

Code of Practice for the Environmental Management of the South Australian Oyster Farming Industry



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South Australian Oyster Farming Industry

*Environment Protection Authority
South Australia*

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CONTENTS

1.	Introduction	1
2.	About this Code	3
2.1	Purpose and application of this Code	3
2.2	Benefits of using this Code.....	3
2.3	Compliance with the Code	3
2.4	Other relevant and important legislation	4
3.	Relevant environmental issues	5
4.	Achieving best practice environmental management.....	6
4.1	Water quality.....	6
4.2	Noise.....	8
4.3	Air quality	9
4.4	Solid waste disposal	10
4.5	Controlled substances	12
4.6	Ecological effects.....	13
5.	Background to relevant environmental issues.....	15
5.1	Water quality.....	15
5.2	Noise.....	16
5.3	Air quality	17
5.4	Solid waste disposal.....	17
5.5	Storage, use and disposal of controlled substances	18
5.6	Ecological effects.....	19
	Glossary and abbreviations	21
	Appendix Environment protection legislation	23
	Bibliography	24

1. INTRODUCTION

The oyster industry in South Australia began in the 1940s with the culture of native flat oysters, *Ostrea angasi*. Today, the industry is a profitable and operationally diverse industry that specialises in the culture of the Pacific oyster, *Crassostrea gigas*.

Pacific oyster culture methods vary from farm to farm, with growers using either the rack and rail method, longlines, or a combination of the two to grow oysters. Oysters are grown in either intertidal or subtidal marine zones, with post-harvest activities taking place predominantly at land-based facilities.

Although many aspects of Pacific oyster farming vary in different farms, there are a number of environmental issues that are relevant to the sector as a whole. These are typically associated with the operation of the farm or the land-based service facility. If the farm is designed or managed inappropriately, there is potential for environmental harm.

Every oyster grower has a general environmental duty, as described in section 25 of the *Environment Protection Act 1993* (the Act), to avoid causing environmental harm. A code of practice offers a set of guidelines containing specific requirements, advice and information that describe how a person undertaking a particular activity (e.g. oyster farming) can comply with their general environmental duty.

The objectives of the *Code of Practice for the Environmental Management of the South Australian Oyster Farming Industry* (the Code) are to highlight the environmental issues relevant to oyster farming and to provide recommendations to assist growers to meet their legislative requirements under relevant environment protection policies (EPPs) and the Act. Figure 1 illustrates the links between codes of practice, EPPs and the Act.

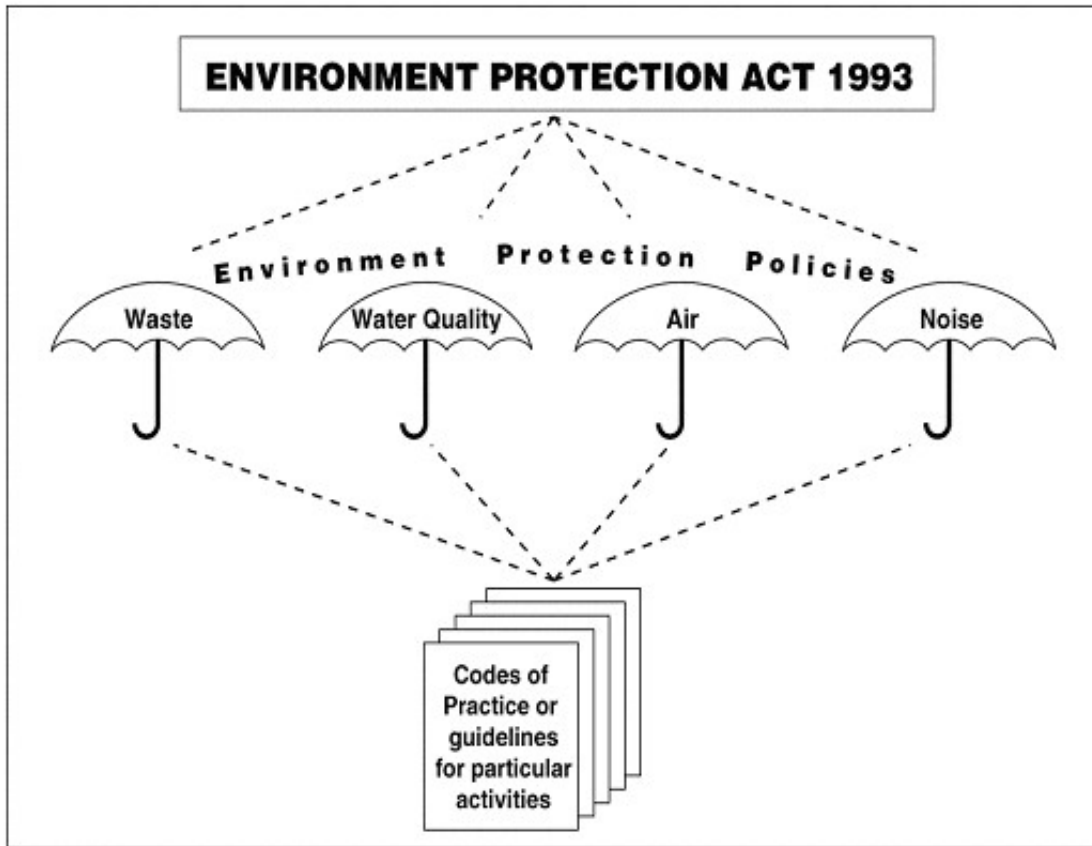


Figure 1 Links between codes of practice, EPPs and the Act

2. ABOUT THIS CODE

2.1 Purpose and application of this Code

The principal purpose of this Code is to assist oyster growers to comply with the provisions of relevant legislation and EPPs developed by the Environment Protection Authority (EPA) and, in doing so, ensure that oyster farming activities do not cause environmental harm.

This Code is applicable to the management of all relevant environmental issues associated with land-based and sea-based oyster farming operations in South Australia.

Codes of practice (in general) are outcome based and not prescriptive. This allows growers to continue their own individual methods of farming oysters as long as the overall environmental objectives of the Code are met.

2.2 Benefits of using this Code

By law, all aquaculture licence holders must ensure that their operations comply with the Act.

In general, the purpose of EPA codes of practice is to assist industries, businesses and the community comply with the Act. By applying this Code, oyster growers should be able to satisfy their obligations under the Act and thus the relevant EPPs (see Bibliography).

Additional benefits to growers in applying the Code may include:

- improved business profile
- cost savings through increased efficiency
- increased customer patronage
- improved environmental conditions for everyone.

2.3 Compliance with the Code

Non-compliance with this Code is not, in itself, an offence. However, growers are still required by law to ensure that their operations comply with the Act and relevant EPPs.

Failure to comply with this Code may result in the issuing of an Environment Protection Order (EPO). EPOs typically require a grower to take specified action within a certain period of time. Failure to comply with an EPO can lead to prosecution.

Equally, compliance with this Code indicates a grower has taken reasonable and practicable measures to prevent or minimise environmental harm, thereby complying with their general environmental duty in accordance with section 25 of the Act. For further legislative information see the Appendix.

2.4 Other relevant and important legislation

The primary legislation controlling aquaculture activities in South Australia is the *Aquaculture Act 2001*. The Aquaculture Act is administered by Primary Industries and Resources SA (PIRSA), which manages aquaculture licensing and other functions, several of which are environmentally focused. Consequently, in parallel with this Code, all oyster growers are required to meet all legislative requirements including those specified in their aquaculture licence.

Every aquaculture licensee must undertake or participate in, as the case requires, an environmental monitoring program (EMP) approved by the Minister for Agriculture, Food and Fisheries in consultation with the EPA.

EMPs specific to the subtidal and intertidal oyster farming industry may include reporting on:

- the presence of uncultured oysters
- the incidence of shellfish disease
- interactions with large marine vertebrates
- the benthic assemblage.

EMPs specific to land-based oyster hatcheries may include reporting on:

- medicine and chemical usage
- disease incident management
- wastewater discharge (volume and quality).

3. RELEVANT ENVIRONMENTAL ISSUES

Oyster farming is a primary industry, thus many general environmental issues applicable to other primary industries may also apply to oyster farming.

Principally, the two components of oyster farming that need to be considered when developing an environmental code of practice are:

- sea-based production—the growing environment
- land-based service facility (i.e. depot) for servicing sea-based production and undertaking post-harvest production.

For both components, the broad environmental parameters that are of particular legislative concern¹ to the EPA include:

- water quality
- noise
- air quality
- solid waste disposal
- storage and disposal of controlled (hazardous) substances
- ecological effects.

Specific issues associated with each parameter are discussed in section 4, together with information that aims to assist growers to achieve best practice environmental management and consequently meet their general environmental duty.

Section 5 provides supporting information on each environmental parameter in the Code.

¹ Either through objects of the Act or relevant EPPs

4. ACHIEVING BEST PRACTICE ENVIRONMENTAL MANAGEMENT

The practical information in this section should allow oyster growers to comply with the Act and ultimately achieve best practice for environmental management.

The environmental issues most relevant to the oyster farming industry are briefly discussed below, as are operational requirements used to appropriately address each issue. More detailed information about each environmental issue can be found in section 5.

Two key words used throughout this section are 'MUST' and 'SHOULD'.

'Must'—the use of the word 'must' indicates a requirement² in this Code, which if ignored, is likely to lead to a breach of relevant environment protection policies.

'Should'—the use of the word 'should' indicates a recommended practice.

Not all of the operational requirements listed will be applicable to all growers; some growers may already use similar practices that achieve the same environmental objective. However, there will almost certainly be practices that may be implemented on every farm.

4.1 Water quality

Objective: To take all reasonable and practicable measures to prevent the discharge or deposit of pollutants into the State's marine, estuarine and inland waters

Relevant documents

Environment Protection Act 1993

Aquaculture Act 2001

Environment Protection (Water Quality) Policy 2003

Stormwater Pollution Prevention Codes of Practice for the Community, & Building and Construction Industry

EPA Guideline: *Bunding and spill management*

EPA Guideline: *Copper chromated arsenate (CCA) timber waste—storage and management*

EPA Guideline: *Wastewater and evaporation lagoon construction*

The protection of water quality is relevant to both land-based and sea-based oyster operations.

Issues for land-based facilities include inappropriate disposal of effluent and contamination of stormwater.

Sea-based issues include the deposition of pollutants such as human wastes, antifoulants, treated timber leachates and oyster faecal material (biodeposits).

² A requirement under the Environment Protection Act. Other legislation, such as the Aquaculture Act, also contains requirements that are not specified in this document.

Operational requirements and advice

Sea-based

- Farmers must:**
- not use any form of treated timber other than copper-chrome-arsenic (CCA) without approval from the EPA
 - not use any type of antifoulant (chemical or biological) on oysters or sea-based infrastructure without approval from the EPA
 - not deposit or discharge human waste (sewage) into any waters.
- Farmers should:**
- not stock oysters at a rate such that the accumulation of faecal matter (biodeposits) exceeds the capability of the site to disperse this material
 - construct and position infrastructure so as not to inhibit dispersal of biodeposits through natural tidal flow or predominant water current, e.g. by ensuring sufficient distances between growing lines
 - recognise the global trend towards prohibiting the use of CCA-treated timber for residential and, in some instances, marine and agricultural uses
 - investigate alternatives to treated timber for construction of infrastructure.

Land-based

- Farmers must:**
- prevent general rubbish and refuse from entering the stormwater system
 - store new treated timber posts in a manner that prevents leachates contaminating surface and ground water (e.g. protected from weather elements)
 - contain and use fuels, oils, etc. in a manner that prevents spillage/runoff and consequent contamination of stormwater (see section 4.5)
 - ensure equipment (e.g. oyster baskets) and vehicles are cleaned within an area that is designed to:
 - contain all wastewater likely to pollute stormwater
 - exclude entry of stormwater runoff
 - ensure vehicle and vessel refuelling practices prevent fuel, and cleaning water from fuel dispensing, from being discharged directly or indirectly to stormwater
 - ensure, when an antifoulant is used on vessels, it is applied in accordance with clause 22 of the Water Quality Policy
 - ensure all stormwater runoff from hardstand areas (e.g. concrete car parks) is diverted into a stormwater treatment system capable of removing litter, sediment and oil products

- if a waste control system (e.g. septic) is installed, ensure it is maintained in a manner that prevents discharge to the environment.
- Hatcheries must:
- treat land-based effluent (e.g. from settlement ponds, tanks) sufficiently to ensure that receiving waters do not contravene water quality criteria set by the EPA, nor cause environmental harm
 - where applicable, construct wastewater settlement ponds in compliance with the Water Quality Policy (see provisions in EPA Guideline: *Wastewater and Evaporation Lagoon Construction*).
-

4.2 Noise

Objective: To minimise the impact of noise on surrounding property owners and other resource users

Relevant documents

Environment Protection Act 1993

Draft Environment Protection (Noise) Policy (Noise EPP)

EPA Guideline: Pressure water blasting activities

Excessive noise is considered to be environmental harm or nuisance under the Act. Consequently, all oyster operations should strive to ensure that noise generated from any activity is minimised.

Operational requirements and advice

- Farmers must:
- use high-pressure water guns only between 7 am and 7 pm Monday to Saturday, and 9 am and 7 pm on Sundays or public holidays. This is applicable when the guns are being used within a noise sensitive zone (e.g. residential) or when the activity is located close enough to a noise sensitive zone to affect the amenity of the area
 - limit construction work to between 7 am and 7 pm Monday to Saturday, and 9 am and 7 pm on Sundays or public holidays. This is applicable when construction is being conducted within a noise sensitive zone (e.g. residential) or when the activity is located close enough to a noise sensitive zone to affect the amenity of the area
 - take all reasonable and practicable steps to minimise the adverse effect noise may have on neighbouring premises.

- Farmers should:**
- undertake land-based oyster farming activities only in areas that have been granted permission by local planning authorities
 - not allow high-pressure water cleaning against structures, such as corrugated iron fences, which are likely to exacerbate noise from the cleaning equipment
 - be mindful of the need for peace and quiet of other inhabitants
 - ensure mechanical equipment, vessels and vehicles are serviced regularly and maintained to minimise noise output.
-

4.3 Air quality

Objective: To protect and enhance air quality by minimising odours and burning-related outputs

Relevant documents

Environment Protection Act 1993

Environment Protection (Air Quality) Policy 1994

Environment Protection (Burning) Policy 1994

Air pollution is defined as the emission of particles and gases, including dust, offensive odours and burning-related odour and smoke. Oyster farming can contribute to poor air quality by the inappropriate disposal of wastes such as biofouling and mortalities, and by incinerating wastes.

Offensive odours and burning may be considered environmental harm or nuisance under the Act.

Operational requirements and advice

- Farmers must:**
- clean oyster baskets, etc. in a location and manner that allows the effective collection and disposal of biofouling and debris (see section 4.4)
 - ensure that stock mortalities and biofouling wastes are contained in enclosed receptacles and disposed of on a regular basis
 - ensure that biofouling from high-pressure cleaning activities is collected and disposed of appropriately (e.g. by high-pressure cleaning directly adjacent to a backdrop that limits distribution of debris)
 - ensure that driveways and main traffic areas of a land-based facility are adequately maintained to minimise dust
 - obtain local council consent under the Burning EPP before burning rubbish or other material (e.g. hardwood timber) on site
 - not burn treated timber waste under any circumstances
 - control dust emissions from the site so as to minimise any adverse effect on the amenity value of an area.

- Farmers should:
- ensure that only equipment that has been cleaned is stacked or stored on land for later use
 - if possible, recycle or reuse waste material instead of burning
 - be familiar with burning restrictions throughout the year.
-

4.4 Solid waste disposal

Objective: To minimise the impact that solid wastes may have on the environment

Relevant documents

Environment Protection Act 1993

Environment Protection (Water Quality) Policy 2003

Stormwater Pollution Prevention Codes of Practice for the Community, & Building and Construction Industry

EPA Guideline: *Pressure water-blasting activities*

EPA Guideline: *Bunding and Spill Management*

EPA Guideline: *Copper chromated arsenate (CCA) timber waste—storage and management*

The three main solid waste products produced by oyster farming are:

- putrescible materials (organic waste such as biofouling and oyster shells)
- office refuse (food wrappers, cigarette butts)
- building and construction materials (oyster baskets and treated timber waste).

Best practice solid waste disposal includes reuse, recycling and the appropriate storage and management of solid wastes. The improper disposal of solid wastes may lead to a variety of pollution concerns, most notably contamination of stormwater and land.

Operational requirements and advice

- Farmers must:
- store solid wastes in appropriate waste storage receptacles that are:
 - covered to prevent stormwater contamination
 - sealed to prevent leakage of putrescible waste
 - located on hard-standing areas that prevent waste entering surface or ground waters
 - not used for oils, solvents, paint materials, flammable substances, toxic materials and sludges
 - ensure solid waste is disposed of to licensed waste depots, e.g. landfill (unless the waste can be recycled or re-used without causing environmental harm)
 - not bury solid wastes on site (on-site waste disposal requires an EPA licence)
 - collect and dispose of all putrescible materials (e.g. barnacles) generated from farming activities in enclosed receptacles and, if unsuitable for recycling, have them

removed by a licensed waste contractor or taken to appropriately licensed waste depots on a regular basis to control offensive odours

- not bury putrescible materials on site, or discard/dispose of them at sea
- not burn treated timber waste (other hardwood timbers may be burnt providing local council approval is obtained)
- ensure that all waste (including shells) collected at sea is disposed of in appropriate waste collection receptacles and deposited at land-based licensed waste depots
- ensure that material stockpiled for building and construction is prevented from entering the stormwater system, e.g. by wind or rain erosion.

Farmers should:

- adopt the principles of the waste management hierarchy: avoid, minimise, re-use, recycle, recover, treat and only then dispose of waste
 - dismantle or shred discarded plastic oyster baskets to reduce the area they occupy in licensed waste depots
 - develop waste disposal plans that clearly describe the responsibility for collection, storage and regular removal of solid waste
 - recycle or re-use treated timber waste, putrescible materials, and building and construction materials whenever possible
 - promote the collection of recyclable and reusable wastes
 - ensure that all staff are trained and understand which wastes can, and cannot, be deposited in receptacles
 - investigate methods of re-using putrescible waste, e.g. by inclusion in commercial fertilisers.
-

4.5 Controlled substances

Objective: To minimise the impact that controlled substances may have on the environment during their use, storage and disposal

Relevant documents

Dangerous Substances Act 1979

Controlled Substances Act 1984

Environment Protection Act 1993

Stormwater Pollution Prevention
Codes of Practice for the
Community, & Building and
Construction Industry

EPA Information: *Household
hazardous waste – management
and disposal*

EPA Guideline: *Bundling and spill
management*

The majority of controlled substances used by the oyster farming industry are found on land, at either service depots or oyster hatcheries, and include:

- fuel
- oil and grease
- cleaning chemicals, such as chlorine, hydrogen peroxide.

At times, veterinary chemicals and drugs are stored and used during oyster hatchery production. These substances must be treated as hazardous and should be stored and disposed of in a manner that prevents land and water (especially stormwater) contamination.

Operational requirements and advice

- Farmers must:
- not allow any direct or indirect (e.g. from hosing down spills) discharge of controlled substances to the stormwater system from land-based cleaning operations or processes
 - ensure that areas where controlled substances are frequently used are covered and associated floor drainage is isolated from the stormwater system by surface grade changes, bunds and/or catch drains
 - ensure that areas where controlled substances are stored are bunded and, where appropriate, enclosed; and, for large quantities of liquid chemicals, the bunded area is impervious and able to contain 120% of the volume of the largest container within the bund
 - ensure that rubbish skips are not used for disposal of oils, solvents, flammable or toxic materials, including paint
 - ensure that all controlled wastes are regularly removed by a licensed contractor and treated by a facility licensed by the EPA to manage these wastes
 - not attempt to refuel vessels at sea or a launching site, unless refuelling occurs at a refuelling facility approved by Transport SA.

- Hatcheries must:**
- ensure that wastewater containing veterinary chemicals—including therapeutic, prophylactic or antifoulant chemicals or drugs—is disposed of separately from other wastewater, e.g. by isolating treatment tanks so that wastewater can be collected and disposed of separately.
- Farms and hatcheries should:**
- adopt principles of the waste management hierarchy: avoid, minimise, re-use, recycle, recover, treat and only then dispose of waste
 - ensure that staff access to controlled substances is limited and that appropriate staff are trained in correct storage, handling and emergency procedures
 - provide appropriate clean-up materials and spill kits
 - contact a licensed disposal contractor, manufacturer or prescribing veterinarian for information about appropriate disposal of unwanted veterinary chemicals
 - prepare emergency spill response plans to deal with controlled and/or potentially polluting material spills, and induct new and existing staff to these plans.

Note: The EPA operates a Hazardous Household Waste Depot which accepts numerous controlled substances from primary producers and householders (tel. 8204 2004 or Freecall 1800 623 445 for more information). Additionally, ChemClear, an industry based chemical waste disposal program, provides a collection and disposal service for chemical users in Australia. Contact ChemClear on 1800 008 182, or visit the web site <www.chemclear.com.au> for further information.

4.6 Ecological effects

Objective: To protect South Australia's aquatic ecology through appropriate oyster farming techniques and procedures

Relevant documents

*Environment Protection Act
1993*

Aquaculture Act 2001

Potential environmental issues relevant to sea-based oyster farming activities may be described under two broad headings:

- aquatic pests, including:
 - uncultivated oysters
 - introduced aquatic pests
- ecological health, including:
 - carrying capacity
 - seagrass impacts
 - sand accretion/scour.

These issues are dealt with under legislation other than the Environment Protection Act and are thus not listed in the following 'Operational requirements and advice' as

mandatory (MUST) requirements. Nonetheless, farmers must comply with other relevant statutes³.

Operational requirements and advice

- Farmers should:**
- avoid practices that disturb or remove seagrass (e.g. excessive shading, boat propeller scour, excessive trampling)
 - comply with any development or activity limitation imposed to protect carrying capacity of a growing region
 - construct and position oyster culture infrastructure so as to prevent sand accretion and/or scour
 - consider the impacts of vehicles and vessels on sensitive coastal areas and the plants and animals these areas support.
-

³ For example, the Aquaculture Act

5. BACKGROUND TO RELEVANT ENVIRONMENTAL ISSUES

This section aims to provide growers with detailed explanations for the inclusion of each environmental issue (section 4) in this Code of Practice.

5.1 Water quality

There are two broad water quality issues associated with oyster farming activities: pollutant discharge and wastewater disposal.

Discharge of pollutants is generally linked to sea-based oyster farming activities, while wastewater disposal is almost wholly related to land-based activities.

Pollutants

The *Environment Protection (Water Quality) Policy 2003* (Water Quality Policy) states that a person must not cause environmental harm⁴ by discharging or depositing a pollutant into any waters.

Any material or substance in the form of a solid, liquid or gas that is directly or indirectly deposited or discharged to any waters is classified as a pollutant under the Water Quality Policy. Pollutants that may emanate from oyster farming activities include:

- ***treated timber leachates (e.g. from CCA-treated timber)***
Recent Australian research indicates that there is insufficient evidence to suggest that CCA-treated timber leachates pose an unreasonable risk to the marine environment. However, because of the considerable concern about the impact that disposal of treated timber to landfill and its inappropriate storage can have on soil and waters, the EPA does not encourage the use of treated timber for sea-based infrastructure, though it does not oppose its use.
- ***biodeposits (oyster faecal material)***
Biodeposition is considered to be a pollutant and excessive amounts can lead to an increase in fine sediment suspended in the water and/or on the seabed, both of which can adversely affect the benthic environment (particularly aquatic vegetation).
- ***application of antifoulants***
The application of any type of antifoulant to oyster infrastructure (including oysters themselves) is opposed by the EPA until such time as sufficient evidence exists to indicate that their use will not cause environmental harm.

The Water Quality Policy specifies the requirements for persons applying antifoulants to vessels. This includes compliance with the *Code of Practice for Antifouling and In-water Hull Cleaning and Maintenance* (ANZECC 1997).

⁴ A list of potential environmental harm is specified in the Water Quality Policy.

Wastewater disposal

The Water Quality Policy defines wastewater as 'effluent and contaminated stormwater'.

Wastewater, in any form, is not to be discharged into any waters (surface and underground) or onto land in a place from which it is reasonably likely to enter waters (including surface, underground and stormwater).

In the context of oyster farming, wastewater disposal is typically only applicable to land-based depots and hatchery facilities.

Effluent

The various forms of effluent that may be produced by land-based oyster farming are presented in the following table.

	Type of land-based facility	
	Service depot	Hatchery
Effluent (1)	Wastewater in the form of human sewage	Wastewater direct from tanks
Effluent (2)	Wastewater as a result of oyster processing (where applicable)	Wastewater held in settlement ponds (also known as lagoons)

Effluent originating from oyster hatcheries may be contaminated by a variety of pollutants, depending on the operational and production practices of the hatchery. Some of these contaminants may include veterinary drugs, and chemicals such as disinfectants.

Stormwater (contaminated)

Stormwater includes rain that runs from roof-tops and buildings down gutters, into drains under the road and then into natural waterways. Thus land-based oyster facilities have the potential to pollute stormwater through:

- inadequate containment of fuels/diesel/oil/grease
- building construction or demolition waste
- leachates from new treated timber posts
- detergents/washdown water
- inadequate containment of general rubbish (e.g. food scraps, cans, bottles, plastic items or materials).

5.2 Noise

A balance needs to be found between the interests of those whose legitimate activities cause noise, and those who are exposed to and affected by the noise (Noise EPP).

Noise issues are particularly relevant to land-based oyster service facilities and hatcheries which use a variety of equipment and practices that emit noise, such as:

- heavy machinery and vehicles
- high-pressure cleaning guns
- sorting and grading equipment
- pumps and generators.

Local government development plans regulate where land-based oyster farming facilities can and cannot be established. Regardless of where land-based depots are situated, oyster farmers can take common sense steps towards minimising noise and avoid being a nuisance to others.

5.3 Air quality

Air quality, with respect to oyster farming, typically relates to odours emanating from land-based facilities or, less frequently, smoke and odour as a result of burning. Both odour and burning may be deemed a nuisance or environmentally harmful under the Act.

Odours

Sea-based oyster farms are not known to emit odours. However, land-based facilities may emit odours from inappropriate disposal of biofouling and stock mortalities. Consequently, growers should be aware that odours are a form of air pollution and that particular procedures can substantially reduce the emission of odours.

Burning

Burning of rubbish or other materials is not a part of normal oyster farming production procedures. However, farmers may be tempted to burn items such as garden clippings, treated timber and office refuse at certain times.

The burning of treated timber is not permitted under any circumstances.

Burning restrictions on other materials depend on whether the premises are domestic or non-domestic. Oyster farming premises are considered non-domestic. Apart from a few exceptions, a person must not cause or permit burning in the open on any non-domestic premises without a permit granted under the Burning EPP.

5.4 Solid waste disposal

The improper disposal of solid wastes may lead to a variety of pollution concerns, most notably contamination of stormwater and land. In order to adequately prevent stormwater contamination, waste storage and collection areas must be roofed to prevent stormwater access. If it is not possible to roof existing facilities, covered receptacles (e.g. rubbish skips) must be used to prevent stormwater entry or dispersal by wind.

The on-site disposal of wastes (e.g. in pits) is prohibited unless a licence is obtained under the Act.

Solid wastes relevant to oyster farming include office refuse, putrescible materials and building and construction waste.

Office refuse

Office refuse includes drink containers, food scraps and food wrappers, papers, and cigarette butts.

Putrescible materials

Putrescible materials include items such as stock mortalities, empty shells, biofouling and, in some instances, processed solids.

Appropriate disposal of putrescible materials is essential. Apart from stormwater contamination, inappropriate disposal may result in the emission of offensive odours (see section 5.3) and pest attraction.

Building and construction materials

On many aquaculture farms, building and construction of oyster farming infrastructure (e.g. oyster racks and baskets, and use of treated timber) is an ongoing activity. Building and construction materials should be reused or recycled wherever possible. Disposal, if required, should be based on preventing stormwater and land pollution (see section 5.1).

5.5 Storage, use and disposal of controlled substances

The main environmental concern in the use of controlled substances⁵ is the potential for stormwater and land contamination. Other legislation⁶ governs appropriate use and storage of hazardous (controlled) substances to avoid adverse human health and general environmental impacts.

Typically, the controlled substances that may be used for oyster farming include:

- fuel (vehicle and vessel)
- oil and grease
- radiator coolants
- cleaning chemicals, such as chlorine, hydrogen peroxide.

Most of these substances are found on land, at either service depots or oyster hatcheries.

In addition, there may be times when veterinary chemicals and drugs are stored and used during oyster hatchery production. These substances must be treated as hazardous and should be stored and disposed⁷ of appropriately (see section 4.5).

⁵ Controlled substances include 'Listed wastes' as defined by the Act.

⁶ The *Dangerous Substances Act 1979* and the *Controlled Substances Act 1984* regulate the keeping, handling, conveyance and use of dangerous and controlled substances and provide directives on how the substances must be stored and disposed of.

⁷ The EPA operates a Hazardous Household Waste Depot which accepts numerous controlled substances from primary producers and householders. Alternatively, ChemClear, an industry based chemical waste disposal program, provides a collection and disposal service for chemical users in Australia (section 4.5).

5.6 Ecological effects

Some oyster farming practices, if managed inappropriately, may result in longer-term aquatic ecological impacts. Several policies and protocols already exist aimed at preventing each of these impacts.

Aquatic pests

Uncultivated oysters

The vast majority of oyster species farmed in South Australia are Pacific oysters, which are not endemic to Australia. They were first introduced to Tasmania and South Australia from Japan, and the resulting establishment of 'feral' or uncultivated oysters has prompted a continuing debate in Australia.

There is evidence in some states of Australia that uncultivated Pacific oysters foul foreshores and compete for space and food with other shellfish species. In South Australia uncultivated oyster numbers are limited, probably by unsuitable environmental conditions (Madigan and Clarke 1998). Nevertheless, it is critical that populations of uncultivated oysters do not become established.

Introduced aquatic pests

The introduction of aquatic pests has the potential to cause significant long-term ecological harm to the marine environment and consequent adverse economic consequences for those who earn their living from it.

Presently, most of South Australia's Pacific oyster spat is imported from Tasmania. Given that a number of aquatic pests inhabit Tasmania, if growers are not vigilant and do not comply with relevant PIRSA translocation policies, the potential exists for these pests to be transferred with spat to South Australian waters.

Three exotic species of particular relevance to oyster spat importation include:

- mudworm (*Boccardia knoxi*)
- seastar (*Asterius amurensis*)
- Japanese seaweed (*Undaria pinnatifida*).

Ecological health

Carrying capacity

Pacific oysters are filter feeders—they obtain most of their nourishment from naturally occurring phytoplankton. The amount of phytoplankton in a given waterbody will determine how many shellfish, and consequently other aquatic animals and plants, it can sustain in the long term. This biological process is broadly known as the carrying capacity of a waterbody.

Over-stocking of oysters can seriously affect phytoplankton availability for other aquatic animals and plants. In a small, localised area this is considered to be exceeding 'carrying capacity' and can affect the economic return of a particular farm. The larger flow-on effect is the potential to exceed the carrying capacity of a whole bay, whereby total productivity of a bay is reduced to the point where its ecological balance is disrupted.

In the interests of ecological and economic sustainability, oyster growers should ensure their stocking practices do not contribute to the decline of the carrying capacity in an area.

Seagrass impacts

Seagrass in the near vicinity of oyster farms may be affected by inappropriate farming techniques.

Physical shading of seagrass by aquaculture infrastructure can lead to seagrass loss by reducing light below necessary levels. A report by Madigan *et al.* (2000) indicates that the traditional 'rack and rail' system of intertidal oyster culture can adversely affect seagrass health and survival.

Loss of seagrass from trampling under foot has also been raised as a potential impact of intertidal oyster farming. The most recent scientific report dealing with this topic (Madigan *et al.* 2000) concluded that trampling was not a key factor in the reduction of seagrass in a particular oyster growing area. Nonetheless, it is important for growers to understand the high sensitivity of seagrass to human interference.

The impact of vehicle wheels and boat propellers on sensitive ecological areas, particularly on seagrass, is an observable environmental impact of oyster growing. This is particularly true in isolated areas where there are limited boat launching facilities and growers choose to launch boats from the foreshore. The issue is relevant to recreational and commercial fishers as well as aquaculturists.

Sand accretion/scour

The presence of inappropriately positioned sea-based infrastructure can potentially disrupt local hydrodynamics. This may lead to the removal or deposition of excessive sand and consequently adverse impacts on the benthic environment.

GLOSSARY AND ABBREVIATIONS

Term	Definition/Explanation
<i>(the) Act</i>	<i>Environment Protection Act 1993</i>
<i>biofouling</i>	the unwanted settlement of aquatic organisms, such as molluscs and bryozoans, on structures that are immersed in water; it can occur in both marine and freshwater environments but is considered a major problem in various marine industries
<i>bund</i>	a wall, moat or other device which is graded or contains graded drains, or combines the two, which is designed to prevent the escape of spilt materials and to exclude stormwater runoff
<i>copper-chrome-arsenic (CCA)</i>	timber treatment or preservative
<i>controlled substances</i>	includes any substances defined within the Controlled Substances Act, and also includes any hazardous substances or wastes listed in the Environment Protection Act or relevant EPP's
<i>effluent</i>	wastewater originating from land-based oyster service facilities and/or hatcheries
<i>environmental harm</i>	'any harm, or potential harm, to the environment (of whatever degree or duration), and includes an environmental nuisance' (the Act); each EPP defines relevant environmental harm differently—for example, in the Water Quality EPP it may be a reduction in numbers of any native species of aquatic animal or insect caused by pollution; in the Noise EPP it may be excessive noise emanating from construction works
<i>Environment Protection Policy (EPP)</i>	a legislative tool provided for by the Act to address environment protection matters. It can be made for any purpose directed towards securing objects of the Act
<i>EPA</i>	South Australian Environment Protection Authority
<i>general environmental duty</i>	'A person must not undertake an activity that pollutes, or might pollute, the environment unless the person takes all reasonable and practicable measures to prevent or minimise any resulting environmental harm.' (section 25 of the Act)
<i>Listed wastes</i>	defined by the Act, Schedule 1 Part B
<i>PIRSA</i>	Department of Primary Industries and Resources South Australia

Term	Definition/Explanation
<i>pollutant</i>	(a) any solid, liquid or gas (or combination thereof) including waste, smoke, dust, fumes and odour; or (b) noise; or (c) heat; or (d) anything declared by regulation to be a pollutant; and includes waste (as defined by the Act; Schedule 5 of the Water Quality EPP lists pollutants)
<i>putrescible</i>	component of the waste stream liable to become putrid
<i>water quality criteria</i>	The Water Quality Policy sets upper and lower limits to numerous potential wastewater pollutants in receiving waters; their levels must not exceed or further exceed the given values. For example, zinc levels in effluent must not exceed 0.5 mg/L if discharging into marine ecosystems and other waters.
<i>Environment Protection (Water Quality) Policy 2003 (Water Quality Policy)</i>	policy developed by the EPA in relation to impacts upon water quality which clarifies the obligation imposed by section 25 of the Act (general environmental duty) on any person in South Australia undertaking an activity that pollutes or might pollute

APPENDIX—ENVIRONMENT PROTECTION LEGISLATION

The principal legislation addressing pollution in South Australia is the *Environment Protection Act 1993* (the Act). In particular, section 25 imposes a general environmental duty on all persons undertaking an activity that may pollute to take all reasonable and practicable measures to prevent or minimise any resulting environmental harm.

The Act provides for legislative tools in the form of Environment Protection Policies (EPPs) to address environment protection matters. At present, there are a number of EPPs in place that address issues such as the production of noise, stormwater contamination and air pollution. Every person, business and industry, including aquaculture, is legally bound to comply with the Act and consequently with relevant EPPs.

Of particular relevance to both sea-based and land-based aquaculture is the *Environment Protection (Water Quality) Policy 2003* (Water Quality Policy), which aims to achieve the sustainable management of South Australian waters by protecting or enhancing water quality while allowing economic and social development. The Water Quality Policy:

- sets water quality objectives by identifying protected environmental values and corresponding water quality criteria
- provides for the management and control of point and diffuse sources of pollution
- outlines obligations relating to particular activities
- specifies water quality criteria, discharge limits and listed pollutants.

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