areas Equal to or greater than Q_{100}	Low	Low	Acceptable

Refer to Section P2.1 for details.

Table 2.6. Translocation risk

Proposed activity	**Probability** (Y Axis - App 3)	**Significance** (X Axis – App 3)	**Risk**
Flood prone areas Less than Q_{100}	Moderate-High	Moderate-High	Unacceptable
Not Flood prone areas Equal to or greater than Q_{100}	Low	Low	Acceptable

Refer to Section P2.1 for details.

Table 2.7. Socio-economic benefits / factors

Proposed activity	**Potential Benefit**
Flood prone areas Less than Q_{100}	nil
Not Flood prone areas Equal to or greater than Q_{100}	nil

Refer to Section P2.1 for details.

Table 2.8. Summary of the qualitative risk of an aquaculture facility flooding and the aquaculture fisheries resources escaping

Activity	**Disease** **(Table 2.5)**	**Translocation** **(Table 2.6)**	**Benefit** **(Table 2.7)**	**Suitability***
Flood prone areas Less than Q_{100}	Unacceptable	Unacceptable	nil	no
Not Flood prone areas Equal to or greater than Q_{100}	Acceptable	Acceptable	nil	yes

* If either the disease Risk or the translocation risk is unacceptable then the activity cannot be supported

Part 3 - Qualitative Risk Analysis for exotic freshwater fish culture

Defining the probability of disease or feral populations of exotic freshwater fish entering and becoming established in an area (probability assessment)

The probability of a disease agent entering and becoming established in an area, or of exotic fish escaping from an aquaculture operation and establishing feral populations, depends on the factors shown in Tables 3.1a and 3.1b.

Table 3.1a. Factors affecting the probability of a disease agent entering and becoming established in an area
1. A disease agent being present in the stock of exotic freshwater fish
2. Infected fish or waters from infected fish populations entering native waters.
3. Temperature
4. Salinity
5. Available hosts

Table 3.1b. Factors affecting the probability of an exotic freshwater fish establishing feral populations in an area
1. The bio-security of the aquaculture facility
2. Competition with native fish
3. Temperature
4. Salinity
5. Food availability
6. Successful breeding of exotic fish species

Table 3.2 defines the terms used to describe the probability of such an event occurring.

Table 3.2. Terms used to describe the probability of an event occurring	
High	Event would be expected to occur
Moderate	There is less than an even chance of the event occurring
Low	Event would be unlikely to occur
Very low	Event would occur rarely
Extremely low	Event would occur very rarely

Negligible	Chance of event occurring is so small that it can be ignored in practical terms

Defining the consequences of disease or feral populations of exotic freshwater fish entering and becoming established in an area (consequence assessment).

The establishment of a new disease agent or feral pest fish species in an area may have a biological effect and consequential effects on industry (eg the affected fishery), social amenity and the environment. These consequences can be measured in quantitative terms (in relation to their economic impact) and in qualitative terms (in relation to their impact on society and the environment. In some cases the effects of a disease or species translocation can be ameliorated to various degrees by the adoption of methods for control or eradication — however these measures are associated with costs that must be included in estimates of economic, social and environmental impact.

Table 3.3. Key factors in classifying the significance of disease or feral species establishment

1. The biological effects on aquatic species.
2. The availability, cost and effectiveness of methods for control/eradication.
3. The economic effects at an enterprise/industry/national level.
4. The duration of effects (long term and short term).
5. The effects on native species and the environment generally, including any loss of social amenity.
6. Any other effects on social amenity (eg degradation of recreational fisheries).

The impact or significance of a disease or feral species establishment in an area is classified into one of five categories, described as catastrophic, high, moderate, low or negligible. The key factors in classifying the significance of a disease or feral species establishment are shown in Table 3.4.

The categories defined in Table 3.4 lie within a continuous range of consequences. The descriptions are indicative of the expected outcomes.

Table 3.4. Terms used to describe the severity of the impact (level of significance)

Catastrophic	associated with an occurrence that would be expected to significantly harm economic performance at a national level. Alternatively, or in addition, they may cause serious, irreversible harm to the environment.
High	associated with an occurrence that would have serious biological consequences (eg high mortality or high morbidity and causing significant impact). Such effects would normally be felt for a

	prolonged period (greater than or equal to a normal production cycle) and would not be amenable to control or eradication. These events would be expected to significantly harm economic performance at an industry level. Alternatively, or in addition, they may cause serious harm to the environment.
Moderate	associated with an occurrence that have less pronounced biological consequences. Such an occurrence may harm economic performance significantly at an enterprise/regional level, but they would not have a significant economic effect at the 'whole industry' level. They may be amenable to control or eradication at a significant cost, or their effects may be temporary. They may affect the environment, but such harm would not be serious or may be reversible.
Low	associated with an occurrence that has mild biological consequences and would normally be amenable to control or eradication. Such events would be expected to harm economic performance at the enterprise or regional level but to have negligible significance at the industry level. Effects on the environment would be minor or, if more pronounced, would be temporary.
Negligible	associated with an occurrence that has no significant biological consequences, may be transient and/or are readily amenable to control or eradication. The economic effects would be expected to be low to moderate at an individual enterprise level and insignificant at a regional level. Effects on the environment would be negligible.

Table 3.5. Disease risk

Proposed activity	**Probability** (Y Axis - App 3)	**Significance** (X Axis – App 3)	**Risk**
Above ground - no discharge	extremely low	high	Acceptable
Above ground - discharge	high	high	Unacceptable
Ponds - no discharge	extremely low	high	Acceptable
Ponds - discharge	high	high	Unacceptable

Refer to Section P3.1 for details.

Table 3.6. Translocation risk (risk of feral population establishing)			
Proposed activity	**Probability** (Y Axis – App 3)	**Significance** (X Axis – App 3)	**Risk**
Above ground - no discharge	extremely low	high	Acceptable
Above ground - discharge	high	high	Unacceptable
Ponds - no discharge	extremely low	high	Acceptable
Ponds - discharge	high	high	Unacceptable

Refer to Section P3.1 for details.

Table 3.7. Socio-economic benefits / factors	
Proposed activity	**Potential Benefit**
Above ground - no discharge	Moderate
Above ground – discharge	Moderate
Ponds - no discharge	Moderate
Ponds – discharge	Moderate

Refer to Section P3.1 for details.

Table 3.8. Summary of the Qualitative Risk Analysis for culture of exotic species				
Species	**Disease** (Table 3.5)	**Translocation** (Table 3.6)	**Benefit** (Table 3.7)	**Suitability***
Above ground - no discharge	Acceptable	Acceptable	Mod	yes
Above ground - discharge	Unacceptable	Unacceptable	Mod	no
Ponds - no discharge	Acceptable	Acceptable	Mod	yes
Ponds - discharge	Unacceptable	Unacceptable	Mod	no

* If either the disease Risk or the translocation risk is unacceptable then the activity cannot be supported.

Part 4 - Qualitative Risk Analysis for the aquaculture of barramundi in inland catchments

Defining the probability of disease or feral populations of barramundi entering and becoming established in an area (probability assessment)

The probability of a disease agent entering and becoming established in an area, or of barramundi escaping from an aquaculture operation and establishing feral populations, depends on the factors shown in Tables 4.1a and 4.1b.

Table 4.1a. Factors affecting the probability of a disease agent entering and becoming established in an area
1. The disease agent being present in the parent stock of barramundi and, if present, its prevalence.
2. The disease agent being present in a viable/infective form in barramundi escaping, or surviving in effluent waters and infecting native fish populations
3. The disease agent, in a viable/infective form, entering the aquatic environment in an area.

Table 4.1b. Factors affecting the probability of barramundi establishing feral populations in an area
1. The bio-security of the aquaculture facility
2. Competition with native fish
3. Temperature
4. Salinity
5. Food availability
6. Successful breeding of barramundi

Table 4.2 defines the terms used to describe the probability of such an event occurring.

Table 4.2. Terms used to describe the probability of an event occurring	
High	Event would be expected to occur
Moderate	There is less than an even chance of the event occurring
Low	Event would be unlikely to occur
Very low	Event would occur rarely
Extremely low	Event would occur very rarely

Negligible	Chance of event occurring is so small that it can be ignored in practical terms

Defining the consequences of disease or feral populations of barramundi entering and becoming established in an area (consequence assessment)

The establishment of a new disease agent or feral barramundi in an area may have a biological effect and consequential effects on industry (eg the affected fishery), social amenity and the environment. These consequences can be measured in quantitative terms (in relation to their economic impact) and in qualitative terms (in relation to their impact on society and the environment). It is generally the case that the effects of a disease or species translocation can be ameliorated to various degrees by the adoption of methods for control or eradication — although these measures are associated with costs that must be included in estimates of economic, social and environmental impact.

Table 4.3. Key factors in classifying the significance of disease or feral species establishment

1. The biological effects on aquatic species.
2. The availability, cost and effectiveness of methods for control/eradication.
3. The economic effects at an enterprise/industry/national level, including effect on marketing of the product.
4. The duration of effects (long term and short term).
5. The effects on native species and the environment generally, including any loss of social amenity.
6. Any other effects on social amenity (eg degradation of recreational fisheries).

The impact or significance of a disease or barramundi establishment in an area is classified into one of five categories, described as catastrophic, high, moderate, low or negligible. The key factors in classifying the significance of a disease or feral species establishment are shown in Table 4.4.

The categories defined in Table 4.4 lie within a continuous range of consequences. The descriptions are indicative of the expected outcomes.

Table 4.4. Terms used to describe the severity of the impact (level of significance)

Catastrophic	associated with an occurrence that would be expected to significantly harm economic performance at a national level. Alternatively, or in addition, they may cause serious, irreversible harm to the environment.

High	associated with an occurrence that would have serious biological consequences (eg high mortality or high morbidity and causing significant impact). Such effects would normally be felt for a prolonged period (greater than or equal to a normal production cycle) and would not be amenable to control or eradication. These events would be expected to significantly harm economic performance at an industry level. Alternatively, or in addition, they may cause serious harm to the environment.
Moderate	associated with an occurrence that have less pronounced biological consequences. Such an occurrence may harm economic performance significantly at an enterprise/regional level, but they would not have a significant economic effect at the 'whole industry' level. They may be amenable to control or eradication at a significant cost, or their effects may be temporary. They may affect the environment, but such harm would not be serious or may be reversible.
Low	associated with an occurrence that has mild biological consequences and would normally be amenable to control or eradication. Such events would be expected to harm economic performance at the enterprise or regional level but to have negligible significance at the industry level. Effects on the environment would be minor or, if more pronounced, would be temporary.
Negligible	associated with an occurrence that has no significant biological consequences, may be transient and/or are readily amenable to control or eradication. The economic effects would be expected to be low to moderate at an individual enterprise level and insignificant at a regional level. Effects on the environment would be negligible.

Table 4.5. Disease risk

Proposed activity	**Probability** (Y Axis – App 3)	**Significance** (X Axis – App 3)	**Risk**
Above ground - no discharge	extremely low	high	Acceptable
Above ground - discharge	high	high	Unacceptable
Ponds - no discharge	extremely low	high	Acceptable
Ponds - discharge	high	high	Unacceptable

Refer to Section P4.1 for details.

Table 4.6. Translocation risk (risk of feral population establishing)			
Proposed activity	**Probability** (Y Axis – App 3	**Significance** (X Axis – App 3)	**Risk**
Above ground - no discharge	extremely low	high	Acceptable
Above ground - discharge	high	high	Unacceptable
Ponds - no discharge	extremely low	high	Acceptable
Ponds - discharge	high	high	Unacceptable

Refer to Section P4.1 for details.

Table 4.7. Socio-economic benefits / factors	
Proposed activity	**Potential Benefit**
Above ground - no discharge	Moderate
Above ground - discharge	Moderate
Ponds - no discharge	Moderate
Ponds - discharge	Moderate

Refer to Section P4.1 for details.

Table 4.8. Summary of the Qualitative Risk Analysis for culture of barramundi in inland catchments				
Species	**Disease** (Table 4.5)	**Translocation** (Table 4.6)	**Benefit** (Table 4.7)	**Suitability***
Above ground - no discharge	Acceptable	Acceptable	Mod	yes
Above ground - discharge	Unacceptable	Unacceptable	Mod	no
Ponds - no discharge	Acceptable	Acceptable	Mod	yes
Ponds - discharge	Unacceptable	Unacceptable	Mod	no

* If either the disease Risk or the translocation risk is unacceptable then the activity cannot be supported

Part 5 - Qualitative Risk Analysis for Bait

Defining the probability of establishment of disease (release and exposure assessments)

The probability of a disease agent entering and becoming established in an area depends on the factors shown in Table 5.1.

Table 5.1. Factors affecting the probability of a disease agent entering and becoming established in an area
1. The disease agent being present in the bait.
2. The prevalence of the disease agent in the population.
3. The infectivity of the agent in the bait.
4. The frequency and volume of bait entering the aquatic environment in an area.
5. The disease agent establishing infection in susceptible hosts.
6. Environmental factors

Table 5.2 defines the terms used to describe the probability of such an event occurring.

Table 5.2. Terms used to describe the probability of an event occurring	
High	Event would be expected to occur
Moderate	There is less than an even chance of the event occurring
Low	Event would be unlikely to occur
Very low	Event would occur rarely
Extremely low	Event would occur very rarely
Negligible	Chance of event occurring is so small that it can be ignored in practical terms

Defining the consequences of establishment of disease (consequence assessment)

The establishment of a new disease agent may have a biological effect and consequential effects on industry (eg the affected fishery), social amenity and the environment. These consequences can be measured in quantitative terms (in relation to their economic impact) and in qualitative terms (in relation to their impact on society and the environment). It is generally the case that the effects of a disease can be ameliorated to various degrees by the adoption of methods for control or eradication — although these measures are associated with costs that must be included in estimates of economic, social and environmental impact.

Table 5.3. Key factors in classifying the significance of disease
1. The biological effects on aquatic species.
2. The availability, cost and effectiveness of methods for control/eradication.
3. The economic effects at an enterprise/industry/national level, including effect on marketing of the product.
4. The duration of effects (long term and short term).
5. The effects on native species and the environment generally, including any loss of social amenity.
6. Any other effects on social amenity (eg degradation of recreational fisheries).

The impact or significance of the establishment of disease is classified into one of five categories, described as catastrophic, high, moderate, low or negligible. The key factors in classifying the significance of a disease are shown in Table 5.4.

The categories defined in Table 5.4 lie within a continuous range of consequences. The descriptions are indicative of the expected outcomes.

Table 5.4. Terms used to describe the severity of the impact (level of significance)	
Catastrophic	Associated with the establishment of diseases that would be expected to significantly harm economic performance at a national level. Alternatively, or in addition, they may cause serious, irreversible harm to the environment.
High	Associated with the establishment of diseases that would have serious biological consequences (eg high mortality or high morbidity and causing significant pathological changes in affected animals). Such effects would normally be felt for a prolonged period (greater than or equal to a normal production cycle) and would not be amenable to control or eradication. These diseases would be expected to significantly harm economic performance at an industry level. Alternatively, or in addition, they may cause serious harm to the environment.
Moderate	Associated with the establishment of diseases that have less pronounced biological consequences. These diseases may harm economic performance significantly at an enterprise/regional level, but they would not have a significant economic effect at the 'whole industry' level These diseases may be amenable to control or eradication at a significant cost, or their effects may be temporary. They may affect the environment, but such harm would not be serious or may be reversible.

Low	Associated with the establishment of diseases that have mild biological consequences and would normally be amenable to control or eradication. Such diseases would be expected to harm economic performance at the enterprise or regional level but to have negligible significance at the industry level. Effects on the environment would be minor or, if more pronounced, would be temporary.
Negligible	Associated with the establishment of diseases that have no significant biological consequences, may be transient and/or are readily amenable to control or eradication. The economic effects would be expected to be low to moderate at an individual enterprise level and insignificant at a regional level. Effects on the environment would be negligible.

Table 5.5. Disease risk

Proposed species	**Probability** (Y Axis – App 3)	**Significance** (X Axis – App 3)	**Risk***
Freshwater finfish	Low	Moderate	Unacceptable
Finfish carcasses	Moderate	Moderate	Unacceptable
Prawns (all members of the Family Penaeidae)	Moderate	High	Unacceptable
Freshwater shrimp (*Macrobrachium australiensis)*	Low	Low	Acceptable
Blood worm (*Marphysa sanguinea)* Sand wriggler worm (*Perinereis nuntia* fam. Nereidae)	Low	Low	Acceptable

Refer to Section P5.1 for details.

Diseases in aquaculture facilities are documented for freshwater finfish and for finfish carcasses (see Reference Section). Disease transmission to wild populations from finfish carcasses may have major ecological and economic risk.

Diseases in aquaculture facilities from prawns (all members of the Family Penaeidae) are well documented (see Reference Section). Aquaculture is known to amplify disease in members of the Family Penaeidae. Disease transmission from members of the Family Penaeidae to wild populations may have major ecological and economic risk.

Diseases unknown in freshwater shrimp (*Macrobrachium australiensis*).

Diseases unknown in blood worm (*Marphysa sanguinea*) and sand wriggler worm (*Perinereis nuntia* fam. Nereidae).

Table 5.6. Translocation risk			
Proposed species	**Probability** (Y Axis – App 3)	**Significance** (X Axis – App 3)	**Risk***
Freshwater finfish	Low	Moderate	Unacceptable
Finfish carcasses	Negligible	Negligible	Acceptable
Prawns (all members of the Family Penaeidae)	Low	Low	Acceptable
Freshwater shrimp (*Macrobrachium australiensis)*	Moderate	Negligible	Acceptable
Blood worm (*Marphysa sanguinea)* Sand wriggler worm (*Perinereis nuntia* fam. Nereidae)	Moderate	Negligible	Acceptable

Refer to Section P5.1 for details.

Translocation is significant for freshwater finfish.

Translocation risk is low in freshwater shrimp (*Macrobrachium australiensis*) – indigenous throughout Queensland.

Translocation of blood worm (*Marphysa sanguinea*) and sand wriggler worm (*Perinereis nuntia* fam. Nereidae) is ongoing.

Note that the principal disqualifying factor for risk analysis of these species is disease rather than translocation. Details of the natural distributions of aquaculture species are available in various sources (refer to the DPI&F website at www.dpi.qld.gov.au/fishweb).

Table 5.7. Socio-economic benefits / factors	
Proposed species	**Potential Benefit**
Freshwater finfish	Low
Finfish carcasses	Moderate
Prawns (all members of the Family Penaeidae)	Moderate
Freshwater shrimp (*Macrobrachium australiensis)*	Moderate
Blood worm (*Marphysa sanguinea)* Sand wriggler worm (*Perinereis nuntia* fam. Nereidae)	Moderate

Refer to Section P5.1 for details.

Table 5.8. Summary of the Qualitative Risk Analysis for the Use of Aquaculture Product as Bait				
Species	**Disease** **(Table 5.5)**	**Translocation** **(Table 5.6)**	**Benefit** **(Table 5.7)**	**Suitability**
Freshwater finfish	Unacceptable	Unacceptable	Low	No
Finfish carcasses	Unacceptable	Acceptable	Moderate	No
Prawns (all members of the Family Penaeidae)	Unacceptable	Acceptable	Moderate	No
Freshwater shrimp (*Macrobrachium australiensis)*	Acceptable	Acceptable	Moderate	Yes
Blood worm (*Marphysa sanguinea)* Sand wriggler worm (*Perinereis nuntia* fam. Nereidae)	Acceptable	Acceptable	Moderate	Yes

* If either the disease Risk or the translocation risk is unacceptable then the aquaculture product cannot be used as bait.