CONSULTATION DRAFT

NSW Land Based **Sustainable Aquaculture Strategy**

A NSW Government Initiative
November 2020

NSW GOVERNMENT

The NSW Land Based Sustainable Aquaculture Strategy is a NSW Government initiative developed by the State Aquaculture Steering Committee, comprising the Department of Premier and Cabinet; NSW Department of Planning, Industry and Environment; NSW Department of Primary Industries (Fisheries); NSW Environment Protection Authority; NSW Food Authority; Department of Planning, Industry and Environment - Crown Lands; NSW National Parks and Wildlife Service; Environment, Energy and Science; Resources and Geoscience; Office of Local Government; Transport for NSW, to encourage sustainable land based aquaculture.

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Copies of the strategy
A copy of this strategy can be accessed from the NSW Department of Primary Industries website.

NOTE: Please note that this document has been compiled using linkages to relevant websites which contain detailed information regarding the topic being discussed in the text. The electronic version of this document contains numerous links to relevant websites and these links are indicated by blue text. To activate these links please place your curser in the word and then press the left mouse button and the web page should open. This document contains a number of key links both within the document and listed in Appendix 2. Web links were active at the time of document preparation and may refer to government agencies that have changed their name. The electronic web version of this document will be updated from time to time.

Executive summary

Aquaculture is one of the fastest-growing industries in the world. Already 54% of seafood consumed worldwide is produced through aquaculture. According to the United Nations' Food and Agriculture Organization, global aquaculture production rose 520% for the period 1990-2018 (FAO, 2020). Aquaculture has contributed benefits to the state economy, with a flow-on effect to seafood processing and retail businesses, providing a likely output of $226 million, as well as 1,758 fulltime jobs to New South Wales (NSW) in 2013/2014 (Barclay et al., 2016).

NSW is poised to capture a significant proportion of this projected growth. A growing number of viable aquaculture investment opportunities are being generated by the drive to satisfy increasing domestic and export demand, and by the competitive advantages (both natural and human) which NSW offers.

NSW has large areas suitable for the development of land based aquaculture with access to high quality surface water, ground water, estuarine and marine waters. The state's transport and energy infrastructure is well developed with the capacity to service growth in the aquaculture sector.

The aquaculture industry and NSW Government's regulatory agencies are very conscious to ensure development of the aquaculture industry in NSW proceeds in a manner that does not jeopardise its ecological sustainability. Industry and government continue to invest heavily in research, technology and management practices to provide for the sustainable growth of this industry. Both recognise the environmental benefits arising from aquaculture, as well as the environmental conditions aquaculture needs to ensure the continuing high quality of its produce.

The NSW Land Based Sustainable Aquaculture Strategy (NSW LBSAS) comprises two interlinked sections – a best management section and an integrated approvals section, so that projects can be established and operated to meet sustainability objectives.

The best management section is the basis of the Aquaculture Industry Development Plan (AIDP) for land based aquaculture in NSW under provisions of the *Fisheries Management Act 1994*. The AIDP identifies best management for business planning; species selection; site selection and design; planning and operation of the facility; and includes the performance requirements for relevant environmental regulations.

Based on best practice in the AIDP, a 'project profile analysis' has been established to provide a preliminary assessment of the likely risk level to the environment from aquaculture proposals. The project profile analysis provides the basis for streamlining approvals. Low risk proposals will require a statement of environmental effects to analyse potential environmental impact. Only those developments identified as high risk in the project profile analysis be classified as designated development and require an Environmental Impact Statement (EIS). Major projects that meet the criteria in *State Environmental Planning Policy (State and Regional Development) 2011* will be classified as *State Significant Development* and also require an EIS. The project profile analysis takes effect under the *State Environmental Planning Policy – Primary Production and Rural Development 2019*.

The NSW LBSAS recognises the important role of the NSW Department of Primary Industries (NSW DPI) in extension and compliance. In addition to NSW DPI staff providing current information from research programs and advice on best practice in aquaculture management, they will be on the front line to ensure adherence to best practice.

The NSW LBSAS is designed to provide information to investors, government agencies and the community, and to ensure that aquaculture enterprises in NSW are established and operated sustainably.

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GLOSSARY

TERM	DEFINITION
Acid sulfate soils (ASS)	Acidic soil material resulting from the oxidation of iron sulfides. 'Acid Sulfate Soils' means actual acid sulfate soils and/or potential acid sulfate soils. 'Actual Acid Sulfate Soils' are soils containing highly acidic soil horizons or layers resulting from the aeration of soil materials that are rich in sulfides, primarily iron sulfide. This oxidation produces hydrogen ions in excess of the sediment's capacity to neutralise the acidity resulting in soils of pH of 4 or less
Australian Height Datum (AHD)	A common national place of level corresponding approximately to mean sea level.
Aquaculture	The cultivation of aquatic animals or marine vegetation for the purpose of harvesting the animals or marine vegetation, or their progeny for sale, or the keeping of animals or marine vegetation in a confined area for a commercial purpose.
Aquifer	A layer of rock or soil which holds water in sufficient quantity to provide a source of water that can be tapped by a bore.
Average recurrent interval (ARI) flood event	It represents a flood that has a particular probability of occurring in any one year. A 1 in 100 ARI flood is a best estimate of a flood of a particular size which has on average, 1 chance in 100 of occurring in any one year. It is important to acknowledge that the 100 year ARI event may occur more than once in a 100 year period as the definition of the event is that it occurs once, on average, in 100 years.
Biosecurity	The protection of the economy, environment and community from negative impacts associated with pests, diseases and weeds.
Biosecurity Risk Management Plan	A document prepared to help you, your staff and visitors prepare for and understand how to reduce aquatic pest and disease risks to your aquaculture business, industry and the environment and to support a rapid response to any suspect pest or disease.
Broodstock	A parent fish.
Catchment area	A drainage area, for example, for a reservoir, river or river reach.
Closed system	An aquaculture facility where there is no direct discharge of water to a waterway.
Discharge water/effluent	Treated water discharged from ponds, hatcheries that may be re-used in the ponds or for irrigation or may be discharged to waterways.
Dissolved oxygen (DO)	The amount of oxygen dissolved in water expressed in milligrams per litre or ppm. In ponds it is a measure of the stability of the water environment. The colder the water, the greater the amount of oxygen that can dissolve in it. In freshwater, oxygen is soluble up to 14.6 mg/L at 0°C, and up to 8.4 mg/L at 25°C. Fish and other aquatic organisms generally require more than 2 mg/L of DO to survive.
Endangered species	The species is likely to become extinct in nature if threats continue, or its numbers are reduced to a critical level, or its habitat is reduced.
Endemic species	A native species confined in occurrence to a locality.
Environmental impact	The potential biophysical, social and/or economic effects of a project on the community or the natural environment
Environmental impact statement (EIS)	A detailed assessment on the potential effects of a development. An EIS is required for Class 3 land based aquaculture projects and State Significant Development (See Chapters 9 and 10). It should be prepared by an appropriately qualified person and must stand up to rigorous community and agency review. The EIS must address all matters requested by the consent authority.
Estuarine	Estuary means any part of a river whose level is periodically or intermittently affected by coastal tides or any lake or other partially enclosed body of water that is periodically or intermittently open to the sea or anything declared by the regulations under the *Water Management Act 2000* to be an estuary.
Estuarine waters	Saline waters sourced from an estuary as defined under the *Water Management Act 2000*.
Extensive aquaculture	Aquaculture undertaken without providing supplementary food for the fish or algae being cultivated

TERM	DEFINITION
Fish	Means any marine, estuarine or freshwater fish or other aquatic animals' life at any stage of their life history (whether dead or alive). Fish includes oysters and other aquatic molluscs, crustaceans, echinoderms and beachworms and other aquatic polychaetes. It also includes any part of a fish but does not include whales, mammals, reptiles, birds, amphibians or other things excluded from the definition by regulations.
Flood planning area	Area below the flood planning level (FPL). Many councils use the 100 year flood event plus a 0.5 m freeboard as the basis for defining the FPL and therefore the flood planning area.
Food conversion ratio	Food conversion ratio (FCR) is the ratio of dry weight of food to the wet weight gain of the fish. The lower the ratio, the more efficiently food has been converted.
Groundwater	Underground waters (aquifers).
Growout	Stage and/or unit where the cultivation of aquatic animals is undertaken from initial seeding of young fry or juveniles up to harvesting of marketable sizes.
Health certificate	A certificate issued by a competent authority attesting to the health status of a shipment of aquatic animals and/or their production facility.
Indigenous species	A species native to a particular region or country.
Intensive aquaculture	Aquaculture undertaken by providing supplementary food for the fish or marine vegetation that are being cultivated (whether or not naturally occurring food is consumed or available for consumption by the fish or marine vegetation).
Introduced species	A native species introduced into an area where it does not naturally occur, or a species that did not occur in an area prior to European settlement.
Landform element	Part of the landform characterised by a distinctive slope, shape, size, form and type of geomorphologic processes (for example, alluvial) active on it.
Local Environmental Plan (LEP)	Local Environmental Plans are made under the *Environmental Planning and Assessment Act 1979* for local government areas and provide the framework for the way land can be used.
Notifiable matter	Pest or disease listed in Schedule 1 of the Biosecurity Regulation 2017, that if suspected is required to be reported to NSW DPI – call the 24-hour Emergency Animal Disease hotline on **1800 675 888**.
Open system	An aquaculture facility which discharges on average between 15 to 100% per day of its culture water directly to a waterway. This system is sometimes referred to as a flow through system.
Pathogen	An infectious agent capable of causing disease.
Permeability	The ease with which water can penetrate or force its way through rocks, gravel and soils. Coarse sand and gravel permit rapid flow and are rated as highly permeable materials. Microscopic pores in clay impede flows; such soils are considered impermeable or of low permeability for dike and dam constructions.
pH	A measure of acidity or alkalinity of a substance.
Probable Maximum Flood (PMF)	The PMF is the largest flood that could conceivably occur at a particular location, usually estimated from probable maximum precipitation, and where applicable, snow melt, coupled with the worst flood producing catchment conditions. Generally, it is not physically or economically possible to provide complete protection against this event. The PMF defines the extent of flood prone land, that is, the floodplain. The extent, nature and potential consequences of flooding associated with a range of events rarer than the flood used for designing mitigation works and controlling development, up to and including the PMF event should be addressed in a floodplain risk management study.
Prohibited Matter	Pest or disease listed in Schedule 2 of the *Biosecurity Act 2015*. It is illegal to buy, sell or otherwise deal with these pests and diseases. If a prohibited matter pest or disease is suspected, you are required to contact NSW DPI – call the 24-hour Emergency Animal Disease hotline on **1800 675 888.**
Project Profile Analysis	A matrix of environmental and operational criteria for ranking the level of environmental risk in relation to the site location and operational attributes of aquaculture development.

TERM	DEFINITION
Pond aquaculture	Type of aquaculture undertaken predominantly in ponds or dams (including any part of the aquaculture undertaken in tanks such as during the hatchery or depuration phases), but not including natural water-based aquaculture.
Quarantine	The holding of aquatic animals or plants in an isolation facility.
Reconditioned water	Water from culture units that has been treated by physical, biological and / or chemical processes to remove waste products.
Recycled water	Wastewater from ponds, tanks or hatcheries that has been treated and re-used for culture.
Saline groundwater	Saline water sourced from a bore or inland saline interception scheme.
Salinity	The measure of salt concentration of water in ponds, tanks or hatchery expressed in part per thousand or ppt.
Semi-closed system	An aquaculture facility which discharges on average less than 15% per day of its culture water directly to a waterway.
State Environmental Planning Policy (SEPP)	State Environmental Planning Policy as an instrument pertaining to issues of state, regional or district environmental planning significance made under S.3.29 of the *Environmental Planning and Assessment Act 1979*.
Statement of Environmental Effects (SEE)	A detailed assessment of the potential effects of a development. SEEs are required for Class 1 or 2 projects.
Stocking densities	Number of animals per square metre of effective pond / tank area.
Suspended solids	The mass of particulate matter (organic and inorganic) that is suspended in the water.
Tank aquaculture	Type of intensive aquaculture that utilises recirculating water technology in tanks (for example, hatcheries and tank aquaculture of barramundi, and abalone).
Vulnerable species	A species that will become endangered unless mitigating action is taken against its threats.
Wastewater	Untreated water discharged from ponds, tanks, hatcheries.
Waterway	Generally, refers to creek, river, wetland, waterbody or groundwater.

ABBREVIATIONS

AHD	Australian Height Datum
AIDP	Aquaculture Industry Development Plan
ASS	Acid sulfate soils
BCA	Building Code of Australia
CFDP	Commercial Farm Development Plan
DA	Development application
DO	Dissolved oxygen
DPIE	Department of Planning, Industry and Environment
DRNSW	Department of Regional NSW
EES	Environment, Energy and Science
EIS	Environmental impact statement
EPA	Environment Protection Authority (NSW)
EP&A Act	*Environmental Planning and Assessment Act 1979*
ESD	Ecologically Sustainable Development
FCR	Food conversion ratio
GIS	Geographic Information System
HACCP	Hazard analysis critical control point
LEP	Local Environment Plan
NSW DPI	NSW Department of Primary Industries
pH	Acidity or basicity of water; amount of hydrogen-ion concentration
PMF	Probable maximum flood
POEO Act	*Protection of the Environment Operations Act 1997*
PPA	*Project Profile Analysis*
PPRD	*State Environmental Planning Policy (Primary Production and Rural Development) 2019*
RAMSAR	Convention on Wetlands of International Importance (Ramsar Convention)
S.x	Section x of referred legislation
SEE	Statement of environmental effects
SEARs	Secretary's environmental assessment requirements
SEPP	State Environmental Planning Policy
SSD	State Significant Development
SSI	State Significant Infrastructure
TfNSW	Transport for NSW
VENM	Virgin excavated natural material
WQOs	Water quality objectives

1. The NSW Land Based Sustainable Aquaculture Strategy

1.1. Introduction

Sustainable seafood production to support future demands of food security for the state is a key focus of the NSW Government.

Aquaculture is a growing industry. NSW estuarine, marine and land based aquaculture is developing steadily, with an annual industry value of over $80 million in 2018/19 (NSW DPI, 2020). Aquaculture has also contributed benefits to the state economy, with a flow-on effect to seafood processing and retail businesses, providing a likely output of $226 million, as well as 1,758 fulltime jobs to NSW in 2013/2014 (Barclay et al., 2016).

The aquaculture industry and the NSW Government are both conscious of ensuring that development of the industry proceeds in a manner that does not jeopardise its ecological sustainability and social licence.

The NSW Land Based Sustainable Aquaculture Strategy (LBSAS) provides information on best practice for land based aquaculture and establishes a streamlined approvals process for land based aquaculture in NSW.

The detailed sections of the NSW LBSAS will assist you to analyse a proposed project and complete the project profile analysis tables found in Chapter 9, along with any environmental assessments required.

In addition, NSW government agencies can assist proponents with information and advice. Key web links for additional information are contained in Appendix 2.

Note: **Aquaculture within public waterways is not addressed in the NSW LBSAS. However, land based aquaculture may access water from public waterways including rivers, estuaries and the ocean.**

1.2. What is land based aquaculture?

Aquaculture, as defined in the *Fisheries Management Act 1994,* means the breeding, growing, keeping and harvesting of *fish* or their offspring, or marine vegetation, with a view to sale or commercial purpose.

Fish, is defined in the *Fisheries Management Act 1994* as marine, estuarine or freshwater fish or other aquatic animal life at any stage of their life history (whether alive or dead) and includes:

- oysters and other aquatic molluscs
- crustaceans
- echinoderms
- beachworms and other aquatic polychaetes.

The NSW LBSAS covers the following types of land based aquaculture to produce fish for food, fish stocking and the ornamental trade, namely:

- pond aquaculture systems
- pen systems within ponds
- tank aquaculture systems

using estuarine, marine, saline groundwater, or fresh water for growing species.

The suite of species produced in land based aquaculture is diverse, with common examples including Murray Cod, prawns, Rainbow Trout, Silver Perch, Yabby, Barramundi, hatchery fingerlings, algae and aquarium fish, as well as live feed for aquaculture species.

1.3. Critical success factors

Some critical factors to consider and resolve when deciding whether an aquaculture venture may be feasible include the following:

Water	access to abundant, good quality water that is pest and disease free
Land	predominantly, appropriately zoned freehold land (application may be made to licence Crown land for pipelines or other services) and free of constraints to proposed development
Stock	safe reliable approved (important for any interstate proposed movement) access to juveniles of your selected species (numbers and time of year)
Feed	access to quality feed that meets the physiological requirements of your selected species
Markets	access to established markets or the ability to establish new markets
Finance	initial finance required for total capital expenditure, plus three year's operating expenses
Biological Security (Biosecurity)	biosecurity risks and hazards can be managed to an acceptable level
Profitability	development of a sound business plan

1.4. Strategy purpose

The purpose of the NSW LBSAS is to detail best practice guidelines that promote ecologically sustainable development (ESD) of the land based aquaculture industry in NSW. It aims to simplify the approvals process, giving greater certainty to investors and the community.

In summary, the NSW LBSAS:

- provides a regulatory and industry best practice framework for the NSW land aquaculture industry in an ecologically sustainable and socially responsible manner
- defines the development assessment and planning approval pathway for land based aquaculture proposals
- provides guidance to industry and consent authorities to prepare and assess applications for aquaculture development
- provides the community and stakeholders with relevant advice to inform them about sustainable land based aquaculture.

1.5. Vision

The vision of this strategy is to achieve the sustainable production of 5,000 tonnes of high quality seafood from land based aquaculture farms in NSW by 2030.

1.6. Ecologically sustainable development

The principles of ecologically sustainable development were adopted by all Australian governments in the National Strategy on ESD (1992) which states that we should be:

'Using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased.'

ESD requires the effective integration of economic, environmental, social and equity considerations in decision-making processes. ESD aims to provide for the needs of present generations, without compromising the ability of future generations to meet their own needs.

ESD has become a major objective of all NSW natural resource management, environment protection and planning legislation. A key object of the *Fisheries Management Act 1994* is to promote ecologically sustainable development, and this is being met in part through the development of statewide sustainable aquaculture strategies. ESD is now accepted as the foundation for aquaculture management in NSW.

The adopted definition of ESD in NSW, as stated in the *Protection of the Environment Administration Act 1991* (s.6) is:

'Ecologically sustainable development requires the effective integration of economic and environmental considerations in decision-making processes. Ecologically sustainable development can be achieved through the implementation of the following principles and programs:

(a) the precautionary principle—namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

In the application of the precautionary principle, public and private decisions should be guided by:

(i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and

(ii) an assessment of the risk-weighted consequences of various options,

(b) inter-generational equity—namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations,

(c) conservation of biological diversity and ecological integrity—namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,

(d) improved valuation, pricing and incentive mechanisms—namely, that environmental factors should be included in the valuation of assets and services, such as:

(i) polluter pays—that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,

(ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,

(iii) environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems'.

The principles of ESD are integrated into the NSW LBSAS by:

- identifying areas where land based aquaculture is a permitted land use and ecologically sustainable, through implementing measures that will lead to the protection of the environment in those areas
- describing best operation and management practices based on ESD principles.

For the land based aquaculture industry, adopting ESD principles will:

- provide a pathway to address issues affecting the industry's long-term viability
- establish a systematic and recognised means for the industry's resource management credentials with regulatory agencies, seafood consumers and the community
- support industry best practice as a legitimate user of water resources and occupier of Crown land(for example, pipelines)
- result in improved development outcomes that provide greater certainty and a simplified assessment and decision-making process.

For individual farmers, the potential benefits are to:

- safeguard business profitability through maintaining access to existing markets; accessing new 'green' markets; and reducing the cost of production
- gain the support of the local community and reduce the risk of conflict with neighbours
- understand obligations to comply with environmental and planning legislation so that the risk of breaches can be minimised
- have ongoing continual improvement that will help the business keep pace with developments in environmental legislation and community expectations.

For the broader community, the potential benefits are:

- improved environmental outcomes that address cumulative issues and provide effective indicators of sustainability
- increased certainty in the nature and operation of the industry
- increased confidence in the environmental performance of the industry
- improved employment outcomes with an improvement in industry viability
- improved outcomes for regional NSW with a coordinated approach to providing sustainable land based aquaculture investment opportunities
- informed consumer choices when sourcing sustainably grown food and products.

1.7. Related strategies

The NSW Oyster Industry Sustainable Aquaculture Strategy (NSW DPI, 2016) and the NSW Marine Waters Sustainable Aquaculture Strategy (NSW DPI, 2018) are the successful platforms for sustainable oyster and marine aquaculture industry development respectively. The strategies ensure a sustainable approach to the development of the industry, increasing confidence for the aquaculture industry, investors and the community.

1.8. Implementation and legislation

Implementation of the NSW LBSAS requires effective collaboration between government, industry and the community. The NSW LBSAS incorporates the interests of economic development, land use planning and sustainable natural resource management to form a partnership that can lead to sustainable land based aquaculture and generate employment in regional NSW.

NSW DPI is the key agency responsible for the outcomes of the NSW LBSAS. Local government and state agencies share responsibility for development assessment processes and other approvals to occupy land or undertake certain activities. NSW LBSAS establishes

details for an AIDP under S.143 of the *Fisheries Management Act 1994,* with additional chapters outlining revised planning provisions for the NSW land based aquaculture industry gazetted in accordance with *State Environmental Planning Policy (Primary Production and Rural Development) 2019*. These provisions link to additional planning provisions for aquaculture in the *Standard Instrument – Principal Local Environmental Plan.*

1.9. Origins and implementation of the NSW LBSAS

The NSW LBSAS was established as an AIDP in 2009 under the provisions of S.143 of the *Fisheries Management Act 1994*. The NSW LBSAS was developed as a whole of government approach under the stewardship of NSW Premier's Department, following extensive consultation with key government agencies, the NSW land aquaculture industry, local government and the general public. The LBSAS was approved by the Minister and published as an AIDP in the Government Gazette in 2009.

The inception of the NSW LBSAS was developed through a working group of government agency representatives to provide an overarching statewide sustainable aquaculture strategy. The aim of a cross-government aquaculture strategy was to develop innovative ways to overcome 'red tape' associated with approvals for aquaculture development.

The major stakeholders in the NSW LBSAS are:

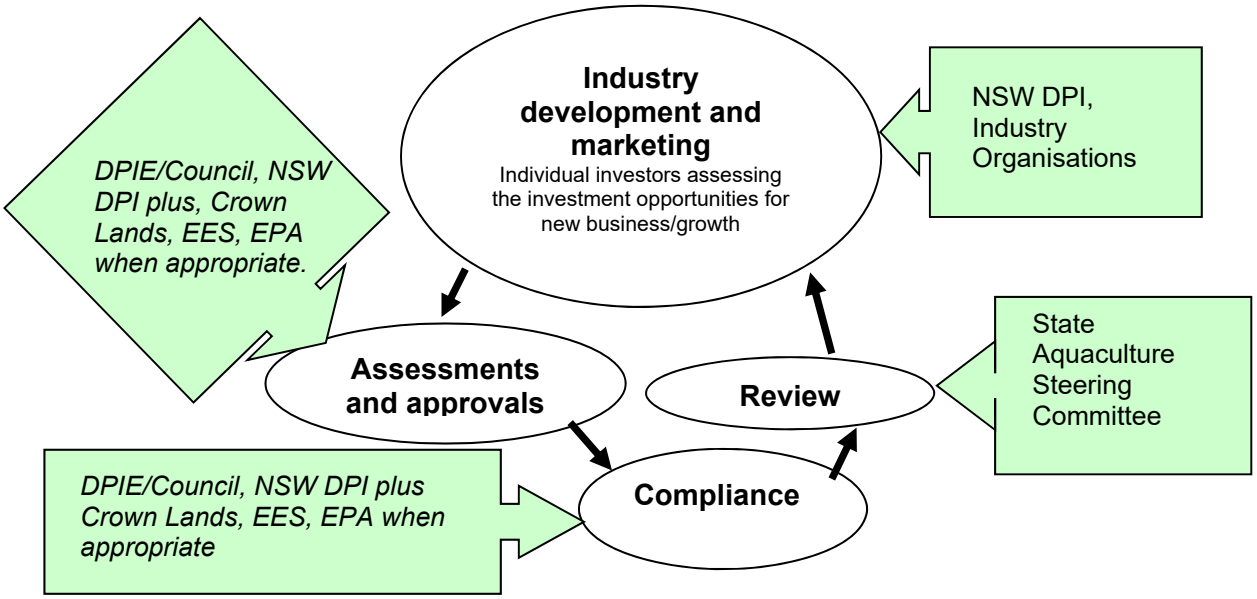
- the private sector – aquaculturalists and other business people investing in aquaculture
- State and local government – NSW DPI is the major state government participant, delivering the outcomes in four action areas; local council or Department of Planning, Industry and Environment, for development consent and integrated approvals (see Figure 1)
- the NSW Aquaculture Steering Committee – providing technical assistance regarding legislative requirements, performance standards and monitoring protocols
- general community**.**

The partnerships between government, industry and the community are essential to:

- maximise efficiencies and competitive advantages for new and expanding aquaculture projects
- avoid duplication of effort by applicants and agencies
- streamline assessment and approval processes, provided that environmental requirements and criteria are met
- provide incentives to adopt best practice guidelines in aquaculture
- strategically consider projects by assessing the environmental impacts both at the individual project level and cumulatively in a catchment.

Implementation of the NSW LBSAS falls into four distinct areas as shown in Figure 1.

Figure 1: NSW LBSAS implementation – the four key areas and key government agencies



1.10. Sustainable aquaculture growth in NSW

Sustainable seafood production is a key focus of the NSW Government's State Aquaculture Steering Committee. The Committee comprises the following agencies:

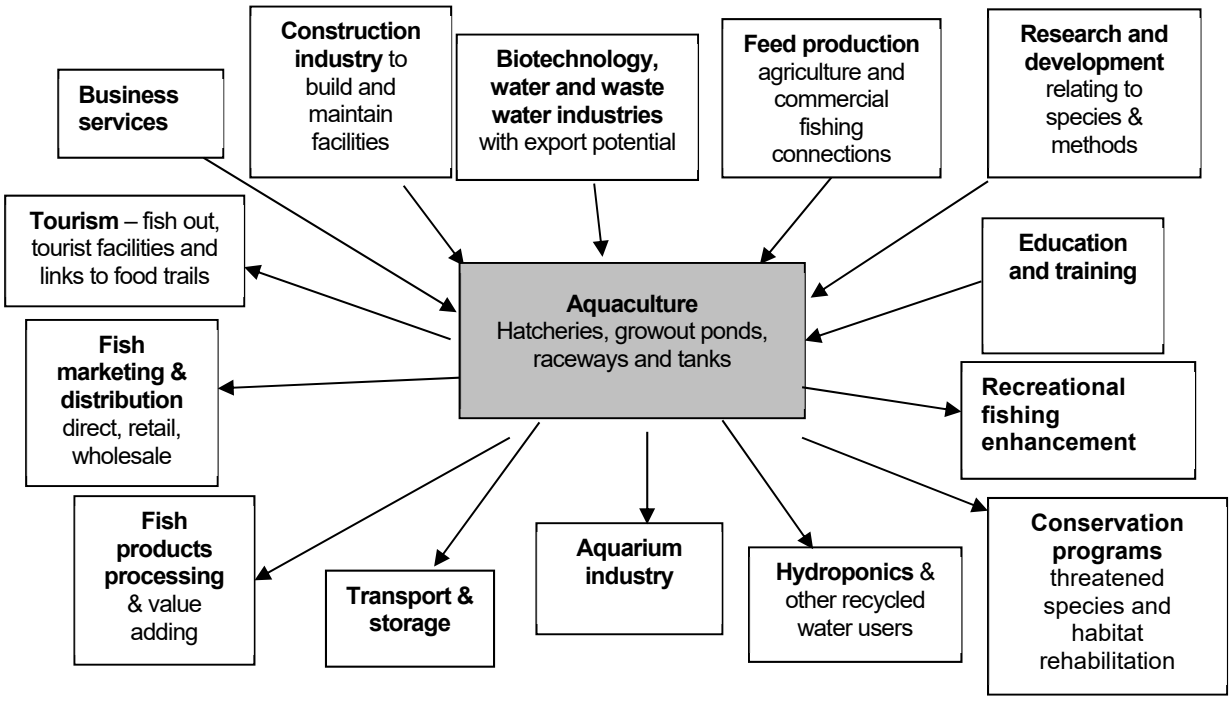
- NSW Department of Primary Industries (Fisheries, Aquatic Environment, Biosecurity)
- NSW Department of Primary Industries - NSW Food Authority
- Department of Premier and Cabinet
- Department of Planning, Industry and Environment - Planning
- Department of Planning, Industry and Environment - Crown Lands
- Department of Planning, Industry and Environment - Resources and Geoscience
- Department of Planning, Industry and Environment - Environment, Energy and Science
- Environment Protection Authority NSW
- Office of Local Government
- Transport for NSW.

There is an ever increasing gap between commercial fishery supply and the growing demand for seafood. This, and the future demands of food security for the state, can only be met by sustainable aquaculture. The state's business infrastructure is well developed, with the capacity to service growth in the aquaculture sector. Aquaculture industry participants and the NSW Government's regulatory agencies are conscious of ensuring that development of the aquaculture industry in NSW proceeds in a manner that does not jeopardise its ecological sustainability. Industry and government continue to invest heavily in research, technology and management practices to ensure the sustainable growth of this industry.

1.11. Investment and employment

Aquaculture is estimated to employ up to one full time person per two hectares of ponds (plus casual labour during busy periods). In addition, it is an industry with significant flow-on value and employment benefits for regional communities, as well as having export potential. If aquaculture is integrated into the local tourism industry, such as has happened on the Eyre Peninsula in South Australia (see Appendix 2 weblink), the flow on employment value of the industry is greatly increased. Figure 2 summarises the multiple employment and investment opportunities that aquaculture has the potential to generate.

Figure 2: Summary of the multiple employment and investment opportunities



2. The Aquaculture Industry Development Plan

The Aquaculture Industry Development Plan (AIDP) is one of the two major components of the NSW LBSAS. It provides a best practice approach to environmental management. It aims to attract investment and employment in economically and environmentally sustainable land based aquaculture by:

- reinforcing environmentally sustainable and biosecurity best practices within the aquaculture industry, and a duty of care for the environment in which the industry is located
- ensuring environmental factors are considered during site selection for new aquaculture enterprises
- ensuring environmental factors are considered during the planning, design and operation of all aquaculture enterprises
- providing the technical basis for the efficient and effective regulation of the industry with up-front certainty to applicants, the community and decision makers, regarding appropriate environmental performance of aquaculture businesses.

Current industry operators and new investors are expected to meet the above environmental performance objectives. Further, there is an expectation of continuous improvement in environmental performance. In practice, this means the encouragement of approaches which provide outcomes above those outlined in the AIDP.

There are five key components of an AIDP to develop an aquaculture venture:

- Business planning - see Chapter 3
- Species selection - see Chapter 4
- Site selection - see Chapter 5
- Planning and designing the farm - see Chapter 6
- Operating the farm - see Chapter 7

3. Business planning

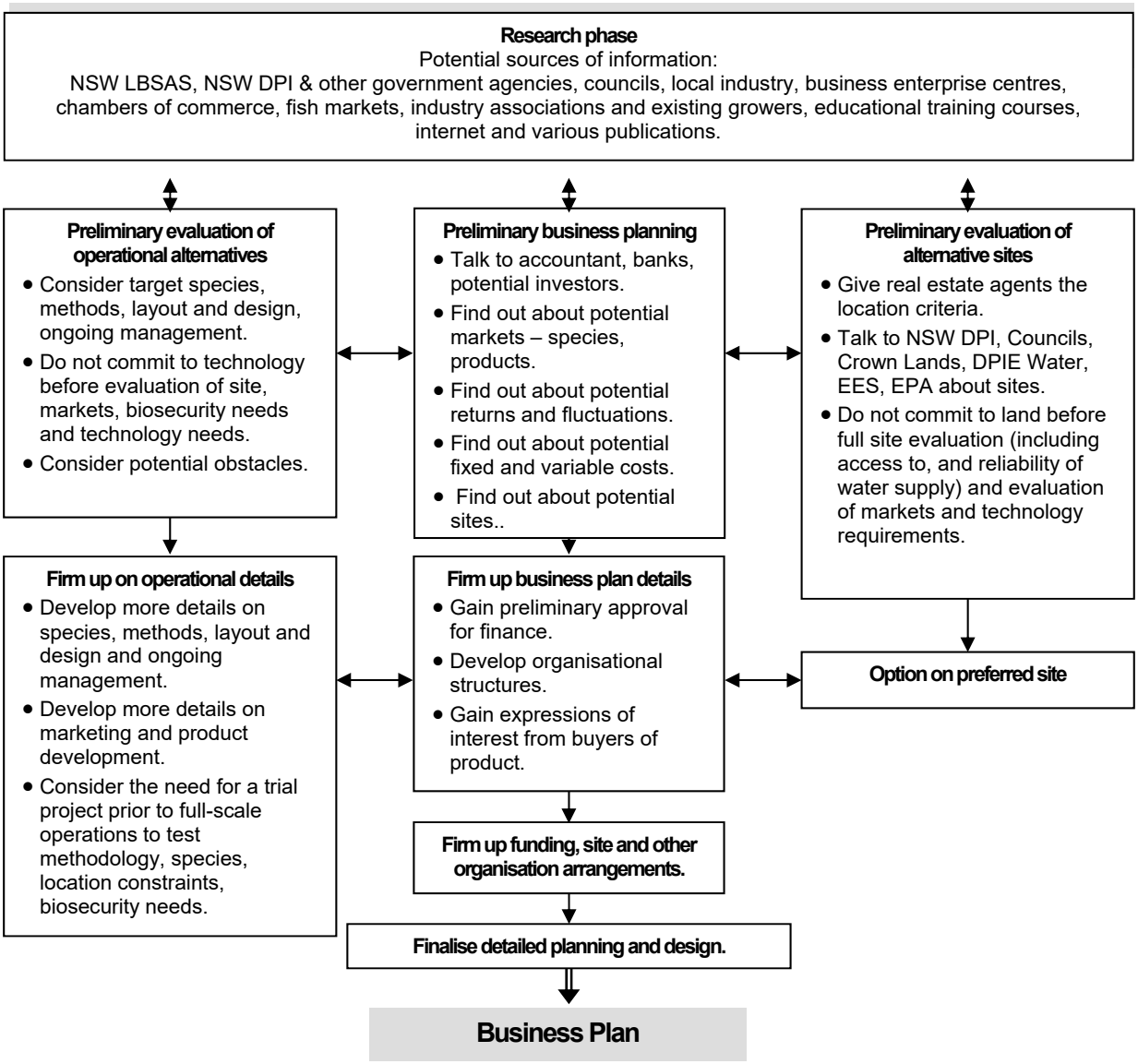
3.1. Introduction

The success of an aquaculture venture will primarily be determined by its ability to operate as a profitable business. New ventures will normally start by identifying a market, then selecting a species, a site and suitable culture technology - in that order.

However, if you already own a site or have previous experience with a species or method, you will probably be inclined to build on these existing assets. In this case, you must still come back to considering the market for your product as an essential part of deciding if the venture is viable.

No two businesses are alike and therefore a business plan specifically addressing your production and marketing issues needs to be one of the first things to be developed. The business plan acts as a blueprint for the future operation and growth of the business. Figure 3 summarises the process of preparing a business plan.

Figure 3: Business and project planning



The business plan will need to demonstrate solid reasoning behind your aquaculture business and the justification for financial support. Its importance cannot be over-stated, as potential investors or financial institutions will use it to evaluate the business and many will be unfamiliar with aquaculture.

Business plans can take various formats, depending on the type and source of funding sought. Before you start writing your business plan, it is useful to do some background preparation. In addition to the information contained within this document, additional information can be found using the following web link, https://www.smallbusiness.nsw.gov.au/. Also, project management software packages are available that enable you to store, document, report and monitor your business.

A commercial farm development plan (CFDP) is required under the *Fisheries Management Act 1994* as part of the application for an aquaculture permit. The requirements of the CFDP will be predominantly addressed by the business plan developed for your aquaculture farm. Therefore, the business plan can either be used to complete the CFDP, or if it addresses all the matters within a CFDP, can be submitted as your CFDP. A requirement of the CFDP is to also prepare a biosecurity plan for your business.

3.2. The business and its structure

Sole owner is a common organisation structure for NSW aquaculture enterprises. Factors affecting the choice of business structure may include access to resources, management issues, long term plans, interrelationships, liability, taxation issues and whether or not you need to register for GST (for example, Food fish for human consumption are GST free but bait and aquarium fish are subject to GST).

You should seek advice from a business planner, accountant and/or legal advisor about the options and potential of different business structures, and how they may affect an aquaculture business at different phases of development.

3.3. Marketing feasibility

The aim of commercial aquaculture is to maintain a profitable business. Therefore, the business requires production of sufficient quantities of marketable product and the ability to receive a market price greater than production costs.

All too often, a decision is made to farm a species based on production factors, with little consideration given to market acceptance and price. A marketing plan is a core part of the business plan and helps determine the marketing strategy. Developing the marketing plan is often the hardest part of an aquaculture business plan. Getting it right can fundamentally influence the business's profitability.

Help is at hand

Potential sources for business information and consumer data include: Regional Development Australia (NSW); Department of Treasury – Business in NSW; Chambers of Commerce; and councils. The Sydney Fish Market is a key source of information on market trends and opportunities.

3.3.1. The domestic market

The main areas of the domestic seafood market are:

- **Live seafood market**. Generally, returns higher prices than chilled product; has the added value of freshness, but can have a degree of risk/costs associated with harvest, holding and transport.
- **High volume markets for fresh seafood**. Chilled product including cooked; fresh chilled; filleted; head on gilled and gutted; frozen; vacuum packed; or smoked.
- **Restaurants and seafood retailers**. Direct sale in live and/or slaughtered form.
- **Recreational markets.** For example, tourism (fish-outs), aquarium trade and fishing bait.

3.3.2. Export markets

Global wild fisheries are expected to plateau or decline over coming years, and aquaculture product has the potential to fulfil shortfalls in supply. Australia is well placed to meet these shortfalls. Establishing export markets requires comprehensive research and marketing. DPI can assist with access to export markets through the NSW DPI international engagement team.

3.3.3. Factors affecting market value and price

The price of aquaculture products can vary between market sectors and geographic locations. There can be significant differences in price between local markets and the Sydney, Brisbane and Melbourne markets, and between wholesalers, retailers (supermarkets and fishmongers), restaurants and the take away food sector.

It is essential to be well informed regarding the cost implications of getting your product to market and the likely differences in returns. The lowest acceptable price once both fixed and variable costs have been factored in should be equal to the cost per kilogram (including profit) to produce the product.

3.3.4. Positioning

In some cases, product can be ‘positioned’ to maximise returns by creating or utilising boutique markets. This can be achieved as individual or regional producers under the banner of aquaculture associations or cooperatives. The implementation of quality assurance protocols helps maintain a quality product through emphasis on careful handling, cleaning, processing, packaging, reliable transport and quality service.

3.3.5. Promotion

Product promotion is essential. One of the best forms of promotion is the product’s reputation, supported by a quality assurance protocol and appropriate branding. Individual business promotion may dovetail with the promotion of the state, region or industry as a whole. Promotion through regular appearances at regional or promotional events, markets and direct contact with customers is effective, particularly as it provides opportunity for customer feedback.

3.3.6. Quality assurance

A quality assurance program is necessary to ensure consistent product quality which involves using industry best practice harvesting, processing and handling of product. All products should meet the National Food Standards and will be required to meet NSW Food Authority requirements.

3.3.7. Packaging and presentation

Packaging and presentation must be considered, especially in the retail market. The use of well-designed innovative packaging can add value and increase returns, especially for speciality products.

3.3.8. Market acceptance

Market acceptance is critical. You must do your research, as market acceptance can change for a wide range of reasons.

3.3.9. Distribution

Market location, distance to market, and logistics of supply are other major practical business planning issues. You will need to determine available delivery options (for example, using agents, distribution companies, or own staff) and costs of reaching your markets.

Direct deliveries to speciality markets often have the greatest potential for the highest return per kilogram. However, the full cost in terms of staff time (lost from production activities), equipment, vehicle operations, packaging, ice, plastic bags, boxes and labels, needs to be considered.

3.3.10. Tourism

Tourism may provide additional returns but must warrant the added expense. It is important that the full cost of a tourism component to the business (for example, customer amenities, insurance, sales display area, equipment and additional staff costs), and costs associated with disruption to the daily operations of the farm, are factored into business planning. Also keep in mind that tourism would introduce an additional pathway for pest and disease to enter your farm that will require management, both in the design of the farm and in the day to day operations.Tourism components could include fish-outs or guided tours (see Planning and Design Chapter).

3.4. Production feasibility

Once business planning has determined there is a potential market for the product, a full production feasibility assessment needs to be undertaken. Preliminary research needs to be undertaken, as any barriers in production could have implications on the long term viability of the business. The production feasibility assessment should consider all fixed and variable costs, including:

- the site's suitability (see the Site Selection chapter)
- the species to be produced (caution should be exercised in trialling new species; species with difficult production phases; no species specific commercial feed available, or specific biosecurity issues)
- production methods
- feed costs and food conversion ratio (FCR)
- infrastructure requirements (caution should be exercised in respect of expensive technical rearing and husbandry equipment)
- staff – the availability of suitably experienced and skilled staff or advisers, and/or access to appropriate training and instruction so the enterprise can run smoothly
- management – including the ability of management to make decisions and take actions for the reliable production of product
- quality controls.

In the production feasibility analysis, slight changes in cost of feed, juveniles, power, labour and health management should be considered to test the sensitivity of the production viability.

3.5. Financial feasibility

A cash flow projection (statement) is required within the business plan to help predict possible cash deficits as well as profitability. It is critical for those enterprises where there will be a single harvest per year while the production and marketing expenses will be spread over the year.

It should also include timing of capital investments and borrowing management, particularly if future expansion is proposed in the business plan. A cash flow projection plan should include monthly budgets for preferably three years, or until the operation is likely to be profitable. In many operations, expenditure occurs in surges, with higher costs experienced during stocking and harvesting when additional labour may be required. You need to distinguish between:

- **fixed costs** – those that do not change as production volume changes (for example, full time employee salaries, overheads, insurance and depreciation on ponds/tanks, plant and equipment)
- **variable costs** – those that change with production levels (for example, costs of juveniles, feed, chemicals, water, electricity and casual labour).

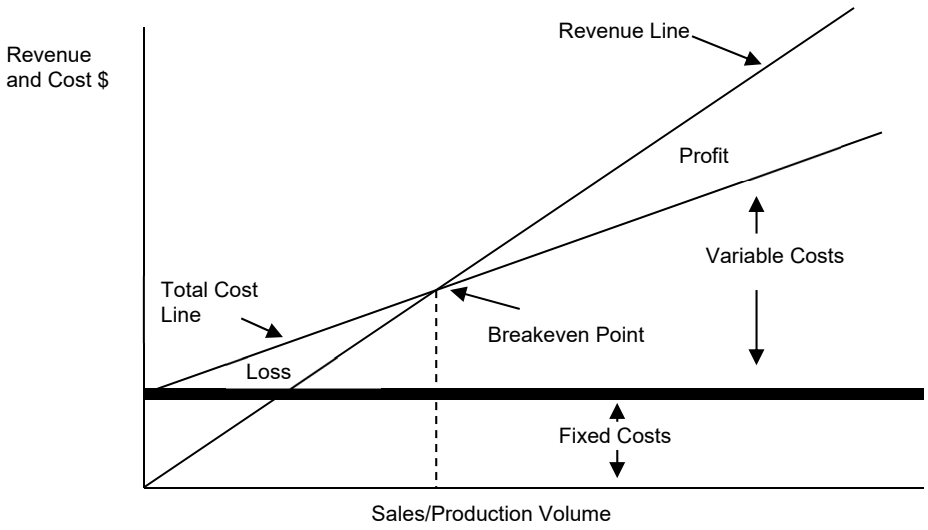
It can be difficult when making predictions on revenue because of price variability and harvest quantities. Therefore, it is essential that you consider variations in:

- sale price for various products in various markets
- costs, including feed, water, juveniles, power and transport.

A risk analysis should also consider the short and longer term viability of the business if various scenarios occur. These may include:

- pest and global and national crises
- disease outbreaks and subsequent mortalities
- constraints on water supply because of droughts or regulations
- major or extreme storm/flood events
- variable interest rates
- shortages in the availability of juveniles
- domestic or overseas market constraints.

Figure 4: Considering fixed and variable costs



3.5.1. Insurance

A comprehensive business plan will greatly assist with acquiring insurances - particularly stock insurance. Some policies are compulsory, and others are essential to mitigate potential risks to the business. Examples of insurances that should be considered include:

- workers compensation
- sickness and accident
- key person
- product liability
- public liability
- loss of profits
- fire
- burglary
- machinery breakdown.

Under-insurance as well as lack of insurance could endanger your business and it should be reviewed on a regular basis. Aside from those required by law, a good starting point is to assess the extent to which the business is at risk from potential hazards. You should discuss your insurance requirements with an insurance broker, insurance company, accountant or legal advisor prior to commencing business.

3.6. Planning for continued success

Business planning doesn't stop once a business has been established – a business plan should be a living document. It needs to be checked from time to time (to ensure the marketing, production and financial strategies remain internally consistent and supportive of each other) and whenever there are major events or changes.

It is good practice to have a regular cycle of review, covering issues including:

- **past performance** – assessing the production yields and cost, quality and any other defined performance variables; and marketing and financial performance measures. It is then possible to compare actual with planned performance and make any necessary adjustments to the strategies.
- **strengths and weaknesses analysis** – including a comparative analysis of your business's performance (as best you can) compared with other growers. This 'benchmarking' review of your performance against others (quantity as well as quality and costs of production) will give some indication of how the farm is performing.
- **opportunities and threats analysis** – you need to be aware of changes in markets and the potential for competition from within the region as well as interstate and overseas. Other changes in value adding, harvest size, transport, technology, cultivation species, species management, interest rates may offer opportunities as well as threats.
- **adjusting the plan as necessary** – you may need to make changes to your business plan as threats and/or opportunities arise.
- **biosecurity plan analysis** – routine review of your biosecurity plan for existing and emerging pests and diseases that may impact your business is recommended to ensure that you have appropriate practices in place to manage potential impacts on your stock.

3.6.1. Avoiding business failure

Aquaculture like any business has potential pitfalls that may hamper the development of a strong business. Some pitfalls include:

- for family operations, the death of the key person (who understood how to operate the farm), marital problems, divorce, attempting to support too many family members - especially during start up times, or succession planning
- natural disasters (storm, flood, drought, extreme heat or cold)
- national and international crises
- speculation of undeveloped technologies without proper research
- poor business plan with unrealistic returns
- under capitalisation
- poor production management
- failure to realise that aquaculture is a farming business and that animals have specific physiological requirements which often requires attention 24/7
- poor marketing
- poor monitoring or record keeping of the production, financial and/or marketing aspects
- appropriate or adequate information not used for decision-making
- lack of 'business' experience or skills
- not planning for expenses such as professional fees and taxes
- lack of reliable and experienced workers and managers
- lack of proper biosecurity planning and practices to adequately manage the risks associated with aquatic pests and diseases.

3.7. Further information

There are many resources available to assist with business plan preparation. The internet is a useful source of information on aquaculture management and business planning in general. The following are some useful web links.

Australian Government Business Entry Point
www.business.gov.au

NSW Government Business Support
https://www.business.nsw.gov.au/support-for-business/businessconnect
https://www.nsw.gov.au/working-and-business/starting-or-running-a-business/small-business-advice-and-support

NSW Department of Primary Industries
www.dpi.nsw.gov.au/fisheries/aquaculture
NSW Aquaculture Directory
NSW Aquaculture Production Reports
www.dpi.nsw.gov.au/fishing/aquatic-biosecurity/aquaculture/biosecurity-planning

Sydney Fish Market
www.sydneyfishmarket.com.au

NSW Food Authority
www.foodauthority.nsw.gov.au

National Aquaculture Council
The National Aquaculture Council (NAC) is the peak body representing the aquaculture industry across Australia. The NAC has established a website called the Australian Aquaculture Portal which has been developed in an attempt to centralise the growing body of information, research

and business opportunities in the Australian aquaculture industry. The Australian Aquaculture Portal contains a number of useful links to federal, state and territory government agencies and aquaculture associations.

Local council

Contact the economic development unit, or equivalent, within your local council which will be able to coordinate advice from relevant sections within the council on site selection and planning issues.

Local tourist authority

Your local tourist authority may provide advice on the tourism potential of a site, particularly a fish-out or public sale outlet, and how it may be linked with other regional tourism facilities.

Local Business Enterprise Centre (BECs)

BECs may assist with business start up and business planning issues.
http://becaustralia.org.au/

Professional and trade sources

Equipment suppliers can also be a useful source of information on the latest technology. Professional associations also have helpful general information on planning and operating a successful aquaculture enterprise.

Universities and TAFEs

There are a number of Universities and TAFEs that run aquaculture courses in NSW and other states. See the NSW Aquaculture Directory.

NSW aquaculture associations

Industry associations can be a useful source of information on the aquaculture industry in Australia.

4. Species selection

4.1. Introduction

Aquaculture businesses and the species they culture are not restricted to the production of protein for human consumption. They can include production for conservation; recreational fish stocking; aquarium trade; production of pharmaceuticals and specialist health products; jewellery; and food for other cultured and farmed organisms.

The decision to culture a specific species is determined by many factors, including:

- Is the species permitted for your intended aquaculture production method and location?
- Is there a ready supply of juvenile stock from hatcheries, or will you need to breed the species yourself?
- Market analysis (for example, acceptability of product at a price that ensures a viable business).
- The biological feasibility of culturing the species (degree of control over the life cycle; spawning; egg incubation; larval and juvenile rearing or availability; growout and feed conversion; sensitivity to crowding; disease; and handling); feed sources, availability and suitability to meet the physiological requirements of the species.
- Do you choose one or more species (and if more than one, which species are most compatible and do some actually present a risk)?
- Site specific attributes (for example, size required to be profitable; degree of flood liability and associated development limits or controls; climate; water quality and quantity) – see Site Selection chapter.
- Management and biosecurity issues, – see Operating the Farm chapter.

4.2. Translocation policy and species selection

Translocation is the introduction of an animal or plant to an area where they do not naturally occur, including genetically distinct populations of endemic species. NSW DPI aims to protect indigenous species from non-indigenous species and this may limit your choice of species or how you farm. All proposals for land based aquaculture must be assessed according to the national translocation policy guidelines. The guidelines set out a risk assessment process for considering translocation issues.

Translocation of non-indigenous species can be approved in some catchments, for example trout stocking for recreational fishing. However, some non-endemic freshwater species capable of breeding in certain NSW regions, have been assessed as having a high environmental risk. Consequently, there are stricter requirements on site selection, design and operational parameters for these species having high biosecurity concerns. (*See* Site Selection, Planning and Design *and* Operating the Farm Chapters).

Translocation issues may vary as new knowledge on a species is obtained, or as new species enter culture. Therefore, it is imperative that when you consider a species to be cultured, you consult with NSW DPI to ascertain if there are any specific translocation issues.

Table 1 summarises the key translocation principles that apply to aquaculture in NSW.

Table 1: Key translocation principles for aquaculture in NSW

1. Non-endemic marine species cannot be translocated into NSW estuaries or semi-enclosed marine or open systems.
2. Non-endemic species may be required to meet prescribed health testing protocols to enable stock to be translocated from interstate.
3. Non-endemic species to NSW with a high biosecurity risk are generally permitted in tank aquaculture only.
4. Non-endemic species to a region having a high biosecurity risk are only permitted if site selection, design and operational components meet the relevant AIDP performance criteria.
5. Other non-endemic species to a region such as Silver Perch, Golden Perch and Yabbies are permitted in freshwater pond aquaculture that meet the relevant AIDP performance criteria.
6. Stock from outside NSW require case by case consideration.
7. Moving stock from interstate will need to be covered under using an approved translocation protocol.

NSW DPI has evaluated the risk of culturing numerous species for aquaculture farming in NSW. Any new species proposed for culture in NSW that have not previously been evaluated by NSW DPI, are required to undergo an evaluation of associated risks. A species may be prohibited from culture if any associated risks cannot be adequately addressed. Species that have been evaluated are listed in Appendix 3, which details the species, translocation issues, culture methods and specific constraints. It must be read in conjunction with Table 2 to determine species for possible cultivation in NSW. NSW DPI may consider a variation of permissible culture methods, provided an appropriate risk management strategy is developed and detailed in a biosecurity risk management plan. For further information see ngle species or polyculture

Monoculture - the culture of a single species at any given time, is the most common form of aquaculture in NSW. ‘Polyculture’ is the growing of more than one species together in the same culture facility, which can help maximise productivity. Polyculture can provide greater economical use of water, feed and energy. Keep in mind that some aquaculture species may provide a disease risk to other species that you intend to cultivate (for example, the risk non-native ornamental fish species can pose to Australian native fish species), and may potentially carry disease without themselves being impacted.

The integration of aquaculture with an agricultural use (for example, hydroponics, rice, trees) can be a valuable addition to an aquaculture business. It can greatly increase the economical use of water and energy.

4.3. Temperature

Water temperature is one of the most critical environmental factors affecting the growth and health of aquatic species. Each species has a preferred water temperature at which biological functions, including growth, are optimal.

Table 2 summarises the optimal growing temperatures of several species. It is important to consider temperature when selecting a site for species grown outdoors, as minimum and/or maximum temperatures may be lethal (See Site Selection chapter).

Table 2: Temperature range for breeding and growout

Species	Ideal temperature	
	Hatcheries	Growout facilities
Prawn – Black Tiger	28 – 32ºC	25 – 32ºC
Prawns – Kuruma	25 – 30ºC	20 – 28ºC
Prawns – School	-	21 – 27ºC
Crustacea – Redclaw	27 – 30ºC	27 – 32ºC
Crustacea – Yabbies	15 – 20ºC	23 – 25ºC
Barramundi	27 – 30ºC	26 – 30ºC
Eels	-	23 – 28ºC
Kingfish	21 – 24ºC	15 – 25ºC
Mahi-Mahi	25 – 30ºC	25 – 30ºC
Mulloway	21 – 26ºC	14 – 30ºC
Murray Cod	19 – 21ºC	23 – 26ºC
Silver Perch	20 – 25ºC	23 – 28°C
Snapper	21 – 24ºC	17 – 30ºC
Trout Brown	6 – 10ºC	4 – 19ºC
Trout Rainbow	9 – 14ºC	10 – 22ºC

4.4. Feed

Intensive and semi-intensive aquaculture generally requires a high degree of management, high stocking levels and feeding of formulated diets. Higher production rates can be achieved when using formulated feeds specific to the selected species. However, not all species readily accept pellets (for example, Australian Bass and Golden Perch), and some species are difficult to wean during early hatchery stages. Consequently, there has been limited progress in the culture of some species.

Dietary requirements vary significantly between species. A good balance of protein, energy, minerals and vitamins is required to meet the physiological requirements of selected species. Often due to the lack of specific dietary research, feeds targeting other species are utilised. However, there is some danger in taking this approach often resulting in poor growth, fatty animals or poor resistance to disease and husbandry issues.

Feed costs often constitute 40 to 55% of total production costs, therefore it is essential to use species that convert food efficiently and use efficient feeding practices. Species that have high meat to total body weight ratio are desirable because of their more efficient conversion of feed into edible flesh.

Aquaculture ventures intending to use live feeds would need to consider biosecurity risks posed and to secure a safe, reliable supply.

4.5. Hatchery and seed stock

Tip

Aquaculture ventures incorporating a hatchery wishing to produce fingerlings for stocking NSW waters will need to be accredited under the NSW Hatchery Quality Assurance Scheme.

A critical issue for any aquaculture venture is the reliable availability of seed stock (juveniles). Some aquaculture growout ventures incorporate juvenile production into their business whereas others are reliant on sourcing stock from other farms and hatcheries. Generally, hatcheries require specialised infrastructure and technical expertise beyond that required for growout operations. However, having control over hatchery operations offers clear advantages to the growout farm including selection and reliability of stock. Some species are only available once per year whereas others may be more frequently available due to manipulative breeding techniques within the hatchery. It is important that a new entrant to the aquaculture industry carefully research the availability of seedstock to make sure the hatchery is capable of producing the quantities of seedstock to satisfy the farm's projected production plan.

Some important aspects a hatchery needs to consider when managing broodstock and seed stock are:

- maintenance of genetic diversity and avoidance of inbreeding
- production of disease-free stock
- seed stock is not contaminated with other species
- maintaining a biosecure site.

Broodstock can be collected from the wild in NSW under the authority of a NSW DPI permit, grown and maintained in a hatchery or purchased from a commercial supplier.

Ventures wishing to undertake hatchery operations should be familiar with the NSW Hatchery Quality Assurance Scheme (HQAS), accrediting businesses to sell fingerlings to stock waterways and the rules and regulations relating to broodstock collection.

5. Site selection

5.1. Introduction

Selection of an appropriate aquaculture site is paramount to the success of the venture. Appropriate site selection can avoid the need for environmental mitigation measures and costly ongoing management, operational and monitoring procedures. Whether the land is already owned or the property is to be purchased, the following should be considered:

1. **Aquaculture must be a permissible land use and compatible with nearby land uses.** The site must not be affected by nearby agricultural activity that could cause chemical spray drift, runoff, or upstream pollution, or be constrained by potential impact on adjacent residents.

2. **Site specific investigations should indicate that the site is fundamentally suitable for an aquaculture operation**. Consider the supply of water (quality & quantity); soils suitable for pond construction; a climate suitable for the culture species; enough land to manage waste water or means of disposal via municipal infrastructure; proximity to power; suitable land slope for construction, minimisation of pumping costs and managing waste; proximity to markets, service providers, supplies and manpower (all can impact adversely on operational costs).

A site-specific investigation and evaluation, commensurate with the size and complexity of the proposal is required. The evaluation will consider all relevant legislation, plans and government policies (for example, in relation to river and estuary flow regimes, water allocation, floodplain management, vegetation management, riparian buffer zones, land use zoning, marine parks and aquatic reserves, heritage strategies, potential land use conflicts, acid sulfate soils and biodiversity protection). In general, the selection of a site should be based on a thorough knowledge of local and regional hydrology, geology, topography, ecology and climate. Although environmental factors are critical when assessing sites other factors such as land and construction costs need to also be considered.

The project profile analysis chapter of this document provides a systematic and rigorous ‘sieve’ approach to site selection. Government agencies and councils will use this approach when formally assessing a proposed aquaculture venture.

Firstly, assessing a project or location against the project profile analysis model will help determine whether your proposal meets minimum mandatory performance criteria. If it does, then the process, in conjunction with the information in this strategy, will help assess how the proposal will be classified from low risk to higher risk.

5.2. Estuarine aquaculture sites

Assessment of estuarine aquaculture sites should refer to the NSW Government’s sea level rise planning benchmarks, relevant coastal zone management plans and address issues related to inundation, water quality, drainage and acid sulfate soils (ASS) which could impact on the long-term viability of aquaculture on the sites.

To provide assistance in identifying potential sites for saline pond aquaculture within estuarine areas of NSW, maps have been prepared for 12 northern NSW estuaries (see Appendix 1).

5.3. Water considerations

5.3.1. Overview

The following is an overview of the issues that need to be considered when determining whether a proposed site would have a reliable water supply of the necessary quality and quantity for the success of an aquaculture business. **This is not an exhaustive list, but a guide only.**

Water budgets for any aquaculture venture must be carefully considered. Water budgets should be calculated based on volumes required to fill tanks, pipes, ponds and storages, seepage, evaporation and operational procedures.

5.3.2. Water supply quantity

PREFERRED LOCATION
A site with abundant, permanent and affordable supply of good quality water with no access restrictions.

An abundant, all-seasons supply of good quality water is essential for land based aquaculture. The quantity of water required will be dependent on the size of the farm, type of farm infrastructure (pond or tank), water budget of the site (rainfall and evaporation), discharge classification (closed, semi-closed or open systems) and species requirements. Water sources may include estuaries, rivers, ocean or bay, irrigation channels, bores, saline interception schemes, municipal supplies and over land catchment. All waters should be tested for compatibility with the selected species early in the planning process. Pumping costs can be high and should be minimised with options for gravity flow, low head or relatively short suction and delivery lines. These issues must be considered when evaluating a site and assessing layout options.

Potential impacts of climate change need to be factored into any water quantity and quality investigations. Department of Planning, Industry and Environment – Water (DPIE Water) may assist early in the planning process to ascertain water management issues affecting water availability including water harvesting or extraction from a water source. Local government approval may also be required for the construction of any water storages.

5.3.3. NSW water quality objectives

Water quality must be of a standard that satisfies all the physiological requirements of the target species. Guidelines exist for acceptable parameters for some species. Sub-optimal or poor water quality can increase the running costs of operations significantly through poor growth, disease, loss of stock, equipment deterioration and expenditure on remediation.

The NSW Government is committed to ensuring the long-term health of NSW waterways, with improved water quality and flow regimes its prime objectives. The intent is to achieve a better balance in the sharing of water between users and the environment and reduce the stress on rivers and aquifer systems.

For each of the state's catchments, the state government has endorsed the community's environmental values for water known as the 'Water Quality Objectives' (WQOs). The NSW WQOs set out:

- the community's values and uses of rivers, creeks, estuaries and lakes
- a range of water quality indicators to help us assess whether the current condition of each waterway supports those values and uses.

Where environmental values are not being achieved to meet the community's expectation of waterways, the WQO's identify and prioritise risks and threats, develop management action plans, and direct on-ground investment to deal with water quality 'hotspots'.

Booklets outlining the WQOs for catchments are available by telephoning the Pollution Line on 131 555 or you can access the documents on the Environment, Energy and Science (EES) website at - https://www.environment.nsw.gov.au/ieo/.

The NSW WQOs are consistent with the agreed national framework for assessing water quality set out in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018). These guidelines provide an agreed framework to assess water quality in terms of whether the water is suitable for a range of environmental values. The WQOs provide environmental values for NSW waters and the ANZG 2018 provide the technical guidance to assess the water quality needed to protect those values. Any proposal involving a discharge to waterways should be supported by an assessment of the impacts on the NSW WQOs prepared consistent with the ANZG 2018.

The NSW water quality and river flow objectives are required for the protection of aquatic ecosystems; visual amenity; recreation, aquatic food, commercial shellfish production; maintaining wetland and floodplain inundation; managing groundwater for ecosystems; minimising the effects of weirs and other structures; maintaining or rehabilitating estuarine processes and habitats; and maintaining natural flow variability. Particular water quality issues include:

- Nutrients and other contaminants in stormwater and sewage outflows and the release of highly acidic waters from ASS areas into estuaries.
- Dredging and drainage works within the flood planning area that could disturb ASS.

The NSW Shellfish Program administered by the NSW Food Authority regularly monitors estuarine water quality to support commercial shellfish production.

5.3.4. Water supply quality for aquaculture

PREFERRED LOCATION
A site having consistent high water quality and unlikely to adversely affect water quality for other users. Access to reliable potable (drinking) water or mains water for processing, pre-market conditioning and employee uses.

Avoid sites downstream of land uses that are likely to adversely affect water quality (for example, downstream of sewage treatment works discharge, town storm-water overflows, industrial centres, proximity to agricultural chemical uses or recreational boating including marinas).

In evaluating the suitability of the quality of a water supply, factors that need to be considered include:

- the water is free of organic, agricultural or industrial pollution (pesticides, heavy metals)
- the level of suspended particles in the water (check particulates - composition (organic and inorganic), size, concentration, likely seasonal variation)
- the waters physical and chemical properties (potential of hydrogen (pH), salinity and tidal amplitudes, temperature, dissolved oxygen, ammonia, nitrite and nitrates, alkalinity and hardness, hydrogen sulphides, chlorine, turbidity, carbon dioxide)
- the water is free of pathogens, trash fish and other undesirable aquatic organisms.

It is desirable that the source of water for aquaculture meets the relevant criteria set down in the ANZG 2018, including protection of aquatic ecosystems and aquaculture and human consumption of aquatic foods. The guidelines suggest levels of physio-chemical parameters that

would be required to maintain a viable natural aquatic community and provide guidance relating to levels of organic contaminants that may cause tainting of the products.

If the water supply does not meet the criteria set out in the ANZG 2018, you need to assess the potential effect this would have on the selected species at all stages of the life cycle (for example, an animal may tolerate waters having a pH of 6.0, however, eggs and larvae may not survive).

In some waterways, the water quality may meet the criteria for protection of the aquatic communities, but not meet the guidelines for human health or food safety requirements. See the ANZG 2018 and consult the NSW Food Authority.

5.3.5. Water licensing

A water licence or activity approval is required to install a pump, construct a levee, divert the river flow, undertake works within 40 metres of a river, install a bore or piezometer or to harvest more than 10% of catchment overland flows across a site.

5.3.6. Measuring water extraction

Under the water licence provisions for water extraction, DPIE Water may, as conditions of licences or approvals, require the quantity of water to be recorded and reported, annually or more regularly, if required using approved measuring equipment. Information required will include hours pumped, monthly extraction rate and use of water. DPIE Water may limit the extraction from a river from time to time to ensure adequate flows remain for other water users and the environment.

5.3.7. Estuarine or marine water supply

Tidal exchange
Ideally you need a satisfactory estuarine water supply on a site adjacent to waterways. The estuarine aquaculture maps (see Appendix 1) identify some north coast sites that potentially have water quality satisfactory for an estuarine water supply source.

Detailed investigations will be required to determine if there is good tidal exchange and circulation, and if the water quality is able to consistently recover quickly following rain events.

Avoid sites with significant freshwater ingress and variable salinity, high suspended solids, low pH (acid sulfate), high organic loading and other poor water quality characteristics.

Tidal amplitude

PREFERRED LOCATION
A site adjoining an estuary with a tidal amplitude of greater than 600 millimetres.

Ideally you need water intake sites in an area of good water ventilation. An indirect measure of ventilation is tidal amplitude. Tidal amplitude is defined as:
MHWN - MLWN where MWHN = Mean High Water Neap, and MLWN = Mean Low Water Neap.

Generally, tidal amplitude will diminish further up river systems and where restriction to tidal movement occurs such as narrow and/or shallow channels and sand bars. Tidal gauge data is available from the Manly Hydraulic Laboratories in Sydney. You may need the assistance of a coastal engineer to calculate tidal amplitude where there are no tidal gauges.

Avoid areas that may be adversely and significantly impacted by adjoining floodgates and land runoff.

Access

PREFERRED LOCATION
A site where no deepening is required of the estuary for a pumping station, or existing infrastructure exists to carry inlet and outlet pipes for estuarine or marine waters.

Carefully consider if potential inlet sites will require a change to the estuary channel (for example, require a sump or deepening or other disturbance of the bed of the estuary). If mangroves, seagrass or foreshore vegetation is likely to be disturbed, a permit may also be required under the *Fisheries Management Act 1994 and Marine Estate Management Act 2014 if the activity is adjoining a marine park to* undertake work (excavation, fill or anything that could affect the flow or quantity of water) in, on or within 40 metres of an estuary, a controlled activity approval will be required pursuant to the *Water Management Act 2000*.

Establishment of pipelines across ocean beaches or estuaries to access marine waters requires detailed investigations as storms may result in catastrophic failure of the pipeline. You will need to consult with DPIE Crown Lands to obtain approval for any pipeline that crosses Crown land, which includes Crown reserves, most intertidal areas below mean high water mark and Crown roads.

Note also that pipelines that cross coastal wetlands identified in *State Environmental Planning Policy (Coastal Management) 2018* will trigger the requirement for an environmental impact statement and if a RAMSAR wetland is involved, a Commonwealth approval under the *Environment Protection and Biodiversity Conservation Act* may be required.

5.3.8. Saline ground water supply

PREFERRED LOCATION
Adjacent to a saline ground water interception scheme.

Access to saline ground water may be from either a saline ground water interception scheme or bore. Care needs to be undertaken in managing the saline ground water within the aquaculture facility to ensure that freshwater aquifers are not impacted. You will need to consult with DPIE Water.

All saline ground water bores must be of an approved diameter, lined and capped to the standards required and licensed by DPIE Water.

5.3.9. Freshwater supply

Access licence or extraction rights

PREFERRED LOCATION
A site with an approved access licence or available rights for water extraction.

Water for freshwater fish farms can be drawn from sources such as streams, on-site dams, underground bore water or town supply providing the relevant permit/entitlement can be obtained. For advice on water extraction rights consult the DPIE Water.

Water Access restrictions

PREFERRED LOCATION
A site with no water access restrictions based on flows under normal conditions.

Detailed investigations will be required to evaluate the reliability of water quantity and quality during drought periods, periods of high demand (multi-users), floods and ‘fresh’ river flows. Sites having the potential to experience periods of restricted water access should consider on-site

storage or alternative sources (bores/wells) and have the capacity to support continued operation during these events.

Pumping station

PREFERRED LOCATION
A site requiring no deepening of the river for intake line and for easy management during floods.

Ideally you need a river site having sufficient depth under all flows and readily accessible to remove infrastructure for maintenance and during rising waters and floods. The existing profile of the channel or bank must not be disturbed more than is necessary to install the pumping facility. The intake should be as protected as possible from debris and excessive flows.

Any location where the bank or the bed of the river would require substantial disturbance (especially of aquatic or foreshore vegetation) should be avoided. The construction of a pump station may require a controlled activities approval under the *Water Management Act 2000*. Where a licence or permit issued for the commercial use of water, an exemption from controlled activity approvals exist, refer to clause 39A of the Water Management (General) Regulation 2018.

Be aware!
Surface water access rules

DPIE Water should be contacted to ascertain the current water access licensing rules applying to basic landholder rights, on farm dams, extraction from watercourses and any surface water licence embargoes that may apply to a selected site.

5.3.10. Groundwater access

All ground water bores must be of an approved diameter, lined and capped to the standards required and licensed by DPIE Water.

You will need to consult with DPIE Water on the principles and issues to be considered relating to groundwater, for example:

- groundwater quality, quantity and vulnerability;
- threats and protecting the resource;
- conservation of water resources.

Be aware!
Groundwater access rules

Under S.112 of the *Water Act 1912*, anyone using a bore or well **must have** a groundwater licence. There are a number of alluvial aquifers in NSW that are embargoed, and therefore no new water licences will be approved. However, applications can be made to transfer allocations from existing licences. Where a water sharing plan in place, the provisions of the *Water Management Act 2000* apply.

Any proposed use of groundwater in areas possessing ASS will need considerable environmental assessment to ensure that such extraction will not lower groundwater tables to levels leading to the formation of acidic ground water. DPIE Water will generally require a full assessment of any works in areas mapped as having either vulnerable groundwater, or significant potential for ASS. See Table 3.

A licence or approval is required **prior** to the construction of any bore and all applications for licences are subject to assessment by DPIE Water.

Sites that have underlying high quality fresh potable groundwater within 3 metres of the surface will require detailed investigations. The quality of the underlying groundwater should not be put at risk by the aquaculture activity, in particular where saline ponds are over fresh water aquifers. Any risk to groundwater used for potable water supplies may result in a proposed aquaculture development being refused.

Multiple use of recycled freshwater pond/tank or processing water
There are significant economic and environmental benefits to multiple water use. Multiple uses include hydroponics, horticulture or irrigated agriculture. Any irrigation schemes associated with aquaculture should be considered as a value adding process utilising the discharged water.

Table 3: Assessment regime for groundwater

Situation	Site selection assessment required
In areas where groundwater is not vulnerable because of the depth, overlying geology and where there are no obvious sources of contaminants and no ASS are present (as indicated in EES ASS Risk Maps).	**No assessment** is necessary.
In areas which have groundwater of 'low' value which may be vulnerable and where there are no obvious sources of contaminants.	**A professional opinion** is required as to the nature of the groundwater resource and the risk the development places on the resource.
In areas where there *may be* a potential risk to groundwater or the environment.	**A desk study** is required showing the nature of groundwater resource, pollution risk, effect of any barriers to pollution flow, either natural or engineered. Calculations need to show the level of environmental risks based on existing knowledge of the site.
In areas where the desk study indicate that there are potential risks to the environment.	**Limited site studies** are required with soil and water testing to establish a baseline and to confirm the characteristics of the resource and the likely effectiveness of barriers or other possible measures (natural or engineered) to protect the resource.
In areas where there are significant risks to the quality of groundwater as indicated by the desk study or the limited site studies.	**Extensive site studies** are required with soil and water testing and modelling of the groundwater flows and quality to predict the likely effectiveness of the barriers and other design and planning options to prevent degradation of the resource. There may be some situations where the groundwater quality cannot be protected and the siting may not be feasible.

5.3.11. Pond siting

PREFERRED LOCATION
A pond aquaculture site not located in areas of high groundwater (within 3 metres of the surface), or areas highly vulnerable to groundwater contamination, which are used for stock, domestic or town water supplies.

If your area is one where there are ASS, you need to consider the cost of minimising the generation and runoff of acid into the ponds or neighbouring environment.

Sites with high groundwater are high risk for pond construction and management. It can be difficult to build the ponds and prevent seepage. It also may not be possible to adequately drain and dry-out ponds built in such areas, something which is necessary for efficient pond management.

5.3.12. Flood liability

PREFERRED LOCATION
A site that is not within the flood planning area and/or a design that will not impede the flow of flood waters or affect catchment stormwater drainage. A site where the development is compatible with the relevant council or EES floodplain management plan, where available.

Freshwater aquaculture ponds should be constructed above the probable maximum flood (PMF) level in the eastern drainage and constructed so not inundated by the discharge of a 1:100 average recurrent interval (ARI) flood event in the western drainage. In the western drainage if data is not readily available regarding the 1:100 ARI flood event a proponent may wish to consider the highest historic flood level. An aquaculture site within a flood planning area is likely to be severely impacted by floodwater and should therefore be avoided.

Ponds using estuarine or marine waters should be constructed above the 1:100 ARI flood event, although a case-by-case evaluation may be considered.

It is preferable that there is no major stormwater drainage across the site. If unavoidable, there should be sufficient space to manage the flows so as not to affect neighbouring properties or ecosystems.

5.3.13. Waterway protection

PREFERRED LOCATION
A site that allows for all infrastructure (except pipelines/water access channels) to be at least 100 metres from the riparian zone.

Separation between the facility and any natural waterbodies is necessary to avoid disturbance of riparian vegetation and to allow for natural hydrological processes (such as bank erosion) without putting ponds or buildings at risk.

DPI Fisheries' Policy and Guidelines for Fish Habitat Conservation and Management recommends a 100 m riparian buffer zone adjacent to Type 1, Class 1 key fish habitat, especially in undeveloped areas or adjacent to marine parks and aquatic reserves. In urban areas a 50 m buffer zone may be acceptable when aligned with Natural Resources Access Regulator requirements.

Disturbed buffer areas should be revegetated to prevent erosion and minimise flow into the waterbody. There should be a vegetated buffer zone of at least 20 to 40 metres between any effluent irrigated areas and the high bank of any adjoining watercourse. It is advisable to also consult the local environment plan for your region to confirm waterway buffer zone requirements.

Tip!

A buffer area of more than 40 metres would avoid the need for a controlled activities approval under the *Water Management Act 2000*. In addition, Aboriginal sites commonly occur adjacent to waterways, and a set back may reduce the likelihood of disturbance to Aboriginal sites.

5.3.14. Water temperature at a site

Water temperature is a key limiting factor in species selection and when selecting a site this must be considered. Information on freshwater temperatures is available for some river systems, however it should be noted that water temperature within culture facilities is often much higher.

5.4. Elevation and topography

PREFERRED LOCATION
Ponds using estuarine or marine waters on a site with an elevation above 1 metre Australian Height Datum (AHD) and a slope of less than 2%.
A site for freshwater ponds that has a slope of less than 5%.

Key elevation and topographic considerations include:

- coastal land below 1 metre AHD is likely to have significant ASS issues. Ponds constructed on these sites are likely to have problems with draining and drying and ASS. Tidal and flooding inundation is likely to occur on land below 1 metre AHD. These sites are also at greater risk from sea level rise
- land above 2 metres AHD is less likely to contain ASS
- the slope of the land will influence the shape of the ponds, drainage system and construction cost.

Topography is an important issue for high security species with translocation concerns. It is also an important factor if pond discharge water is to be used on-site for irrigated crops. NSW DPI Agnote DPI-493, "*Landform and soil requirements for biosolids and effluent re-use"* (NSW DPI 2004) contains further information on landform assessment and requirements for effluent re-use.

5.5. Soil and soil contamination

PREFERRED LOCATION
A site that:

- has clay loam or a soil/sand mix with low erosion potential
- has no soil contamination from previous land uses
- has no ASS, or ASS landform Process Class A with Landform Element class b, l, t, p, y or w
- is suitable for freshwater recycle systems/irrigated agriculture.

The soil characteristics of a site can influence construction costs and the long term maintenance and management costs. With high security species, particularly those with translocation concerns, the assessment of suitability of the soil for pond or dam construction is essential.

Key soil considerations include:

- sites which have clay or clay loam soil characteristics suitable for pond construction (stable and nil seepage). A soil survey is recommended covering the pond construction site and at the estimated pond excavation depth to determine if there are likely to be any gravel or sand layers, rock strata and other soils characteristics that may interfere with water holding qualities and thus add to the construction costs. Soil specialists at the Land and Property Information Authority and/or EES may have soil survey information or maps of particular sites. If saline water is used the risk of seepage is high even in clay soils as the saline water can cause the clays to flocculate and increase permeability
- for sites with highly dispersive or flocculate soils, additional erosion controls and other measures (dam liners) to prevent dam wall failure through 'tunnelling' may need to be factored into the costs
- land previously used for crops, should be tested for accumulated pesticide residues such as organophosphate, carbamates and synthetic pyrethroids. Current pesticide and herbicide use on adjoining lands and within the catchment need to be investigated to ensure minimal impact on site

- in estuarine areas, high-risk ASS should be avoided. ASS can impact on aquaculture operation through poor water quality, acid runoff and costly remediation. Sulfidic muds also have poor load bearing characteristics resulting in pond wall instability and leakages. Soil survey work will be required to identify the depth to the ASS and any likely 'hot spot' areas, particularly as ASS may not be evenly distributed across a site. Reference should be made to the ASS Manual for sampling and assessment regimes
- with some soils the preloading of the site prior to construction may need to be considered to ensure stability. However, consideration of the effects of compaction on groundwater levels and the potential for discharge of acid is required.

Tip!

ASS risks maps (available from EES) are a useful tool for ruling out unsuitable aquaculture sites. Sites on ASS should be evaluated using methods in the ASS Manual.

5.5.1. Irrigation Soils

The characteristics of the receiving soils for irrigation need to be thoroughly investigated to ensure they are suitable to receive such waters into the future without creating environmental or management issues.

Tip!

If irrigation is proposed using recycled water or processing wastewater, the suitability of the soil for pasture, crops or tree plantations must be considered. Factors such as fertility, permeability and slope should be considered when assessing methods of irrigation and crop types. All relevant soil characteristics should be fully established when designing an irrigation system. NSW DPI Agnote DPI-493, *Landform and soil requirements for biosolids and effluent re-use* (NSW DPI 2004) and the Environment Protection Authority (EPA) Environmental Guidelines: Use of Effluent by Irrigation contains further information on landform assessment and requirements for effluent re-use.

5.6. Local climate and air quality

Key climate and air quality considerations include:

- **Growing cycle** – Water temperature significantly affects the metabolism and growth of aquatic animals and plants. The longer the temperature is below the optimum range, the longer the growout cycle. It is therefore important to consider climate when evaluating a site. (See Water temperature)
- **Design and construction issues** – Climate and weather conditions should be considered when planning construction timetables, use of solar energy, positioning of ponds (water fetch, wave action, erosion), runoff, catchment and flood management facilities or flood control works
- **Effect on environmental performance** – Noise and odour impacts are likely to be more of an issue in areas that experience local temperature inversions
- **Effect on irrigation water use** – Temperature, humidity, rainfall, sunlight and wind patterns will affect plant growth and evapotranspiration levels. These factors will dictate the effectiveness of an irrigation area to utilise discharged water.

5.7. Ecological factors

PREFERRED LOCATION
The site should have:
- no impact on threatened species, populations or ecological communities or their habitats or critical habitat listed under the *Biodiversity Conservation Act 2016* or the *Fisheries Management Act 1994*
- no disturbance of native vegetation (including trees, shrubs, grasses).

Key ecological considerations include:

- If terrestrial or aquatic threatened species, populations or ecological communities or their habitats occur on the site or in the area of impact, a biodiversity assessment and approval may be required.

  Assessment and approval pathways for biodiversity impacts will depend upon the purpose, nature, location and extent of the vegetation clearing. In some cases you may be required to obtain development consent or a native vegetation clearing approval. You may need to engage an accredited assessor to prepare a Biodiversity Development Assessment Report in accordance with the Biodiversity Assessment Method and to submit that report with your application for consent or approval. In other cases you may not be required to obtain a Biodiversity Development Assessment Report but may need to obtain a permit from the local council to carry out clearing. The Policy and guidelines for fish habitat conservation and management offers some guidance to permissible development, required assessment and permits related to the harm of key fish habitats.

  The Office of Local Government has designed a helpful tool to help decide which approvals are likely to apply:
  https://www.olg.nsw.gov.au/councils/land-management/biodiversity/biodiversity-assessment-and-approvals-navigator/

  Further information is also available on the NSW Department of Planning, Industry and Environment's website:
  https://www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity
- Areas of native vegetation and habitat should be retained wherever possible to maintain or improve biodiversity values of a site. The site layout should be designed to minimise the destruction or disturbance of native terrestrial and aquatic vegetation
- The clearing of native trees, shrubs or grasses on rural land will usually require an approval under the *Local Land Services Act 2013* and the *Biodiversity Conservation Act 2016*. Native vegetation may be permitted to be cleared under the Transitional Native Vegetation Regulatory Map (see NVR Map). If the vegetation is removed within 40 metres of the bank of a waterway or wetland, a controlled activity approval could also be required under the *Water Management Act 2000* If mangroves, seagrass or foreshore vegetation is to be disturbed by the inlet and outlet pipes or drains, an approval may be required under the *Fisheries Management Act 1994* (both Acts list threatened species, population and ecological communities and protected habitats) and *Water Management Act 2000*
- If mangroves, seagrass or foreshore vegetation is to be disturbed by inlet and outlet pipes or drains, an approval may be required under the *Marine Estate Management Act 2014* if the development is within, or adjacent to a marine park or aquatic reserve
- Vegetation management on rural land under the *Local Land Services Act 2013* and the *Biodiversity Conservation Act 2016* is administered by LLS

- If abutting an estuarine area, consideration should be given to the likely risks to any nearby oyster aquaculture particularly Priority Oyster Aquaculture Areas or important fish nurseries or habitat.

Tip!

To determine the appropriate level of assessment for an aquaculture proposal, a test of significance and a project profile analysis can be referred to the consent authority for consideration.

The *Biodiversity Conservation Act 2016* and *Fisheries Management Act 1994* requires the following factors to be considered when assessing whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitat:

(a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

(b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity—

  (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

  (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

(c) in relation to the habitat of a threatened species or ecological community—

  (i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

  (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

  (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,

(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

(e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

Tip!

EES maintains a GIS database of information on the flora and fauna of NSW - *Atlas Listing of Fauna and Flora Records in NSW* (Contact: Data Licensing Officer (02) 9585 6684). This may provide an early warning of the occurrence of threatened wildlife species on or near the site. councils may also have lists of species, populations and ecological communities in their areas and other useful data.

You should contact DPI Fisheries to see if any threatened species, populations or ecological communities have been recorded for a particular estuary or river. Maps of the distribution of freshwater threatened species listed under the *Fisheries Management Act* can be obtained online from the DPI Fisheries Spatial Data Portal.

5.7.1. Conservation sites

Good site selection avoids sites that may impact on areas of high conservation value. Various pieces of legislation protect these sites and are require additional assessment and additional approvals if they are potentially impacted. Conservation sites include:

- **Coastal rainforest** especially Littoral Rainforest (see State Environmental Planning Policy (SEPP) Coastal Management 2018)

- **Wetlands** especially Coastal Wetlands (see SEPP Coastal Management 2018), wetlands listed in the *Directory of Important Wetlands in Australia* should also be considered
- **RAMSAR** wetlands. Please note that a project does not need to be in or adjacent to a RAMSAR wetland to have an impact, for example development in a catchment of RAMSAR wetland could significantly alter water quality and quantity in the RAMSAR wetland;
- **Habitat of migratory species** protected under CAMBA and JAMBA international agreements
- **Critical habitat** declared under the *Biodiversity Conservation Act 2016* and part 7A of the *Fisheries Management Act 1994*
- **EES protected areas** which include all lands managed by the EES and protected under the *National Parks and Wildlife Act 1974* such as national parks, nature reserves, historic sites, Aboriginal areas, karst conservation areas, state recreation areas and regional parks
- Wilderness Areas declared under the *Wilderness Act 1987*
- **World Heritage Area.** Please note that a project does not need to be in or adjacent to a World Heritage Area to have an impact, for example development in a catchment of World Heritage area could significantly alter water quality and quantity in the World Heritage area
- **Marine parks**: The management rules of marine parks permits aquaculture where it can be demonstrated that the activity is environmentally sustainable and does not impact adversely on the marine park environment or its flora and fauna (see management rules for each park)
- **Aquatic reserves***:* These Reserves provide protection for important sensitive fish habitat as well as providing unspoilt natural sites for recreation, education and research
- **Areas** identified as high conservation value in regional strategies and regional conservation plans.

5.7.2. Aquatic ecology

You need to consider the risks of the site's operation to native aquatic species within the catchment. Risks may include escape of stock, spread of disease (discharge water or flood breaches), water use or erosion. These issues are considered in the species selection chapter, however they are also listed here as a site selection factor as the preferred species may have locational constraints.

5.7.3. Predators

The impact of bird or other predators needs to be assessed as their activity can impact significantly on farm operational costs.

Tip!

Avoid sites near where predatory aquatic birds congregate as the long term costs, either through loss of fish or in mitigation measures, can be very significant (See Planning and Design chapter for more details).

5.8. Heritage

Land previously cleared and used for agriculture is less likely to contain heritage items (Aboriginal or non-Aboriginal). However, if heritage issues are suspected to occur on the site (built and non-built) the following 2-step process should be considered at the site selection stage.

Step 1: Research and collate information from the following sources:

i) consult relevant heritage or historical research on the area

ii) consult with the local council, the Aboriginal community (Heritage NSW can provide relevant contacts) and local historical societies

iii) inspect existing heritage registers, databases or lists including:

- in LEPs and SEPPs for relevant heritage issues
- in heritage studies prepared by a local council
- on State Heritage Register for items protected under the *Heritage Act 1977* or subject to Interim Heritage Orders or S.136 Orders
- on the National Trust Register
- on Heritage NSW Aboriginal Heritage Information Management System (AHIMS) (if affecting an estuary or its banks or accessing marine waters)
- on the National Heritage List (Australian Heritage Commission).

Step 2: Survey the area to identify any items of potential heritage significance:

iv) The Aboriginal Cultural Heritage Standards and Guideline Kit provides guidance on methodology for surveying, identifying and assessing the importance of Aboriginal sites

v) The NSW Heritage Manual 1996 provides guidance on methodology for surveying, identifying and assessing the importance of non-Aboriginals sites.

Tip!

The Heritage Office maintains a computerised State Heritage Inventory with listings of items protected under the *Heritage Act 1977* and LEPs or SEPPs.

5.8.1. Aboriginal heritage

PREFERRED LOCATION
The site does not contain or impact any recorded Aboriginal sites, places or values of significance to the Aboriginal community and/or Aboriginal sites, places or values.

Aboriginal sites or items have been recorded across the landscape in the state. Other cultural values may also be associated with this landscape, such as traditional uses of an area (for example, a ceremonial area, a historic event or place, and/or contemporary values such as access to wild resources). Areas that are adjacent to creek lines and waterways often have a high potential to contain Aboriginal sites.

NSW Aboriginal heritage management is guided and influenced by the following legislation:

- *National Parks and Wildlife Act 1974*
- *Environmental Planning and Assessment Act 1979*
- *Coastal Management Act 2016*
- State Environmental Planning Policy (Coastal Management) 2018
- Aboriginal Land Rights Act 1983

The presence of Aboriginal cultural heritage can be identified through literature searches such as the Comprehensive Coastal Assessment by Andrews *et al.* (2006), field investigations, database searches, such as the Aboriginal Heritage Information Management System, and via

consultation with local Aboriginal communities and organisations, including Local Aboriginal Land Councils. Consultation should be in line with Aboriginal cultural heritage consultation requirements for proponents.

Engagement with Traditional Owners should be sought early in the planning process and not just through a statutory consultation process (refer to Engage Early – Guidelines for proponents on best practice Indigenous engagement for environmental assessment under the *Environment Protection and Biodiversity Conservation Act 1999*). Investigations should be in line with the Code of practice for archaeological investigation of Aboriginal objects in NSW and Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW, which can also be used to support the process of investigating and assessing Aboriginal cultural heritage in the region surrounding the proposed site. It is an offence to harm Aboriginal objects and places under the NPW Act. If harm cannot be avoided, an Aboriginal Heritage Impact Permit (AHIP) can be issued by the Chief Executive of the NSW OEH under Part 6 of the NPW Act.

Steps to identify potential Aboriginal sites include searching the EES Aboriginal Heritage Information Management System and the State Heritage Inventory, and early consultation with the local Aboriginal community and/or Local Aboriginal Land Council (LALC) is advisable. There is a fee for each search of the AHIMS contact: (02) 9585 6513 or 9585 6345. All search requests should clearly identify the site and state the reason for the request, that is to accompany an aquaculture development application (DA) in accordance with the NSW LBSAS. The results of the search and accompanying advice will be sent to the applicant. In determining the assessment required, Heritage NSW considers a range of factors including:

- the results of the Heritage NSW Aboriginal Heritage Information Management System search
- reference to general archaeological models relating to Aboriginal site locations within a given area
- the views of the local Aboriginal community.

Tip!

It is wise to consult the relevant Aboriginal communities early in the site selection and evaluation process to determine if there are any major constraints on the site relating to Aboriginal heritage issues.
When lodging a request with Heritage NSW, applicants should send a letter of notification to the Aboriginal groups in the area (Heritage NSW can advise of the relevant groups). This letter should include a copy of the relevant 1:25,000 topographic map clearly illustrating the area of the proposal and a brief description of works proposed. It should request notification of the presence of any Aboriginal sites on the property and further discussions with the group should Aboriginal sites be present which require active management.
Under the integrated development assessment (IDA) process Heritage NSW can require up to an additional 46 days to consult with Aboriginal communities, organisations or LALC after the DA has been lodged prior to issuing general terms of approval, if it is considered by Heritage NSW that an Aboriginal place or object is likely to be disturbed or destroyed.

A survey may be required, by an appropriately qualified and experienced person in consultation with the relevant Aboriginal community group/s. The significance of any places or values that are recorded should be assessed, and appropriate management options developed. Places of high significance should be conserved in-situ wherever possible.

5.8.2. Non-Aboriginal heritage

PREFERRED LOCATION
The site does not contain any heritage items identified in a local environment plan (LEP) and if present the project will not affect the significance of these items.

You should check the LEP, any relevant SEPP, the State Heritage register, the National Heritage list and the National Trust register for any historic or cultural items on the site already listed for protection.

You may need to engage an appropriately qualified and experienced heritage expert to undertake an investigation of the site. If in doubt, contact council officers and/or Heritage NSW regarding the appropriate provisions for the identification, assessment and conservation of heritage items.

5.9. Native title

Native title rights are based on the traditional laws of Aboriginal and Torres Strait Islander groups. Aboriginal Traditional Owners are recognised as custodians of, and maintain a special connection with lands and waters occupied by their ancestors for millennia. This special connection is explained well in DECC (2009) - *"The land and water within the NSW landscape are central to Aboriginal spirituality and contribute to Aboriginal identity. Aboriginal communities associate natural resources with the use and enjoyment of foods and medicines, caring for the land, passing on cultural knowledge and strengthening social bonds. Aboriginal heritage and connection to nature are inseparable from each other and need to be managed in an integrated manner across the landscape"*.

5.9.1. Commonwealth native title

Aboriginal Traditional Owners, as native title holders under the Commonwealth's Native Title Act, may have rights over inland waters which can include the right to protect areas of importance or significance, to access and take resources and to share or exchange those resources. As the Commonwealth's Native Title Act is about the recognition and protection of existing rights, it is important to recognise that these rights may exist regardless of whether a native title claim or determination has been made.

5.9.2. NSW native title

The NSW *Aboriginal Land Rights Act 1983* recognises the rights of Aboriginal people in NSW. Native title rights are usually non-exclusive and coexist with the rights of other people to lawfully access and use Crown land. Approximately half of NSW is currently under native title claims. Native title claims are made by application to the Federal Court. Once an application is filed, it must be successfully registered with the National Native Title Tribunal (NNTT).

A full list of all the current registered native title claimant applications in NSW is available from the NNTT register of claims. NNTT also provide a series of maps of native title claimant applications.

Key native title considerations include:

- Native title matters can be complex and may take considerable time and legal advice to resolve. Substantial areas of Crown land in NSW are subject to claims under *NSW Land Rights Act 1983*. Crown Lands can undertake searches and advise on land status, Aboriginal land claims or whether land is held under tenure (this is usually done by lodging a search application with a fee)
- Aquaculture proposals that need to cross Crown land (subject to either of these claims) to gain access to water supply should be avoided unless agreements can be made with the claimants.

5.9.3. Aboriginal land claims

The NSW Government will generally not authorise any dealing, such as a lease or licence, in land that is subject to an Aboriginal land claim that will:

- prevent the land being transferred to a claimant Land Council in the event it is found to be claimable or
- impact on the physical condition of the land.

The *Aboriginal Land Rights Act 1983* (NSW) (ALR Act) is important legislation that recognises the rights of Aboriginal people in NSW. The preamble of the legislation recognises that land in NSW was traditionally owned and occupied by Aboriginal people, and is of spiritual, social, cultural and economic importance to Aborigines. It recognises the need of Aboriginal people for land, and acknowledges that land for Aboriginal people in the past was progressively reduced without compensation.

DPIE Crown Lands is responsible for assessing Aboriginal land claims against statutory criteria outlined in S.36 of the ALR Act. Generally, Crown land that is not being lawfully used or occupied; is not needed for an essential public purpose; and is not impacted by Native Title (registration application or determination), can be granted through this process (as freehold land to a Local Aboriginal Land Council).

More information is available in the Crown Lands Aboriginal land claims fact sheet and the Definition of terms fact sheet.

5.10. Amenity issues

Conflicts can arise if there is a perception that the amenity of residents or recreational users is likely to be impacted by an aquaculture business. Site evaluation must consider the compatibility of the aquaculture business with surrounding existing or future land and water uses. Concerns raised may include:

- risks to any heritage significance of the adjacent properties, buildings or sites
- the amenity of the area being compromised due to noise, air or water emissions, and stock loss
- the visibility of sheds, ponds and other plant on the site could affect the visual quality of the landscape of the area.

If there is potential for conflicts, consideration should be given to acquiring additional land to provide adequate on-site separation to mitigate noise or odour generating activities including pumps, aerators, plant and waste storage areas. The level of odour, dust or noise beyond the site boundary must be kept to acceptable levels. Landscaping can act as a visual barrier or vegetation buffers from nearby houses. This will help maintain good relationships with neighbours.

5.11. Strategic land use issues

PREFERRED LOCATION
The site is compatible with neighbouring land uses.

Early discussions with the local council are required to understand the local community's aspirations for the relevant local government area. This includes industry and economic development, as outlined in the long-term community strategic plan for the local community and related council plans and strategies under each council's integrated planning and reporting framework.

The council will also be able to advise you about future strategic land use and zoning in the local government area, as outlined in the local environment plan and related council plans.

Sites in 'stable' agricultural areas (or industrial areas for tank production) in which agricultural production is supported by local communities are optimal. Areas in transition from agriculture to rural residential or residential carry long term risks which may require future costly mitigation measures or even pressure the aquaculture enterprise to relocate.

Sites for pond aquaculture will generally have an agricultural land use or for tank culture an agricultural or industrial land use. Evaluations need to consider:

- if the land is prime agricultural land, the practicality and cost of returning the land to agriculture if aquaculture should fail
- if the site is on prime agricultural land, marrying the aquaculture project with agricultural production that could utilise discharge water (for example, hydroponics, horticulture, orchards, vineyards or fodder) may be considered
- residual agricultural chemicals, for example pesticides, fungicides, nemocides or herbicides on the site or adjacent land. Soil analysis should be undertaken early in the site evaluation process. Sites with significant soil contamination should be avoided
- the potential for chemical contamination from chemical sprays used on surrounding land should be considered. The site should be assessed for prevailing winds, neighbouring spray regimes and buffer zones.

5.12. Potential cumulative impacts

Cumulative impacts can arise from the clustering of similar industries in a catchment. Table 4 identifies most common cumulative impacts.

Table 4: Potential contributing industries/activities to cumulative impacts

Potential cumulative impact	Examples of contributing industries/activities to cumulative impacts
Water quality - sedimentation	Urban development, agriculture, storm water, forestry, estuarine aquaculture and road works.
Surface water quality - nutrients	Urban development, agriculture, sewage treatment & stormwater, manufacturing and estuarine aquaculture.
Sub-surface water quality	Agriculture, manufacturing, aquaculture, sewage treatment and the disturbance of ASS.
Water supply usage	Urban development, agriculture, aquaculture and manufacturing industry.
Disturbance of ASS	Urban development, agriculture, estuarine aquaculture, road works and manufacturing industry.
Aquatic diseases	Aquaculture, fishery activities and stress from poor water quality especially ASS discharge.
Land clearing – loss of vegetation & habitats	Urban development, agriculture, forestry, aquaculture and road works.
Noise & odour	Urban development, agriculture, aquaculture and sewage treatment.

5.13. Size of the site

A site needs to be large enough for current production needs plus any future expansion or buffers. Depending on the project type, there should be adequate area for:

- growing facilities - ponds and/or tanks

- the ability to isolate different parts of the facility based on the operation and biosecurity risk
- spawning and/or hatchery facilities/laboratory complex
- cold storage and packing and possibly processing sheds
- water storage tanks/dams
- pond/tank water recycling and re-use facilities including storage dams
- waste management facilities - mortalities, sludges, processing waste water, sewage
- management and staff facilities
- roadways, loading docks and carparks
- tourist facilities if relevant.

5.14. Energy

The site should permit the facility to be designed to minimise energy use and maximise opportunities for the use of alternative energy sources. The layout and design of the facility on the site needs to critically consider energy issues including alternative energy sources (solar or wind) to reduce operation and production costs.

Water pumping is expensive. Where possible the site should provide for the use of gravity for water recirculation.

Initiate early discussions with the appropriate power transmission authority about power supply (3 phase), capacity and access. You should also contact NSW Department of Primary Industries and the Department of Industry, Science, Energy and Resources (in Canberra) about energy saving in business design and management.

5.15. Availability of services and other practical matters

PREFERRED LOCATION
The site has access and services available or can be readily connected.

Practical factors for consideration include:

- access to power (three phase)
- vehicle access (safe truck entry and exit) and transport networks
- proximity to markets; efficient transport options to Sydney, Canberra or Melbourne
- distance and availability of stock, feeds, plumbing and other supplies
- availability of suitable manpower to operate the farm
- ability to secure the site against poaching and sabotage
- proximity to processors
- availability of services for staff (for example, schools, health services).

5.16. Access and location for tourists

If an aquaculture facility is to be developed as a tourist attraction then site aspects such as ease of access, prominent location and integration with other tourist facilities or existing food trail routes should be considered. Businesses incorporating tourism may need to consider insurance, construction aspects such as coach or car with caravan access, public amenities, safety and decontamination or hygiene stations.

6. Planning and designing the farm

6.1. Good planning and design are key elements

In 2018, inland aquaculture accounted for 62.5% of the world's farmed food fish production (FAO, 2020). Earthen ponds are used in many regions of the world and are practical, reliable and viable. The use of intensive tank recirculation systems is increasing as new technology improves the reliability, performance and viability of these systems. The success of both culturing methods is dependent upon the selection of good sites and the implementation of good design features.

It cannot be over emphasised that planning and design are critical steps when building a new facility or expanding an existing aquaculture farm. Construction is one of the major capital investments of aquaculture. Sound planning and design can minimise the costs associated with construction, operation and management of an aquaculture development and any associated environmental protection measures. They can also reduce the risks associated with aquatic pests and diseases entering, spreading within or exiting your aquaculture facility.

Be aware!

A land based aquaculture farm must be developed in accordance with any approved development consent conditions for the farm.

6.2. Biosecurity risk management planning

Biosecurity planning will help you, your staff and visitors prepare for and understand how to reduce risks to your aquaculture business and support a rapid response to any suspect disease.

For information on what to include in your biosecurity plan and a template to help get you started see: www.dpi.nsw.gov.au/fishing/aquatic-biosecurity/aquaculture/biosecurity-planning. It is a requirement that a biosecurity plan accompany a DPI aquaculture permit application.

The commonwealth Department of Agriculture, Water and the Environment also have a number of resources available to assist in this process, including both generic and sector-specific biosecurity planning guidance found at: www.agriculture.gov.au/animal/aquatic/guidelines-and-resources

6.3. General site layout and design issues

Once a site is identified, the next step is the physical site planning and design. Advice and assistance from professionals such as aquaculturists, water and soil chemists, engineers, irrigation and agricultural scientists, accountants, veterinary consultants and relevant government departments should be sought and used. It is advised that similar aquaculture facilities are visited to discuss operational procedures and view farm design features.

A detailed survey of the site will determine the most efficient location of facilities, minimising construction costs and providing for efficient running of the operation. A plan detailing the farm's most efficient and biosecure layout of water supply, reticulation and drainage lines, power access, buildings and roads, predation control, visual barriers should be drawn up and specifications documented. Water supply must be able to be isolated. Consider what infrastructure can be put in to improve the quality of incoming and outgoing water. Make a

checklist and consult with NSW DPIE as to available information sources and what approvals may be required given the risk profile (see Site Selection and Project Profile Analysis chapters).

6.4. Water supply dams

If an aquaculture project is located on a large property, water catchment could be significant and could provide a primary or supplementary source of water. The implications of harvestable rights should be considered with the option to 'capture' and use 10% of the average yearly runoff from the property without needing a licence. Off-river storage during periods of high quality water may be an optional design feature and should be discussed with DPIE Water.

Guidance on the location, design and construction of dams may be provided by Land and Property Management Authority (Soil Conservation Services). Factors to be considered include:

- The location of the dam in relation to local water flows.
- The dam construction features – wall design, heights, method of construction.
- Volume of water and extent of the land inundated when the dam is at capacity.
- The relative height and dimensions of the by-wash to control the dam's capacity or the provisions to ensure that inundation of land does not exceed the specified extent.
- Provision to provide for passing flows.

DPIE Water approval is required if dam design or location is to be altered. Aquaculture projects, particularly pond aquaculture, should not rely on small dams (and limited catchments) as their major water supply.

6.5. Accommodating operational facilities

Buildings are essential components of an aquaculture facility and their design and location should be planned so that space, labour and equipment are used efficiently and economically within the site. The layout should meet the relevant local council development control plan or other development controls. Consider what areas will be accessible only by the personnel that need to be using them, including clear signage to limit access and clearly articulate biosecurity needs.

6.6. Road access

Road access should provide for safe entry and exit from the site. The design needs to consider the traffic flow in the road adjacent to the site and the likely level of vehicle movements particularly during peak flows. Public roads having high flows may require design features in accordance with the Transport for NSW (TfNSW) road design guidelines. Adequate off street, designated parking spaces should be provided for trucks and cars (particularly if tourist or fish-out facilities are part of the aquaculture project). Car parking layout should take into consideration the provisions of AS 2890.1-1993.

6.7. Crown lands and road reserves

A licence is required for any structure that is built on Crown land or crosses it or is attached to the estuary bottom (for example, pipeline for water access). Under the *Crown Land Management Act 2016,* the bed of most tidal waterways and estuaries below the high tide mark is Crown Land. Some river beds are also Crown land, but they may also be private property as some freehold land extends to the centre of the waterway.

You may need to undertake a title search to determine the status of estuary and riverbanks and to determine the exact land status of the proposed development site.

Road corridors can be managed by TfNSW (freeways/major arterial roads), local councils (gazetted council public roads - usually where constructed) or Crown Lands (crown roads – sometimes referred to as paper roads). Crown roads are often not constructed and require approvals under the *Roads Act 1993* for works and services. Developments that require use of Crown roads and that generate traffic may need to be transferred to council and constructed to council standards in order to obtain planning approval to use the corridor.

Crown roads may also be enclosed in freehold properties and held under an enclosure permit from Crown Lands. These permits generally act as fencing concessions, though must have unlocked gates along the corridor to allow public thoroughfare.

Ongoing occupation of Crown land or a Crown road for services and pipelines will require an approval from DPIE Crown Lands. Before any aquaculture works are built on these roads proponents should consult with relevant agencies.

6.7.1. Setback from any natural waterbody

PREFERRED DESIGN
Culture or effluent pond/dam/buildings which are at least a distance of 100 metres from any riparian areas.

The setback distance provides protection for riparian vegetation and allows for natural hydrological processes such as bank erosion without putting infrastructure at risk. There should be sufficient buffer (may be greater than 50 metres depending on the size, location and morphology of the stream or subject to any property vegetation plan (PVP)) so that if any pond water should overtop or be accidently released, it will not drain directly into the natural waterbody. The buffer areas should be vegetated to prevent erosion and minimise flow into the waterbody.

In addition, a vegetated buffer zone of not less than 20 metres should be maintained between any irrigated areas and any adjoining watercourse. It should be maintained to protect any existing native plant species.

Tip!

A setback of more than 40 metres would avoid the need for a permit from DPI Water under the *Water Management Act 2000* and reduce the likelihood of disturbance to Aboriginal sites.

6.8. Disturbance of native vegetation

PREFERRED DESIGN
No native vegetation/habitat to be disturbed.
No riparian vegetation, mangroves or aquatic habitat to be disturbed.

The site layout for the ponds, dams, buildings, water intake, outlet and water reticulation system and operational facilities should be designed to minimise the destruction or disturbance of native terrestrial and/or aquatic vegetation or the habitat of native fauna.

Any disturbance of native vegetation (terrestrial or aquatic communities) must be undertaken in accordance with any relevant approvals (for example, under the *Biodiversity Conservation Act 2016*, the *Local Land Services Act 2013*, *State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017*, or the *Fisheries Management Act 1994*). Native vegetation located near construction activities (which are not to be disturbed) should be marked or temporarily fenced (or equivalent) to ensure that accidental damage does not occur. In particular, threatened or protected species for which disturbance has not been approved, should be marked to avoid

accidental disturbance. Wherever possible, native vegetation including grasses should be used in the rehabilitation or stabilisation of disturbed areas.

The clearing of native trees, shrubs or grasses will usually require an approval by the relevant Native Vegetation Panel, EES and/or local council under the *Local Land Services Act 2013 or State Environmental Planning Policy (Vegetation in Non-Rural Areas)* 2017. Reference should be made to any regional vegetation plan or catchment action plan prepared for the catchment. Also if vegetation is removed within 40 metres of the bank of a waterway or wetland, a controlled activity approval could also be required under the *Water Management Act 2000.*

Any channels, drains, pipes or pumping equipment should be installed to minimise disturbance of foreshore or aquatic vegetation communities (in particular mangrove communities). If mangroves, seagrass or foreshore vegetation is to be disturbed by the inlet and outlet pipes or drains, an approval may be required under the *Fisheries Management Act 1994* and *Water Management Act 2000*. If mangroves, seagrass or foreshore vegetation is to be disturbed by the inlet and outlet pipes or drains and the proposed development is adjacent to a marine park or aquatic reserve, an approval may be required under the *Marine Estate Management Act 2014*.

If vegetation is cleared or lopped, the material should be mulched and used on-site to minimise erosion and to encourage revegetation of disturbed areas using native endemic species as soon as possible.

6.9. Threatened species issues

PREFERRED DESIGN
No impact on threatened species, populations or ecological communities or their habitats.

If terrestrial or aquatic threatened species, populations or ecological communities or their habitats occur on the site or in the area of impact, a biodiversity assessment and approval may be required. Assessment and approval pathways for biodiversity impacts will depend upon the purpose, nature, location and extent of the vegetation clearing. In some cases you may be required to obtain development consent or a native vegetation clearing approval. You may need to engage an accredited assessor to prepare a Biodiversity Development Assessment Report in accordance with the Biodiversity Assessment Method and to submit that report with your application for consent or approval. In other cases you may not be required to obtain a Biodiversity Development Assessment Report but may need to obtain a permit from the local council to carry out clearing. Also see DPI Fisheries' Policy and guidelines for fish habitat conservation and management and part 7 of the *Fisheries Management Act 1994*.

The Office of Local Government has designed a helpful tool to help decide which approvals are likely to apply. See the OLG's Biodiversity assessment and approvals navigator for further information.

Further information on biodiversity conservation is also available on the NSW Department of Planning, Industry and Environment's website.

6.10. Noise issues

The design and layout should mitigate the impacts of the aquaculture facility on neighbours and the broader community. Noisy activities (for example, truck loading areas or plant/equipment) should be located away from or with a barrier between the noisy activity and the receiver.

NSW EPA's Noise Policies and information provides details of the requirements or contact NSW EPA or your local council. Where operational noise could become a nuisance, options to reduce noise impacts may include:

- quieter, insulated plant/equipment including pumps
- enclosing the noisy activities in a building
- building noise barriers
- adjusting work schedules
- minimising on-site traffic movements.

6.10.1. Construction Noise

During construction the requirements of a development consent or recommended maximum noise levels as outlined in the NSW EPA's noise guidelines should be adhered to. Where recommended levels cannot be adhered to discussions should be held with neighbours and the council on how activities can be managed. Generally, a construction noise management protocol is required with the level of detail matching the level of noise nuisance. The protocol should include:

- compliance standards
- community consultation
- complaints handling monitoring/system and site contact person to follow up complaints
- contingency measures where noise complaints are received
- mitigation measures, with design and orientation of the proposed mitigation method demonstrating best practice
- construction times
- monitoring methods and program.

6.11. Heritage considerations

PREFERRED DESIGN
No heritage items present on the site or disturbance or impact on items should be avoided.

As outlined in the site selection chapter an assessment should be undertaken of Aboriginal and non-Aboriginal heritage items and their significance established. The aquaculture project should be designed to ensure that there is no disturbance or impact on heritage items and their significance on the site.

If during construction, a previously unrecorded Aboriginal site (for example, midden or tools) is uncovered, work in the area should cease immediately and the regional office of Heritage NSW contacted. Prior to further disturbance occurring to Aboriginal sites, an approval is required from Heritage NSW. Under S.140 of the *Heritage Act 1977*, works involving the disturbance of other archaeological relics (land or under water) require Heritage Council approval.

6.12. Pond design

Ponds are constructed by excavating earth and reshaping it to create a purpose built pond that has the capacity to hold and exchange water. These structures may be constructed below or above ground level and may be lined with impervious soils or with a liner such as concrete, rubber, plastic or fibreglass in areas where seepage is a problem or to prevent erosion in open (flow through) systems.

Common pond features include batters, inlets and outlets, sloping bottoms, sumps or low points, power outlets, walkways and vehicle access roads. Ponds are typically 0.1 to 1.0 ha (1000 to 10,000 m^2) in size, rectangular or square in shape, have a water inlet and outlet and have

power to drive aerators and pumps. Ponds may have a sump area (lowest point) made of concrete, fibreglass or plastic to facilitate harvest and final draining of the pond. Ponds may contain raceway or netted pen devices that, although being tank like they are fully contained within the ponds, and therefore are considered pond aquaculture.

Existing dams on farms that are used for stock or domestic water supplies or as irrigation storage may be used for extensive aquaculture under a Class C or E aquaculture permit issued under the *Fisheries Management Act 1994*. These dams/ponds must meet the criteria as outlined in the project profile analysis chapter. There is a move in the Murray Cod industry for suspended pens in irrigation storages which are authorised under a Class D aquaculture permit.

6.12.1. Water and system type

The type of water used within the pond aquaculture facility also needs consideration in the design phase, as saline waters such as estuarine, marine and saline ground waters may cause soils to flocculate and therefore ponds may need to be specially lined.

Open pond (flowthrough) systems generally have large volumes of water flowing through them and therefore will require careful design to prevent erosion.

6.12.2. Designing for climatic effects

A pond site that is open to the weather is advantageous because it allows some wind aeration of ponds. However, at exposed sites, ponds should be built having their long axis perpendicular to prevailing winds to reduce bank erosion and any predatory netting needs to be well constructed. In areas where there are likely to be temperature inversions, any noisy or odour generating activities could be amplified.

6.12.3. Drainage and flooding controls

PREFERRED DESIGN

- Aquaculture development is not liable to flooding and is consistent with any council or EES Floodplain Management Program relevant to the site.
- The design will not adversely affect the passage of flood waters or have adverse impacts on other developments. The development will maintain environmental flows to flood dependant ecosystems.
- Design will not affect site stormwater drainage.
- No stormwater catchment drainage into excess water (effluent) storage pond/dam.

An analysis of any flooding implications should be undertaken and discussed with the relevant local council. Any flood mitigation works must be constructed and installed so as not to obstruct the passage of floodwaters flowing in, to or from a river. These should be designed in consultation with the local council and EES. For further information, refer to the Floodplain Development Manual. The plans for levees or other flood control works should:

- specify the location and nature of the works
- specify the level of the crest of the works
- be consistent with any relevant local council or EES Floodplain Management Program
- show analysis to indicate that flood behaviour will not result in adverse impacts on nearby land
- meet the requirements of Part 8 of the *Water Act 1912* or the *Water Management Act 2000* for flood control works, where applicable.

The blockage of stormwater drainage passage across the site by ponds, drains, roads or other structures can result in management and maintenance problems as well as local flooding problems for neighbouring properties.

Ponds used to hold excess water (effluent) discharged from culture/growout ponds, tank or hatchery facilities must have no stormwater catchment draining into them. This is to prevent the ponds filling during storm events and nutrient rich waters escaping into the environment uncontrolled.

6.12.4. Pond shape and size

Aquaculture ponds should be designed for efficient filling, cleaning, draining and water circulation and for efficient management. The shape and size of a pond effects:

- the cost of construction
- the level of production
- the size of inlet and outlet pipes, water circulation, the amount of aeration and power outlets
- the stocking density, harvesting and feeding methods
- the water volume and farm water budget.

Management, topography and site characteristics will determine the pond size and shape. Square and rectangle ponds are the most efficient use of space. Rectangular ponds are generally easier to manage than square ponds as they offer good water circulation (provided they are not too narrow), they are relatively cheap to build and have practical feeding and harvesting advantages. Most earthen aquaculture ponds that stock fish directly into the pond range from 1 to 2 metres in depth, this allows good light penetration, good aeration of the water and bottom muds and uniform temperature with little chance of stratification.

Ponds generally are designed to have a deep section (2 – 2.5 metres) and a shallow section (about 1 metre). Depths will vary but generally having a deep section provides a buffer against extremes of temperature, reduces evaporation during summer, facilitates harvesting and reduces the growth of large aquatic plants (macrophytes). Ponds designed to hold floating walkways and suspended net pens will be usually deeper than 4 metres.

Pond size is determined by several factors; namely, the target level of production, land area and ease of management (water quality monitoring, harvesting, aeration). Larger ponds tend to have lower cost per unit area to construct and maintain compared to smaller ponds. However, they have some disadvantages including: they are more difficult to control disease; they require more aeration, power outlets and larger inlet and outlet pipes; and, they are more difficult to harvest and maintain stock inventories. Well managed smaller ponds (for example, less than 0.5 hectares) can maintain relatively higher production levels without these issues.

6.12.5. Pond banks and floor

Earthen pond banks should be designed with optimal batter angles to prevent slump or erosion. It is important that they are wide enough to ensure strength, stability and vehicular access. The recommended dimensions of pond embankments are:

- crest approximately three metres in width
- 2.5:1 on the inside and 2:1 on the outside for embankments less than three metres high
- 2.5:1 for embankments greater than three metres but less than six metres
- 3:1 for embankments greater than six metres (rare)
- have freeboard minimum of 0.5 m (where wave action fetch is less than 100 m)
- have a cut-off trench minimum 300 mm into good clay.

Ponds made of manufactured products such as plastic/rubber liners or reinforced embankments utilising concrete may have steeper gradients. However, care must be taken so that the steepness does not create access and maintenance issues.

Walkways to any drainage outlet structures (for example, penstocks and monks) enable efficient control of the boards, screens and valves, as well as being ideal sites for observing and feeding stock and monitoring water quality.

ASS should not be used in pond bank construction. If no alternative is available, consult the ASS Manual to ensure that the long-term use of the ponds and surrounding environments is not jeopardised.

Be aware!

The construction on and disturbance of ASS would constitute a 'high risk' option, requiring a high level of assessment and approval.

Earthen pond banks, batters and backfill should be covered with stockpiled topsoil and planted with grasses to ensure stability and prevent erosion. In some circumstances (highly erodable soils, or with some water circulation/aeration systems), a pond bank liner should be used. Any embankment at the water inlet should be fortified to prevent erosion. Animals (cattle, horses and to a lesser extent sheep and goats) grazing the banks may lead to bank degradation, and increase turbidity and eutrophication.

6.12.6. Pond water inlet

PREFERRED DESIGN
Inlet pipes that allow the largest pond to be filled within 24 hours or less for 1-2 metre deep ponds.

Water inlets, other than bore water, must be screened to prevent the entry of fish and undesirable aquatic fauna. Where there is likely to be poor water quality or restricted access to water supply because of seasonal variations in flows, it is good practice for the farm to include a storage system of high quality water.

Each pond should have a separate water inlet and outlet of at least 150 mm in diameter depending on pond dimensions. Water supply reservoirs should be aerated and if topography permits piped by gravity to the individual ponds and buildings.

6.12.7. Pond water outlets

Ponds should be designed so that they can be drained individually, completely and rapidly. This will enable the removal of all stock, maintain inventories, dry-out, de-silt and re-shape bottoms and walls.

The water outlet (for example, monk, tower, penstock, gate or standpipe) is the most important feature for regulating the water levels and draining the pond. Outlets vary in construction and costs and should be screened to allow water passage during water exchange and rainfall whilst retaining stock.

Ponds using a monk as an outlet are usually 300 mm to 800 mm in width. There must be adequate space between the rear board and back wall of the monk to avoid restricting the drainage capacity of the pipeline. The drainage pipeline traversing the embankment should have an incline between 0.5% and 1.5%. If fish are to be externally harvested through the outlet pipe, pipes should be a minimum 300 mm diameter, the receiving sump should be at least 30

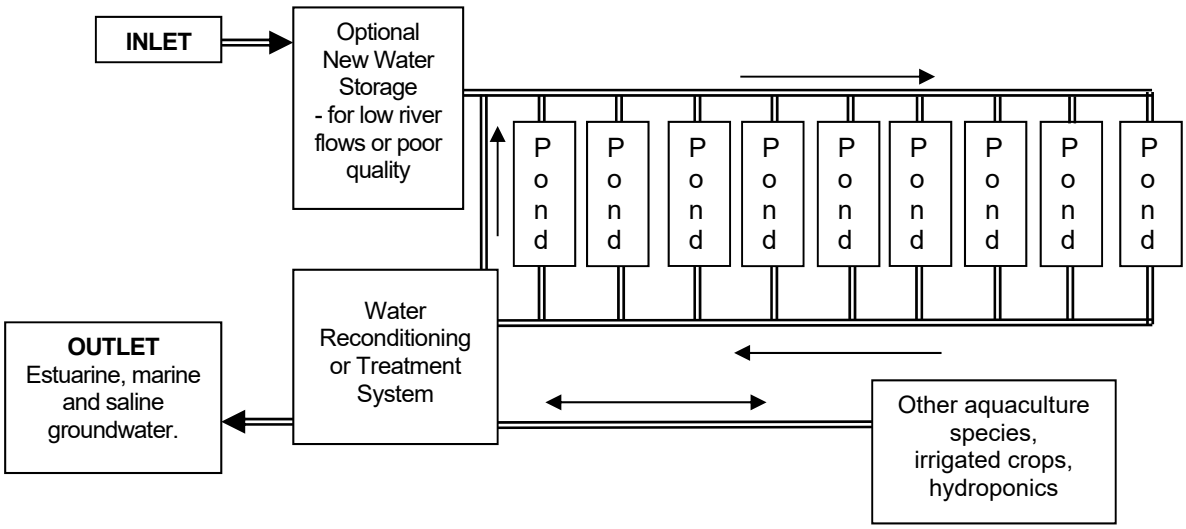
cm in depth and large enough to hold most of the fish. External drain harvest is most successful when harvesting small fingerlings and fry (for example, hatchery operations).

6.12.8. Circulation and drainage systems

Ponds should be sited to allow for efficient water reticulation. Main features include water supply facilities, storage dams, culture/growing ponds, discharge ponds and drainage lines. Reticulation systems should be designed to allow:

- culture pond discharge water to be retained in reconditioning ponds (to reduce suspended solids and to allow for appropriate treatment if necessary)
- ample capacity to recirculate the culture water on the farm or release/re-use the water in an appropriate manner (see Figure 5)
  Ability to isolate and quarantine individual ponds or production units for health management.

Figure 5: Water recirculation and reconditioning system



Site planning should include drainage earthworks:

- to protect the farm and ponds from excessive runoff drainage from surrounding land during storms or flooding
- to protect surrounding areas from run-off water from the farm.

For freshwater farms, site planning needs to provide for efficient use of reconditioned water following pond use. In some areas, it may be possible to provide discharge water to nearby irrigated agriculture, hydroponics or other water users. If on-site irrigation is proposed, the irrigation layout should consider land slope and relief, soil type, distance from natural creeks or drainage lines, location of pumping systems, irrigation reticulation systems and catch drains (if relevant). See Site Selection Chapter for further information on site and soil assessment for proposed irrigation areas.

For estuarine and marine farms, the discharge points need to be located to maximise the dispersal of the discharge water, minimise disturbance of marine vegetation or any oyster leases in the estuary and sited away from water intake points.

6.12.9. Fencing ponds and/or the farm

Ponds culturing freshwater crayfish and eels may require perimeter fencing to prevent stock from escaping. Properly constructed fencing can also help exclude water rats, turtles and eels from entering ponds, which are both nuisance predators for yabby farmers.

6.13. Pond water reticulation system

6.13.1. Water management as a resource

Reconditioning and recycling of culture pond discharge water should be part of standard environmental management practice for aquaculture farms. Any new or expanding existing farms should incorporate a reconditioning area and/or treatment systems so that water is re-used within the aquaculture farm.

Tip!

For estuarine and marine farms, a water recirculation system should include appropriate reconditioning areas to strip nutrients and suspended solids before reticulation or discharge.

6.13.2. Discharge to waterway

It is an offence under S.120 of the *Protection of the Environment Operations Act 1997* (POEO Act) to pollute waters. However, sections 121 and 122 of the Act provide a defence against a prosecution under S.120 where the pollution was regulated by a licence or regulation which was complied with fully. Schedule 1 of the POEO Act lists a broad range of activities that are regulated by environment protection licences, including some aquaculture activities involving a discharge to waterways.

It is an offence under S.216 of the *Fisheries Management Act 1994* to release (including permitting escape) fish into any waterway. Any intentional stocking of fish into NSW waters requires a permit under this same part.

It is NSW DPI policy that intensive freshwater aquaculture enterprises (except approved open (flow-through) systems) are not permitted to discharge water directly onto public or Crown roads, Crown land, neighbouring land (without landowner permission), rivers, creeks or natural wetlands or groundwater aquifers.

Open (flow through) systems and semi-closed systems using estuarine, marine and saline ground waters may be permitted to discharge to waterways subject to an environment protection licence issued by the EPA. S.45 of the POEO Act sets out the matters that the EPA must consider when making licensing decisions, such as in relation to issuing a licence. These matters include:

- The pollution caused or likely to be caused by the carrying out of the activity or work concerned and the likely impact of that pollution on the environment.
- The practical measures that could be taken to prevent, control, abate or mitigate that pollution, and to protect the environment from harm as a result of that pollution.
- The environmental values of water effected by an activity or work that causes, is likely to cause, or has caused water pollution, and the practical measures that could be taken to restore or maintain those environmental values.

Therefore, proposals involving a discharge to waters that would require an environment protection licence should be supported by a water quality impact assessment addressing these matters and prepared consistent with the NSW WQOs and *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* as this information will be needed by the EPA to

determine a licence application. This will also require extensive consideration by DPI Water in terms of water extraction, embargoes and water quality impacts on the river system. See *Operating the Farm* chapter for further information on discharge considerations and requirements. Culture water sourced from a saline interception scheme should be discharged back to the same scheme.

6.13.3. Discharge water reconditioning system

PREFERRED DESIGN
Freshwater reconditioning storage capacity of greater than two times the size of the largest culture/growout pond (except open systems and extensive systems).
For open freshwater (for approved species) or estuarine, marine and saline ground water semi-closed pond aquaculture, water treatment system to ensure discharge meets WQOs of receiving waters or licence requirements.

The capacity to recirculate water discharged from culture/growing ponds within a farm system relies on the pond discharge water being appropriately reconditioned.

Saline ground water discharged from a farm into a saline interception scheme may require treatment in accordance with any conditions applied by the scheme managers.

Open aquaculture farms may have filtering and a water treatment system to reduce impacts on water quality in receiving waters. They may require other design features in accordance with any conditions of an environment protection licence issued by the EPA regarding the management of the discharged water

If using sedimentation basins as a water treatment system, the two most important factors determining efficiency are *retention time* and *pond geometry*. The four main features are an inlet zone (water is dispersed across the full width of the basin); settling zone; bottom zone (settled particles accumulate as sludge) and; outlet zone (wastewater is drawn and/or discharged). Ideally, the length to width ratio of sedimentation basins should be at least 4:1 and preferably 8:1 with the long side set transversely to prevailing winds. This arrangement helps achieve uniform horizontal and vertical mixing throughout the depth and breadth of the basin and hence good deposition of suspended particles.

A reconditioning area or any channel systems should have the ability to be completely drained and maintained for de-silting and re-shaping.

6.13.4. Use of reconditioned freshwater

Efficient use of water is a management goal on aquaculture farms. You should consider establishing an integrated aquaculture/agriculture system with the reconditioned freshwater water used for hydroponics or agricultural crops, preferably substituting for raw water. It may be possible to pass on or on-sell to a neighbouring water user.

6.13.5. Use of reconditioned saline water (estuarine, marine or saline groundwater)

In some saline water aquaculture systems overseas, the water is used by species such as fish, filter-feeding organisms, and seaweeds prior to the water passing through mangroves or wetlands into the natural system.

PREFERRED DESIGN
Disposal of saline groundwater via piping or channels lined with impervious liner to a saline groundwater interception and evaporation scheme, on-site evaporation facility or reinjection to a saline aquifer.

The use of saline groundwater will require the design of evaporation ponds if discharge water cannot be sent directly to a saline groundwater interception and evaporation scheme, or reinjected into an aquifer or discharged to the sea or an estuary.

6.13.6. Pre-market conditioning facilities

Some species require pre-market conditioning (purging) in clean water for 3 to 14 days to improve the product taste. Some algae and bacteria produce off-flavours in pond and tank aquaculture systems. Taste testing the product will determine the presence of any off-flavours. The design of pre-market conditioning systems should include:

- fibreglass or plastic tanks
- clean water, free of algae and off flavour compounds (for example, underground bore or spring, rainwater or domestic (dechlorinated)
- the ability to exchange water and provide good aeration.

6.14. Predator management

During the site selection process, you need to evaluate the extent of any predatory bird activity in the area. In addition to cormorants, nuisance predators may include water rats, night herons and pelicans. In addition to impacts from predation, these fish eating animals are an additional pathway for the spread of pests and diseases.

6.14.1. Avian predators

PREFERRED DESIGN
Netting of fingerling ponds and deterrent system for other ponds.

Pond aquaculture needs to be designed to minimise losses to predator birds. Ponds require daily checking, particularly at dawn when birds often visit. Methods could include:

- deterring the birds from gathering around the farm (for example, removing dead roosting trees)
- deterring the birds from entering the water (for example, pond netting, deterrent wires, drones, lighting, regular checking, activity around ponds).

6.14.2. Exclusion and partial exclusion netting

Total exclusion netting is costly but may be a requirement at some sites. Netting design can be at the water surface level using props of wire or timber, waist level using perimeter fencing and cross-wires as support; or elevated (approximately 4 metres) using a grid of poles and tension cables.

Other systems include nylon scare line set 300 millimetres apart and running in two directions across the pond.

6.14.3. Fright methods for avian predator control

Fright devices (for example, gas guns) used to manage predator birds can have noise implications and should be avoided if residences are nearby. Discussions should be held with neighbours and the council to determine if acceptable protocols can be developed for the use of

noisy scare devices. The neighbours should be informed of the likely frequency of use, the times of the day and season to be used, the loudness and likely effect on the birds.

'Fright' methods (see Table 5) utilising gas guns or scarecrows tend to have limited or short term success and should not be considered as the first line of defence. Surveillance (often a person on a motor bike doing 'rounds') coupled with a number of fright mechanisms seems to offer the best solution.

Table 5: Summary of some fright methods

Lighting	This could include movement or randomly activated lights or laser type lighting that flashes across an area.
Drone	Drones can be used to simulate flying birds of prey and may be programmed to have variable flight patterns around the farm.
Birdfrite	Cartridges are fired from shotguns or pistols that explode in the air. When fired at random and aimed at the flock it is likely to be more effective.
Birdscare, Bird Deter or recorded calls	Various commercial machines have been developed which generate distress calls of target species, which are turned on and off at random or in response to the presence of birds. Devices that emit more random noises, or respond to movement are likely to be more effective as birds do become familiar with the device.
Water bird effigies	Life size models of birds which can simulate a bird in distress in combination with birdscare calls can be effective for a time.
Chemicals	The use of chemicals around the ponds is not recommended.
Hawk kites & silhouettes or Scarecrow	When the wind is favourable, the flying of simulated birds of prey can be effective. The approach is labour intensive and effective for a short time and like scarecrows need to be moved around to remain effective. Otherwise the birds become familiar with them.
Dogs	Some breeds of dogs can be trained to deter birds. Dogs which will also swim can be quite effective.
Motor bikes or vehicles	Regular monitoring of ponds at dawn and dusk is the most effective deterrent but is labour intensive.
Gas guns	Emit regular loud bangs; birds can become familiar with it.

Predator birds, particularly cormorants, can lead to significant fish losses. Research has shown uncontrolled bird predation can lead to complete loss of fish in unprotected ponds. The daily presence of any predators causes stock stress, disease, poor feeding and subsequently lower productivity.

6.14.4. Summary of potential risks

Great Cormorant

The Great Cormorant (*Phalacrocorax carbo)* occurs in most areas of NSW, breeding along rivers and lakes in the Murray Darling and some coastal rivers of NSW. They congregate in significant numbers at breeding locations and can travel considerable distances in search of suitable feeding habitats. Estuaries can support cormorants year round, with the numbers boosted significantly during droughts.

Great Cormorants are sociable feeding birds, their diet being mainly freshwater fish supplemented by crustacean, salt-water fish, frogs and insects. They principally feed in daylight but have been observed feeding at night. They are capable of taking fish up to 1kg with a daily intake of a breeding bird of around 750 grams and can make significant impacts on the stock in a short period if unchecked.

Risk: Significant risk, visitation at dawn and dusk and ability to take large numbers of large fish.

Little Black Cormorant
The Little Black Cormorant's (*Phalacrocorax sulcirostris)* distribution is similar to the Great Cormorant. During summer and autumn they tend to congregate in colonies of up to 100 birds in breeding localities such as swamps, lakes and along rivers but tend to disperse during other times. Drought will increase the numbers in coastal areas. The Little Black Cormorant feeds socially taking fresh and salt water fish, crustacea and insects. They tend to take smaller slow swimming fish but because of their abundance in NSW, they have significant impacts on aquaculture farms.

Risk: Significant risk; unprotected fingerling ponds most vulnerable; can hunt in large numbers.

Pied Cormorant
The Pied Cormorant (*Phalacrocorax varius*) occurs sporadically in NSW. They tend to breed in colonies during autumn and winter in estuarine areas. They feed principally on fish but also take crustacea and molluscs. Because of their size, they are capable of taking quite large fish but are less of a problem compared with the Great Cormorant.

Risk: Less of a risk because of their lower numbers.

Little Pied Cormorant
The Little Pied Cormorant (*Phalacrocorax melanoleucos)* is widespread and most common of the cormorants along most of the rivers, lagoons and swamps of NSW. Colonies may include as many as 4000 birds. These Cormorants tend to be solitary feeders mainly on freshwater crustacea, invertebrates or small slow moving fish up to about 90 millimetres in size. Generally, they are not considered to be a risk for fish farms but can be a major concern for yabby farms. They mainly take slower moving trash fish.

Risk: Low risk due to solitary behaviour; can become a problem for crustacean farms.

Darter
The Darter (*Anhinga melanogaster*) distribution is similar to other cormorants but is usually seen in low numbers but may form colonies of up to 100 birds. They can be nomadic with a sudden appearance at water bodies. Their main source of food is fish, small crustacea, molluscs and aquatic insects. Because of their size, it is expected that they will consume similar quantities of fish to the Great Cormorant. However, as they are solitary feeders, they are thought to pose less of a problem than the Great Cormorant.

Risk: Reasonable risk, can cause stress to stock and damage to cages.

Other potential problem birds
Nankeen Night Heron (usually at night) and White Faced Herons can be problematic for crustacea, larvae and smaller fish.

Water rats
Water rats can be a nuisance at some sites particularly east coast yabby farms. Water rats are very agile and are often capable of climbing low perimeter fencing.

Fish predators
Poorly designed screening of inlet water can allow the entry of 'trash' fish (including eels) into ponds. Trash fish compete for feed and harbour disease; some species are capable of causing physical damage to stock. Filtering water at the intake, the reservoir and at the pond can eliminate this problem.

Poaching
Poaching of aquaculture stock occurs irregularly particularly from perimeter ponds adjacent to public roads. Some sites may require gates and fencing to prevent access. Strategically placed movement detection lights may be an effective deterrent.

6.15. Construction of ponds and related facilities

It is strongly recommended that you invest in professional construction of ponds to avoid, costly maintenance caused by pond wall erosion, slump, leakage or failure. Leaking ponds (seepage) result in unnecessary cost due to additional water pumping and repair work.

The most common pond type is the 'excavated' pond in which earth is removed and used for building the banks and can be constructed on flat or undulating land. 'Levee' ponds are constructed on very flat land typically with imported material and are similar in structure to rice bays but have pond walls.

6.15.1. Soil material

The pond walls and floor should be constructed and/or lined with material capable of retaining water with hydraulic conductivity (for example, less than 10^{-9} metres/sec). Clay or clay/loam is preferable. In loamy soils, heavy compaction using rollers or bulldozers is required. Prior to construction, the proposed site should be surveyed for rock, gravel or sand layers at proposed pond depths. Ponds constructed in sandy or other porous soils may be made watertight by lining the bottom and sides with clay, using sealers or artificial liners. However, this is often expensive and the pond water quality, waste assimilation and ecosystem operate vastly different to earthen surfaces.

The construction of ponds in areas of high groundwater can be problematic as it may be difficult to build ponds that can be completely drained and dried at these sites. Ponds leaking saline water to groundwater pose contamination risks.

Seasonal conditions can affect construction and must be considered in the scheduling of work contracts. Wet weather can create difficulties with plant and equipment and add significantly to costs. Dry conditions will necessitate the application of water to maintain soil moisture during construction.

The main factors that contribute to pond failure are insufficient soil moisture, lack of compaction and the use of poor soil material.

6.15.2. Erosion and sediment controls

Disturbed areas should be kept to a minimum to reduce erosion during construction activities including problems associated with soil stockpiles, rehabilitation works or truck movements.

Measures to reduce erosion during construction and intercept mobile sediment should include silt fences, sediment traps and the use of straw bales. At some sites, it may be necessary to bund the construction site and soil stockpiles to prevent overland flows from entering the construction area. Measures should include:

- integrating clearing and grading with layout design
- limiting grading to areas involved in current construction activities
- limiting the time during which unprotected graded areas are exposed to the wind and rain
- subdividing drainage catchments into smaller units, at a size appropriate to the type of sediment control measure to be used

- trapping sediment as close to the source as possible, with sediment traps or filters below all disturbed areas to intercept and detain sediment laden runoff and above all prevent sediment entering environmental sensitive areas such as streams
- reducing runoff velocity by minimising the length of flow paths and constructing channels with gentle gradients, with rough linings to the steeper channels
- intercepting and diverting clean runoff water from flowing onto all disturbed areas, including soil stockpiles
- installing permanent stormwater drainage works as soon as possible
- applying temporary vegetation or mulch to all disturbed areas, including soil stockpiles, where construction is only partially completed and which will remain exposed for a period of 14 days or more
- progressively stabilising all disturbed areas either with permanent vegetation or mulch as each stage is completed.

6.15.3. Rehabilitation of the pond walls and disturbed areas

At the commencement of pond construction, topsoil should be stripped and stored for later use on pond walls, batters or in the rehabilitation of other disturbed areas. As soon as possible, pond walls, batters, backfilling and disturbed areas should be rehabilitated preferably with local native vegetation. All cleared vegetation should be mulched and used to help stabilise disturbed areas. This material should not be placed where it could enter streams during heavy rains or impede drainage.

Any disturbance to coastal or riparian zones including the bed or banks of rivers, estuaries or drainage lines should be stabilised and restored using native vegetation.

6.15.4. Contaminated soils

You may need to test previous agriculture sites for chemical residues (pesticide, herbicides, cattle dips). If present, it may be necessary to remove all the topsoil and not use it in the rehabilitation of the pond and batter walls. Leachate from contaminated soil into aquaculture ponds can cause water quality and long-term production problems. You should also consider the provisions *of SEPP 55 – Remediation of Land* and the *Contaminated Land Management Act 1997* where a site may be contaminated.

6.15.5. Acid sulfate soils

PREFERRED DESIGN
In a location where there is no ASS, or ASS Landform Class A with Landform Element class b, l, t, p, y or w. (ASS Risk Maps can be obtained from the DPIE).

The excavation or disturbance of ASS during construction of ponds, access roads or reticulation drains should be avoided. If the disturbance of ASS is unavoidable, then the construction must be undertaken in accordance with an approved environmental management plan that is consistent with the ASS Manual. Soil survey work will be required to identify the depth to the ASS and any likely 'hot spot' areas. All excavated ASS material should be treated in accordance with the ASS Manual.

Preloading of the site may be required, with hydrological analysis necessary to determine the effects of compaction on groundwater levels and the potential for discharge of acid.

Be aware!

Some ASS clays have the consistency of a gel with up to 70% water content; they have low load bearing capacity resulting in lateral movement or subsidence under load.

6.16. Tanks and related facilities

Tank aquaculture may be in open (flow through), semi-closed or closed systems. Semi-closed and closed farms may also utilise what is referred to as a recirculating aquaculture system (RAS). The tanks may be constructed from materials such as fibreglass, plastic, concrete, glass or metal and are usually situated either wholly or partly above ground. The technologies used in a RAS enable water to be reconditioned and recycled through the farm. The high rates of recycling, together with high stocking levels require sophisticated equipment to recondition the culture water for re-use. This equipment includes filtration such as a swirl separators, drum filters and settling tanks, oxygenation, ozonation or UV sterilisation units, pumps, de-gassing chambers, foam fractionators and bio-filters.

Tank aquaculture is generally undertaken in a purpose built farm, industrial or plastic covered shed to assist in controlling environmental factors. They typically have a concrete floor with an integrated drainage system. Tanks are successfully used to rear Murray Cod, Barramundi and ornamental fish.

The risk of loss in these systems increases proportionally with intensification due to the inherent dependence on life support technology. However, a closed tank aquaculture farm utilising RAS technologies is a secure facility providing protection to both the environment and the aquaculture farm.

6.16.1. General provisions

The advantages of tank aquaculture include control over stock (including non-endemic species), conservation of water, flexibility in site selection and extended growing seasons with temperature control.

However, tank aquaculture often has higher capital and operational costs and requires skilled technicians to manage the system. RAS often have:

- structurally sound sheds or buildings
- stock culture tanks (may include troughs/raceways)
- water pumps and drainage system
- recirculation system with mechanical filters to remove solids, biological filter systems to remove nitrogenous wastes; degassing towers; UV or ozone; temperature control
- laboratory and general workroom with tanks for holding, sorting, quarantining and treating fish
- handling/ packaging room for preparing stock for packaging and dispatch
- plant room(s) with backup generators
- store rooms for chemicals, feed, equipment
- office(s) and staff meeting room, toilet and washroom
- solid waste management facilities (filters, dead fish, packaging, solid waste)
- reconditioned water-holding tanks and disposal provisions if there is no trade waste agreement with council
- vehicular access.

6.16.2. The buildings/structures

The fundamental requirements for structures housing tank aquaculture are that they:

- use well-insulated material to maintain temperature
- have a concrete floor with high insulating properties and drains
- have cladding that is salt and water resistant
- are structurally sound and meet the functional needs of the proposal

- are well lit to control photoperiod and for workplace safety
- are cost effective to construct or convert and maintain
- have sufficient room surrounding the building(s) to handle waste water.

It is preferable that tank drainage lines are not enclosed in the floor concrete as routine cleaning and airing of drainage lines is important. It also allows easy access to all plumbing fixtures and allows for later modifications to the design if necessary.

Tank aquaculture systems can generate high humidity within buildings. Low humidity areas for office and feed storage are required. Electrical service to the site should be sufficient to accommodate immediate and future needs.

6.16.3. Recirculation aquaculture systems (RAS) components

1. Tanks
Generally, circular tanks allow for efficient water circulation and solids removal. However, rectangular tanks/troughs/raceways use floor space more efficiently. Fibreglass tanks have the advantage over concrete of reduced frictional loss, weight, manoeuvrability, wear, colour choice and may be cheaper.

2. Solids removal
The removal of settleable, suspended and fine solids is fundamental to the successful operation of RAS. Suspended solids and fine solids are the most difficult to remove. Equipment required to achieve this process include drum, screen, belt and bead filters, hydroclones, swirl separators and foam fractionators.

3. Biofiltration
The assimilation and breakdown of protein (from feed) generates ammonia. The biofilter is a 'living' filtration unit designed to convert ammonia to nitrite and then to nitrate by nitrifying bacteria (for example, *Nitrobacter* sp. and *Nitrosomonas* sp.) growing on high surface to volume ratio media.

4. Water disinfection
The high bacterial load in a RAS often necessitates the use of ozonation or UV sterilisation units.

5. Aeration
RAS require high stocking densities to operate profitably. High densities can adversely affect water quality and generally RAS require oxygen generators and/or carbon dioxide stripping devices to maintain water quality. Larger systems may incorporate automated pH control to prevent acid waters developing.

6.16.4. Discharged water reconditioning system

PREFERRED DESIGN
Freshwater closed tank aquaculture with tanks or ponds capable of storing greater than 2 times the volume of the largest culture/growout tank.

If storage ponds are used, then they should comply with the design features outlined in the pond chapter above.

6.16.5. Discharge water management

PREFERRED DESIGN
Open (flow through) freshwater (for approved species) or estuarine, marine or saline ground water tank aquaculture with screening to avoid escapement of stock and a water treatment system.

Open (flow through) tank aquaculture farms or semi-closed tank aquaculture farms using estuarine, marine or saline ground waters may require additional design features in accordance with any conditions of an environment protection licence issued by the EPA regarding the management of the discharged water.

In semi-closed tank aquaculture, the volume of discharged water tends to be relatively small (5 to 15% of culture tank volume/day). Therefore, in some land use zones (for example, industrial estates) waste water may be disposed of through the municipal sewage system under a trade waste agreement with the local council.

It is NSW DPI policy that freshwater tank aquaculture (except approved open (flow through) systems) are not permitted to discharge directly to natural waterbodies or wetlands. Discharged freshwater should be collected in a storage unit (tank or pond) prior to another use such as irrigated agriculture (see *Pond Water Reticulation System*). In land use zones where other uses may not be readily available (for example, industrial estate) freshwater may be discharged with approval to sewer.

6.17. Water inlets and outlets

PREFERRED DESIGN
Existing infrastructure to carry inlet and outlet pipe for estuarine or marine water based farms (for example, wharf).

The location of marine inlet and outlet systems is critical from an engineering perspective, particularly in areas exposed to high energy waves and currents. Pipelines traversing sandy beaches must be designed to ensure they are not affected by coastal storms and erosion. Existing infrastructure (for example, piers) or use of existing bedrock for anchoring the pipeline is another option. Amenity issues will be considered in any application by Crown Lands.

In freshwater open (flow through) production systems, place the inlet and outlet points to prevent dramatic modification to stream levels and flows, taking account of the large volumes of water required.

Be aware!

The use of freshwater for open systems will require extensive consideration by DPI Water, the EPA and EES in terms of water extraction, embargoes and managing potential impacts of discharges on waterways (See Operating the Farm chapter for further information).

6.18. Hatcheries

Hatcheries are facilities where seed stock (fry, spat) is produced for use in aquaculture and stock enhancement of waterways (See Species Selection chapter). Hatchery facilities include specialised buildings having tanks, incubators, laboratories, live food rearing systems, offices, and earthen ponds. Hatcheries may be stand alone facilities or integrated with a growout aquaculture farm.

Hatcheries require a high degree of technical knowledge involving broodstock conditioning, egg incubation, larval rearing, live feed production and nursery management.

6.18.1. Hatchery water management systems

With an integrated hatchery/aquaculture farm, it is recommended that the hatchery water reconditioning system be kept separate from the farm's system.

Generally, nutrient loading from hatcheries is relatively minor due to a small biomass, low levels of feed input and regular de-stocking to growout farms. However, freshwater hatcheries are still not permitted to discharge to natural waterways or wetlands except for approved open systems which would be evaluated and licenced by DPI Water and the EPA.

Estuarine, marine and saline ground waters based hatchery discharge will be considered on a case by case basis, however, systems should be designed to contribute to maintaining or restoring environmental values of the receiving waterways. A licence issued by DPI Water and an environment protection licence issued by the EPA may be required to discharge waste water to waterways from these facilities.

6.18.2. Hatchery Quality Assurance Scheme (HQAS)

NSW DPI has developed a Hatchery Quality Assurance Scheme (HQAS) that describes the key features of the design and operation of fish hatcheries. The program provides a framework for best practice. Consult the HQAS when developing an aquaculture project plan that includes a hatchery facility.

The HQAS accredits fish hatcheries for the production of Murray Cod, Golden Perch, Silver Perch and Australian Bass fingerlings for recreational fishing enhancement stocking programs. It is planned to expand the HQAS to cover marine species. The scheme is a component of the NSW DPI Fisheries Management Strategy (FMS) for fish stocking and was developed by NSW DPI Aquaculture and Recreational Fishing Staff with industry consultation and input.

A major objective of stocking programs is to maintain genetic diversity and the HQAS is designed to ensure the genetic integrity and health of consignments as well as the absence of non-target species. Hatcheries in NSW that produce fingerlings for stocking under the FMS, must be accredited under the scheme.

HQAS accreditation for aquaculture production is also available for Murray Cod, Silver Perch, Golden Perch and Australian Bass as a quality assurance measure for the production of fingerlings to supply the aquaculture industry.

6.19. Tourist destination

There is community interest in visiting aquaculture facilities and buying produce directly from the growers. Visits provide an opportunity for the industry to showcase the sustainability of the aquaculture industry and for the broader community to develop an increased understanding of aquaculture operations.

An aquaculture business can include visitor facilities having displays explaining life cycles, operational procedures, farm design or tanks holding live product. Tourism facilities should include toilet facilities, tables and designated car parking. It is advisable to contact local tourism authorities for assistance. You should also consider confirming with your local council that the type of tourism activities you are considering are permissible on the land and include details of these uses in your DA. The farm's biosecurity plan will detail any risks associated with tourist entry to an aquaculture farm. Fish maintained in an aquarium for public display, may require a

permit under the *Exhibited Animals Protection Act 1986*.

6.20. Fish-out facility

A fish-out is a business where anglers pay to fish in private ponds or tanks. The fish-out may be associated with accommodation developments or located in close proximity to urban areas and in rural settings. Intensive fish-outs are similar to an aquaculture culture/growout facility that has relatively high stocking levels and aeration to ensure high catch rates and to maintain good water quality and healthy stock. Extensive (no feeding) fish-outs also offer quality recreational fishing experiences.

Fishouts must provide fishing tackle as anglers using their own tackle could introduce disease to the facility. Anglers visiting NSW fish-outs do not require a NSW recreational fishing licence. Bag and size limits do not apply to fish-outs, but the operator must supply the angler with a 'record' of the fish taken (date, number, size, combined weight by species and location of fish-out). This is to prove the fish was not been taken from the wild.

6.21. Waste management

PREFERRED DESIGN
Site design should provide for daily disposal of organic wastes (material held so not to generate odour or other issues) and the disposal method does not affect groundwater or the local amenity. Site management should focus on reduced packaging, re-using materials and recycling waste.

Design the aquaculture farm to minimise waste and maximise re-use and recycling of materials at every opportunity. This includes:

- Pond and processing water.
- Pond sludge and filter materials.
- Processing wastes and dead fish.
- Packaging material.

Adequate facilities should be included in the design for the safe and efficient management of all wastes, especially organic material. The short-term storage of waste on site or its permanent disposal can lead to odour and vermin issues that can evolve into amenity and health issues. Any proposal that includes the on-site disposal of waste, in particular organic waste, must consider the potential impacts on nearby residences or for contamination of surface or ground water. It is also important to identify suitable locations for disposal of large numbers of stock in the unfortunate situation of a mass mortality event. These locations may be the local refuse depot or composter. For farms that are regulated by an environment protection licence, waste must be managed consistent with the conditions of that licence.

DPI Fisheries is part of a whole of NSW government initiative to change the way we produce, assemble, sell and use products to minimise waste and to reduce our environmental impact. The whole-of-government initiative provides a long-term strategic focus where communities, industry and all levels of government are working together to build resilient services and markets for waste resources. The approach promotes valuing resources by keeping products and materials in use for as long as possible. This approach will benefit business by maximising the use of valuable resources, and by contributing to innovation, growth and job creation. The basic principles promoted by the NSW government includes:

- Using resources sustainably - choosing recycled products to reduce demand for finite natural resources and minimise environmental impacts from extraction and processing of raw materials

- Minimising inefficient use of raw materials and recognising the value of resources throughout multiple cycles of use and re-use
- Choosing products designed for longevity - re-use, recycled and resource recovery
- Choosing products that provide value - repairability and recyclability
- Encouraging solutions for resource efficiency - supporting innovative technologies that preference higher value re-use opportunities
- Create jobs in new manufacturing, service and resource recovery sectors associated with recycling, re-use, re-manufacturing and increased services
- Encourage behaviour change through education and engagement.

7. Operating the farm

7.1. Business management

Be aware!

A land based aquaculture farm must operate in accordance with any development consent conditions for the farm.

7.1.1. Annual production goals, products, markets

A business plan is a living document that should be prepared and reviewed regularly as the business evolves (see Business Planning chapter) and when major events occur, change of species, technology, production rates or management is proposed. The enterprise's progress and operation should be checked against the plan.

7.1.2. Personnel management and training

PREFERRED MANAGEMENT
Staff trained in water quality monitoring, husbandry practices, water management, disease management and emergency response.

Experienced staff are essential in the operation of an aquaculture business. All new and existing staff must be aware of the need for the aquaculture enterprise to operate in an environmentally sustainable manner. They need specific training in biosecurity, water quality management and correct husbandry procedures. Training should include:

- stock management, health and welfare
- product quality control post-harvest, quality assurance and food safety
- pond/tank water management procedures
- familiarisation with discharge permit, chemical approvals and licence conditions
- commitment to waste prevention and energy conservation
- contingency and management procedures
- the importance of monitoring and reporting.

Aquaculture courses exist at both tertiary and TAFE levels and training should include Occupational Health and Safety (including first aid, chemical use and machinery operation).

7.2. Species management

Only those species authorised by an Aquaculture Permit issued by NSW DPI can be cultured on the aquaculture farm. Also, certain species sourced from interstate are required to fulfil specific biosecurity and translocation protocols prior to stocking a farm.

Before fish are introduced to the culture environment, conditions should be favourable for survival and growth. Check water quality variables including temperature, salinity, pH, dissolved oxygen, ammonia, nitrite and alkalinity. Exclude potential predators. Stock containment practices must ensure that no farmed stock is released into the environment.

7.2.1. Stocking densities

Stocking density has a significant effect on the performance of aquatic animals. It influences behaviour, feeding patterns, incidence of disease, water quality and growth. Generally, stocking densities are much higher in tank aquaculture compared to pond aquaculture. To calculate an appropriate stocking density, consider:

- Species.
- Culture system.
- Production strategies including life stages.
- Operator's skills and management systems.

7.2.2. Avoid stress

Aquatic animals are very prone to stress that may occur during handling (for example, grading, harvesting, transferring between ponds and under transport), heavy predation (for example, cormorants), during chemical treatments, poor water quality, malnourishment or overcrowding events. Stress will reduce growth, elevate FCRs, cause disease, lessen marketability and impact on the success of an aquaculture business. Good husbandry techniques to help stress prevention include:

- Maintaining good water quality.
- Optimum stocking rates.
- Quarantining of stock entering the farm and following handling.
- Use of high quality appropriately stored feeds.
- Regular monitoring of water quality and disease; prompt application of chemical treatments.
- Implementation of disease preventative measures (for example, Filtration, use of bore water, disinfection).
- Biosecurity protocols that limit access to operative areas of the farm.

7.2.3. Health management

PREFERRED MANAGEMENT
Staff aware of the farm's biosecurity plan and emergency response arrangements, trained with appropriate equipment to monitor water quality and disease; quarantining facilities available.

Good aquaculture practices minimise stress and reduce disease risk in cultured animals. Initially, the purchase of certified pathogen free stock is advisable; new stock is a common pathway for disease transmission to farms. Quarantine and treat all new stock, including broodstock, prophylactically prior to stocking.

Most species are susceptible to disease under intensive and semi-intensive culture conditions. The interactions that cause disease outbreaks relate to the following three key components:

- The presence of a pathogen.
- The host (the cultured organism).
- The environment (water, pond, tanks, feed).

7.3. Disease prevention and management

7.3.1. Disease prevention

Many pathogens already exist in the culture environment and it is when an adverse environmental change occurs (for example, stress, poor water quality, over-crowding, poor husbandry practices) the disease manifests. Disease on farms has a significant impact on

production with the loss of stock and productivity, costs for chemical treatments and disruption of farm processes and staff. Disease in hatcheries can be a particular problem as it can affect the hatchery itself (loss of income) and any growout farms or programs reliant upon the hatchery stock.

Disease specific prevention programs will minimise the risk of disease outbreaks occurring. Disease can enter a farm via new stock, water exchanges (especially surface waters), borrowed equipment and visiting vehicles, personnel or animals. It is often costly and difficult to rid a farm of disease therefore it is advisable to take all precautionary measures. Equipment and operator transfer between tanks/ponds is a common way of spreading infectious agents once on the farm. Nets and boots should be sterilised using baths (chlorine/iodine) and sun dried. An ability to isolate water movement on farm is critical when disease is suspected to prevent spread whilst investigation is underway.

For more information and useful tools for preventing disease in your facility see “Biosecurity Planning” on the NSW DPI website at: https://www.dpi.nsw.gov.au/fishing/aquatic-biosecurity/aquaculture/biosecurity-planning.

7.3.2. Disease management

Australia is fortunate in being free of many of the major diseases impacting on overseas aquaculture. In NSW high risk diseases, regardless of whether present in other parts of Australia are listed as a prohibited matter under Schedule 2 of the *Biosecurity Act 2015*. Those diseases that are either less of a disease risk by comparison, or are already known to be present and unable to be contained within NSW, are listed as a notifiable matter under the Biosecurity Regulation 2017.

For suspected prohibited or notifiable matters, phone the 24 hour Emergency Animal Disease Hotline on **1800 675 888**. It is an aquaculture permit condition that the permit holder must notify an Authorised Officer (Fisheries Officer/Biosecurity Officer) as soon as practical, and no later than 24 hours from the observation or discovery of any suspected listed disease of aquatic animals or marine vegetation, or unexplained or unusual significant fish or marine vegetation mortality event. It is extremely important to act early where disease is suspected.

It is important to monitor your biosecurity plan to help diagnose, treat and manage disease. A disease monitoring protocol should include routine monitoring of stock behaviour and feeding activity, monitoring of water quality, disease and disease management. Priority should be given to ponds or tanks having:

- high biomass or high feeding rates, particularly during summer months
- episodes of poor or changed water quality
- signs of moribund stock, mortalities or poor feeding responses
- stock behaving abnormally (including stock that has not been sighted for a few days).

New ventures need to plan for disease management within their biosecurity plan. Approaches may include:

- Protocols in place to submit disease samples to a diagnostic laboratory and a veterinarian.
- Appropriate training of staff in disease recognition and treatment.
- Clear quarantine procedures and processes of notification – including reports of suspected pests and diseases to NSW DPI on 1800 675 888.

Most disease management can occur on-farm. The tools required to do this (water quality meters, dissection kit, microscope and references) are an essential component of any aquaculture operation.

Some disease profiles

Freshwater crayfish
Thelohania 'white tail disease'; protozoan, microsporidian; commensals, rotifers, platyhelminthes (*Temnocephala spp*).other protozoans, some records of nematodes, cestodes, polychaetes and arachnids found on Australian crayfish.

Freshwater native fishes
Ecto-parasitic protozoans common, myxosporeans, ect-commensals, gill flukes and copepods, fungal (*Saprolegniosis*) and less common, bacterial diseases

Trout
Temperature stress, bacterial diseases (*Streptococcus spp*); common parasites as for freshwater native fish, viral diseases, Epizootic Haematopoietic Necrosis Virus (EHNV).

Barramundi
As for freshwater native fish particularly ecto-parasitic diseases; barramundi restricted to tank (RAS) systems in NSW, bacterial diseases (*Streptococcus, Mycobacteriosis*) can be problematic, barramundi potential carrier of Barramundi nervous necrosis virus (BNNV), has potential to affect native endemic species.

The document "*Diagnosis, treatment & prevention of diseases of the Australian freshwater fish Silver perch"* on the NSW DPI website contains a number of useful disease diagnostic tools and management procedures that can be applied to other species. The Federal government has also prepared the *"Aquatic Animal Diseases Significant to Australia: Identification Field Guide"*, which is also available as an app. This and other resources can be found on the NSW DPI website.

Be aware!

Note: if you observe or discover any suspected listed disease of aquatic animals or marine vegetation, unexplained or unusual significant fish or marine vegetation mortality event in the area, within which a permit holder is authorised to undertake aquaculture, it must be reported to NSW DPI within 24 hours. Call the Emergency Animal Disease hotline on **1800 675 888**.

7.3.3. Therapeutants and chemicals

At times, it will be necessary to apply therapeutants to treat stock for diseases and parasites.

No aquaculture therapeutants should be used unless approved for use by the Australian Pesticides and Veterinary Medicines Authority (APVMA) or a veterinary script is obtained. They should be used in accordance with the manufacturer's instructions as outlined on labels or permits, veterinarian directions and relevant state and federal legislation. Aquaculturalists should maintain accurate records regarding the use of chemicals. Any withholding periods stated on the labels/permits must be adhered to prior to sale for human consumption.

7.3.4. Aquatic predator management

PREFERRED MANAGEMENT
Screening/filtering on intake of surface water, regular drying of storages, ponds and channels and exclusion netting or deterrent systems.

Predator management should be considered as part of the biosecurity plan as predators can cause stress and disease in stock. Screening of intake water and outlet structures, regular drying of ponds/storages and removal of mortalities is recommended. Predatory birds should be

deterred by using netting, overhead wires, deterrent systems and staff patrols (See Planning and Design chapter).

7.3.5. Avian predator management

Licenses to control native avian predators
It is illegal to harm native animal species unless a licence to control predatory birds has been granted by EES. Licences issued by EES under S.121 of the *National Parks & Wildlife Act 1974* are considered an extreme measure for managing bird predation. Also, Commonwealth approval may be required ('migratory species of interest' under the EPBC Act) to harm some bird species. (see Integrated Approvals chapter).

Be aware!

Killing cormorants or other native birds or animals (for example, water rats) is an offence. Aquaculturalists should not rely on EES continuing to issue licences to control predators.

If the birds are listed under the *Biodiversity Conservation Act 2016*, applications for licences to harm these species will require a detailed level of assessment. As a general rule, EES is not likely to issue a licence to 'lethally harm' threatened species.

7.4. Feed management

Tip!

A system that delivers feed at optimum levels will promote maximum growth and feed conversion, prevent disease, maintain water quality and results in the lowest cost of production.

Feeds and feeding are usually a major component of total operating costs of aquaculture operations. Improvements in feeding strategies (that is, feeding frequency, feeding rates and delivery methods) can significantly improve farm profitability. The goal is to feed efficiently using a diet that will produce rapid growth, best food conversion efficiency for the least cost.

Feed is the major contributor to pond/tank water quality deterioration. To minimise feed waste managers should:

- regularly sample stock for growth and biomass; grade stock, adjust rations and pellet sizes as the stock grows. over feeding causes poor water quality and wastage; underfeeding will result in poor growth
- use high quality feeds meeting the species nutritional requirements (for example, for protein and essential amino acids, digestible energy, total fat and essential fatty acids, trace minerals and vitamins)
- store feed in a rodent proof, low humidity, cool room
- regularly check feed for contaminants and signs of deterioration such as mould or rancidity
- suspend feeding when water quality or disease problems are suspected.

The rate of delivery of feed is as important as the ration amount to prevent wastage.

7.5. Harvest management

Incorrect harvest procedures can cause fish stress and injury that will adversely affect product quality, marketability and the subsequent selling price. Harvesting methods might include the use of nets, traps, trawls or the draining of ponds/tanks.

Harvest procedures should minimise stress, even if animals are to be slaughtered. It is important to maintain water quality during harvest procedures; maintain aeration for example, use bottled oxygen when practicable. Design pre-harvest procedures to ensure:

- a planned approach is undertaken; avoid harvesting if water quality is poor, following feeding, when animals are diseased and during the heat of the day
- adherence to any therapeutic or chemical withholding periods and purge animals if required
- seafood is chilled internally (use a probe thermometer) and packed well in ice.

7.6. Animal welfare

Potential animal welfare concerns include activities associated with manual handling, the use of therapeutics (for example, anaesthetics), the confinement of stock to a designated area (for example, tanks, cages and culture apparatus), stocking densities, diseased stock disposal procedures, feed quality, harvest procedures and environmental conditions (for example, water quality and dissolved oxygen concentrations).

To mitigate potential animal welfare concerns, husbandry techniques and practices must comply with the *Australian Aquaculture Code of Conduct* which includes a number of guiding principles to achieve humane treatment of animals, including:

- Seeking the development of expertise in ecological sustainability and health management.
- Promoting maintenance of sustainable and efficient stocking densities.
- Addressing the biological and physical requirements of the cultured species.
- Encouraging the installation of anti-predator devices that exclude predators but do not cause injury.
- Maintaining good water quality.
- Seeking methods that reduce stress when transferring and harvesting stock.
- Endorsing humane slaughter methods, including stun guns and ice baths.
- Supporting the development of appropriate contingency plans to deal with the spread of diseases, parasites and other pathogens and unplanned releases of aquaculture stock.
- Encouraging the containment of diseased or infected stock and immediate reporting of any mass mortalities of stock or other environmental problems to the relevant agencies.
- Promoting the appropriate disposal of dead stock in a manner to ensure no diseases or pathogens are released into natural waterways.

Of particular importance is keeping stocking densities at a level that minimises stress to stock and regularly monitoring stock health to ensure early detection of disease, parasites or other health conditions that may arise. The expected outcome of harvesting aquaculture stock is that animals are treated humanely during all stages of the operation.

In NSW, the *Prevention of Cruelty to Animals Act 1979* applies to fish, including farmed fish. There are certain defences under S.24 of the Act that apply if fish are caught or captured, or if fish are being destroyed or prepared for destruction for producing food for human consumption, provided it is done in a manner that inflicts no unnecessary pain upon the animal. While there are no codes, standards or guidelines on fish welfare prescribed under POCTA, the Humane Harvesting of Fish and Crustaceans guidelines provide a guide for enforcement agencies when undertaking POCTA compliance and enforcement.

7.7. Comprehensive quality assurance systems

Establish a comprehensive Quality Assurance System to assure product quality. A number of accredited systems have been developed and these usually revolve around hazard analysis critical control point (HACCP) principles.

1. Determine what the hazards may be. 'Hazards' for the produce at the farm including pre-harvest, harvest and post harvest issues.
2. Identify the *Critical Control Points*. These are the important areas or stages where things may go wrong, so they are critical to eliminating the hazards (for example, product exposure to high temperatures following harvest).
3. Set the '*critical limits'* for each Critical Control Point. Again, these will vary from business to business, but an example could be a chiller temperature setting. Exceeding the critical limit will cause a problem.
4. Monitor the *Critical Control Points* to record whether the targets are being met and any problems can then be traced.
5. Establish corrective *Actions*. These are the actions taken when monitoring shows there is a problem.
6. Verify that the HACCP system is working correctly. It is all very well having an effective system, but it must be doing the job required. For example, this step might involve microbiological testing.
7. Keep an accurate record so those responsible can track trends to improve management decisions. Record keeping must be thorough. Regulators also need records for compliance and auditing purposes. Producers who have their quality systems accredited need comprehensive auditable records. Independent third party auditing proves to customers that the stated procedures are being followed.

Hazards may be introduced into any stage of the handling and distribution of fish products. Prevention relies on:

- attention to the design and construction of the premises
- equipment design
- water quality controls
- appropriate premarket conditioning protocols (if necessary for aesthetic or health reasons)
- pest/vector control programs
- cleaning control programs
- personnel hygiene and health awareness.

These practises are defined as good manufacturing practises and good handling practises. Of particular importance is the need to prevent cross contamination from raw to cooked product and the exclusive use of potable water and ice at all times. Automatic temperature controls are necessary for the maintenance of quality and in some cases is vital for ensuring food safety. Temperature control throughout the distribution chain, from harvest to retail, is an essential precaution.

7.8. NSW Food Authority issues

NSW Food Authority administers the *Food Act 2003*. The NSW Food Authority is responsible for food safety arrangements from catch or harvest to plate. The NSW Food Authority is progressively developing Food Safety Programs for food industry sectors in NSW.

7.8.1. Seafood businesses - NSW Food Authority licensing requirements

Seafood businesses in NSW are required to be licensed with the NSW Food Authority. Seafood businesses are defined under S.134 of the Food Regulation 2015.

There are heavy penalties for the operation of a seafood business without a NSW Food Authority licence with maximum fines of up to $275,000. To apply for a license you should contact the NSW Food Authority licensing branch on (02) 6552 3000 or go to the website for a licence application form.

7.8.2. The Food Standards Code

All food sold in Australia is required to meet the requirements of the Food Standards Code (the Code). Food that does not meet the requirements of the Code may be seized and destroyed. In addition the manufacturer of the food maybe prosecuted for non-compliance with the Code. The Code can be obtained from the Food Standards Australia New Zealand website.

The NSW Food Authority has adopted codes of practice that regulate the design and construction of seafood premises in addition to the food safety programs mentioned above which regulate the processing and storage of seafood.

As a part of its licensing and approval process, the NSW Food Authority assists businesses in the development of a Food Safety Program that complies with the Food Standards Code. Freezers, cool rooms, processing and packaging rooms must comply with certain design requirements in relation to floors, walls, ceilings, fittings and amenities. The NSW Food Authority can provide advice on the construction and fit out of these facilities to ensure compliance with the relevant standards. For further details call the NSW Food Authority information line on 1300 552 406 (local call Australia wide).

7.9. Farm preparation before stocking

7.9.1. Pond and Tanks

Preparation of ponds or tanks for stocking is a step undertaken following total harvest of the culture unit or initial construction and start up. In the case of all in/all out production regimes, this usually follows a farm dry-out, repair and maintenance phase.

A pond and tank preparation protocol should be developed with a timetable for activities such as maintenance, repair and reinstallation of all screens, aeration and filtration equipment, pumps and pond and tank structures. Pond preparation usually occurs at the completion of growout season or during cooler non-productive months.

7.9.2. Dry-out periods (ponds & tanks)

Generally, complete dry-out of the entire farm is favoured for some species, as this practice has shown to reduce disease incidence and result in higher production. At the completion of the growout cycle, the culture unit should be dried completely. For ponds a drying period can be completed in about one month under favourable weather conditions. Following the drying of ponds, the bed is usually tilled (5 to 10 centimetres) to ensure the oxidation of residual organic matter. Excess silt can be removed and pond walls repaired if necessary. Where soils are acidic, agricultural lime may be added. Calcium hydroxide ($Ca(OH)_2$) or calcium oxide (CaO) may be used to sterilise persistent damp patches.

7.9.3. Establishing optimal plankton populations for larvae/fry rearing stages (ponds)

Ponds with newly stocked larvae require microscopic animals (zooplankton) as a food source in order for them to survive. Zooplankton feeds upon phytoplankton (microscopic plants). The latter's growth is promoted by adding inorganic and organic fertilisers to the pond. This is often more an art than a science, individual farms having unique fertiliser regimes based on their climate, soil types and plankton response.

7.9.4. Recirculating aquaculture systems

Pre-activation of the recirculation systems biofilter to stimulate the colonisation of nitrifying bacteria can be accomplished by seeding with appropriate bacteria or fish may be stocked with a gradual increase in feed (over four to six weeks). Biofilters usually take a period of months before being fully colonised and stable. Therefore, caution should be used when first stocking a RAS.

7.10. Pond/tank water management

Intensive aquaculture involves the use of formulated feeds that result in elevated nutrient levels in the culture systems and effluents. The degree of management of water quality will depend upon the type of culture undertaken.

Feed input (which contains protein) can alter water quality by increasing turbidity (algae and suspended solids), ammonia, nitrite and nitrates. These processes can in turn, influence levels of dissolved oxygen (DO), pH, alkalinity, carbon dioxide, hydrogen sulfides and other parameters.

Pond aquaculture usually employs a 'static' water rearing method where water is required for initial filling and then only to replace evaporation, seepage and water exchanges. The pond environment usually assimilates wastes generated from feed input. Water quality is more problematic under summer conditions due to high feed inputs and elevated temperatures. However, an additional feature for pens within ponds is the use of aeration and water management strategies to better manage water rather than using the flow in/flow out method. Paddlewheels have traditionally been used for aeration, however venturi pumps and/or side channel blowers are also used now to provide targeted aeration and improve water quality toward eliminating the need for water flow out.

Water quality management is more intensive in a RAS than pond aquaculture. RAS require sophisticated life-support equipment to maintain water quality. This includes swirl separators, biofilters, other filter units, pH buffering systems and de-gassing chambers. All tank facilities operate under partial water exchange to replace water lost through backwashing, cleaning and husbandry processes. Daily water exchange could range from 5% to 25% depending upon the system design and operation.

7.10.1. Monitoring

PREFERRED MANAGEMENT
Provide for regular monitoring of DO, pH, temperature, ammonia, nitrite, nitrate and alkalinity.

Pond aquaculture should be monitored for water quality, DO, pH, temperature, total ammonia nitrogen (TAN), ammonia every day in summer. Tank aquaculture systems should be monitored for water quality daily (DO, ammonia, nitrite, nitrate, alkalinity, pH, salinity and temperature). Meters should be of high quality and calibrated regularly (once/week).

7.11. Reconditioned discharge water

NSW DPI Policy!

It is NSW DPI policy that intensive freshwater aquaculture farms are not permitted to directly discharge water to natural waterbodies or wetlands (exception for approved open (flow through) systems).

Be aware!

Aquaculture farms discharging water (for example, fresh, estuarine, marine or saline ground waters) to natural waterways may require an environment protection licence issued by the EPA under the *Protection of the Environment Operations Act 1997*. Discharge structures placed in, on or within 40 metres of a water source will require a controlled activity approval for their construction under the *Water Management Act 2000, the Fisheries Management Act 1994 and if relevant, the Marine Estate Management Act 2014*.

Land Based aquaculture systems should endeavour to recirculate as much water as possible. The management of the ecological processes within the reconditioning areas or tanks can significantly improve discharge water quality prior to its return to the culture unit, re-use system or the environment (if permitted).

Aquaculture farms that are permitted to discharge water to natural waterbodies must manage this water to ensure it complies with the conditions of the aquaculture permit, the development consent and environment protection licence.

Where oyster leases or major fishing grounds are located nearby, there may be additional requirements for protection of water quality for safe consumption of aquatic foods. In the event of a disease issue, NSW DPI may order the farm water to be quarantined with no discharge being permitted from the premises.

Freshwater that cannot be discharged to natural waterbodies or wetlands can be managed in the following ways:

- Retained in a discharge pond and recycled in the aquaculture enterprise.
- Discharged via town sewerage infrastructure (trade waste agreement).
- Stored and utilised for agriculture, hydroponics or horticulture.
- Disposed of by irrigation or evaporation.

7.11.1. Monitoring quantity and quality of discharge

EPA environment protection licences for aquaculture may include discharge concentration, volume and pollutant load limits and monitoring requirements for a range of parameters. Environment protection licences also include reporting requirements including annual compliance reporting.

7.11.2. Substituting raw water with discharge water

As part of an integrated freshwater aquaculture farming enterprise, horticultural or agricultural crops may utilise discharge water instead of raw water. Other uses on an aquaculture farm may include irrigation of landscaping or gardens. In some locations, it may be possible to transfer discharge water to neighbouring properties for irrigation use. Provision must be made to store discharge water during rainy periods. Discharge ponds should be constructed with plenty of leeway and runoff from surrounding land must not be captured. Land for irrigation should not be within 50 metres of a natural waterbody.

When irrigating with discharge water, the following factors should be considered:

- Soil characteristics (plant growth, permeability).
- Avoiding sloping land unless drip irrigation.
- Efficient application methods, metering/monitoring so not to over water.
- Adequate erosion management provisions.
- Avoiding land with salinity or potential salinity problems.

Under normal circumstances where water is used as a substitute for raw water, specific licence conditions for its use are not required.

7.11.3. Sludge management

Ponds should be dried regularly and de-silted. Removed silt/sludge can be used on-farm depending on the nature of the material. Sludge from tank aquaculture may be de-watered and disposed of:

- to a commercial composter
- in agriculture
- to landfill.

7.12. Managing other environmental issues

7.12.1. Noise

On farm noise sources such as those associated with construction, equipment for feeding, pumping, aeration, harvesting, maintenance and construction need to be managed, particularly if located near residential areas. Sound may travel at night due to the effects of temperature inversion, cloud cover and wind. Consequently, the responsibility is on the operator of the farm to ensure that noise impacts do not unreasonably affect neighbouring residents not only during the day but also evenings or weekends. EPA can provide information on the assessment and management of noise issues.

With all plant and equipment, every effort should be made to reduce the noise levels at the source, for example with fitted silencers, insulation, vegetated bund walls or maintenance programs. For farms needing a licence under the POEO Act, there is a requirement that all plant and equipment should be operated and maintained so as not to exceed the prescribed sound levels.

The use of noisy predator scare systems, sirens, PA systems, vehicle backing or other noisy devices that may be a noise nuisance should be minimised where possible.

7.12.2. Odour

Odour emissions from aquaculture facilities can be associated with drying ponds, storage of feeds and management of any dead stock or fish processing wastes.

Minimising impacts of odours should be considered in the farm layout (for example, feed storage area, equipment, waste, cleaning and maintenance depots) and during operational procedures (pond/tank dry-out procedures). Solid waste should be stored, transported and disposed of so as not to cause an odour nuisance, or disposed of according to consent conditions.

Sediment from ponds or sludge from tanks must be disposed of in a manner that will minimise odour or leachate problems. Do not disturb sediments in ponds until dry, when it can be either incorporated into the bed of the pond or removed. Sediment from tanks should be stored in a

designated storage area (within appropriate bunding or sediment trap to prevent sediment runoff to adjoining areas/waterways) prior to:

- spreading as top soil in appropriate crop or pasture areas
- transport to a commercial composter or landfill.

7.12.3. Dust

Dust can pose problems during construction stages and dry periods (see Planning and Design chapter). Appropriate surfacing of high volume traffic roads and vegetating wind exposed areas can minimise dust emissions. Until disturbed areas are stabilised, water and/or mulch should be used to control dust. It is recommended that neighbours be advised ahead of work schedules that are likely to generate dust.

7.12.4. Visual appearance

Neat and tidy operations, vegetative screen plantings, earth mounds and aesthetically placed and coloured building should be adopted. In rural environments, landscaping should be used to soften the impact of 'industrial' shed complexes including planting of native species along boundaries.

7.12.5. Energy and greenhouse issues

Energy efficiency initiatives can lead to benefits which extend beyond energy savings to include pollution prevention, process efficiencies and increased productivity. Farm operations should be designed to minimise energy usage (for example, gravity distribution of water) and use renewable energy technologies (solar or wind power) wherever possible.

In addition, consider energy conservation and cost reduction opportunities including:

- Monitoring annual and quarterly energy expenditure.
- Use energy efficient pumps and equipment and maintain equipment performance.
- Use of 'off-peak' energy.
- Identifying and rectifying actions or activities that waste energy or use energy inefficiently.

Aquaculture operators may also be able to minimise their greenhouse gas emissions by participation in programs run by state and Federal Governments.

7.12.6. Waste management

Waste management protocols should be developed to reduce and recycle waste and to store and dispose of waste material responsibly.

The POEO Act establishes a classification system for wastes, which is documented in the *Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes* (Waste Guidelines – EPA 1999). The obligations in respect of the management of wastes are based on their classification in accordance with the waste guidelines.

Table 6: Waste categories likely to be generated by aquaculture farms

Types of waste	Implications
Non-liquid inert waste *These types of waste are subject to minimal regulation*	

Virgin excavated natural material (VENM) for example, Clay, gravel, sand, soil or rock that has not been mixed with other waste. This category does not include chemical contaminated soils or ASS unless treated to meet criteria approved by EPA.	If material is to be brought onto the site for the construction of ponds, it should be clearly established that the material is from an approved quarry or meets the VENM classification. In addition, if there is excess material to be removed from site following pond construction, ensure that it is not mixed with other materials or waste, so it meets the VENM classification. If ASS is to be removed from site, ensure that it is treated in accordance with the ASS Manual (ASSMAC) prior to removal from site to neutralise/remove the acid generating potential.
Building and demolition waste not mixed with other wastes or containing asbestos	Preferably building waste should always be sorted into components (for example, Brick/concrete, glass, timber and metal) for re-use or recycling.
Packing and office waste (paper, plastics, glass, metal and timber) not mixed with other wastes.	Preferably these should be recycled. A major source of waste is the plastic or paper bags used to transport feed. Reductions in the use of feed as a result of efficient feeding management result in reduced waste generated or the supply of feed in bulk form.
Solid waste	
Food waste.	Should pursue options to recycle material (for example, fishmeal, compost). Otherwise dispose of to an approved landfill.
Cleaned pesticide, biocide, herbicide or fungicide containers (cleaned in according to AVCARE protocols).	Avcare Protocols require recycling of containers as a first option. For copies of the Avcare Container Management Strategy, contact: Avcare, Level 2, AMP Building, Hobart Place, Canberra, mail to Locked Bag 916, Canberra ACT 2601. Phone 02 6230 6399 Fax 02 6230 6355. Email: avcare@ozemail.com.au
Pond/tank sludge that does not contain heavy metals or hazardous chemicals.	The preferred use of the material is in compost mixes and/or incorporation into agricultural purposes. If these preferred uses are not available or inappropriate it is appropriate to send to an approved landfill site. Composting and agricultural use of sludge may not be appropriate for sludge from salt-water ponds/tanks.
Industrial waste	
Asbestos waste from old buildings or industrial plant.	Any asbestos should be managed in accordance with the requirements of Clause 29 of the Protection of the Environment Operations (Waste) Regulation 1996 and disposed at a lawful waste management facility.
Hazardous liquid or non-liquid waste	
Quarantine waste.	This material must be stored, handled, transported and pre-treated in accordance with the requirements of the Australian Quarantine and Inspection Service (AQIS) prior to disposal at a disposal facility approved by AQIS. It should be noted that most landfills are not licensed for disposal of quarantine waste.
Chemicals, pharmaceuticals and poisons.	If chemicals are not to be use, inquiries should be made with distributors about the possibility of returning the material. Alternatively inquiries could be made as to whether other users are interested in taking the material. As a last option, the *Assessment, Classification and*

	Management Guidelines should be followed regarding the safe disposal of the material.
Liquid wastes *other than hazardous above*	
Group A: Oils, solvents and solvent containing liquids.	Arrangements should be made with a contractor to remove these materials from the site preferably for re-use or recycling.
Group B: Liquid food waste or grease traps from food processing.	Arrangements should be made with a contractor to remove these materials from the site preferably for re-use or recycling.
Group C: Sewage – if on-site system.	Where connection to a reticulated sewerage system is not an option, on-site sewage treatment should be in accordance with the Guideline - –*On-Site Sewage Management for Single Households 1998*.

7.12.7. Contingency planning

A contingency plan should be established with specified management actions documented to deal with problems should they occur. Issues that should be dealt with in the plan include:

- Water quality incidents.
- Predators.
- Chemical spills.
- Fires, storms, flooding or other natural disasters.
- Dam/pond security.
- Power failure or mechanical failure of key equipment (especially important for tank aquaculture systems).

The contingency plan should include protocols which all staff should be made aware of including:

- Agreed indicators that suggest that there is likely to be a problem.
- A requirement to alert appropriate senior person in the company immediately.
- What actions will be taken should the conditions deteriorate.
- What actions should be taken in the event that problem results in environmental breaches occurring.
- What actions should be taken in the event that the problem results in a loss of stock.
- When the regulatory authority and others should be alerted.

Other issues that may need to be contained in the contingency plan include adaptation to climate change.

7.12.8. Climate Change

PREFERRED MANAGEMENT
Conscious and demonstrated choices to reduce the impact of the aquaculture operation on climate change.
Contribution to global warming and climate change arising from materials used in, or from the conduct of aquaculture operations, are first avoided or minimised wherever possible.

Proponents are expected to consider the overall impact of their operation on climate change and make every effort to align with NSW government policy on reducing global warming. This may include the following:

- The choice of manufacturer and/or materials used in manufacturing aquaculture operation infrastructure.
- Utilising fuel efficient, low emission equipment.

- Utilising best practice renewable energy.
- Reducing energy use.
- Reduce consumption, re-use materials and recycle waste.
- Minimise the number of transport trips.

7.12.9. Decommissioning an aquaculture facility

The objective of the NSW LBSAS is to ensure that aquaculture enterprises are established and operated in a sustainable manner. As a result, emphasis has been placed on the need for careful site selection, design, operation and business management.

In the advent of an aquaculture enterprise ceasing operations, the site should be secured and not generate unacceptable off-site environmental impacts or create an unsafe environment (for example, electrical infrastructure, chemical storage, building security).

Decommissioning works may include:

- Closure of water intake and outlet channels and removal of pipes/pumps from rivers/estuary
- Removal of any intake and discharge infrastructure placed in or adjacent to the estuary
- Stabilisation of disturbed riparian zones
- Stabilisation of ponds/dams
- Perimeter fencing
- Removal of predator netting.

7.12.10. Good neighbour policy

The establishment and maintenance of good public relations is essential for individual farms and reflects on the industry as a whole. Aquaculture, in part due to its novelty, attracts a large amount of community interest. It is important to recognise this interest and deal with it in a sensitive manner.

The NSW aquaculture industry is an integral part of many NSW communities. Aquaculture farming businesses not only generate economic benefits, but also make a positive and constructive contribution to the social fabric of these communities. Aquaculture farmers appreciate the wider social responsibilities of their businesses and aim to be recognised in their communities as good corporate citizens and environmentally responsible, professional primary producers.

Aquaculture farmers recognise that the land adjacent to their farm is either community owned public land or private land. In either case, this land is treated with respect and farming activities are conducted so as to minimise any existing and potential impact on this land.

Responsible NSW aquaculture farmers:

- Ascertain ownership of adjacent lands and liaise with these ‘neighbours’
- Recognise that Crown land or National Park is land owned and managed for the public good, and is not vacant land
- Acknowledge the responsibility that goes with the right of access to public waterways and infrastructure
- Operate so as not to interfere with the reasonable peace, comfort or privacy of neighbours
- Minimise noise
- Treat neighbours and the community cordially and with respect
- Actively participate in community forums
- Give preference to purchasing local products and employing local people

- Develop and maintain excellent relationships with their communities, building mutual trust and respect
- Acknowledge community concerns and co-operate with neighbours to resolve them
- Recognise that Aboriginal people may have occupied land adjacent to their farms
- Are committed to assessing and preserving the Aboriginal heritage values
- Encourage, where practical, opportunities to employ and/or train Aboriginal people in the aquaculture industry.

7.12.11. Right to Farm Policy

The NSW Government recognises the value of agriculture for growing food and fibre for domestic and international markets and is concerned about the potential loss or impaired use of land for primary production. Aquaculture is important to local, regional, and state economies and communities.

The NSW Government has developed a comprehensive, state-wide approach to deal with the issue of right to farm. The Right to Farm policy brings together a collection of actions including:

- reinforcing rights and responsibilities
- establishing a baseline and ongoing monitoring and evaluation of land use conflicts
- strengthening land use planning
- ensuring ongoing reviews of relevant environmental planning instruments include consideration of options to ensure best land use outcomes and to minimise conflicts
- improving education and awareness on management of land use conflicts
- considering potential future legislative options, should additional government intervention be required.

7.12.12. Tourism and the community

Consumers are increasingly concerned with the environmental credentials of food production and aquaculture enterprises can benefit from demonstrating its environmental credentials. The public should be dealt with openly and honestly even when things go wrong. It may be useful to seek advice in preparing a public relations management plan for promoting products as well as for dealing with routine enquiries and complaints. Active and transparent management of community relationships can pay long term dividends.

Making provision for the public to visit the facility either as part of a tourist visitor centre or as an active program (fish-out) can help establish an ‘open door’ approach to the broader community. This can help to promote aquaculture in the local economy as well as help promote the industry as a whole.

7.12.13. Complaints handling procedures

Aquaculture farms may be required to establish complaint handling protocols under their conditions of consent. Local councils should be informed of the procedures so that on receipt of any complaints they are able to redirect issues to the appropriate regulatory departments. The Complaints Handling Protocols may include:

- a contact number and a site contact person who manages complaints
- a complaints register including a record of the complainant, the date/time, the nature of the complaint
- proposed mitigation measures and follow up with the complainant
- any contingency measures when repeated complaints are received including provisions for additional monitoring and amelioration measures
- any compliance performance agreements with residents
- any reporting procedures to relevant government agencies or council.

It should be recorded if complaints originated from normal operational procedures, an 'incident' or occasional procedure:

- if from occasional procedures, discussions should be held with complainants regarding whether it was the timing or nature of the impact and how the impacts can be better managed. In many cases an agreement can be reached between parties regarding procedures, timetables, duration and intensity
- if it resulted from normal operation procedures, these procedures should be reviewed in discussion with the relevant approval authorities.

7.13. Integrated compliance monitoring and reporting

7.13.1. Monitoring

An Environmental Monitoring Program, if required under a development consent, should be carefully designed and related to the key environmental indicators that demonstrate the sustainability of the aquaculture farm. The program requirements will be provided by the consent authority.

7.13.2. Record keeping

Comprehensive record keeping is essential, not only as a requirement of licence and permit conditions, but as a fundamental tool in farm management and trouble shooting. A database for record keeping should be established for tracking both business and environmental performance.

From a business management point of view, data sets make analysis of expenditures, production levels, returns and environmental performance for sound future planning. In addition, the data is available for reporting to relevant government agencies on environmental performance. EPA usually requires records to be held for a minimum of 3 years so if necessary, the details of longitudinal trends can be checked.

7.13.3. Reporting

An annual report may be required under your development consent, aquaculture permit, environmental protection licence and any other approval. The report may include matters relating to stock management including translocation issues, disease management, sales and production.

EPA may require more regular reporting (for example, monthly or quarterly) for farms that hold an environment protection licence under the POEO Act to discharge water to natural waterbodies.

Incident reporting
Aquaculture operators are required to report incidents that are not authorised under an approval of the appropriate regulatory authority. Table 7 summarises some incidents and the response required.

Table 7: Incident reporting

Incidents	Authority	When
Disease outbreak or unusual stock behaviour	NSW DPI - Emergency Animal Disease hotline on **1800 675 888**	As soon as practicable but within 24 hours

Incidents involving breaches of quarantine or translocation protocols	NSW DPI - Emergency Animal Disease hotline on **1800 675 888**	Immediately and in not more than 24 hours
Incidents causing or likely to cause environmental harm whether on or off the premises which are not authorised under the approval (for example, chemical spills, accidental release of untreated water)	The EPA pollution line if appropriate regulatory authority or council	Immediately upon becoming aware of the incident
Dam safety or flooding issues	EES and local council	As soon as practicable
Incidents involving harm to birds or other native fauna which are not authorised under the approval	EES	Immediately and in not more than 24 hours
Bushfires	Fire authority and local council	Immediately

8. Assessment and Approvals

8.1. The strategy's assessment regime

The NSW LBSAS includes identification of appropriate aquaculture sites and a streamlined, risk-based approvals process. It is gazetted under the *State Environmental Planning Policy (Primary Production and Rural Development) 2019* (PPRD SEPP).

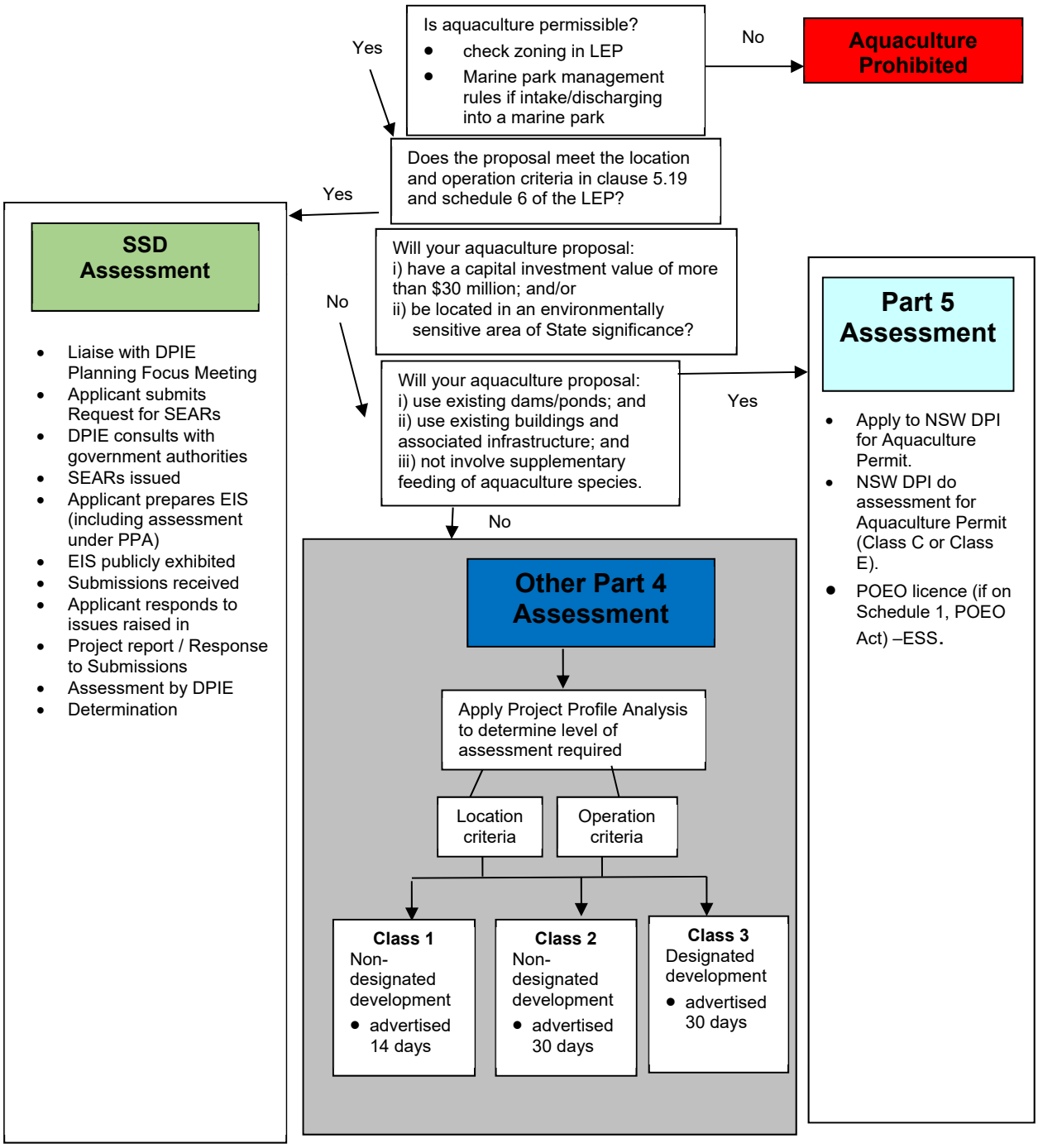
The PPRD SEPP replaced *State Environment Planning Policy No 62 - Sustainable Aquaculture* in February 2019. Some provisions from SEPP 62 were also transferred into the *Standard Instrument – Principal Local Environmental Plan* (Standard Instrument LEP) which must be incorporated into each council's standard LEP.

The NSW LBSAS also contains an AIDP, which is gazetted under the *Fisheries Management Act 1994*. The AIDP specifies best practice guidelines based on ESD principles.

This chapter outlines the planning assessment process under the *Environmental Planning and Assessment Act 1979* (EP&A Act) and includes information relating to:

- permissibility of land based aquaculture projects
- determining the type of application that is required (that is, whether the application is state significant infrastructure (SSI), state significant development (SSD), or local development under part 4 or part 5 of the EP&A act
- information to be submitted with an application (also discussed in Appendix 4)
- the assessment processes
- determination and post approval, including appeals
- other approvals that may be required
- further sources of information.

Figure 6: Assessment pathways under the *Environmental Planning and Assessment Act 1979*



8.2. Permissibility of land based aquaculture projects

An overview of the zones in which pond and tank aquaculture is permissible is set out in Chapter 9. However, it is advisable to check this against the LEP that applies to a site at the time a development is being considered as zoning may change over time.

Zoning and other planning information about a property can be found on the NSW Planning Portal.

In addition to zoning permissibility, the minimum site location and operational requirements set out in clause 5.19 and Schedule 6 of the Standard Instrument LEP must be met. The few areas of the state not yet covered by a standard LEP are covered by equivalent provisions in Schedule 4 of the PPRD SEPP. These requirements must be met for both state significant DAs and local development.

If aquaculture is permissible on the land and meets the site location and operational requirements, you will need to apply for development consent from DPIE or your local council (depending on the scale and nature of the project) (see section 8.3).

8.3. Determining the type of application that is required

After establishing whether the proposed aquaculture project is permissible, you need to determine whether your project is of state, regional or local significance.

Below is a broad overview of the different types of applications under the EP&A Act:

- **State significant development (SSD) applications** are submitted to DPIE and are determined by the Minister for Planning and Public Spaces (Minister) or the Minister's delegate. Development that is SSD is set out in Schedule 1 of the *State Environmental Planning Policy* (*State and Regional Development) 2011* (SRD SEPP) and includes land based aquaculture projects that:
  - have a capital investment of more than $30 million, and/or
  - are located in an environmentally sensitive area of state significance (more detail below).
- **State significant infrastructure (SSI) applications** are also submitted to DPIE but are usually only relevant where the proponent is a public authority. These applications are not addressed further in this chapter.
- **Local development Part 4 applications** are submitted to local councils and determined by either the council or its local planning panel. There are three classes of local development for land based aquaculture. To determine which class of development your proposal fits within, an assessment must be made against the Project Profile Analysis (see Chapter 9). This assessment will determine whether your application is designated development or not. A more detailed assessment process applies to designated development. It will also be necessary to determine whether your application is integrated development (detail below).
- **Part 5 applications** are submitted to NSW DPI where:
  - the development is for extensive pond-based aquaculture and
  - it meets the requirements of clause 5.19(4) and part 2 of Schedule 6 of the Standard Instrument LEP.

These requirements are also set out in Chapter 9.12 of this document.

8.3.1. State significant development criteria

To be considered SSD, your proposal must meet the criteria shown below.

State Environmental Planning Policy (State and Regional Development) 2011

Schedule 1 State significant development—general

Aquaculture

(1) Development for the purpose of aquaculture that has a capital investment value of more than $30 million.

(2) Development for the purpose of aquaculture located in an environmentally sensitive area of state significance.

(3) This clause does not apply to development for the purpose of oyster aquaculture.

Environmentally sensitive areas of state significance include(*):

(a) coastal waters of the state, or

(b) land identified as "coastal wetlands" or "littoral rainforest" on the *Coastal Wetlands and Littoral Rainforests Area Map* (within the meaning of *State Environmental Planning Policy (Coastal Management) 2018*), or

(c) land reserved as an aquatic reserve under the *Fisheries Management Act 1994* or as a marine park under the *Marine Estate Management Act 2014* or**

(d) a declared Ramsar wetland within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999* of the Commonwealth, or**

(e) a declared World Heritage property within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999* of the Commonwealth, or

(f) land identified in an environmental planning instrument as being of high Aboriginal cultural significance or high biodiversity significance, or

(g) land reserved as a state conservation area under the *National Parks and Wildlife Act 1974*, or

(h) land, places, buildings or structures listed on the State Heritage Register under the *Heritage Act 1977*, or

(i) land reserved or dedicated under the *Crown Land Management Act 2016* for the preservation of flora, fauna, geological formations or for other environmental protection purposes, or

(j) land identified as being critical habitat under the *Biodiversity Conservation Act 2016 or* Part 7A of the *Fisheries Management Act 1994*.**

**correct at time of printing – please check for updates on www.legislation.nsw.gov.au*

***** The location requirements in clause 5.19 and schedule 1 of the Standard instrument LEP prohibit aquaculture from being carried out on land identified in (c), (d) and (j)***

All SSD applications require the preparation of an EIS. Further information is provided on the EIS process in Part 8.4 below and in the Appendix 4 Preparing a Statement of Environment Effects (SEE) or EIS Application Guidelines.

SSD applications must also be assessed against the project profile analysis (PPA) (see Chapter 9) in accordance with clause 27 of the PPRD SEPP. This assessment will assist DPIE to assess the application and determine whether objector appeal rights exist.

8.3.2. Local development criteria

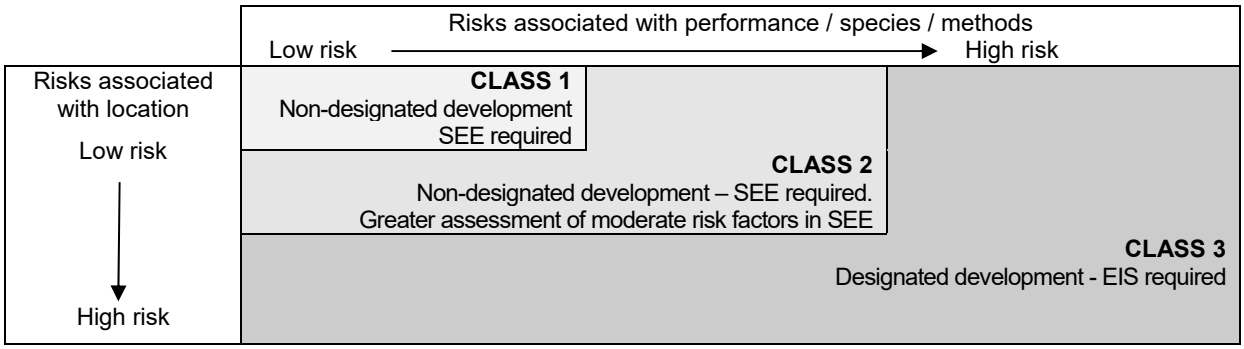
If you do not meet the criteria for SSD, you must determine which class of local development you fall within by assessing the project against the PPA.

The detail of the PPA is in Chapter 9 and in clause 27 of the PPRD SEPP. In summary, the PPA is an assessment tool that provides for three classes of aquaculture development:

- Class 1 - Non-designated development (low level risk) if all risk levels for each site location and operational attributes are Level 1 (that is, lowest risk) in the PPA
- Class 2 - Non-designated development (medium level risk) if all the risk levels for each attribute are Level 2 (medium risk) or Levels 1 and 2 in the PPA

- Class 3 - Designated development if any risk level in relation to an attribute is Level 3 (high risk) in the PPA.

Figure 7: Level of assessment based on risk profile



As well as determining the class of your development, your application will be **integrated development** as an aquaculture permit is required. You may also require one or more of the other approvals, licences or permits listed in Table 8.

These approvals will be sought from the relevant government agency during the development assessment process and included in any conditions of consent (see below for further details).

Table 8: Summary of relevant integrated approvals under the EP&A Act

(*Most approvals will only relate to the establishment phase of the project. Those marked with * may be relevant throughout the life of the project. A full list of approvals is in S.4.46 of the EP&A Act).*

Act	Provision	Integrated approvals applying to aquaculture
Fisheries Management Act 1994	S.144* S.201/205/219	• aquaculture permit. • permit to carry out dredging or reclamation work in any waters, • permit to cut, remove, damage or destroy marine vegetation on public water land or an aquaculture lease, or on the foreshore of any such land or lease, • activity must not impede the passage of fish.
Heritage Act 1977	S.58 S.139	• approval in respect of the doing or carrying out of an act, matter or thing referred to in s 57(1), • an excavation permit.
National Parks and Wildlife Act 1974	S.90*	• consent to knowingly destroy, deface or damage or knowingly cause or permit the destruction or defacement of or damage to, a relic or Aboriginal place.
Protection of the Environment Operations Act 1997	S.43 (a), 47 and 55* S.43 (b), 48 and 55* S.43 (d), 45, 55, 120* and 122*	• Environment protection licence to authorise carrying out of scheduled development work at any premises. • Environment protection licence to authorise carrying out of scheduled activities at any premises (excluding any activity described as a 'waste activity' but including any activity described as a 'waste facility'). • Environment protection licences to control carrying out of non-scheduled activities for the purposes of regulating water pollution resulting from the activity.
Roads Act 1993	S.138	Consent to: • erect a structure or carry out a work in, on or over a public road, or • dig up or disturb the surface of a public road, or • remove or interfere with a structure, work or tree on a public road, or • pump water into a public road from any land adjoining the road, or

Act	Provision	Integrated approvals applying to aquaculture
	Part 8	• connect a road (whether public or private) to a classified road. • Approval to construct a flood controlled work.
Water Management Act 2000	S.89 S.90 S.91	• Water use approval to use water for a particular purpose at a particular location. • Water management works approval to construct and use a specified water supply/drainage/flood work at a specified location. • Activity approval to carry out a controlled/aquifer interference activity at a specified location or in a specified area.
Note: 'S.' refers to 'section' of an Act.		

8.4. Preparing your application and the assessment process

Appendix 4 provides detailed guidance for preparing a SEE or an EIS.

8.4.1. Preparing an SSD application and assessment process

SSD applications are lodged with DPIE and must be accompanied by an EIS.

8.4.2. Scoping an EIS

Scoping a proposal is the first step in the environmental assessment for SSDs. Scoping identifies the matters and impacts that are likely to be relevant, establishes terms of reference for the EIS and the appropriate level of assessment. The scoping phase is critical to steering the remainder of the DA and EIS.

Early engagement with the community and other stakeholders during the scoping phase is important for providing information about the project and for understanding matters to be addressed in the EIS.

When you have developed a development concept that demonstrates an initial understanding of the potential impacts of the proposal and the likely interest from the community and other stakeholders, you should arrange a Scoping Meeting with DPIE. The Scoping Meeting allows you to discuss the development concept and reach agreement on the approach to engaging with the community and other stakeholders prior to finalising the formal request for the Planning Secretary's Environmental Assessment Requirements (SEARs).

The Scoping Meeting also allows DPIE to discuss site suitability, strategic context, confirm the planning pathway and provide feedback on the information required to support the request for SEARs.

At the Scoping Meeting, you should be able to describe what is proposed, where and when it is proposed, the strategic justification, the history of project development, alternatives considered, how the proposal aligns with the planning framework, likely relevant matters and potential impacts and engagement undertaken. The request for SEARs can be finalised following the Scoping Meeting.

8.4.3. Planning Secretary's environmental assessment requirements

You must make a request for SEARs to identify the matters that must be addressed in the EIS. DPIE will consult with other agencies, such as the NSW EPA and EES, and local councils when

developing the SEARs to identify all key issues to be included in the EIS at the start of the process.

A planning focus meeting may be also convened with DPIE and other relevant government agencies. This meeting is held to determine if there are additional matters to be addressed.

You will also need to assess whether the proposal is likely to significantly affect terrestrial or aquatic threatened species, populations or ecological communities or their habitats. If it does, further assessment and offsets may be required. Detail on the statutory requirements under the *Biodiversity Conservation Act 2016* and *Fisheries Management Act 1994* is set out in Appendix 4.

8.4.4. Preparing the EIS

When preparing an EIS, you are encouraged to consult with the community and relevant councils and state and Commonwealth agencies. Appendix 4 provides further information on the requirements for an EIS.

If a development is likely to have a significant impact on matters of National Environmental Significance, it will also require an approval under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). This approval would be in addition to any approvals required under NSW legislation and it is your responsibility to contact the Commonwealth Department of Agriculture, Water and the Environment to determine if an approval under the EPBC Act is required (https://www.environment.gov.au/ or (02) 6274 1111).

8.4.5. Lodging and exhibiting an SSD application

Once you have prepared the EIS addressing the SEARs, DPIE will ensure it addresses all requirements. If satisfactory, the DPIE will exhibit the EIS for public comment for a minimum of 28 days. The public exhibition of an EIS provides a formal opportunity for the community and , relevant government agencies and other stakeholders to share their knowledge and opinions by making a written submission on the proposal. You must carefully consider the issues raised in submissions and where appropriate, address them in the development, the performance criteria or mitigation measures.

Following exhibition, you must prepare a Response to Submissions Report (RtS) responding to the issues raised during consultation. If necessary, changes may need to be made to the project to minimise environmental impact or respond to concerns. DPIE will make all key application documents publicly available on its website.

8.4.6. Evaluation and determination

DPIE will refer the RtS to relevant agencies for final comment and will make it publicly available on the DPIE website. Following receipt of all final submissions and resolution of any outstanding issues, DPIE will undertake a thorough merit assessment of the application in consultation with relevant government authorities, consider the issues raised in submissions and assess the application against the matters for consideration in S.4.15 of the EP&A Act.

DPIE will prepare an Assessment Report and recommend whether the application should be approved or refused. DPIE will also recommend conditions of consent to be imposed on any approval.

The Independent Planning Commission (Commission) determines SSD applications, rather than the Minister, if any of the following apply and the applicant is not a public authority:

- The local council has objected to the DA.
- Fifty or more unique objections have been made.
- The applicant has made a reportable political donation.

When determining a DA, the Commission may:

- undertake a site inspection or tour of the local area
- hold a public meeting
- hold meetings with key stakeholders and publish the records of these meetings.

The Minister for Planning and Public Spaces (or delegate) is the consent authority for all other SSD applications.

The application can be approved, modified subject to conditions or refused. Approval of a proposal will be subject to conditions. These conditions will prevent, minimise, or offset adverse environmental impacts, set standards and performance measures for acceptable environmental performance, require regular monitoring and reporting and provide for the ongoing environmental management of the development.

8.4.7. Preparing a local development application and assessment process

Your local DA must be lodged with the local council and:

- for Class 1 and 2 development, be accompanied by a SEE
- for Class 3 designated development, be accompanied by an EIS.

Appendix 4 and the relevant performance goals and best practice in the AIDP will assist preparation of a SEE or EIS.

Your assessment will also need to assess whether the proposal is likely to significantly affect terrestrial or aquatic threatened species, populations or ecological communities or their habitats. If it does, further assessment and offsets may be required. Further detail on the requirements under the *Biodiversity Conservation Act 2016* and *Fisheries Management Act 1994* are set out in Appendix 4.

To assist in the DA process NSW DPI offers a pre-lodgement case management service which can include reviewing your draft DA and Aquaculture Permit Application prior to submitting to your local council. The case management service will assist in identifying any deficiencies in your applications and greatly assist in streamlining your DA assessment process.

8.4.8. Lodging an application

Care should be taken to ensure all relevant information is provided with the DA to minimise delays. You should contact your local council for specific requirements, however as an overview, the information to provide includes:

- the DA on the appropriate form with relevant supporting documentation
- indication of all approvals required
- the landowner's consent (if the applicant is not the owner. The state government must give consent if Crown Land is affected)
- the SEE or EIS
- the relevant DA fee sent to the consent authority and assessment fee sent directly to each of the relevant approval authorities.

If the information in the application and accompanying documents is insufficient, the consent authority and the integrated approval bodies may reject the DA or request additional information from the applicant during the first 25 days of the DA being lodged.

8.4.9. Integrated development

Integrated approval bodies have a fixed period to inform the consent authority of its "general terms of approval".

The general terms of approval should be consistent with the performance provisions in the AIDP.

The general terms should take a performance-based approach with more specific requirements detailed in the subsequent licence or other approval. If the approval body fails to inform the consent authority of its general terms within the prescribed period, the consent authority may proceed to determine the DA. In these circumstances, the agency will be bound by the development consent conditions as if they had given general terms of approval and the agency cannot subsequently refuse to issue an approval.

Any approval issued within three years of the development consent by the approval body must be consistent with the consent.

When an approval body is not prepared to give its general terms of approval, it can require the consent authority to refuse the DA.

8.4.10. Statutory exhibition period

Once the council has received your DA and is satisfied that sufficient information has been provided, the DA will be placed on exhibition to allow the community to make submissions on your application. The timeframe for exhibition will depend on the class of application:

- Class 1 and 2 development must be placed on public exhibition for a minimum of 14 days unless it is 'nominated integrated development' (that is, approval required under the *Water Management Act 2000,* the *Heritage Act 1977*, or the *Protection of the Environment Operations Act 1997*[1]), in which case a 28 day exhibition period is required.
- Class 3, as designated development the DA must be publicly exhibited for 28 days.

For Class 1 and 2 above, the exhibition period may also be longer if:

- a community participation plan requires more extensive exhibition (these can be found on the NSW Planning Portal)
- the development is likely to significantly affect threatened species the application must be placed on public exhibition for 28 days under clause 8A of Schedule 1 of the EP&A Act.

Following exhibition, the council will give you an opportunity to respond to submissions and amend the application if necessary to resolve community concerns.

8.4.11. Evaluation

The council will determine the application once it has:

- reviewed the application including further information and amendments
- received responses to internal and external referrals (including general terms of approval from integrated approval bodies)
- prepared an assessment report, including a recommendation and draft conditions of consent (if recommended for approval).

[1] See section 4.46 and clause 8A of Schedule 1 of the EP&A Act.

In making a determination, the council must consider the following matters (S.4.15 of the EP&A Act):

- Matters in environmental planning instruments (SEPPs and LEPs), including draft instruments, instruments that are or have been subject to public consultation, development control plans and planning agreements.
- The impact of the development on the built and natural environments, and social and economic impacts in the locality.
- The suitability of the site for the development.
- Any submissions received.
- The public interest.

The council has 40 days (if Class 1) or 60 days (if Class 2 or 3) from the day the DA was lodged to determine the application, before appeals can be made. However, there are a number of reasons that the "clock" can be stopped, including where further information is requested from the council or state agencies.

It is therefore very important that you discuss with the consent authority the applications and assessment reports that are needed to accompany a DA, as this information will be used to advise other agencies involved in the integrated development assessment process. Poor or missing information in the DA and/or assessment report may result in a delayed assessment.

8.4.12. Determination

Once the assessment has been completed, the DA will be determined by:

- the council
- a local planning panel if the criteria in the Minister's Direction is met.

8.5. Post approval and appeals

8.5.1. Merit appeal right

If you are dissatisfied with the decision made by the council or DPIE on your application as it has been refused or you are unhappy with the conditions of consent, you may have a right to appeal the decision to the Land and Environment Court.

If you are concerned that the council is taking too long determine your application, you may also have a right to appeal the 'deemed refusal' to the Land and Environment Court. A DA is deemed to be refused if a decision has not been made within 40 days (Class 1), 60 days (if Class 2 or 3) and 90 days (SSD) not including the number of days the 'clock' has been stopped throughout the assessment process as set out here.

The Court will look at the application afresh on the merits and determine whether or not a different decision should be made.

For all types of applications, you have six months to lodge an appeal.

For Class 3 applications that are designated development (including SSDs that meet the Class 3 criteria), any person who made a submission on the application during the exhibition period also has a right to appeal on the merits to the Land and Environment Court within 28 days of being notified of the decision.[2]

[2] Note that for the two year period commencing 25 March 2020, appeal periods have been double as a result of the COVID-19 pandemic.

Statutory provisions relating to merit appeals can be found in Division 8.3 of the EP&A Act.

If you are considering lodging an appeal or an appeal is lodged by an objector against your approval, we recommend you seek legal advice.

8.5.2. Conditions

All DAs (including local development and SSD) that are approved are granted subject to conditions of consent, which outline requirements that must be met prior to commencing construction, during construction and for the life of the development. It is an offence under the EP&A Act (S.4.2) not to comply with conditions of consent. Some important milestones in the construction process are outlined below.

8.5.3. Construction certificate

Under S.6.7 of the EP&A Act, a construction certificate must be issued by the consent authority or an accredited certifier prior to any building works commencing. The purpose of the construction certificate is to ensure the building is safe for use taking into consideration structural and fire safety matters and compliance with the relevant provisions in the *Building Code of Australia* (BCA).

Once a construction certificate has been issued, it becomes part of the development consent. It is possible to issue construction certificates for various stages of the development.

8.5.4. Before works begin

Before works begin, a principal certifier (PC) must be appointed to ensure the construction is in accordance with the development consent. The PC must assess the building works by carrying out specified inspections and/or by relying on other certifiers or professionals to assess parts of the works. The PC may serve a notice to require a person to comply with the development consent.

8.5.5. Occupation certificate

Before a PC can issue an occupation certificate, they must be satisfied the specific works have been completed in accordance with the construction certificate and development consent and that the building complies with the relevant provisions in the BCA.

8.5.6. Lapsing

Development consents generally lapse after five years, although this period can be shortened by the consent authority.[3] During this time, you must 'physically commence'[4] the development for your consent to remain valid.

8.6. Other approvals outside the planning system

As well as your development consent, you may require other approvals to commence construction or operations (in addition to integrated approvals that are incorporated into local development consents). These include:

[3] The 5 year lapsing period cannot be shortened below 5 year during the 2 years from 25 March 2020 arising from the COVID 19 pandemic - see section 4.53 of the EP&A Act.
[4] Clause 124AA of the Environmental Planning and Assessment Regulation 2000 sets out the types of works that do not satisfy the requirement for physical commencement.

- *Aquaculture Permit*. All aquaculture projects must hold a valid Aquaculture Permit from NSW DPI (there is an exemption for ornamental fish producers with a production volume of less than 10,000 L). The following classes of aquaculture permits are prescribed for the purposes of the *Fisheries Management Act 1994*:
  (a) a class C permit authorising extensive aquaculture (non-feeding)
  (b) a class D permit authorising intensive aquaculture (feeding)
  (c) a class E permit authorising extensive freshwater yabby aquaculture
  (d) a class F permit authorising a person to operate a fishout
  (e) a class H permit authorising a fish hatchery to be operated.
- *Environment Protection Licence.* A land based aquaculture project will require a licence under the *Protection of the Environment Operations Act 1997* if it is listed in Schedule 1 – Schedule of EPA-licensed activities.
- *Local Land Services Act 2013* or the Vegetation in Non-Rural Areas SEPP. The clearing of native vegetation will usually require approval.
- *Exhibited Animals Protection Act 1986* (if intending to display live fish).
- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) - you may require Commonwealth government approval if your project is likely to have an impact on matters of national environmental significance (for example, threatened species, migratory birds). For information about EPBC Act requirements go to the Commonwealth government's website - www.environment.gov.au/epbc/.
- *Marine Estate Management Act 2014* - if a proposal is to be carried out in the vicinity of a marine park, the likely impact on the marine park must be considered. The department/s responsible for administering the *Marine Estate Management Act 2014* must be consulted, as a permit may be required for certain developments, for example pipelines.
- *Fisheries Management Act 1994* if a proposal requires a permit under Part 7 for harm to marine vegetation or dredging and reclamation.

8.7. Information sources

There are a number of sources of information from key government agencies which will be useful in preparing your application.

8.7.1. Department of Planning Industry and Environment (DPIE)

To assist applicants with the SSD process and to improve environmental assessment, DPIE has guidance material on Scoping an EIS, Community and Stakeholder Engagement, Preparing an EIS and Responding to Submissions. Information on the planning assessment pathways can also be found on the DPIE website.

8.7.2. NSW Department of Primary Industries

NSW DPI has a range of aquaculture, aquatic habitat protection and aquatic threatened species information to assist investors or consultants.

8.7.3. NSW planning portal

DPI has the capacity to case manage investors through the approvals process. The NSW Planning Portal contains key planning information needed for lodging a DA. Its spatial viewer contains a number of useful mapping layers such as LEP zoning, the location of certain environmentally sensitive areas and areas affected by SEPP controls. The Planning Portal also contains general information on the Planning System and can be used to lodge and track DAs.

8.7.4. Local council

It is essential to consult with the local council to determine the zoning of the land on which the proposal and any ancillary works (pipelines, roads) will be located. Also, LEP maps can provide information on the location of road reserves or corridors identified for highway upgrades, wetlands mapped in *SEPP (Coastal Management) 2018* and land reserved for environmental protection.

The information regarding the minimum performance criteria for your site is available in council LEPs. Local councils may also have floodplain management policies and floodplain management plans that may provide background on flood related issues and controls and advice on flooding in the vicinity of the site.

8.7.5. Department of Planning, Industry and Environment - Water (DPIE Water)

DPIE Water holds important information relating to:

- activities carried out in or near a lake, river or estuary
- licence and approval requirements under the *water management act 2000* and *water act 1912*
- harvestable rights for farm dams
- groundwater policies including the groundwater policy, policy on groundwater dependant ecosystems and groundwater quality policy
- the water availability in river catchment/sub-catchments and groundwater aquifers
- the water sharing plan process under the *water management act 2000*.

8.7.6. Crown Lands information

Crown Lands can provide information about all aspects of matters relating to the use and occupation of Crown land in NSW and how it is regulated.

8.7.7. Environment, Energy and Science (EES) information

EES hold information on the important areas for conservation and protection. These include:

- EES protected areas - National & Regional parks, reserves, historic sites, state recreation areas
- recorded Aboriginal sites and places, relevant contacts for local Aboriginal communities
- areas subject to conservation or management agreements, critical habitats
- areas where threatened species, populations and ecological communities have been recorded
- recovery and threat abatement plans prepared under the *Biodiversity Conservation Act 2016*
- acid sulfate soils risks
- tidal characteristics of many estuaries.

8.7.8. Environment Protection Authority

The EPA website contains information on the requirements for applying for an Environment Protection Licence under the POEO Act (https://www.epa.nsw.gov.au/licensing-and-regulation/licensing/environment-protection-licences).

9. Project Profile Analysis (PPA)

The AIDP sets out best practice for the establishment and operation of land based aquaculture projects. Based on this information, a PPA has been developed to enable a preliminary evaluation of the risks associated with site selection, species, design and planning and operational criteria. The PPA is published in accordance with clause 26 of the PPRD SEPP. These criteria allow the applicant and the consent authority to evaluate the likely risks associated with a project and establish the level of assessment to match the likely risks to the environment.

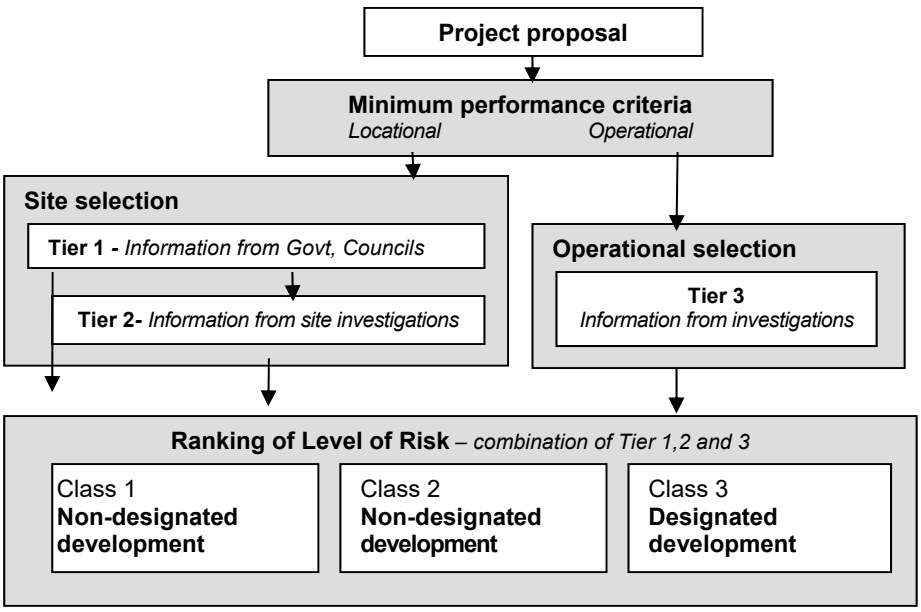
All projects, including SSD, must be assessed against the PPA and meet the minimum performance criteria set out in clause 5.19 and Schedule 6 of the Standard Instrument LEP.

The project profile analysis provides the following three 'sieves' to evaluate options:

- The ***minimum performance criteria*** provide the first environmental sieve for selecting sites and project characteristics. These must be met in order for the project to proceed.
- The ***site selection criteria*** (Tier 1 and Tier 2) provide the next two environmental sieves to determine the acceptability of risks. Tier 1 information is available from government or council sources. Tier 2 information will need to be obtained from site investigation or studies.
- Following the selection of a site, ***operational selection criteria*** (Tier 3) provides the next 'sieve' to evaluate various options including species, layout and operation factors. The Tier 3 evaluation can serve as a cost effective tool to determine the relative risk associated with species, design and operational options and to assist in deciding if certain options should be excluded from further consideration.

These factors can be used to rank the likely risks associated with establishing an aquaculture facility in a particular location, for example Level 1, 2 or 3 risk. Figure 8 provides an overview of the sieving process.

Figure 8: 'Sieves' in project profile analysis



9.1. Minimum site performance and operational criteria

It is essential at the outset, that the minimum performance criteria for land based aquaculture set out in clause 5.19 and Schedule 6 of the Standard Instrument LEP is considered, as aquaculture projects (including SSD projects) that cannot meet these minimum performance criteria cannot be pursued. Information regarding the minimum performance criteria is readily available from NSW DPI, council, EES or DPIE.

9.2. Tier 1 evaluation

For sites that meet the minimum locational performance criteria, the Tier 1 information should be sourced to determine the level of risk for the site for aquaculture. The Tier 1 criteria can be sourced from information held by NSW DPI, council, EES or DPIE. The ranking of Level 1, 2 or 3 for individual criteria will begin to provide a picture of the potential hurdles in developing a site and the likely level of environmental assessment and regulation that could apply. Whenever possible, higher risk sites should be avoided at Tier 1 evaluation.

9.3. Tier 2 evaluation

For sites that are suitable after Tier 1 evaluation, the next layer of information should be sourced. Tier 2 investigations may involve significant expenditure with site investigations by technical experts, and in some cases, laboratory analysis may be required:

- to confirm the levels of ASS or soil contamination and develop management options
- to determine soil suitability for dam construction
- to identify threatened species, populations or ecological communities or their habitat
- to identify any Aboriginal sites, areas of high potential to contain sites, areas of cultural sensitivity or other values of cultural significance to the Aboriginal community
- to assess of potential water supply quality and security of supply.

It should be noted that the level of analysis at this stage needs to provide sufficient information for an informed decision to be made. Risk levels associated with the site along with the risk levels associated with operational constraints will decide the assessment regime of the project. The lower the risks, the lower the costs in assessment, mitigation and environmental supervision by authorities.

9.4. Tier 3 operational evaluation

Following the selection of a site, and confirmation that the proposed design and planning parameters meet the minimum performance criteria, Tier 3 evaluation criteria provides the next ‘sieve’ to determine the relative level of risk associated with the aquaculture proposal.

The Tier 3 evaluation can serve as a cost effective device to determine if any of the proposed operational parameters are likely to lead to longer term costs associated with expensive mitigation measures. The ranking of Level 1, 2 and 3 operational criteria will begin to provide a picture of the potential hurdles and the likely level of environmental assessment and regulation that could apply; the lower the level of risk, the lower the level of assessment and regulation required.

9.5. Interpreting the rankings

The tables associated with Tier 1, 2 and 3 provide a ranking in relation to the criteria and the level of risk associated with the project characteristics. These rankings assist in evaluating individual sites and operational options as well as providing for a comparison between alternative options.

Table 9 provides an overview of how the rankings are interpreted to determine the class of development with Figure 9 providing an overview of the evaluation process.

Table 9: Interpreting the rankings

Project profile analysis rankings	Class of development	Development assessment	Assessment document
Minimum performance criteria not met	**Prohibited**		
Minimum performance criteria met and all the rankings are level (1)	Class 1	Non-designated development	SEE
Minimum performance criteria met, any of the rankings are level (2) and none are level (3)	Class 2	Non-designated development	SEE with greater assessment of moderate risk factors
Minimum performance criteria met and any of the rankings are level (3)	Class 3	Designated development	EIS

It must be reinforced that aquaculture projects undertaken in NSW, must meet the minimum locational and operational performance criteria.

SSD applications must be assessed against the PPA to determine the class of development. Although this will not impact upon the level of assessment to be undertaken as an EIS is always required for SSD, it will provide a useful assessment tool for the consent authority and determine whether objector appeal rights are available (only if Class 3).

9.6. Who makes the decision?

The consent authority (the local council Local Planning Panel, or the Minister for Planning and Public Spaces (or delegate) will decide whether the project meets the minimum performance criteria and the level of assessment (Class 1, 2 or 3) required, based on the project profile analysis and the DA.

Usually, the local council will be the consent authority and as the development will also require an aquaculture permit from NSW DPI it is an 'integrated development' and falls within the provisions of Part 4 of the EP&A Act. In some cases, where the project is determined to state significant development, the Minister for Planning and Pubic Spaces will be the consent authority. NSW DPI will usually be the consent authority under Part 5 of the EP&A Act for extensive aquaculture (Class C & E aquaculture permits) proposals, where existing farm dams and buildings are being used. Further detail on assessment pathways is in Chapter 8.

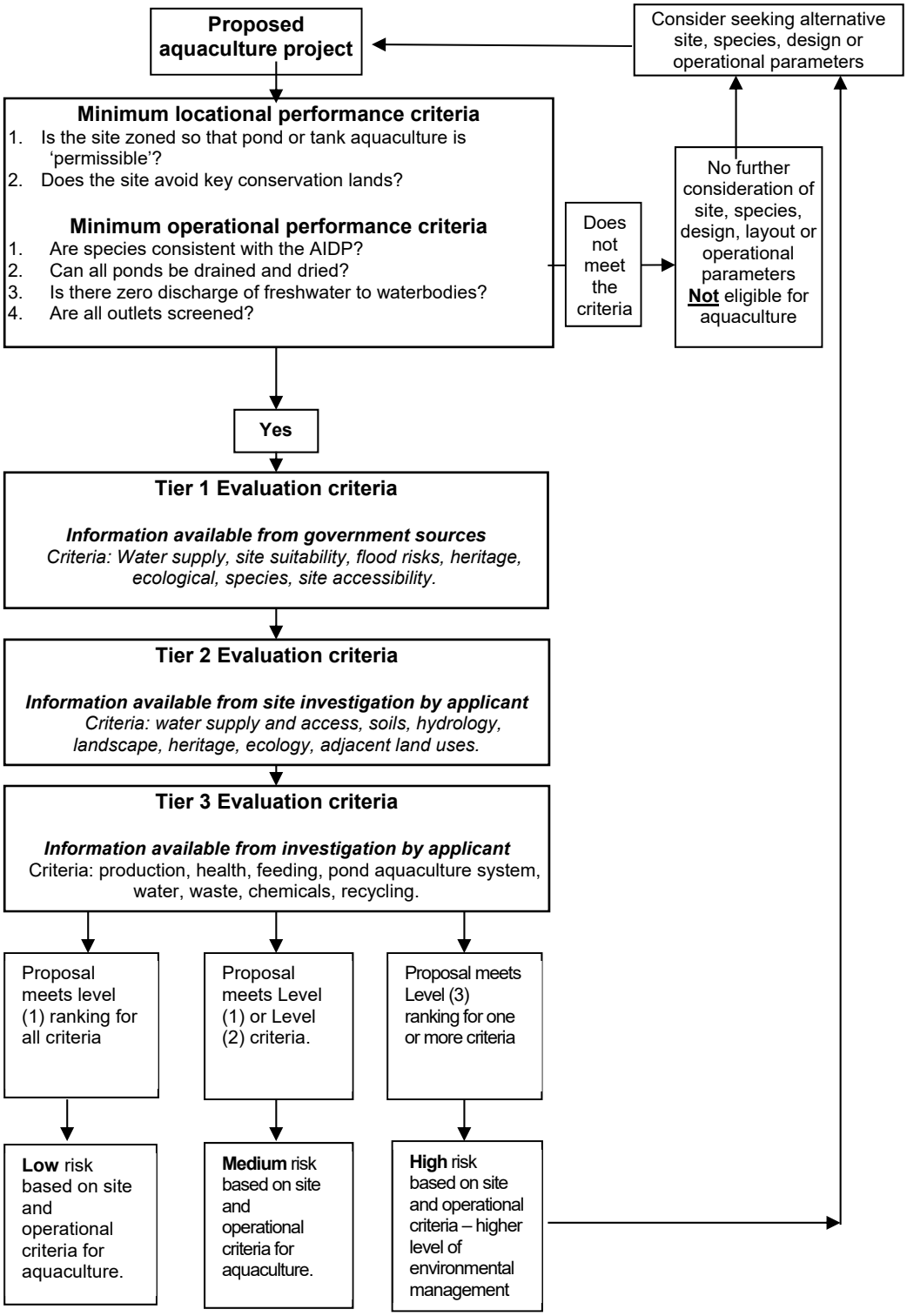
9.7. Transitional provisions

Where there is an abandoned aquaculture enterprise and there is a proposal to upgrade or re-establish an aquaculture operation on that site, the NSW LBSAS will apply.

9.8. Project profile analysis - minimum performance criteria for ponds and tanks

The following are minimum performance criteria, as set out in clause 5.19 and Schedule 6 of the Standard Instrument LEP that proposals must meet to be permissible development within NSW.

Figure 9: Project evaluation process



Locational criteria	Minimum performance
1. LEP zones for ponds or tanks	Within permitted zones of LEP zoning table.
2. Conservation exclusion areas[1]	(1) Must not be carried out on land dedicated or reserved under the *National Parks and Wildlife Act 1974*: (2) Must not be carried out on the following land, except to the extent necessary to gain access to water: (a) land declared an area of outstanding biodiversity value under the *Biodiversity Conservation Act 2016*, (b) vacant Crown land, (c) land within a wetland of international significance declared under the Ramsar Convention on Wetlands. (3) Must not be carried out on the following land, except for purposes of minimal infrastructure to support the extraction of water from, and discharge of water to, the land concerned: (a) land declared as an aquatic reserve under the *Marine Estate Management Act 2014*, (b) land declared as a marine park under the *Marine Estate Management Act 2014*
Operational criteria	
1. Species selection	Species of fish or marine vegetation cultivated or kept must be consistent with the relevant AIDP.
2. Intensive pond aquaculture—pond design	Ponds must be capable of being drained or pumped and then completely dried.
3. Intensive pond and tank aquaculture freshwater discharges	No discharge of freshwater used to intensively cultivate or keep fish to natural waterbodies or wetlands is permitted, except freshwater discharge from open flow through systems
4. Outlets from ponds	All outlets from culture ponds, tanks or other culture facilities must be screened to avoid the escape of fish.

[1] Nothing in subclause (2) or (3) affects any requirement under an Act relating to land specified in subclause (2) or (3) to obtain a licence or other authority under that Act for development of the land.

LEP Zoning Table

LEP ZONES	AQUACULTURE TYPE	
	Pond	**Tank**
Rural		
RU1 Primary Production	Permissible	Permissible
RU2 Rural Landscape	Permissible	Permissible
RU3 Forestry	Permissible	Permissible
RU4 Rural Small Holdings	Permissible	Permissible
RU5 Village	Prohibited	Permissible
RU6 Transition	Prohibited	Permissible
Residential		
R1 General Residential	Permissible (1)	Permissible (1)
R2 Low Density Residential	Permissible (1)	Permissible (1)
R3 Medium Density Residential	Prohibited	Permissible (1)
R4 High Density Residential	Prohibited	Prohibited
R5 Large Lot Residential	Permissible (1)	Permissible (1)
Business		
B1 Neighbourhood Centre	Prohibited	Permissible
B2 Local Centre	Prohibited	Permissible
B3 Commercial Core	Prohibited	Permissible
B4 Mixed Use	Prohibited	Permissible
B5 Business Development	Prohibited	Permissible
B6 Enterprise Corridor	Prohibited	Permissible
B7 Business Park	Prohibited	Permissible
Industrial		
IN1 General Industrial	Prohibited	Permissible
IN2 Light Industrial	Prohibited	Permissible
IN3 Heavy Industrial	Prohibited	Permissible
IN4 Working Waterfront	Permissible	Permissible
Special Purpose Zones		
SP1 Special Activities	Permissible	Permissible
SP2 Infrastructure	Permissible	Permissible
SP3 Tourist	Permissible	Permissible
Recreation		
RE1 Public Recreation	Permissible	Permissible
RE2 Private Recreation	Permissible	Permissible
Environment protection		
E1 National Parks and Nature Reserves	Prohibited	Prohibited
E2 Environmental Conservation	Prohibited	Prohibited
E3 Environmental Management	Permissible (2)	Permissible (1)
E4 Environmental Living	Permissible (2)	Permissible (1)
Waterway		
W1 Natural Waterways	Permissible (3)	Permissible (3)
W2 Recreational Waterways	Permissible (3)	Permissible (3)
W3 Working Waterways	Permissible (3)	Permissible (3)

Note (1) Permissible only if the development is for the purposes of small scale aquarium fish, shellfish nursery or shellfish hatchery production.
Note (2) Permissible only if the development is for the purposes of extensive aquaculture.
Note (3) Permissible only if the development will utilise waterways to source water.

9.9. Project profile analysis - criteria for pond & tank aquaculture

Tier 1 - Site evaluation

Information for Tier 1 evaluation criteria is available from government sources such as councils, Crown Lands and Water, Department of Planning, Industry and Environment and other relevant government agencies.

SITE EVALUATION CRITERIA	TIER 1 LEVEL OF ASSESSMENT		
	Level 1	**Level 2**	**Level 3**
1. Water Supply Information			
a) Saline ground water availability	Saline water available from Saline Interception and Evaporation Scheme.	Bore required to source saline waters.	
b) Fresh - Water availability	• Existing licence approved for bore or river extraction, or • Licence available.	• New licence required for bore or river extraction, or • Reliant upon on-farm dam and 10% of local run-off. • Use of a mains water supply for growout, nursery or hatchery.	
c) Freshwater projects that plan to pump water from a river – Environmental flows	No access restrictions based on flows in normal conditions	Access permitted only during high flows in normal conditions	
2. Acid Sulfate Soils			
If site is less than 2 metres AHD based on survey data, ASS soil profile based on ASS Risk Maps[2]	ASS Landform Process Class A with Landform Element Class b, l, t, p, y or w	ASS Landform Process Classes A,W, B, E, L, S with other Landform Element than b, l, t, p, y or w	
3. Heritage Issues			
a) Heritage sites based on LEP or REP maps and State Heritage Inventory	No listings on the proposed site	Listings on-site	
b) Aboriginal heritage based on Heritage NSW Aboriginal Heritage Information Management System and Local Aboriginal Land Council	No recorded sites or places and Heritage NSW advises that no cultural or archaeological assessment is required	Sites or places recorded on the land and/or Heritage NSW advises that a cultural and/or archaeological assessment is required.	Sites/places of regional or national significance present and likely to impact on sites/places.
4. Native Title Issues			
Status of native title interests	Crown Land, previous determination Native Title extinguished	Crown Land Native Title interest needs to be determined	
5. Flooding *EES or council information where available*			
a) Consistency with council and/or EES floodplain management plans	Development is consistent with the outcomes of management plans and needs no controls	Development of the site is consistent with the management plan but will be restricted or controlled	Development of the site is inconsistent with the outcomes of management plans
b) Floodway Area	Development is not proposed in a floodway	Development is proposed in a floodway	

[2] *Sourced from the ASS Risk Maps*

Tier 2 - Site evaluation

Tier 2 requires the proponent to undertake a detailed site assessment including investigations by technical experts and in some cases, laboratory analysis. The information gained from this investigation can provide the basis for preliminary design and operation planning.

SITE EVALUATION CRITERIA	TIER 2 LEVEL OF ASSESSMENT		
	Level 1	**Level 2**	**Level 3**
6. Water Supply Quality			
a) Water quality risks from nearby land uses	Growout water quality is consistently suitable for aquaculture and has low risk of contamination.	Growout water quality is mostly suitable for aquaculture and has low risk of contamination.	Growout water quality is not generally suitable for aquaculture and requires treatment OR has a high risk of contamination.
b) Potable water for processing.	• Mains water; or • Reliable supply of potable water on-site.	• Insecure supply of potable water requiring supplementation during dry periods; or • No existing potable water supply on site.	
7. Water Supply Access			
a) Saline groundwater supply access	Via piping from a saline groundwater interception and evaporation scheme	Via saline groundwater bore on property	Via compacted earthen channel from a saline groundwater interception and evaporation scheme.
b) Location of inlet/outlet pipe for estuarine or marine farms.	• Existing infrastructure suitable to carry inlet/outlet pipe, or • Sump/pit or any deepening of bed of estuary or waterway is not required.	• Rock anchoring of inlet/outlet pipeline for marine water, or • Requires a sump/pit in estuary or waterway, or • Establishment across ocean beach	
c) Fresh water pump station site	Does not require sump/pit or any deepening of bed of river.	Requires a sump/pit in river	
8. Stock Security			
a) Proposed species consistent with Appendix 3 (species culture methods and constraints).	Pond or tank site above the PMF level in the eastern drainage or above 1:100 ARI flood level in the western drainage. [3]	Pond or tank site below PMF level in the eastern drainage or below 1:100 ARI flood level in the western drainage but constructed so unlikely to be inundated and lose stock in a flood event. [3]	
9. Hydrology Issues			
a) Catchment Drainage including Stormwater	• No catchment drainage across site, or • Provision to manage across site flows not likely to affect surrounding area	• Catchment drainage across site; or • Alteration of the drainage of stormwater likely to affect surrounding properties	Flood management likely to alter the course of the river or drainage patterns.
b) Excess water (effluent) storage pond/dam.	No stormwater catchment drainage into excess water (effluent) storage pond/dam.		
10. Mean site elevation			
Mean elevation of the area occupied by ponds or tanks	>1 metre AHD	< 1 metre AHD	
11. Ecology			
a) Vegetation type on the actual development site (flora survey required)	Cultivated land, improved pasture, or predominantly cleared and no need for consent to clear or disturb native vegetation under the *Local Land Services Act 2013* or SEPP (Vegetation in Non-Rural Areas) 2017 or *Water Management Act 2000*.	Predominantly native vegetation – trees, shrubs, grasslands OR Clearing vegetation requires consent under the *Local Land Services Act 2013* or SEPP (Vegetation in Non-Rural Areas) 2017 or *Water Management Act 2000*.	Proposal likely to impact on vegetation of ecological significance.

SITE EVALUATION CRITERIA	TIER 2 LEVEL OF ASSESSMENT		
	Level 1	**Level 2**	**Level 3**
b) Occurrence of threatened species, populations or ecological communities or their habitats (flora & fauna survey required)	No threatened species, populations or ecological communities or their habitats known or likely to occur – Test of significance required not required	Threatened species, populations or ecological communities or their habitats known or likely to occur – Test of significance required	Likely to significantly affect threatened species, populations or ecological communities or their habitats. [4]
c) Likely impact on aquatic habitats and mangroves.	No likely disturbance or impact	Disturbance or impact on aquatic habitat or mangroves – approval or permit needed to disturb mangroves or seagrasses, reclamation or dredging works or impeding fish passages.	
12. Aboriginal Heritage			
a) Consultation with Aboriginal community (Call Heritage NSW for appropriate contacts)	No values of cultural significance to the Aboriginal community identified.	Values of cultural significance to the Aboriginal community identified. Agreement reached between Aboriginal community, Heritage NSW and proponent on the management of these values.	Values of cultural significance and no agreement reached with Aboriginal community or Heritage NSW on the management of these values.
b) Location of Aboriginal Sites	No recorded Aboriginal site/place and Heritage NSW advises that no cultural or archaeological assessment is required	Recorded Aboriginal site/place and/or Heritage NSW advises that a cultural and/or archaeological assessment is required	
c) Likely impact on Aboriginal heritage [4]	No impact on Aboriginal sites/places or values of cultural significance to Aboriginal community	Impact on Aboriginal sites/places or values of cultural significance to Aboriginal community	Sites/places of regional or national significance present and likely to impact on sites/places.
13. Provision of Riparian Buffer			
Riparian buffer distance from the edge of the culture or effluent pond.	> 50 metres	< 50 metres	
14. Excess Water Disposal			
a) Management of excess freshwater from closed systems (ponds and tanks)	• Non-irrigation re-use scheme (e.g. Hydroponics, re-use, discharge to sewer with a trade waste agreement); OR • Irrigation re-use scheme and irrigation site has adequate area and soils have slight limitations[5].	Irrigation re-use scheme and irrigation site has inadequate area and/or soils have moderate or severe limitations[5]	
b) Management of excess saline groundwater	Disposed to a saline groundwater interception and evaporation scheme, estuary or ocean via piping or channels lined with impervious liner.	Disposal from a closed system to an on-site evaporation system or direct injection to a saline aquifer.	Disposed to a saline groundwater interception and evaporation scheme, estuary or ocean via earthen channel.
15. Adjacent Land Use			
Potential for conflict with neighbours	Neighbouring land zoning compatible e.g. agriculture/industrial development.	Neighbouring land zoned for residential or rural residential purposes or has been identified as suitable for this purpose in an LEP or SEPP.	
16. Flooding *Proponent Studies considering EES or council information where available.*			
Impacts of development on flooding	Development not likely to adversely impact flood behaviour	Development likely to adversely impact on flood behaviour	

[3] Note: Highest historical flood level may be considered where 1:100 ARI flood level is not readily available in the western drainage
[4] Note: approval from EES is required.
[5] See Table 1 & Table 3 respectively in Agnote DPI-493 Landform and soil requirements for biosolids and effluent re-use for more details.

Tier 3 - Operational evaluation

The proponent in Tier 3 is required to investigate operational criteria for species, design, layout and operation of the aquaculture proposal.

OPERATIONAL CRITERIA	TIER 3 LEVEL OF ASSESSMENT		
	Level 1	**Level 2**	**Level 3**
17. Health Management			
Identification and treatment of disease	• On site trained staff with appropriate facilities, or • Demonstrated arrangement with accredited laboratory or veterinary practice	No on-site provision for diagnosis of disease and no backup arrangements with an accredited laboratory or veterinary practice	
18. Feed Management			
Feed storage	Vermin proof facilities to store feed (e.g. enclosed shed, cool, low humidity)	Feed stored outdoors or so as not to minimise odour or other problems	
19. Water Monitoring for Intensive Culture			
a) Capacity to monitor water quality.	Provisions of high quality water quality meters or test kits to monitor DO, Temperature, ammonia, salinity and pH	No provisions for regular monitoring	
20. Organic Waste Management (e.g. mortalities, processing waste and other waste)			
a) Temporary storage of organic waste	• Daily disposal; or • Held prior to disposal so no odour generated (e.g. frozen or chilled)	Held in sealed or covered containers prior to intermittent disposal	No specific arrangements
b) Disposal of organic waste on-site or off-site	• Disposed at an approved off-site recycling, composting or landfill facility; or • Buried (with lime) or composted in an area which is > 100m from a waterways and where the groundwater is > 3m and the soil has low permeability	Buried (with lime) or composted in an area which is < 100m from a waterways or where the groundwater is < 3m or the soil is not low permeability.	No specific arrangements
c) Disposal of stock in the event of a mass mortality, on-site or off-site	Arrangements in place for disposal at an approved off-site recycling, composting or landfill facility.	Buried (with lime) or composed in an approved on-site disposal area.	No specific arrangements
21. Recirculating Water Management for Intensive Culture			
Storage capacity for recycling water in semi-closed and closed intensive culture systems.	> 2 times the volume of largest growout pond or tank	1 - 2 times the volume of largest growout pond or tank	< the volume of largest growout pond or tank
22. Discharge Water Management for Open (flow through) freshwater (for approved species) or estuarine, marine or saline ground water Systems			
a) POEO Act Licence	Not required	POEO Act licence required.	
b) In stream water quality objectives.	In stream water quality objectives met.	In stream water quality objectives not met. Mitigation measures to meet WQOs required.	
c) Discharge water treatment.	Discharge water screened to avoid escapement of stock and a water treatment system.	Discharge water screened to avoid escapement of stock and no treatment.	

OPERATIONAL CRITERIA	TIER 3 LEVEL OF ASSESSMENT		
	Level 1	**Level 2**	**Level 3**
d) Daily Discharge limits for species approved for freshwater open systems e.g. salmonids.	**Upland Rivers** • Turbidity 25NTU • Total nitrogen 0.25mg/L • Total phosphorus 0.015mg/L **Lowland Rivers (inland)** • Turbidity 50NTU • Total nitrogen 0.5mg/L • Total phosphorus 0.05mg/L **Lowland Rivers (coastal)** • Turbidity 50NTU • Total nitrogen 0.35mg/L • Total phosphorus 0.025mg/L **Freshwater lakes and reservoirs** • Turbidity 20NTU • Total nitrogen 0.35mg/L • Total phosphorus 0.01mg/L **Estuaries** • Turbidity 10NTU • Total nitrogen 0.3mg/L • Total phosphorus 0.03mg/L **Marine (inshore)** • Turbidity 10NTU • Total nitrogen 0.12mg/L Total phosphorus 0.025mg/L	**Upland Rivers** • Turbidity 25NTU • Total nitrogen 0.25mg/L • Total phosphorus 0.015mg/L **Lowland Rivers (inland)** • Turbidity 50NTU • Total nitrogen 0.5mg/L • Total phosphorus 0.05mg/L **Lowland Rivers (coastal)** • Turbidity 50NTU • Total nitrogen 0.35mg/L • Total phosphorus 0.025mg/L **Freshwater lakes and reservoirs** • Turbidity 20NTU • Total nitrogen 0.35mg/L • Total phosphorus 0.01mg/L **Estuaries** • Turbidity 10NTU • Total nitrogen 0.3mg/L • Total phosphorus 0.03mg/L **Marine (inshore)** • Turbidity 10NTU • Total nitrogen 0.12mg/L • Total phosphorus 0.025mg/L	

9.10. Project profile analysis - additional criteria for pond aquaculture

Tier 1 – Additional specific site evaluation criteria for pond aquaculture

SITE EVALUATION CRITERIA FOR PONDS	TIER 1 LEVEL OF ASSESSMENT FOR PONDS		
	Level 1	Level 2	Level 3
1. Water Supply Information			
Estuarine - Tidal amplitude	Greater than 600mm	Less than 600mm	

Tier 2 - Additional specific site evaluation criteria for pond aquaculture

SITE EVALUATION CRITERIA FOR PONDS	TIER 2 LEVEL OF ASSESSMENT FOR PONDS		
	Level 1	Level 2	Level 3
2. Topography			
a) Estuarine ponds – slope of land	< 2% slope	>2% slope	
b) Freshwater ponds – slope of land	< 5% slope.	>5% slope	
3. Soils			
a) Soil Characteristics – Suitability for pond/dam construction	Clay with mixture of soil/sand and low erosion potential and suitable for dam construction	Sandy/gravely with erosion potential and/or limited water holding capacity – may need to import most pond clay for lining material or an artificial liner	
b) Soil Contamination based on SEPP 55 criteria for the area occupied by any pond	Suitable for residential use or for animal occupation	Exceed levels safe for animal or residential uses	
4. Hydrology Issues			
Potential to affect groundwater below any pond	No underlying potable or high quality fresh groundwater within 3m of the surface	Underlying groundwater within 3m of the surface.	
5. Saline Groundwater Pond Design			
a) Saline groundwater ponds including excess water storage ponds.	Artificial liner with compacted clay underneath and ground water monitoring bores.	Compacted clay and groundwater monitoring bores.	

Tier 3 - Additional specific operational evaluation criteria for ponds

OPERATIONAL CRITERIA FOR POND AQUACULTURE	TIER 3 LEVEL OF ASSESSMENT FOR PONDS		
	Level 1	Level 2	Level 3
6. Health Management for Intensive Culture			
a) Period of total farm dryout after every production cycle for prawns.	>6 weeks between crops	<6 weeks between crops	
b) Predators management of fingerling or growout ponds	All fingerling ponds screened/netted, or other management systems not intending harm to predators in place for growout ponds.	Only 'scare' systems (Note: may trigger need for Test of significance if threatened bird species are affected)	
7. Pond Water Management for Intensive Culture			
a) Supply pipe or channel capacity	Largest growout pond can be filled in < 1 day	Largest pond can be filled in > 1 days	
b) Intensive Pond Outlet system	No pumping required to drain a pond completely.	Requires pumping from an internal or external sump to drain pond.	

9.11. Project profile analysis - additional criteria for tank aquaculture

Tier 1 - Additional specific site evaluation criteria for tanks

SITE EVALUATION CRITERIA FOR TANKS	TIER 1 LEVEL OF ASSESSMENT FOR TANKS		
	Level 1	Level 2	Level 3
1. Water Supply information			
Estuarine – Tidal amplitude	>300mm	< 300mm	

Tier 3 - Additional specific operational evaluation criteria for tanks

OPERATIONAL CRITERIA FOR TANK CULTURE	TIER 3 LEVEL OF ASSESSMENT FOR TANKS		
	Level 1	Level 2	Level 3
2. Health Management			
Disinfection of tank aquaculture system	Systems capable of disinfection and dry-out to break pathogen cycle	Difficulty in total disinfection and dry-out of facility or no provisions	
3. Culture Water Management			
Semi-closed and closed tank aquaculture systems	Recirculating aquaculture system with biofiltration, solids filtration (fine, suspended, settleable) oxygen, UV, or ozone, pH control	Recirculating aquaculture system having reduced or non-standard componentry.	

9.12 Project profile analysis - extensive pond aquaculture permissible without consent

Extensive pond aquaculture that is authorised under a Class C or E aquaculture permit that utilises existing on-farm water storages (dams or ponds) and buildings and meets all of the following criteria is permissible without consent.

It should be noted that Silver Perch, Golden Perch, Murray Cod, Eel Tailed Catfish, Barcoo Grunter, Spangled Perch, Rainbow Trout, Brown Trout, Brook Trout, Atlantic Salmon, and eel species are not permitted in extensive aquaculture under a Class E aquaculture permit.

Locational Criteria	Minimum Performance
1. LEP zones	Within rural zone RU1 (Primary Production), RU2 (Rural Landscape), RU3 (Forestry), RU4 (Rural Small Holdings), or RU6 (Transition).
2. Conservation exclusion areas[6]	(1) Must not be carried out on land dedicated or reserved under the *National Parks and Wildlife Act 1974*: (2) Must not be carried out on the following land, except to the extent necessary to gain access to water: a. land declared an area of outstanding biodiversity value under the *Biodiversity Conservation Act 2016*, or b. vacant Crown land, or c. land within a wetland of international significance declared under the Ramsar Convention on Wetlands.
3. Flood liability	Must be designed or constructed on land so that it will not be inundated by the discharge of a 1:100 ARI (average recurrent interval) flood event.
Operational Criteria	
1. Species selection	Species of fish cultivated or kept must be consistent with the relevant AIDP.
2. Pond design	1. Must not require the construction of new ponds, water storages, dams or buildings. 2. Must not be located on permanent watercourses, creeks, billabongs or isolated outreaches of creeks or rivers. 3. Must be capable of preventing the escape of stock into natural water bodies or wetlands.
3. Culture Water	Must use freshwater.

[6] Nothing in in subclause (2) affects any requirement under an Act relating to land specified in subclause (2) to obtain a licence or other authority under that Act for development of the land.

10. Performance indicators and review

The *Fisheries Management Act 1994* requires performance indicators to be established within an AIDP to determine if the objectives set out in the plan are being achieved. The plan must also specify at what point a review is required if these performance indicators are not being met.

NSW DPI will report annually on the performance indicators. This report shall consider the need to update or review the NSW LBSAS, generally or in relation to particular culture systems, or particular aspects of environmental performance. New species, improved land based farming practices and management responses to emerging issues will also be considered. The NSW LBSAS will be reviewed if triggered by the performance indicators given in **Table 10**.

Table 10: Triggers for review of the NSW LBSAS

Indicator	Measure	Trigger for review
1. Annual production	Production trends indicate industry viability and development.	Five year average production drops by 15% or more
2. Number of new or expanded aquaculture permits per annum	Reflect effectiveness of objective to encourage aquaculture industry development.	Less than 5 aquaculture permits per annum
3. Percentage of aquaculture farms achieving 'acceptable' compliance reports by NSW DPI per annum	Reflects effectiveness of the industries' acceptance of responsibility for environmental performance.	Less than 90% per annum
4. Surface area of estuary-connected pond farms per estuary, compared with the area suitable for estuary pond farms per estuary	Potential cumulative water quality issues	Greater than 10% of area suitable for estuary-connected pond farms in an estuary developed.
5. Percentage of designated development or state significant project proposals.	Reflect the effectiveness of objective to encourage lower risk projects	Greater than 30% of aquaculture projects being designated development or of state significance.

11. Appendices

Appendix 1: Fisheries spatial data portal and north coast and Port Stephens maps

NSW DPI Fisheries creates and maintains a range of significant spatial datasets that are useful to a number of stakeholders. Datasets are being made available to stakeholders free of charge through the portal. The spatial portal provides access to spatial datasets through an intuitive public interface that allows the searching, viewing and downloading of this data.

Maps of estuary aquaculture areas in the North Coast and Mid North Coast of NSW are also available on the NSW DPI website. These areas include:

1. Tweed River Estuary
2. Brunswick River Estuary
3. Richmond River Estuary
4. Clarence River Estuary
5. Bellinger and Kalang River Estuaries
6. Nambucca River Estuary
7. Macleay River Estuary
8. Hasting River Estuary
9. Camden Haven River Estuary
10. Manning. River Estuary
11. Port Stephens including Myall and Karauh rivers.
12. Hunter including Hunter, Patterson and Williams Rivers.

These maps have been developed using GIS information and identify potential locations based on attributes including:

- elevation above Australian Height Datum
- spatial salinity for the estuary and bathometry assessment
- acid sulfate soil profile
- land use zoning
- conservation exclusion zones.

Although maps have only been prepared for the above estuarine areas, saline pond aquaculture is potentially suitable within other NSW estuaries provided the site meets the minimum location performance criteria.

Note: **It should be noted that the 12 estuarine aquaculture maps were compiled based on data available at the time of production and only represent areas that may have potential for aquaculture. Detailed site assessment as outlined in this chapter is still required and current LEP and other mapping information may need further investigation.**

Because of the extent of location possibilities for freshwater tank, raceways and ponds, a detailed mapping approach to identify potential freshwater aquaculture sites has not been undertaken.

Appendix 2: References and key weblinks for additional information

References

Barclay, K., McIlgorm, A., Mazur, N., Voyer, M., Schnierer, S., Payne, A.M., 2016, *Social and Economic Evaluation of NSW Coastal Aquaculture.* Fisheries Research and Development Corporation (FRDC 2015/302) and University of Technology Sydney, Sydney, December.

Department of Environment, Climate Change, 2009. *Turallo Nature Reserve Plan of Management.* DECCW, Sydney.

Food and Agriculture Organisation, 2020. Web reference downloaded 1 October 2020 from http://www.fao.org/state-of-fisheries-aquaculture

NSW DPI, 2020. *Aquaculture Production Report 2018-2019*. Published by the NSW Department of Primary Industries, Port Stephens Fisheries Institute.

NSW Department of Primary Industries

www.dpi.nsw.gov.au
www.dpi.nsw.gov.au/fisheries/aquaculture/
http://www.dpi.nsw.gov.au/fishing/aquaculture/contacts
https://www.dpi.nsw.gov.au/fishing/aquaculture/faqs
https://www.dpi.nsw.gov.au/fishing/aquaculture/publications/species-freshwater
https://www.dpi.nsw.gov.au/fishing/aquaculture/publications/industry-directory
http://www.dpi.nsw.gov.au/fishing/aquaculture/publications/aquaculture-production-reports
www.dpi.nsw.gov.au/fisheries/aquaculture/publications/water-quality-management
https://www.dpi.nsw.gov.au/fishing/aquatic-biosecurity/aquaculture

NSW Government business support

https://www.business.nsw.gov.au/support-for-business/businessconnect
https://www.nsw.gov.au/working-and-business/starting-or-running-a-business/small-business-advice-and-support

Department of Planning, Industry and Environment - Planning

www.planning.nsw.gov.au/
https://www.planningportal.nsw.gov.au/

Crown Lands

https://www.industry.nsw.gov.au/lands

Department of Planning, Industry and Environment - Water

https://www.industry.nsw.gov.au/water

DPIE Environment, Energy and Science

https://www.environment.nsw.gov.au/
www.environment.nsw.gov.au/contact/
https://www.environment.nsw.gov.au/topics/land-and-soil/soil-degradation/acid-sulfate-soils
https://www.environment.nsw.gov.au/topics/aboriginal-cultural-heritage/protect-and-manage/aboriginal-heritage-information-management-system
https://www.environment.nsw.gov.au/vegetation/state-vegetation-type-map.htm

Environment Protection Authority
https://www.epa.nsw.gov.au/
https://www.epa.nsw.gov.au/about-us/contact-us
https://www.epa.nsw.gov.au/your-environment/water/managing-water-pollution-in-nsw/environment-protection-licensing

NSW Food Authority
www.foodauthority.nsw.gov.au

Transport for NSW
http://www.rms.nsw.gov.au/

NSW Office of Local Government
https://www.olg.nsw.gov.au/

Other NSW state agencies, organisations and websites

NSW legislation	www.legislation.nsw.gov.au/
NSW Marine Protected Areas	www.mpa.nsw.gov.au/
Manly Hydraulics Laboratory	www.mhl.nsw.gov.au
Local Land Services	www.lls.nsw.gov.au/
National Trust NSW	www.nationaltrust.org.au/nsw/
Sydney Fish Market	www.sydneyfishmarket.com.au

Other state/federal agencies or organisations

Australian BPD Foundation	http://bpdfoundation.org.au/
Australian Institute of Building	www.aib.org.au/
Qld Department of Agriculture and Fisheries	www.daf.qld.gov.au/
Food Standards Australia New Zealand	www.foodstandards.gov.au/
Australian Department of Agriculture, Water and Environment	www.environment.gov.au/epbc/
Australian Department of Agriculture, Water and Environment	www.environment.gov.au/water/wetlands/australian-wetlands-database
Australian Department of Agriculture, Water and Environment	www.environment.gov.au/biodiversity/migratory/index.html
Australian Department of Agriculture, Water and Environment	www.environment.gov.au/heritage/index.html
National Native Title Tribunal	www.nntt.gov.au/Pages/Home-Page.aspx
Australian Department of Agriculture, Water and Environment	www.environment.gov.au/climate-change/greenhouse-gas-measurement/ageis
Eyre Peninsula South Australia Tourism	http://www.eyrepeninsula.com/experiences/seafood-frontier-touring-route

Appendix 3: Species culture methods and constraints

Species	Disease/ Pathogen security status	Risk of survival and establishment following escape	*Permissible culture methods*[5]				Specific operational and site constraints
			Tank	Ponds below the PMF[6] level in the eastern drainage or below the 1:100 ARI flood level in the western drainage[7]	Ponds above the PMF level in the eastern drainage or above 1:100 ARI flood level in the western drainage [3]	Open system (Flow – through)	
Any hybrid fish, any species not listed in this table or a variation of culture method listed in this table	**Assessment must be done on a case by case basis according to the National Policy Guidelines for the Translocation of Live Aquatic Animals**						
Freshwater aquarium species							
Exotic freshwater aquarium species listed on Schedule 6 of the EPBC Act.	High	High	Yes	No	Yes	No	
Flat Head Gudgeon (Philypnodon grandiceps)	Natives: Low within endemic area – high outside	Natives: Low within endemic area – high outside/ domesticated natives: High	Yes	Yes	Yes	No	
Climbing Galaxias (Galaxias brevipinnis)	As above	As above	Yes	Yes	Yes	No	
Common Jollytail (Galaxias maculatus)	As above	As above	Yes	Yes	Yes	No	
Eastern Dwarf Galaxias (Gallaxiella pusilla)	As above	As above	Yes	Yes	Yes	No	
Empire Gudgeon (Hypseleotris compressa)	As above	As above	Yes	Yes	Yes	No	
Firetailed Gudgeon (Hypseleotris galii)	As above	As above	Yes	Yes	Yes	No	
Goldfish (Carassius auratus)	High	High	Yes	No	Yes	No	Prohibited in catchments free of Carp/Goldfish.
Koi carp (Cyprinus carpio)	High	High	Yes	No	Yes	No	Prohibited in catchments free of Carp
Cox's Gudgeon (Gobiomorphus coxii)	Natives: Low within endemic area – high outside	Natives: Low within endemic area – high outside/ domesticated natives: High	Yes	Yes	Yes	No	
Purple spotted gudgeon (Mogurnda adspersa)	As above	As above	Yes	Yes	Yes	No	
Murray Cray (Euastacus armatus)	As above	As above	Yes	Yes	Yes	No	

[5] For any **culture methods** not listed in this table, an assessment must be done on a case by case basis according to the National Policy Guidelines for the Translocation of Live Aquatic Animals

[6] Probable Maximum Flood

[3] Highest historical flood level may be considered where a 1:100 average recurrent interval (ARI) flood event is not readily available in the western drainage.

Species	Disease/ Pathogen security status	Risk of survival and establishment following escape	*Permissible culture methods*[5]				Specific operational and site constraints
			Tank	Ponds below the PMF[6] level in the eastern drainage or below the 1:100 ARI flood level in the western drainage[7]	Ponds above the PMF level in the eastern drainage or above 1:100 ARI flood level in the western drainage[3]	Open system (Flow – through)	
Pacific Blue Eye (Pseudomugil signifer)	As above	As above	Yes	Yes	Yes	No	
Murray River Rainbowfish (Melanotaenia fluviatilis)	As above	As above	Yes	Yes	Yes	No	
Striped Gudgeon (Gobiomorphus australis)	As above	As above	Yes	Yes	Yes	No	
Sydney Crayfish (Euastacus spinifer)	As above	As above	Yes	Yes	Yes	No	
Western Carp Gudgeon (Hypseleotris klunzingeri)	As above	As above	Yes	Yes	Yes	No	
Bullrout (Notesthes robusta)	As above	As above	Yes	Yes	Yes	No	
Floodplain Mussel (Velesunio ambiguus)	As above	As above	Yes	Yes	Yes	No	
River Blackfish (Gadopsis marmoratus)	As above	As above	Yes	Yes	Yes	No	
Marine aquarium species							
Barramundi Cod (Cromileptes altivelis)	High	Low	Yes	No	No	No	
Spotted Seahorse (Hippocampus kuda)	Low in east high in West	As above	Yes	No	No	No	
Highcrown Seahorse (Hippocampus procerus)	As above	As above	Yes	No	No	No	
Low Crowned/Flat Faced Seahorse (Hippocampus trimaculatus)	As above	As above	Yes	No	No	No	
Sad Seahorse (Hippocampus tristis)	As above	As above	Yes	No	No	No	
White's Seahorse (Hippocampus whitei)	As above	As above	Yes	No	No	No	
Wrasse (Labroides bicolor)	As above	As above	Yes	No	No	No	
Wrasse (Labroides dimidiatus)	As above	As above	Yes	No	No	No	
Wrasse (Labroides pectoralus)	As above	As above	Yes	No	No	No	
Species non endemic to NSW							
Atlantic Salmon (Salmo salar)	High	Low within present distribution or High elsewhere	Yes	Yes	Yes	Yes	Not permitted under a Class E permit.
Brook Trout (Salvelinus fontinalis)	High	As above	Yes	Yes	Yes	Yes	Not permitted under a Class E permit.
Brown Trout (Salmo trutta)	High	As above	Yes	Yes	Yes	Yes	Not permitted under a Class E permit.
Koi Carp (Cyprinus carpio)	High eastern / Low western	High	Yes	Yes	Yes	No	Prohibited in catchments free of Carp
Rainbow Trout (Oncorhynchus mykiss)	High	Low within present distribution or High elsewhere	Yes	Yes	Yes	Yes	Not permitted under a Class E permit.

Species	Disease/ Pathogen security status	Risk of survival and establishment following escape	*Permissible culture methods*[5]				Specific operational and site constraints
			Tank	Ponds below the PMF[6] level in the eastern drainage or below the 1:100 ARI flood level in the western drainage[7]	Ponds above the PMF level in the eastern drainage or above 1:100 ARI flood level in the western drainage [3]	Open system (Flow – through)	
Barramundi (Lates calcarifer)	High	Low	Yes	No	No	No	Farms are to be above the PMF in the eastern drainage or above 1:100 ARI flood event level in western drainage or above level of highest historic flood level. No discharge of any waters to natural water bodies permitted.
Marron (Cherax tenuimanus)	High	High	Yes	No	Yes	No	Special fencing may be required
Redclaw (Cherax quadricarinatus)	High	High	Yes	No	Yes	No	Special fencing may be required
Sleepy Cod (Oxyeleotris lineolata)	High	High	Yes	No	No	No	
Brine Shrimp (Artemiidae sp.)	High	High	Yes	Yes	Yes	No	
Freshwater species							
Australian Bass (Macquaria novemaculeata)	High in Western drainage Low in Eastern Drainage	High	Yes	Yes	Yes	No	Eastern drainage sites
Eel Tailed Catfish – eastern form (Tandanus tandanus)	High in Western drainage Low in Eastern Drainage	High	Yes	Yes	Yes	no	Stock to be sourced from approved genetic broodfish. Not permitted under a Class E permit.
Eel Tailed Catfish – western form (Tandanus tandanus)	High in Eastern drainage Low in Western Drainage	High	Yes	Yes	Yes	No	Stock to be sourced from approved genetic broodfish. Not permitted under a Class E permit.
Longfin Eel* (Anguilla reinhardtii)	High in Western drainage Low in Eastern Drainage	High in Western drainage Low in Eastern Drainage	Yes	Yes	Yes	No	Special fencing may be required of ponds. Not permitted under a Class E permit.
Southern Short fin Eel* (Anguilla australis)	High in Western drainage Low in Eastern Drainage	High in Western drainage Low in Eastern Drainage	Yes	Yes	Yes	No	Special fencing may be required of ponds. Not permitted under a Class E permit.
Freshwater Mullet (Trachystoma petardi)	High in Western drainage Low in Eastern Drainage	High in Western drainage & South of Shoalhaven - Low in remaining Eastern Drainage	Yes	Yes	Yes	No	
Cusped Crayfish (Cherax cuspidatus)	High outside natural range / low within natural range	Low North Coast / High otherwise	Yes	Yes	Yes	No	Special fencing may be required outside natural range
Rotund Crayfish (Cherax rotundus)	High outside natural range / low within natural range	High outside natural range / low within natural range	Yes	Yes	Yes	No	Special fencing may be required outside natural range

Species	Disease/ Pathogen security status	Risk of survival and establishment following escape	*Permissible culture methods*[5]				Specific operational and site constraints
			Tank	Ponds below the PMF[6] level in the eastern drainage or below the 1:100 ARI flood level in the western drainage[7]	Ponds above the PMF level in the eastern drainage or above 1:100 ARI flood level in the western drainage [3]	Open system (Flow – through)	
Strong Crayfish (Euastacus valentulus)	High outside natural range / low within natural range	High outside natural range / low within natural range	Yes	Yes	Yes	No	Special fencing may be required outside natural range
Freshwater Prawn Macrobrachium australiense	High outside natural range / low within natural range	High	Yes	Yes	Yes	Yes	Broodstock must be sourced from local catchment
Freshwater Shrimp (Atyidae sp.)	High outside natural range / low within natural range	High	Yes	Yes	Yes	Yes	Broodstock must be sourced from local catchment
Mussels (freshwater) (Velesunio entatee)	High outside natural range / low within natural range	High outside natural range / low within natural range	Yes	Yes	Yes	Yes	Broodstock must be sourced from local catchment
Barcoo Grunter (Scortum barcoo)	High	High	Yes	No	No	No	Not permitted under a Class E permit.
Bony Bream (Nematalosa erebi)	High in Eastern drainage Low in Western Drainage	High in Eastern drainage Low in Western Drainage	Yes	Yes	Yes	No	
Golden Perch (Macquaria ambigua)	High in Eastern drainage Low in Western Drainage	high (high genetic variation)	Yes	Yes	Yes	No	Not permitted under a Class E permit.
Murray Cod (Maccullochella peelii)	High in Eastern drainage Low in Western Drainage	High in Eastern drainage Low in Western Drainage	Yes	No in Eastern Drainage	Yes	No	Prohibited in ponds within Richmond and Clarence River catchments. Not permitted under a Class E permit.
Silver Perch* (Bidyanus bidyanus)	High in Eastern drainage Low in Western Drainage	High in Eastern drainage Low in Western Drainage	Yes	Yes	Yes	No	Not permitted under a Class E permit.
Spangled Perch (Leiopotherapon unicolor)	High in Eastern drainage Low in Western Drainage	High in Eastern drainage Low in Western Drainage	Yes	Yes	Yes	No	Not permitted under a Class E permit.
Welchs Grunter (Bidyanus welchi)	High	High	Yes	No	No	No	Not permitted under a Class E permit.
Yabby (Cherax destructor)	High in Eastern drainage Low in Western Drainage	High in Eastern drainage Low in Western Drainage	Yes	Yes	Yes	No	Special fencing may be required in East
Marine / estuary species							
Balmain Bugs (Ibacus peronii)	High in Western drainage Low in Eastern Drainage	low	Yes	Yes	Yes	Yes	Open system in eastern drainage
Banana Prawn (Fenneropenaeus merguiensis)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage
Banded Coral Shrimp (Stenopus hispidus)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage
Beachworm (Australonuphis parateres)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage
Beachworm (Australonuphis teres)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage
Slimy Beachworm (Hirsutonumphis mariahirsuta)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage

Species	Disease/ Pathogen security status	Risk of survival and establishment following escape	*Permissible culture methods*[5]				Specific operational and site constraints
			Tank	Ponds below the PMF[6] level in the eastern drainage or below the 1:100 ARI flood level in the western drainage[7]	Ponds above the PMF level in the eastern drainage or above 1:100 ARI flood level in the western drainage[3]	Open system (Flow – through)	
Black Tiger Prawn (Penaeus monodon)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage
Blacklip Abalone (Haliotis rubra)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage
Bloodworms (Marphysa sanguinea)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage
Blue mussel (Mytilus galloprovincialis)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage
Brown tiger prawn (Penaeus esculentus)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage
Cobia (Rachycentron canadum)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage
Coral Trout (Plectropomus leopardus)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage
Dusky Flathead (Platycephalus fuscus)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage
Eastern King Prawn (Melicertus plebejus)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage
Eastern Rock lobster (Sagmariasus verreauxi)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage
Estuarine Clam (Katelysia rhytiphora)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage
Estuarine Clam (Tapes dorsatus)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage
Estuary Cod (Epinephelus coioides)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage
Estuary Perch (Macquaria colonorum)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage
Fingermark Bream (Lutjanus johni)	As Above	As Above	Yes	No	No	No	Open system in eastern drainage
Native Oysters (Ostrea angasi)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage
Flowery Rockcod (Epinephelus fuscoguttatus)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage
Greasyback Prawn (Metapenaeus bennettae)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage
Greenback Flounder (Rhombosolea tapirina)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage
Yellowtail Kingfish (Seriola lalandi)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage
Kuruma Prawn (Marsupenaeus japonicus)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage
Mahi Mahi (Coryphaena hippurus)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage
Mangrove Jack (Lutjanus argentimaculatus)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage
GiantMud Crab (Scylla serrata)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage
Sea Mullet (Mugil cephalus)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage
Mulloway (Argyrosomus japonicus)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage

Species	Disease/ Pathogen security status	Risk of survival and establishment following escape	*Permissible culture methods*[5]				Specific operational and site constraints
			Tank	Ponds below the PMF[6] level in the eastern drainage or below the 1:100 ARI flood level in the western drainage[7]	Ponds above the PMF level in the eastern drainage or above 1:100 ARI flood level in the western drainage[3]	Open system (Flow – through)	
Offshore Greasyback Prawn (Metapenaeus ensis)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage
Pacific Oysters (Crassostrea gigas)	As Above	As Above	Yes	Yes	Yes	Yes	Subject to estuary assessment and approval
Queensland Groper (Epinephelus lanceolatus)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage
Red Emperor (Lutjanus sebae)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage
Sand Whiting (Sillago ciliata)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage
School Prawn (Metapenaeus macleayi)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage
Yellowfin Bream (Acanthopagrus australis)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage
Silver Trevally (Pseudocaranx dentex)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage
Snapper (Pagrus auratus)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage
Black Bream (Acanthopagrus butcheri)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage
Sydney Rock Oysters (Saccostrea glomerata)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage Subject to estuary assessment and approval
Tube Worm (Diopatra aciculata)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage
Tube Worm (Diopatra dentata)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage
Yelloweye Mullet (Aldrichetta forsteri)	As Above	As Above	Yes	Yes	Yes	Yes	Open system in eastern drainage

*It should be noted that Silver Perch, Golden Perch, Murray Cod, Eel Tailed Catfish, Barcoo Grunter, Spangled Perch, Rainbow Trout, Brown Trout, Brook Trout, Atlantic Salmon, and eel species are not permitted in extensive aquaculture under a Class E aquaculture permit.

Appendix 4: Preparing a Statement of Environmental Effect (SEE) or Environmental Impact Statement (EIS)

These guidelines identify important factors to be considered when preparing a SEE or an EIS to accompany a DA (for both local development and SSD) for a sustainable land based aquaculture proposal.

The SEE or EIS should predict the likely environmental impacts of the proposal (including construction and ongoing operation) and provide the basis for the project's on-going sustainable management. This information is important for the applicant in making business decisions and for the broader community to understand what is happening in their community and the approval bodies so they have adequate information to make a decision.

The preparation of a SEE or EIS should be preceded by effective consultation with relevant government agencies, local councils and surrounding landowners and occupiers, including residences and local businesses. There should be early evaluation of alternatives, taking into consideration the factors in this guideline and in the relevant chapters in the NSW LBSAS. A high priority should be given to:

- considering environmental factors in site selection;
- evaluating alternative species, design, layout and management practices;
- ascertaining the suitability of the proposal in the intended location.

The analysis and justification for the preferred site, species and technology should be consistent with ecological sustainability principles. The assessment process should focus on key environmental issues. Key matters for land based aquaculture facilities and related activities include:

- selection of an appropriate location and design layout to provide for sustainable management;
- water lifecycle management: source and availability of water and minimisation; management of wastewater;
- minimisation of adverse impacts on flora and fauna, in particular the risks associated with the species to be farmed and management of predators.

The SEE/EIS should outline commitments to the ongoing environmental management of the proposal, including monitoring.

The relevance of matters in this guideline to a particular land based aquaculture proposal will depend upon the proposed location, the species cultivated, intensity of production and the proposed cultural methods. The greater the potential environmental impacts, the more carefully the site, design and operational practices must be considered and assessed.

A. Do I need an EIS or a SEE??

If an aquaculture proposal is a Class 3 - designated development or state significant development, an EIS must be prepared and submitted with the DA.

If your application is Class1 or Class 2 local development, a SEE is required and must be submitted with the DA.

B. Factors to consider when preparing an application

The aim of an environmental impact assessment is to enable the approving authority, public, local council, government authorities and the applicant to properly consider the potential

environmental consequences arising from a proposal. The SEE or EIS should also provide the basis for sound ongoing environmental management.

It is the applicant's responsibility to identify and address, as fully as possible, the matters relevant to the specific proposal and to comply with the statutory requirements for EIS preparation. The SEE/EIS should address relevant issues in sufficient detail so that the consent authority can make an informed judgement about the environmental impacts of the proposal. The following factors are important when preparing a SEE/EIS.

C. Early consideration of the strategic context

Strategic environmental issues need to be considered at the outset when selecting options for the proposal. These broader strategic issues have been considered in the development of the NSW LBSAS.

The LBSAS refers to a series of maps identifying sites that have the potential for the development of land based aquaculture, provided the site meets the minimum locational performance criteria.

The AIDP applies a simple, streamlined assessment process to those aquaculture developments that are appropriately sited, employ best practices and pose a low risk to the environment.

Based on the AIDP, a development PPA for the proposed aquaculture development should be included in the EIS/SEE. The PPA allows the applicant to confirm the proposal meets the minimum site performance and operational criteria and determine the likely level of risk to the environment (using risks associated with performance, species, methods and locational criteria). Refer Chapter 9 for more details on the PPA.

D. Early assessment of options

The applicant should liaise closely with NSW Department of Primary Industries, EPA and the council at the early stages of a development proposal particularly, in identifying and testing various options to meet the applicant's objectives for the proposal. When weighing up all feasible alternatives, the biophysical, economic and social costs and benefits throughout the whole life cycle of the proposal should be considered. Early adoption of ESD principles can reduce possible conflicts, and additional costs and delays at later stages of the approval process.

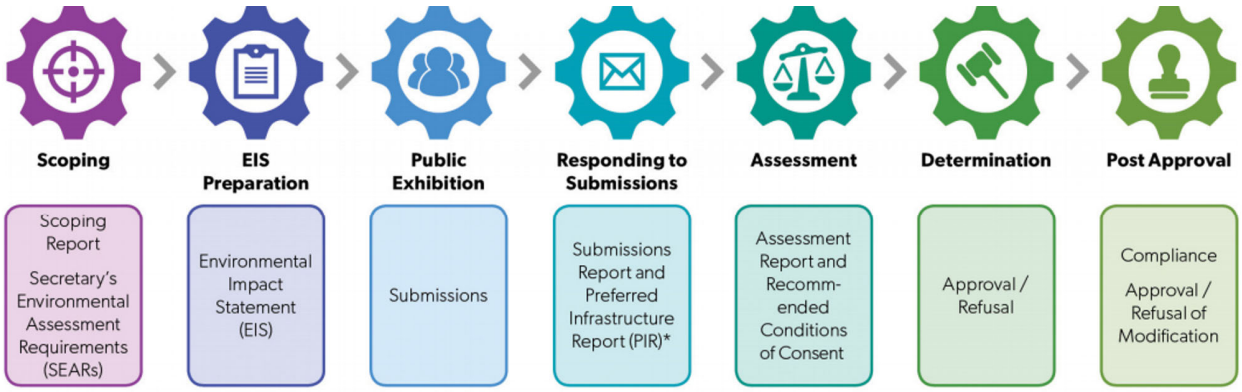
E. Identifying issues

There is no prescribed framework for a SEE however there are general requirements about the documents that must accompany a DA in Part 1, Schedule 1 of the EP&A Regulation and the general framework for an EIS can be used as a guide.

The general framework for an EIS is prescribed in Schedule 2 of the EP&A Regulation . If an EIS is required, a request must be made to the Planning Secretary for the Secretary's Environment Assessment Requirements (SEARS) which will outline the issues that must be assessed in the EIS.S. In issuing the SEARs the Planning Secretary must consult with relevant government authorities . The requirements of these authorities will also be sent to the applicant at this time.

Figure 10 below shows the steps involved in the development assessment process where an EIS is required:

Figure 10: Steps involved in the development assessment process where an EIS is required



DPIE has a number of draft guidelines regarding the Environmental Impact Assessment Process. These guidelines are designed to help applicants through the assessment process and to aid them in producing sufficient high-quality documentation for a development proposal. This is likely to lead to a more efficient assessment and better outcomes for the applicant and the community.

In addition to the specific requirements, the applicant has a broader responsibility to consider all potential environmental issues in relation to the proposal. As a precursor to identifying potential environmental issues, the applicant must outline:

- the important characteristics of the project
- the proposed site
- a preliminary assessment of the sensitivity of the site.

In addition to the issues outlined in this guideline, other sources of information that may assist in the identification of potential issues include:

- any relevant guidelines produced by NSW Government authorities, other States or overseas
- EISs for similar projects, and any relevant Commission of Inquiry report, determination report and conditions of approval
- Relevant research and reference material on similar proposals.

To help identify issues relating to a particular proposal, informal consultation or a structured process with a high level of consultation with all stakeholders should be undertaken. The choice of the approach will depend on the scale and type of proposal and the sensitivity of the environment.

F. Prioritising issues

The relative importance placed on different issues identified in this guideline will vary from case to case, and is a function of the type and size of the proposal and the sensitivity of the surrounding environment. Issues should be prioritised according to their importance in the decision-making process.

It is important there is sufficient the budget for preparing the SEE/EIS so the studies which are essential to predicting impacts and making decisions are undertaken and unnecessary studies which may not be important to the decision-making or the long term management of the site are not prepared. It is critical that resources are focused on ‘key’ issues with the AIDP and the project profile analysis in ranking the likely risks associated with land based aquaculture proposals.

The outcome of the identification and prioritisation process should result in:

a) a list of all issues with a preliminary estimate of the relative significance of their impacts;
b) identification of the key issues taking into consideration the project profile analysis;
c) an estimate of the scope of the information required for these key issues;
d) an explanation as to why other issues are not considered to be key.

The SEE/EIS should address the key issues as fully as practicable. However, the level of analysis should reflect the level of significance of the impacts and their importance for the proposal.

Selection of impact assessment team

The professional expertise, competency and judgment of the applicant's study team is key to identifying relevant matters and impacts. It is therefore critical that this team be selected carefully. Substantive consultation, early identification of issues, addressing concerns and submission of high-quality documentation prepared by a team of competent consultants has the benefit of potentially shorter assessment times arising from better community awareness of the project and a more focussed and well-prepared EIS or SEE.

G. Impact analysis and prediction

Discussion of likely impacts should include predictions of the nature and extent of potential impacts and the effectiveness of mitigation strategies. This information is fundamental in deciding the potential ecological sustainability and hence the acceptability of a particular proposal.

1. Baseline information

A certain amount of baseline information is required to determine the level of risk associated with the project based on the project profile analysis. A project considered high risk will require more detailed baseline information for predicting the likely level of impacts than a project considered to be low.

In some circumstances, there may be sufficient existing data available for assessment purposes without the need for additional data collection. Where existing data is used, its adequacy and appropriateness for assessment of the proposal's impacts should be reviewed and discussed.

In all cases, sampling programs and analysis procedures should reflect current scientific approaches for design, sampling methodology, data analysis and interpretation of results. Where baseline data is to be collected first-hand, careful consideration must be given to the design of the sampling program. The need for long term sampling to discern the variability of the environment should also be considered as early as possible to avoid time constraints. This could be an issue where discharges to natural waterways are proposed. Any assumptions and extrapolations used to draw conclusions from the data should be justified.

2. Predicting the likely impacts and identifying mitigation

Impact prediction should consider magnitude, duration, extent, direct and indirect effects, beneficial and adverse effects and whether impacts are reversible or permanent. All predictions of impacts using predictive models should be justified in terms of appropriateness for the task, outlining its strengths and weaknesses, the likely success of mitigation strategies, and the element of uncertainty associated with them. The applicant should identify and, where possible, indicate the level of uncertainty associated with these predictions and mitigation measures. This information is fundamental in developing appropriate management strategies and informs the applicant, community, government agencies and the decision-maker of the degree of risk associated with the proposal and the importance of that risk.

Whenever conclusions and recommendations have been based substantially on judgements instead of facts or objective analytical results, the basis of the judgements should be clearly identified. A staged development may be required in order to monitor and test predicted impacts.

3. Mitigation strategies

Mitigation strategies must be considered both in relation to individual impacts and collectively for all impacts. This helps to avoid conflict between mitigation strategies and ensures that measures applied with respect to one (or more) potential impacts do not increase the magnitude or significance of other likely impacts. The mitigation strategy should include the environmental management principles that would be followed including:

1. a compilation of locational, layout, design or operational features in the EIS;
2. an outline of ongoing environmental management and monitoring plans.

Predictions made in the SEE/EIS should be monitored in an environmental management plan (EMP). With projects posing potentially controversial environmental impacts, it may be appropriate to:

- consult with relevant government bodies, the local council and the community
- trial proposed mitigation measures in the EMP (obtaining necessary approvals)
- develop contingency measures to deal with impacts should mitigation measures not deliver the predicted outcomes
- exhibit an annual environmental management report outlining the environmental performance of the proposal.

It is not expected that a detailed EMP be prepared at the DA stage. However, the EIS/SEE should contain an outline of the content of an EMP addressing critical issues, structure and commitment to prepare an EMP if required.

H. Ecologically sustainable development

Under the EP&A Regulation, it is necessary to justify the proposal having regard to the principles of ESD. Ecological sustainability requires a combination of good planning and an effective and environmentally sound approach to design, operation and management. The applicant should have regard to the principles of ESD throughout the whole project life cycle especially in the use and re-use of resources, consideration of neighbours and minimising irreversible impact on the natural environment. Continual reference should be made to the question 'Is this proposal ecologically sustainable?'

I. Threatened species impacts

If terrestrial or aquatic threatened species, populations or ecological communities or their habitats occur on the site or in the area of impact, a biodiversity assessment and approval may be required.

Assessment and approval pathways for biodiversity impacts will depend on the purpose, nature, location and extent of vegetation clearing. In some cases, you may be required to obtain development consent or a native vegetation clearing approval. You may need to engage an accredited assessor to prepare a Biodiversity Development Assessment Report in accordance with the Biodiversity Assessment Method and to submit that report with your application for consent or approval. In other cases, you may not be required to obtain a Biodiversity Development Assessment Report but may need to obtain a permit from the local council to carry out clearing. Also refer to part 7 of the *Fisheries Management Act 1994* regarding a permit to harm marine vegetation.

The Office of Local Government has designed a helpful tool to help decide which approvals are likely to apply:

https://www.olg.nsw.gov.au/councils/land-management/biodiversity/biodiversity-assessment-and-approvals-navigator/

Further information is also available on the NSW Department of Planning, Industry and Environment's website:
https://www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity

J. Consultation

1. Purpose of pre-assessment consultation

One of the Objects of the EP&A Act (S.1.3) is to provide increased opportunity for community participation in environmental planning and assessment. The EP&A Act and EP&A Regulation set out public exhibition and notification requirements for DAs in NSW, including requirements for public notices, the length of public exhibition periods, access to and availability of exhibition documents, and the provision, publication and response to submissions.

Participation in environmental assessment requires actions and inputs from applicants, the community, stakeholders and DPIE.

Early consultation with the local residents, other industry, councils and government agencies is of great assistance in making a preliminary assessment of the potential viability and likely acceptability of the project at a particular site. It can also assist in ensuring that the SEE or EIS is focused on those matters that will add value to the decision-making process.

Effective consultation should enable an applicant to:

- clarify the objectives of the proposal taking into consideration community concerns or issues
- clarify the relationship of the proposal to relevant government policy directions or land use, economic, estuary or vegetation management plans which may constrain development on the site
- identify feasible alternatives and their relative merits
- identify environmental issues to:
  - prioritise and identify issues key to the decision-making process of the investors as well as to the consent and approval authorities
  - identify the studies for key issues to provide adequate information for the decision-making process
  - identify performance objectives or indicators for key issues
  - when appropriate, identify experts (in government agencies or from other sources) who can assist in guiding and reviewing the assessment key issues
- identify processes for continued community consultation, if appropriate.

In preparing the SEE or EIS, consultation with relevant parties should be undertaken early in the process and their comments taken into account in the SEE or EIS.

2. Planning focus meetings for major projects

To facilitate consultation with relevant government agencies, it may be appropriate to hold a planning focus meeting (PFM). PFMs should be held for all major or potentially controversial proposals. The consent authority would usually be responsible for organising the PFM which would include government authorities which have an approval role, other agencies or independent technical experts.

3. Pre-lodgement meetings for smaller projects

For smaller projects, less formal meetings or discussions with relevant authorities, particularly the local council, should be undertaken. Issues such as whether a proposal is consistent with

the council's strategic plan for the area and is permissible at the particular site should be clarified at the outset.

4. Formal consultation required for an EIS

Under the provisions of the *EP&A Regulation*, an applicant or proponent must formally seek the Planning Secretary's SEARs regarding the content of an EIS. In many cases, DPIE/council will facilitate a PFM before the applicant seeks the SEARs. In the case of a council facilitated PFM, the minutes of the PFM or issues canvassed in the discussions be forwarded to DPIE when the Planning Secretary's requirements are requested.

The SEARs for an SSD application include requirements for applicants to engage with the community and other stakeholders on a case by case basis. These requirements, which apply during the preparation of the EIS, construction and operation, recognise the importance of participation by the community and other stakeholders in the environmental assessment process.

5. Community consultation

The community likely to be affected, whether directly or indirectly, should be informed of the proposal and consulted early in the preparation of the EIS or SEE. Engagement must be genuine and provide opportunities for the community to provide feedback on project design. The EIS/SEE should include details of how issues raised during consultation have been addressed and whether they have resulted in changes to the development. The community can be a valuable source of information about a locality and by taking a 'partnership' approach with the local community, these factors can be identified early and appropriately considered. Consultation should aim to include affected individuals, community groups and groups with special interests such as local Aboriginal communities.

Consultation usually includes two phases:

- Firstly, seeking to inform the community (public meetings, public displays or newsletters).
- Secondly, seeking to gain input on issues of community concern, to identify community values and to identify and evaluate alternatives (for example, focus meetings, 'issues' workshops and surveys).

Once the application has been submitted, a formal exhibition process will also be undertaken.

K. Who should be consulted on technical issues?

The consent authority (council, Local or Regional Planning Panel or Department of Planning, Industry and Environment) should be able to direct proponents to relevant state government agencies that may be able to assist on technical issues. These agencies may include:

- Department of Planning, Industry and Environment - Water
- Department of Planning, Industry and Environment - Resources and Energy
- NSW Department of Primary Industries - Fisheries
- Department of Planning, Industry and Environment - Crown Lands
- Department of Planning, Industry and Environment - Environment, Energy and Science
- Department of Primary Industries - NSW Food Authority
- Transport for NSW or State Rail Authority
- Aboriginal Affairs
- NSW Rural Fire Service
- Environment Protection Authority

CONSULTATION DRAFT

A NSW GOVERNMENT INITIATIVE

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