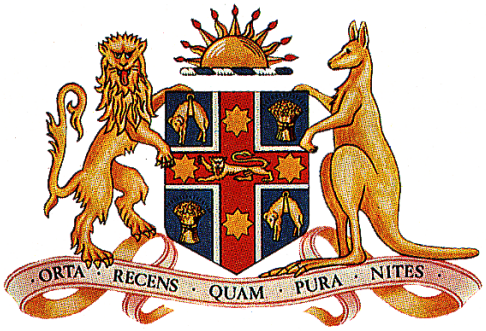

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NSW Oyster Industry **Sustainable Aquaculture Strategy**

A NSW Government Initiative
August 2021

NSW GOVERNMENT

Department of Primary Industries

NSW Oyster Industry Sustainable Aquaculture Strategy

Fourth Edition

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Department of Planning, Industry and Environment – Crown Lands

Department of Regional NSW – Local Land Services

Department of Regional NSW – Department of Primary Industries – Biosecurity & Food Safety

Transport for New South Wales

NSW Shellfish Committee

Foreword to the fourth edition

The fourth (2021) edition of the NSW Oyster Industry Sustainable Aquaculture Strategy (OISAS) is a review of the third edition of OISAS in response to the development of new floating cultivation and the availability of new materials that can be used to construct oyster farming infrastructure. These developments highlighted the need to clarify what constitutes a tidy oyster lease. The strategy updates the essential elements of the previous edition to ensure that they reflect the current administrative and approvals processes applicable to the NSW oyster industry.

The vision of a healthy and sustainable NSW oyster industry remains and with an increasing production trend, an aspirational production goal has also been retained. This is in the belief that the recent upward production trend will be maintained and enhanced by new investment and from innovative culture technology.

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 contributes 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).

The NSW oyster aquaculture industry is Australia's largest producer of edible oysters, the fourth largest Australian aquaculture industry and accounts for 73% of the value of NSW aquaculture production. It is the state's most valuable fishery.

In recent years annual production has continued to grow steadily to 3,695 tonnes valued at the farm gate at approximately $58.6 million in the 2018-2019 financial year. This growth has been driven by increasing investment in new environmentally sustainable farming technology and steadily increasing farm gate prices.

NSW Department of Primary Industries (DPI) estimates that the sustainable production level for oysters in NSW estuaries is around 7,500 tonnes and the principal aim of NSW Oyster Industry Sustainable Aquaculture Strategy (OISAS) is to establish the regulatory environment within which the industry can grow to this level.

This growth can be achieved within the boundaries of ecological sustainability and within the boundaries developed in co-operation with all relevant State government agencies, neighbouring communities and the oyster industry.

These boundaries are set physically, by the identification of suitable 'priority' areas for edible oyster aquaculture. Specifying areas where commercial oyster aquaculture is a priority intended outcome from a state perspective is the first recommendation of the Healthy Rivers Commission in its *Healthy Oysters, Healthy Rivers Report* (HRC, 2003).

Consistent with this recommendation, every 'priority' area in the state was individually inspected and evaluated against a list of location, environmental and socio-economic suitability criteria and classified as either suitable or unsuitable for classification as a Priority Oyster Aquaculture Area (POAA). Management and operational boundaries are established in a regularly updated set of best practice standards within OISAS, which are supported by a commitment to environmentally sustainable practices.

The importance of farmed oysters to healthy estuaries should not be underestimated. They are a sentinel species, in that, if the oysters are healthy and suitable for human consumption, then it is likely that the estuarine waters in which they are grown are also healthy. On average, a farmed oyster will filter in excess of 250,000 litres of estuarine water in its lifetime, removing large quantities of suspended material, chiefly nutrients bound in phytoplankton. This means that in many estuaries oysters play an important role in mitigating man made nutrient inputs and assist in maintaining estuary health, but in performing this role they are exceedingly vulnerable to poor estuarine water quality.

In recognition of this dichotomous relationship, OISAS establishes a set of water quality and flow objectives for oyster aquaculture areas that, if met, will provide for the healthy growth of oysters that are safe for human consumption. A set of water quality protection and improvement measures are proposed to achieve the desired water quality objectives for oyster aquaculture areas.

The assessment of all environmental aspects of oyster aquaculture in this strategy, and the establishment of best practice standards, allows for a streamlined approvals process for proposals that are located in the areas identified as POAA. Oyster aquaculture in these areas

will be ‘development without consent’ but will require an aquaculture permit and aquaculture lease from DPI.

Oyster aquaculture outside of POAA can be undertaken, but only with development consent from the relevant local council or Department of Planning Industry and Environment for state significant proposals. In the National Park estate, planning approval from the relevant authority and written Ministerial concurrence are required.

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Abbreviations

Abbreviation	Definition
AHD	Australian Height Datum
ASQAP	Australian Shellfish Quality Assurance Program
CL	Department of Planning Infrastructure and Environment (Crown Lands)
CLM Act	*Crown Land Management Act 2016*
CSIRO	Commonwealth Scientific Industrial Research Organisation
DAWE	Federal Department of Agriculture Water and Environment
DPI	NSW Department of Primary Industries
DPIE	Department of Planning Infrastructure and Environment
DRNSW	Department of Regional NSW
EIS	Environmental Impact Statement
EPA	Environment Protection Authority NSW
EP&A Act	*Environmental Planning and Assessment Act 1979*
ESD	Ecologically Sustainable Development
FMA Act	Fisheries Management Act 1994
ha	Hectare
HEHO	Healthy Estuaries for Healthy Oysters Guidelines 2017
LEP	Local Environment Plan
LLS	Local Land Services
MEMA	Marine Estate Management Authority
MEMS	Marine Estate Management Strategy
NPW Act	*National Parks and Wildlife Act 1974*
NPWS	National Parks and Wildlife Service

Abbreviation	Definition
OISAS	NSW Oyster Industry Sustainable Aquaculture Strategy
POAA	Priority Oyster Aquaculture Area
POEO Act	*Protection of the Environment Operations Act 1997*
POMS	Pacific Oyster Mortality Syndrome
PPRD	State Environmental Planning Policy (Primary Production and Rural Development) 2019
QX	A disease of Sydney Rock Oysters
REF	Review of Environmental Factors
SEE	Statement of Environmental Effects
SEPP	State Environmental Planning Policy
TARA	NSW Marine Estate Threat and Risk Assessment Final Report (2017)
TfNSW	Transport for NSW

Definitions

Term	Definition
Aquaculture	The commercial 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 commercial purposes as defined in *Fisheries Management Act 1994*.
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 shellfish.
Catchment area	A drainage area, for example for a reservoir, river or estuary (includes subject water body as well).

Term	Definition
Carrying capacity	The maximum biomass (weight) of shellfish that an area can support and remain commercially viable.
Culling	The division by hand of clumps of oysters into single oysters or the removal by hand of unwanted marine organisms which attach to oyster crops.
Catching	The collection of wild juvenile shellfish spat - settled onto artificial 'catching' materials such as plastic slats placed on an aquaculture lease.
Depoting	A historical practice of using blocks of catching sticks bound together. The protection of the block enables oysters to grow to a size that can withstand predation by fish, prior to separation into a single layer of sticks.
Depuration	A statutory process that requires oysters to be placed in a sterilised recirculation tank for 36 hours. During this process oysters self-cleanse in recirculation water, which is sterilised using ultraviolet light.
Development without consent	Has the same meaning as it would under the *Environmental Planning and Assessment Act 1979*.
Development with consent	Has the same meaning as it would under the *Environmental Planning and Assessment Act 1979*.
Diploid oyster	A normally reproductive oyster containing two sets of chromosomes
Floating cultivation	Sub-tidal cultivation of oysters, on sticks or in baskets suspended beneath floatation systems. Floating cultivation may include lines and/or polyethylene floats, buoys or pipes.
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 species confined in occurrence to a local region.
Environmental impact	The potential biophysical, social and/or economic effects of an activity on the community or the natural environment.
Environmental Impact Statement	A detailed assessment on the potential effects of a proposed development prepared in accordance with the requirements of the *Environmental Planning and Assessment Act 1979*.
Estuarine	Pertaining to or formed in an estuary (brackish water). Also relates to those soil materials, which have been under the influence of brackish water during their deposition.
Fish	As defined in *Fisheries Management Act 1994*.

Term	Definition
Indigenous species	A species native to a particular region or country at the time of first British colonisation.
Introduced species	A species introduced into an area where it does not naturally occur.
Keystone species	Marine keystone species provide architectural complexity that serves as essential habitat in which many other marine species find refuge for their young and also from predators.
Lease Maintenance and Development Plan	A document that describes all the oyster aquaculture lease areas held by an aquaculture permit holder, the condition of infrastructure on the lease areas and how the infrastructure will be maintained and/or the lease area will be developed in the future.
Mudworm	A group of marine boring polychaete worms which can cause significant oyster mortality.
National Parks Estate	Lands reserved or acquired under the *National Parks and Wildlife Act 1974.*
NSW Shellfish Program	A NSW oyster industry food safety program administered by the NSW Food Authority.
Notifiable matter	Pest or disease listed in Schedule 1 of the Biosecurity Regulation 2017, that if suspected is required to be reported to DPI.
Oyster aquaculture lease	An area of submerged Crown land that is leased for the purpose of oyster aquaculture.
Oyster aquaculture land base site	An area of non-submerged Crown land that is leased or licensed for the purpose of supporting oyster aquaculture.
Pathogen	An infectious agent capable of causing disease.
pH	A measure of acidity or alkalinity of a substance. A pH of 7.0 denotes neutrality, higher values indicate increasing alkalinity, and lower values indicate increasing acidity.
POMS	A viral disease of Pacific Oysters caused by the OsHV-1 micro variant.
Post supported intertidal cultivation	A series of parallel vertical posts that support horizontal rails or lines on which oyster sticks, trays and/or baskets that are attached so the oysters are submerged for varying periods of the tidal cycle.

Term	Definition
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 it is required to be reported to DPI.
QX disease	A disease of the Sydney Rock Oyster caused by the protozoan parasite (Marteilia sydneyi).
Raft cultivation	Sub-tidal cultivation of oysters in trays or baskets suspended from a permanently anchored, rigid, high buoyancy structure such as a pickle drum raft. Rafts generally have a rigid frame from which the cultivation material is suspended.
Ramsar Convention	Convention on Wetlands of International Importance to which Australia is a signatory
Salinity	The measure of salt concentration of water in ponds, tanks or hatchery expressed in part per thousand or ppt.
Siltation	The deposition of silt or sand in the estuarine environment.
Single seed oyster	An individual unattached oyster that is grown from small spat produced by removing wild oysters at a very early age from plastic collectors or produced as single oysters in a shellfish hatchery.
Spat	Small juvenile oysters either wild caught or hatchery stock.
Stick cultivation	Traditional growing of wild caught oysters on the sticks that they are caught on. Suitable method for areas subject to significant wave action. ‘Stick oysters’ may be removed from sticks and fattened on trays or in baskets prior to harvest.
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 EP&A Act.
Stocking density	Number of animals per given area.
Tray cultivation	Growing out single seed oysters on trays. Suitable method for sheltered areas. Often used for the final stage of growth prior to harvest.
Triploid oyster	A functionally sterile oyster bred to contain three sets of chromosomes (triploid oysters occur naturally at low frequency in nature)
Winter Mortality	Causative agent currently under review, thought to be caused by Bonamia (Mikrocytos roughleyi).

Chapter 1 Introduction

1.1. Vision statement

The vision of the NSW Oyster Industry Sustainable Aquaculture Strategy (OISAS) is to achieve the ecologically sustainable production of 7,500 tonnes of premium NSW oyster products for domestic and export markets by 2030.

1.2. Scope and objectives

OISAS applies to the edible oyster aquaculture industry which cultivate oysters on Class 1 aquaculture leases in estuarine waters in NSW issued under the *Fisheries Management Act 1994* (*FM Act*). This strategy only applies to other non-oyster species where they are grown on an oyster aquaculture lease using oyster farming practices described in this document.

In non-estuarine waters the cultivation of oysters must comply with the provisions of the NSW Marine Wates Sustainable Aquaculture Strategy.

Oyster aquaculture is the commercial cultivation of any species of edible oyster (e.g. Sydney Rock Oyster, Native (flat) Oyster, Pacific Oyster). Oyster aquaculture includes all routine activities associated with the cultivation of oysters, including the construction and maintenance of culture infrastructure and stock management activities for nursery and grow-out operations.

OISAS:

- identifies those areas within NSW estuaries where oyster aquaculture is a suitable and priority outcome
- secures resource access rights for present and future oyster farmers throughout NSW
- documents and promotes environmental, social and economic best practice for NSW oyster farming and ensures that the principles of ecological sustainable development, community expectations and the needs of other user groups are integrated into the management and operation of the NSW oyster industry
- formalises industry's commitment to environmentally sustainable practices and a duty of care for the environment in which the industry is located
- provides a framework for the operation and development of a viable and sustainable NSW oyster aquaculture industry with a clear approval regime and up-front certainty for existing industry participants, new industry entrants, the community and decision makers
- identifies the key water quality parameters necessary for sustainable oyster aquaculture and establishes a mechanism to maintain and where possible improve the environmental conditions required for sustainable oyster production
- ensures that the water quality requirements for oyster growing are considered in the State's land and water management and strategic planning framework.

1.3. The need for this strategy

The need for OISAS arose from concerns of both the NSW government and the NSW oyster aquaculture industry, as to the existing and potential impact on the oyster aquaculture industry associated with the rapid development of the NSW coastline. The strategy has been developed by the government in partnership with the NSW oyster aquaculture industry and local community and other key stakeholders. The strategy sets out best practice in the identification and use by the oyster aquaculture industry of those estuarine areas suitable as Priority Oyster Aquaculture Areas (POAA) and provides for the protection of water quality in these areas. The strategy is one of a suite of strategies initiated by the NSW government for the management and development of aquaculture in NSW.

1.4. Ecological sustainable development

Ecological sustainable development (ESD) is not just about the environment, but also about the viability of businesses and the broader community's wellbeing. 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.'

At the national level ESD is being addressed in aquaculture through the National ESD Framework. The *How to Guide for Aquaculture* (Fletcher et.al. 2004) is the first stage in the development of this framework and documents the methods needed to enable the initial analyses of any aquaculture sector against the principles of ESD. OISAS has been developed with reference to this framework. More information regarding the National Strategy on ESD can be found at www.fisheries-esd.com.au/c/implement/implement0300.cfm.

Since NSW adopted the National Strategy on ESD, it has become a major objective of all NSW natural resource management, environment protection and planning legislation. A key object of the *FM Act* is to promote ecologically sustainable development and this object is being met in part through the development of state-wide Sustainable Aquaculture Strategies. ESD is now accepted as the foundation for aquaculture management in NSW.

The relevant definition for ESD in NSW is given in the *Protection of the Environment Administration Act 1991* (s.6), which states:

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:

- 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:
    - careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment
    - an assessment of the risk-weighted consequences of various options.
- 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
- conservation of biological diversity and ecological integrity—namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration
- improved valuation, pricing and incentive mechanisms—namely, that environmental factors should be included in the valuation of assets and services, such as:
    - polluter pays—that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement
    - 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

- 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 OISAS by:

- identifying areas where oyster farming is an intended outcome and implementing measures that will lead to the protection and improvement of water quality in those areas
- permitting oyster farming in areas only where it is ecologically sustainable by virtue of its location, for example navigation channels and environmental sensitive areas are excluded
- describing best operational and management practices for the industry that are based on ESD principles.

For the oyster industry, adopting ESD principles will:

- provide a pathway to address issues affecting the industry's long-term survival
- put in place a systematic and recognised means of establishing the industry's resource management credentials with regulatory agencies, oyster consumers and neighbours
- put the industry in a stronger position to argue for the protection of the environmental conditions required for oyster growing
- support the industry's position as a legitimate user of public water land
- 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 scale, 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 oyster aquaculture investment opportunities.

1.5. Implementation and legislation

OISAS is as an Aquaculture Industry Development Plan for the purpose of s.143 of the *FM Act*.

State Environmental Planning Policy (Primary Production and Rural Development) 2019 (PPRD) gives effect to planning provisions for oyster aquaculture. These provisions link to additional

planning provisions for aquaculture in the Standard Instrument – Principal Local Environmental Plan.

The implementation of OISAS requires effective collaboration between government, industry and the community. The strategy brings together the interests of economic development, land use planning and sustainable natural resource management to form a partnership that can lead to sustainable oyster aquaculture and employment generation in regional NSW.

NSW Department of Primary Industries (DPI) is the key agency responsible for delivery of the on-the-ground oyster industry management outcomes of the strategy. Local government and state agencies share responsibility for implementing the water quality measures and development assessment process detailed in Chapter 3 and Chapter 9 respectively.

The *FM Act*, requires performance indicators to be established within an Aquaculture Industry Development Plan 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. The indicators in Table 1 will be used to meet these requirements.

1.6. Community and stakeholder consultation

This strategy was prepared under the auspice of the State Aquaculture Steering Committee with representatives from the following NSW government agencies:

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

The strategy is the product of a whole-of-government process that integrates the requirements of all state government agencies to achieve a cohesive and consistent government position.

The NSW oyster industry was included through consultation with the NSW Shellfish Committee and an invitation for submissions sent to all oyster aquaculture permit holders.

In addition, copies of the strategy and an invitation to comment on it were sent to the agencies participating in preparation of the strategy, coastal Local Land Services and relevant Councils.

The strategy was placed on public exhibit prior to finalisation and gazettal.

1.7. Performance indicators and review

DPI, other agencies, local government and the NSW oyster industry are responsible for making recommendations on the need to review and update any aspects of the strategy as a result of cumulative impacts, technological developments or other changes in an estuary or area of an estuary.

The strategy will be reviewed at the direction of Deputy Director General DPI Fisheries and Game Licensing or if a review is triggered by the performance indicators given in Table 1. The

indicators relate to performance and cumulative issues and will provide a trigger that will initiate a review of the strategy.

DPI will review the performance indicators annually. This review shall consider the need to update the strategy generally or in relation to particular estuaries or particular aspects of environmental performance.

Table 1: Triggers for review.

Indicator	Justification	Trigger for review of the strategy (Triggers calculated at June 30 every year)
Annual production.	Production trends indicate industry viability and development.	Five-year moving average production drops by 187.5 tonnes or more.
Lease compliance.	Indicates commitment to best practice standards.	Number of compliant leases falls by more than 10% from previous year, OR More than 10% of current leases are not compliant five years after this strategy is gazetted.
Rainfall threshold for harvest closures.	Harvest closures are indicative of short-term water quality trends and are affected by catchment land use.	Rainfall threshold that triggers a closure is reduced in more than three harvest area management plans since the last review.
Harvest area classification.	Classification is an indicator of longer-term water quality.	More than two harvest areas have harvest classification downgraded due to water quality deterioration since the last review.
Leases abandoned due to water quality conditions.	Indicates sustainability of oyster farming areas and trends in water quality protection.	More than 5% of the total NSW lease portfolio abandoned due to water quality issues since the last review.

Chapter 2 Industry overview

2.1. Industry history

The utilisation of natural stocks of oysters in NSW has a long history. Oyster shells are common in Aboriginal middens along the coast, with some being carbon dated back to 6,000 BC. With the colonisation of NSW by Europeans, oysters were also gathered for food and burnt in large quantities (alive or dead) to provide lime for building mortar. As a result of these colonial activities, wild oyster stocks were quickly depleted and in 1868 legislation was passed to prohibit the burning of live oysters for lime. This legislation and the demand for edible oysters, fostered the establishment of commercial oyster cultivation practices during the 1870's. In 1884 the *Oyster Fisheries Act* was proclaimed, which regulated the gathering of oysters and the leasing of oyster beds.

The practice of commercial cultivation of oysters accompanied the early settlement and development of the NSW coast, becoming a significant element in the history of many coastal areas and towns. As such, the industry today has a strong association with the character and community of coastal NSW. It provides employment and contributes significantly to local regional economies. In many areas, oyster aquaculture leases and the industry's shore-based infrastructure delineate areas of community use and are now important elements in the historical heritage of these areas.

Oyster production grew steadily, reaching its peak in the 1976/77 financial year, by which time the industry had grown to the most important sector of the NSW fishing industry with an annual production approaching 9375 tonnes (Figure 1). This is equivalent to 17 million dozen oysters, valued (in today's dollars) at the farm gate at around $136 million. This peak was driven mainly by a peak production of 2688 tonnes at Port Stephens and 2563 tonnes at the Georges River.

Since the mid 1970's, oyster production has declined. This has been attributed to many factors including supply-side factors such as; oyster disease; the effects of Pacific Oyster introduction and proliferation in key estuaries; the degradation of water quality in many coastal rivers, estuaries and lakes (White, 2001); and demand-side factors such as non-contested competition in the marketplace from oysters grown in other Australian states and the diversification of consumer tastes.

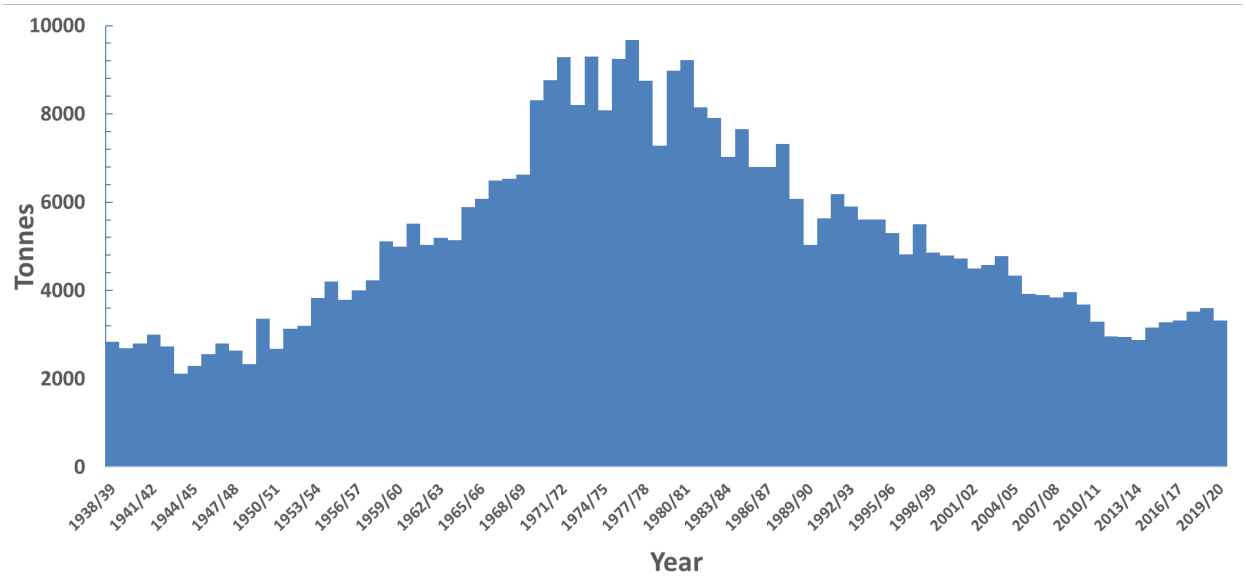


Figure 1: Annual NSW oyster production (tonnes) 1938/39 to 2019/20

Table 2 shows peak production of oysters for human consumption from the main oyster producing estuaries and the year the peak occurred. Of note is the significant loss of production due to the effects of QX disease (see Chapter 6.13) on the North Coast (Tweed to Clarence) in the early 1980's, Georges River in the mid 1990's and Hawkesbury River in 2004 and the effects of Pacific Oyster Mortality Syndrome (POMS) in Botany Bay in 2010 and the Hawkesbury River in 2013. The introduction and proliferation of the Pacific Oyster at Port Stephens in the mid 1980's and subsequent implementation of measures to control the spread of this oyster species had a significant impact on oyster production at Port Stephens and in a number of other NSW estuaries that were reliant on Port Stephens for juvenile oyster (spat) for on growing. It has been estimated that prior to the restriction on the movements of spat from Port Stephens, over 70% of all oysters sold for human consumption in NSW originated from spat sourced from this key estuary. Also of note is that peak production has occurred only recently in a number of NSW estuaries particularly on the NSW south coast driven by advances in farming technology and the resilient demand for NSW oysters.

Table 2 also shows the maximum 10 year moving average production from historical records. These records date back to 1930's for most estuaries and cover periods of high and low production. Ogburn (2011) uses the maximum 10 year moving average to estimate sustainable production levels at approximately 7500 tonnes taking into account the effects of production losses due to QX disease, POMS and Pacific Oyster infestation. This equates to approximately 2.6 tonnes per hectare grown on the currently leased area in NSW (June 2020).

At the estuary level, production records do not include spat produced and sold within the industry or the inter-estuarine transfer of oysters prior to sale for human consumption, so the actual biomass production from some estuaries greatly exceeds the DPI data records which only report annual oyster production of human consumption.

Table 2: NSW oyster aquaculture production (human consumption).

Estuary	2019/20		Historic Peak		Historic maximum 10 year moving average
	(tonnes)	dozens	(tonnes)	(year)	(tonnes)
Tweed River	*	*	246.5	1980/81	152.1
Brunswick River	*	*	60.3	1981/82	24.8
Richmond River	*	*	48.2	1940/41	31.9
Clarence River	*	*	131.6	1974/75	97.5
Wooli River	*	*	54.3	1966/67	39.6
Bellinger River	*	*	54.1	2001/02	30.3
Nambucca River	47.1	82326	191.6	1985/86	115.1
Macleay River	32.6	57041	367.6	1974/75	248.9
Hastings River	134.4	235155	433.9	1987/88	320.3
Camden Haven	132.7	232050	229.5	1977/78	167.1
Manning River	37.9	66414	428.4	1960/61	303.4
Wallis Lake	709.8	1241550	1802.6	1987/88	1448.8
Port Stephens	591.5	1034749	2695.6	1976/77	2123.3
Hunter River	*	*	42.9	1993/94	25.9
Brisbane Waters	74.1	129570	842.1	1982/83	557.7
Hawkesbury River / Patonga	108.98	189090	1328.3	1969/70	1049.9
Georges River/ Botany Bay	*	*	2566.8	1971/72	2057.7

Estuary	2019/20		Historic Peak		Historic maximum 10 year moving average
	(tonnes)	dozens	(tonnes)	(year)	(tonnes)
Shoalhaven*/ Crookhaven	74.6	130554	208.7	1990/91	143.4
Conjola/Burrill Lake & Narrawallee Creek	*	*	354.9	1980/81	59.1
Clyde River	345.2	603880	494.8	2003/04	381.5
Moruya & Tomaga	*	*	74.7	1981/82	31.8
Tuross Lake	51.0	89152	137.8	1994/95	87.0
Wagonga River	190.4	332969	204.8	1987/88	141.1
Bermagui & Cuttagee Lakes	*	*	62.5	1998/99	22.7
Nelson Lagoon	*	*	10.6	2001/02	6.9
Wapengo Lake	90.5	158376	113.3	1988/89	69.6
Merimbula Lake	405.5	709395	180.5	1999/00	134.8
Pambula River	156.2	273238	99.3	1986/87	59.8
Wonboyn Lake	59.0	103110	141.9	1990/91	66.6
Miscellaneous Estuaries	76.7	134427			
State Production	3,318.1	5,803,046	9,166.6	1976/77	

* A small number of permit holders farm these estuaries and data is combined and reported as 'Miscellaneous Estuaries' to ensure confidentiality.

2.2. Current industry profile

Oyster aquaculture is currently undertaken in 32 estuaries spread along the entire length of the NSW coast from the Tweed River on the Queensland border to Wonboyn Lake adjacent to the Victorian border (Figure 2). The industry comprises approximately 262 oyster aquaculture permit holders that hold between them 2,352 oyster aquaculture leases occupying 2,944 hectares of submerged Crown lands (April 2021).

While the NSW oyster industry is based almost entirely on the cultivation of the Sydney Rock Oyster (*Saccostrea glomerata*) which accounts for over 90% of the state's oyster production. The production of this species, which is native to the NSW and southern Queensland coast, is increasingly being supplemented by the expansion of production of the introduced Pacific Oyster (*Crassostrea gigas*) and small numbers of the Native Oyster (*Ostrea angasi*) being produced in a small number of estuaries in southern NSW.

Since the late 1990's the oyster industry has been moving away from the use of treated timber infrastructure developed in the early 1900's to the use of resilient UV stable and recyclable high density polyethylene (HDPE) infrastructure which includes the use of HDPE encapsulated recycled timber support posts and HDPE mesh baskets and trays for the cultivation of oyster crops. There has also been a significant shift away from traditional intertidal post and rail supported farming methods to the use of floating and post supported long-line basket farming systems. Due to significantly reduced seagrass shading impacts this production technology has reduced the impact of oyster farming activities on seagrass and benthic communities within lease areas. The use of these systems has also reduced the industry's demand for high value native marine grade timbers that are in short supply and significantly reduced the amount waste generated by the industry. It has also enabled the development of more efficient and cost-effective farming methods and an increase in the productive capacity existing oyster lease areas.

Currently around 80% of the supply of juvenile seed oysters to be on-grown by the NSW oyster industry is derived from the natural seasonal settlement of wild Sydney Rock Oysters on catching material placed on reliable catching lease located near the mouths of a number of key estuaries. This natural settlement which is caught on reusable plastic slats is removed by flexing the slats to produce single unattached oysters (single seed oysters). These single seed oysters are then placed in plastic mesh baskets and moved to nursery and grow-out lease areas where they usually remain for between two to three years. During this time, they are regularly returned to the farm land base site for size grading and thinning before being returned to the grow-out lease area. When the oysters are approaching a marketable size, they are moved to high value fattening leases where they remain for a short period prior to sale for human consumption. While the majority of oysters produced by the NSW oyster industry originate from wild catch the oyster hatchery supply sector is growing steadily. The development of hatchery technology for the production of Sydney Rock Oyster seed stock has enable the development of fast growing and disease resistant breeding Sydney Rock Oyster which are now available to the NSW oyster industry. All Pacific Oyster and Native Oyster production in NSW is based on hatchery produced seed stock.

The increasing uptake of recent advances in oyster growing technology facilitated a 25% increase in production from 2882 tonnes in 2012/13 to 3,603 tonnes in 2018/19. Over the same period, strong demand and increasing farm gate prices, resulted in the states farm gate value of production increasing by 67% from $32.1 million to $58.6 million. Unfortunately, the impact of catastrophic bushfires and the COVID 19 pandemic saw production fall to 3,318 tonnes (farm gate value $53.6 million) in 2019/20.

The oyster aquaculture industry is the largest aquaculture industry in NSW by production value and accounts for approximately 32% of the State's total commercial fisheries production. In 2018 the industry was the fifth largest aquaculture industry in Australia, behind Tasmanian Atlantic salmon, South Australian southern bluefin tuna, Queensland prawn and the Western Australian pearl aquaculture industries. Oyster aquaculture is also one of the State's most valuable per hectare agricultural enterprises with long term gross average production of $20,000/ha across the state and as high as $40,000/ha in some estuaries, and with some individual high value leases in excess of $400,000/ha.

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). The NSW oyster aquaculture industry is Australia's largest producer of edible oysters, the fourth largest Australian aquaculture industry and accounts for 73% of the value of NSW aquaculture production. It is the state's most valuable fishery. White (2001) estimated that the total capital investment in the industry was in the vicinity of $268 million. Currently the establishment cost for modern best practice oyster cultivation lease infrastructure is between $50,000 and $85,000/ha. DPI estimates that the current lease capital replacement cost for the NSW oyster industry is between $102 and $173 million at 70% lease utilisation. This does not take into account investment in land-based facilities and other plant and equipment which is estimated to be in the vicinity of $60 million.

Around 85% of all oysters grown in NSW are sold within the State, while the majority of the remaining oysters are sold to interstate markets, there is also a small but growing number of oysters exported overseas. Classification of harvest areas under the NSW Shellfish Program (NSW SP), which is recognized internationally, is required to achieve export approval.

To export oyster overseas export approval is also required from the Federal Government Department of Agriculture, Water and the Environment (DAWE). While this enables access to most markets it currently excludes the EU and USA. To date NSW oysters and other shellfish

have been exported to a number of countries including China, Malaysia, Dubai, Japan, Singapore and Fiji. NSW currently has 32 export approved harvest areas.

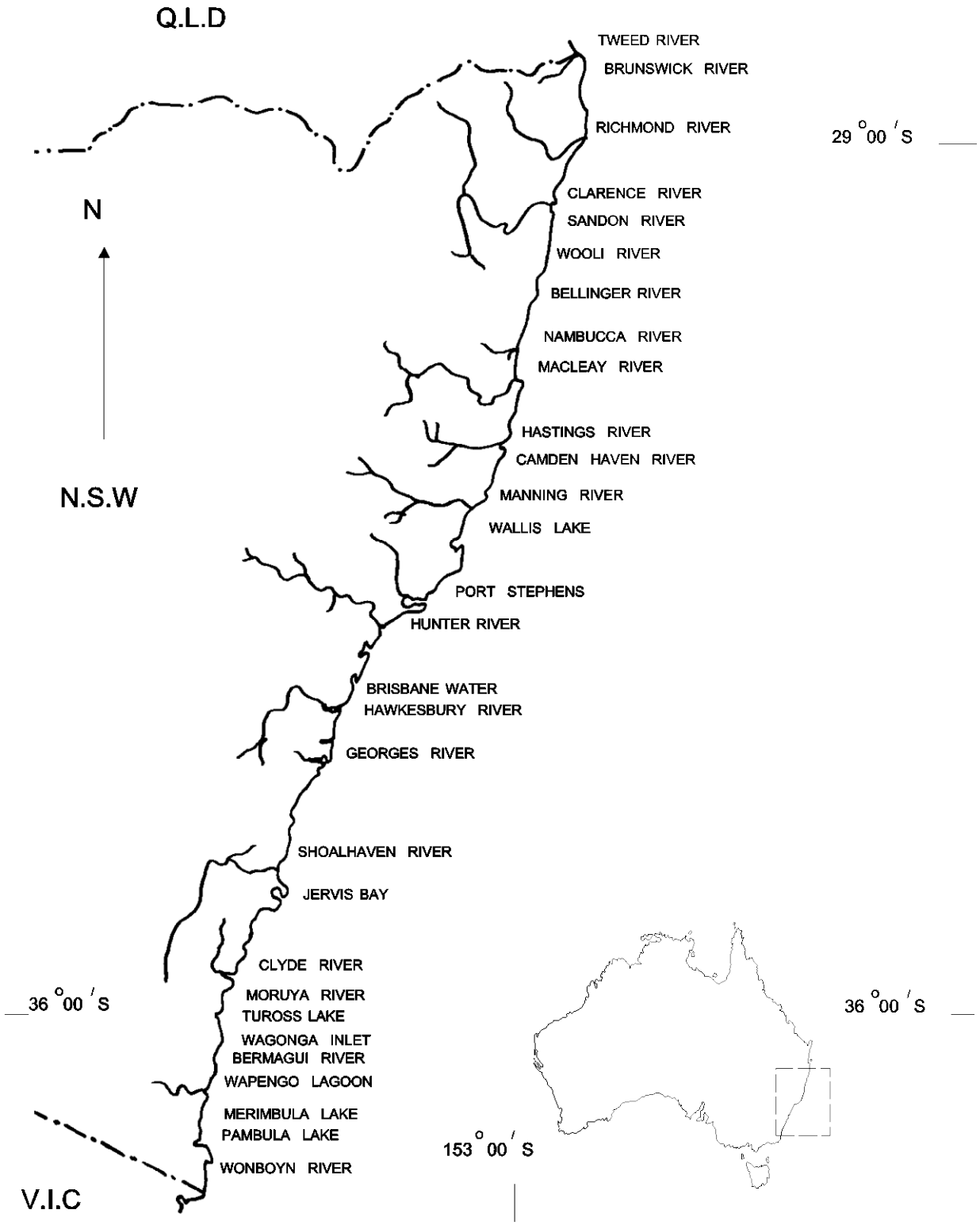


Figure 2: The location of major oyster producing estuaries in NSW.

2.3. Agency roles and responsibilities

The key agencies, and their responsibilities with respect to the NSW oyster industry, are summarised below.

NSW Department of Premier & Cabinet

The Department of Premiers & Cabinet (DPC) has provided direction and leadership to ensure a whole of government approach to the development of this strategy.

NSW Department of Primary Industries (an agency within the Department of Regional NSW cluster)

NSW Department of Primary Industries (DPI) is the key regulatory agency for the NSW oyster industry. The department administers leases and permits, collates production data and develops policy. The department is also the key NSW aquatic habitat protection, biosecurity and compliance agency and develops policies and guidelines for the industry that are consistent with habitat protection objectives.

NSW Department of Planning, Industry and Environment

The NSW Department of Planning Industry & Environment (NSW DPIE) cluster comprises four key areas relevant to the oyster industry:

- Environment, Energy and Science (including the National Parks and Wildlife Service and NSW Environment Protection Authority);
- Housing and Property (Crown Lands);
- Planning and Assessment;
- Water

NSW DPIE Planning and Assessment is the key department for the oyster industry in ensuring that the OISAS is integrated into the state land use planning and development control frameworks. This part of DPIE ensures that strategies such as OISAS integrate the government's social, economic and environmental agendas to promote sustainability.

NSW DPIE Environment, Energy and Science (National Parks and Wildlife Service) has statutory responsibilities for protected and threatened wildlife throughout NSW, whether on or off the National Parks Estate. Of particular relevance to oyster aquaculture leases is the agency's role in the protection of marine mammals and reptiles, such as dolphins and sea turtles which may swim into shallow water, and shorebirds or waders which often forage in the intertidal zone and roost nearby. NSW DPIE (via the NPWS) has care and control of parks and other lands reserved or acquired under the *National Parks and Wildlife Act 1974* (*NPW Act*) throughout NSW, and these are often located in estuarine areas. Although oyster aquaculture leases are granted under the *FM Act*, any new lease on the National Parks Estate requires the written concurrence of the Minister administering the *NPW Act* (currently the Minister for Energy and Environment.

NSW DPIE Environment, Energy and Science supports local government through the Coastal Management Programs which provides guidance and support for both coastal and estuary management planning and actions. NSW DPIE also works with the oyster industry to provide estuary process information when available to help resolve issues such as dredging and estuary opening.

NSW DPIE Water also has a lead role in developing environmental objectives for water quality and river flows for government and has developed a number of resources and tools for water managers, including local councils, and Local Land Services (LLS).

NSW Food Authority (an agency within the NSW Department of Primary Industries)

The NSW Food Authority (NSW FA) provides the regulatory framework for safe and correctly labelled food to be produced in NSW. Of particular importance to the oyster industry, the NSW FA has responsibility for implementing the NSW SP that classifies and establishes management plans for oyster harvest areas. The NSW FA also licenses oyster depuration, processing, transport and handling facilities.

Environment Protection Authority (an agency within the NSW Department of Planning Industry and Environment cluster)

The NSW Environment Protection Agency (EPA) is the primary environmental regulator for New South wales. The EPA regulates pollution from activities specified in Schedule 1 of the POEO Act (scheduled activities) and those undertaken by a public authority. In most other cases, the local council is responsible for regulating environmental impacts from land based activities and Transport for NSW (TfNSW) regulate water pollution from vessels.

Crown Lands (an agency within the NSW Department of Planning Industry and Environment cluster)

Crown Lands (CL) is the primary administrator for Crown land tenures, Crown roads and Crown Reserves across NSW. CL leases and licences Crown land to the oyster industry for land based activities oyster farming activities and also gives land owners consent to lodgement of development applications for new oyster aquaculture lease areas and development on oyster land base tenure sites where development consent is required.

Future management of land-based sites located on Crown land will be driven by the need for both the oyster farmer and CL to maintain an environmentally sensitive and professionally well managed land base. This will be achieved through the process of lease and licence agreements and an associated Work Plan that is developed in partnership with the oyster farmer to achieve sound environmental and social outcomes.

Another key role for CL is the determination of Aboriginal land claims over the Crown estate under the *Aboriginal Land Rights Act 1983* and consideration of native title under the Commonwealth *Native Title Act 1993*.

Transport for NSW

Transport for NSW (TfNSW) is the state government's maritime regulator responsible for providing safe and sustainable ports and waterways. TfNSW helps to establish oyster aquaculture lease marking requirements and helps to determine if a lease area will adversely affect navigation. TfNSW also has responsibilities for pollution from vessels.

Marine Estate Management Authority NSW

Marine Estate Management Authority (MEMA) manages the NSW marine estate including the Marine Parks estate. MEMA seeks to conserve all forms of marine plant and animal species (biodiversity) in the NSW marine estate. MEMA brings together key agencies including DPI, Environment Energy and Science, Planning and Assessment and TfNSW for the declaration, management, selection and zoning of marine parks and the regulation of ecologically sustainable use of these areas and other marine areas in NSW.

Office of Local Government (an agency of NSW Department of Planning Industry and Environment cluster)

Local government has a diverse role covering town planning, building approvals, local roads, parking, public libraries, public toilets, water and sewerage, approval and inspection of septic systems, waste removal, domestic animals and community facilities. Of particular importance to the NSW oyster industry is councils' part in managing estuarine water quality and resolving land

and water use conflicts through estuary management planning, land use planning and development control. Councils' may also provide waste management services to the industry. Councils also assist the oyster industry with water quality monitoring and have a role in investigating water pollution incidents.

Local Land Services (an agency within the Department of Regional NSW cluster)

Local Land Services (LLS) coordinate natural resource management at the catchment scale. The LLS are responsible for involving regional communities in catchment planning and identification of natural resource management priorities for their region, and are the primary means for the delivery of funding from the NSW and Commonwealth Governments to help land managers improve and restore the natural resources of the State. Key roles include preparing Catchment Action Plans, managing investment programs to implement the plans, and promoting community participation in regional natural resource management action and decision making. Implementation of the Catchment Action Plans in the coastal LLS regions will lead to favourable outcomes for the oyster industry.

2.4. Industry management initiatives

2.4.1. Department of Primary Industries

DPI is the key agency responsible for the licencing and administration of aquaculture leases and permits issued under the *FM Act.*

Oyster aquaculture lease bond system

In January 2001 the oyster aquaculture lease Security Arrangements (bond) came into effect in NSW. Payment of a bond applies to all oyster farmers in NSW. The bond system was introduced to ensure that the industry shares responsibility for problems arising from lease management and maintenance issues.

The bond is either a cash deposit or bank guarantee to the value of $1000 per hectare OR an annual non-refundable contribution of $40 per hectare.

Leasing and re-leasing

DPI has a competitive biannual tender process for letting all vacant lease areas so that the commercial value of these areas can be realised. Leases with derelict infrastructure on them will be re-let subject to the new lessee removing all old materials prior to placing new infrastructure on the lease.

Oyster aquaculture on-line business platform

DPI has developed an e-business platform for aquaculture lease and permit holders. The system enables oyster farmers to:

- set up an online account so they can view their lease, permit, farm holdings
- organise for other individuals (agents) to view their lease, permit, farm holdings
- submit their annual production returns.

Aquaculture compliance strategy

In order to ensure high standards of environmental and operational performance by industry, DPI provides a combination of consistent management, monitoring, education and enforcement.

This involves:

- **Regular permit and lease condition inspections conducted by DPI** – The standard inspection period is every three years, however where required a lease condition inspection may be undertaken at any time.

  Permit holders are also required to electronically acknowledge that they understand their lease and permit obligations regarding lease marking and tidiness when completing their annual production return online. It is compulsory for all aquaculture permitholders to submit an annual production return to DPI.

  Where an inspection conducted by a DPI Fisheries Officer indicates that the lease is not compliant the leaseholder will be issued with a formal Notice to Comply which outlines the work required and the time period in which the work must be completed. Failure to comply with a Notice to Comply may result in a financial Penalty Infringement Notice (PIN) being issued to the permitholder or leaseholder; and in a worst-case scenario may lead to permit and lease cancellation.

  - **Outstanding debt** – An application for a new lease or lease transfer, consolidation, sub-division, renewal or sublet will normally be refused if the applicant has outstanding debt in relation to their business.

- **Poor record of management** – Where the permit holder/lessee has a poor record of management, administrative sanctions and civil action may be taken as described in Chapter 9.6.
- **Notice to Comply – extension of time to comply** – Oyster aquaculture permit holders and lessees may submit a request for approval to extend the time given in a Notice to Comply where there is a large quantity of work, extenuating circumstances or high seasonal workloads. Where their request is approved, they will be issued with a new Notice to Comply. The conditions of the new Notice to Comply will be negotiated between by the permit holder/lessee and the relevant District Fisheries Officer.

Lease marking notices – Lease marking and signs must be attended to in the time given on all Notices to Comply and this work cannot be extended in a new Notice to Comply due to navigation safety issues.

- **Removal of infrastructure from a terminated lease** – Lessees are required to remove all improvements (including cultivation material, lease markings and structures) from expired or otherwise terminated leases within six months.
- **Extenuating circumstances may reduce time periods for removal of improvements from terminated lease** – Time allowed to bring leases into compliance for the removal of infrastructure from terminated leases may be issued for shorter periods if the issue requires more immediate attention to reduce risks to navigation, environmental damage or serious public nuisance.

Historic and current legacy oyster aquaculture leases clean-up initiatives

It is the intention of the NSW oyster industry to phase out the use of historic preservation products used to treat timber infrastructure by the end of 2025.

The majority of legacy oyster aquaculture leases are the result of catastrophic disasters such as the QX disease outbreaks in the Georges and Hawkesbury Rivers and the incursion of the Pacific Oyster into the waters Port Stephens in the mid to late 1980's. These events resulted in the financial collapse of a significant number of oyster farming businesses.

When clean-up costs cannot be recovered from the lessee or the bond, responsibility for the clean-up of oyster cultivation material passes to the State (as landowner).

More than 300 oyster aquaculture leases (more than 360 hectares) have been cleaned up since the Oyster Aquaculture Lease Clean-up Project commenced in July 2009. Some historic derelict leases have also been cleaned up as a result of grants from Local Land Services. Others have been cleaned up by farmers who have taken up derelict lease area. The majority of leases have been cleaned up as a result of legal and administrative action undertaken by DPI.

The number of leases becoming derelict and adding to the list of State legacy leases has dramatically decreased as a result of the oyster aquaculture lease bond system; the oyster aquaculture lease compliance program; legal action against individuals who do not meet their clean-up responsibilities; and administrative policies which prevent individuals with outstanding clean-up responsibilities from completing lease transactions.

2.4.2. Crown Lands

CL issues land tenures under the NSW *Crown Land Management Act 2016* (*CLM Act*) and is committed to working with the oyster industry to provide opportunities for oyster farming/aquaculture activities on Crown land.

Applications for use of Crown land under a lease or licence for oyster farming/aquaculture activities (oyster land base site) are assessed on merit. CL consider a range of factors when

making an assessment, such as compliance with the *CLM Act*, land capability, native title, Aboriginal land claims, the Crown land Community Engagement Strategy and OISAS.

Leases and Licences

A Crown land lease provides exclusive possession to the holder to occupy and use Crown land for a specified term and purpose. While applicants may prefer a lease to a licence, it may not be possible to lease certain Crown land sites.

Where an oyster farmer is proposing a substantial development on the Crown land that involves significant capital investment, a lease may be more appropriate than a licence, providing there are no constraints that preclude CL from granting a lease. The consent of the Minister is usually required prior to the transfer of a lease, and you can't transfer a lease if there is any debt to the Crown outstanding on the lease.

Tenure agreement

A tenure holder has responsibilities under the terms and conditions of their tenure agreement. This includes using the site in accordance with the permitted use, paying rent, complying with environmental obligations and other relevant laws, and holding current insurances.

A holder of a Crown tenure for oyster farming/aquaculture activities must be a bona fide oyster farmer and hold a current:

- aquaculture permit under the *FM Act*
- NSW FA Licence issued under the Food Regulation 2015 (FR 2015) to cultivate and/or harvest oysters (including spat).

Work plan compliance

The tenure holder is responsible for ensuring that they meet obligations outlined in their individual work plan agreements issued by CL. CL may initiate compliance actions if an oyster farmer does not comply with work plan requirements or tenure conditions, or if they do not pay rent. Actions may include lease forfeiture or licence revocation.

Subletting or sale

Should an oyster farmer wish to sublet or sell a leased or licenced Crown land land-based site they are encouraged to have early discussions with CL. Sublicensing and on-selling is not permitted on sites licenced for oyster farming/aquaculture activities. In many cases, tenures are not directly transferrable.

More information

You can find general information about leases and licences in Chapter 9.9 below and on the department's website at: industry.nsw.gov.au/lands/use/, or by contacting CL by phone on 1300 886 235.

2.4.3 The NSW Shellfish Program

The NSW Shellfish Program (NSW SP) is a quality assurance program that assists in ensuring the public health safety of oysters and other shellfish grown and harvested from NSW waters. The NSW SP is administered by the NSW FA under the *Food Act, 2003* FA 2003). This strategy does not affect the operation of the program. Full details of the NSW SP including water quality monitoring details can be obtained from the NSW FA at: www.foodauthority.nsw.gov.au/industry/shellfish

The objective of the NSW SP is to protect the health of shellfish consumers through the administration and application of procedures described in the NSW Shellfish Industry Manual (NSW SIM) that:

- assess the risk of shellfish contamination by pathogenic bacteria and viruses, biotoxins and chemicals derived from the growing area
- control the harvest of shellfish in accordance with the assessed risk
- protect shellfish from contamination after harvesting.

In addition the NSW SIM describes administrative procedures for the operation of Local Shellfish Programs as specified under the Food Regulation, 2015. The NSW SP adheres to the principles and objectives of the Australian Shellfish Quality Assurance Program (ASQAP).

To ensure compliance with the NSW SP and conditions attached to the oyster farmers Seafood License issued by the NSW FA regular audits of licensed business are carried out by auditors authorised under the FA 2003. These audits assess food safety compliance, food handling practices, reviews food safety documentation and compliance with the NSW SP. Auditors carrying out audits of export registered establishments are also authorised officers under the *Export Control Act 1982*.

Classification of oyster harvest areas

Harvest area risk assessment (also known as a comprehensive sanitary survey) is the cornerstone of the NSW SP. The completion of a risk assessment for each harvest area is an objective process that is taken independently of the oyster aquaculture industry and follows the requirements of the ASQAP Operations Manual 2019 and the NSW SIM (NSW Food Authority, 2018).

Each initial risk assessment is completed over a period of one to three years and results in each harvest area being classified as either approved, restricted or prohibited according to its sanitary status. The harvest area classification then determines the food safety controls to be applied to shellfish harvested from the area. Additionally, where a harvest area's classification is 'conditional' (essentially meaning it is subject to closure in prescribed conditions), a specific harvest area management plan is prepared which details harvest area closure and opening parameters as well as other requirements for the efficient and effective management of the area.

Components of the risk assessment process

The following are key components of the risk assessment process:

- shoreline survey which includes a thorough physical examination of the catchment area draining into the shellfish harvest area in order to identify the actual or potential sources of pollution that may adversely affect water quality
- a bacteriological survey of the shellfish growing waters, which provides quantitative data to explore and develop preliminary findings of the shoreline survey, data that describes the extent of faecal contamination of the harvest area and quantitative data for the classification of the area (see Table 3)
- a bacteriological and chemical examination of the shellfish which includes an assessment of the microbial, chemical and algal biotoxin contaminants
- an evaluation of the meteorological, hydrographic and geographic characteristics to assist the development of a harvest area management plan
- an algal biotoxin risk assessment to assist in the appropriate classification of the area.

Table 3: Sanitary water quality standards for oyster harvest area classification.

Parameter	Classification Status		
	Approved	Restricted	Prohibited (Nursery)
Faecal (thermotolerant) coliforms	90th percentile of randomly collected Faecal coliform samples do not exceed 43MPN or 21 MF/100mL ASQAC	90th percentile of randomly collected Faecal coliform samples do not exceed 300MPN or 85 MF/100mL	A sanitary survey has not been completed for this area.

Note: MPN – mean probable number, MF – membrane filtration

Implications for oyster cultivation and harvest

Classification determines the management regime under which oysters are harvested. Also, oysters may only be exported from classified areas according to DAWE export criteria for shellfish.

Under the risk assessment process oyster growing areas are classified into one of the following five categories:

1. **Approved Harvest Area**. Direct harvest for human consumption under prescribed conditions
2. **Conditionally Approved Harvest Area**. May operate as an Approved Harvest Area under prescribed conditions and when the Approved Harvest Area is closed under prescribed conditions my operate as a Restricted Harvest Area under prescribed conditions
3. **Restricted Harvest Area.** Product requires depuration in an approved deputation plant under prescribed conditions or relay to an Approved area for a specified time prior to sale for human consumption
4. **Prohibited Area (Nursery).** The harvest of shellfish for sale for human consumption is not permitted; or
5. **Prohibited Area (Closed Safety).** Identifies areas that are not suitable for growing or harvesting shellfish due to significant or unpredictable contamination, e.g. areas directly adjacent to sewage treatment plant outfalls.

Oysters may be progressed to a higher category by relaying those oysters into the higher category waters, under prescribed conditions, for a set period of time. More information can be found at: www.foodauthority.nsw.gov.au/sites/default/files/2020-02/Relay_Operational_Procedure.pdf

Most oyster growing areas currently fall within the approved or restricted classification and operate under rainfall and salinity management plans. Oysters may be harvested from Approved harvest areas and sold directly for human consumption without the additional cost of the depuration process. These areas are therefore the most valuable and sought-after areas for oyster aquaculture in NSW.

Chapter 3 Healthy oysters and healthy estuaries

Estuaries (where all NSW oyster farming occurs) are essentially the confluence point for all runoff and groundwater flow yielded by their catchments. Estuarine health is therefore a good indicator of the sustainability of catchment activity.

There are numerous potential sources of pollution that may affect estuaries, including urban and industrial effluent discharges, boat discharges, contaminant transport by rivers and agricultural run-off.

Raised concentrations of pollutants can have serious effects on the health of marine plant and animal populations. Oysters are particularly susceptible because they rely on high quality water for their food. On average, a farmed Sydney Rock Oyster will filter an estimated 250,000 litres of estuarine water in its lifetime. It has been estimated that the farmed oysters in NSW remove over 1 million tonnes of suspended material, chiefly phytoplankton, in their lifetime (White, 2001). Oysters are recognised globally as a “keystone species” and provide additional important ecosystem services, including acting as sinks for anthropogenic nutrients and in many instances shoreline erosional buffers. The key role oysters play in the ecology of estuaries is indisputable.

As oysters filter such large volumes of water, they are particularly sensitive to changes in water chemistry. For this reason, they are also excellent biological indicators of estuary health. Their feeding habits and lifestyle make oysters extremely valuable, integrative indicators of water quality in estuaries and coastal lakes (White, 2001).

3.1. Water quality for food safety

Bacteria, viruses, marine biotoxins and environmental pollutants may all impact on the suitability of oysters for human consumption. Most are a direct result of human activity with the exception of marine biotoxins.

Sources that may pose a risk to food safety include:

- sewerage system and septic tank overflows and leaks
- sewage discharges from vessels
- contaminated sediments
- stormwater run-off
- discharges from industrial premises or runoff from agricultural activities.

To provide local councils, state government agencies, private landowners and developers with advice on how to ensure development in close proximity to estuaries is compatible with the requirements of oyster aquaculture the *Healthy Estuaries for Health Oysters – Guidelines* (HEHO) were published in 2017. The guidelines were prepared to meet the requirements of management action (MA 7) of the NSW Diffuse Source Water Pollution Strategy (NSW DECC, 2009). This strategy identified pathogen levels exceeding the Australia and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018) as one of the top three priority problems from diffuse source water pollution in NSW. The HEHO also compliment initiatives under the Marine Estate Management Strategy 2018-2028 to address water quality and ecosystem protection.

The intended outcome of HEHO is to see development that protects the oyster industry and that estuarine water quality objectives are being met. Where water quality objectives are not being met, development should contribute to the objectives being met within a specified timeframe and subsequent monitoring results indicate desired targets are being achieved. These outcomes will not only protect the environmental conditions required for healthy oyster production but will also result in improved estuarine health, increased amenity for tourism and improved conditions for recreational and commercial fisheries. HEHO is available online at:

www.dpi.nsw.gov.au/__data/assets/pdf_file/0009/738972/Healthy-Estuaries-for-Healthy-Oysters-Guidelines.pdf

3.2. Water quality for healthy oyster growth

Oyster growth and production shows a wide variation from lease to lease, season to season and year to year. The majority of this variation would be explained by natural variations in water chemistry, temperature and food availability although, surprisingly, there are gaps in knowledge on the Sydney Rock Oysters basic physiology and ecology (White, 2001).

On top of these natural effects, oyster growth and production can be affected by water quality problems caused or exacerbated by human activity. This activity is predominantly catchment land use and activities close to the estuary.

The 'healthy growth' water quality parameters most likely to be affected by human activity are:

- **Suspended solids.** Silt affects the sensitive feeding apparatus of oysters and can lead to infestations of mudworm and poor natural oyster settlement and recruitment. In general, oysters feed more efficiently in relatively clear waters (White, 2001). Increased turbidity may also reduce primary production and available food levels. Suspended solids levels can be raised by any catchment land use that exposes and leaves soil bare to erosion or by excessive wave wash arising from activities such as power boating, within the estuary
- **pH.** The optimal pH range for oysters appears to be between 6.75 to 8.75 with growth rates rapidly declining at either side of this range (White, 2001). Large areas of acid sulfate soils occur in coastal floodplains in NSW and the drainage of acid waters from these areas is a major concern to the oyster industry (White, 2001). An oyster can survive in low pH waters for a time, but eventually the shell dissolves and the oyster dies (Dove and Sammut, 2007a)
- **Toxic elements and substances.** Detailed knowledge of all substances that may affect oyster growth is not available, however Dove et al. (2007b) observed that elevated soluble concentrations of iron and aluminium at low pH could cause significant mortality in oysters. Suspended iron compounds (flocs) associated with acid drainage can also smother growing oysters and clog the oyster's gill structures (Dove et al., 2007b).

3.3. Tidal range, water flow, salinity and estuary entrance intervention

Traditional oyster aquaculture ideally requires a stable mean water level that varies with each tide cycle. This allows oysters to be grown at a height where predictable periods of inundation and drying can be achieved that provides commercially viable growth rates while eliminating most competing intertidal organisms (biofouling). Modern floating oyster aquaculture methods are less reliant on tidal levels.

Tidal variation also drives currents that exchange water through lease areas, delivering planktonic food. In some instances, stream flow and wind driven circulation may supplement tidal currents, although these are highly variable and cannot be relied upon alone.

Salinity affects oyster growth and larval distribution and therefore catchment diversions, extractions, periodic releases of freshwater or changes to estuary entrances and channels may pose a threat to long established farming intertidal farming practices and optimal oyster production. Salinity is also an important parameter in the operation of the NSW SP.

Tidal range and flows are affected by the morphology (shape and depth) of the estuary and the size of the entrance. Oyster farming is situated mainly in permanently open estuaries and estuaries that close infrequently.

Estuaries are also dynamic environments and the shape and position of channels and the estuary entrance has a natural pattern of variation. The state of the entrance and channels is a balance between the river and tidal flows, sediment dynamics and coastal (oceanic) process.

Entrance closures and channel movements often occur during extreme climatic conditions, but may be exacerbated by regulated river flows, abstractions and catchment land use leading to accelerated estuarine sedimentation.

When an estuary entrance closes or major flow channels become clogged this may lead to increased periods of low salinity (or high salinity during drought conditions), higher water temperatures, poor circulation and poor water quality. Under these conditions, oyster aquaculture may experience:

- increased mortality, increased susceptibility to disease, reduced production and poor oyster growth
- increased restrictions on harvest due to increased periods of low salinity
- increased production costs as oysters may need to be moved frequently to other parts of the estuary or to different growing heights or other estuaries.

High water and flood levels associated with closed entrances may also adversely affect infrastructure and property; recreational and commercial fishing; recreational use of the estuary; and estuarine ecology.

The oyster industry recognises that inappropriate interventions in natural geomorphological processes at estuary mouths can have significant impacts on estuarine and fringing habitats.

DPI policy does not support the artificial opening of Intermittently Closed and Open Lakes and Lagoons (ICOLLs) unless it can be demonstrated that the social, environmental and economic benefits greatly outweigh any potential adverse impacts. The Department supports using Coastal Management Programs and environmental assessment processes to analyse the issues relating to opening a particular ICOLL, and where appropriate the development of an entrance management plan or entrance management policy. Where a problem is clearly identified, DPI will support the development of an interim strategy prior the development of an entrance management plan. The interim strategy should be developed in consultation with all relevant natural resource management agencies. Criteria to be met may include:

- a pre-set water level above which a breach is recommended
- a pre-set range between which a breach is recommended if heavy rainfall is predicted
- a pre-set duration of high-water level and/or wetland/pasture inundation over which a breach may be recommended
- other environmental parameters (e.g. avoiding the breeding season of threatened species such as the Little Tern).

Further information regarding management of coastal lakes and lagoons is available on the DPI Fisheries website at: www.dpi.nsw.gov.au/fishing/habitat/aquatic-habitats/wetland/coastal-wetlands/management-of-coastal-lakes-and-lagoons-in-nsw

The oyster industry also recognises that any decision to artificially open an estuarine entrance or dredge a channel has to balance all potential social, economic and environmental impacts and is ideally planned well ahead of the need to undertake the work.

The oyster industry will encourage and support this course of action where there are imperatives for intervention such as flood impact mitigation or seriously deteriorating water quality. The social and economic cost of potential impacts on the oyster industry are relatively easy to determine and need to be considered in the preparation of Coastal Management Programs,

entrance opening strategies and estuary dredging strategies that may affect salinity, tidal range and flows in an oyster growing estuary.

The NSW Shellfish Committee determined that changing pressures on estuaries due to human induced factors such as climate change and catchment development also impact opening/closing regimes and need to be addresses in developing Coastal Management Programs.

3.4. Water quality and flow objectives for oyster aquaculture areas

Objectives

The water quality objective and flow objective for areas identified as POAA mapped in Chapter 5 are:

- protecting water quality for safe human consumption and viable production of edible oysters
- maintain or rehabilitate estuarine processes and habitats.

Background

The NSW Government has established water quality objectives for 31 NSW catchments which recognise existing principals and guidelines recommended in the National Water Quality Management Strategy.

These water quality objectives aim to provide policy direction for local government, state government agencies and LLS for the protection of the identified objectives for each catchment. Objectives identified include aquatic ecosystem protection, visual amenity, recreation, water supply and aquatic foods (cooked).

Objectives are used by these agencies to guide the issuing of permits, approvals, development consents and licenses for activities that may impact on water quality. They also provide a reference against which the state of water quality in a particular area can be assessed and help to determine whether water quality studies and improvement strategies should be initiated.

Oyster production requires water quality that supports healthy oyster growth and results in a product that is safe to eat following harvest under the NSW SP. The water quality guidelines (Table 4) established in this strategy, are designed specifically to meet this objective.

The most important water quality parameter in oyster aquaculture is sanitary water quality. The most relevant guideline for sanitary water quality in oyster growing areas is the internationally accepted ASQAP Operations Manual 2019 (ASQAPOM) and the NSW SP Operations Manual 2018 (NSWSPOM).

These two manuals use faecal coliform bacteria as an indicator of faecal pollution. The standard for Approved classification has been used as the objective for oyster aquaculture so that current Approved and Restricted Harvest areas may see an improvement in water quality that results in a future upgrading.

NSW DPI has partnered with the University of Technology Sydney and the Food Agility Cooperative Research Centre to explore the application of new technologies for faecal pollution monitoring and risk assessment. However, the current faecal coliform/E.coli standards that apply to the regulation of the harvest of shellfish for human consumption are based on established national and international standards. Any amendments to these standards will require extensive method development, validation, risk assessment and agreement between national and international jurisdictions.

Five other key water quality guidelines have been set. The objectives are based on published values and are given in Table 4.

The NSW Government has also established river flow objectives for 31 NSW catchments. Four objectives have been set for estuarine areas:

- Maintain or rehabilitate estuarine processes and habitats
- Maintain wetland and floodplain inundation
- Manage groundwater for ecosystems
- Minimise effects of weirs and other structures.

The most relevant to the protection of the environmental conditions required for oyster aquaculture, has been specifically adopted by this strategy, but achieving the other three will also assist in providing the environmental conditions required for healthy oyster growth.

Table 4: Water quality guidelines for oyster aquaculture areas.

Parameter	Guideline	Source
Faecal (thermotolerant) coliforms	90th percentile of randomly collected Faecal coliform samples do not exceed 43MPN or 21 MF/100mL	ASQAP Operations Manual 2002 and the NSW Shellfish Program Operations Manual 2001.
pH	6.75 – 8.75	Shumway (1996).
Salinity	20.0 – 35.0 g/L	Australia and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018)
Suspended solids	<75 mg/l	
Aluminium	<10µg/L	
Iron	<10µg/L	
Other parameters	For other parameters please refer to the Australia and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018)	

Note: MPN – mean probable number, MF – membrane filtration

Chapter 4 Water quality protection guidelines

4.1. Recognition of oyster aquaculture in land and water use planning

The aim of this strategy is that water quality, tidal range and flow in oyster growing areas is maintained and where possible improved to ensure the long-term security and sustainability of the NSW oyster aquaculture industry. Three of the five triggers for OISAS review relate to water quality.

The maintenance of existing water quality, tidal range and flow will be achieved primarily through establishing links between the requirements for the sustainable cultivation of healthy oysters and catchment land and water use planning.

Three such links are established by this strategy.

Firstly, when preparing statutory environmental management plans that govern activities (both upstream and downstream) that may influence POAA the relevant agency is required to:

- consider the potential impact of the activity or plan on oyster aquaculture areas
- include specific actions that will contribute to the protection and/or improvement of water quality for oyster aquaculture.

Secondly, in determining applications for consent or approval under the *Environmental Planning and Assessment Act 1979* (*EP&A Act)* the consent or determining authority needs to consider the potential impacts of the activity on oyster aquaculture areas in the locality. Of particular concern is whether catchment or foreshore development will reduce the suitability of an oyster aquaculture area for its intended purpose.

Thirdly, the NSW oyster industry is recognised as a neighbour/stakeholder and will be notified of relevant applications for approvals and consents and natural resource plan making activities.

These links are established through the planning system described in Chapter 9.4.

4.2. Guidelines for harvest area protection

This section lists some specific actions that will contribute to the protection and/or improvement of water quality for oyster aquaculture. Wherever possible, local government, state government agencies, private landowners and developers should directly implement these actions. They should be included in strategic land and water use planning as development standards and considered in determining development applications.

Non point sources

Some specific actions include:

- riparian zones in agricultural areas being fenced to prevent access of livestock to estuary
- encourage establishment of riparian filters and settlement areas for run-off drainage in landscape with potential high animal faecal/fertiliser/chemical contamination (e.g. livestock, golf link, turf farm)
- elevate monitoring and awareness of septic safe programs in areas adjacent to harvest zones
- where practicable, implement the installation and careful regulation of vessel pump out facilities at marinas
- carefully regulate marinas and mooring areas to minimise the risk associated with vessel discharges
- the provision of educational and advisory signs for recreational boating warning of the need to protect sanitary water quality

- avoid artificially attracting large numbers of birds into an oyster harvest area
- investigate the need for exclusion of recreational/private boating in specific oyster harvest area to protect sanitary water quality if required
- inclusion of buffer zones between foreshore sub-divisions and the shoreline.

Point sources

Some specific actions include:

- sewerage management authorities prepare and implement an On-site Sewerage Management Strategy that includes classifying systems in close proximity to POAA as high risk with annual compliance inspection
- the preferred on-site sewerage management system for sites close to POAA is secondary treatment (aerated wastewater treatment system) with disinfection, sub-surface irrigation and a minimum buffer of 100 m to a water body or drain. In circumstances where these requirements cannot be met then additional risk management measures should be incorporated in the design
- sewer systems improved, maintained and operated so that overflows do not occur as a result of maintenance or operational failure, overflows in dry weather are eliminated or occur only under exceptional circumstances and wet weather overflows are minimised
- addressing illegal discharges from recreational or commercial boating
- identification of priority urban storm water drains and installation of suitable treatment systems
- priority treatment drains would include those with a catchment from large hard stand car parks and roadway car parks, caravan parks, golf links, subdivision, commercial/business and shopping centres and industrial areas
- at source control of stormwater for new developments to reduce stormwater impacts.

Community Responsibilities

Members of the community have a general duty of care responsibility to:

- have their on-site sewerage management system approved by the local Council and to operate it in accordance with that approval
- understand how to use their on-site sewerage management system and to make sure regular maintenance inspections are conducted by suitably qualified and experienced technicians
- quickly have their on-site sewerage management system repaired if it fails and report any discharge of effluent to the local Council
- report any pollution incidents to the NSW EPA Environment Line 131555
- remove stock access to the riparian zone adjacent to oyster harvest areas
- ensure that stormwater run-off is not contaminated with chemicals, animal effluent or manure
- use pump-out systems and ensure that no effluent, rubbish or waste goes from your boat to the waterway
- participate in community programs that build resilience in the natural environment and help improve water quality.

The NSW oyster industry has an established record of engaging with land holders and environmental agencies such as LLS to achieve effective remediation of riparian zones in oyster farming catchments. Examples of this work include the long-term efforts to improve water quality in the Wallis Lake catchment and work with specific dairy farmers in the Shoalhaven and Crookhaven River estuary and at Wapengo Lagoon.

Prioritising actions to address existing water quality issues

Declining water quality trends may be detected by the routine monitoring undertaken by the oyster industry for the NSW SP, from growing area production records and from visual impacts detected while working on leases. State government agencies and local councils also undertake water quality monitoring.

The NSW LLS and the Marine Estate Management Authority (MEMA) have responsibility for establishing regional standards and targets for natural resource management, including water quality. These standards and targets are implemented through a Catchment Action Plan and the Marine Estate Management Strategy (MEMS).

In setting regional water quality objectives, LLS and MEMA refer to the state-wide Standards and Targets prepared by the NSW Natural Resources Commission and any relevant water quality objectives. The water quality objectives and guidelines for oyster aquaculture, established in this strategy, will assist LLS and MEMA to set specific objectives relevant to the protection of estuaries and their catchments, including oyster growing areas.

The relevant LLS, MEMA and local council have responsibility for establishing priorities for action through their planning processes. Where it is identified that water quality is degraded in an oyster aquaculture area the issue needs to be bought to the attention of the relevant LLS, and local government Coastal Management Program for prioritisation.

The oyster industry fully supports the NSW Government's coastal management framework to manage the coastal environment in an ecologically sustainable way, for social, cultural and economic well-being of the people of NSW. In this regard the oyster industry plays and active role in the preparation of Coastal Management Programs by councils.

4.3. Case Study – Farquhar Inlet Entrance Management Strategy.

The problem:

Early in 2008 a series of moderate rainfall events kept the lower Manning River fresh for an extended period but none of the events were large enough to naturally deepen the south arm of the river or to trigger a mechanical opening. A severe oyster mortality event occurred and water quality in oyster growing areas and adjacent to residential properties in the south arm deteriorated significantly. However, at that time the existing entrance management plan for the south arm of the river at Farquhar Inlet only allowed for mechanical opening of the estuary when Taree, some 18 km upstream was threatened by flood.

What the local oyster industry did:

- initiated action to find a solution
- engaged the council, community and other key stakeholders
- participated in the preparation of a revised entrance management plan
- helped to raise money to support the work being done.

The outcome:

The Farquhar Inlet Management Group was formed and in partnership with the Greater Taree City Council and water quality triggers were built into the Farquhar Inlet Entrance Management Plan (FIMP) to ensure that prolonged periods of static fresh water would be avoided. The local

community purchased a dredge to assist in the implementation of plan and in partnership with the Greater Taree City Council dredging commenced to improve flushing, recreational boating access and navigation in the south arm. Dredge spoil has been being used to construct Little Tern nesting habitat in consultation with the NPWS.

In 2020 flooding that followed extensive bushfires in the Manning River catchment led to large amounts of nutrient rich ash and other debris being washed into the estuary. These events quickly resulted in significant water quality issues in the estuary. Due to the existence of the FIMP and its approvals pathway enabled the south arm at Farquhar Inlet to be quickly opened and problems associated with rapidly deteriorating water quality were alleviated. Again, in the major flooding event of March 2021 the existence of the FIMP enable action to be taken early in the event which more than likely significantly reduced flood impacts in the south arm.

For more information see the Greater Taree City Council website at: www.gtcc.nsw.gov.au

Chapter 5 Priority Oyster Aquaculture Areas

5.1. Areas where oyster farming is a desired outcome

Since its inception in the 1870's, the oyster aquaculture industry has undertaken extensive and on-going commercial assessment of sites that appeared to the 'experienced industry eye' to be suitable for oyster aquaculture. Much of this process took place in an era where there were few productive uses, other than fisheries, for the States estuarine waterways and urban development on estuary foreshores was relatively limited. This process of commercial assessment was often dynamic, with the suitability of sites often changing as industry cultivation practices evolved in each estuary.

In addition to commercial considerations, however, the modern oyster industry recognises that a range of environmental and socio-economic factors must also be considered in determining suitable oyster farming areas.

The potential impacts of oyster aquaculture on the marine estate are assessed in the NSW Marine Estate Threat and Risk Assessment Final Report 2017 (TARA). The TARA identified oyster aquaculture as a low to minimal threat other than in seagrass areas where it identifies as a potentially moderate threat due to physical disturbance from propellers, sediment resuspension and shading.

Suitable areas have been designated as POAA in line with the recommendations of the Healthy Rivers Commission in its 'Healthy Oysters, Healthy Rivers report' (HRC, 2003). Identifying POAA recognises the importance of the industry to state and regional economies and the need to implement planning provisions that facilitate the environmental sustainability of the industry.

The assessment criteria for POAA in NSW estuaries (Table 5) ensures that potential environmental impacts and the needs of the community and other legitimate users of the State's estuarine resources are considered in the location and allocation of oyster aquaculture areas.

POAA suitability assessment

The first edition of this strategy restricted the original assessment of areas suitable as POAA to those that were held under an oyster aquaculture lease in 1980 issued under the *Fisheries and Oyster Farms Act, 1935* (*FOF Act*) and any lease issued over previously unleased area since that time either under the *FOF Act* or the *FM Act*. Small contiguous areas between adjacent oyster aquaculture leases were also assessed.

In 2005-06 each area was individually inspected and evaluated against a list of locational, environmental and socio-economic suitability criteria. This process classified current and previous oyster aquaculture areas as either suitable or unsuitable. All suitable areas are mapped as POAA on the oyster aquaculture maps. Table 5 lists the key location, environment and socio-economic criteria.

Areas in the National Park estate were assessed for oyster aquaculture suitability, but not mapped as POAA as this is not consistent with the intent of reserving National Park land. Current suitable leases in the National Park estate may continue subject to the relevant park management plan.

Areas not currently or previously leased may still be subject to application for oyster farming, but these applications will be dealt with on a case by case basis and will require development consent (see Chapter 9, Planning and Approvals).

Table 5: Assessment criteria for new priority oyster aquaculture areas in NSW estuaries.

Assessment Issue	Standard for an area to be classified as a priority oyster aquaculture area
Navigation	Not within an identified navigation channel as marked by the TfNSW (except dredge bed leases).
	Not directly offshore from, or 50 m to either side of any public wharf or public boat ramp. Greater distances may be required in high use areas.
	Not directly offshore from, or 50 m to either side of, any public or privately operated marina. Greater distances may be required in high use areas.
	Not within a recognised mooring area.
	Not within 50 m of an area identified by TfNSW as a specific watercraft operation area. Greater distances may be required in high use areas.
Conservation areas	Not within any areas identified as "coastal wetlands" on the Coastal Wetlands and Littoral Rainforests Area Map in State Environmental Planning Policy (Coastal Management) 2018 (CM SEPP 2018) if oyster aquaculture is likely to have significant adverse impacts on the wetland.
	Not in an area mapped as "Posidonia" seagrass bed
	Not in an area where oyster aquaculture is likely to have a significant adverse impact on matters of national environmental significance under the *Environment Protection and Biodiversity Conservation Act 1999*.
	Not in an area declared as an Aquatic Reserve under Part 6 of the *FM Act* if oyster aquaculture is likely to have significant adverse impacts on the conservation values of the Reserve.
	Only within areas within a Marine Park that identify oyster aquaculture as a permitted activity.
	Not within an area if oyster aquaculture is likely to have significant adverse impacts on threatened species or habitats listed under Part 7A of the *FM Act or* under the *Biodiversity Conservation Act 2016*.
	Not within the National Park estate unless it has the planning approval of the relevant authority and the written concurrence of the Minister administering the *NPW Act*.
	Not immediately adjacent to any area reserved or acquired under the *NPW Act* if oyster aquaculture is likely to have significant adverse impacts on the conservation values of the area.
Heritage	Not within over or adjacent to any area likely to adversely affect items listed on the State Heritage Inventory e.g. shipwrecks.
Aboriginal heritage	Not within, over or adjacent to sites/places of regional or national aboriginal significance without consultation and endorsement by the local Aboriginal community.
Public health safety	Not within any areas classified as a Prohibited (Closed Safety) under the NSW SP.
Commercial fishing	Not within a commercial net hauling ground recognised in a Fisheries Management Strategy made under the *FM Act*.
Recreational activity	Not directly offshore from, or 50 m to either side of, an area managed for public recreation.
	Not within 50 m of an area identified by the TfNSW as a designated swimming area.
Miscellaneous	Not over any area deemed as commercially non-viable for oyster aquaculture or not in the public interest.

5.2. Oyster aquaculture area available for leasing

Oyster aquaculture lease holdings have contracted since the mid 1970's and at June 2019 were 2920 ha, down from a peak of over 5,550 ha in 1976/77 (not including foreshore leases let on a linear rather than area basis). Chapter 2 discusses the reason for this contraction.

It is anticipated that lease area will continue to consolidate due to the advent of single seed production technology and faster growing selected oyster lines. These culture methods do not require 'catching leases' and may require less grow out area for the same production, as fewer age classes of stock need to be held. It is noted that estuaries affected by contraction due to

disease or by poor water quality may be able to return non-viable areas back into production in the future if disease resistant oyster breeding lines now in development are proven to be commercially successful and water quality issues are addressed.

Demand for lease area in an estuary is driven by the cost of production, demand and price for the product, water quality, production methods, availability of land bases and supporting infrastructure, and confidence in the security of access to the water and land resources required. Supply is controlled by competition from other estuarine user groups, estuarine carrying capacity and the availability of suitable area.

This strategy therefore establishes an orderly process of adjusting the lease area available to industry. The POAA identified on the oyster aquaculture maps may be adjusted to facilitate the objectives of this strategy.

Adding new POAA

The POAA identified on the oyster aquaculture maps may be increased by adding new lease area approved by development consent under Part 4 of the *EP&A Act* detailed in Chapter 9. Maps indicating the location of POAA in NSW estuaries are available online on the DPI Fisheries Spatial Portal available at:
https://webmap.industry.nsw.gov.au/Html5Viewer/index.html?viewer=Fisheries_Data_Portal

Extinguishment of POAA for non-oyster activities

DPI Policy O-072 (Extinguishment of Priority Oyster Aquaculture Area) sets out the circumstances and process under which a POAA will be extinguished to allow for non-oyster aquaculture development.

Under the terms of this policy POAA will only be extinguished for the purpose of non-oyster aquaculture related activity if:

- no other viable option for the proposed non-oyster aquaculture related activity can be identified
- where significant adverse effect on the oyster aquaculture industry is mitigated
- any compensation required by the Act or Regulation is paid.

When considering the adequacy of mitigation measures identified by a proponent/agency, DPI will consider:

- the viability and productivity of the subject lease(s)
- the strategic importance of the lease(s) to local industry (for example, is the lease the only catching lease in the estuary? Is the lease within a NSW SP harvest area?)
- any other matter raised in consultation with the local oyster industry.

The mitigation of any adverse effects on POAA of non-oyster aquaculture development may consist of:

- Replacement with a new reasonable equivalent lease area that will be classified as POAA at the next staged review; or

  Note: *Reasonable equivalent area will be assessed on the basis of area, productive capacity and culture potential (i.e. spat catching, raft, water depth etc) by DPI in consultation with the local industry and the Local Shellfish Program (LSP). The area must be approved by Deputy Director General DPI Fisheries and Game Licensing.*

- Works that mitigate the impact of the development to the local oyster industry to a value agreed to by DPI in consultation with the local oyster industry. Works may take the form of:

- clean up work, e.g. the removal of derelict cultivation material from public water land
- contribution to the LSP
- other work as agreed to by DPI in consultation with the local oyster industry.

Extinguishment of unused POAA

Any POAA identified on the oyster aquaculture maps that remains unleased for more than 10 years may be considered for extinguishment.

5.3. Oyster aquaculture maps

Maps describing the location of oyster aquaculture leases in NSW estuaries are published on the DPI Spatial Data Portal which is available on the DPI website. These maps also indicate lease boundary marking requirements and NSW Shellfish Program harvest area classifications. An overview of historic and current aquaculture lease holdings (ha) is provided in Table 6.

Table 6: Lease area for oyster aquaculture.

Estuary	Greatest area historically leased (ha)	Current leases in the National Parks estate (ha)	Area mapped as POAA (ha)
Column 1	Column 2	Column 3	Column 4
Tweed River	41.0		23.8
Brunswick River	15.0		9.1
Richmond River	29.0		20.9
Clarence River	37.0		13.2
Sandon River	7.0		
Wooli Wooli River	32.0		17.8
Bellinger River	29.0		24.3
Nambucca River	75.0		64.8
Macleay River	118.0		95.5
Hastings River	144.0		126.9
Camden Haven	166.0	17.9	93.9
Manning River	331.0		288.7
Wallis Lake	414.0		373.6
Port Stephens	1705.0		919.1
Hunter River	35.0		
Brisbane Waters	228.0		151.6
Hawkesbury River & Patonga Creek	329.8		292.9
Botany Bay / Georges River	371.0		128.0
Shoalhaven River	21.0		13.2
Crookhaven River	260.0	35.5	149.4
Currambene Creek	13.0		
Moona Moona Creek	<1		
Conjola River	14.0		8.5
Narrawallee Creek	12.0		

Estuary	Greatest area historically leased (ha)	Current leases in the National Parks estate (ha)	Area mapped as POAA (ha)
Column 1	Column 2	Column 3	Column 4
Burrill Lake	19.0		
Clyde River	236.0		201.2
Tomaga River	11.0		3.4
Moruya River	25.0		12.6
Tuross Lake	145.0		109.4
Wagonga Inlet	112.0		92.1
Wallaga Lake	28.0		5.2
Bermagui River	45.0		33.0
Murrah Lagoon	<1		
Wapengo Lake	94.0		79.3
Nelson Lagoon	48.0		22.5
Bega River	7.0		1.8
Merimbula Lake*	142.5		140.7
Pambula River	116.0		96.3
Towamba River (Kiah)	9.0		
Wonboyn Lake	62.0		53.3

* does not include 16.4 ha sub-let from the lessees of the Merimbula Airport.

Chapter 6 Commitment to environmentally sustainable practices

6.1. Good neighbour policy

The NSW oyster industry is an integral part of many NSW coastal communities. Oyster farming businesses not only generate economic benefits, but also make a positive and constructive contribution to the social fabric of these communities.

Oyster 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. Safeguarding water quality is a primary driver for oyster farmers.

Oyster farmers recognise that the land adjacent to leased areas is either community owned public land or private land. In either case, this land is treated with respect and oyster farming activities are conducted to minimise any existing and potential impact on this land.

Responsible NSW oyster farmers:

- do not abandon infrastructure and equipment as it can cause a hazard to watercraft, land vehicles and the environment
- 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 other estuarine and foreshore neighbours
- minimise noise, especially in the vicinity of residences and during the quiet times of the day
- 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 oyster aquaculture lease areas and/or land adjacent to lease areas
- are committed to assessing and preserving the Aboriginal Heritage values of coastal communities
- encourage, where practical, opportunities to employ and/or train Aboriginal people in the oyster industry.

6.2. Estuarine stewardship policy

Stewardship is the management of a resource on behalf of someone else. In the context of Ecologically Sustainable Development the stewardship of estuarine resources is on behalf of present and future generations. The estuarine stewardship ‘team’ consists of governments, the local community, local industries that are dependent on the estuary, and other industries and communities whose activities are affecting the estuary.

The NSW oyster industry is dependent on healthy environmental conditions in estuaries for healthy and productive oyster growth. The industry therefore has a vested interest in seeing estuarine ecosystems protected and restored. In turn, farmed oysters now provide much of the filtering of estuarine water previously undertaken by natural oyster reefs. Extensive natural oyster reefs were once dominant structural and ecological features in many NSW estuaries. These reefs all but disappeared from NSW estuaries in the late nineteenth century following historical exploitation to be burnt to produce lime for building and agricultural purposes and significant catchment development which degraded estuary health (Beck et. al., 2019). The introduction of a mudworm into NSW waters in the early 1900's which is often lethal to the Sydney Rock Oyster (Ogburn, 2011) also had a devastated effect on the remaining natural oyster reefs and early attempts at cultivation. Mudworm spread rapidly between east coast estuaries and forced oyster farmers to develop intertidal post and rail cultivation methods that elevated the oyster crops and reduced mudworm mortality rates.

In cooperation with DPI the NSW oyster industry is assisting research by a number of organisations into the habitat and trophic value and interconnections between estuarine habitat mosaics comprising oyster cultivation infrastructure, remnant oyster reef, seagrass beds, mangroves and bare substrate.

For many years oyster farmers have supported community groups to undertake waterway clean-up activities, volunteering their equipment and knowledge for the public good. In 2019 OceanWatch Australia initiated state-wide an annual clean-up program "Tide to Tip". This program puts the oyster industry at the centre of clean-up efforts, helping to demonstrate the value that farmers place on a healthy, productive environment. Tide to Tip clean-ups occur annually in late February and early March to align with Clean Up Australia Day. More information is available at www.nswoysters.com.au

The oyster industry also has an intimate knowledge of estuarine processes and resources, developed over generations of 'working the water'. Estuaries would benefit from having this knowledge incorporated into land and water planning. A focused involvement can also establish a positive feedback loop for the industry that is likely to increase consumer confidence and community acceptance of a sustainable oyster industry remaining in NSW estuaries (Healthy Rivers Commission, Oysters Review, 2003). To facilitate the protection of water quality in oyster growing areas, DPI in cooperation with other key government agencies and the NSW oyster industry, developed the Health Estuaries for Healthy Oysters – Guidelines (2017). The key objective of this document is to assist local councils, state government agencies, private landowners and developers with advice about how to ensure development in close proximity to estuaries is compatible with the requirements of oyster aquaculture.

Responsible NSW oyster farmers:

- do not litter or pollute land or waters
- take all reasonable measures to minimise any existing or potential impacts on adjoining land and remove any oyster farming materials that unintentionally wash ashore, as soon as possible
- operate their business to minimise any existing and potential environmental impact
- support catchment management and land use planning processes that maintain and/or improve estuarine health
- become involved in local resource management planning, estuary management and land use decision making
- ensure that the industry's intimate knowledge of estuaries and the industry's reliance on healthy estuaries is heard and incorporated into land and water management processes

- continue to work with government and the community to manage pests and disease
- support and assist research designed to investigate and/or mitigate the impact of oyster farming activities on the environment
- keep an eye on their patch and report environmental changes and potential water quality problems to the relevant authority
- recognise and promote the public benefit of estuarine water and environmental monitoring and reporting
- ensure that their activities do not degrade conservation and care of unique natural and cultural resources
- act as a good example to others and actively promote responsible habitat management and estuarine stewardship for example participation in annual clean up events.

6.3. Commitment to comply with, and where possible exceed, regulated standards

Government establishes minimum standards of performance in key areas of the operation of the oyster industry on behalf of the people of NSW. These standards attempt to balance potential environmental and social impacts of activities with the operational and viability needs of industry. These aims are not mutually exclusive, and the oyster industry is committed to identifying and implementing improvements to their businesses that meet, and where possible exceed, regulatory standards; improve business profitability; and, improve environmental performance and pest and disease management. Currently eighteen estuaries have prepared environmental management systems (see Chapter 10.4, Environmental Management Systems) to formally address these issues and incorporate them into their business operation.

Responsible NSW oyster farmers:

- make themselves aware of the regulations that apply to their businesses and as a minimum standard comply with those standards
- are proactive in pest and disease management, including staff training on the signs and symptoms of notifiable aquatic pests and diseases and early reporting of suspicions of these to DPI via the Emergency Animal Diseases 24 Hotline, details of which are on the DPI website at: www.dpi.nsw.gov.au/fishing/aquatic-biosecurity/reporting
- seek to identify aspects of their business activities that can improve profitability and environmental performance
- support and participate in training programs to improve skills and knowledge on industry best practice, environmental and community issues
- support research and development initiatives that aim to improve the profitability and environmental performance of the industry
- become involved in the development of appropriate standards for industry regulation.

6.4. Oyster industry Crown land base sites

Land base sites are required by oyster farmers to carry out their day to day land based activities such as the culling, depuration and management of oyster crops, storage of materials, and provide a staging and receiving point for farm watercraft and road based transport requirements. While there are a small number of freehold sites used for this purpose the majority of land base sites are in low-lying areas on the estuary foreshore which are leased or licensed from the Crown.

To ensure a sustainable industry which is in harmony with the surrounding environment, including the need for stewardship and accountability for land management over the areas held under tenure from the Crown it is important that:

- activities are carried out within the lease boundaries and do not encroach onto adjoining Crown land, including the bed of adjoining waterway
- disposal of oyster shell and other by-products does not occur within the lease or on the adjoining Crown land, including the bed of adjoining waterways
- waste is not to be burnt on site
- residing on these sites is not permitted without approval
- submerged land is not reclaimed by filling with oyster shell or other materials without written approval of all relevant authorities
- native vegetation, including riparian vegetation is not interfered with, both within and outside the leased areas
- disused and abandoned equipment is removed from Crown land, including the bed of waterways
- any occupation of Crown land outside of the leased area such as jetties, or ramps must be licensed or otherwise authorised
- any activity on leased areas is consistent with the purpose of the lease
- the Aboriginal heritage values of the site are assessed in consultation with DPIE, the Aboriginal Community and by making reference to the Aboriginal Heritage Information Management System
- 'Land owners consent' is sought from CL prior to the lodgement of any development applications. Also, any such development must be consistent with the zoning and undertaken in accordance with any relevant approvals and consents.

6.4.1. Definitions for Crown land base sites

'Crown land lease' means lease under the *CL Act*

'Oyster aquaculture land base site' means an area of non-submerged land (frequently leased Crown land) used for the purpose of supporting oyster aquaculture

'Premises' – means land and improvements within the leased area

'Oyster industry purposes' – means depuration, spat growing (nursery) and operations directly related to the transfer of oysters to and from cultivation areas.

6.4.2. Delineation of lease boundaries and identification of structures and works

The holder of a Crown land leased for oyster industry purposes is required to undertake a program to identify the surveyed boundaries of the lease and the position of any buildings, works or uses thereon.

Boundary identification and marking

Boundaries and/or corners of leases are to be clearly marked and remain clearly marked for the duration of the lease. CL, as a minimum, the positioning of white painted posts (minimum 100mm diameter) extending no less than one (1) metre above ground level, on all corners and at intervals no greater than 20 metres apart. In some instances, particularly where there is a history of continued encroachment and/or dumping of waste outside the lease boundaries, CL may require the lease holder to fence the landward boundaries of the lease.

Identification of structures and works

The holder of a lease is required to provide the local office of CL a description of all existing works and structures (size, materials, condition, etc.).

Unauthorised developments

All structures, works or uses are to be authorised and holders are required to show proof of any authorisation. Structures, works and uses without the appropriate consents are regarded as 'unauthorised developments' and the holder will need to remove the structures or cease the unauthorised use. Lease holders will need to justify why any structures, works or uses regarded as 'unauthorised developments' should not be removed or ceased. This will apply to those structures, works or uses that do not comply with the lease purpose.

6.4.3. Condition and maintenance of premises

Visual amenity

To minimise potential impacts on the visual amenity of the estuary, oyster industry land base sites should be kept in a reasonably neat and tidy condition at all times and all structures are to be kept in good repair. The visual amenity of the area is to be maintained by painting the structures in colours acceptable to the relevant local council.

Materials and equipment are to be stored in an orderly fashion and storage of chemicals and other hazardous materials to comply with Australian Pesticides and Veterinary Medicines Authority and EPA requirements.

Any redundant material or equipment is to be removed from the premises. Materials and/or equipment are not to be stored temporarily or otherwise on adjoining Crown lands (including waterways).

Disposal of shell, disused sticks and other used oyster waste material

The deposition of oyster shell, solid waste (including tarred sticks), debris and contaminated by-products within the premises, other than on a temporary basis, is prohibited. All such materials are to be removed from the premises to a disposal site authorised to accept such materials.

For further information regarding Crown land base sites see Chapter 9.9.

6.5. Stocking density

Over-stocking is where oyster stocking levels exceed the carrying capacity of an individual growing area or estuary. Overstocking means that stock does not have access to sufficient planktonic food. Poor growth, increased susceptibility to disease and increased susceptibility to heat kills have been linked to stress caused by overstocking in a number of NSW estuaries (Ogburn, 2011).

The number of oysters an estuary, or area within an estuary, can carry and produce is dependent on a wide range of environmental variables and there is currently insufficient data and knowledge to successfully estimate it on an environmental basis (for example using the primary productivity of an estuary). Consequently, no practical scientific tools exist to accurately quantify optimal stocking densities.

Stocking density varies widely between estuaries, method of cultivation and individual farmer preference. Estuary stocking levels are controlled to a large extent by lease stocking density decisions made by individual farmers. White (2002) estimated that, on average, over the period 1968/69 to 2000/01 the annual yield for NSW oyster aquaculture leases for human consumption was 1.3 tonnes/ha. Ogburn (2011) used 2003/04 production data (for human consumption) and estimated that the average yield was closer to 3.125 tonnes/ha given that approximately 50% of the lease area was fallow or uncultivated. Taking into consideration that it takes 3 to 4 years to

grow an oyster, stocking densities tend to vary between less than 6.25 tonnes/ha for some extensively cultivated stick growing areas to over 37.5 tonnes/ha in prime intensively cultivated tray fattening areas.

Experienced oyster farmers can estimate local carrying capacities based on previous production, observed growth rates and environmental conditions. It is acknowledged however, that because oyster farmers rely on a common food resource, a conflict between individual interests and the common good may develop. Where necessary DPI can prepare stock management plans to manage this issue, for estuaries or parts of estuaries, at the request of the local oyster industry. These plans would be prepared in consultation with all affected parties and would be given effect under the *FM Act*.

The following infrastructure stocking densities can be used as a guide for an average lease in a NSW oyster producing estuary:

- the minimum distance between post and rail tray cultivation is 8 metres
- the maximum length of single strand of supported baskets/tumblers or floating cultivation on a lease is 2.5 km per ha of lease
- the maximum area of raft cultivation on a lease is 540 square metres of raft per ha of lease.

6.6. Seagrass protection

All seagrasses provide habitat for fish and other aquatic fauna, help to reduce erosion and improve water quality, and are a source of food for fish and other aquatic fauna. Of the six NSW species of seagrass *Posidonia australis* is particularly susceptible to impacts from human activity because it has a limited distribution and once disturbed is slow to recover.

Existing oyster aquaculture that is over or may potentially shade seagrass should:

- regularly maintain the lease area to keep broken rails and fallen culture infrastructure off the bottom
- ensure outboard motors are trimmed as necessary to avoid the propeller cutting seagrass fronds.
- report significant changes in seagrass coverage to DPI
- use supported baskets/tumblers, floating cultivation, or other methods that minimise shading.

Multiple layer stick cultivation, tray cultivation, shade cloth and any other materials or culture methods that would unduly shade a *Posidonia* bed are not recommended.

New oyster aquaculture leases applications that are not in a POAA:

- will not be approved over *Posidonia sp.* seagrass beds
- will only be considered over *Zostera sp.* seagrass beds where the proposed method of cultivation does not result in significant shading impacts.

6.7. Live oyster reef protection

Live oyster reefs are located in estuarine systems adjacent to and within POAA. Some of the reefs are naturally occurring and some are the result of past oyster cultivation practices. Research has shown the important role these reef areas play in maintaining estuarine processes such as water quality and aquatic species diversity and abundance. Efforts to protect and restore oyster reef and bring back lost ecological functions are growing globally. Under the NSW Marine Estate Management Strategy, DPI with the support of the local community and local oyster farmers, delivered the first large-scale oyster reef restoration effort in NSW waters in

2019/20 at two locations in Port Stephens. This project is paving the way for the development of such projects in other NSW estuaries.

DPI does not support the removal of natural live oyster reef within POAA. Conditions apply to the removal of live oyster reef formed on derelict oyster cultivation within POAA (see Chapters 8.1.7 and 9.1.5).

6.8. Threatened species protection

To meet their ESD and environmental responsibilities oyster farmers should:

- take all possible care to avoid hitting marine fauna with boats or propellers
- not discard any debris into the estuary or adjacent lands
- ensure all ropes and mooring lines are relatively taut and design floating cultivation to prevent entanglement
- immediately record and report any instances of entangled, entrapped or distressed wildlife to NPWS
- participate in the protected, threatened and pest species sighting program to improve knowledge of the distribution and abundance of the species, particularly on oyster aquaculture lease areas
- become familiar in how to identify threatened estuarine species for example, Green Sawfish, Little Tern, Osprey, Pied Oyster Catcher, Sooty Oyster Catcher, Beach Stone Curlew and Turtles
- take care not to disturb potential nest tree sites or nests on or adjacent to oyster aquaculture leases
- take care not to disturb known or potential habitats adjacent to oyster aquaculture areas, for example, Little Tern, Osprey, Beach Stone Curlew, Pied Oyster Catcher and Sooty Oyster Catcher.

6.9. Hours of operation

The hours on which oyster aquaculture leases are worked can be restricted by tides and weather conditions. Therefore, it is important that routine stock handling operations and emergency lease and marking repairs can be conducted at all times.

The hours of operation for routine, well managed, stock handling operations, harvest and emergency lease and marking repairs are not restricted. These activities include:

- harvest
- washing
- Grading
- stocking and de-stocking a lease
- marking
- emergency lease and marking repairs.

However, within 200 m of private residences programmed lease construction and unduly noisy operations should only be conducted on oyster aquaculture leases during the period from 7:00 am to 6:00 pm Monday to Friday. Emergency repairs and emergency stock management operations are exempt from this restriction.

6.10. Noise

Oyster farmers operate in an extremely variable noise climate. Background noise varies with wind and wave action and the noise from other boats and shore-based activities. Noise propagation varies depending on the climatic conditions and the distance to the activity. The sensitivity of receivers also varies depending on the time of day and the perceptions and attitudes of individual receivers.

Oyster farming is not known as a noisy activity and has not, historically, been the source of serious noise problems. The main routine noise sources, outboard motors and on-board equipment (winches and pumps) are generally less noisy than recreational powerboats and many other waterway activities. In recent times the industry has switched to modern four-stroke and fuel injected two stroke motors and the noise levels of outboard motors and on-board equipment has dropped significantly. These modern engines also have significantly reduced emissions.

The *POEO Act* and the *Protection of the Environment Operations (Noise Control) Regulation 2017* are the primary legislative means of controlling noise on NSW waterways. TfNSW is the main agency responsible for noise from vessels and may issue regulatory notices and directions under the Act and penalty notices under the Act and Regulation. Police and council officers may also issue directions and penalty notices.

For example, where it is determined ongoing offensive noise is occurring, TfNSW may seek to identify a compromise between being able to conduct legitimate activities that may emit noise and the responsibility to minimise noise. A regulatory notice issued by TfNSW may require, for example, that certain equipment no longer be used, that the equipment be modified or that the equipment only be used at certain times of the day.

There is a general expectation that whoever is creating offensive noise should implement all feasible and reasonable measures to control it. Guidance on determining offensive noise can be found in Part 2 of the EPA's Noise Guide for Local Government available at: www.epa.nsw.gov.au/your-environment/noise/regulating-noise/noise-guide-local-government

Industry best practice for noise management includes:

- using only four-stroke or fuel injected two stroke outboard motors or other boat motors that enable the vessel to operate without causing offensive noise
- reducing boat speed near sensitive receivers
- keeping all on-board motors in good repair with appropriate mufflers fitted
- aiming to develop amicable relations with residential neighbours and have regular contact so that potential problems can be identified and resolved at an early stage
- acknowledging complaints and aiming to resolve them co-operatively
- complying with any direction of a TfNSW authorised officer
- using courteous language in the vicinity of other waterway users and residential neighbours.

6.11. Washing and temperature control spraying of oyster crops

Washing oysters is undertaken to control parasitic mud worm infection and spraying is used to cool intertidally exposed oysters to prevent heat induced mortality in very hot conditions and to meet food safety standards. The material washed from oysters is fine silt that settles from the water column and small amounts of marine bio-fouling.

Washing is undertaken by pumping water from the estuary through sprays and nozzles and returning this water to the estuary. Stock and infrastructure is either returned to a land base for washing or washed in-situ on an oyster aquaculture lease.

In-situ washing must be:

- undertaken using equipment kept in good repair with mufflers attached to all motors
- undertaken to keep noise to a minimum
- managed and undertaken to minimise any adverse effects on water quality.

6.12. Dredging and reclamation

Reclamation and dredging to maintain adequate water depth by oyster farmers is not a routine oyster aquaculture activity and may only be undertaken with the appropriate development consent under the *EP&A Act*. Other approvals may also be required including a permit under Part 7 of the *FM Act*.

6.13. Platforms and sheds

New work platforms, culling sheds and structures for the storage of un-used culture materials (i.e. depot sticks and trays) will not be approved on oyster aquaculture leases.

A future review of existing platform and shed structures on oyster aquaculture leases will be undertaken in conjunction with CL, to verify approval status, condition and tenure these structures if possible and appropriate. In some cases, these will not be able to be approved and may require removal.

6.14. Pest and disease control

DPI Aquatic Biosecurity unit supports the development of measures to eliminate, prevent or minimise aquatic pests and diseases.

Where there has been a significant level of oyster mortality or there is a suspicion oysters are being affected by a disease/organism DPI must be notified immediately.

There are aquatic pest and disease issues that impact the NSW oyster industry, such as POMS, QX disease, Winter Mortality disease and wild Pacific Oyster overcatch. DPI has developed and implements provisions to reduce the risks of translocation of QX disease, POMS under the *NSW Biosecurity Act 2015* and wild Pacific Oyster translocation via inter-estuarine shipments of oysters and cultivation equipment under the Fisheries Management (Aquaculture) Regulation 2017 (FMAR 2017).

Make 'clean' part of your routine

DPI Primefact No. 1290, (Biosecurity NSW, 2015) outlines how to routinely minimise the chance of spreading aquatic pests and diseases on boats and marine equipment. For more information see the DPI Biosecurity website at www.dpi.nsw.gov.au. The main points from Primefact No. 1290 are:

When arriving at a waterway:

- check your equipment is clean and remove any visible oysters/sediment/biofouling before entering the water

When departing a waterway:

- use fresh, clean water to flush outboard motors, trailers, vehicles and equipment. Commercial car wash facilities provide high pressure sprayers and are a good option
- ensure that all visible debris and biological material is removed – dispose of all waste collected during cleaning in general waste

- pay particular attention to areas where biological material tends to accumulate such as wheel arches, boots and farming equipment
- drain all water from trailer-boats prior to leaving a location - ensure wastewater does not return to any other NSW waterway
- to the best extent possible, all washed items should be allowed to completely air dry before being used at a new location.

QX disease

QX disease is caused by the parasite *Marteilia sydneyi* and is only known to affect the Sydney Rock Oyster. There are no human health issues associated with QX disease. This disease is capable of causing significant impacts and losses of this species and to prevent the spread of QX disease in NSW a risk based approach has been implemented in a biosecurity zone described under Part 3 of the Biosecurity Regulation 2017 (BR 2017) which prohibits the movement of all oysters from high risk QX disease estuaries to lower QX disease risk estuaries. Further, the movement of oyster farming equipment out of high and medium QX disease risk estuaries is only permitted if it has been treated in accordance with the provisions of the specific QX Disease Biosecurity Order.

Pacific Oyster Mortality Syndrome (POMS)

In late November 2010 oyster farmers in the Georges River, Botany Bay, reported to DPI that they had experienced a large mortality event in their Pacific Oyster crop and also noted that wild Pacific Oysters had died too. Subsequently there were reports of wild Pacific Oysters dying in the upper reaches of Sydney Harbour in late February 2011. Investigations confirmed that the mortality had been caused by the virus responsible for POMS. Oyster farmers in the Hawkesbury River reported significant mortality of farmed and wild Pacific Oysters at Mullet Creek in late January 2013 which within 12 months had resulted in the total collapse of the Pacific Oyster sector of the industry in the estuary. Sydney Rock Oysters and Native Oysters are not affected by POMS. There are no human health issues associated with POMS.

To control the spread of POMS, a biosecurity zone has been established under part 3 of the BR 2017 providing for a total ban on the movement of oysters from the Hawkesbury River, Brisbane Waters, Georges River, Botany Bay and Port Jackson to any other unaffected estuary in NSW and movement controls are in place regarding the movement of oyster farming infrastructure and equipment from these estuaries.

DPI is undertaking research into the infectivity mechanisms of this disease and is working closely with other research groups to better understand the mechanisms for the spread and management of this disease and to develop a POMS resistant Pacific Oyster.

Pacific Oyster control

The Pacific Oyster is an introduced species and may only be cultivated in NSW under the authority of an Aquaculture Permit endorsing the cultivation of this species. Pacific Oysters were first introduced into Australian waters in 1947 (Tasmania and Western Australia), 1953 (Victoria and 1969 (South Australia). Wild pacific Oysters are now endemic in NSW in all estuaries south of and including the Hastings River.

Part 2, Division 3 of the FMAR 2017 sets out criteria for wild Pacific Oyster over catch management that must be complied with when moving oysters between estuaries in NSW to prevent translocation of this aquatic pest.

Oyster shipment zones

NSW oyster estuaries have been split into estuary groups based on the prevalence of QX disease and the Pacific Oyster. There are restrictions on sending oysters between different

groups because of risk of translocation of disease (QX disease, POMS) and/or Pacific Oysters to other estuaries. Under Part 2, Division 3 Clause 10 of the FMAR 2017, all oyster movement in NSW must be documented in the Oyster Shipment Logbook system. Information regarding the Oyster Shipment Logbook and the inter-estuarine movement of oysters is available on the DPI website www.dpi.nsw.gov.au.

Oyster Shipment Logbook and IVR oyster movement reporting system

All shipments of oysters (except those being moved within the one estuary or those being harvested directly for human consumption) must have shipment details recorded in the permit holders Oyster Shipment Logbook or the interactive voice record system (IVR) prior to shipping.

Fisheries Officers must be given notification of high-risk shipments not less than 48 hours and not more than 2 weeks prior to the movement. For low risk shipments the notification must be given not less than 2 hours and not more than 2 weeks prior to the movement.

The original copy of the Oyster Shipment Logbook sheet or a note of the IVR number must accompany the shipment of oysters to another estuary. This copy must be kept by the receiving permit holder.

The remaining copies of the completed logbook forms must be sent monthly to DPI as described on the logbook form.

Inspections of shipments can be conducted by Fisheries Officers at any time and may include inspection of the logbook. In certain circumstances an inspection may be compulsory.

Where the correct procedures have not been followed Fisheries Officers can detain and/or seize the shipment.

Importation of hatchery spat from interstate

Section 216 of the *FM Act* specifically prohibits the release into any NSW waters of live fish (the definition of which includes oysters and other shellfish) except under the authority of a permit issued by the Minister. It is a condition of every Aquaculture Permit that “for the purposes of Section 216(1) of the *FM Act*, unless specified in a Specific Condition attached to the permit, the permit does not authorise the release into any waters any live fish of any species imported into NSW from interstate or overseas”. A breach of an Aquaculture Permit condition may lead to permit cancellation under Section 160 of the *FM Act.*

Where a permit holder wishes to import hatchery spat from another Australian state they must first make application to DPI to have their Aquaculture Permit varied to permit the importation and possession. This involves the completion of an Aquaculture Permit/Lease Variation Application form which is available online on the DPI website at: www.dpi.nsw.gov.au/fisheries/aquaculture

Currently only shellfish produced at approved interstate shellfish hatcheries may be imported and relayed in NSW waters under specific conditions.

The importation and relaying of shellfish harvested or collected from open waters in other states is not permitted.

An application to import and relay shellfish from an interstate shellfish hatchery will only be considered where the application is accompanied by a Biosecurity Import Risk Assessment (BIRA) completed by the applicant. Only where the BIRA has adequately identified and appropriately mitigated any potential risks will DPI consider the application. Where the application has been approved, DPI will prepare a Shellfish Hatchery Import Protocol (SHIP) specifying conditions under which the importation and relaying may occur. Oyster hatchery spat production and importation must comply with the provisions of the SHIP attached to the importer’s aquaculture permit.

The importation and relaying of shellfish without permit authorisation or in breach of the conditions specified in a SHIP is breach of an aquaculture permit condition and may lead to permit cancellation and/or penalties under the relevant legislation.

For further information regarding the importation of shellfish is available on the DPI website at: www.dpi.nsw.gov.au/fishing/aquatic-biosecurity/legislation-regulations

6.15. Theft of oysters and damage to oyster aquaculture leases

The oyster aquaculture lease/permit holder owns all oysters cultivated on the lease area. It is an offence under the *Crimes Act, 1900* to steal oysters and under the *FM Act* to remove oysters or other cultivated species from an oyster aquaculture lease without authority.

All thefts should be reported to local police for investigation in the first instance, on the NSW Police Assistance line ph. 131 444.

DPI local fisheries compliance should then be informed so that patrols can observe any suspicious activity and liaise with the police and farmers to reduce further theft. Call the Fishers Watch number 1800 043 536.

It is also an offence under the *FM Act* to interfere with aquaculture infrastructure on an oyster aquaculture lease without the consent of the lessee.

Reports of illegal or suspicious activity should be made to your local Police Station or Crime Stoppers (1800 333 000) and your local DPI Fisheries Office.

Chapter 7 Lease Marking

This Chapter is an Aquaculture Industry Development Plan for the purposes of Division 7 of Part 4 of the Fisheries Management (Aquaculture) Regulation 2017 (FMAR 2017) Marking of leased areas, boat channels and access ways.

Lease marking is required for safe navigation, to establish the use of the area for oyster aquaculture and to clearly identify individual oyster aquaculture leases.

Compliance with lease marking requirements is mandatory.

Marking with lease corner and intermediate posts is the default standard unless:

- an exceptional circumstances approval to mark contrary to these standards is granted
- the special marking provisions for foreshore leases apply.

7.1. Marking standards 'common' to all leases

7.1.1. Marker post materials

All oyster aquaculture lease marker posts must:

- be constructed of materials that are long lasting, pose no risk of significant environmental harm, be recyclable and made from renewable resources and/or recycled materials
- be white (Pantone 11-0203 TSX or lighter) in colour above the low water mark
- not be constructed of steel or materials that will corrode rapidly.

7.1.2. Marker post maintenance and repair

The following conditions apply to the maintenance and repair of lease marker posts:

- all lease marking (corner posts and intermediate market posts) must be wholly separate from the oyster cultivation infrastructure. That is, lease culture infrastructure must not be connected (in any way) to lease corner or intermediate marker posts
- all oyster aquaculture lease markers must be kept in good condition and be free of un-serviceable or prohibited materials
- all open-ended posts greater than 150mm diameter must be capped.

7.1.3. Lease corner marker posts

An oyster aquaculture lease corner marker post is required at each point on the lease where there is a change in the compass heading of the boundary of more than 20 degrees or the boundary point is shared with one or more adjacent oyster aquaculture leases. An oyster aquaculture lease corner post must:

- have an approved DPI oyster aquaculture lease sign attached at least 1 metre above the high-water mark
- have a minimum diameter or diagonal width of,
    - 90 millimetres where the post is constructed wholly of white plastic with internal timber reinforcing (minimum diagonal width of 80mm)
    - 150 millimetres where the post is constructed wholly of timber
- be firmly placed
- be equal in height to adjacent intermediate posts
- appear to be square to the water surface to the casual observer

- be white (Pantone 11-0203 TSX or lighter) in colour above the low water mark
- have between 1.25 metres and 1.5 metres showing above high-water mark (spring tides)
- must not be used as a point of attachment for oyster culture infrastructure

7.1.4. Intermediate lease marker posts

An intermediate oyster aquaculture lease marker post marks the boundary of a lease between two lease corner posts. Intermediate oyster aquaculture lease marker posts must:

- have a minimum diameter or diagonal width of
    - 75 millimetres, where the post is constructed wholly of white plastic with internal timber reinforcing (minimum diagonal width of 70 millimetres)
    - 100 millimetres, where the post is constructed wholly of timber;
- be firmly placed
- be equal in height to adjacent intermediate posts and evenly spaced
- appear to be square to the water surface to the casual observer
- be white (Pantone 11-0203 TSX or lighter) in colour above the low water mark
- have between 1.25 metres and 1.5 metres showing above high-water mark (spring tides)
- must not be used as a point of attachment for oyster culture infrastructure.

7.1.5. Intermediate lease marker post spacing

The oyster aquaculture maps categorise the water adjacent to each oyster aquaculture lease boundary using Categories 1, 2, 3 and 4. The requirements for intermediate lease marker post spacing are given in Table 7.

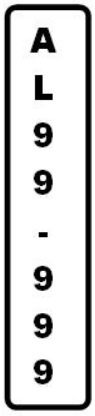
Table 7: Intermediate lease marker post spacing.

Marking Category	Description	Minimum intermediate post spacing
1	High level of boating activity – i.e. adjacent to main navigation channels, ways of access, and recreational areas.	10 metres
2	Medium level boating activity.	25 metres
3	Low use areas and foreshore boundaries with public access.	50 metres
4	Minimal use areas with boundaries adjoining other oyster aquaculture leases and minimal use/limited access foreshores such as bushland.	100 metres
SPECIAL	Where exceptional circumstances apply.	As directed

7.1.6. Oyster aquaculture lease signs

An oyster aquaculture lease sign must be attached to each lease corner post. The oyster aquaculture lease sign must be a sign provided by a DPI approved supplier or a sign that meets the specifications prescribed in Table 8.

Table 8: Oyster aquaculture lease sign specifications.

		Diamond Square	Vertical Rectangle
Sign specifications	Size	300mm x 300mm	100mm x 550mm
	Material	Marine Grade UV Stable	Marine Grade UV Stable
	Finish	Rounded corners	Rounded corners
	Colour	White (see Chapter 8.1.1)	White (see Chapter 8.1.1)
Lettering	Minimum Character size	60mm high x 25mm wide	60mm high x 25mm wide
	Colour	Black (UV Stable)	Black (UV Stable)
	Wording	Oyster Farm	
	Numbering	Lease number	Lease number
Format			

7.1.7. Navigation aids

Navigation aids (e.g. directional arrows, port and starboard colours and/or visual marks) must not be placed on any oyster aquaculture lease or oyster aquaculture lease boundary without prior consultation and written approval of the local TfNSW Boating Safety Officer.

TfNSW may require the installation or removal of navigation aids in some circumstances and will advise leaseholders in writing of any such requirements.

7.2. Special marking standards

7.2.1. Foreshore oyster aquaculture leases

The following additional marking requirements apply to all foreshore oyster aquaculture leases:

- foreshore leases, being natural rock or break-walls where no cultivation infrastructure has been placed on the lease area are to be marked on the shore, directly adjacent to the lease boundary and the mark must be clearly visible from the water and land
- the shoreline mark must have an approved DPI oyster aquaculture lease sign attached at least 1m above the high-water mark
- no sign may be installed on a National Park or Nature Reserve without approval from the NPWS.

7.3. Approval to mark contrary to these standards

Division 7 of the FMAR 2017 provides for the Minister or a Fisheries Officer to direct a lessee to mark an oyster aquaculture lease contrary to the standards given in this Chapter if these standards are impractical. These directions must be given in writing.

7.3.1. Fisheries Officer approval for reduced marking

DPI Fisheries Officers may approve in writing:

- for a lease to be not marked at all if the lease is completely free of all cultivation material
- marking only a used section of a lease where only a small portion of a very large lease is cultivated, for example on long narrow leases close the shore.

7.3.2. Approval to use raft infrastructure as a boundary markers

DPI Aquaculture Administration may approve in writing for lease markers to be placed on or incorporated into raft cultivation where the raft is located on the boundary of a lease or where it is unreasonable for the lessee to install marker posts due to water depth or substrate conditions.

Applications must be made using a Lease/Permit variation form.

The following additional marking requirements apply to all oyster aquaculture leases approved for raft markers to be incorporated into raft design in shallow waters:

- on the side of the raft that adjoins a navigational channel only, all vertical mooring post that pass vertically through the raft and secure the raft on the lease area must,
    - be white (see Chapter 8.1.1)
    - have a minimum diameter of 200mm
    - have between 1.25 metres and 1.5 metres showing above high-water mark (spring tides)
    - have reflectors fitted if required by TfNSW
- at the vertical mooring post at the end of a raft located closest to each corner of the oyster aquaculture lease, a lease sign must be fixed (between 1.25 metres and 1.5 metres showing above high-water mark)
- on the end, or any side of the raft that adjoins a navigational channel the raft must incorporate a substantially white stripe of a minimum width of 90mm.

The following additional marking requirements apply to all oyster aquaculture leases approved for raft markers to be incorporated into raft design where it is unreasonable for the lessee to install marker posts due to water depth and/or substrate conditions as well as to minimise visual impact:

- at each corner of a raft that adjoins a navigational channel, a vertical post must be fitted that,
    - is of a minimum height of 0.7 metres above the waterline
    - has attached near the top, two flat white panels (attached at 90 degrees to one another) each of a dimension of 300 mm x 300 mm when sighted from any horizontal position
    - has post and fixture painted white (see Chapter 8.1.1)
    - has reflectors fitted if required by TfNSW

- at the end of a raft located closest to each corner of the oyster aquaculture lease, a lease sign must be fixed (between 1.25 metres and 1.5 metres showing above high-water mark),
    - such signs may form part of the corner marks of the raft
    - may substitute for a 'common' oyster aquaculture lease corner post and sign.
- on the end, or any side of the raft that adjoins a navigational channel the raft must incorporate a substantially white stripe of a minimum width of 90mm.

Note: *Only the raft that adjoins a navigational channel must be marked as described above. Any other raft on the lease must meet the Chapter 8 Lease Tidiness standards and be substantially black, dark grey or dark grey/green in colour (the use of blue flotation drums on rafts is permitted contrary to Chapter 8.1.1).*

7.3.3. Aquaculture Administration approval to use floating markers

DPI Aquaculture Administration may approve in writing for a lease, or for sections of a lease, to be marked with floating markers where it is unreasonable for the lessee to install marker posts due to water depth and/or substrate conditions. Approval may also be granted for floating markers to minimise visual impact.

Applications must be made using a Lease/Permit Variation form available online at: www.dpi.nsw.gov.au/fishing/aquaculture/forms/lease-based.

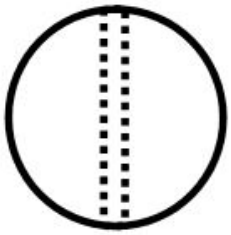
7.3.4. Standards for floating marks

The specifications for floating lease marks are prescribed in Table 9.

Floating marks must be securely attached to an anchor appropriate to the prevailing conditions with nylon rope with a minimum diameter of 10mm. To minimise the entanglement risk to marine mammals the minimum possible amount of rope must be used, and the float rope must be counterweighted near the bottom to ensure that the rope remains vertically taught throughout the tidal cycle.

Table 9: Floating lease boundary marks.

		Corner Mark	Intermediate Mark
Float specifications	Size	Minimum 200mm Maximum 400mm	Minimum 90mm Maximum 200mm
	Material	Polystyrene or Plastic	Polystyrene or Plastic
	Finish	Round	Round
	Colour	White (see Chapter 8.1.1)	White (see Chapter 8.1.1)
Lettering	Minimum Character size	60mm high x 25mm wide	
	Colour	Black (UV Stable)	
	Numbering	Lease number	

	Corner Mark	Intermediate Mark
Format		

7.4. Lease marking compliance

If an oyster aquaculture lease does not comply with the relevant lease marking standards specified in this strategy the lessee will be issued a Notice to Comply to ensure that the markings comply in accordance with Clause 58(1) of the FMAR 2017.

A Clause 58(1) Notice will give not less than 7 days from the date of issue to bring the oyster aquaculture lease marking into compliance with the standards specified in the strategy.

Clause 58(2) provides for a Fisheries Officer to complete the work if the lessee fails to comply with a Clause 58(1) Notice. The cost of this work can be recovered from the lessee under Clause 58(3).

A monetary Penalty Infringement Notice (PIN) may be issued for failure to maintain lease markings.

Chapter 8 Lease Tidiness

Aquaculture Lease Tidiness standards aim to:

- reduce the likelihood of the lease maintenance burden becoming overwhelming
- reduce lease abandonment and potential expenditure of lease security trust funds
- reduce adverse visual, amenity and safety impacts consistent with the oyster industry's estuarine stewardship responsibilities (see Chapter 5).

For the purpose of s.162 of the *FM Act*, 'tidy" is defined as being in accordance with these tidy standards. Nothing in these standards stifles any innovation that achieves an even higher standard of performance.

8.1. Tidy standards 'common' to all leases

The following aquaculture lease tidiness standards apply to all aquaculture lease areas.

8.1.1. Colour

To create visual harmony and compatibility, aquaculture lease infrastructure must be:

- substantially black, dark grey (Pantone 4128 C or darker) or dark grey/green (Pantone 196026 TCX or darker) in colour on installation
- consistent in colour
- lease corner and intermediate markers must be white (Pantone 11-0203 TSX or lighter).

Note: *white culture infrastructure is prohibited in order to reduce visual amenity impacts and to prevent confusion with white lease boundary marker posts while navigating in oyster aquaculture areas. However, light coloured posts are permissible if the cultivation (baskets, tumblers, trays) substantially hides or obscures the posts. Blue recycled drums are also permitted as raft floatation devices)*

8.1.2. Shape and design

To create visual harmony and compatibility, aquaculture lease infrastructure must be:

- consistent in shape and design
- consistent and low in height and appear square to the water surface to the casual observer
- consistent in line and direction to the casual observer
- consistent with the scale of the surroundings.

Note: *If possible, leases that are within the same visual catchment should use the same types of cultivation equipment, same spacing and alignment as this creates uniformity.*

8.1.3. Materials and Construction

The following conditions apply to materials and construction method use on oyster aquaculture areas:

- unless approved under Section 7.3.2 all aquaculture lease culture infrastructure must be kept separate from white lease markers and intermediate markers posts
- all aquaculture lease infrastructure must be installed so that it is kept wholly within the surveyed lease boundary at all times, including floating infrastructure, rafts, moorings, anchors and ropes

- all oyster aquaculture lease infrastructure must be constructed of materials that are long lasting, pose no risk of significant environmental harm, be recyclable and made from renewable resources and/or recycled materials
- all oyster aquaculture leases must be kept free of the following prohibited materials:
    - conveyor belting – no new installation is permissible, existing unserviceable conveyor belting must be removed from the lease area and cannot be replaced
    - vertically hung netting
    - steel, steel star pickets and corrugated iron
    - tyres *(Contrary to this section the use of small car tyres as sliding mooring collars or raft module shock absorbers is permissible).*

8.1.4. Maintenance and Repair

The following conditions apply to the maintenance and repair of oyster lease infrastructure:

- all oyster aquaculture leases must be kept in good condition and be free of un-serviceable or prohibited materials
- any fallen, damaged or unserviceable materials or infrastructure must be repaired or removed as soon as tides, weather and normal work schedules permit, or in accordance with a Section 162(1) Notice issued by a Fisheries Officer
- all oyster aquaculture leases must be kept free of waste and must not be used to store un-used cultivation materials
- overcatch and other marine biofouling must be removed if it threatens to the structural integrity of the lease infrastructure and markers.

8.1.5. Mooring of oyster industry vessels

The following conditions apply to the mooring of vessels on oyster aquaculture leases:

- punts and boats must not be permanently moored on an oyster aquaculture lease
- punts and boats not removed from the water daily must be moored at work sheds, private jetties or on TfNSW registered moorings
- floating shuttle devices used for the purpose of turning or harvesting floating basket longline cultivation may be temporarily secured in a lease area (including overnight).
- a shuttle must:
    - remain wholly within the boundaries of the lease during all wind and tidal conditions
    - have a fully enclosed hull
    - be less than 5m long by 3m wide
    - be securely attached to the longline
    - be designed to host infrastructure to service longline basket cultivation.

8.1.6. Waste management

The following conditions apply to the management of oyster industry waste:

- reduce, re-use and recycle waste materials where possible

- all lease infrastructure removed from a lease must be returned to shore for processing or disposal
- all wastes from culling activities conducted on leases must be returned to shore for processing or disposal
- where possible bio-fouling removed from lease infrastructure (markers, rail etc) should be collected and returned to shore for processing or disposal.

8.1.7. Removal of derelict cultivation that has formed live oyster reef in POAA

The following conditions apply to the removal of live oyster reef from oyster aquaculture leases:

- where an oyster farmer wishes to remove from a lease area derelict oyster cultivation that has collapsed into the substrate and is fully encrusted with hard living oyster biofouling with little or no cultivation exposed, DPI will only consider its removal where:
    - an environmental impact assessment has been prepared by the applicant
    - any necessary approvals have been obtained under the *EP&A Act.*
- DPI will only consider the removal of traditional rock cultivation where it can be demonstrated that it poses a serious navigation, or safety risk, and can be removed without causing significant net environmental harm and where:
    - an environmental impact assessment has been prepared by the applicant
    - any necessary approvals have been obtained under the *EP&A Act.*
- DPI will not support the removal oyster encrusted natural reef or natural rock.

8.1.8. Fallow leases

The following conditions apply to oyster leases that are left fallow (unused):

- leases may be left fallow for up to five years. Longer fallow periods are permitted if identified in an approved Commercial Farm Development Plan (CFDP) submitted by the leaseholder or with the prior written approval of DPI
- only sound posts and rail may remain on fallow leases - all rafts trays, sticks, supported baskets/tumblers and floatation longlines must be removed
- lease marking must be maintained during the fallow period
- rails and posts must be maintained in serviceable order during the fallow period.

8.2. Special tidy standards

8.2.1. Catching slats

- White plastic catching slats are permitted (contrary to Section 8.1.1).

8.2.2. Raft cultivation

The following conditions apply to raft cultivation:

- rafts must be constructed of materials that are long lasting in the marine environment and pose no risk of significant environmental harm
- rafts must be constructed with marine grade fastening systems
- rafts must not be used to store waste, infrastructure or materials

- plastic drums and floats must be adequately secured to the raft at all times and replaced if broken or leaking.
- rafts must be low in height and must be designed and constructed to float horizontally to the water surface
- the use of steel or concrete flotation devices is prohibited
- rafts must be constructed of either good quality structural grade hardwood or aluminium, or equivalent
- only plastic drums sourced from a licensed drum recycling company may be used for oyster raft flotation
- black coloured floatation is preferred but blue flotation drums are permitted (contrary to Chapter 8.1.1).
- small sized securely fixed tyres may be used for raft buffers or post sleeve collars (contrary to Section 8.1.3)
- broken or damaged rafts must be removed from the lease area or repaired as soon as possible
- broken or damaged rafts must not be stored on any oyster lease or any public water land

For further information regarding best practice for raft cultivation see Best Practice Guidelines for Raft available on the DPI website at: www.dpi.nsw.gov.au/fisheries/aquaculture

8.2.3. Floating cultivation

The following conditions apply to not-raft floating cultivation:

- any spherical surface float used to support floating cultivation must not be greater than 400mm in diameter
- horizontal white floatation (for example white pipe) is only permitted in Wallis Lake and the Manning River as an historical stick cultivation method but is not approved for floating basket cultivation in any other estuary
- horizontal white floats must be secured appropriately so that they do not drift outside of the lease boundaries
- horizontal white floats (for example white pipe) must not be bundled for storage on a lease area or any public water land when not being used
- small sized, securely fixed tyres may be used for floating cultivation post collars (contrary to Section 8.1.3).

For further information regarding best practice for floating cultivation see Best Practice Guidelines for Floating Cultivation available on the DPI website at: www.dpi.nsw.gov.au/fisheries/aquaculture

8.2.4. Wave barrier fencing

The following conditions apply to wave or boat wash barrier fencing:

- wave barrier fences can only be constructed on leases approved and endorsed by DPI for these structures
- must not unreasonably restrict ways of access to other leases, or to other public waters
- must not obstruct access to an intertidal shoreline
- may incorporate lease corner marks and intermediate markers

- floating fences must not extend more than 50cm above or below the water surface and must be fixed such that they do not drift or extend beyond the boundaries of the lease
- unless approved by DPI, fixed (not floating) fences must not extend above Mean High Water Mark and where possible, fences should not extend more than 50 cm above the highest level of cultivation materials and must not extend more than 20cm below the lowest level of cultivation.

8.2.5. Spray Irrigation

The following conditions apply to spray irrigation used to cool intertidal rack and rail cultivation:

- spray irrigation can only be constructed on leases approved and endorsed by DPI for these structures
- all reasonable care must be taken to ensure that irrigation pumps do not pollute the marine environment.

8.3. Maintenance Schedule

As a guide, the following lease maintenance schedule is recommended. However in the event of significant environmental event oyster farmers should check their lease infrastructure to ensure that it does not significantly impact on visual amenity or pose a risk to the safe navigation of oyster lease areas.

MATERIAL	***MAINTENANCE***
Lease superstructure – markers, cultivation posts and rails.	Routine once every 12 months Repair at any time if it has collapsed, is in danger of imminent collapse or if a marker post or sign is missing
Catching material or depot blocks	Routine once every 12 months Repair at any time if it has collapsed or is in danger of imminent collapse Must not remain continuously on a lease for more than two years before being stripped or nailed out
Stick Cultivation	Routine once every 12 months Repair at any time if it has collapsed or is in danger of imminent collapse Must not remain continuously on a lease for more than three years after being nailed out
Trays, Baskets and Cylinders	Routine once every 12 months Repair at any time if it has collapsed or is in danger of imminent collapse
Rafts	Routine once every 12 months Repair at any time if it has failed or in danger of imminent failure: • raft timbers and metal fixings, moorings, ropes, attachments and anchors

MATERIAL	MAINTENANCE
	• location within the lease boundary • floatation devices and attachments • signs, markers and navigation aids.

8.4. Lease tidy compliance

If an oyster aquaculture lease does not comply with the relevant lease tidy standards specified in this strategy the relevant permit holder will be issued a Notice to Comply to achieve compliance in accordance with Section 162 of the *FM Act*.

A Section 162 Notice will normally specify a timeframe of between 30 and 120 days from the date of issue to bring the oyster aquaculture lease into compliance with the tidy standards specified in the strategy.

The time allowed to bring leases into compliance with tidy standards may be shorter if the issue requires more immediate attention to reduce risks to navigation, environmental damage or serious public nuisance. The frequency of lease inspections may also increase to address compliance concerns.

In accordance with Section 162(3) failure to comply with such a notice is taken as a contravention of a condition of the aquaculture permit.

Oyster farmers may negotiate with the local District Fisheries Office to extend timeframes up to a maximum of 3 years. The local Fisheries Officers will exercise their discretion to extend timeframes on a case by case basis, in consultation with DPI Aquaculture Management. Where agreement has been reached a new Notice to Comply will be issued under Section 162 specifying the new time frame.

Sections 162 (4)-(7) provides for the Minister to complete the work if the permit holder fails to comply with a Section 162(3) notice and to recover costs.

A PIN may be issued for contravention of an aquaculture permit condition in relation to maintaining a lease in a tidy condition.

8.5. Decommissioning oyster aquaculture leases

Leases that are expired, cancelled or surrendered must be completely cleared of all cultivation materials, stock, equipment, wave barrier fences and marker posts before the lessee is discharged from legal responsibility for the area (*Section 171 FM Act*).

The removal of rock cultivation will only be ordered if it poses serious navigation, amenity or safety risk and can be removed without causing significant net environmental harm. Rock cultivation may only be removed with the approval of DPI.

A Section 171(3) notice will specify a timeframe of between 30 and 180 days from the date of issue to completely clear the oyster aquaculture lease.

The time allowed to clear the lease may be shorter if the issue requires more immediate attention to reduce risks to navigation, environmental damage or serious public nuisance.

Sections 171 (4)-(5) provides for the Minister to complete the work if the former lessee fails to comply with a Section 171(3) notice and to recover costs from the former lessee. This entails advertising for a contractor to undertake works, clearing the area and creating a debt. Where a former lessee does not pay off the debt, debt collectors are engaged. Where the debt is deemed irrecoverable, the debt will be covered by the Lease Security Trust.

A Penalty Infringement Notice may be issued for failure to comply with a Section 171(3) notice.

Chapter 9 Planning and Approvals

9.1. Approval of new oyster aquaculture leases

A person may only apply for oyster aquaculture lease where:

- they are the holder of a current Class A Aquaculture Permit
- have a Class A Aquaculture Permit approved in principal awaiting the addition of leases to the permit
- where they have an agreement to sublet the oyster aquaculture lease to an existing Class A Aquaculture permit holder should it be approved.

DPI Aquaculture Administration should be contacted for current advice and information before any formal application is made to lease any area for oyster farming.

New applicants should consult the publicly available Fisheries Spatial Data Portal to identify current and vacant POAA, lease boundary marking requirements, oyster harvest zones established under the NSW SP, wetlands declared under the Coastal Management SEPP 2018 and the location of National Park and Marine Park boundaries. Different assessment and approval processes apply to each of these areas. The Fisheries Spatial Data Portal is available online at:
https://webmap.industry.nsw.gov.au/Html5Viewer/index.html?viewer=Fisheries_Data_Portal

9.1.1. New lease in a POAA.

- an application for a new lease in a POAA must be submitted on the prescribed DPI form
- DPI will make an assessment in accordance with Section 5.5 of the *EP&A Act* to determine if the area is suitable and appropriate for leasing and provide planning approval for the activity.
- if available, the lease will be offered by competitive tender in accordance with the DPI Policy O-071 (*Oyster Aquaculture Lease Allocation*)
- the new lease will be gazetted by DPI if approval is granted.

9.1.2. New lease in a POAA in a Marine Park

- an application for a new lease in a POAA in a Marine Park must be submitted on the prescribed DPI form
- DPI will consult with the relevant Marine Park Manager
- DPI will make an assessment in accordance with Section 5.5 of the *EP&A Act* and the Marine Parks Act, 1997 (*MP Act*) to determine if the area is available for leasing
- if available, the lease will be offered by competitive process in accordance with the DPI Policy O-071 (*Oyster Aquaculture Lease Allocation*)
- the new lease will be gazetted by DPI if approval is granted.

9.1.3. New lease NOT in POAA

An application for a new lease area that is not in POAA must be accompanied by:

- a suitability assessment using the assessment criteria in Table 5 (see Chapter 5.1)
- DPI will liaise with TfNSW and the Marine Estate Management Authority (MEMA) and NPWS if required and make a preliminary assessment of the application and determine if the area appears to be available for leasing

- if available, the applicant should prepare a SEE that addresses the potential environmental impacts of the proposed new lease
- if deemed available, the lease will be offered by competitive tender in accordance with DPI Policy O-071 (*Oyster Aquaculture Lease Allocation*)
- the preferred applicant will prepare a development application (DA) to the relevant local council for assessment under Part 4 of the *EP&A Act*. The DA will need to be supported by a SEE, or for designated development an EIS. A Species Impact Statement is required if a threatened species is likely to be significantly affected
- prior to submitting a DA to council an application must be submitted to CL as land owner for consideration. CL must assess an application to determine whether it will provide Landowner's Consent and if so, provide endorsement prior to the DA being lodged with council for consideration under the *EP&A Act*. Applications for Land Owners Consent are available on the website listed below and enquiries should be directed to:

  Crown Lands
  PO Box 2215
  Dangar 2309

  Telephone: 1300 886 235 (Australia wide)
  Email: cl.enquiries@crownland.nsw.gov.au
  Website: www.industry.nsw.gov.au/lands

- any application for Landowners Consent must include:
  - the original DA form
  - any applicable fees
  - the SEE submitted to DPI with the lease application
  - a copy of a letter from DPI supporting the application
  - detailed plans showing the location and dimensions of proposed development with respect to tenure boundaries
- if the proposed lease area is in a Marine Park and the consent authority intends to grant consent to the lease, the concurrence of the relevant Ministers will be sought
- the new lease will be gazetted by DPI if consent (and concurrence if required) is granted.

9.1.4. New lease in or adjacent to the National Park estate

- an application for a new lease in or adjacent to the National Park estate must be accompanied by:
  - a suitability assessment using the assessment criteria given in Table 5
- DPI will liaise with TfNSW, CL and NPWS and will make a preliminary assessment of the application and determine if the area appears to be suitable and appropriate for leasing. This assessment will also consider other tenures, including potential impacts on native title rights, and the requirements of any Indigenous Land Use Agreement
- if apparently suitable and appropriate (and if available), the lease will be offered by competitive tender in accordance with the DPI Policy O-071 (*Oyster Aquaculture Lease Allocation*)
  - the successful tenderer will be required to submit a REF that addresses the potential environmental impacts of the proposed new lease, including an assessment of impacts on the natural, cultural and social values of the National

Park area and its management. An EIS will be required if the proposed new lease is likely to significantly affect the environment.

- DPI will exhibit the proposed lease and its REF for public and agency comment
- DPI will consider any feedback on the proposal in collaboration with NPWS and assess the application in accordance with Section 5.5 of the *EP&A Act* to determine if the area remains suitable and appropriate for leasing and provide planning approval for the activity
- the written concurrence of the Minister administering the *NPW Act* will be sought if DPI approves the lease – this request will be accompanied by the REF and its determination notice
- the new lease will be granted where the written concurrence of the relevant Minister(s) has been granted.

9.1.5. New lease in areas containing live oyster reef

- DPI will not consider a new application over existing POAA in a Marine Park sanctuary zone that contains significant areas of oyster reef unless:
    - the applicant identifies how they intend to farm around the presence of the existing oyster reef, or
    - agrees to provide a new lease survey removing the oyster reef from the POAA area
- an application for new lease over existing POAA (other than above) that contains oyster reef will only be considered where the applicant:
    - identifies how they will farm around the presence of the existing oyster reef
    - agrees to provide a new lease survey removing the oyster reef from the lease area, or
    - provides an environmental impact assessment adequately addressing the environmental issues associated with the removal of the oyster reef (see Chapter 8.1.7 above)
- any vacant POAA that is identified on oyster aquaculture maps that contain significant areas of oyster reef may be considered for full, or partial extinguishment in consultation with Shellfish Committee.

9.2. Competitive allocation of new lease areas

Under DPI Policy O-071 (*Oyster Aquaculture Lease Allocation*) the default allocation process for all new oyster aquaculture lease applications is by competitive public tender. This policy ensures transparent equal opportunity and maximizes the return to the state from the allocation of this public resource to a private/commercial use. The new lease assessment and allocation process is outlined in Figure 3.

Non-competitive relocation of a portion of a lease that has become unsuitable for oyster aquaculture

DPI will only consider an application to relate a portion of a lease by non-competitive process where:

- it is to correct an administrative error in the existing survey plan

- to shift the boundary of the lease in order to replace a section of the lease that is unsuitable for aquaculture with a new suitable area and the applicant is the current lessee. This exception only applies if:
    - the resurveyed lease incorporates at least 50% of the current lease
    - the total area of the proposed lease does not exceed the total surveyed area of the current lease
    - the applicant has a good history of managing their aquaculture lease areas and agrees to surrender the area that is being excluded from the proposed new lease and remove all improvements from that area (including cultivation material, lease markings and structures).

Note: Oyster aquaculture on public water land that is partly within and partly outside a priority aquaculture area is permissible without development consent, but only if the land outside the area is no more than 0.1 hectares in area as per clause 5.19(6) of the Standard Instrument – Principal Local Environmental Plan and Schedule 4 of the PPRD SEPP where a non-standard LEP still applies.

9.3. Making Local Environmental Plans that may affect oyster aquaculture

To address this issue Council must have regard for Local Planning Direction 1.4 – Oyster aquaculture when preparing any Local Environmental Plans.

9.4. Determining development applications that may affect oyster aquaculture

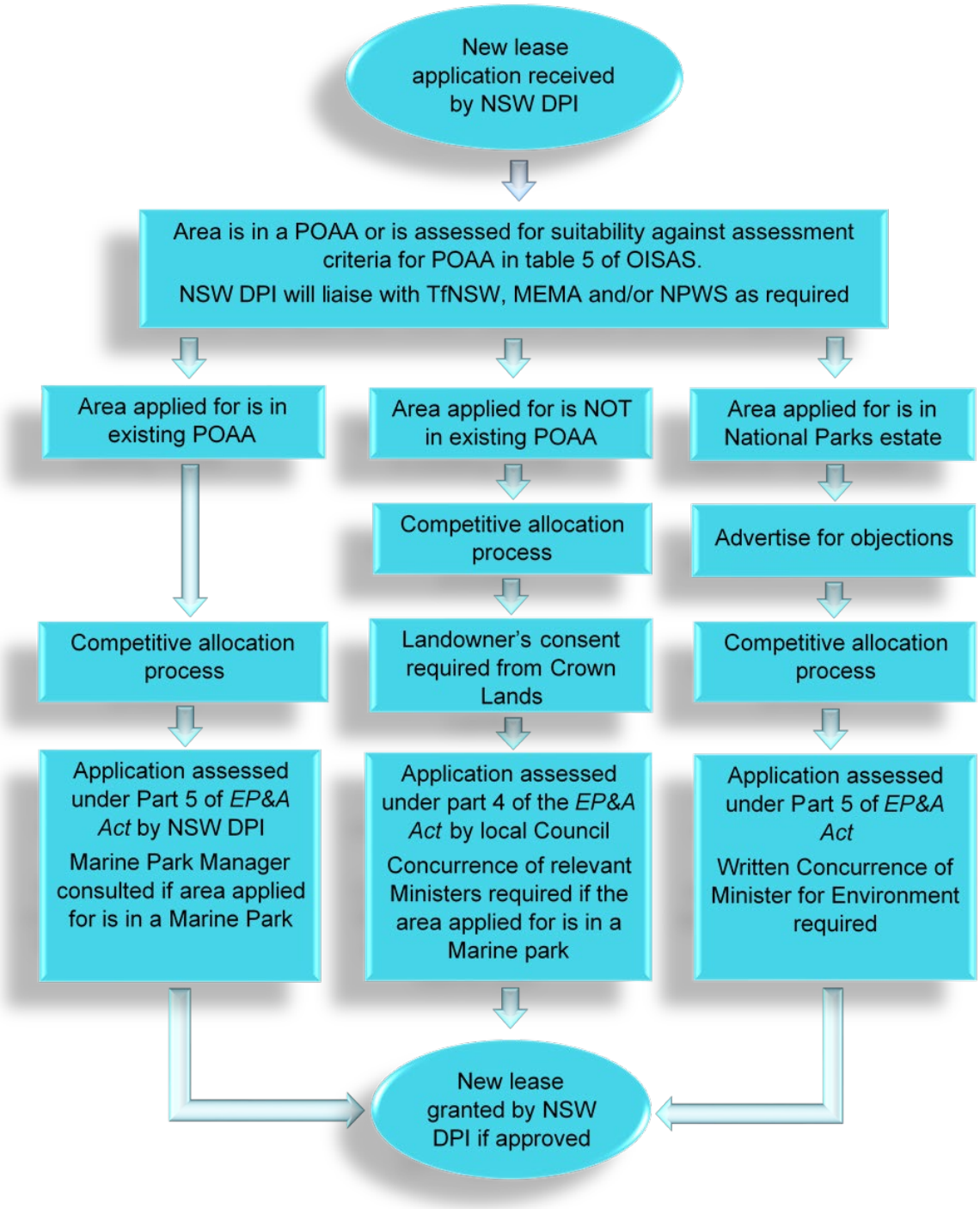
Division 4 of Part 5 of the PPRD requires consent authorities to consider the effects of the proposed development on oyster aquaculture and to take OISAS into consideration.

When considering an application for development that, because of its proposed location, may affect a priority oyster aquaculture area or oyster aquaculture outside such an area, the consent authority must:

- give the Secretary of the Department of Industry written notice of the development application and take into consideration any written submissions made in response to the notice within 21 days after notice was given
- take into consideration the provisions of OISAS
- consider any issues that are likely to make the development incompatible with oyster aquaculture and evaluate any measures that the applicant has proposed to address those issues. Examples of potential land use incompatibility issues include access to oyster aquaculture leases being limited by the development or the risk of adverse impacts of the development on water quality and, consequently, on the health of oysters and on the health of consumers of those oysters.

The consent authority may refuse to grant consent to development if, in the opinion of the consent authority, the development is likely to have an unreasonable impact on a priority oyster aquaculture area or on oyster aquaculture outside such an area.

Figure 3: New lease assessment and allocation process.



9.5. Aquaculture permits

Aquaculture permits are not transferable and remain in force until cancelled at the request of the permit holder or by DPI.

The permit holders listed on a permit cannot be changed. If there are changes to a business partnership, business name or group of farmers working under the one permit, then a new permit must be applied for and assessed by DPI.

The permit, as well as the lease, will specify the species allowed to be cultivated on a lease area.

Applying for a permit

DPI Aquaculture Administration should be contacted for advice. Information regarding aquaculture permits is also provided on the DPI website. Applications for oyster aquaculture permits will be assessed by DPI against the Best Practice Standards in OISAS.

A new entrant to the industry will normally be required to demonstrate access to an approved land base site (work area) and have an aquaculture permit or preliminary approval, prior to obtaining any leases.

Commercial Farm Development Plan

All new class 'A' Aquaculture Permits (includes oysters) must submit a CFDP that is assessed by DPI. A CFDP must include a Lease Maintenance and Development Plan (LM&DP) and a Biosecurity Risk Management Plan (BRMP). Further information regarding the preparation of a LM&DP and a BRMP can be found in Chapter 10, or on the DPI website at: www.nsw.gov.au/fishing/aquaculture/

A CFDP may be reviewed by DPI where farm management and/or compliance issues arise.

A new CFDP will also be required, or an existing CFDP will need to be updated, where there is a change in ownership or a significant increase in lease area operated under an aquaculture permit.

Suspension and cancellation of permits

Aquaculture permits can be suspended and/or cancelled under s.159 and s.160 of the *FM Act*. Some reasons for suspension or cancellation given under these sections of the Act are:

- the permit holder dies or requests the permit be suspended or cancelled
- the permit application contained false or misleading information
- permit conditions, including Compliance Notices, are not complied with
- the permit holder has been convicted of stealing fish (includes oysters) or marine vegetation
- aquaculture is not being carried out in line with the CFDP
- Other circumstances consistent with the *FM Act* or the FMAR 2017.

In cases other than when the permit holder dies or asks for the permit to be cancelled, the permit holder is given an opportunity to explain why the suspension or cancellation should not go ahead before this action is taken.

The permit holder can request an internal review of a permit suspension or cancellation. If still not satisfied, application can then be made to the NSW Civil and Administrative Tribunal to review the case.

Permit suspension and cancellation may also lead to the cancellation of leases held under the permit.

9.6. Administration of oyster aquaculture leases

An oyster aquaculture lease gives the leaseholder the exclusive right to farm the species listed on the lease within the lease area.

Other community members still have rights of access to the area for fishing and boating, however, it is an offence for a person to interfere with or damage lease structures or stock on the leased area. There are severe penalties for theft and/or damage to stock or infrastructure on oyster aquaculture leases.

Administrative Sanctions and civil action for non-compliance

Where the permit holder/lessee has a poor record of management such as non-completion of required work specified in a Compliance Notice or a former lease areas not being cleaned up, an application for a new lease or lease transfer, consolidation, sub-division, renewal or sublet will normally be refused.

In addition, DPI will take civil action against current and former lease and permit holders under DPI Policy O-041 (Undertaking works on oyster aquaculture lease areas and permit areas and recovering costs) if clean-up, marking or other work is required on a lease to make it comply with this strategy, the Act or the Regulations. This action consists of a final warning, engaging contractors to do the work then recovering the debt from the responsible person(s).

Transfer, subdivision, consolidation and sublet

On application, leases can be transferred, subdivided, consolidated or sublet. Certain conditions have to be met for each of these transactions and DPI Aquaculture Administration should be consulted.

Potential lessees are warned not to exchange a payment or enter into an agreement to take over a lease from a current lessee until they have consulted DPI Aquaculture Administration to obtain current information about the lease and lease transfers. NOTE: The transfer of a lease is not automatic and is not complete until the deeds have been issued to the transferor.

The assessment of the application will consider financial and compliance records, use of existing leases by an applicant, the condition of the lease area and ensuring that the area remains or is brought into a tidy condition.

Lease transactions will not be approved unless the lease(s) is in a compliant condition or the person taking over the lease agrees to undertake the work necessary to bring the lease area into compliance. (e.g. marking, clean-up).

Surrenders, cancellations, renewals and expired leases.

Leases surplus to oyster farmer's requirements may be surrendered on application. A lease will not be accepted for surrender unless the lease is in a compliant condition and completely free of cultivation materials.

The *FM Act* makes provisions for oyster aquaculture leases to be cancelled in certain cases. Should a lease be cancelled, the previous lessee remains legally responsible for removing any cultivation materials, infrastructure or stock on the lease.

Oyster aquaculture leases are issued for a maximum 15 year term with the leaseholder being entitled to the first renewal for a further maximum 15 year term. Leases are renewable subject to the area remaining available for aquaculture and taking into consideration the lessee's compliance record. The *FM Act* gives preferential rights to the current lessee, on renewal.

Leases that are not otherwise tenanted prior to their expiry date revert to public water land. However, the previous lessee remains legally responsible for removing all cultivation materials from the lease area.

Changes to activity on a lease

The permit holder/leaseholder must obtain written approval from DPI before commencing any activity that is not consistent with the permit and lease conditions. This may include the introduction of novel cultivation methods, new materials, a new species or other significant change in activity. Changes in activity that are not consistent with this document may require development consent.

In particular, written approval from DPI must be obtained before constructing on an oyster aquaculture lease:

- floating markers, raft markers or reduced marking
- fences
- spray irrigation,
- platforms
- pump-stands.

Annual production reports

All permit holders must complete an annual production report.

Public liability insurance and indemnity

Aquaculture permit holders must have public liability insurance cover over all leased areas. Public liability insurance cover must be to a minimum of $10 million dollars for property owner's and occupier's liability.

Aquaculture permit holders must also indemnify the NSW Government and their officers and agents in respect to any activities carried out on the oyster aquaculture lease area for the purpose of aquaculture. This includes all action, suits, claims and demands, in respect of accident or injury to any person or property arising from the use of the public water land.

The permit holder's public liability insurance and indemnity must remain current at all times and apply to all leases listed on the permit and include terminated/surrendered leases where improvements remain on the lease.

Sub-lessees must list lease details on their permit and must provide public liability insurance and indemnity cover for the area.

9.7. Maintenance dredging of oyster aquaculture leases

Dredging to maintain adequate water depth on an oyster aquaculture lease situated on Crown submerged land will require a licence issued under the *CLM Act*. The provisions of the relevant local environmental plan and/or the *EP&A Act* may require development consent to be obtained. Development applications will require Land Owners Consent from CL prior to lodgement.

CL will give written notice to the Minister for Primary Industries and consider any matters raised by the Minister concerning the proposed work within 28 days of giving the notice. CL and the relevant consent authority should be consulted for further advice. A permit may also be required from DPI under Section 201 of the *FMA Act*.

The NSW Government has no statutory responsibility to maintain any particular depth of water beneath an area leased for oyster aquaculture or within channels leading to the lease. If an oyster aquaculture lease or permit holder wishes to undertake maintenance dredging then they will have to take full responsibility for gaining all consents and approvals and for funding the work.

DPI will only consider maintenance dredging of oyster aquaculture areas where:

- the material to be dredged is clean marine sand
- no potential or actual acid sulphate materials will be disturbed
- maximum dredging depth is 2.5 m below AHD
- no seagrass is destroyed without a permit from DPI

- the dredging activity will have no significant adverse impact on any threatened species or habitats
- no current oyster reef is destroyed or removed without a permit from DPI
- an approved spoil disposal site or other option is available
- the activity will not result in any significant water pollution.

DPI, CL and the consent authority should be consulted for further advice.

9.8. Aquaculture species

Species to be cultivated on a Class 1 lease

There are three main species cultivated on oyster aquaculture leases in NSW, the Sydney Rock Oyster, the Native Oyster and the introduced Pacific Oyster. Both the Sydney Rock Oyster and the Pacific Oyster belong to a group of oysters known as 'cupped oysters', while the Native Oyster belongs to the 'flat oyster' group. Worldwide, the vast majority of oysters harvested for human consumption are 'cupped oysters'. In general, 'cupped oysters' may be farmed using similar techniques and have a well-studied effect on the environment. In the past, Native Oyster cultivation has been a major industry in Europe and wild Native Oyster fisheries have been important in the past in southern Australia. However, due to disease and overfishing this oyster is now only grown in relatively small quantities. Native Oysters can be grown with only minor modifications to the systems used for 'cupped oysters' and their cultivation using these techniques have not been reported to have a significant impact on the environment.

The NSW oyster industry is mostly based on the production of the Sydney Rock Oyster. While the geographic range of this species extends from Wingan Inlet in eastern Victoria north along the eastern Australian coast, across northern Australia to the West Australia coast, wild populations of the oyster are most prolific in southern Queensland and NSW estuaries. In these estuaries the Sydney Rock Oyster is the dominant intertidal species.

A cultivation of the Native Oyster is largely confined to marine dominated estuaries in southern NSW, however individual Native Oysters have been found as far north as Moreton Bay in southern Queensland.

The Pacific Oyster was introduced into southern Australian states in the late 1940's and early 1950's by the CSIRO in an attempt to establish a cupped oyster industry in these states in lieu of a suitable indigenous cupped oyster species. At that time the importation of Pacific Oysters into NSW was prohibited by the NSW Government. However, by the 1970's the wild Pacific Oyster had found its way into a number of NSW estuaries and since then wild Pacific Oyster populations are now found in most NSW estuaries south of Port Macquarie.

Oyster farmers in eight estuary systems are currently approved to cultivate the functionally sterile triploid Pacific Oyster hatchery produced variety; Port Stephens (both diploid and triploid), Tweed River, Georges River, Hawkesbury River/Patonga Creek, Brisbane Water, Shoalhaven/Crookhaven Rivers, Clyde River, Lake Conjola and Wapengo Lagoon).

The species selected for cultivation will affect the design of cultivation infrastructure as well as the viability of the aquaculture business. An aquaculture business may cultivate more than one species. In designing the facility, flexibility of design and layout allows switching of species to meet opportunities created by changing markets, supply or production technologies. Where a proposed farming technology deviates significantly from the farming technology or it's impact on the environment is unclear or unknown a REF or in some instances an EIS may be required to be prepared by the applicant (see below).

Factors in the selection of species include:

- constraints on translocation of species (see below)

- genetic factors
- availability of seed stock (reliability, quality, quantity, seasonality)
- documented performance of the species in the aquaculture system proposed
- site specific attributes e.g. scale required, flood liability, temperature and water quality requirements
- cost of production and business viability
- market demand and price
- potential disease
- other management factors, such as DPI translocation protocols.

In some situations, 'polyculture' (i.e. two or more species farmed simultaneously in the one area) may increase returns to industry, improve business resilience and provide a more productive use of an aquaculture lease area. A potential example of this is Sydney Rock Oyster and Native Oyster farming on the one lease. Table 10 lists the edible oyster species currently approved for commercial cultivation on NSW oyster aquaculture leases by estuary.

Table 10: Species of oyster currently approved for commercial cultivation on oyster aquaculture leases in NSW.

Estuary	Sydney Rock Oyster	Native Oyster	Pacific Oyster	Other
Tweed River	yes	no	Yes - Triploid Only	
Brunswick River	yes	no	no	
Richmond River	yes	no	no	
Clarence River	yes	no	no	
Sandon River	yes	no	no	
Wooli River	yes	no	no	
Bellinger/Kalang Rivers	yes	no	no	
Nambucca River	yes	no	no	
Macleay River	yes	yes	no	
Hastings River	yes	no	no	
Camden Haven River	yes	yes	no	Akoya sp.
Manning River	yes	no	no	
Wallis Lake	yes	yes	no	
Port Stephens	yes	yes	Yes - Diploid and Triploid	Akoya sp.
Hunter River	yes	no	no	
Brisbane Water	yes	Yes	Yes - Triploid only	Akoya sp.
Hawkesbury River	yes	yes	Yes - Triploid only	Akoya sp.
Georges River/Botany Bay	yes	no	Yes - Triploid only	
Crookhaven Shoalhaven	yes	no	Yes - Triploid only	
Clyde River	yes	yes	Yes - Triploid only	
Lake Conjola	yes	no	Yes - Triploid only	
Moruya River	yes	yes	no	
Tuross Lake	yes	yes	no	
Wagonga Inlet	yes	yes	no	Akoya sp.

Estuary	Sydney Rock Oyster	Native Oyster	Pacific Oyster	Other
Wallaga Lake	yes	yes	no	
Bermagui River	yes	yes	no	
Wapengo Lagoon	yes	yes	Yes - Triploid only	
Nelson Lagoon	yes	yes	no	
Bega River	yes	no	no	
Merimbula Lake	yes	yes	no	
Pambula Lake	yes	yes	no	
Wonboyn Lake	yes	yes	no	

Protocol for assessing a new species for commercial aquaculture

One of the potential risks of aquaculture is the inadvertent introduction of live species into natural waters beyond their natural range or to areas within their natural range that have genetic stocks or populations that are distinct from the aquaculture stock by translocation Ministerial Council on Forestry, Fisheries and Aquaculture (1999) (MCFFA). Translocation of non-indigenous species is sanctioned in some catchments. In other circumstances, it may occur accidentally or deliberately. Translocation of live aquatic organisms has a number of inherent risks for the receiving aquatic habitats as well as for endemic organisms.

The MCFFA developed a national translocation policy to meet the needs of Australia's aquaculture and aquarium industries for the translocation of live aquatic species within jurisdictions and across jurisdictional boundaries. The policy sets out a risk assessment process for considering translocation issues and identifies potential risks under the headings of escape/release, survival and establishment.

An example of such a translocation occurred in Port Stephens where the Pacific Oyster was illegally introduced in 1984. Wild Pacific Oyster populations are now established in the majority of the estuary, and wild Pacific Oyster settlement on growing Sydney Rock Oyster crops can significantly increase farming costs due to the need to manage fast growing wild Pacific Oyster over catch on Sydney Rock Oyster and Pacific Oyster crops.

On application, DPI may consider approving new species for culture on aquaculture leases. When proposing new species for cultivation on an aquaculture lease, the proponent needs to submit to DPI an assessment of potential environmental effects on:

- any critical habitats, threatened species, ecological communities and their populations
- any community of aquatic plant or animal
- existing commercial oyster cultivation
- the visual, scientific, cultural or recreational amenity
- any cumulative effects with other existing or likely future activities
- any necessary modification to the applicant's CFDP.

DPI may impose special conditions on the approval of new species and may require a trial period of farming to monitor and assess potential environmental impacts. If critical habitats, threatened species, populations ecological communities and their populations are likely to be affected a Species Impact Statement may be required and if the proposal is likely to significantly affect the environment an EIS may be required.

9.9. Approval of Crown Land land base leases and licences

Current oyster aquaculture activities that are lawfully approved may continue despite the provisions of this strategy. You can find more information on leases and licences on the department's website at: industry.nsw.gov.au/lands/use/ and on the Leases and licences for oyster farming on Crown land Fact Sheet https://www.industry.nsw.gov.au/__data/assets/pdf_file/0019/272422/leases-and-licences-oyster-farming-fact-sheet.pdf

Leases

A lease is a registrable dealing, which means that it can be recorded on the title for the land. Generally, to be registered, the leased area must be identified as one or more lots in a registered plan of the land. If a site has not been surveyed and is not identifiable in a registered deposited plan, CL are unable to lease the site. Environmental planning restrictions to the subdivision of land may also prevent the creation of a title for the land by registered plan, and therefore restrict CL's ability to lease the Crown land.

Where an oyster farmer is proposing a substantial development on the Crown land that involves significant capital investment, a lease may be more appropriate than a licence, providing there are no constraints that preclude CL from granting a lease. The consent of the Minister is usually required prior to the transfer of a lease, and you can't transfer a lease if there is any debt to the Crown outstanding on the lease.

Licences

Generally, a Crown land licence does not provide for exclusive use and possession of Crown land. It provides an authority to occupy and use Crown land for a specified purpose and term. Usually licences can be terminated at will by the Minister administering the *Crown Land Management Act 2016* (CLM Act) Unlike leases, licence areas do not need to be identified by surveyed lot boundaries and may be defined by diagram. Licences may accompany a lease site to authorise jetties or infrastructure connected with oyster farming operations that extend outside of the leased area, such as below the mean high-water mark.

Licences are generally not transferable. An application must be lodged with CL and be determined before a new licence can be considered for offer to a new holder (see the *Revocation of existing tenure and issue of a new licence* form on the department's website).

Considerations for leasing and licensing Crown land

Native title

Native title is the recognition by Australian law that some Indigenous people have rights and interests to their land that come from their traditional laws and customs. The Commonwealth *Native Title Act 1993* (*NT Act*) sets out how native title rights are recognised and protected in Australia.

When assessing Crown land tenure applications, CL consider whether there is evidence that native title is extinguished or the proposed use is permissible under the *NT Act*. CL assess whether there are also any procedural requirements relating to native title groups or representative bodies, such as notification requirements or a right to comment.

Native title can be a key reason CL cannot issue a lease over Crown land. In such cases, it may be possible to issue a licence to authorise occupation of a site required for oyster farming/aquaculture activities. Refer to the fact sheet "How native title rights affect oyster farming tenures on Crown land' (go to industry.nsw.gov.au/lands and search for the title) for more information about native title and how this relates to oyster farming/aquaculture activities on Crown land.

Aboriginal land claims

The NSW *Aboriginal Land Rights Act 1983* recognises the rights of Aboriginal people in NSW.

The legislation allows Aboriginal Land Councils (ALC) to lodge land claims over Crown land, which are determined by the relevant Minister.

CL generally will 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 ALC in the event it is found to be claimable
- impact on the physical condition of the land.

For sites already developed for oyster farming/aquaculture activities, CL generally only consider a Crown land application if the applicant has obtained a letter of consent from the claimant ALC. The claimant ALC is under no obligation to grant such a request and may prefer to have the claim fully investigated and determined.

Tenure agreement

A tenure holder has responsibilities under the terms and conditions of their tenure agreement. This includes using the site in accordance with the permitted use, paying rent, complying with environmental obligations and other relevant laws, and holding current insurances.

A holder of a Crown tenure for oyster farming/aquaculture activities must be a bona fide oyster farmer and hold a current:

- aquaculture permit issued under the *FM Act*
- Food Authority Licence issued under the FR 2015 to cultivate and/or harvest oysters (including spat).

Subletting or sale

Should an oyster farmer wish to sublet or sell leased or licenced Crown land land-based site they are encouraged to have early discussions with CL. Sublicensing is not permitted on sites licenced for oyster farming/aquaculture activities. In many cases, tenures are not directly transferrable.

Environmental planning approvals

As a tenure holder, the oyster farmer is responsible for obtaining all necessary environmental planning, development, building, and operating approvals relating to structures and activities on tenured Crown land. Any proposed construction or demolition of buildings, retaining walls, jetties, tar pits, onsite sewerage management system, etc. may require development consent or other approvals from local councils. Applications will generally require landowner's consent from CL before they are lodged. The *Landowner's consent application form* outlines the requirements and is available from industry.nsw.gov.au/lands/what-we-do/fees-and-forms/forms

Agency approvals

Oyster farmers may also require approvals from other authorities such as TfNSW or DPI to carry out activities associated with oyster farming/aquaculture. As the tenure holder, it the oyster farmers responsibility to ensure that they are aware of these requirements and hold all required approvals.

Work plan compliance

The tenure holder is responsible for ensuring that they meet obligations outlined in their work plan agreements issued by CL. CL may initiate compliance actions if an oyster farmer does not

comply with work plan requirements or tenure conditions, or if they do not pay rent. Actions may include lease forfeiture or licence revocation.

More information

You can find general information about leases and licences on the department's website at industry.nsw.gov.au/lands.

9.10. Transitional provisions

Current oyster aquaculture activities that are lawfully approved may continue despite the provisions of this strategy.

Chapter 10 Risk management and business resilience

10.1. Risk Management

The size, severity, timing, location and impacts of natural disasters and disease events are difficult to predict, and our changing climate increases the uncertainty about future risks. In the past, standard emergency management planning emphasised the documentation of roles, responsibilities and response procedures. Traditionally, primary producers looked towards government for financial support to get through the aftermath of an adverse event (e.g. drought assistance).

Increasingly, emergency management is moving its focus towards arrangements for prevention, mitigation, preparedness and recovery. Also, natural disaster relief and recovery programs are now structured to provide immediate short-term assistance only. The majority of the cost of re-building and restocking after a major disaster event must be borne by industry. Therefore, industry needs to plan well ahead to make sure they are prepared. Natural disaster relief does not cover disease related events and at this time cost-sharing arrangements between the aquaculture industry and government to cover these events are still being considered.

Other risks to the business include changes in the financial climate that impact on profitability. The impact of changes to interest rates, market prices and the costs of business inputs need to be considered well before they occur. Succession is a longer-term risk and, in most cases, will affect retirement planning. This risk needs to be factored into the business plan many years before retirement age.

At the business level, financial resilience is also important so that the business can survive a period of little to no income and rebuilding following an event. In some cases, businesses have taken the decision to build infrastructure that is resistant to flood and storm damage and to diversify the species cultivated to manage the risk of pest and disease incursion and the risk of market uncertainty. Training, education and planning are essential risk management tools that help to build resilience into the business.

Some areas of risk to an oyster business and to the industry as a whole include:

- disease
- environmental extremes - floods, heat kill, drought and storms
- climate change
- water quality - harvest area contamination, toxic algae blooms
- personal injury
- social interruptions, such as bushfires
- public liability
- the economy and oyster markets

Assistance and support with risk management planning is provided by:

- Rural Support Workers

  www.dpi.nsw.gov.au/aboutus/services/community/support-workers
- Rural Financial Counsellors

  www.daff.gov.au/agriculture-food/drought/rfcs/counsellors/nsw
- Rural Assistance Authority - www.raa.nsw.gov.au/
- DPI – see www.dpi.nsw.gov.au/agriculture/emergency

10.2. Biosecurity Risk Management Plan

The best defence against diseases and pests is the implementation of sound biosecurity practices on farm. The development of a farm-based Biosecurity Risk Management Plan (BRMP) facilitates the identification and prioritisation of biosecurity practices to protect the farm against diseases and pests. The development of a BRMP will enable permit holders to identify biosecurity weaknesses and strengths associated with farming practices and implement actions and procedures to protect their farm from potential disease and pest risks. The development of a BRMP will also provide greater disease and pest protection for the wider industry.

DPI requires that all Class A Aquaculture Permit applications include a BRMP. As a minimum the BRMP should address the following:

- the identification and assessment of potential biosecurity risks
- mitigation measures to manage potential biosecurity risks associated with all movements of stock, vehicles, vessels and equipment on-farm, inter-farm and inter-estuary, including compliance with permit conditions relating to:
    - the movement of oysters and material between estuaries (Part 2, Division 3 of the FMAR 2017)
    - QX disease biosecurity zone (Part 3, Division 2 of BR 2017)
    - Pacific Oyster Mortality Syndrome biosecurity zone (Part 3, Division 3 of BR 2017)
    - Biosecurity Order (Permitted Activities) 2019
    - Biosecurity (Pacific Oyster Mortality Syndrome) Control Order (N0. 2) 2018.
- staff biosecurity training to ensure that staff have a clear understanding of their responsibilities to maintain farm biosecurity. Staff must be able to recognise signs of stock ill health, be informed about the major disease transmission routes onto, within and from the farm, as well as be familiar with work practices and standard operating procedures that support farm biosecurity. Staff must also have a clear understanding of how to implement response protocols and emergency procedures
- record keeping procedures to document the movements of all stock onto the farm, between zones of different biosecurity status within the farm and from the farm. Records must also be kept for the health of all the different stock populations within the farm, including details such as disease testing, sickness, treatments, mortality and relevant information on environmental factors
- records keeping procedures for staff biosecurity training, stock receipts, inspections, disinfection cleaning and audits
- movement reporting procedures and records for oysters and equipment – Oyster Shipment Logbook and IVR system
- cleaning procedures and general hygiene for vessels and equipment
- an Emergency Disease Action Plan
- signage and secure areas where entry by authorised personnel only is permitted
- a timeline for the review and audit of the BRMP.

10.3. Lease Maintenance and Development Plan

All applicants for a Class A aquaculture permit are required to submit with their permit application a CFDP which includes a LM&DP. In completing their LM&DP, the permit applicant must describe how all leases that will be authorised by the permit will comply with the lease

marking and cultivation standards prescribed in the OISAS and how the condition of the lease(s) would be improved or maintained should the permit be granted. The completion of a LM&DP is also a valuable check for new industry entrants to understand the potential costs and liability of taking on leases with on-going statutory maintenance obligations. The best defence against diseases and pests is the implementation of sound biosecurity practices on farm.

Specifically, the LM&DP must address the following:

- the type and condition of all lease marking present on the lease area, including any missing or sub-standard marking
- the construction type (e.g. timber post and rail; post supported long-line basket; floating basket; raft, etc.), quantity and condition of all infrastructure currently present on the lease area
- where a lease listed on the permit is undeveloped or partially developed, the permit holder must provide a development strategy for the lease area over the next five years
- to assist with the maintenance of the lease marking and tidiness standards, permit applicants must develop a lease maintenance and development schedule. The lease maintenance and development schedule should specify the order of priority for all works (e.g. navigational markers and lease signs are higher order priorities). A recommended lease maintenance schedule is provided in Chapter 8.3)

10.4. Environmental Management Systems

A good first step towards developing disaster preparedness at the estuary level is to include risk management in the estuary environmental management system. Many NSW oyster farming estuaries have already prepared these plans and have commenced implementing key actions to build resilience. Estuary level issues include harvest area water quality and risks to harvest area classification, floods, disease and pests.

An environmental management system is a process through which oyster farmers can determine which risks pose the biggest threat to the industry. The process systematically identifies, assesses and prioritises all risks then constructs a plan to mitigate these risks.

These risks can result from internal oyster farming practices (for example the continued use of treated timber, running inefficient outboards), but may also arise from external catchment based activities (e.g. livestock effluent in creeks, faulty sewerage pumping stations). Addressing these risks will require working closely with other stakeholders, which will include the LLS, DPI, Local Council, your neighbours and NPWS.

Documenting the risk assessment process, and clearly outlining an action plan to reduce industry exposure, gives oyster farmers a clear vision for the future. It also helps farmers achieve better outcomes when negotiating with catchment mangers, opens the door for funding opportunities, and allows partnerships that improve environmental conditions for the oyster industry to develop. For an insight into how EMS has been effectively used by south coast oyster farmers, South Coast Oyster Growers and Australia's Oyster Coast short documentary videos at vimeo.com/76913593 and vimeo.com/69287281 are available on line.

OceanWatch Australia and the coastal LLS are actively involved with the industry and there are now 18 estuary-wide EMS documents in varying stages of development that outline local industry priorities for the future. The estuaries that have committed to an environmental management system, and the documents themselves can be viewed at: www.oceanwatch.org.au/our-work/ems-nsw-oysters/ems-database/. More information can also be obtained from OceanWatch Australia at www.oceanwatch.org.au/.

Once prepared, attention needs to be given to EMS implementation. South Coast oyster grower groups with the assistance of the LLS employed Oyster EMS Implementation officers. These officers enabled the smooth implementation of the estuary-wide EMS's and assisted the oyster

industry make full use of their EMS's in building the partnerships necessary to ensure the long-term sustainability of the local oyster industry.

10.5. Climate Change

Climate change is a change in the average pattern of weather over a long period of time. Weather patterns are naturally highly variable and the changes in weather averages due to climate change are difficult to identify within natural variability over the shorter-term time scales. The NSW Government is working to identify the long-term effects of climate change for NSW and to identify approaches to adapting to the effects of climate change.

Potential long-term impacts of climate change on NSW oyster industry

The potential impacts of climate change on the NSW oyster industry have been identified and analysed by University of Tasmania researcher Peat Leith (Leith and Haward, 2010). The main areas where change may occur in the longer term that could impact on oyster growing include:

- air and water temperature
- acidification
- sea level rise
- wind speed
- rainfall
- changes in salinity
- frequency of extreme events
- changes in the geographic distribution of pests and diseases.

Addressing climate change – adaptive capacity

There is uncertainty about the timing and impacts of climate change on the oyster industry. It will affect different estuaries in different ways and to different degrees. The best way to deal with this uncertainty is to maximise the industry's ability to adapt to changes when they occur. Assessment of new aquaculture lease sites needs to factor in the potential impacts of climate change including sea level rise and changes to rainfall and runoff as well as local hydrodynamic processes.

What the NSW oyster industry can do to adapt to climate change:

- develop knowledge-action networks that include local industry bodies, scientists, and natural resource management agencies
- develop monitoring programs in order to understand baseline conditions, local variability, sensitivities, and to detect changes (for example see Nash et al, 2013)
- work together at an estuary or regional level rather than working as individuals
- support research to develop resilient oyster breeding lines.

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NSW Land Based Sustainable Aquaculture Strategy

A NSW Government Initiative
May 2021

NSW GOVERNMENT

NSW Land Based Sustainable Aquaculture Strategy

Second Edition

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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; and 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 this document has been compiled with reference to relevant websites containing detailed information on the topic being discussed. 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 on the blue word and then press the left mouse button and the web page should open. Key links are also listed in Appendix 1. 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 New South Wales (NSW) 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).

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 potential 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 will 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 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 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 sufficient quantity of water to provide a water source that can be tapped by a bore
Average recurrent interval (ARI) flood event	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	Treated water discharged from ponds or 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 parts per million (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^{o}C, and up to 8.4 mg/L at 25^{o}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 withstand 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 aquatic plants 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 - an aquifer
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
Hatchery	A place where the progeny of fish or aquatic plants are produced for the purpose of selling them
Health certificate	A certificate issued by a competent authority verifying the health of aquatic animals being shipped 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 aquatic plants that are being cultivated (whether or not naturally occurring food is consumed or available for consumption by the fish or aquatic plants)
Introduced species	A native species introduced to 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 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% of its culture water directly to a waterway per day. 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	Holding 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% of its culture water directly to a waterway per day
State Environmental Planning Policy (SEPP)	State Environmental Planning Policy is 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 developments
Stocking densities	Number of animals per square or cubic 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 and hatcheries
Waterway	Generally refers to creek, river, wetland, waterbody or groundwater

ABBREVIATIONS

Abbreviation	Full text
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) to which Australia is a signatory
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 in NSW grew over 66% in 10 years to the 2019/20 financial year. NSW estuarine, marine and land based aquaculture continues to develop steadily, with a production volume of 1,362 tonnes and an industry value of $90 million in 2019/20 (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 1.

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 (aquatic plants), 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 or aquatic plants 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

Critical factors to consider when deciding whether an aquaculture venture may be feasible include:

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 based 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 Strategy 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 and the NSW Marine Waters Sustainable Aquaculture Strategy are the best practice 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 Section (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.

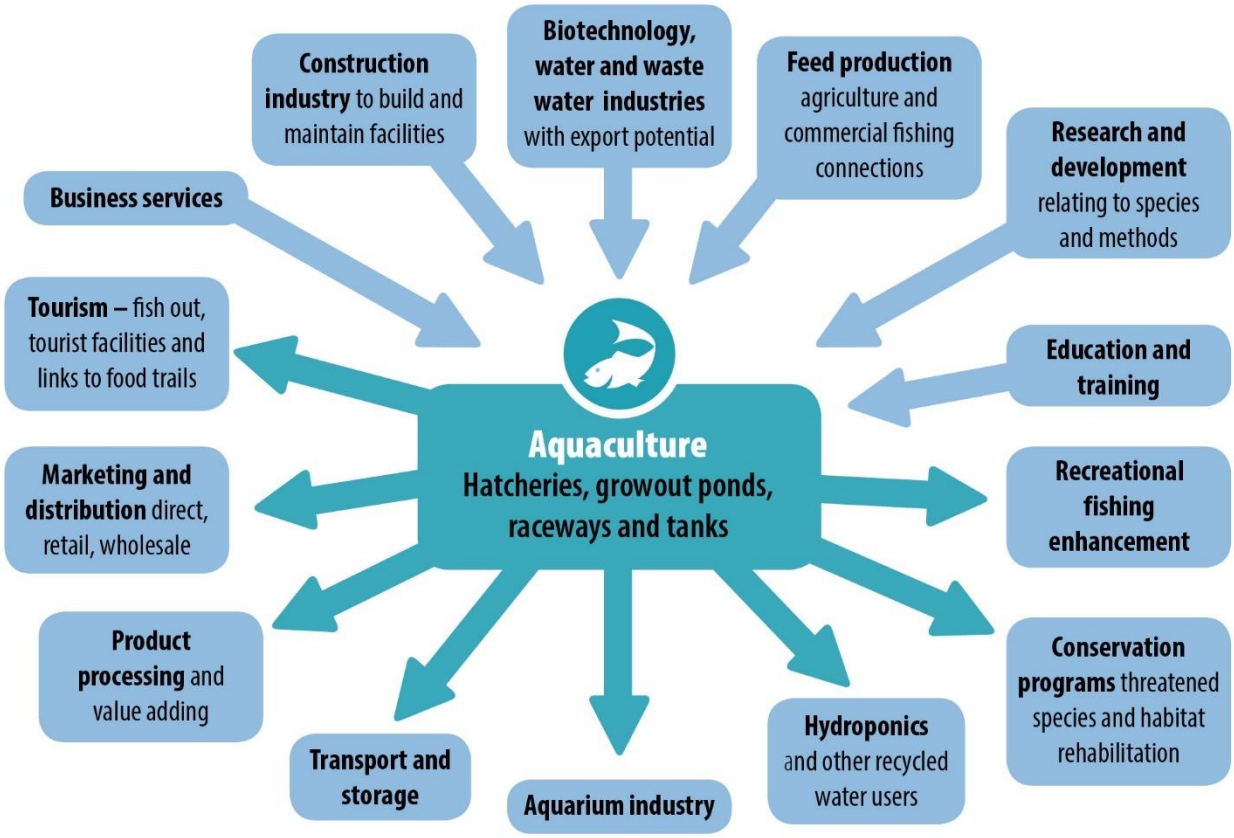
There is an ever increasing gap between commercial fishery supply and the growing demand for seafood. This, and the future demands of food security for the state, can only be met by sustainable aquaculture. The state's business infrastructure is well developed, with the capacity to service growth in 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 1 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.

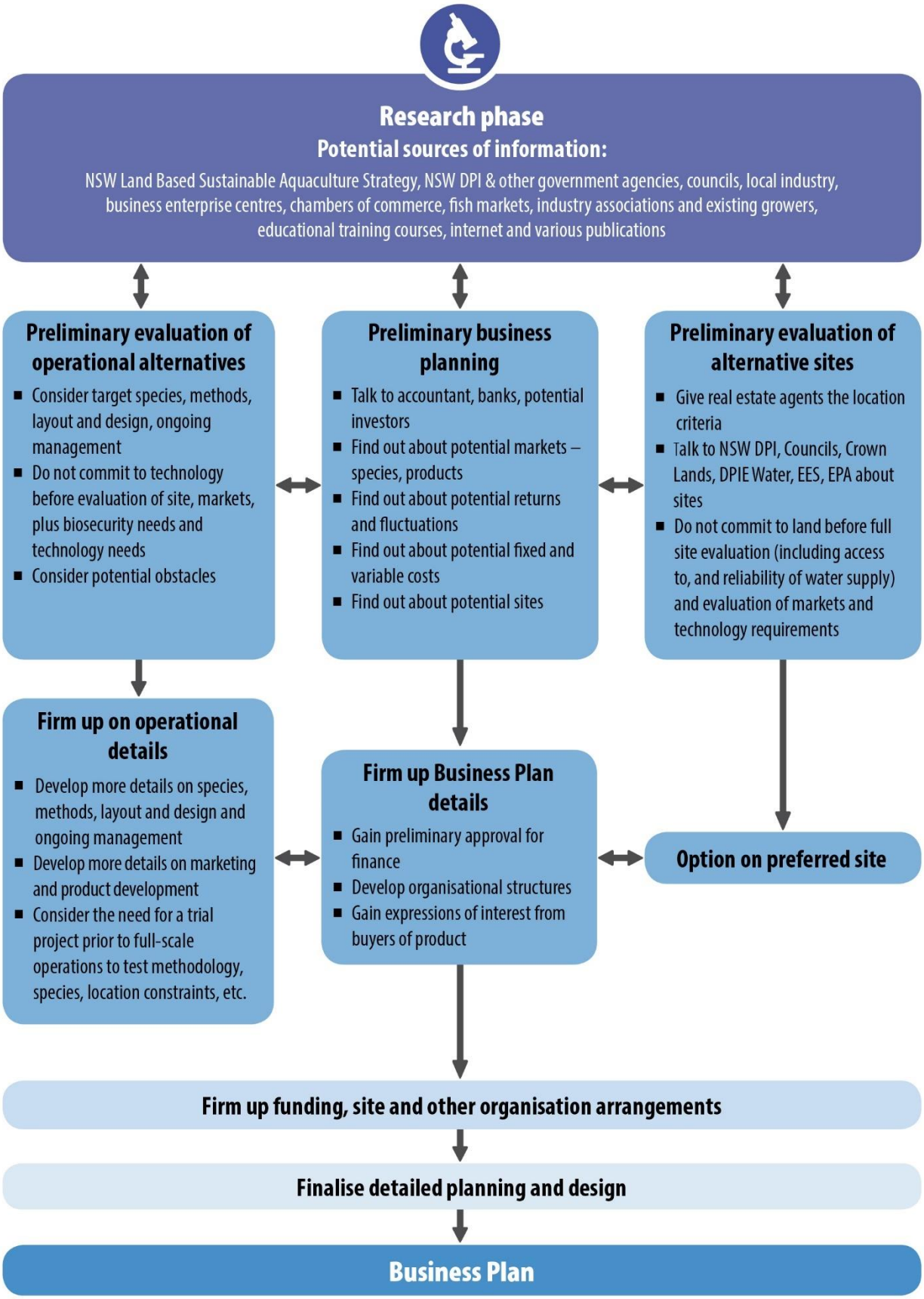
No two businesses are alike and therefore a business plan specifically addressing your production and marketing issues needs to be one of the first things to be developed. The business plan acts as a blueprint for the future operation and growth of the business. Figure 3 summarises the process of preparing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

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 on the NSW Government's website for small business. Project management software packages may be helpful 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.

Figure 3: Business and project planning



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 have plateaued and aquaculture product has the potential to fulfil shortfalls in seafood 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 takeaway 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, 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. 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 if product processing is involved.

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 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) (see Figure 4).

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

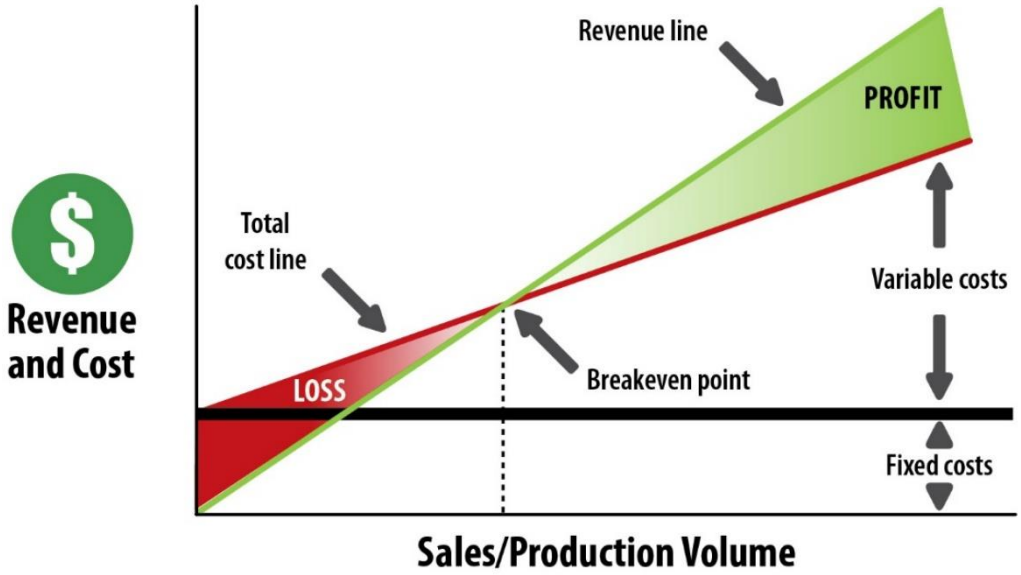
- sale price for various products in various markets
- costs, including feed, water, juveniles, power and transport.

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

- pest, national and global 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** – assess 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 and 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 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 development of a strong business. Some pitfalls include:

- for family operations, the death of the key person (who understood how to operate the farm), relationship issues, 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 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 Technical and Further Education facilities (TAFEs)
There are a number of universities and TAFEs that run aquaculture courses in NSW and other states.

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 regions of NSW, have been assessed as having a high environmental risk. Consequently, there are stricter requirements on site selection, design and operational parameters for species with 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 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 2, 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 on biosecurity risk management, see the DPI website.

Monoculture - the culture of a single species at any given time, is the most common form of aquaculture in NSW. ‘Polyculture’ is growing more than one species together in the same culture facility, which can help maximise productivity. Polyculture can provide greater economical use of water, feed, nutrients 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, irrigated agriculture, trees or aquatic plants) 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: Ideal Temperature range for breeding and growout

Species	Hatcheries	Growout facilities
Barramundi	27 – 30ºC	26 – 30ºC
Crustacea – Redclaw	27 – 30ºC	27 – 32ºC
Crustacea – Yabbies	15 – 20ºC	23 – 25ºC
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
Prawn – Black Tiger	28 – 32ºC	25 – 32ºC
Prawns – Kuruma	25 – 30ºC	20 – 28ºC
Prawns – School	–	21 – 27ºC
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 requirements

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, the danger taking this approach often results in poor growth, fatty animals, 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. Even aquatic plants in aquaculture utilise ‘feed’ and this can comprise a nutrient rich waste stream or purchased fertilizers. 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 that incorporate a hatchery, and wish 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 reliable availability of seed stock, or 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 new entrants to the aquaculture industry carefully research the availability, or establish the technology, to ensure the hatchery is capable of producing the quantities of seedstock required to satisfy the farm's projected production plan.

Important aspects a hatchery needs to consider when managing broodstock and seed stock include:

- 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) that accredits 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:

- **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
- **Site specific investigations should indicate that the site is fundamentally suitable for an aquaculture operation**.
  Consider the supply of water (quality and 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 labour - all of which can adversely impact 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 (ASS) 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 also need to 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.

By assessing a project or location against the project profile analysis model, this 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

Consideration of estuarine land based aquaculture sites should refer to the NSW Government’s sea level rise planning benchmarks, relevant Coastal Management Programs, and address issues related to inundation, water quality, drainage and ASS, - all of which can impact the long-term viability of aquaculture on these sites.

5.3 Water considerations

5.3.1 Overview

The following is an overview of 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 overland catchment. All waters should be tested for compatibility with the selected species to be cultured 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. 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 WQO outline three components:

1. The community environmental value and use of waterways within NSW including rivers, creeks, estuaries and lakes
2. The biological or physicochemical indicator used to determine if the water quality supports the community environmental value or use

3. The numerical or descriptive criteria that sets, the quality of water required to support the described community environmental value or use.

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.

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'.

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 whether ambient water quality is suitable for a range of environmental values and should be considered in terms of a long term supply of 'good quality' water for land based aquaculture sites. Note that the guidance for assessing good water quality in ANZG 2018 is reflected in the NSW Government 'Risk-based Framework for considering waterway health outcomes in strategic land use planning decisions'. This Risk-based Framework is being used by the NSW Government to implement the Marine Estate Management Strategy 2018-2028 and development of Coastal Management Programs and is relevant when assessing impacts of land based activities. 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 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. 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 1999* 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 freshwater 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 indicates 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 discharge water 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 agriculture. 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 discharge water 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 discharge water 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* and *Water Management Act 2000* (both Acts list threatened species, population and ecological communities and protected habitats)
- 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 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*
- **Protected areas** which include all lands managed by the NSW NPWS 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.

Both Ramsar wetlands and World Heritage areas are matters of national environmental significance that require consideration under the *Environmental Planning and Biodiversity Conservation Act 1999*.

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 items and places

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:

- LEPs and SEPPs for relevant heritage issues
- heritage studies prepared by a local council
- State Heritage Register for items protected under the *Heritage Act 1977* or subject to Interim Heritage Orders or S.136 Orders
- the National Trust Register
- the Heritage NSW Aboriginal Heritage Information Management System (AHIMS) (if affecting an estuary or its banks or accessing marine waters)
- 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 objects and Aboriginal places 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*
- National Parks and Wildlife Regulation 2019
- *Environmental Planning and Assessment Act 1979*
- *Coastal Management Act 2016*
- State Environmental Planning Policy (Coastal Management) 2018
- *Aboriginal Land Rights Act 1983*
- *Native Title Act 1993 (Cth)*

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, if conducting an Aboriginal Cultural Heritage Assessment Report (ACHAR) and applying for an Aboriginal Heritage Impact Permit (AHIP).

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*). Any due diligence needs to follow the Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW. Archaeological 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 AHIP can be issued by the Coordinator General of DPIE-EES under Part 6 of the NPW Act.

Steps to identify potential Aboriginal objects and Aboriginal places include searching the Heritage NSW AHIMS 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. When approving or refusing an AHIP, Heritage NSW considers a range of factors including:

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

Heritage NSW cannot advise if you will need an AHIP and cannot review due diligences. The proponent needs to decide whether to undertake these processes. Heritage NSW can advise proponents what factors to consider and the locations of Aboriginal objects and Aboriginal places.

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 Native title

Aboriginal Traditional Owners, as native title holders under the Commonwealth's *Native Title Act 1993*, 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 1993* 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.

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. A significant proportion of NSW has also had native title determined.

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 and native title determinations is available from the NNTT register of claims. NNTT also provide a series of maps of native title claimant applications and native title determinations.

Key native title considerations include:

- Native title matters can be complex and may take considerable time and legal advice to resolve

- Aquaculture proposals that need to cross Crown land (subject to native title claims or native title determinations) to gain access to water supply should be avoided unless agreements can be made with the claimants or native title holders.

5.9.2 Aboriginal land claims

Substantial areas of Crown land in NSW are subject to claims under *NSW Land Rights Act 1983*. DPIE 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).

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
- impact on the physical condition of the land.

Aquaculture proposals that need to cross Crown land (subject to Aboriginal land claims) to gain access to water supply should be avoided unless agreements can be made with the claimant Local Aboriginal Land Council.

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 wastewater, sewage
- management and staff facilities
- roadways, loading docks and carparks
- tourist facilities if relevant.

5.14 Energy use

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 discharge water 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 DPIE 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*.

Impacts related to threatened species of fish and aquatic plants listed under the *Fisheries Management Act 1994* are assessed by NSW DP Fisheries. For further information on threatened species impact assessment, see the DPI website.

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 discharge water 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 discharge water 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 erodible 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, 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.

Annually, millions of fish are being removed from Australian rivers when water is extracted for human use, placing significant pressure on the sustainability of native fish populations. These losses are preventable by using state-of-the-art self-cleaning diversion screens which not only stop fish being sucked out of rivers, but also deliver cleaner, debris free water to users.

A practical screening guide has been produced by DPI and can be found at www.fishscreens.org.au. The guide highlights what needs to be considered when planning, designing, installing and maintaining a contemporary screen for improved fish protection and debris control.

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

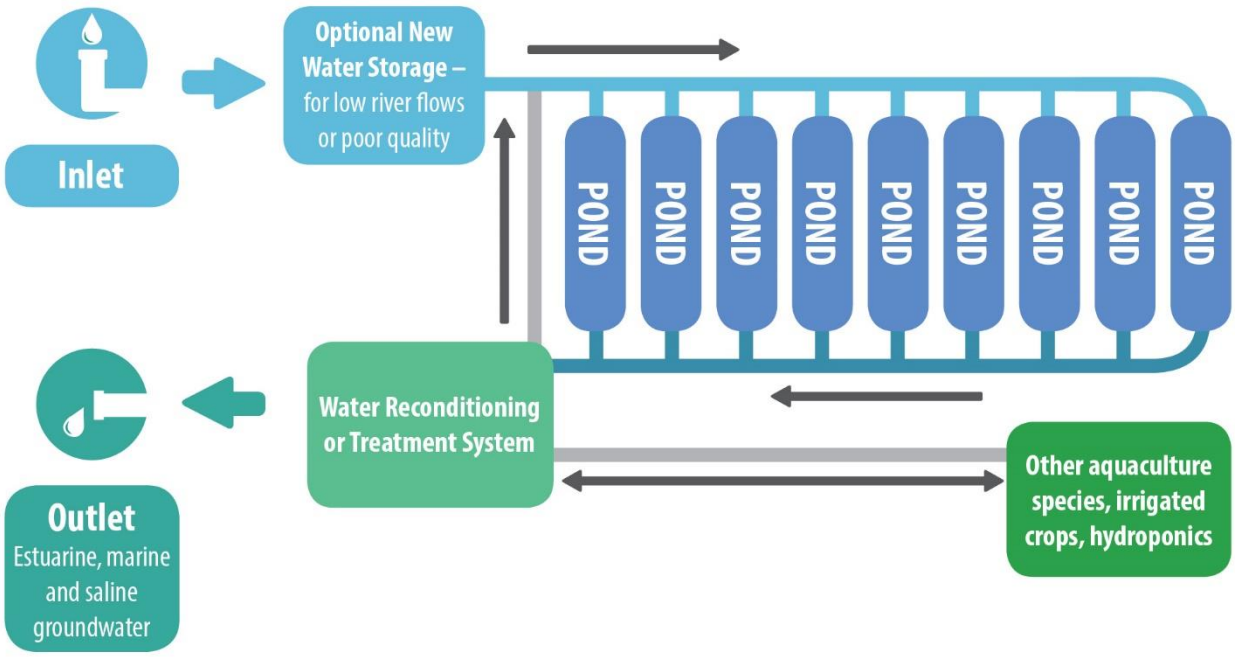
Ponds should be sited to allow for efficient water reticulation. Main features include water supply facilities, storage dams, culture/growing ponds, discharge ponds and drainage lines. Reticulation systems should be designed to allow:

- culture pond discharge water to be retained in reconditioning ponds (to reduce suspended solids and nutrient reduction to allow for appropriate treatment if necessary) or filtration systems where nutrient levels are low
- 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.

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.

Figure 5: Water recirculation and reconditioning system



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 so 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 section of the Act.

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

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 Bird predator control methods

The management of predator birds is generally undertaken using fright devices (for example, gas guns). A biodiversity conservation licence may be required if seeking to use deterrent fright techniques on native bird predators. Special considerations may be required if the bird predator is a threatened species.

Fright devices 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. 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.

Deterrent '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 bird predator deterrent fright methods

	This could include movement or randomly activated lights or laser type lighting that flashes across an area
	Drones can be used to simulate flying birds of prey and may be programmed to have variable flight patterns around the farm
	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
	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
	Life size models of birds which can simulate a bird in distress in combination with birdscare calls can be effective for a time
	The use of chemicals around the ponds is not recommended
	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
	Some breeds of dogs can be trained to deter birds. Dogs which will also swim can be quite effective
	Regular monitoring of ponds at dawn and dusk is the most effective deterrent but is labour intensive
	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.

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 saltwater 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.

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.

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.

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.

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.

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 as well as some aquatic plants.

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 or aquatic plants, 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 discharge 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

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.

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.

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.

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

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) wastewater 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.

Similar to hatcheries, aquatic plants require a high degree of technical knowledge which is still in its infancy in Australia. It is important to demonstrate that the maintenance of parent stock and control of the life cycle and grow out of aquatic plant species is well developed. Even species identification can be difficult in the case of marine macroalgae. Genetic barcoding will

be an important aspect of this work to demonstrate that introduced species are not being propagated, as there are many introduced seaweed species that are visibly similar species to native species, for example in the genus *Codium*.

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 DPIE 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 DPIE Water and an environment protection licence issued by the EPA may be required to discharge wastewater 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 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 or aquatic plants
- 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.

It is 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
- creating jobs in new manufacturing, service and resource recovery sectors associated with recycling, re-use, re-manufacturing and increased services
- encouraging 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 TAFE and tertiary 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 or aquatic plants 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 species. 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 and aquatic plants 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.

Poaching of aquaculture stock occurs irregularly particularly from perimeter ponds adjacent to public roads. This can lead to stock stress and health management issues. Some sites may require gates and fencing to prevent access and/or strategically placed movement detection lights to mitigate poaching.

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 facility 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.

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, crop condition, 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!
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 Bird predator management

Licenses to control native bird 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 *the Biodiversity Conservation Act 2016* are considered an extreme measure for managing bird predation. Also, Commonwealth approval may be required ('migratory species of interest' under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act)) to harm some bird species - see Integrated Approvals chapter.

Contact your local NPWS area office if you wish to discuss obtaining a licence, or see the EES website.

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 or aquatic plant 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 or aquatic plant 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

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 may be 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 discharge water. 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.

In the case of aquatic plants aquaculture, there is the potential to remediate waste nutrient streams from other food grade industries, or to return water to the source in an even cleaner state than intake water.

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!

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 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 topsoil 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 of energy efficient pumps and equipment and maintaining 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. Table 6 details various waste categories commonly generated by aquaculture farms.

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, enquiries should be made with distributors about the possibility of returning the material. Alternatively, enquiries 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.
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
- actions to be taken should conditions deteriorate
- actions to be taken in the event a problem results in an environmental breach
- actions to be taken in the event a problem results in stock loss
- when a 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) (see Figure 6) 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 3)
- the assessment processes
- determination and post approval, including appeals
- other approvals that may be required
- further sources of information.

8.2 Permissibility of land based aquaculture projects

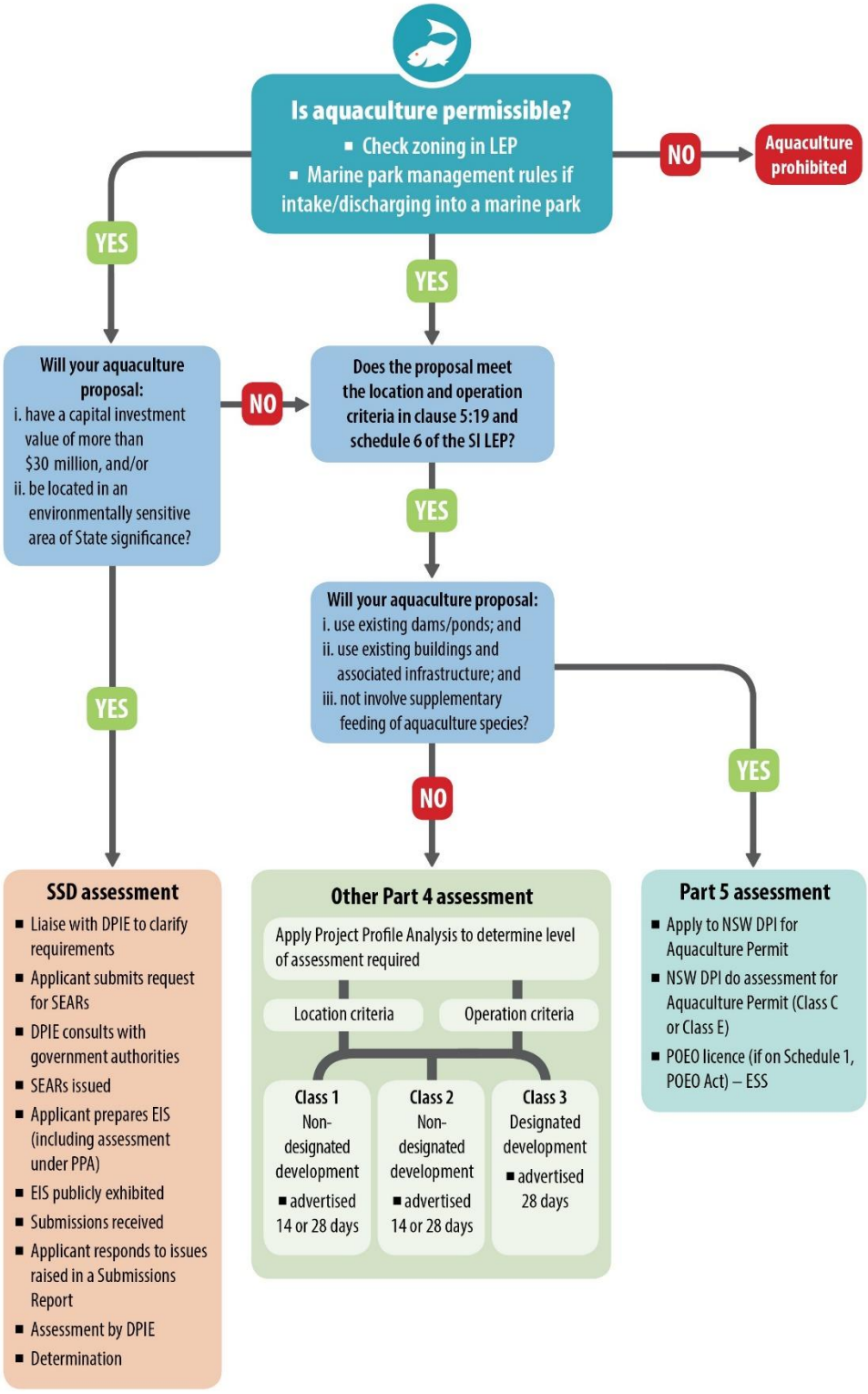
An overview of the zones in which pond and tank aquaculture is permissible is set out in Chapter 9. However, it is advisable to check this against the LEP that applies to a site at the time a development is being considered as zoning may change over time. If aquaculture is prohibited in the zone that applies to the land, aquaculture cannot be carried out.

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).

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



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), the Minister's delegate or the Independent Planning Commission. Development can be declared SSD in a State Environmental Planning Policy, or an order made by the Minister. Schedule 1 of the *State Environmental Planning Policy* (*State and Regional Development) 2011* (SRD SEPP) declares the following land based aquaculture projects to be SSD:
  - development that has a capital investment of more than $30 million, and/or
  - development located in an environmentally sensitive area of state significance (more detail below)
- **State significant infrastructure (SSI) applications** are also submitted to DPIE but these projects primarily involve the delivery of infrastructure, such as transport, other linear infrastructure and utilities along with environmental services. 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, an aquaculture 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 3 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. It is important to ensure that your development meets the locational and operational requirements in the PPA as consent cannot be granted to development which does not meet these criteria. 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 (see Figure 7).

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).

Figure 7: Level of assessment based on risk profile

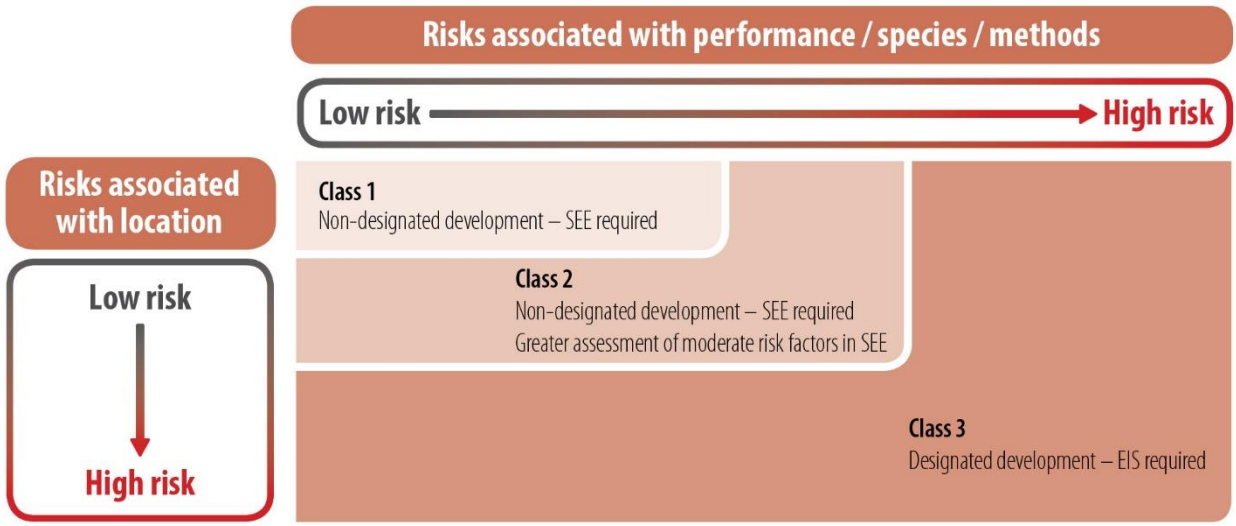


Table 8: Summary of relevant integrated approvals under the EP&A Act

(*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

Act	Provision	Integrated approvals applying to aquaculture
		• 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 • connect a road (whether public or private) to a classified road.
	Part 8	• Approval to construct a flood controlled work.
Water Management Act 2000	S.89	• Water use approval to use water for a particular purpose at a particular location.
	S.90	• Water management works approval to construct and use a specified water supply/drainage/flood work at a specified location.
	S.91	• 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 SSD application and the assessment process

Appendix 3 provides detailed guidance for preparing an SEE or an EIS[1].

8.4.1 Preparing an SSD application and assessment process

SSD applications must be lodged in the approved form with DPIE on the DPIE Major Project's website and must be accompanied by an EIS[1].

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.

[1] In December 2020, the Department of Planning, Industry and Environment exhibited the draft Rapid Assessment Framework package which seeks to deliver system improvements that increase the efficiency of major project assessments and speed up assessment timeframes. A draft SSD Guide was exhibited as part of the RAF. For more information, see https://www.planningportal.nsw.gov.au/major-projects-reform.

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.

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 3.

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 3 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 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, the SSD application must be submitted in the approved form on the DPIE Major Project's website. DPIE will check that it addresses all requirements. If satisfactory, 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, 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 may be required by DPIE to prepare a submissions report 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 submission report 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
- hold a public hearing if requested by the Minister for Planning and Public Spaces.

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.

8.5 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 3 and the relevant performance goals and best practice in the AIDP will assist preparation of a SEE or EIS.

Your report 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 3.

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.

8.5.1 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.

For developments where the local council is the consent authority, it is advisable to contact the council prior to lodging your DA to organise a pre-lodgement meeting. The council will provide advice on the documentation required for the meeting and identify any additional information required.

8.5.2 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.

8.5.3 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*[2]), 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.

[2] See section 4.46 and 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.

8.5.4 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).

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.

8.5.5 Determination

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

- the council
- a local planning panel if the criteria in the Local Planning Panels Direction – Development Applications and Applications to Modify Development Consents is met.

8.6 Post approval and appeals

8.6.1 Appeal rights

If you are dissatisfied with a council or DPIE decision to refuse your application, or you are unhappy with consent conditions, you may have a right to appeal the decision in the Land and Environment Court. The Court will look at the application on its merits from the start and determine whether or not a different decision should be made.

If you have a right to appeal the decision, 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.

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.

If you are concerned that the council is taking too long to 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.

8.6.2 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.

8.6.3 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.

8.6.4 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.

8.6.5 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.

8.6.6 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.

[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.

8.7 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:

- *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 or aquatic plant nursery 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.

8.8 Information sources

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

8.8.1 Department of Planning Industry and Environment (DPIE)

To assist applicants with the SSD process and to improve environmental assessment, DPIE has guidance material and information on the planning assessment pathways on DPIE's Major Project's website.

8.8.2 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.

8.8.3 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.

8.8.4 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.

8.8.5 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*.

8.8.6 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.

8.8.7 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.

8.8.8 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.

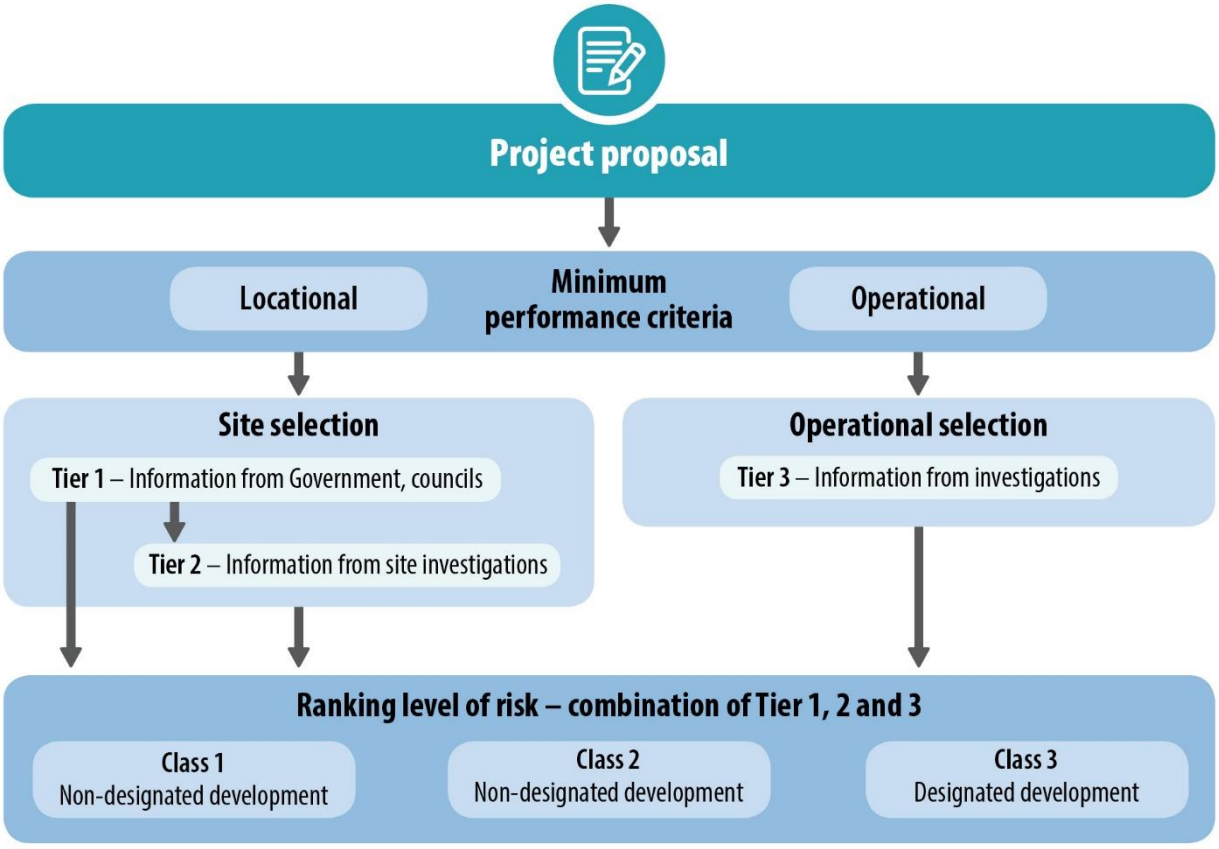
All projects, including SSD, must be assessed against the PPA and meet the minimum performance criteria set out in clause 5.19 and Schedule 6 of the Standard Instrument LEP.

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

- **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
- **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
- **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?

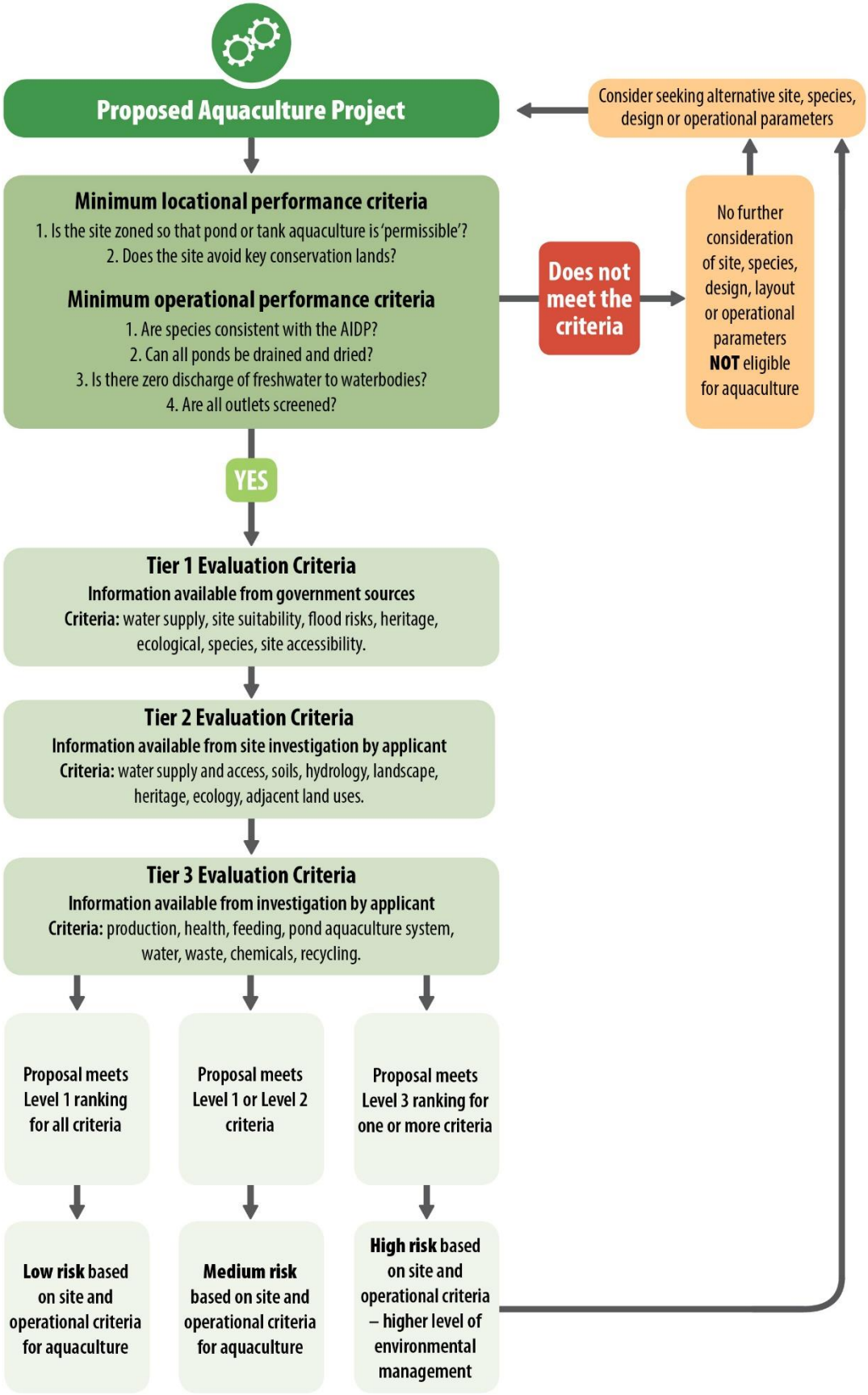
The consent authority (the local council, Local Planning Panel, or the Minister for Planning and Public Spaces (or delegate) will decide whether the project meets the minimum performance criteria and the level of assessment (Class 1, 2 or 3) required, based on the project profile analysis and the DA.

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 Public 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.

Figure 9: Project evaluation process



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.

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 aquatic plants 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 or aquatic plant propagules.

[1] Note: 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	Permissible (1)	Permissible
RU6 Transition	Permissible (1)	Permissible
Residential		
R1 General Residential	Permissible (1)	Permissible (1)
R2 Low Density Residential	Permissible (1)	Permissible (1)
R3 Medium Density Residential	Permissible (1)	Permissible (1)
R4 High Density Residential	Permissible (1)	Permissible (1)
R5 Large Lot Residential	Permissible (1)	Permissible (1)
Business		
B1 Neighbourhood Centre	Permissible (1)	Permissible
B2 Local Centre	Permissible (1)	Permissible
B3 Commercial Core	Permissible (1)	Permissible
B4 Mixed Use	Permissible (1)	Permissible
B5 Business Development	Permissible (1)	Permissible
B6 Enterprise Corridor	Permissible (1)	Permissible
B7 Business Park	Permissible (1)	Permissible
B8 Metropolitan Centre	Permissible (1)	Permissible
Industrial		
IN1 General Industrial	Permissible (1)	Permissible
IN2 Light Industrial	Permissible (1)	Permissible
IN3 Heavy Industrial	Permissible (1)	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 (4)
E4 Environmental Living	Permissible (2)	Permissible (4)
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 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.
Note (4) Permissible only if the development is for the purposes of small scale aquarium fish, shellfish nursery or shellfish hatchery production.

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. European Heritage Issues			
Heritage sites based on LEP or REP maps and State Heritage Inventory	No listings on the proposed site	Listings on-site	
4. Native Title Issues			
Status of native title interests (Crown Land)	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] Note: *Sourced from the Acid Sulphate Soils (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 2 (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) Discharge water storage pond/dam.	No stormwater catchment drainage into discharge water 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 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) Biodiversity	Does not trigger the Biodiversity Offsets Scheme under the *Biodiversity Conservation Act 2016*. Biodiversity development assessment report is not required.	Triggers the Biodiversity Offsets Scheme under the *Biodiversity Conservation Act 2016.* Biodiversity development assessment report is required. [5]	
d) 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) 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.
b) 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.
c) 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	
d) Likely impact on Aboriginal heritage	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.[4]	Sites/places of regional or national significance present and likely to impact on sites/places. [4]
13. Provision of Riparian Buffer			
Riparian buffer distance from the edge of the culture or discharge water 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[6].	Irrigation re-use scheme and irrigation site has inadequate area and/or soils have moderate or severe limitations. [6]	
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.

Site evaluation criteria	Tier 2 level of assessment		
	Level 1	Level 2	Level 3
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.] Note: You will need to determine if the Biodiversity Offsets Scheme under the *Biodiversity Conservation Act 2016* applies to your proposal regardless of the level of assessment. Information on the Biodiversity Offset Scheme is available on the EES website.
[6.] Note: 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 waterway 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 waterway 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. Discharge Water Management for Intensive Culture			
Storage capacity for discharge 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

Operational criteria	Tier 3 level of assessment		
	Level 1	Level 2	Level 3
22. Discharge Water Management for Open (flow through) freshwater (for approved species) or estuarine, marine or saline ground water Systems			
a) POEO Act Licence	POEO Act licence required. (oysters exempt)	POEO Act licence required. (oysters exempt)	
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.	
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 the following criteria is permissible without consent.

It should be noted that only crustacean and mollusc species are 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[7]	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	**Minimum performance**
1. Species selection	Species of fish or aquatic plants 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.

[7] Note: 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. 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: References, key weblinks and 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.

Key weblinks

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
https://www.dpi.nsw.gov.au/fishing/species-protection/legislation-and-approvals/impact-assessment

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

Fisheries spatial data portal

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 spatial data portal. The spatial portal provides access to spatial datasets through an intuitive public interface that allows the searching, viewing and downloading of this data.

Given the extent of location possibilities for tank, raceways and ponds, a detailed mapping approach to identify potential land based aquaculture sites has not been incorporated in this document.

Note: Detailed site assessment as outlined in this chapter is still required and current LEP and other mapping information may need further investigation.

Appendix 2: Species culture methods and constraints

Species	Disease/ Pathogen security status	Risk of survival and establishment following escape	Permissible culture methods [1]				Specific operational and site constraints
			Tank	Ponds below the PMF level in the eastern drainage, or below the 1:100 ARI flood level in the western drainage [2]	Ponds above the PMF level in the eastern drainage, or above 1:100 ARI flood level in the western drainage [2]	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	
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	

Species	Disease/ Pathogen security status	Risk of survival and establishment following escape	Permissible culture methods [1]				Specific operational and site constraints
			Tank	Ponds below the PMF level in the eastern drainage, or below the 1:100 ARI flood level in the western drainage [2]	Ponds above the PMF level in the eastern drainage, or above 1:100 ARI flood level in the western drainage [2]	Open system (Flow – through)	
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	
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.
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

Species	Disease/ Pathogen security status	Risk of survival and establishment following escape	Permissible culture methods [1]				Specific operational and site constraints
			Tank	Ponds below the PMF level in the eastern drainage, or below the 1:100 ARI flood level in the western drainage [2]	Ponds above the PMF level in the eastern drainage, or above 1:100 ARI flood level in the western drainage [2]	Open system (Flow – through)	
							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
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

Species	Disease/ Pathogen security status	Risk of survival and establishment following escape	Permissible culture methods [1]				Specific operational and site constraints
			Tank	Ponds below the PMF level in the eastern drainage, or below the 1:100 ARI flood level in the western drainage [2]	Ponds above the PMF level in the eastern drainage, or above 1:100 ARI flood level in the western drainage [2]	Open system (Flow – through)	
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
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

Species	Disease/ Pathogen security status	Risk of survival and establishment following escape	Permissible culture methods [1]				Specific operational and site constraints
			Tank	Ponds below the PMF level in the eastern drainage, or below the 1:100 ARI flood level in the western drainage [2]	Ponds above the PMF level in the eastern drainage, or above 1:100 ARI flood level in the western drainage [2]	Open system (Flow – through)	
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
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

Species	Disease/ Pathogen security status	Risk of survival and establishment following escape	Permissible culture methods [1]				Specific operational and site constraints
			Tank	Ponds below the PMF level in the eastern drainage, or below the 1:100 ARI flood level in the western drainage [2]	Ponds above the PMF level in the eastern drainage, or above 1:100 ARI flood level in the western drainage [2]	Open system (Flow – through)	
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

[1] Note: 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.

[2] Note: 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.

NOTE: It should be noted that only crustacean and mollusc species are permitted in extensive aquaculture under a Class E aquaculture permit.

Appendix 3: 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 to 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 your application is Class 1 or Class 2 local development, a SEE is required and must be submitted with the DA.

If an aquaculture proposal is a Class 3 - designated development or state significant development, an EIS must be prepared and 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.

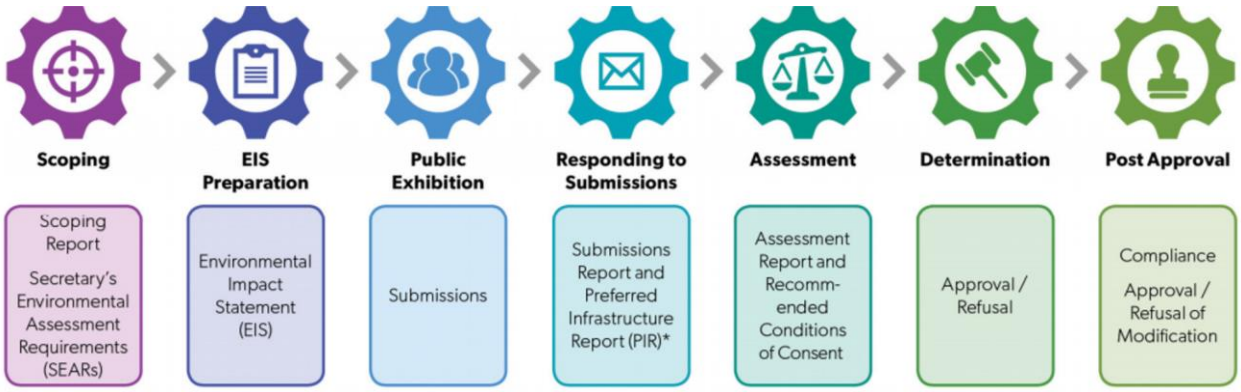
E. Identifying issues

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. 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



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. You must ensure that adequate information has been provided for the consent authority to reach a conclusion as to whether the development is likely to have any significant biodiversity impacts. 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.

Impacts related to threatened species of fish and aquatic plants listed under the *Fisheries Management Act 1994* are assessed by NSW DP Fisheries. For further information on threatened species impact assessment, see the DPI website.

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. DPIE has also prepared a draft Undertaking Engagement Guide as part of the RAF package. This Guide applies to all SSD projects.

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. Early consultation with DPIE for major projects

Prior to lodging a DA for an SSD project, the applicant should consult with the Department. The purpose of this consultation is to clarify what approvals are required, identify what information must be included in the EIS, and determine what community engagement must be undertaken by the applicant during the preparation of the EIS.

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 and is permissible at the particular site should be clarified at the outset. Councils may require preliminary documentation for pre-lodgement meetings. It is important to contact your local council early to ensure that all relevant information can be provided in preparation for the meeting.

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, councils will facilitate a planning focus meeting (PFM) before the applicant seeks the SEARs. The minutes of the PFM or issues canvassed in the discussions will 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

Pursuant to section 136 of the *Mining Act 1992* and section 16 of the *Petroleum (Onshore) Act 1991*

NOTICE is given that the following applications have been received:

EXPLORATION LICENCE APPLICATIONS

(APP-2021-298)

No. 6354, LM2 METALS PTY LTD (ACN 650292676), area of 20 units, for Group 1, dated 7 October 2021. (Wagga Wagga Mining Division).

(APP-2021-299)

No. 6355, LM2 METALS PTY LTD (ACN 650292676), area of 20 units, for Group 1, dated 7 October 2021. (Orange Mining Division).

(APP-2021-301)

No. 6356, COBAR MINERALS PTY LTD (ACN 623 510 430), area of 5 units, for Group 1, dated 11 October 2021. (Cobar Mining Division).

(APP-2021-302)

No. 6357, KALI METALS PTY LTD (ACN 653279371), area of 386 units, for Group 1, dated 12 October 2021. (Wagga Wagga Mining Division).

(APP-2021-305)

No. 6358, COOLABAH METALS LIMITED (ACN 652352228), area of 100 units, for Group 1, dated 19 October 2021. (Cobar Mining Division).

(APP-2021-306)

No. 6359, COOLABAH METALS LIMITED (ACN 652352228), area of 100 units, for Group 1, dated 19 October 2021. (Cobar Mining Division).

(APP-2021-307)

No. 6360, COOLABAH METALS LIMITED (ACN 652352228), area of 100 units, for Group 1, dated 19 October 2021. (Cobar Mining Division).

NOTICE is given that the following applications have been granted:

EXPLORATION LICENCE APPLICATIONS

(TMS-APP432)

No. 6213, now Exploration Licence No. 9307, LOCKSLEY RESOURCES LIMITED (ACN 629 672 144), Counties of Flinders, Kennedy, Narromine and Oxley, Map Sheet (8333), area of 90 units, for Group 1, dated 16 October, 2021, for a term until 16 October, 2027.

(TMS-APP435)

No. 6231, now Exploration Licence No. 9301, P S & G F FORWOOD PTY LTD (ACN 006 109 780), Counties of Clyde and Cowper, Map Sheet (8237), area of 18 units, for Group 1, dated 1 October, 2021, for a term until 1 October, 2023.

(APP-2021-111)

No. 6262, now Exploration Licence No. 9307, LOCKSLEY RESOURCES LIMITED (ACN 629 672 144), County of Kennedy, Map Sheet (8333), area of 90 units, for Group 1, dated 16 October 2021, for a term until 16 October 2027.

(APP-2021-119)

No. 6265, now Exploration Licence No. 9307, LOCKSLEY RESOURCES LIMITED (ACN 629 672 144), Counties of Flinders and Kennedy, Map Sheet (8333), area of 90 units, for Group 1, dated 16 October 2021, for a term until 16 October 2027.

(APP-2021-131)

No. 6278, now Exploration Licence No. 9302, HAVERFORD HOLDINGS PTY LTD (ACN 142660553), Counties of Canbelego and Flinders, Map Sheet (8134, 8234), area of 112 units, for Group 1, dated 13 October, 2021, for a term until 13 October, 2027.

(APP-2021-165)

No. 6298, now Exploration Licence No. 9303, MONZONITE METALS PTY LTD (ACN 165 629 818), County of Lincoln, Map Sheet (8633, 8634, 8733, 8734), area of 48 units, for Group 1, dated 14 October, 2021, for a term until 14 October, 2027.

MINING LEASE APPLICATION

(TMS-APP431)

Singleton No. 600, now Mining Lease No. 1815 (Act 1992), MANGOOLA COAL OPERATIONS PTY LIMITED (ACN 127 535 755), Parish of Wybong, County of Brisbane, Map Sheet (9033-4-S), area of 13.1 hectares, for the purpose of any cable, conveyor, pipeline, telephone line or signal, any reservoir, dam, drain or water race and any road, railway, tramway, bridge or jetty, dated 29 September, 2021, for a term until 29 September, 2042. As a result of the grant of this title, Exploration Licence No. 8064 has partly ceased to have effect.

NOTICE is given that the following applications for renewal have been received:

(REN-2021-174)

Exploration Licence No. 5138, CENTENNIAL NEWSTAN PTY LIMITED (ACN 101 508 865), area of 1469 hectares. Application for renewal received 8 October 2021.

(REN-2021-181)

Exploration Licence No. 6915, RAREX LIMITED (ACN 105 578 756), area of 40 units. Application for renewal received 13 October 2021.

(REN-2021-183)

Exploration Licence No. 8401, RIMFIRE PACIFIC MINING N.L. (ACN 006 911 744), area of 100 units. Application for renewal received 15 October 2021.

(REN-2021-184)

Exploration Licence No. 8402, FORTIUS MINES PTY LTD (ACN 140 151 917), area of 57 units. Application for renewal received 19 October 2021.

(REN-2021-182)

Exploration Licence No. 8479, PROVIDENCE GOLD AND MINERALS PTY LTD (ACN 004 881 789), area of 46 units. Application for renewal received 13 October 2021.

(REN-2021-175)

Consolidated Coal Lease No. 762 (Act 1973), CENTENNIAL MANDALONG PTY LIMITED (ACN 101 508 892), area of 2940 hectares. Application for renewal received 8 October 2021.

(REN-2021-187)

Consolidated Mining Lease No. 16 (Act 1992), BORAL CEMENT LIMITED (ACN 008 528 523), area of 616.5 hectares. Application for renewal received 18 October 2021.

(REN-2021-171)

Mining Lease No. 1496 (Act 1992), GRAYMONT (NSW) PTY LTD (ACN 004 776 989), area of 160 hectares. Application for renewal received 12 October 2021.

(REN-2021-176)

Mining Lease No. 1632 (Act 1992), CENTENNIAL MYUNA PTY LIMITED (ACN 101 508 981), area of 6125 hectares. Application for renewal received 8 October 2021.

(REN-2021-173)

Mining Lease No. 1785 (Act 1992), GREAT SOUTHERN ENERGY PTY LTD (ACN 621 409 201), area of 1301 hectares. Application for renewal received 11 October 2021.

RENEWAL OF CERTAIN AUTHORITIES

Notice is given that the following authorities have been renewed:

(TMS-REN226)

Assessment Lease No. 19, MUSWELLBROOK COAL COMPANY LTD (ACN 000 009 521), Parish of Brogheda, County of Brisbane; Parish of Clanricard, County of Brisbane; Parish of Ellis, County of Brisbane; Parish of Halscot, County of Brisbane; Parish of Strathearn, County of Brisbane; and Parish of Wybong, County of Brisbane, Map Sheet (9033-1-3, 9033-1-S, 9033-2-4, 9033-2-N, 9033-3-1, 9033-3-N, 9033-4-2, 9033-4-S), area of 8100 hectares, for a further term until 9 September, 2026. Renewal effective on and from 6 October 2021.

(TMS-REN236)

Exploration Licence No. 4232, NYMAGEE RESOURCES PTY LTD (ACN 154 131 138) AND AUSMINDEX PTY LIMITED (ACN 003 287 634), County of Mouramba, Map Sheet (8133), area of 5 units, for a further term until 17 March 2025. Renewal effective on and from 7 October 2021.

(V17-2957)

Exploration Licence No. 5418, COAL & ALLIED OPERATIONS PTY LTD (ACN 000 023 656) AND ANOTERO PTY LIMITED (ACN 618503674), Map Sheet (9033), area of 2039 square metres, for a further term until 23 December 2022. Renewal effective on and from 7 October 2021.

(REN-2021-122)

Exploration Licence No. 6105, TRITTON RESOURCES PTY LTD (ACN 100 095 494) AND OXLEY EXPLORATION PTY LTD (ACN 137 511 141), Counties of Flinders, Mouramba and Robinson, Map Sheet (8134), area of 13 units, for a further term until 28 July 2024. Renewal effective on and from 30 September 2021.

(TMS-REN204)

Exploration Licence No. 6587, WHITEHAVEN COAL MINING LIMITED (ACN 086 426 253), County of Arrawatta, Map Sheet (9139), area of 109 hectares, for a further term until 3 July 2026. Renewal effective on and from 8 October 2021.

(TMS-2020-518)

Exploration Licence No. 8224, WHITEHAVEN COAL MINING LIMITED (ACN 086 426 253), County of Nandewar, Map Sheet (8936), area of 1281 hectares, for a further term until 10 January 2027. Renewal effective on and from 29 September 2021.

(REN-2021-66)

Exploration Licence No. 8763, NICO YOUNG PTY LTD (ACN 132 050 205), Counties of Bland and Monteagle, Map Sheet (8529), area of 9 units, for a further term until 27 June 2024. Renewal effective on and from 4 August 2021.

(REN-2021-129)

Exploration Licence No. 8781, EVOLUTION MINING (COWAL) PTY LIMITED (ACN 007 857 598), County of Gipps, Map Sheet (8331, 8430, 8431), area of 47 units, for a further term until 25 July 2027. Renewal effective on and from 14 October 2021.

TRANSFERS

(TMS-TRF3)

Exploration Licence No. 5674, formerly held by SILVER MINES LIMITED (ACN 107 452 942) has been transferred to WEBBS RESOURCES PTY LTD (ACN 614 125 665). The transfer was registered on 14 October 2021.

(TRF-2021-26)

Exploration Licence No. 8398, formerly held by SCORPIO RESOURCES PTY LTD (ACN 109 158 769) has been transferred to COBAR MINERALS PTY LTD (ACN 623 510 430). The transfer was registered on 8 October 2021.

(TRF-2021-17)

Mining Purposes Lease No. 108 (Act 1973), formerly held by BELINDA STONE AND ISOBEL WALFORD has been transferred to JASON DOUGLAS STONE AND CLAUDE LESLIE STONE. The transfer was registered on 5 October 2021.

(TMS-TRF68)

Mining Purposes Lease No. 290 (Act 1973), formerly held by GARY DOUGLAS STONE has been transferred to JASON DOUGLAS STONE AND CLAUDE LESLIE STONE. The transfer was registered on 5 October 2021.

REQUESTED CANCELLATIONS

Notice is given that the following authorities have been cancelled:

(CAN-2021-11)

Exploration Licence No. 8859, NIMROD RESOURCES LIMITED (ACN 130 842 063), County of Gunderbooka and County of Irrara, Map Sheet (8038), area of 131 units. Cancellation took effect on 15 October 2021.

(CAN-2021-11)

Exploration Licence No. 8860, NIMROD RESOURCES LIMITED (ACN 130 842 063), County of Gunderbooka, Map Sheet (8037, 8038, 8138), area of 108 units. Cancellation took effect on 15 October 2021.

ERRATUM

Erratum notice for Government Gazette No 400, published 20 August 2021: Under the heading ‘Transfer of Part of an Authority’ it was listed that the grant of Mining Lease 1784 was for an area of about 112.6 hectares. This area was in fact an area of about 113.6 hectares.