

Appendix 1

Draft Environmental Management Plan



Department of
Primary Industries

Commercial Shellfish Aquaculture Leases Jervis Bay, NSW

Draft Environmental Management Plan

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TABLE OF CONTENTS

LIST OF ABBREVIATIONS	ii
1 BACKGROUND	1
1.1 Introduction.....	1
1.2 Project Description.....	1
1.2.1 Project Description.....	1
1.2.2 Structure Design.....	3
1.2.3 Supply of Stock.....	5
1.2.4 Construction Activities.....	5
1.2.5 Operational Activities.....	5
1.2.6 Decommissioning Activities (if required).....	6
1.3 Environmental Management Plan - Context.....	6
1.4 Environmental Management Plan - Objectives.....	6
2 ENVIRONMENTAL MANAGEMENT	7
2.1 Structure and Responsibility.....	7
2.2 Approval and Licensing Requirements.....	9
2.3 Reporting.....	9
2.4 Environmental Training.....	10
2.5 Emergency Contacts and Response.....	10
3 IMPLEMENTATION	11
3.1 Environmental Management Plans.....	11
3.1.1 Waste Management Plan.....	11
3.1.2 Work Health and Safety Management Plan.....	11
3.1.3 Traffic Management Plan.....	12
3.1.4 Marine Fauna Interaction Management Plan.....	12
3.1.5 Disease, Parasite and Pest Management Plan.....	12
3.1.6 Food Safety Plan.....	13
3.2 Environmental Monitoring.....	13
3.2.1 Structural Integrity and Stability Monitoring Program.....	15
3.2.2 Water Quality and Benthic Environment Monitoring Program.....	16
3.3 Environmental Management Protocols.....	20
3.3.1 Marine Fauna Entanglement Avoidance Protocol.....	20
3.3.2 Observer Protocol.....	23
3.4 Environmental Reporting.....	23
3.4.1 Logs and Registers.....	24
3.4.2 Management Reports - Moderate Risk Issues.....	25
4 Review	25
4.1 Annual Review.....	25
4.2 Environmental Auditing.....	26
5 References	27
6 Attachments	28

LIST OF ABBREVIATIONS

BACI	Before, After, Control, Impact
CMA	Catchment Management Authority
DGRs	Director-General's Requirements
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EPA	Environmental Protection Authority
EP&A Act	Environmental Planning and Assessment Act (1979)
FM Act	New South Wales Fisheries Management Act (1994)
GIS	Geographic Information Systems
IALA	International Association of Lighthouse Authorities
KTP	Key Threatening Process
LGA	Local Government Area
MSDS	Material Safety Data Sheet
NPWS	National Parks and Wildlife Service
NSW DPI	New South Wales Department of Primary Industries
NSW DoPI	New South Wales Department of Planning and Infrastructure
NSW OEH	New South Wales Office of Environment and Heritage
NSW TSC Act	New South Wales Threatened Species Conservation Act (1995)
POEO Act	Protection of the Environment Operations Act (1997)
PSFI	Port Stephens Fisheries Institute
JBMP	Jervis Bay Marine Park
NSW RMS	New South Wales Roads and Maritime Service
SWMS	Safe Work Method Statement
TMP	Traffic Management Plan
TOC	Total Organic Carbon
WH&S	Work Health and Safety

1 BACKGROUND

1.1 Introduction

Fisheries NSW, a division of the NSW Department of Primary Industries (NSW DPI) is seeking approval for the establishment of Commercial Shellfish Aquaculture Leases within the open marine embayment of Jervis Bay.

Extensive aquaculture is permitted in the Jervis Bay Marine Park (JBMP) but cannot exceed more than 2% (440 hectares) of the park. NSW Marine Parks Authority (NSW MPA) requested Fisheries NSW to develop an aquaculture strategy to ensure any development is consistent with the management plans for JBMP. Fisheries NSW have also had representation from potential investors interested in developing aquaculture facilities in Jervis Bay.

Jervis Bay is one of only three marine embayments on the NSW coast that are suitable for extensive aquaculture. The other embayments are Port Stephens, which has an established edible oyster industry and Twofold Bay, which already has extensive Blue Mussel aquaculture (Joyce *et. al.*, 2010). The proposed leases would assist in providing food security during seasonal fluctuations that may affect Port Stephens and Twofold Bay.

The NSW Government recognises the need to look at opportunities for sustainable and viable aquaculture development. The proposed Commercial Shellfish Aquaculture Lease project would assist in the strategic and coordinated development of aquaculture in Jervis Bay rather than a piecemeal “ad hoc” approach. It is proposed that if the lease areas are approved they will be offered to commercial aquaculture proponents through a tender process.

The purpose of this Environmental Management Plan (EMP) is to identify the management measures aimed at preventing or minimising potential adverse environmental impacts arising from the operation of the Commercial Shellfish Aquaculture Leases. The EMP has also been developed to ensure compliance with environmental regulatory requirements.

The viability of the operation of the Commercial Shellfish Aquaculture Leases is dependent upon maintaining the quality of the surrounding marine environment.

1.2 Project Description

1.2.1 Project Description

The proposed Commercial Shellfish Aquaculture Leases are located within the open marine embayment of Jervis Bay which is located on the south coast of NSW (Figure 1).

Jervis Bay is approximately 180 km south of Sydney and 20 km southeast of Nowra - the region's largest town.

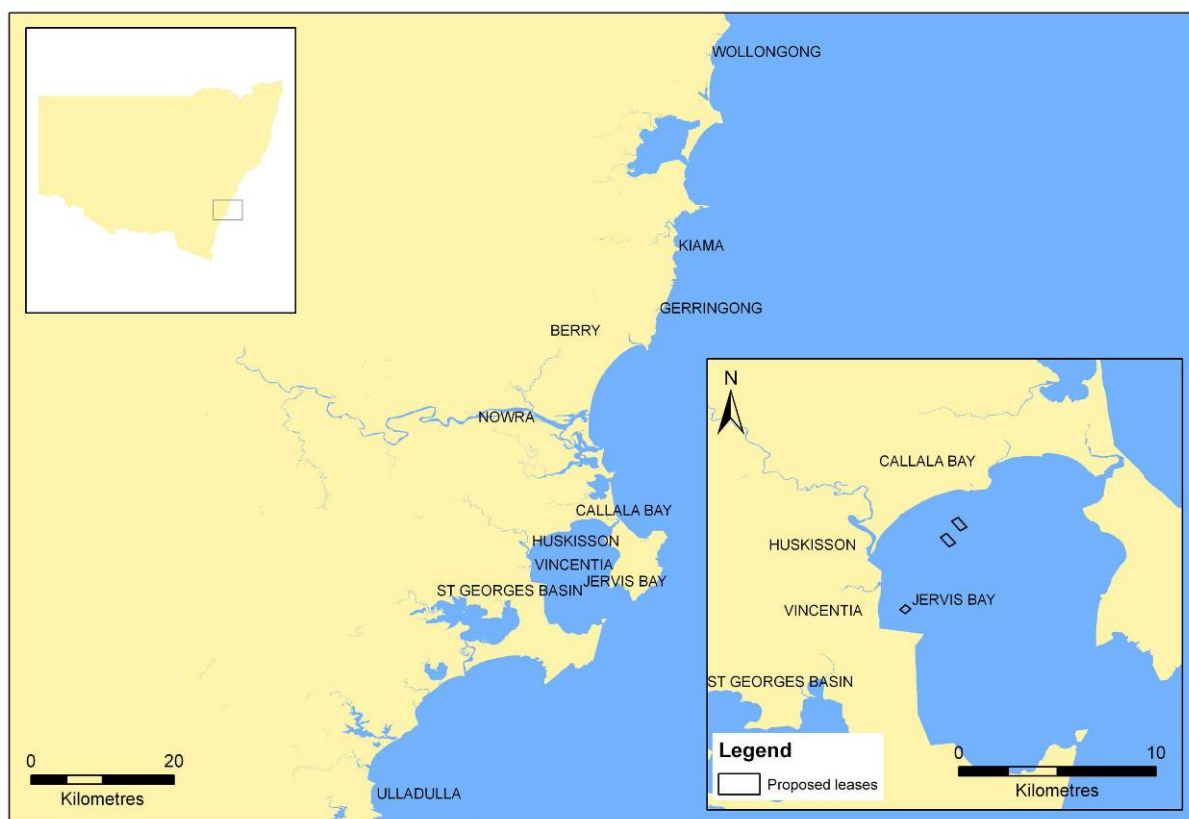


Figure 1: Regional map of Jervis Bay and the proposed locations for the Commercial Shellfish Aquaculture Leases (Source: Fisheries NSW, 2012).

The proposed Commercial Shellfish Aquaculture Leases would occupy a total area of 50 hectares consisting of the following:

- Callala Lease (north) - 20 hectares;
- Callala Lease (south) - 20 hectares; and
- Vincentia Lease - 10 hectares.

The Callala Leases (north and south) are located approximately 1.5 km and 1.9 km southeast of Callala Beach, respectively. The Vincentia Lease is approximately 660 m north of Orion Beach in Vincentia. The exact layout of the sites in the proposed locations will be finalised once a formal survey is undertaken by a registered surveyor during placement of the lease corner navigation buoys.

The proposed leases are located in a Habitat Protection Zone of the JBMP which is a multiple use zone that caters for a wide range of sustainable activities. The proposed aquaculture lease activities are permissible within this zone. The Vincentia Lease is located over one of the former mussel aquaculture leases that was active between 1979 and 2008.

1.2.2 Structure Design

The proposed Commercial Shellfish Aquaculture Lease infrastructure will consist of longline culture systems which will include an anchoring and mooring system that is connected to backbone ropes from which culturing apparatus would be suspended. The number of longlines within each lease may vary depending on the wave climate, depth and currents at each site.

The anchoring and mooring system would consist of anchors at each end of the system connected to lengths of chain and polypropylene hard lay UV stabilised rope (25-35 mm diameter) which would be connected to the main backbone rope of similar dimensions (Figure 2).

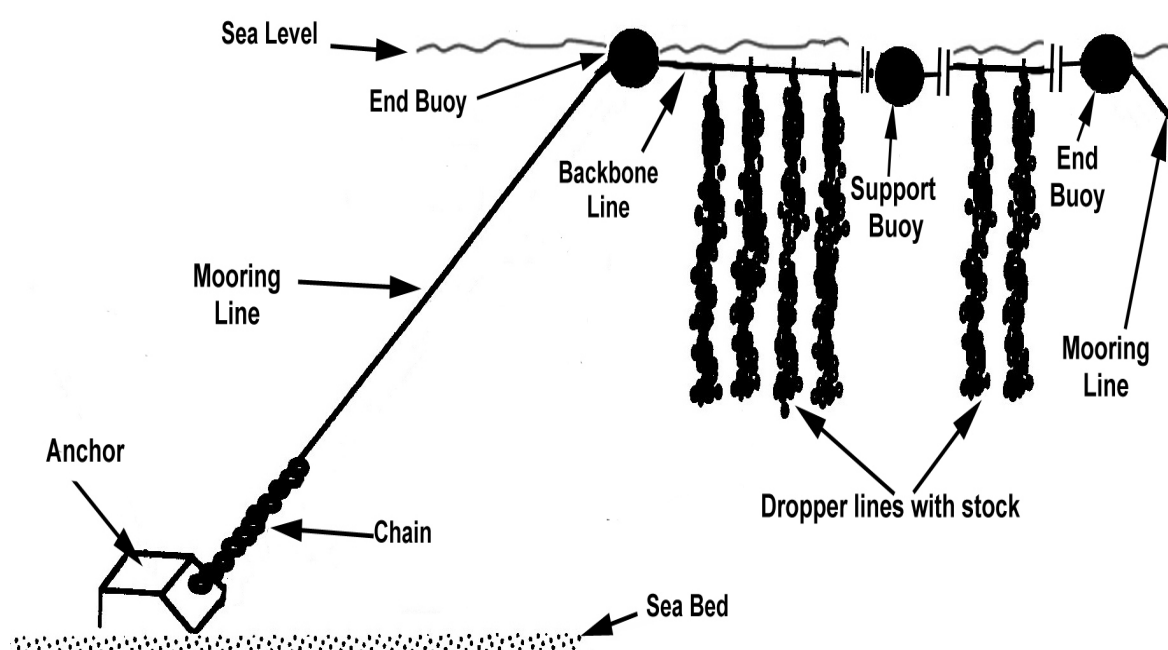


Figure 2: A schematic diagram of longline infrastructure (Source: Fisheries NSW, 2012).

The apparatus used to culture the shellfish will vary depending on the species cultured and may include:

- Dropper lines which are lengths of specially manufactured rope that enables certain shellfish species to adhere to them. Dropper lines can also be continuous where they are looped along the backbone in a continuous line;
- Pyramid nets and/or cages which are meshed containers in the shape of a pyramid in which the cultured stock are contained (Figure 3);
- Pocketed panel nets are generally a rectangular shaped structure which has a mesh like structure consisting of a number of “pockets” in which stock are placed for culture (Figure 3);

- Lantern nets and/or cages which are cylindrical shaped apparatus with an outer cover of mesh and a number of cross sectional layers in which the stock are placed for culture (Figure 3); and
- Baskets or trays which are generally constructed from plastic mesh and are available in a range of shapes and sizes. This apparatus is commonly used for the intertidal culture of oysters.

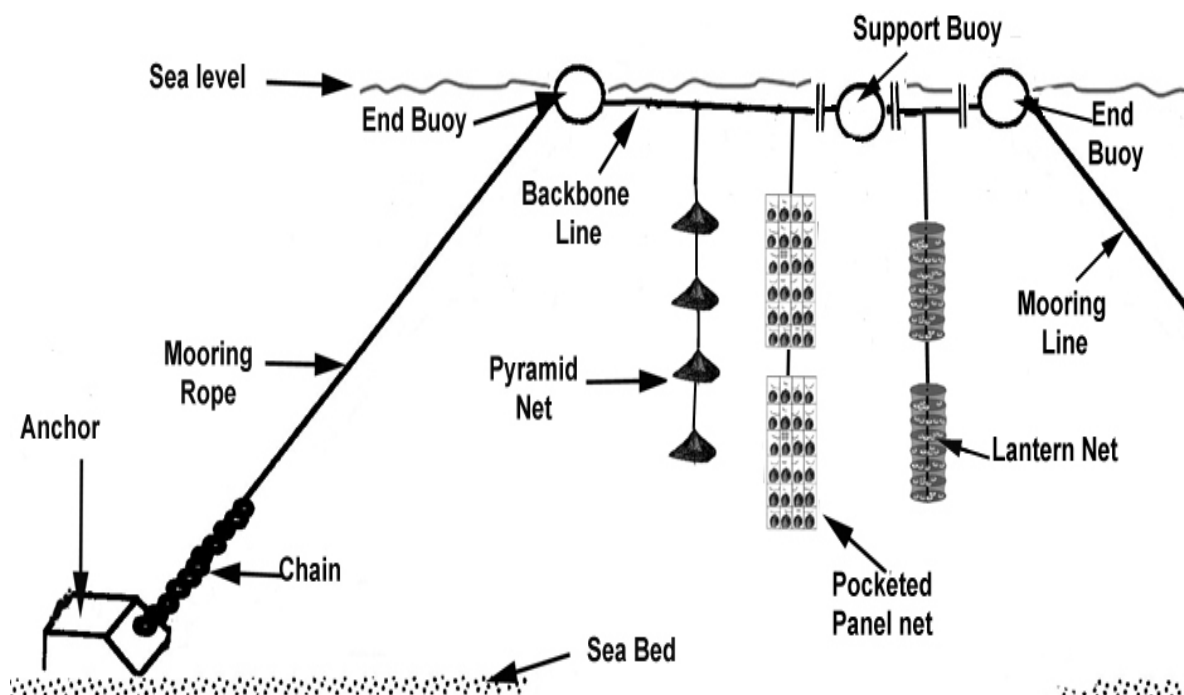


Figure 3: A schematic diagram of a longline system and cages typically used for shellfish culture (Source: Fisheries NSW, 2012).

Buoys will be attached to the longlines to assist with supporting the system. The number of buoys used along each longline will vary depending on the growth stage of the stock and the need to secure cultured stock at an appropriate depth off the seabed away from potential predators. Buoys are usually positioned 20-30 m apart when stocked with juveniles and as the crop increases in biomass additional buoys may be placed along the longlines. The support buoys generally have a volume of 150-200 litres and are black in colour. Floatation from the buoys combined with the anchors and chains would also assist with the maintenance of taut ropes to prevent marine fauna entanglement.

At least four navigation buoys will be positioned on the corners of the proposed Commercial Shellfish Aquaculture Leases in accordance with the requirements of NSW Roads and Maritime Services (NSW RMS).

1.2.3 Supply of Stock

Shellfish spat for culture will be either naturally wild caught or produced at authorised industry hatchery facilities depending on the species. Hatchery produced stock will originate from locally collected broodstock or if unavailable, broodstock will be sourced from other localities but individuals will be from the same genetic population. During the hatchery stage shellfish will be monitored for diseases and parasites and inspected prior to transportation to the leases.

The shellfish stock will rely on naturally occurring plankton and other nutrients in the waters of Jervis Bay for their feed. The species to be cultured, age of the stock and the water temperature will determine the standing biomass.

1.2.4 Construction Activities

Most of the longline infrastructure will be prefabricated on land and then transported by vessels to the site for assemblage and installation. The construction/installation stage will consist of the following activities:

- Installation of the anchors for the navigation buoys;
- Fitting of the mooring lines of the navigation buoys to the anchors;
- Installation of the anchors for the longline system;
- Fitting of the longlines to the mooring lines; and
- Fitting of the floatation buoys to the longline system.

The installation of the anchors, navigation buoys and longlines is anticipated to be undertaken during daylight hours during calm sea state conditions. Construction works outside these hours may be necessary to complete critical installations to ensure structural integrity and associated maritime safety. It is anticipated that the installation stage will be undertaken over about 6 months (not necessarily continuous) involving up to 15 people. The installation of the longline system and navigation buoys will be undertaken from marine vessels suitable for heavy lifting and the placement of the anchors, supporting dive personnel and transportation of staff and equipment.

1.2.5 Operational Activities

The operational stage will comprise of the following activities:

- Maintenance of the longline system and navigation buoys;
- Collecting data for monitoring programs;
- Stock husbandry; and
- Stock harvesting.

1.2.6 Decommissioning Activities (if required)

If for any reason the decommissioning of the lease/s is required at anytime it will include:

- Removal of any remaining stock from the longline infrastructure;
- Removal of culture apparatus and the return to suitable land based facilities for disposal or sale;
- Removal of longline backbone and floats from the mooring lines and return to land based facilities for disposal or sale;
- Removal of mooring lines from the anchors and return to land based facilities for disposal or sale;
- Removal of the anchors and return to land based facilities for disposal or sale; and
- Removal of navigation buoys and associated anchors.

1.3 Environmental Management Plan - Context

This draft EMP has been developed to provide clear direction on the implementation of environmental management best practices during the construction/installation, operation and, if required, decommissioning stages of the Commercial Shellfish Aquaculture Leases.

A number of environmental management requirements associated with the proposed Commercial Shellfish Aquaculture Leases are likely to be identified in the development application consent and/or are requirements associated with licences or other approvals required in the operation of the Commercial Shellfish Aquaculture Leases. The EMP also ensures that the Commercial Shellfish Aquaculture Leases do not have a significant impact on the marine environment, surrounding communities or Commercial Shellfish Aquaculture Lease staff.

1.4 Environmental Management Plan - Objectives

The objectives of the EMP are to ensure that the Commercial Shellfish Aquaculture Leases are managed sustainably and that their operation does not result in a significant impact on the marine environment, surrounding communities or staff.

The purpose of the management plans, monitoring programs and protocols described in this EMP are to:

- Ensure that aquaculture best practices are employed during the construction, operation and, if required, decommissioning stages of the Commercial Shellfish Aquaculture Leases;
- Minimise marine fauna interactions;
- Maintain water quality for both humans and the marine communities;

- Maintain the structural integrity and stability of the longline infrastructure;
- Minimise the occurrence of diseases, parasites, and pests and provide prompt management and/or remedial action if these events occur;
- Ensure the safety of staff and surrounding communities;
- Ensure waste is appropriately disposed of;
- Maintain navigational safety in Jervis Bay; and
- Evaluate the performance of the Commercial Shellfish Aquaculture Leases by reviewing environmental management and monitoring records.

2 ENVIRONMENTAL MANAGEMENT

2.1 Structure and Responsibility

Fisheries NSW will tender the proposed Commercial Shellfish Aquaculture Leases if they are approved. The successful tender applicant/s will then be required to obtain an aquaculture permit and/or lease to authorise their activities on the leases. Figure 4 provides a generic organisational structure of personnel during the operation stage of the proposed leases.

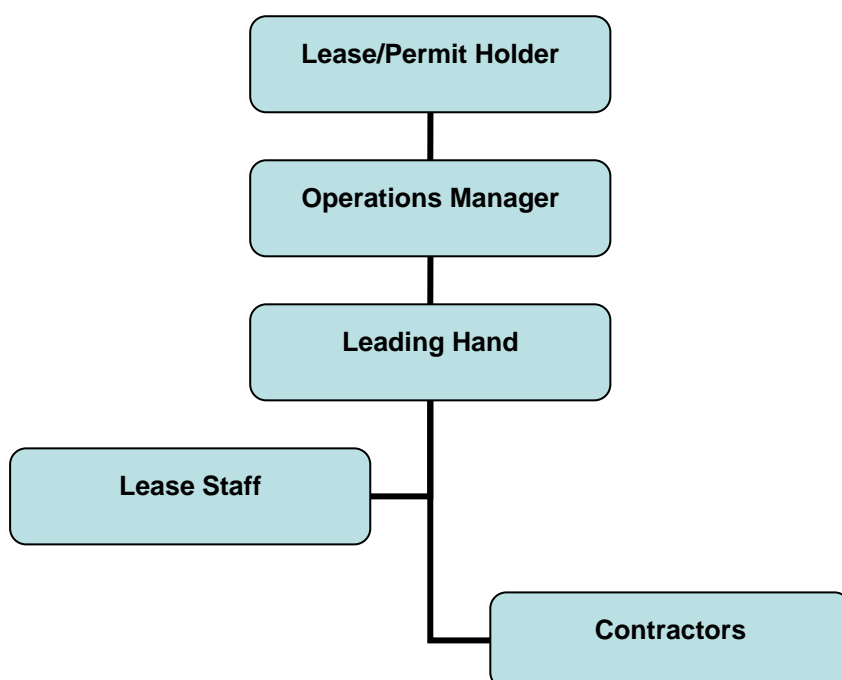


Figure 4: Organisational structure of personnel involved in the operation stage of the Commercial Shellfish Aquaculture Leases.

In accordance with line management, the staff of the lease operator/s will have specific environmental management responsibilities as follows:

Lease/Permit Holder

- Ensure that adequate resources are available to enable compliance with the requirements of the EIS and EMP during the construction/installation, operation and, if required, decommissioning stages of the lease/s;
- Ensure that the operation of the lease/s does not have a significant impact on the environment and complies with NSW environmental statutory requirements;
- Maintain official communications about the lease/s with the relevant environmental regulators e.g. NSW DoPI, Fisheries NSW and NSW OEI; and
- Participate in environmental audits of the leases and take preventative and corrective actions as necessary.

Operations Manager

- Ensure that all personnel are aware of the requirements of the EMP, as well as undergo appropriate training (including competency based assessment) and supervision relative to their areas of responsibility in order to be able to comply with the relevant requirements of the EIS and EMP;
- Plan environmental monitoring and reporting activities;
- Advise personnel on environmental best practices during all stages;
- Monitor compliance with the NSW environmental statutory requirements, regulatory approval conditions, the EIS and the EMP; and
- Record and review environmental incidents and community complaints and ensure that the most appropriate corrective and preventive actions are implemented.

Leading Hand

- Supervise the installation and operation of the leases to ensure compliance with the EIS, EMP and statutory requirements;
- Supervise environmental audits/inspections of the leases in accordance with the EMP;
- Ensure that the environmental management plans, monitoring programs, protocols and other mitigation measures are implemented and are achieving their objectives;
- Provide advice to staff and contractors on the EMP; and
- Participate in environmental audits of the leases, report non-conformance and take preventive and corrective actions as necessary.

Lease Staff

- Comply with the EMP and statutory requirements under the direction of the Leading Hand and other personnel authorised by the Lease/Permit Holder; and
- Participate in environmental audits of the lease/s, report non-conformance and take preventive and corrective actions as necessary.

Contractors

- Comply with the EMP and statutory requirements under the direction of the Leading Hand and other personnel authorised by the Lease/Permit Holder; and
- Participate in environmental audits of the lease/s, report non-conformance and take preventive and corrective actions as necessary.

2.2 Approval and Licensing Requirements

A preliminary list of approvals and licences required for the operation of the Commercial Shellfish Aquaculture Leases is provided in Table 1. Upon receipt of the development consent conditions, additional licences and approvals may be required.

Table 1: Approval and licensing requirements for the operation of the Commercial Shellfish Aquaculture Leases.

Regulatory Authority	Approval/Licence
Minister for Planning and Infrastructure	Development consent under the <i>Environmental Planning and Assessment Act 1979</i> .
Fisheries NSW	The following are administered under the <i>Fisheries Management Act 1994</i> : Class 2 Aquaculture Lease Class A Aquaculture Permit Broodstock Collection Permit Permit administered under the <i>Marine Parks Act 1997</i> .
NSW Food Authority	Licence for a food business – seafood This is administered under the <i>Food Regulation 2010</i> .

2.3 Reporting

The draft EIS and EMP outline a number of reporting requirements but the development consent may be accompanied by additional requirements. The EMP will be required to be completed by the successful tenders of the Commercial Shellfish Aquaculture Leases prior to commencement of development activities.

2.4 Environmental Training

Personnel employed on the Commercial Shellfish Aquaculture Leases are to receive appropriate training and must have the required skills and qualifications to fulfil their respective roles in a competent manner. Only contractors that meet the required training and competency requirements should be used on the leases.

Minimum environmental training will include:

- An induction onto the Commercial Shellfish Aquaculture Leases;
- Specialised environmental training and instruction required for undertaking allocated tasks;
- Other specific training and instruction requirements such as emergency response and operation of specific equipment; and
- Regular meetings which will include discussions on safety issues, risk assessments and controls.

2.5 Emergency Contacts and Response

Commercial Shellfish Aquaculture Lease operators will be required to develop an emergency response plan to enable prompt and effective responses to emergency situations. The emergency response plan will include qualified personnel, specific actions to be undertaken in response to different emergency situations, the reporting requirements and regular training.

Commercial Shellfish Aquaculture Lease operators will be required to establish a contact number for the public to report any emergency events that will be available 24 hours a day, seven days a week.

Complaints Handling

Community complaints in relation to the operation of the Commercial Shellfish Aquaculture Leases will be recorded on a complaints register (See Attachment 1) and will be reviewed by the lease/s operators to determine the most appropriate action.

Commercial Shellfish Aquaculture Lease operators will be required to establish a hotline for the operation of the Commercial Shellfish Aquaculture Leases once the construction/installation stage commences, which will be listed in local papers and on the lease operators website.

3 IMPLEMENTATION

3.1 Environmental Management Plans

The following provides an overview of the proposed environmental management sub-plans to be developed to provide guidelines for the operation of the Commercial Shellfish Aquaculture Leases. These plans will be further developed upon development approval consent and appointment of successful tender/s.

3.1.1 Waste Management Plan

The Waste Management Plan will be developed to ensure responsible waste management and disposal including provisions for recycling materials and the disposal of wastes at approved disposal facilities. The plan will also include procedures on the handling and storage of wastes, including biological waste, general waste and worn infrastructure, as well as the provision of appropriate containers for storage and disposal, infrastructure cleaning and biofouling management. Local government authorities, the Environment Protection Authority (EPA) and public submissions for the EIS for example, may identify additional waste management requirements to be included in the plan.

3.1.2 Work Health and Safety Management Plan

The on-going success of the Commercial Shellfish Aquaculture Leases relies on the competency and safety of lease personnel. Staff training to cover potential Work Health and Safety (WH&S) hazards including SCUBA diving, construction and deployment activities, service and maintenance activities, associated navigation issues, use and storage of chemicals (e.g. petrol), stock and the environment, as well as waste disposal.

Staff will be made aware of the environmental obligations of the Commercial Shellfish Aquaculture Leases by becoming familiar with and contributing to the review of the EMP. Staff will also be provided with relevant Safe Work Method Statements (SWMS) and Material Safety Data Sheets (MSDS) for any products that will be used on the Commercial Shellfish Aquaculture Leases. Staff will have qualifications appropriate to their positions and the tasks they are allocated. Contractors and subcontractors will be required to undertake an on-site induction and will be presented with relevant sections of the EMP to ensure compliance with the stated provisions.

SCUBA divers conducting any monitoring, maintenance and/or inspections for example, will comply with commercial diving standard and must be familiar with relevant SWMS and WH&S hazards prior to any diving activity. The WH&S plan will include information such as the qualifications and role responsibilities of diving personnel, first aid qualifications of

diving personnel, procedures and equipment used during particular conditions, diving emergency procedures and contact details for NSW hyperbaric units.

3.1.3 Traffic Management Plan

The Traffic Management Plan will consider the movements of road vehicles and marine vessels. The plan will address potential impacts on marine fauna and other road and waterway users, particularly in relation to navigational safety, the maintenance of navigation buoys, minimising the risk of boat strikes to marine fauna, minimising acoustic pollution and mitigating road congestion issues associated with the transport of products and movement of staff.

During the construction stage, road and marine vessel traffic will be managed in accordance with the requirements of NSW RMS.

3.1.4 Marine Fauna Interaction Management Plan

The Marine Fauna Interaction Management Plan is to be developed to identify and mitigate potential impacts on marine fauna through direct and indirect interactions. The plan will include the Marine Fauna Entanglement Avoidance Protocol (See Section 3.3.1) and the Observer Protocol (See Section 3.3.2).

3.1.5 Disease, Parasite and Pest Management Plan

The longline infrastructure and the shellfish cultured may be exposed to a range of endemic diseases, parasites and pests. The Disease, Parasite and Pest Management Plan will outline preventative measures (e.g. how to minimise stress to stock associated with stocking density, water quality and predatory interactions), inspection schedules (surveillance program), identification procedures, contact details of appropriate personnel to assist with the management of pathogens and treatments for stock and infrastructure (e.g. veterinary specialists).

Commercial Shellfish Aquaculture Lease operators will be required to develop a manual to assist in the identification of diseases, parasites and pests and provided to lease staff to assist with prompt and effective treatment of potential pathogens. The manual would include a description of the syndrome, symptoms and measures to prevent, control or eliminate the pathogen.

A number of guidelines and/or protocols may be developed as part of the plan to assist in dealing with disease, parasite and pest management issues including:

- Water quality monitoring;
- Biofouling management;

- Inspecting shellfish health;
- Steps to follow if a 'declared disease' is detected and/or unexplained mortalities
- Emergency response in the unlikely event of a major disease outbreak event e.g. AQUAVETPLAN;
- Treatment procedures;
- Collecting samples for laboratory examination; and
- Maintenance of personnel and farm equipment hygiene.

Inspections of stock for disease and parasites will provide the lease operator/s with an opportunity to compile a listing of pathogens which are a potential threat to cultured shellfish in NSW waters, as well as contribute to the database on native pathogens of wild shellfish populations. Pathogen occurrence and the effectiveness of treatments, if required, will be documented in the annual environment report. Unusual and/or unidentifiable fouling organisms will also be documented, which may assist with early detection of declared diseases and pests, as well as improve the species inventory for native and/or introduced pathogens in NSW coastal waters. Any incidences of disease, parasites or pests will be reported in a daily work log.

3.1.6 Food Safety Plan

Considerable quantities of stock for human consumption will be produced on the Commercial Shellfish Aquaculture Leases. To ensure that this stock is fit for human consumption a Food Safety Plan will be required to minimise the risk of hazards associated with the culturing of stock (e.g. monitoring water quality), as well as the handling and storage of stock to ensure adherence with NSW Food Authority regulatory requirements. The Food Safety Plan is to be developed in accordance with the requirements of the *Seafood Safety Scheme* administered by NSW Food Authority under *Food Regulation 2010*.

3.2 Environmental Monitoring

Environmental monitoring programs will outline procedures to monitor potential changes in significant components of the marine environment and assess the structural integrity of the longline infrastructure, marine fauna interactions and environmental impacts (Table 2). The monitoring programs will also enable the effectiveness of mitigation measures to be evaluated which will be adapted if inadequate or more appropriate management options become apparent. Monitoring objectives may also be determined by the development consent requirements. Further details on the locations, timing, review periods and sampling

procedures will be provided once these requirements are finalised and successful tender/s have been appointed.

Table 2: Environmental monitoring proposed during the operation of the Commercial Shellfish Aquaculture Leases.

Issue	Monitoring Actions	Frequency	Responsibility
Noise	<ul style="list-style-type: none"> ▪ Noise assessments ▪ Noise assessments in response to community complaints or working outside of normal hours 	<ul style="list-style-type: none"> ▪ During scheduled maintenance 	Lease/Permit Holder/s
Fuel leaks	<ul style="list-style-type: none"> ▪ Inspect vessels and onboard equipment to ensure no leaks 	<ul style="list-style-type: none"> ▪ Daily ▪ During scheduled maintenance 	Lease/Permit Holder/s
Benthic environment	<ul style="list-style-type: none"> ▪ Collect benthic sediment samples before, during and after lease installation. ▪ Monitor changes in sedimentation and benthic community structure 	<ul style="list-style-type: none"> ▪ (To be confirmed) 	Lease/Permit Holder/s
Water quality	<ul style="list-style-type: none"> ▪ Collect water samples in accordance with the NSW Shellfish Program 	<ul style="list-style-type: none"> ▪ (To be confirmed) 	Lease/Permit Holder/s
Marine fauna interactions	<ul style="list-style-type: none"> ▪ Investigate movements of high priority species within direct study area <ul style="list-style-type: none"> ○ Humpback and Southern Right Whales ▪ Record all observations of marine fauna interactions with infrastructure and vessels <ul style="list-style-type: none"> ○ Threatened & protected species ○ Boat strikes ○ Behavioural changes ○ Entanglements 	<ul style="list-style-type: none"> ▪ Daily 	All staff
Structural integrity and stability of infrastructure	<ul style="list-style-type: none"> ▪ Inspections and maintenance of longline infrastructure e.g. faults, damage, excessive biofouling and/or loose lines, or buoys ▪ Monitor the effectiveness and suitability of the longline design <ul style="list-style-type: none"> ○ How frequently are repairs needed? ○ Is tautness of lines being maintained? 	<ul style="list-style-type: none"> ▪ Regular scheduled inspections & maintenance ▪ After severe weather ▪ During biofouling cleaning 	Lease/Permit Holder/s
Navigation	<ul style="list-style-type: none"> ▪ Inspections of navigation 	<ul style="list-style-type: none"> ▪ Regular 	Lease/Permit

	<ul style="list-style-type: none"> marks for faults or damage ▪ Record any navigation issues in daily work log ▪ Regularly review observations, complaints and vessel incident reports 	<ul style="list-style-type: none"> scheduled inspections & maintenance for marks ▪ Regular review of navigation issues 	Holder/s
Disease, parasites and pests	<ul style="list-style-type: none"> ▪ Regular inspections of stock for disease, parasites and pests to ensure early detection ▪ Regular inspection of longline infrastructure for pests to ensure early detection ▪ Regular inspections to ensure early detection of the unlikely occurrence of 'declared diseases' ▪ Record diseases, parasites and pests - contribute to the species inventory for NSW waters ▪ Record the occurrence of pathogens, the treatment details and their effectiveness ▪ Monitor biofouling i.e. amount, composition and details of its removal ▪ Regularly review the occurrences of pathogens and the effectiveness of treatments given to assess if management measures are appropriate and adequate or need to be improved 	<ul style="list-style-type: none"> ▪ Monthly visual inspections of stock (may be greater during periods of high water temperature) ▪ Removal of biofouling in a timely manner (dependant on water temperature) 	All staff
Waste production and disposal	<ul style="list-style-type: none"> ▪ Regular inspection of waste storage containers ▪ Record details about waste production and disposal <ul style="list-style-type: none"> ○ Bio waste e.g. biofouling cleaned from culture apparatus ○ General waste ○ Worn infrastructure ▪ Review waste production and disposal procedures 	<ul style="list-style-type: none"> ▪ Daily inspection and empty of waste storage containers ▪ Daily removal of bio wastes when cleaning of biofouling from culture apparatus occurs 	All Staff

3.2.1 Structural Integrity and Stability Monitoring Program

The Structural Integrity and Stability Monitoring Program will outline the details on the procedures and schedules for inspections of the longline infrastructure to determine its structural integrity and stability. Evidence of faults, damage, excessive biofouling and loose lines or buoys will be the focus of the inspections which will be followed by appropriate

maintenance. Inspections will be particularly important after severe weather, and the cleaning of infrastructure in order to minimise marine fauna entanglements and navigation hazards. Routine visual inspections will be undertaken at least every week with more detailed servicing inspections to be undertaken at least once a year and will cover all aspects of the infrastructure including anchors, ropes, chains and connectors. An inspection checklist will be developed which will include a list of actions to be undertaken, items to be inspected, issues identified and actions undertaken to rectify any structural integrity issues, especially those that may result in the detachment of infrastructure.

The Structural Integrity and Stability Monitoring Program will monitor the effectiveness and suitability of the infrastructure design, such as whether it adequately withstands the sea conditions in Jervis Bay, how frequently repairs are required and whether line tautness is being maintained.

3.2.2 Water Quality and Benthic Environment Monitoring Program

The Water Quality Monitoring Program will be employed in accordance with the NSW Food Authority and the NSW Shellfish Program. The Benthic Environment Monitoring Program proposes to employ a similar experimental design to that used by the Centre for Research on Ecological Impacts of Coastal Cities (University of Sydney, NSW) to assess the ecological affects of mussel culture in Twofold Bay (Underwood & Hoskin 1999). These studies used a 'Before vs. After - Control vs. Impact' (BACI) sampling design, which is one means by which causality models can be rigorously tested in environmental investigations (Underwood, 1992; 1994). The use of multiple control sites coupled with multiple sampling times before and after the proposed activity enables an estimate of natural temporal and spatial variation of the environment to be obtained (Green, 1979). Such estimates can then used to determine if impacts from the activity (i.e. the Commercial Shellfish Aquaculture Leases) cause greater variation in the environment than would occur naturally through time (Kingsford & Battershill, 1998).

The use of this type of sampling design was strongly advocated in the 1996 guidelines of the United Nations Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP) on monitoring the ecological effects of aquaculture (Hoskin & Underwood, 2001).

Fisheries NSW currently requires other marine based aquaculture (finfish and mussel farms) to undertake benthic environment monitoring using a BACI sampling design (See Attachment 7).

3.2.2.1 Water Quality Sampling

Maintenance of water quality is critical to the health of the cultured stock and to ensure food safety of the product for human consumption.

The NSW Shellfish Program has been developed, which is a compulsory, industry funded program that assists in ensuring the public health safety of shellfish grown and harvested from NSW waters. The NSW Shellfish Program is administered by the NSW Food Authority under the *Food Act 2003*. The objective of the program is to protect the health of shellfish consumers through the administration and application of procedures described in the *New South Wales Shellfish Program Operations Manual* 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; and
- protect shellfish from contamination after harvesting.

The program requires that shellfish producers undertake a water quality monitoring program to ensure the cultured shellfish are suitable for human consumption. An initial two year monitoring period is required to determine the classification of Jervis Bay under the program.

The initial two year monitoring period requires the collection of water samples both within and outside the leases with particular attention to location of potential pollution. It also has two distinct recognised water sampling strategies, systematic random sampling and significant rainfall event / pollution event sampling.

Systematic randomly sampling is to occur once a month to obtain a general picture of the water quality of Jervis Bay. Significant rainfall events and/or pollution event sampling attempts to quantify the threat that potential pollution sources may represent. Consequently, the timing of sample collection is important and should coincide with conditions when faecal pollution will be at its worst e.g. a creek which flows after rainfall or a sewage release event.

Significant rainfall events that need to be sampled are 10–19 mm, 20–30 mm and 40–60 mm within a 24 hour period. These samples are to be collected about 24 hours after the event and no later than 48 hours after the event.

During sampling data on the climatic conditions, water temperature, salinity and tide are collected. All collected water samples are then to be analysed by a NATA accredited laboratory for faecal coliform or *E. coli* counts. Biotoxin (algae) monitoring may also be required during the initial two year monitoring period.

Once the classification of the water quality monitoring program for Jervis Bay is completed, the NSW Food Authority will then be in a position to develop any further requirements for ongoing water quality monitoring program that may be required for the Commercial Shellfish Aquaculture Leases.

3.2.2.2 Benthic Sediment Sampling

The benthic environment beneath and surrounding the longline infrastructure would be monitored biologically (e.g. macrofauna abundance and species diversity) and chemically (i.e. organic matter and sediment composition).

Sediment samples will be collected for determination of total organic carbon (TOC) and analysed using a simplified BACI sampling program similar to that outlined in Hoskin & Underwood (2001) and that currently required for other marine aquaculture activities in NSW (See Attachment 7).

Sites will be monitored within the lease/s and at two control sites. The control sites will be located at least 500 m from the lease/s boundary. Benthic samples (where possible) will be collected from under two longlines stocked with commercial densities of shellfish.

The distance of 500 m from the lease/s is considered to be sufficient for the control sites based on the results of previous studies on more intense nutrient producing activities such as sewage outfalls. A 10 ML daily discharge of secondary treated sewage for example, is generally limited to within 300 m of an outfall for the majority of variables (Smith, 1996; Smith, 2000). GPS coordinates of each site will be recorded so that subsequent sampling can be undertaken within the same area.

Biological Monitoring

Observing benthic fauna is a common environmental monitoring tool worldwide (de Jong & Tanner, 2004). Many studies have demonstrated that benthic fauna is a reliable indicator of environmental changes that are induced by increased nutrient and sediment loads (Ritz *et al.*, 1990; Weston, 1990).

A range of factors that may affect the abundance and species diversity of macrofauna within Jervis Bay were identified from the literature, such as depth, sediment size, organic content of sediment, salinity, habitat type, temporal variation, temperature and nutrients (Table 3).

Table 3: Important factors that may affect the abundance and species diversity of macrofauna within Jervis Bay and how this study may address them.

Factor	Approach
Depth	Controlled (5-10 m)
Sediment size	Controlled (sand and coarse sand)/measured
Organic content of sediment	Measured
Salinity	Controlled/measured (equivalent areas)
Habitat type	Controlled (all sand and coarse sand sediment)
Temporal variation	Small scale (animal activity) – Controlled (samples collected at same time of day) Medium scale (season) – Controlled (sites sampled in all seasons) Large scale (annually) – Controlled (sites sampled over two years)
Temperature	Measured
Nutrients	Measured (sediment samples)

Sediment samples may be collected by using hand-held corers or by using an appropriate sample grab. Macrofauna (animals less than 0.5 mm) will be extracted from the core samples by various methods which may include vigorously swirling the sediment in a container of water and magnesium chloride (a relaxant), and pouring floating animals onto a 0.5 mm sieve-mesh (Underwood & Hoskin, 1998). Remaining sediment may be examined for larger and heavier animals (e.g. gastropods and bivalves).

Identification and counting of macrofauna in each sample may be aided by staining the animals with Biebrich Scarlet and through the use of a dissecting microscope. Macrofauna will be identified to intermediate levels (i.e. class, order or family) and the measures of abundance and species diversity will be recorded. These two variables have been chosen as they have been successfully used in many studies investigating the ecological effects of nutrient producing activities (e.g. sewage pollution) by the means of examining community structures (Underwood & Peterson 1988; Roper, 1990; Underwood & Chapman, 1995). Macrofauna samples will be preserved in buffered formalin in seawater (Underwood & Hoskin, 1999).

Chemical Assessment of Sediments

Sediment samples may be collected using either hand-held corers or using a suitable grab sampler. The same sites and plots used to collect the cores for macrofauna analysis will be used to collect these samples. The cores of sediment will be refrigerated or frozen until analysed in order to prevent microbial degradation.

The amount of carbon in the sediments will be estimated using appropriate analytical techniques by an NATA accredited laboratory.

Video and photo documentation of the seafloor beneath the longlines may also be used to assess the impacts of the Commercial Shellfish Aquaculture Leases on the benthic environment at various stages. Recovery rates following fallowing for example, may be assessed using this technique. These results will also be used to monitor and assess the impact of *in situ* cleaning of biofouling.

3.3 Environmental Management Protocols

Environmental management protocols may be linked to one or more of the above environmental management sub-plans. The protocols will provide direction for reporting, assessment and management and will be further developed upon development approval consent.

3.3.1 Marine Fauna Entanglement Avoidance Protocol

The Marine Fauna Entanglement Avoidance Protocol has been successfully used on other marine based aquaculture farms in NSW and was developed in consultation with NSW Office of Environment and Heritage (NSW OEH). The protocol aims to minimise the threat of entanglement and entrapment of marine fauna in the longline infrastructure, as well as implement prompt and appropriate management if incidences occur in order to maximise successful releases and minimise injuries and stress to marine fauna. Any entanglement events will be recorded in the Marine Fauna Entanglement Report Form (See Attachment 5) and reported to the Entanglement Committee which will be formed to monitor the implementation and effectiveness of this protocol (Table 4).

Table 4: Draft listing of potential Entanglement Committee members.

Representative	Position	Name	Contact details
Lease/Permit Holder	Lease/Permit Holder		
Lease/Permit Holder	Operations Manager		

NSW OEH	Coordinator Marine Fauna Programs	Geoffrey Ross	0411110882 geoff.ross@environment.nsw.gov.au
NSW DPI - Fisheries	Policy Officer	G. Bowley	
NSW DPI - Fisheries	Duty Officers	Various	
NSW Roads & Maritime			
JBMPA	Manager		
NPWS	NPWS State Ops Duty Officer		98957128
NPWS	Coastal Duty Officer		66507124
NPWS	Coordinator, Wildlife Management		

There are a series of requirements that the lease operator/s must adhere to in order to comply with the Marine Fauna Entanglement Avoidance Protocol. Requirements and/or objectives of this protocol include:

- The lease operator/s must take all reasonable action to remedy, alleviate and reduce the incidence of marine fauna entanglements;
- The lease operator/s must conduct regular inspections of anchors, chains, ropes and buoys to ensure compliance with the 'taut rope policy' as the chance of entanglement is greatly reduced if culture equipment is kept taut and is correctly serviced. Regular inspections also promote early detection of entanglements and/or entrapments which increases the chance of successful release of marine fauna and minimises the chance of infrastructure damage;
 - Inspections of longline infrastructure will be conducted from Monday to Friday to ensure compliance with this policy.
 - Rigid rope with a large diameter (not less than 25mm) will be used where practical to assist in the maintenance of taut ropes.
 - Taut ropes and the rigidity of the longline infrastructure should ensure that large fauna (e.g. whales) do not become entangled on the unlikely occurrence that there is direct interaction.
 - Servicing of the longline infrastructure must occur at least once a year.
- The lease operator/s must ensure that there are no loose ropes or other aquaculture gear on any component of the infrastructure;

- The lease operator/s must immediately notify relevant government agencies, including the NSW OEH, if an entanglement incident occurs, including events where the entangled or entrapped animal may have been released (assisted or self released);
- The lease operator/s must develop a response plan to deal with entanglement incidents in consultation with NSW OEH and other relevant departments and organisations;
- The lease operator/s must ensure that a number of staff members receive regular training on wildlife rescue and rehabilitation techniques, as well as conduct response plan drills, to ensure appropriate responses to potential entanglement incidents. Drills should be conducted with the members of the rescue team;
- The lease operator/s must keep a copy of the protocol and the contact details of the entanglement committee members on all service vessels. In the event of an entanglement, the lease operator/s must provide assistance to the entanglement committee, including the rescue team, if required; and
- The lease operator/s must document any incidence of death or injury to marine fauna associated with the infrastructure and activities of the lease/s, including a statement of how the incident occurred and any action taken.

If marine fauna become entangled or entrapped, the main priority with is to assess their condition and determine the most appropriate and safe release method, as well as whether the animal needs to recuperate and further treatment under veterinary supervision (See Attachment 6). In the unlikely event of deceased animals, the carcasses of dead marine fauna will be disposed of appropriately after consultation with the Entanglement Committee. The method of disposal will be determined largely by the size of the carcass. Some carcasses may be kept for scientific purposes (e.g. Australian Museum or other authorised research institutions). The Coordinator, Wildlife Management (NSW OEH) will be contacted to ensure all relevant procedures have been carried out e.g. incident has been record in Marine Fauna Database. A protocol for dealing with marine fauna carcasses will be formed if the proposal is given development approval.

An incident report detailing the time, location, species and the entanglement circumstances, will be prepared and presented to relevant authorities. The protocol and any incident reports will be periodically reviewed to identify any issues of concern or areas of inadequate management, as well as to enable modifications to be made based on field experiences and/or professional advice.

3.3.2 Observer Protocol

The Observer Protocol aims to minimise adverse interactions between the Commercial Shellfish Aquaculture Leases, marine fauna and other waterway users. The Observer Protocol is a key component of the Marine Fauna Interaction Management Plan. Observers must be present during all vessel movements and lease/s activities to minimise the risk of boat strikes and navigational issues, as well as monitor marine fauna interactions. Appropriate distances from marine fauna will be maintained by lease/s service vessels.

Observations of marine fauna interactions with the lease/s and the service vessels will be recorded in the daily log or in the Marine Fauna Interaction/Observation Register (See Attachment 2). Particular attention will be given to the movements of threatened and protected species, migratory species (e.g. humpback and southern right whales) and light sensitive species (if conducting night work), as well as any boat strike incidences, behavioural changes, entanglements and predatory interactions. The protocol, daily log entries and any incident reports will be periodically reviewed to identify any issues of concern or areas of inadequate management, as well as contribute to the assessment of the impacts of the leases.

All records of marine fauna that are observed during the construction and operation stages will be provided to the (i) 'NPWS BioNet Atlas' database, (ii) local NPWS office in Nowra, and (iii) to the local MPA office at Huskisson; for their records.

3.4 Environmental Reporting

Environmental reporting requirements for the Commercial Shellfish Aquaculture Leases will be further developed upon development consent approval but are likely to include the following:

- Water quality monitoring (as required by NSW Food Authority);
- Inspections of longline infrastructure (as required e.g. daily or weekly);
- Observations of marine fauna interactions (daily work log or Marine Fauna Interaction / Observer Register);
- Annual benthic monitoring report;
- Annual marine fauna interactions report;
- Annual navigation incidents report;
- Annual complaints report;
- Annual stock report (including a summary of disease, parasite and pest records);
- Annual WH&S report; and
- Annual structural integrity and stability report.

Checklists will be prepared and maintained by the lease operator/s for environmental inspections (e.g. See Attachment 3) and environmental audits (e.g. See Attachment 4).

3.4.1 Logs and Registers

A number of registers will be maintained by the lease operator/s as part of the operation of the leases. A summary of the matters within the registers will be included in the annual environmental management report. The registers will be further developed upon development approval consent and will include but are not limited to the following:

Daily Work Log

All activities associated with the operation of the Commercial Shellfish Aquaculture Leases are to be recorded in a daily works log which may include:

- General weather observations;
- Maintenance issues;
- Management actions undertaken;
- Records of staff and comments; and
- WH&S issues.

The daily work log may be used as an initial point for data collection prior to completing other logs or registers. As part of the environmental monitoring process, the daily work logs will be summarised and analysed fortnightly to ensure compliance with environmental management plans, monitoring programs and protocols.

Complaints Register

A complaints register will be maintained by the lease operator/s (See Attachment 1). The register will list information such as the following for each complaint:

- Date;
- Person/s receiving the complaint;
- Name, address and contact phone number of person/s making the complaint;
- Specific details of the nature of the complaint; and
- Action undertaken in response to the complaint.

Marine Fauna Interaction / Observer Register

The Marine Fauna Interaction/Observer Register will list information such as the following (See Attachment 2):

- Date;
- Time;

- Fauna species (if known);
- Number of individuals;
- Approximate size;
- Nature of interaction;
- Description of displayed behaviour;
- Management issue; and
- Management actions.

Water Quality Monitoring Register

This register will be in accordance with the requirements of the NSW Shellfish Program which is administered by the NSW Food Authority under the *Food Act 2003*.

3.4.2 Management Reports - Moderate Risk Issues

Management reports will be completed for the three issues identified as representing a 'moderate' risk during the risk assessment, including:

- Water quality and sedimentation;
- Genetics, disease and introduced pests; and
- Entanglement and ingestion of marine debris.

The management reports will incorporate the guidelines provided in Fletcher *et al.* (2004), such as the use operational objectives, indicator levels, performance measures and/or limits, management responses, consideration of external factors that may have an impact, as well as regular evaluation of management, the robustness of indicators, limits etc and possible actions if limits were to become unacceptable.

4 REVIEW

4.1 Annual Review

It is proposed that an annual environment report will be completed at the end of each year. The aim of the report will be to assess environmental and socio-economic impacts of the Commercial Shellfish Aquaculture Leases, evaluate the effectiveness of mitigation, monitoring and management measures, and make modifications to the operation of the leases in accordance with the report findings. The annual environment report will consist of information such as the following:

- Annual water and benthic monitoring report;
- Annual marine fauna interaction/observations report;
- Annual navigation incidents report;

- Annual complaints report;
- Annual diseases, parasites and pests report;
- Annual WH&S report; and
- Annual structural integrity and stability report.

4.2 Environmental Auditing

A program and procedures will be developed for the periodic auditing of the EMP's implementation and effectiveness. The audit will also provide information for the EMP's review. The audit program will cover both internal and external auditing requirements, including scope, methods and frequency, as well as the requirements and responsibilities for conducting the audits and reporting the results.

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6 ATTACHMENTS

Attachment 1 – Complaints Register

Attachment 2 – Marine Fauna Interaction / Observation Register

Attachment 3 - Environmental Inspection Checklist

Attachment 4 - Environmental Audit Checklist

Attachment 5 – Marine Fauna Entanglement Report Form

Attachment 6 – Entanglement Assessment Process

Attachment 7 – Twofold Bay Mussel Farming Monitoring Program

Attachment 1

Complaints Register

No.	Date	Name	Contact details	Nature of complaint	Action taken

Attachment 3

Environmental Inspection Checklist

Date	Time
Inspection Officer:	
Stage: Construction/Installation <input type="checkbox"/> Operation <input type="checkbox"/> Decommissioning <input type="checkbox"/>	

If answer 'No' - please provide comment.

	Question	Yes	No	N/A	Comment
1	Are noise suppression measures adequate and effective?				
2	Are waste disposal containers adequately labelled and covered?				
3	Are good housekeeping/rubbish removal practices being used?				
4	Are navigation buoys and lights operating effectively?				
5	Check: Have personnel including contractors been made aware of environmental protection measures relevant to their respective work?				
6	Check: Is the Complaints Register up to date and is appropriately actioned?				
7	Check: Is the Marine Fauna Interactions/Observer register up to date and is appropriately actioned?				
8					
9					
10					
11					
12					
13					
14					
15					

**Environmental Inspection Checklist
Comments/Corrective Action required:**

Q No.	Detailed comment	Corrective action

Auditor Signature: _____

Corrective actions approved by Lease/Permit Holder as appropriate (if actions required).

Signature: _____ Date: ____/____/201__

Attachment 4

Environmental Audit Checklist

Date	Time
Inspection Officer:	
Research Stage: Installation <input type="checkbox"/> Research <input type="checkbox"/> Decommissioning <input type="checkbox"/>	

If answer 'No' - please provide comment.

	Question	Yes	No	N/A	Comment
1	Is there good knowledge of the emergency response plans?				
2	Is the EMP current and up to date?				
3	Is the environmental monitoring plan effective?				
4	Are environmental incidents and community complaints being investigated and followed up appropriately?				
5	Are preventative and corrective actions being undertaken in an appropriate and timely manner?				
6	Are personnel aware of their responsibilities under the EMP?				
7	Are current waste management practices operating effectively?				
8	Are the current marine fauna interaction mitigation measures working effectively?				
9	Are the communication systems for environmental issues adequate and being adhered to?				
10	Is the frequency of environmental auditing sufficient and of good quality?				
11	Do the current environmental protection practices appear to be appropriate?				

Environmental Audit Checklist
Comments/Corrective Action required:

Q No.	Detailed comment	Corrective action

Auditor Signature: _____

Corrective actions approved by Lease/Permit Holder as appropriate (if actions required).

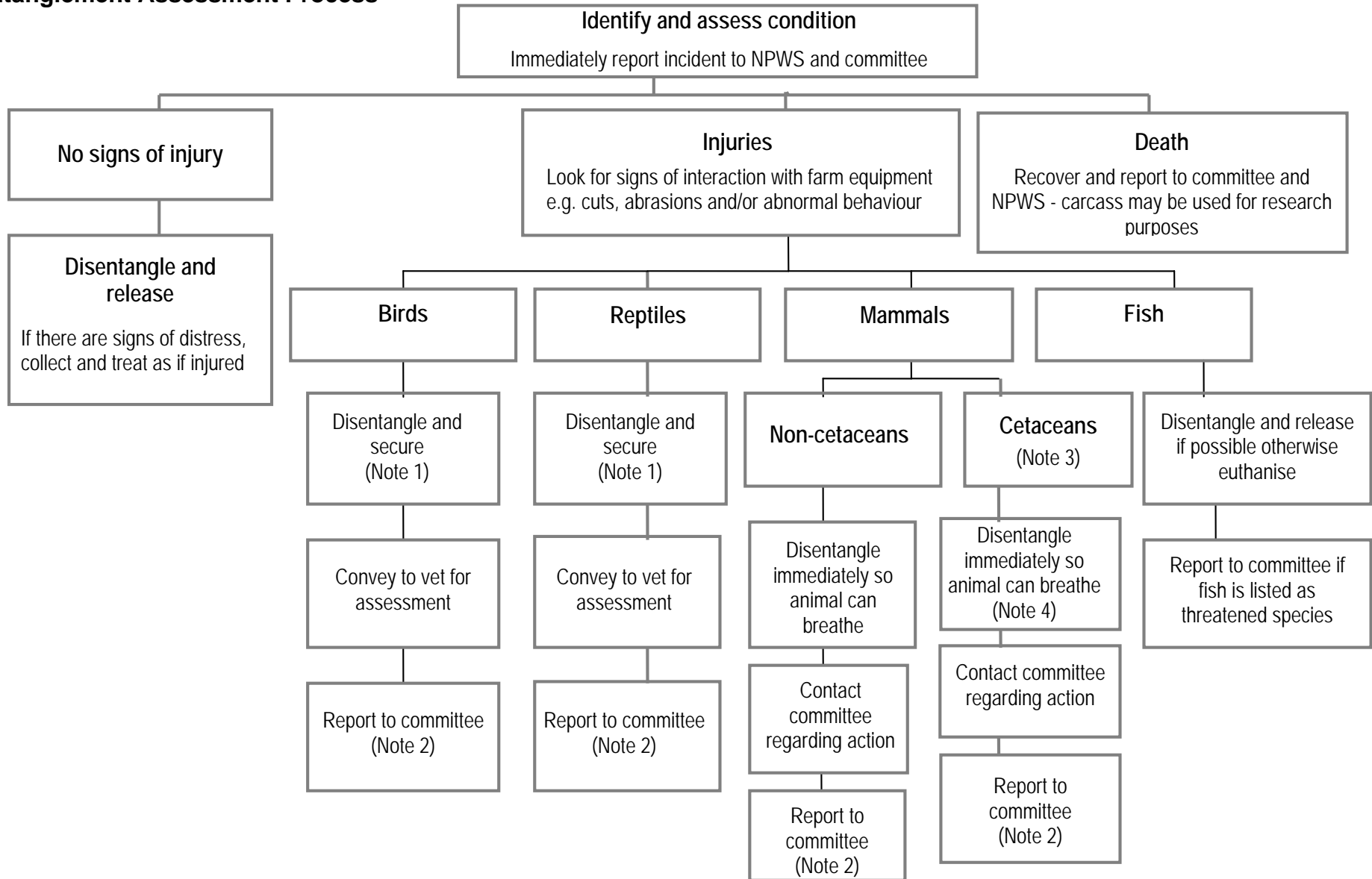
Signature: _____ Date: ____/____/201__

Attachment 5

Marine Fauna Entanglement Report Form

	Date:	Time:
Name of observer/s:	<i>Location:</i> <i>Lat:</i> _____ <i>Long:</i> _____ <i>GPS ref:</i>	<i>Description of location:</i>
Type of species (e.g. whale/dolphin/turtle /fish/bird):	<i>Description of animal</i>	<i>Photo or Video taken (attach if taken)</i> Yes No
Weather conditions:	<i>Other animals present (e.g. sharks)</i>	<i>Animal alive?</i> Yes No
Name of officer contacted (OEH or NSW DPI) Location:	<i>Date:</i>	<i>Time:</i>

Attachment 6 Entanglement Assessment Process



- Note 1:** Secure means hold animal in a dark warm container such as a plastic dive box or insulated bin. For reptiles, the bottom of the container needs to be padded.
- Note 2:** Report means prepare an incident report as detailed as possible stating all circumstances relating to the entanglement event including a veterinary report. The report will be submitted to the committee and relevant authorities.
- Note 3:** Cetaceans that are injured will have lacerations, irregular buoyancy and irregular swimming behaviour.
- Note 4:** When disentangling cetaceans need to be as gentle as possible, suspend in the water and do not handle if possible.

Attachment 7

Twofold Bay Mussel Farming Monitoring Program

The monitoring program provided below has been designed to identify if there are any significant changes to the marine benthic environment due to the presence of the mussel farms. The monitoring program utilises the parameters of Total Organic Carbon (TOC) and benthic fauna in sediments under lease areas and at control sites to monitor any changes that may occur. This monitoring program is reviewed after a period of time that enables a sufficient number of samples to be collected to provide a high degree of certainty that there are no significant long term impacts resulting from the mussel aquaculture activities. If however, during the monitoring program significant impacts are found then appropriate management regimes will be employed to ameliorate these impacts.

Sampling regime

Within Twofold Bay there are three lease areas which have two associated control sites. Six samples are collected at each site for both TOC and benthic fauna, which results in a total of 12 samples per site. Thirty six samples are collected per lease area and the associated control sites (i.e. 18 TOC samples and 18 benthic samples). These samples are taken annually at a nominated time of the year and in accordance with methods approved by Fisheries NSW. Aquaculture permit holders are required to provide appropriate facilities to fix, label and store all samples in a secure location approved by Fisheries NSW.

Processing of samples

Prior to the processing of any samples the aquaculture permit holder has to provide details of the laboratory/s to be utilised for processing of samples, for approval by Fisheries NSW.

The aquaculture permit holder is to have three of the six lease samples and three of the samples from each of the two control sites analysed for TOC annually. The result of this analysis is to be forwarded to Fisheries NSW for consideration. If a significant impact is found from the initial analysis then the remaining three samples from each site are to be analysed for TOC by the permit holder. If it is determined from the results of this further TOC analysis that a significant impact has occurred then the fauna benthic samples are required to be analysed and the results provided to Fisheries NSW. If it is determined from the analysis of the benthic fauna samples that a significant impact has occurred then appropriate management regimes will be employed to ameliorate these impacts. The diagram below outlines the process above.

