



Department of  
Primary Industries

# Healthy estuaries for healthy oysters guidelines



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*Healthy Estuaries for Healthy Oysters - Guidelines*

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**More information**

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**Acknowledgments**

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## For Further Information

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Referral of Local Environmental Plans (LEP) and development applications to the NSW Department of Primary Industries under clause 15B(1)(b) of SEPP 62 should be addressed to:

### **North Coast (Hastings River to Tweed River)**

Fisheries Office - NSW Department of Primary Industries  
1243 Bruxner Highway Wollongbar NSW 2477  
Phone: 02 6626 1200

### **Central Coast (Manning River to Brisbane Water)**

Fisheries Office - NSW Department of Primary Industries  
Private Bag 1, Nelson Bay 2315  
Phone: 02 4982 1232

### **Sydney North**

Fisheries Office - NSW Department of Primary Industries  
PO Box 1305, Crows Nest NSW 2065  
Phone: 02 8437 4914

### **Sydney South**

Fisheries Office - NSW Department of Primary Industries  
1 Water Street, Sans Souci NSW 2219  
Phone: 02 9529 6021

### **South Coast (Shoalhaven River to Wonboyn River)**

Fisheries Office - NSW Department of Primary Industries  
PO Box 97, Huskisson NSW 2540  
Phone: 02 4428 3400

**Current and historic water quality data collected under the NSW Shellfish Program may be obtained from:**

Manager  
NSW Shellfish Program  
NSW Food Authority  
PO Box 6682, Silverwater NSW 1811  
Phone: 1300 552 406

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## 1. Introduction

*Oysters have been referred to as the “canary of the estuary” as a decline in their health present an early warning sign of river health problems (Healthy Rivers Commission, 2003, p.5).*

### 1.1 Background and Objective

The New South Wales oyster industry is one of the state’s most valuable seafood industries and has a farm gate production value of approximately \$45 million per annum. Oysters are produced in 41 estuaries from the Tweed River in the north to Wonboyn Lake in the south (Figure 1).

Coastal aquaculture has a positive impact on regional employment, economic growth, tourism, provision of high quality sustainable seafood, and supports the culture of coastal communities. The NSW general public believes the NSW seafood industry is important for local food security – 94% agree it is important we produce our own seafood in NSW. 96% of NSW coastal residents indicated that the desire to support their local community was a major motivation in purchasing local product (Barclay 2016).

On average, a farmed Sydney Rock Oyster will filter an estimated 250,000 litres of estuarine river water in its lifetime, removing large quantities of suspended material, chiefly nutrients bound in phytoplankton. This means that oysters are important in maintaining healthy estuaries but in performing this role they are exceedingly vulnerable to poor estuarine water quality.

The objective of this document is to provide councils, state government agencies, private landowners and developers with advice about how to ensure development in close proximity to estuaries is compatible with the requirements of oyster aquaculture.

These guidelines have been prepared to meet the requirements of management action (MA 7) of the *NSW Diffuse Source Water Pollution Strategy* (NSW DECC, 2009). This strategy identified pathogen levels exceeding the *Australia and New Zealand Environment and Conservation Council* (ANZECC) *Guidelines* as one of the top three priority problems from diffuse source water pollution in NSW.



Figure 1: Oyster aquaculture occurs in 41 estuaries within NSW (Source: NSW DPI, 2017).

The intended outcome of this document is to see development that protects the oyster industry and that estuarine water quality objectives are being met. Where water quality objectives are not being met, development should contribute to the objectives being met over time i.e.

management actions are implemented to address water quality objectives within a specified timeframe and subsequent monitoring results indicate desired targets have been achieved.

These outcomes will not only protect the environmental conditions required for healthy oyster production but will also result in improved estuarine health, increased amenity for tourism and improved conditions for recreational and commercial fisheries.

Appendix 1 provides the web addresses for the web references referred to in this document.

## 1.2 OISAS and SEPP 62

The *NSW Oyster Industry Sustainable Aquaculture Strategy* (OISAS) and enabling amendments to State Environmental Planning Policy 62 – Sustainable Aquaculture (SEPP 62) were gazetted in December 2006.

The need for OISAS arose from concerns of both the NSW Government and the NSW oyster aquaculture industry about existing and potential impacts associated with the rapid development of the NSW coastline.

OISAS identifies Priority Oyster Aquaculture Areas (POAAs) in each estuary and sets water quality objectives for these areas in line with the recommendations of the Healthy Rivers Commission (HRC, 2003). OISAS also identifies other oyster aquaculture areas such as leases on the National Park estate and leases on land controlled by the Merimbula Airport.

OISAS also establishes oyster industry best management practice standards which are supported by a commitment to environmentally sustainable practices.

When considering an application for development that may affect a Priority Oyster Aquaculture Area or other oyster aquaculture area, SEPP 62 requires the consent authority to:

1. Give the Director-General of the NSW DPI written notice of the development application and take into consideration any written submissions made in response to the notice within 14 days after notice was given;
2. Take into consideration the provisions of OISAS; and
3. Consider any issues that are likely to make the development incompatible with oyster aquaculture and evaluate any measures that the applicant has proposed to address those issues.

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

SEPP 62 also requires that councils have regard for POAAs in preparing new Local Environmental Plans (LEP) and making changes to land zoning. POAAs must also be identified on LEP maps.

The requirements of SEPP 62 are summarised in two Planning Circulars, PS07-13 and PS07-14 (see Appendix 2).

## 1.3 Neutral or Beneficial Effect on Water Quality Assessment Guideline

The *Neutral or Beneficial Effect on Water Quality Assessment Guideline* (NorBE Guideline) is also available to provide information to authorities (e.g. councils) assessing development proposals about minimising the impacts of pollution (including diffuse through development applications) on the water quality of sensitive receiving bodies such as oyster estuaries (Water NSW, 2015).

This guideline provides clear direction on what a neutral or beneficial effect means, how to achieve it, and how to assess an application against the neutral or beneficial effect on water

quality test using the 'Neutral or Beneficial Effect on Water Quality Assessment Tool' (the NorBE Tool). The guideline also provides the decision-making framework for the NorBE Tool (Water NSW, 2015).

The NorBE Guideline helps consent and public authorities to consider whether or not the proposals in the drinking water catchment will have a neutral or beneficial effect on water quality. The guideline can also help applicants and their consultants to prepare development proposals for consent and public authorities.

### 1.4 Where is the Greatest Risk?

Development and activities that are likely to have an adverse effect on estuarine water quality and oyster aquaculture are best considered from the perspectives of location and type.

Developments and activities located in close proximity to a waterway which is part of the estuary's catchment will be more of a risk than those which are remote from a waterway.

As a guide, any development or activity within an estuary catchment that is located within 10 kilometres of an oyster aquaculture lease, or any development or activity that is located within 10 kilometres of a point where a stream enters an estuary that is within 10 kilometres of an oyster aquaculture lease is considered to represent a significant risk. However, some judgement is required. An intense development at 11 kilometres is of greater concern than a low impact development at 9 kilometres.

The following types of development are also more likely to present a risk to oyster aquaculture:

- Subdivision of land where the future development created by the subdivision will rely on on-site sewage disposal;
- Development that will rely on on-site disposal of wastewater effluent;
- Subdivision of land adjacent to a river or estuary or adjacent to foreshore Crown reserve or on land which is steep or erodible;
- Development which involves a significant amount of earthmoving and soil exposure;
- Development that includes small or private wastewater treatment plants where effluent might be discharged to or infiltrate to receiving water;
- Reticulated wastewater systems with overflows or designated discharge points;
- Biosolid, effluent or purified wastewater reuse schemes;
- Development where significant volumes of organic or mineral fertiliser will be used or stockpiled in the open such as golf courses, turf farms, soil supplies, landscape supplies, nurseries and composting facilities;
- Development that may limit marine access to Priority Oyster Aquaculture Areas (POAA);
- Tourism and recreation-related development immediately adjacent to a POAA or other oyster aquaculture;
- Marine-related development, including marinas, jetties, wharves, boat-launching ramps, boat repair facilities, charter and tourist boat facilities, boatsheds, moorings for visiting vessels, pump out facilities and commercial port facilities;
- Intensive livestock industries, livestock processing facilities, animal boarding or training facilities, animal racetracks and stock or saleyards;
- Dredging or reclamation of tidal or subtidal areas; and
- Development involving earthworks on potential or actual acid sulfate soil.



## 1.5 NSW Shellfish Program

Oyster production requires water quality that supports healthy oyster growth and results in a product that is safe for human consumption. If water quality declines, strict and costly food safety measures are imposed (e.g. depuration of oysters in tanks of sterilised water). While the causes of declining water quality are beyond the control of the oyster industry, industry operators bear the cost of the resulting food safety measures.

Oyster industry food safety is assured by the NSW Shellfish Program (Figure 2). This program is a compulsory, jointly industry and government funded program that classifies harvest areas on the basis of water quality and pollution source risks; establishes harvest management plans, and mandates post-harvest handling procedures.

The NSW Shellfish Program is based on international best practice and is administered by the NSW Food Authority under the *Food Act 2003*.



Figure 2: Oyster industry food safety is assured by the NSW Shellfish Program (NSW DPI, 2008).

### Classification of Oyster Harvest Areas

Harvest area risk assessment (also known as a comprehensive sanitary survey) is the cornerstone of the NSW Shellfish Program. Each initial risk assessment is completed over a period of one to three years and results in each harvest area being classified as either approved, restricted or prohibited according to its sanitary status. The harvest area classification then determines the food safety controls to be applied to shellfish harvest from the area.

Additionally, a harvest area may be sub-classified as 'conditional' (essentially meaning it is subject to closure in prescribed conditions) and a specific harvest area management plan is prepared.

### Components of the Risk Assessment Process

- A shoreline survey which includes a thorough physical examination of the catchment area draining into the shellfish harvest area in order to identify any actual or potential sources of pollution that may adversely affect water quality.

- A bacteriological survey of the shellfish and growing waters, which provides quantitative data to examine and develop the preliminary findings of the shoreline survey.
- Bacteriological and chemical analysis of shellfish from the area.
- An evaluation of the meteorological, hydrographic and geographic characteristics of the harvest area.
- An algal biotoxin risk assessment.

Oysters may be harvested from direct harvest areas and sold directly for human consumption without the additional cost of depuration. These areas are therefore the most valuable and sought after areas for oyster aquaculture.

## 1.6 Water Quality Objectives

While sanitary water quality is the most important water quality parameter for oyster aquaculture food safety, a number of other water quality parameters are important to provide the necessary conditions for healthy oyster growth.

OISAS adopted the following water quality objective for oyster aquaculture areas in NSW:

### **Protecting water quality for safe human consumption and viable production of edible oysters.**

The water quality guidelines established in OISAS are designed specifically to meet this objective (Table 1).

Table 1: Water quality guidelines for oyster aquaculture areas.

Parameter	Guideline	Source
<i>Faecal (thermotolerant) coliforms</i>	90th percentile of randomly collected Faecal coliform samples do not exceed 43MPN or 21 MF/100mL	ASQAP Operations Manual (2016) and NSW Shellfish Industry Manual (2015)
pH	6.75 – 8.75	Schumway (1996)
Salinity	20.0 – 35.0 g/L	Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000).
Suspended solids	<75mg/l	
Aluminium	<10µg/L	
Iron	<10µg/L	
Other parameters	For other parameters please refer to Section 4.4 and Section 9.4 of the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000)	

Resource	Content
NSW Department of Primary Industries (NSW DPI) 2016 <i>NSW Oyster Industry Sustainable Aquaculture Strategy</i> (OISAS) Third Edition. NSW DPI ( <a href="#">Web Reference 1</a> ).	The OISAS document and estuary maps are all available for download from this website.

Water NSW 2015 <i>Neutral or Beneficial Effect on Water Quality Assessment Guideline</i> , Water NSW, Sydney ( <a href="#">Web Reference 2</a> )	This guideline assists in determining whether or not developments will have a neutral or beneficial effect on water quality.
NSW Food Authority 2015 <i>NSW Shellfish Industry Manual</i> , NSW Food Authority ( <a href="#">Web Reference 3</a> ).	All oysters and mussels in NSW are harvested in accordance with the NSW Shellfish Program, which has adopted the Australian Shellfish Quality Assurance Program (ASQAP) as a minimum standard.
Healthy Rivers Commission 2003 <i>Final report – HRC Review of the Relationship between Healthy Oysters and Healthy Rivers</i> . Healthy Rivers Commission, Sydney ( <a href="#">Web Reference 4</a> ).	This report investigates the relationship between estuarine health and the oyster industry and makes five recommendations essential to the health of oyster growing catchments.
Clarence Landcare 2011 <i>A Community Resource – Clarence Coast and Estuary Resource Kit</i> . Clarence Landcare ( <a href="#">Web Reference 5</a> ).	The kit explains basic estuary function and includes a detailed discussion of oysters as indicators of estuarine health.

## ESTUARY PROTECTION IN ACTION

### DRAMATIC IMPROVEMENT IN WALLIS LAKE WATER QUALITY

*Two decades ago, water quality in Wallis Lake deteriorated to the point where oyster harvest was prohibited. Business and the community suffered as the all-important tourism and seafood industries were abandoned by their customers. Now Wallis has some of the best water quality on the coast with all oyster harvest zones classified for direct harvest and average rainfall closure times reduced from ten days to four days. The turnaround is thanks to a sustained effort by Great Lakes Council with help from the then Catchment Management Authority as well as state and federal funding. Projects include a new on-site wastewater management inspection and compliance system, stormwater treatment and improved agricultural land use.*



## 2. Mitigation Measures for New Developments

*Estuaries support a diverse range of functions and uses, and no use is more dependent on clean water and susceptible to pollution than oyster cultivation and harvest because its health is determined by the health of the water in which it grows (English, 2007, p12).*

### 2.1 On-site Treatment and Disposal Systems

Applications for subdivision or development which rely on the on-site land application and dispersal of domestic wastewater in the vicinity of POAAs must be referred to NSW DPI. POAAs are vulnerable and sensitive environments and are considered to be high risk areas with respect to this type of development. Poorly designed or incorrectly sited systems may have an adverse impact on water quality and consequently, on the health of oysters or the consumers of those oysters.

These development applications must be accompanied by a detailed report which outlines the matters listed in Table 2. If this information is not provided, NSW DPI may recommend that the consent authority refuse the application. This checklist and other information in this Section is based on Geary (2007).

On-site sewage management systems should be designed in accordance with *On-site Sewage Management for Single Households* and *AS/NZS 1547-2012 On-site Domestic Wastewater Management*.

When considering hydraulic load, the designer should conservatively use the higher potential rate if the household is connected to a reticulated water supply. A larger land area for the dispersal of effluent on-site is therefore needed in these circumstances.

To achieve a neutral or net benefit to water quality systems should:

- have disinfection;
- have sub-surface dispersal of effluent;
- be located on hill crests or convex slopes;
- be greater than 100 metres from waterways;
- have a minimum depth of 600 millimetres to the water table;
- have high sun and wind exposure; and
- be located so as to not be affected by flooding, surface wetness or erosion.

**Table 2: On-site wastewater management system checklist.**

Does the on-site wastewater management system report provide:	Y	N
<ul style="list-style-type: none"> <li>• Details of the relevant development control plans (DCP) or regulatory guideline used in the preparation of the report.</li> </ul>		
<ul style="list-style-type: none"> <li>• A detailed land capability study that determines the type and depth of soil, the hydraulic properties of the soil, the location of the water table, the slope of the land, the 1:100 year and 1:20 flood contour.</li> </ul>		
<ul style="list-style-type: none"> <li>• Details of the type of on-site wastewater treatment system being proposed, the means of utilisation or dispersal of the final effluent, the basis for selection relative to other available systems,</li> </ul>		
<ul style="list-style-type: none"> <li>• The hydraulic load to the system, the design loading rate (DLR) or the design irrigation rate (DIR).</li> </ul>		
<ul style="list-style-type: none"> <li>• Identify the proposed land application area for the treated wastewater and show how this area was calculated.</li> </ul>		
<ul style="list-style-type: none"> <li>• A dimensioned site plan (to scale) showing:</li> </ul>		
<ul style="list-style-type: none"> <li>○ the location of the proposed system, dispersal area and diversion drains or soil berms;</li> </ul>		
<ul style="list-style-type: none"> <li>○ soil types;</li> </ul>		
<ul style="list-style-type: none"> <li>○ property boundaries'</li> </ul>		
<ul style="list-style-type: none"> <li>○ the distance to any POAA or other oyster aquaculture and waterways;</li> </ul>		
<ul style="list-style-type: none"> <li>○ topography and the 1:100 year and 1:20 flood contour;</li> </ul>		
<ul style="list-style-type: none"> <li>○ any visible signs of surface dampness, such as moisture-tolerant vegetation and seepages, soaks and springs;</li> </ul>		
<ul style="list-style-type: none"> <li>○ any signs of erosion e.g. rills, gullies, mass movement, slope failure; and</li> </ul>		
<ul style="list-style-type: none"> <li>○ an analysis of the potential impacts of the on-site wastewater system on the sanitary water quality of any POAAs or other oyster aquaculture areas.</li> </ul>		
Is the design loading rate (DLR) or the design irrigation rate (DIR) for the effluent from the proposed on-site wastewater system appropriate for the type of soil described (refer to <b>Table 3</b> )?		
Is the proposed on-site wastewater system likely to have a limitation associated with flooding?		
Does the dispersal area have high sun and wind exposure?		
Are there proposed stormwater management measures in place, including any proposal to divert stormwater around the site?		
Are there mitigation measures proposed to prevent any adverse and cumulative impacts to the sanitary water quality of POAAs?		
Does the system and dispersal area meet minimum buffer distance of 100 m from waterways?		
Is there a minimum depth to groundwater of at least 600 mm below the dispersal area OR is raised mound proposed?		

Are the treatment system, tanks, vents, openings, and electrical components above 1 in 100 year flood contour and is the dispersal area above 1 in 20 year flood contour?		
Is disinfection included in the proposed system or is the exclusion of disinfection justified?		

**Table 3: Typical Conservative Design Loading Rates (Source: Adapted from AS/NZS1547:2012).**

Soil Texture	Land Application System Type			
	Absorption trenches and beds (mm/day)	Evapotranspiration beds (water balance calculation required) (mm/day)	Surface mounds (mm/day)	Irrigation (DIR) (mm/week) Different unit
Gravels and sands	20	N/A		35
Sandy loams	15 - 20	N/A	24	35
Loams	10 - 15	N/A	16	28
Clay loams	4 - 10	5 – 12	8	25
Light clays	* - 5	5 – 8		20
Medium Heavy clays	*	5	*	15

<b>Resource</b>	<b>Content</b>
Standards Australia 2012 AS/NZS 1547-2012 <i>On-site Domestic Wastewater Management</i> ( <a href="#">Web Reference 6</a> ).	Sets out the requirements for primary and secondary treatment units for individuals and agencies involved in the management of domestic on-site wastewater. Accommodates current legislative requirements.
NSW Department of Local Government 1998 <i>Environment and Health Protection Guidelines - On-site Sewage Management for Single Households</i> ( <a href="#">Web Reference 7</a> ).	Developed to help local councils assess, regulate and manage the selection, design, installation, operation and maintenance of single household on-site sewage management systems.
NSW Department of Local Government 2000 <i>The Easy Septic Guide (Septic Safe)</i> . Social Change Media for the NSW Department of Local Government ( <a href="#">Web Reference 8</a> ).	Guidelines for individual property owners on the installation, operation and maintenance of on-site sewerage systems.

## 2.2 Waterless Composting Toilets

Waterless composting toilets use the principle of composting to break down human excreta to a humus-type material. The liquid fraction is evaporated or directed to an appropriate management system.

Households relying on waterless composting toilets require a separate system for the treatment and dispersal of greywater. NSW DPI recommends that these systems meet the requirements

for on-site treatment and disposal given in Section 2.1. Any liquid discharged from a waterless composting toilet should be processed and disposed of through the greywater system.

Composted humus must be managed according to *Onsite Domestic Wastewater Treatment Units Part 2: Waterless Composting Toilets* (ANZS 1546.2-2008) and must not be buried within a 100 metre buffer distance from waterways.

<b>Resource</b>	<b>Content</b>
Standards Australia and Standards New Zealand 2008 <i>AS/NZS 1546.2-2008 Onsite Domestic Wastewater Treatment Units Part 2: Waterless Composting Toilets</i> ( <a href="#">Web Reference 9</a> ).	Sets standards for waterless composting toilet construction, operation and humus management.
NSW Department of Health (now NSW Health) 2005 <i>Waterless Composting Toilets (WCT) Accreditation Guideline</i> ( <a href="#">Web Reference 10</a> ).	Provides a set of performance statements which define the requirements for WCT's; a performance evaluation test against which any WCT, conventional or innovative, may be assessed; and details for manufacturers of WCT's to enable product accreditation by an independent third party.

## 2.3 Pump Out Wastewater Management Systems

Pump out systems are those where effluent is collected in an on-site tank (or tanks) for periodic removal by a tanker truck. Pump out systems may be operated on the basis of a pay for use scheme i.e. the cost is based on the volume of effluent removed or on the basis of a flat rate charge for a regular removal service.

The former option may be prone to abuse as homeowners or occupiers are charged as long as effluent is generated and removed from the household. This system provides an incentive to householders to discharge effluent illegally, particularly following periods of high water usage or when there is a shortage of money in the household. Pump out may also be an issue if the property is later sold and occupied by a tenant who does not wish to or has difficulty paying for effluent disposal from the household.

A flat rate charge for a regular removal service effectively removes many of these problems and is the preferred pump-out management system. However, this system will inevitably be more expensive for low use households and does not encourage water conservation.

Any applications which rely on the regular pump-out removal of effluent from the property will need to demonstrate to NSW DPI that there are no other feasible on-site land management or dispersal options and that the removal of effluent by pump out can be appropriately managed for the longer term.

To reduce the risk of over flows affecting oyster aquaculture the top of any pump out tank must be clear of the 1:100 year flood level and the tank must be fitted with a high water alarm.

## 2.4 Reticulated Wastewater Management Systems

New reticulated sewage treatment systems within the same catchment or within 10 kilometres flow to a POAA or oyster aquaculture should:

- Designed so that they do not discharge to waterways due to overflows in dry weather and wet weather overflows should be minimised; and

- Reticulation systems should incorporate measures such as telemetry, storage, back-up systems and power sources. As well, operators should have emergency response systems in place and ensure that sufficient spare parts are available to ensure that breakdowns can be fixed before overflows occur.

Detailed guidelines for the appropriate design and management of reticulated sewage treatment systems are contained in the following resource.

<b>Resource</b>	<b>Content</b>
NSW Environment Protection Authority 2003 <i>Licensing Guidelines for Sewage Treatment Systems</i> ( <a href="#">Web Reference 11</a> ).	Large sewage treatment plants and reticulation systems are a scheduled activity under the <i>Protection of the Environment Operations Act 1997</i> (POEO Act). An EPA licence regulates both sewage treatment plant discharges and discharges (overflows) from the sewage reticulation system. Smaller systems also require a licence if they discharge to waters.

## 2.5 Subdivision and Development Adjacent to a Waterway

Development adjacent to any estuary or estuarine waterway may have a detrimental impact on that waterway through soil erosion; the removal of vegetation, particularly riparian vegetation; disturbance of acid sulfate soils and faecal contamination associated with poorly performing and/or poorly designed on-site wastewater disposal systems. The close proximity of development to receiving waters, steep slopes and erosion prone soil all increase the risk of impact.

The design of the subdivision layout is critically important to protecting water quality. Road and street surfaces readily convey sediment and nutrients into waterways when they slope downwards towards drainage lines and gullies. To minimise the risk, the road and street network should follow the contours of the land to the greatest extent possible and reduce the number of waterway crossings to the minimum required for safety. Where waterway crossings are unavoidable, the approaches to the crossing should slope uphill so that runoff water is directed away from the waterway.

The quality and width of riparian vegetation is a key factor in protecting against these risks. It slows the overland movement of water, and traps sediment and attached nutrients before they reach the waterway. Riparian vegetation can also take up and remove some of the nutrients being transported. This vegetation also uses significant quantities of sub-surface waters and can therefore influence groundwater flows and the nutrients, salt or other substances that may be entering waterways by this route.

In general, development should not occur on the banks of waterways unless there is a specific requirement for it to be there.

To reduce the risk of subdivision and development adjacent to a waterway impacting on estuarine health and oyster harvest zone classification and management:

- Where possible an environmental protection zone adjacent to estuarine foreshores should be established in the Local Environmental Plan;
- Any new subdivision adjacent to an estuarine waterway should include a minimum 100 metres vegetated riparian zone buffer;
- Removal of native riparian vegetation should be avoided where possible. Any planted riparian vegetation associated with subdivision and development should comprise locally appropriate Australian native species;



- Subdivision should incorporate Water Sensitive Urban Design with particular emphasis upon stormwater capture and treatment prior to discharge;
- Subdivision should utilise a reticulated wastewater management system where possible. The system should be designed and constructed so that overflows into waterways (particularly in proximity to oyster areas) are avoided;
- Subdivision and development involving excavation should be avoided in areas with high potential for acid sulfate soils, or an acid sulfate soil management plan should be prepared and implemented if this can't be avoided;
- A water quality monitoring program should be designed and implemented to demonstrate that OISAS water quality objectives (refer to Table 1) are met pre- and post- construction; and
- Plan and implement erosion and sediment control in accordance with Section 2.9 and consider independent auditing of large subdivision sites.

The subdivision of rural land to create rural residential lots usually results in an intensification of land use. New residents to these areas need to develop the skills to manage land within its capability so that denuded and/or overstocked areas that produce rainfall run-off high in sediment and faeces are avoided. Improving landholder's knowledge of best practice construction and maintenance of unsealed tracks and driveways is also important. Technical and extension advice on animal husbandry, land management and dam construction should be sought from NSW DPI, other agencies (e.g. Local Land Services) and consultants.

Some resources relevant to the importance, establishment and management of riparian vegetation and rural residential sub-division are listed below.

<b>Resource</b>	<b>Content</b>
Living and working in rural areas website ( <a href="#">Web Reference 12</a> ).	A guide aimed at rural landholders and local council planners that provides an easy to read coverage of topics such as; what to expect when buying and living on a rural block, rural land use conflict issues, hints for buying and living in rural areas, land use planning principles, duty of care and resolving disputes.
A Guide to Rural Residential Living website ( <a href="#">Web Reference 13</a> ).	A guide designed especially for those living on rural residential properties that brings together a range of useful information and resources on neighbours, property planning, cultural heritage, water, weeds, waste management, bushfires, vegetation, water flow, wildlife, livestock and pets, gardening, pests, fencing, saving energy, soil and legal issues.

<b>Resource</b>	<b>Content</b>
Lovett, S. and Price, P. 2007 <i>Principles for Riparian Lands Management</i> . Land and Water Australia, Canberra ( <a href="#">Web Reference 14</a> ).	Best Practice guidelines for river and riparian management. These are central reference documents for most catchment management organisations in Australia. They are aimed at a more technical audience.
Staton, J. & O'Sullivan, J. 2006 <i>Stock and Waterways: A Managers Guide</i> . Land and Water Australia, Canberra ( <a href="#">Web Reference 15</a> ).	The guidelines are available through Land and Water Australia's National Riparian Lands Research and Development Program. Land and Water Australia is a statutory research and development corporation within the Department of Agriculture and Water Resources.
Bennett, J. <i>et al</i> 2002 <i>Guidelines for Protecting Australian Waterways</i> . Land and Water Australia, Canberra ( <a href="#">Web Reference 16</a> ).	
Land and Water Australia Factsheets: <i>Managing Riparian Lands</i> ( <a href="#">Web Reference 17</a> ).	These fact sheets set out general principles and practices regarding the management of riparian land.
<i>Improving Water Quality</i> ( <a href="#">Web Reference 18</a> ).	
<i>Managing Riparian Widths</i> ( <a href="#">Web Reference 19</a> ).	
<i>Managing Riparian Land for Multiple Uses</i> ( <a href="#">Web Reference 20</a> ).	
<i>Rapid Appraisal of Riparian Condition</i> ( <a href="#">Web Reference 21</a> ).	
<i>Managing Stock</i> ( <a href="#">Web Reference 22</a> ).	
<i>Planning for River Restoration</i> ( <a href="#">Web Reference 23</a> ).	
<i>Managing Weeds in Riparian Areas</i> ( <a href="#">Web Reference 24</a> ).	
NSW DPI 2005 <i>Degradation of native riparian vegetation along NSW watercourses</i> . Primefact 12 ( <a href="#">Web Reference 25</a> ).	Summarises requirements associated with listing of 'degradation of native riparian vegetation along NSW water courses' as a key threatening process under the <i>Fisheries Management Act 1994</i> .

## 2.6 Biosolid or Effluent Re-use Schemes

The re-use of effluent and biosolids has many benefits such as replacing water that otherwise would be taken from rivers and wetlands, improving soils, reducing pressure on landfill sites and reducing the need for mineral fertilisers.

However, biosolids and effluent may contain chemicals, endocrine disrupters, hormones and pathogenic microorganisms that pose a risk to estuarine health, public health and oyster harvest zone classification and management unless they are managed appropriately.

These risks can be minimised by ensuring that:

- The level of treatment of the effluent/biosolids is consistent with the protection of a highly sensitive receiving environment. An added risk reduction measure in close proximity to oyster aquaculture is to provide disinfection;

- Effluent irrigation is only undertaken in areas that are deemed suitable for irrigation based on an analysis of soil capability, surface flows and groundwater conditions;
- Separation distances and buffer zones are consistent with the protection of a highly sensitive receiving environment and should include a minimum 100 metres vegetated riparian zone buffer;
- Irrigation schedules are based on measurements of soil moisture and knowledge of the water requirements of the crop in order to avoid the application site being overloaded;
- Stormwater and tailwater leaving the irrigation area is collected in an appropriate collection system for reuse; and
- The system has adequate capacity to store effluent during wet weather.

Regular water quality monitoring both pre- and post-development may also be required to ensure that the OISAS water quality objectives set out in Table 2 are not compromised.

Guidelines for the appropriate design, operation and monitoring of biosolid and effluent re-use schemes are listed below.

<b>Resource</b>	<b>Content</b>
NRMMC, EPHC and AHMC 2006 <i>Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 1)</i> ( <a href="#">Web Reference 26</a> ).	Details a proactive risk management approach to protecting public health and the environment in the design of a recycling scheme.
NSW Department of Primary Industries 2004 <i>Landform and Soil Requirements for Biosolids and Effluent Reuse</i> . AgNote ISSN 1034-6848 ( <a href="#">Web Reference 27</a> ).	Provides four landform and soil suitability tables which aim to identify appropriate sites for biosolids or effluent reuse and eliminate inappropriate sites.
Department of Environment and Conservation (now NSW OEH) 2004 <i>Environmental Guidelines: Use of Effluent by Irrigation</i> ( <a href="#">Web Reference 28</a> ).	Details principles and objectives that should be considered when establishing an irrigation system that uses effluent. The environmental objectives include protection of surface waters, groundwater, plant and animal health, and prevention of public health risks.
NSW Environment Protection Authority, 2000 <i>Environmental Guidelines: Use and Disposal of Biosolids Products</i> ( <a href="#">Web Reference 29</a> ).	Guidelines for the reuse of biosolids from municipal sewage treatment processes in direct land applications (the direct application of biosolids to large tracts of land). For use by regulators, producers and users of biosolids.

## 2.7 Development that relies on Fertilisers or Pesticides

Fertilisers exported from a development in run-off may result in algal blooms, native vegetation dieback and weed growth in waterways. Similarly, pesticides can affect aquatic ecosystems by killing or affecting the growth and life expectancy of non-target plants and animals. If pesticides are misused they may bioaccumulate in the tissues of some organisms, including oysters.

The use of organic fertilisers such as manures has the added risk of being high in pathogenic microorganisms that pose a risk to estuarine health and oyster harvest zone classification and management.

These risks to aquatic ecosystems and oyster aquaculture can be minimised by ensuring that:

- A fertiliser and pesticide management plan is prepared by the proponent for approval by the consent authority and NSW DPI;
- Pelletised processed organic fertiliser is preferred over raw manures. Raw manures should not be applied within 250 metres of a water course or drain;
- Fertilisers and pesticides are applied according to product instructions and applied in appropriate weather conditions;
- Fertilisers and pesticides are not applied within riparian buffer zones;
- Apply fertiliser only if required, based on land capability assessment and soil test results;
- If applying nitrogen fertiliser use small amounts applied frequently to ensure appropriate absorption (rather than large amounts infrequently);
- Groundcover is maintained in all areas, especially where phosphorus is being applied because it binds strongly with soil and can be readily transported into waterways; and
- Contingency procedures be established for the event of failure of management procedures including remedial and restoration action.

Detailed guidelines regarding the appropriate use of fertilisers and pesticides are listed below.

<b>Resource</b>	<b>Content</b>
NSW Department of Primary Industries 2004b <i>Managing Soil Amendments and Fertilisers for a Cleaner Environment</i> . Agfact AC.29 ( <a href="#">Web Reference 30</a> ).	Guidelines for managing soils, fertilisers and soil amendments to minimise detrimental environmental effects.
NSW DPI 2010 <i>Organic vegetable production - soil management and crop establishment – Prime Facts 803</i> . NSW DPI ( <a href="#">Web Reference 31</a> ).	Nitrogen and phosphorous are particularly prone to leaving the farm through leaching into groundwater and through direct run-off into waterways from heavy rainfall or over-irrigation so their use requires careful management. Appropriate management requires an understanding of the chemical and physical nature of soil type and its nutrient needs.
Havilah, E., Warren, H., Lawrie, R., Senn, A. and Milham, P. 2005 <i>Fertilisers for Pastures</i> . NSW Department of Primary Industries ( <a href="#">Web Reference 32</a> ).	Guidelines on the use of fertilisers for farmers. Recommendations are made about the type and amounts of fertilisers required, nutrient interaction and environmental impacts. For example, small frequent applications of fertiliser nitrogen are recommended to minimise environmental and animal health problems.
Swan River Trust 2014 <i>Environmental Guidelines for the Establishment and Maintenance of Turf and Grassed Areas</i> ( <a href="#">Web Reference 33</a> ).	Provides information on the environmental issues associated with the establishment and maintenance of turfed and grassed areas such as golf courses, sports grounds, public open space etc.

## 2.8 Urban Stormwater

Urban catchments typically have lots of surfaces that don't allow rain to soak into the ground. Rainfall then runs off quickly and takes with it suspended and dissolved contaminants (detergents, oils, pesticides, leaves, garden clippings and animal droppings) that are picked up

in streets and gutters. In the worst case, urban stormwater can have similar levels of faecal contamination as raw sewage. Urban stormwater therefore poses both a chemical and pathogenic risk to estuarine water quality.

Stormwater is often not treated and usually flows directly into waterways. Gross pollution traps may be used to capture some of the sediment, sludge and solids but they do not stop dissolved contaminants entering the waterway. Constructed wetland treatment systems may be used as an additional level of treatment.

The other approach to the urban stormwater issue is to try to counteract the effect of the impervious urban landscape by using infiltration systems, grass swales instead of gutters, rainwater storage, stormwater storage and re-use systems.

This approach to urban development is a component of Water Sensitive Urban Design and its principles can be used to reduce the risk to estuarine water quality and oyster aquaculture from urban stormwater. The key principles are to:

- Protect natural drainage systems;
- Integrate stormwater treatment into the landscape;
- Protect water quality;
- Reduce run-off and peak flows; and
- Minimise drainage infrastructure costs of development.

The majority of local councils have prepared guidelines and fact sheets about the concept of Water Sensitive Urban Design and how it can be implemented. Information, case studies and management tools can also be obtained from <http://www.water.nsw.gov.au/urban-water>.

Specifically, to reduce the risk to oyster harvest zone classification and management:

- New urban development should be designed to ensure that the stormwater management system will result in stormwater management objectives being met. Stormwater management objectives are outlined in *Managing Urban Stormwater: Council Handbook* (NSW EPA, 1997) and the *Neutral or Beneficial Effect on Water Quality Assessment Guideline* (Water NSW, 2015);
- Where possible, new urban development should be sited so that areas with higher export rates of pollutants are replaced with urban development incorporating best practice stormwater management. This approach can result in a net improvement in water quality;
- Prior to seeking development approval, a stormwater management plan should be prepared that details the drainage requirements of the area and design specifications for the planned stormwater management system. The system should include both measures to reduce the generation of contaminated stormwater and treatment systems for any discharges; and
- The stormwater management objectives should be referenced and the plan should demonstrate how these objectives will be met once the stormwater system is in operation.

## 2.9 Construction Erosion and Sediment Control

Uncontrolled run-off from construction sites can carry high concentrations of sediment into waterways. Sediment causes reduced light penetration through increasing the suspension of fine particles and turbidity. This in turn inhibits the growth of aquatic plants and algae; it can overwhelm filter feeders like oysters with inorganic particles and damage or clog their gills; smother bottom-dwelling animals and plants; and it can also act as a means of transport for other pollutants such as paints, oils, nutrients and pathogens.

The *Protection of the Environment Operations Act 1997* (POEO Act) makes it an offence to allow waste materials to leak, spill or escape from a construction site or to place it where it may cause harm to the environment. *Managing Urban Stormwater: Soils and Construction (The Blue Book)* (Landcom, 2004) is one of the key guiding documents for the management of construction sites. NSW Office of Environment and Heritage (2006) has also published *A Resource Guide for Local Councils: Erosion and Sediment Control* that provides practical information and resources for on-the-ground implementation of the *Blue Book*.

Many individual councils have also prepared guidelines for the preparation of Erosion and Sediment Control Plans (ESCP) or Development Control Plans (DCP) that detail how sediment and erosion will be managed during construction. The *Neutral or Beneficial Effect on Water Quality Assessment Guideline* (NorBE Guidelines) (Water NSW, 2015) is another resource for demonstrating how these can be managed by councils for water quality protection.

The risks to aquatic ecosystems and oyster harvest zone classification and management from construction activities can be minimised by ensuring that:

- Erosion and sediment control measures are designed in accordance with *The Blue Book* (Landcom, 2004) and any sediment and erosion control guidelines or DCP produced by the relevant local council;
- All erosion and sediment controls in areas that may impact on estuaries and oyster aquaculture areas are designed with special reference to the sensitive nature of these environments by applying the NorBE Guidelines; and
- Councils recognise the high risk of construction sites located in these areas and give them a high priority for compliance inspections.

<b>Resource</b>	<b>Content</b>
Landcom 2004 <i>Managing Urban Stormwater: Soils and Construction</i> . Volume 1 (Fourth Edition) (Blue Book) ( <a href="#">Web Reference 34</a> ).	Provides guidelines regarding sediment and erosion control with the aim of mitigating the impacts of land disturbance activities on soils, landforms and receiving waters.
Various local council guidelines for the preparation of plans for erosion and sediment control, as well as soil and water management.	Details the type of information that developers/landholders should include in these plans.

## 2.10 Development Affecting Acid Sulfate Soils

Acid sulfate soils are soils that contain iron sulfides. They are often found in low-lying areas such as floodplains surrounding estuaries and coastal lagoons (NSW DPI, 2003). If these soils are exposed to air through excavation or lowering of the water table, they can react with oxygen and produce sulfuric acid which in turn may be transported to the adjacent waterway. Direct impacts of these acid discharges to oysters include increased mortality, reduced growth, shell dissolution, reduced feeding activity and soft tissue damage (Dove & Sammut, 2007a; 2007b). Also, associated with acid discharges is high levels of iron and aluminium that may be toxic to oysters. It is also worth noting that some soil types (e.g. Yellow Pinch Soils in Bega Valley Shire) can discharge aluminium and significantly reduce pH even though they are not classified as acid sulfate soils.

Acid sulfate soil pollution is best managed at its source. This is continuing to be addressed in New South Wales through a cooperative approach between government, floodplain landowners, industry and researchers. Additionally, the majority of affected local councils have planning controls in place in the form of policies and LEP/DCP requirements.

To reduce the risk to oyster and estuary health, it is recommended that:

- Potential acid sulfate soils or other problematic soil types are identified at the proposal stage of developments;
- Disturbance or drainage of areas with high potential for acid sulfate soils is avoided;
- An acid sulfate soil management plan is prepared for developments that are likely to disturb acid sulfate soils. The plan should include:
  - A description of the soil and water attributes of the site;
  - A description of the acid sulfate soil management strategies to prevent oxidation of pyrite (avoiding disturbance of acid sulfate soil by excavation or changes to groundwater levels);
  - Treat or manage the acid sulfate soil (including burial, neutralisation and separation and treatment);
  - Prevent, control or minimise the escape of acid sulfate leachate to the surrounding environment;
  - Allow for the neutralisation of acid leachate from acid sulfate soils;
- A monitoring program for soil, surface and groundwater quality is implemented with sampling occurring both pre- and post-construction; and
- Contingency procedures be established for the event of failure of management procedures including remedial and restoration action.

<b>Resource</b>	<b>Content</b>
NSW Environmental Protection Authority (Blunden, B. and Naylor, S) 1998 <i>Assessing and Managing Acid Sulfate Soils: Guidelines for Land Management in NSW Coastal Areas</i> .	Guidelines regarding assessment of the acid sulfate soil status of a site, the likely impact of development on these soils and options for managing the impacts.
Dove, M.C. and J. Sammut 2007a Impacts of estuarine acidification on survival and growth of Sydney Rock Oysters <i>Saccostrea glomerata</i> (Gould, 1850). <i>Journal of Shellfish Research</i> , 26 ( <a href="#">Web Reference 35</a> ).	Results of studies on the impacts of acid sulfate pollution on oysters.
Dove, M.C. and J. Sammut 2007b Histologic and feeding response of Sydney rock oysters, <i>Saccostrea glomerata</i> , to acid sulfate soil outflows. <i>Journal of Shellfish Research</i> , 26 ( <a href="#">Web Reference 36</a> ).	
Johnston, S., Kroon, F., Slavich, P., Cibilic, A. and Bruce, A. 2003 <i>Restoring the Balance: Guidelines for Managing Floodgates and Drainage Systems on Coastal Floodplains</i> . NSW Agriculture, Wollongbar ( <a href="#">Web Reference 37</a> ).	Guidelines for local Government authorities, landholders, industry and community groups to improve environmental performance (reduce drainage of acidity) of coastal floodplain drainage systems.

<b>Resource</b>	<b>Content</b>
National Working Party on Acid Sulfate Soils 2000 National Strategy for the Management of Coastal Acid Sulfate Soils ( <a href="#">Web Reference 38</a> ).	Economic, social, environmental and technical acid sulfate soils issues requiring a national approach, roles and responsibilities of various levels of government and community, and resources required.
NSW Acid Sulfate Soil Management Advisory Committee 1998 <i>Acid Sulfate Soils Manual</i> ( <a href="#">Web Reference 39</a> ).	Guidelines regarding planning, assessment and management of acid sulfate soils.
NSW Department of Planning and Environment <i>Acid Sulfide Soils Planning Maps</i> ( <a href="#">Web Reference 40</a> ).	Maps produced by the NSW Department of Planning and Environment and other relevant local councils.
NSW Department of Primary Industries 2007 <i>Oysters and Acid Sulfate Soil Pollution</i> . Primefact 591 ( <a href="#">Web Reference 41</a> ).	A brief description of the effects of acid sulfate soil pollution on oysters. Includes suggestions for oyster industry on how to minimise effects.
NSW Department of Primary Industries ( <a href="#">Web Reference 42</a> ).	General information regarding acid sulfate soils

## 2.11 Dredging and Reclamation

Dredging and reclamation works in an oyster producing estuary have the potential to affect oyster health and growth through increased turbidity and through the mobilisation of toxins if they exist in the disturbed area. Wild oyster spat collection operations can also potentially be affected by these activities. Re-suspension of sediments may also increase the levels of pathogenic microorganisms (such as *Vibrio sp.*) in the water column and subsequently in oysters.

Increased turbidity and the deterioration of other water quality parameters can lead to direct oyster injury and also to oyster stress which may result in secondary infections and oyster disease. Dredging and reclamation may also alter flow and tidal patterns and affect the suitability of an area for oyster aquaculture.

Note that a permit from NSW DPI may be required for dredging and reclamation. NSW DPI's *Policy and Guidelines for Fish Habitat Conservation and Management* (2013 update) sets out the assessment and licensing requirements associated with these activities.

To reduce the risk to oyster harvest zone classification and management, it is recommended that:

- A detailed assessment of the potential environmental effects on oyster aquaculture is undertaken;
- Dredging/reclamation be approved only where the activities are unlikely to:
  - Cause a deterioration in water quality;
  - Damage or destroy marine vegetation;
  - Damage or destroy riparian vegetation; or
  - Interfere with oyster aquaculture activities;
- Dredging and reclamation is not undertaken during oyster harvest periods (direct consultation with local oyster farmers will be required);



- Material to be dredged be tested for contaminants;
- Dredge spoil is not disposed of in the waterway but at a suitable offshore or onshore location;
- Spoil is not stockpiled within 50 metres of sensitive aquatic habitats and structures such as settlement ponds be constructed above mean high water mark and be secure from 1 in 10 year flood levels to ensure that entrained silt is not returned to the waterway;
- Dredging in shallow areas does not exceed a depth of -2.5 metres AHD. The bottom of the dredge area should be even, battered to a slope of 1 in 6 or less, and be free of holes;
- The dredging method used minimises environmental impact. For example, a cutter suction dredge generally causes less impact than a dragline; and
- Reclamation is not permitted if it covers marine or estuarine habitats such as mangroves, seagrass, saltmarsh, wetlands or rocky reefs.

## 2.12 Marine-related Development

Marine related development such as jetties, marinas, breakwalls, groynes and levees often requires foreshore reclamation, dredging or other works that disturb the natural aquatic habitat. NSW DPI's *Policy and Guidelines for Fish Habitat Conservation and Management* (2013 update) sets out the assessment and licencing requirements associated with these activities.

Marine related development also has the potential to affect the activities of oyster aquaculture by affecting water quality or through increased adverse boating interactions such damage from boat generated wash.

To reduce the risk to oyster harvest zone classification and management, it is recommended that:

- New public and multiple-use private wharves, boat ramps, marinas or any other similar marine related development should not be located in areas where increased or concentrated boat traffic will affect access to, or operation of, oyster areas. A minimum distance from oyster aquaculture areas for these developments is 50 metres;
- New mooring areas or specific watercraft operation areas be located a minimum of 50 metres from any oyster aquaculture area;
- New designated swimming areas or public recreation areas be located a minimum of 50 metres from any oyster aquaculture area;
- Local oyster farmers are directly consulted about any other developments that may have an impact on their ability to carry out farming activities; and
- Marinas be designed so that there is a high rate of water exchange and have a water quality management plan.

## 2.13 Tourism and Residential Development

Residential or tourist developments that overlook existing oyster aquaculture areas need to consider the potential for conflict between the established oyster industry and new residents and visitors.

The oyster industry is an established part of the estuarine landscape in many estuaries in NSW (Figure 3) and is important to many regional economies. Historically, there have been issues with untidy and derelict lease infrastructure. The industry understands that this is an unacceptable practice and is working with NSW DPI and other agencies (e.g. Local Land Services) to rectify the problem. Between the years 2009 to 2016, 487 hectares consisting of 422 leases have been cleaned up, remediated and returned for public use.

Developers, new residents to the coast and visitors need to accept of the right of the oyster industry to continue to operate.

It is recommended that:

- Developers of proposals in the visual catchment of oyster aquaculture be made aware that oyster aquaculture lease areas have existing use rights and they will not be removed or altered as a result of subsequent residential or tourist development;
- Any proposed development cannot impact on the current or future activities required to viably farm oysters in that area. This may include for example, reducing access or increasing marine related impacts (see Section 2.12); and
- The proponents of new development that overlooks oyster aquaculture areas must consider either filtering or blocking views in that direction or making a feature of it.



Figure 3: The oyster industry and associated infrastructure is an established part of the estuarine landscape in many NSW estuaries (Source: NSW DPI, 2017).

## 2.14 Intensive Agricultural Industries

New or expanding intensive agriculture industries have the potential to have a detrimental impact on water quality in oyster harvest areas, mainly through faecal contamination but also from sediment, fertilisers and pesticides, as well as hormones and antibiotics which can be endocrine disrupters.

There are guidelines on how to minimise impacts to the environment for the majority of intensive industries (see resource list). All effluent management systems and other pollution controls in areas that may impact on estuaries and oyster aquaculture areas should be designed with special reference to the sensitive nature of these environments.

Specifically it is recommended that:

- All runoff from production areas be diverted into a controlled drainage and effluent management system (this should include shed leachate, spent litter, manure storage areas and carcass composting areas) in order to prevent contaminated water entering streams;

- All clean water from overland flow or roof run-off be diverted away from intensive animal production areas in order to minimise contaminated runoff;
- Irrigation of treated effluent should be managed to avoid surface ponding and soil saturation which could lead to contamination of groundwater;
- A 100 m vegetated buffer zone be maintained between intensive animal activities and all waterways; and
- Stock be removed from grazing pastures in wet conditions for 5-10 days in order to minimise pasture and soil damage, and erosion.

<b>Resource</b>	<b>Content</b>
NSW Department of Primary Industries 2004 <i>Managing Soil Amendments and Fertilisers for a Cleaner Environment</i> . Agfact AC.29 ( <a href="#">Web Reference 43</a> ).	Guidelines for managing soils, fertilisers and soil amendments to minimise detrimental environmental effects.
Meat and Livestock Australia 2012 <i>National Guidelines for Beef Cattle Feedlots in Australia (3rd Edition)</i> ( <a href="#">Web Reference 44</a> ).	Provides a framework of acceptable principles for the establishment and operation of feedlots in Australia. Details environmental performance objectives regarding effluent and manure utilisation, land protection, groundwater and surface water protection and community amenity.
NSW Department of Primary Industries 2012 <i>Best Practice Management for Meat Chicken Production in NSW – Manual 1 – Site Selection and Development &amp; Manual 2 – Meat Chicken Growing Management</i> ( <a href="#">Web Reference 45</a> ).	Guidelines for the planning, design, construction, operation and management of meat chicken farms in NSW. Addresses issues such as land-use conflicts between farmers and residents and increased potential for environmental impact as a result of increased intensification of production technology.  Guidelines regarding the protection of surface water, groundwater and soils include: do not locate farm in a flood prone area; areas of nutrient and chemical storage, including the chicken sheds, litter stockpiles and dead bird management areas should be on an impervious base material to protect groundwater from pollution; and stock access to streams and stream bank damage should be minimised.
NSW DPI 2006a <i>Preparing a development application for intensive agriculture in NSW</i> . NSW DPI, Orange ( <a href="#">Web Reference 46</a> ).	Details requirements for a development application for intensive agriculture in NSW. Details environmental issues that will need to be addressed.
ARMCANZ & ANZECC 1999 <i>Effluent Management Guidelines for Intensive Piggeries in Australia and New Zealand</i> ( <a href="#">Web Reference 47</a> ).	Provides information on how to manage effluent without pollution.
NSW DPI 2006b <i>Deep-litter Housing for Pigs. Primefact 68</i> ( <a href="#">Web Reference 48</a> ).	Explains benefits of deep-litter housing. Details appropriate drainage control to avoid pollution of groundwater and surface water.

ARMCANZ & ANZECC 1999 *Effluent Management Guidelines for Dairy Sheds in Australia and New Zealand* ([Web Reference 49](#)).

Rogers, L. 2008 *Environmental management guidelines for the dairy industry*, NSW Department of Primary Industries ([Web Reference 50](#)).

NSW Department of Primary Industries and Northern Rivers Catchment Management Authority 2008 *Soil and Water Management Practices for Blueberry Growers in Northern NSW* ([Web Reference 51](#)).

NSW Department of Primary Industries 2002 *Rabbit Farming: Planning and Development Control Guidelines* ([Web Reference 52](#)).

A guide for new and existing blueberry growers in northern NSW, focusing on the management of soil and water resources.

Guide aims to improve quality of development applications to councils for rabbit farming, to assist councils in evaluating proposals, and to improve relevant planning and development controls

## ESTUARY PROTECTION IN ACTION

### HAWKESBURY OYSTER FARMERS GET STUCK INTO IT

*Hawkesbury River oyster growers are proving their estuarine stewardship credentials with clean-up and other estuarine restoration works under the Tide to Table Project. The local growers have been involved in the removal of derelict materials from abandoned oyster farming areas and the restoration of riparian vegetation with the local National Parks rangers. These clean-up activities have occurred in numerous estuaries across NSW.*

*A separate project is installing toilets in an uncontrolled camping area close to their most important oyster harvest zone. These projects are on top of their personal commitment to use only environmentally sustainable cultivation equipment and methods.*



### 3. Rehabilitation of Existing Issues

*“Clean, unpolluted waters capable of sustaining and producing products acceptable to the domestic and overseas markets are an asset of inestimable value to an area” (submission to HRC, 2003, p2).*

#### 3.1 On-site Wastewater Management

Poorly performing on-site wastewater systems can introduce nutrients, pathogens and other micro-organisms into nearby waterways. Pollution incidents resulting from such systems have caused the closure of major oyster harvesting areas in some estuaries.

The *Easy Septic Guide (Septic Safe)* was prepared for individuals who have an on-site septic system. It explains how to check if a septic system is working effectively and how to maintain a healthy system. It also describes the various septic systems available on the market. The information contained in this document is particularly important in catchments that support existing or potential oyster aquaculture operations.

Councils should aim to educate individual system owners on the effective operation of an on-site system. Some councils have developed specific fact sheets to do this (e.g. Bega Valley Shire Council and Tumut Council have 13 factsheets available through their ‘Get Septic Smart’ campaign). These issues are:

- Having septic tanks de-sludged every three to five years to prevent sludge build up, which may block the pipes and absorption trenches;
- Having grease traps cleaned out regularly;
- Keeping a record of pumping, inspections and other maintenance;
- Being aware of the location and layout of the system and land application area;
- Ensuring household products are suitable for use in an on-site system;
- Ensuring biodegradable liquid detergents are used (those with low phosphorus and low sodium); and
- Regularly maintaining the disposal area (long grass and weeds reduce the evapo-transpiration efficiency).

NSW Government regulations require that every septic system is registered with the relevant local council. This allows the council to manage and monitor the overall impact of septic systems in the drainage catchment.

*On-site Sewage Management for Single Households* by the NSW Department of Local Government (1998) addresses the environmental and public health performance requirements of on-site systems for councils. The document also provides administrative and technical guidance on how to comply with these requirements.

#### 3.2 Local Council On-site Sewage Management Strategies

With limited resources, councils face challenges in the implementation of appropriate on-site sewage management (OSM) strategies. While all councils have an OSM strategy they differ greatly in effectiveness.

This Section details the common features of a *best practice* approach for councils that have the job of managing large numbers of onsite disposal systems within close proximity to Priority Oyster Aquaculture Areas (POAA) and demonstrates some innovative strategy features that councils have implemented.

### ***Risk classification***

*Septic Safe* is based on a risk management approach. OSM systems that are located in the same estuary catchment as a POAA, are within 10 kilometres of a POAA or other oyster aquaculture and are in close proximity to a waterway must be classified into the highest risk category.

A high performance system must still be classified high risk in these areas as the consequences of a failure are high.

### ***Inspections – prioritising high risk systems***

Inspection frequency must reflect the level of risk that a system poses. For instance, a high risk system should be inspected annually, while lower risk systems can be inspected less frequently.

If a system fails its inspection, the time in which the owner is required to complete upgrade works must also reflect the risk of a system. Owners of failing high risk systems should be given no more than 30 days to complete upgrade works.

Owners of high risk, or even medium risk, systems must never be allowed to self certify their own systems. If self certification is permitted for low risk systems, a targeted audit program should be introduced to ensure compliance.

### ***Effective record keeping and information sharing***

Perhaps the most important component of a successful OSM strategy is effective and efficient record keeping as the number of OSM systems in a Local Government Area can number in the thousands.

Whilst considering limitations under the *Privacy Act 1988*, such information must be made available to the NSW Food Authority.

### ***Managing pump-out systems***

Ideally, pump-out systems should be council operated and funded through an annual charge, as opposed to a pay for volume system. The latter encourages residents to illegally drain their systems instead of ordering a pump-out.

It is imperative to keep track of pump-out volumes and pump-out frequency so that compliance can be monitored and compliance action appropriately targeted.

### ***Funding the strategy***

The implementation and operation of an OSM strategy that successfully protects public and ecosystem health can be a costly exercise and finding a reliable source of funding is a significant challenge for most councils.

The most straightforward way of sourcing funds is by requiring premises with OSM systems to contribute to the program (i.e. a fee system). However, the problem here obviously lies in gaining public support and acceptance. Educational initiatives would be crucial in gaining support from owners who are unlikely to appreciate added or rising costs to their OSM systems.

### ***Impetus and support***

Great Lakes Council received strong community support when they introduced their OSM strategy, as it was done when immediate action was required to address the serious sewage contamination that occurred in Wallis Lake in 1997. This major public health incident resulted in the closure of significant oyster harvest areas, had a significant impact on the local tourism and seafood industries and proved to be a valuable lesson for regulators – that problems caused by failing OSM systems can quickly become a whole-of-community issue.

Taking a preventative approach to the management of OSM systems is paramount.

### ***Innovative features that work***

- Hornsby Shire Council's classification system makes a distinction between high risk areas and high risk OSM systems. Systems classified as high risk because of performance failure are not approved.
- Bega Valley Shire Council classifies systems as high risk if they occur on village lots with access to reticulated town water.
- Hornsby Council requires owners of high risk systems to complete upgrade works within 21 days while owners of medium risk systems are given 40 days. Prevention Notices are issued under the *Protection of Environment Operations Act 1997* to systems that fail to comply, following re-inspection.
- Both Hornsby and Great Lakes Councils inspect high risk systems annually, while their medium risk systems are inspected every 3 years and low risk systems, every 5 or more years.
- Great Lakes Council manages approximately 6200 OSM systems. A comprehensive electronic database that maintains individual property files is used to manage this. Information such as type of installation, application details, site inspection details and effluent pump-out volumes and frequencies as well as any audit and service documentation is included. This database enables the Council to easily keep track of each system's inspection program as well as its history in terms of operational performance.
- Bega Valley Council has taken a catchment-based assessment of high risk sites which allows them to report aggregated data to the NSW Food Authority on an estuary basis in regard to the number and types of systems and the number of failures and upgrades. This information sharing greatly improves the operation and effectiveness of the NSW Shellfish Program.
- Great Lakes Council receives the pump-out figures of all systems serviced by approved contractors on a monthly basis and maintains these on an electronic database. Volumes and frequency of services for individual systems are monitored regularly to ensure that a satisfactory service is being maintained. Great Lakes inspect pump-out systems as a medium risk installation unless other parameters of risk classification make individual systems high risk.
- Great Lakes Council publishes an annual OSM Strategy newsletter with the aim of educating system owners on their responsibilities and keeping them and the greater community aware of any OSM issues. This has encouraged community acceptance for the Council's fee system which includes:
  - a standard annual levy of \$60,
  - an inspection fee of \$100,
  - a re-inspection fee of \$200,
  - an application fee of \$210 to install and \$105 to alter, and
  - a pre-purchase inspection fee of \$250

The money raised from these fees has been enough to cover the costs of the program, including the recruitment of a full-time Co-ordinator, Trainee and Inspector as well as a part-time Clerical Officer.

<b>Resource</b>	<b>Content</b>
NSW Department of Local Government 2000 <i>The Easy Septic Guide (Septic Safe)</i> . Developed by Social Change Media for the NSW Department of Local Government ( <a href="#">Web Reference 53</a> ).	Guidelines for individual property owners on the installation, operation and maintenance of on-site sewerage systems.
NSW Department of Local Government 1998 <i>Environment and Health Protection Guidelines: On-site Sewage Management for Single Households</i> ( <a href="#">Web Reference 54</a> ).	Developed to help local councils assess, regulate and manage the selection, design, installation, operation and maintenance of single household on-site sewage management systems.

### 3.3 Reticulated Wastewater Management Systems

Overflows from existing reticulated wastewater management systems may occur during high rainfall events when rainwater infiltrates the pipes, as a result of pump or pipeline failure, or during electricity blackouts when pumps stop working. Most sewer systems are gravity systems and pipelines and pumping stations are often located close to waterways. As a result, sewer overflows may introduce large volumes of untreated sewage directly into an estuary. Sewer overflows can be reduced by:

Overflows from existing reticulated wastewater management systems can be reduced by:

- Cleaning and maintaining the system;
- Reducing infiltration and inflow by fixing leaking or broken sewers lines;
- Enlarging or upgrading sewers, pumping stations and sewage treatment plant capacity; and
- Constructing wet weather storage to temporarily store flows.

Other actions that can be taken to manage overflows include:

- Develop a 24 hour emergency response plan that includes immediate notification to the NSW Shellfish Program;
- Use telemetry or dial-up systems to provide early advice of failure;
- Use back-up pumps and controls;
- Have standby/alternative power available; and
- Ensure that spare parts are readily at hand (NSW EPA, 2003).

Further information is detailed in the resources list.

<b>Resource</b>	<b>Content</b>
NSW Environment Protection Authority 2003 <i>Licensing Guidelines for Sewage Treatment Systems</i> ( <a href="#">Web Reference 55</a> ).	Large sewage treatment plants and reticulation systems are a scheduled activity under the <i>Protection of the Environment Operations Act 1997</i> and so require an Environment Protection Licence from NSW EPA. The licence regulates both sewage treatment plant



discharges and discharges (overflows) from the sewerage system.

### 3.4 Urban Stormwater

Types of pollution transported by stormwater include soil particles, chemical substances such as detergents and oils, gross pollutants (e.g. paper, plastics and bottles) and natural material such as animal faeces, leaf litter and garden clippings. Many local councils undertake community education programs in an effort to make people aware of the impacts their activities can have on water quality. Taking care with everyday activities undertaken in an urban setting can substantially reduce the risks to sanitary water quality.

It is recommended that local councils and other relevant agencies inform the public to undertake the following activities routinely:

- Collect and dispose of leaves, grass and other natural material so that it does not enter street gutters and drains;
- Apply fertiliser and topsoil appropriately so that it does not blow or wash into the stormwater system;
- Avoid the use of raw manures as fertiliser;
- Dispose of litter appropriately;
- Wash cars, boats and caravans so that detergents and dirty water does not enter the stormwater system; and
- Collect and dispose of pet droppings appropriately so that it does not enter the stormwater system.

In most cases retro-fitted stormwater treatment will be required. Gross pollutant traps may be used to capture gross pollutants and some of the sediment, sludge and solids but they do not stop dissolved contaminants entering the waterway. Constructed wetland treatment systems, biofiltration and other water sensitive urban design devices may be used to add an additional level of treatment.

Great Lakes Council and the Office of the Lake Macquarie Catchment Co-ordinator have implemented water quality improvement programs for Wallis Lake and Lake Macquarie respectively that have achieved impressive results. These two examples show what can be done with a concerted effort from government in partnership with the community. Refer to the resource list below for details of each of these programs.

<b>Resource</b>	<b>Content</b>
Healthy Lakes Program: Structural Solutions for Urban Water Quality. Great Lakes Council.	Improving water quality in Wallis, Smiths and Myall Lakes is the focus of the Coastal Catchments Initiative, a Federal Government funded project.
<i>Constructed wetland factsheet</i> ( <a href="#">Web Reference 56</a> ).	The Coastal Catchments Initiative is a project managed by Great Lakes Council that focuses on improving water quality and reducing pollution at the source.
Office of the Lake Macquarie and Catchment Coordinator ( <a href="#">Web Reference 57</a> ).	Since the Lake Macquarie Estuary Management Plan was completed in 1997 many millions from the Council's Lake Levy and the NSW Government has

<p>Lake Macquarie City Council Adopt a SQID program (stormwater quality Improvement device) (<a href="#">Web Reference 58</a>).</p>	<p>been spent on improvements in the lake and its catchment. An increase in the extent of seagrass and a measured improvement in water quality are early indicators that this program is having some success.</p>
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### 3.5 Riparian Management Issues

Riparian vegetation acts as a filter strip, significantly reducing the amount of sediment and nutrient that reaches waterways. Maintaining these areas will ensure their long term beneficial effects.

Of particular importance in close proximity to oyster aquaculture is the management of stock in riparian zones. Uncontrolled access can lead to the area being denuded and defecation directly into the water. Ideally, stock should be excluded and alternate watering and shade provided well away from the riparian area. “Crash”- grazing may be required to control weeds.

A significant amount of work has been undertaken to assist private landholders with managing their riparian zone by Catchment Management Authorities (CMA) and Local Land Services (LLS). Southern Rivers CMA used the unique focus of oyster health to underpin their 10 year ‘Oyster Partnerships Program’ which achieved significant improvements to the South Coast industry’s sustainability. A key element of this program was partnering with landholders to fence and revegetate riparian areas in 10 of their oyster-producing estuaries.

For estuarine riparian zones, it is recommended that:

- Riparian areas be managed to maintain the health of existing native vegetation, encourage recruitment of juvenile trees and shrubs and incorporate weed control;
- Areas where little or no vegetation remains, be rehabilitated by replanting or by encouraging natural regeneration;
- Stock access to riparian areas be managed, alternative watering points be provided and alternate shade be provided; and
- Exotic vegetation be replaced with native vegetation (NSW DPI, 2005a).

A list of useful references and guidelines regarding the establishment and management of riparian areas is provided in Section 2.5.

### 3.6 Recreational Boating

#### 3.6.1 Discharges

The *Marine Pollution Act 2012* and the *Marine Pollution Regulation 2014* (Marine Pollution Regulation) aims to improve the management of sewage pollution from vessels and simplify requirements with regard to sewage holding tanks.

Under the Marine Pollution Regulation, it is illegal to discharge raw sewage into the waters of NSW. Additionally, certain areas have been declared “no-discharge” zones for treated sewage. These include all inland waterways, intermittently opening lagoons, aquatic reserves and marine parks, and all waters within 500 metres of aquaculture, bathing, mooring and anchoring areas, persons in the water, beaches and marinas.

The Marine Pollution Regulation also requires that Class 1 (passenger-carrying commercial) and Class 4 (hire and drive) vessels be fitted with toilets and toilet waste holding tanks or have an approved plan of management for the disposal of waste. Recreational boaters with an onboard toilet should also install a holding tank.

Raw sewage from a holding tank or portable toilet should be deposited at appropriate pumpout facilities and never into NSW waterways. Public pump out facilities are provided in many locations throughout NSW. Some marinas also provide private pumpout facilities for clients (NSW RMS, 2016).

There are no specific requirements for non-commercial recreational vessels but all vessel operators must ensure that they do not pollute waterways. Sound environmental practices on and around waterways include:

- Collecting your rubbish on board and disposing of it properly ashore;
- Wiping cooking utensils and plates clean with a paper towel before washing;
- Using low or non-phosphate soaps in sinks and showers;
- Keeping bilges clean to prevent pollutants being discharged overboard; and
- Removing your boat from the water and clean it in places where debris can be captured and disposed of properly.

Under the *Protection of the Environment Operations Act 1997*, NSW Roads and Maritime Services officers can issue on-the-spot infringement notices where cases of pollution from boats are detected.

Suggestions regarding how boat users can minimise their impacts are contained in *Leave Only Water in Your Wake* (NSW RMS, 2015). Suggestions include: avoiding spillages when filling fuel tanks, installing a holding tank or an approved on-board sewage treatment system and disposing of all rubbish properly ashore.

In areas where boating discharges are having a detrimental impact on water quality and the classification and management of oyster harvest zones it is recommended that:

- The need for holding tank pump-out facilities be considered;
- The need for providing on-shore toilets be considered;
- Educational and warning signs be erected; and
- Compliance activities be targeted to the areas if the problem persists.

### 3.6.2. Collision and Tie-up

It is an offence under the *Fisheries Management Act 1994* to interfere with aquaculture infrastructure on an aquaculture lease without the consent of the lessee. Tying a boat to posts, rails or any other infrastructure within an oyster lease is therefore prohibited. Collision and contact between boats and oyster lease infrastructure is also prohibited. Any damage must be reported to the local NSW DPI office as soon as possible.

## 3.7 Agriculture

Agricultural practices such as cropping and grazing can increase the rate of sediment production and the amount of sediment that enters waterways. Clearing and drainage can also affect the hydrological balance of catchments, the frequency and severity of flooding, the distribution and velocity of surface runoff, and groundwater levels. These activities will eventually have an effect on the ecological health of an estuary. Other practices such as the use of dairy laneways, effluent reuse and the application of fertilisers and pesticides can also result in contaminated water reaching waterways.

NSW DPI (1998) has prepared a *Policy for Sustainable Agriculture in New South Wales*. It provides an agreed goal for sustainable agriculture for agencies, farmers, industry groups, local councils and environmental interest groups. One of the key objectives is to achieve satisfactory

water quality, and one of the main strategies to achieve this is to develop, promote, and adopt agricultural management practices that contribute beneficially to rivers and estuaries.

Fish Friendly Farms is another relevant NSW DPI program that encourages farmers to protect fish habitat on and off their properties through sustainable agricultural practices. The program encourages actions which enhance the health of our rivers and at the same time improve on-farm productivity.

General recommendations include:

- All agricultural activity in estuary catchments should be undertaken with reference to the sensitivity of the estuarine receiving water;
- Land-based farmers should get to know their local oyster farmers and Local Land Services Officers to work out ways all parties can benefit from improved land and riparian zone management (see Web Reference 60 for case studies);
- Vegetated buffer zones of a minimum of 100 metres should be established adjacent to all waterways, rivers and drains by fencing;
- Modify floodgates to allow exchange with estuarine water during non-flood periods;
- Make drains shallower. Shallow dish drains (0.3 m depth) minimise the potential of disturbing acid sulfate soils;
- Construct and maintain farm roads, tracks and laneways to minimise run-off and soil erosion;
- Manage irrigation systems according to the soil’s infiltration rate and other relevant factors in order to minimise soil-surface run-off;
- Avoid grazing and cultivation of steep slopes and rotate grazing pastures regularly to prevent stock camps and tracks forming;
- Establish off-stream watering points and design on-stream watering points to prevent damage to riparian vegetation and banks; and
- Maintain groundcover as much as possible to minimise run-off and erosion.

<b>Resource</b>	<b>Content</b>
NSW Government 1998 <i>Policy for Sustainable Agriculture in New South Wales</i> . NSW Agriculture ( <a href="#">Web Reference 59</a> ).	Information on ecologically and economically sustainable agriculture. A number of strategies are identified to achieve water quality and environmental flow objectives (refer to Chapter 7.3).
Davies, H., Keating, J., Perry, M., Fraser, M., McPhee, D. and Presland, C. 2007 SPAT: Southern Producers Achieving Together. Southern Rivers Catchment Management	Case studies of land-based farmers, local oyster farmers and Local Land Services Officers working together to achieve improved land and riparian zone management.

<b>Resource</b>	<b>Content</b>
Authority, NSW ( <a href="#">Web Reference 60</a> ).	
Fish Friendly Farms website ( <a href="#">Web Reference 61</a> ).	See 7 Key Tips for a Fish Friendly Farm and also information on wetlands on farms
Department of Land and Water Conservation (DLWC) 1994 <i>Guidelines for the Construction and Maintenance of Tracks</i> (Brochure) ( <a href="#">Web Reference 62</a> ).	Outlines the principles of planning, constructing and maintaining tracks to minimise soil erosion and to control runoff.
Northern Rivers Catchment Management Authority <i>Soil Erosion Solutions – Helping North Coast landholders reduce soil erosion (fact sheet)</i> ( <a href="#">Web Reference 63</a> ).	Guidelines to minimise erosion on farm roads and tracks.
Murray Darling Basin Commission, Irrigation Association of Australia and NSW Agriculture (now NSW DPI) 2001 <i>Australian Code of Practice for On-farm Irrigation</i> ( <a href="#">Web Reference 64</a> ).	Minimum desirable practices and actions to undertake when developing a new irrigation system or renovating an existing system.
NSW Agriculture (now NSW DPI) 2001 <i>Environmental Management Guidelines for Growing Cut Flowers</i> ( <a href="#">Web Reference 65</a> ).	Best management practices for flower growers. Includes discussion of effective irrigation systems, management of run-off, safe and effective use of chemicals.
NSW Department of Primary Industries 2004 <i>Soil management for commercial vegetables and small crops</i> ( <a href="#">Web Reference 66</a> ).	Details how the correct rate and amount of water can be calculated. This is dependent upon the soil's infiltration rate. Too high an application rate will result in soil surface runoff.
NSW Department of Primary Industries 2005b <i>Maintaining Groundcover to Reduce Erosion and Sustain Production</i> . AgFact P2.1.14 ( <a href="#">Web Reference 67</a> ).	Explains importance of groundcover and how it can be used to minimise runoff and erosion.
NSW Department of Primary Industries and the Department of Natural Resources 2006 <i>Best Management Practices for Temperate Perennial Pastures in NSW</i> ( <a href="#">Web Reference 68</a> ).	Guidelines for sustainable management of grazing lands. For example, in order to ensure clean runoff into waterways: establish fenced vegetation buffer zones, avoid fertilising buffer areas, rotate graze pastures to prevent stock camps and tracks forming. Best Management Practice 1 (Managing Pastures for Clean Water), 2 (Managing Pastures for Protective Groundcover) and 3 (Managing Pastures to Reduce Soil Erosion) are of particular relevance to the protection of water quality on oyster aquaculture areas (refer to pages 12-17).
Croke, J. 2002 <i>Managing Phosphorus in Catchments</i> , Fact Sheet 11, Land and Water Australia, Canberra ( <a href="#">Web Reference 69</a> ).	Provides information about how and why phosphorus gets into waterways and what can be done to reduce this.

<b>Resource</b>	<b>Content</b>
Land, Water and Wool 2006 <i>Rivers and Water Quality: Managing Rivers, Creeks and Streams – A Woolgrowers Guide</i> ( <a href="#">Web Reference 70</a> ).	These guidelines are tailored to different industry groups so that appropriate management of rivers and riparian areas can be integrated into on-farm management systems.
Lovett, S., Price, P. & Lovett, J. 2003 <i>Managing Riparian Lands in the Cotton Industry</i> . Cotton Research and Development Corporation ( <a href="#">Web Reference 71</a> ).	
Lovett, S. and Price, P. 2001 <i>Managing Riparian Lands in the Sugar Industry. A Guide to Principles and Practices</i> . Sugar Research & Development Corporation / Land & Water Australia, Brisbane ( <a href="#">Web Reference 72</a> ).	

### 3.8 Coastal Drains and Acid Discharges

Over the past 200 years, most of our coastal wetlands have been drained and floodgated for agricultural purposes. These low-lying areas are particularly susceptible to over-drainage and have led to the exposure of underlying acid sulfate soils. Subsequent oxidation of the iron pyrite within those soils has produced and exported vast quantities of sulfuric acid, with enormous consequences for estuarine health, oyster aquaculture, commercial and recreational fishing and land-based agriculture. Farmers have found that over-drained wetlands are more susceptible to frosts without the buffering impact of an overlying water body. Peat fires are also far more likely when the land is drained and dries out.

The key agricultural management action is to use wet pasture management, a tool that seeks to reduce the impact of drainage by returning freshwater to suitable areas of low elevation country. Using simple engineering techniques, water is held to desired levels within the former swamps for longer periods. The techniques were originally developed at the request of farmers who were keen to grow more nutritious wet pasture species (such as water couch) to enhance agricultural production. When undertaken correctly, wet pasture management also offers the 'fringe' benefits of reduced acid sulfate soil impacts, fewer crop-damaging frosts and better peat fire control. Due to the 'win-win' nature of wet pasture management, a greater number of landholders are being encouraged to participate.

An alternate approach is to return natural water flows to former wetlands and restore a wetland ecosystem. This approach has been used to rehabilitate the Darawakh/Frogalla wetlands on the Wallamba River and the Yarrahappini Wetlands on the Macleay River.

<b>Resource</b>	<b>Content</b>
Johnston, S., Kroon, F., Slavich, P., Cibilic, A. and Bruce, A. 2003 <i>Restoring the Balance: Guidelines for Managing Floodgates and Drainage Systems on Coastal Floodplains</i> . NSW Agriculture, Wollongbar ( <a href="#">Web Reference 73</a> ).	Guidelines for local government authorities, landholders, industry and community groups to improve environmental performance (reduce drainage of acidity) of coastal floodplain drainage systems.

<b>Resource</b>	<b>Content</b>
Wetland Care Australia 2003 <i>Darawakh Creek and Frogalla Swamp Wetland Management Plan</i> ( <a href="#">Web Reference 74</a> ).	

## **ESTUARY PROTECTION IN ACTION BELLINGER AND TILLIGERRY BACK IN BUSINESS**

*December 20 2007 saw the lifting of oyster harvest closures from the Bellinger River and parts of Tilligerry Creek following the successful work of two interagency taskforces set-up by the NSW Department of Premiers and Cabinet. These taskforces investigated the source of the problem and facilitated the implementation of remedial actions. This model is now formalised in the Incident Response Protocol: Aquaculture Estuaries in NSW. The actions in these guidelines are directed towards preventing closures like this from occurring in*



## 4. Strategic Planning

*Oyster farmers are like any farmers, but what sets them apart is the area in which they farm, the estuary. Their paddocks are water, their livestock are hidden beneath and it is sometimes difficult to appreciate what they are producing until it appears on your plate (English, 2007, p12).*

### 4.1 Local Environmental Plans

The impacts of past development of estuarine catchments (e.g. stormwater, septic seepage, sewerage outfalls) has, in many cases, resulted in a deterioration in the environmental conditions required for oyster cultivation.

To address this issue, the NSW Oyster Industry Sustainable Aquaculture Strategy (OISAS) introduced new provisions to ensure that oyster aquaculture is considered in the preparation of Local Environmental Plans (LEPs).

These provisions are designed to implement the Healthy River Commission recommendation (HRC, 2003) that regional and local planning processes for land and other resource uses should be specifically directed to achieve the protection of Priority Oyster Aquaculture Areas (POAA).

The Minister for Planning issued a Section 117 direction, which commenced on 19 July 2007 (Direction No. 1.4) requiring councils to show POAAs on LEPs and have regard for these areas in preparing a new LEP. The Director-General of the Department of Primary Industries may object to the terms of a draft LEP on the grounds of deleterious effects on an oyster aquaculture area - see Appendix 1: *Amendment No. 3 to SEPP 62 – Implications for development that may affect oyster aquaculture for more information.*

Affected LEPs should be referred to the relevant office listed on Page i.

Where possible an environmental protection zone adjacent to estuarine foreshores should be established in the LEP.

### 4.2 Coastal Management Plans

The NSW Coastal Zone Management Planning (CZMPs) process is administered by the NSW Office of Environment and Heritage (NSW OEH) and aims to support the goals and objectives of the *NSW Coastal Policy 1997* and assist in implementing integrated coastal zone management. CZMPs can be developed for individual estuaries or for groups of geographically related estuaries.

The primary purpose of a CZMP is to describe proposed actions to be implemented by a council, other public authorities and potentially by the private sector to address priority management issues in the coastal zone over a defined implementation period. CZMPs are developed in accordance with Part 4A of the *Coastal Protection Act 1979* and the requirements of the CZMP guidelines. The Minister administering the *Coastal Protection Act 1979* certifies completed plans and they are endorsed by council and ultimately published in the Government Gazette.

Oyster farmers are a major stakeholder in the management of many estuaries (Figure 4). The inclusion of an oyster industry representative is, therefore, important when establishing a Coastal Zone Management Committee for an oyster producing estuary to ensure that the requirements and concerns of the industry are addressed in the planning process. Oyster farmers may also be able to contribute important local knowledge regarding the estuary. Current and historic water quality data collected under the local NSW Shellfish Program may also be useful base data. This can be obtained from the NSW Food Authority in consultation with local farmers.



CZMPs for oyster producing estuaries should recognise the existence of the oyster industry and include the aim of achieving OISAS water quality objectives as a major goal. The plan should also ensure that other management actions are compatible with the operation of the industry.



Figure 4: Oyster farmers are a major stakeholder in the management of many estuaries (Source: NSW DPI, 2008).

### 4.3 Environmental Management Systems

The future of the oyster industry relies not only on a healthy environment, but also on the ability to demonstrate that farmers are utilising the environment in a responsible and sustainable manner. One way of doing this is to develop an Environmental Management System (EMS).

An EMS is a simple yet powerful approach where farmers identify environmental issues that pose a risk to their business and the wider catchment. The process systematically identifies, assesses and priorities risks, and then constructs a plan to mitigate these risks. Such an approach increases industry resilience.

Risks can result from internal oyster farming practices (e.g. the continued use of tar and running inefficient 2-stroke outboards) but may also arise from external catchment based activities (e.g. livestock effluent in creeks and faulty sewerage pumping stations). Addressing these risks require farmers to work closely with other stakeholders, including Local Land Services (LLS), NSW DPI, local councils, other landholders and NPWS.

For an insight into how EMS has been effectively used by south coast growers, watch the South Coast Oyster Growers short documentary video ([Web Reference 75](#)).

OceanWatch Australia and the coastal LLS are actively involved with the industry and of 32 oyster producing estuaries in NSW, there are now 18 estuary-wide EMS documents in varying

stages of development that outline local industry priorities for the future. See [Web Reference 76](#) to view the estuaries that have committed to an EMS and the EMS reports.

Once prepared, attention needs to be given to EMS implementation. South Coast oyster grower groups with the assistance of OceanWatch, Sapphire Coast Wilderness Oysters and the South East LLS employed Oyster EMS Implementation officers. These officers have enabled the smooth implementation of the estuary-wide EMS and assist the oyster industry make full use of their EMS in building the partnerships necessary to ensure the long-term sustainability of the local oyster industry.

#### 4.4 Stormwater Management Plans

Council stormwater management plans and specific development stormwater management plans should take into consideration the protection of the local oyster aquaculture industry and make reference to OISAS water quality objectives. Stormwater management plans must also address soil management by undertaking a detailed soil analysis if the development is within 10 km of a Priority Oyster Aquaculture Area.

The presence of oyster aquaculture is a strong justification for prioritising stormwater remediation activities in that area.

#### 4.5 Prioritising Actions

There are various management plans that include actions to improve estuarine water quality. They include estuary management plans, coastal management plans, Local Land Services strategic plans and stormwater management plans.

Inevitably, these plans propose actions that exceed the available budget for implementation and therefore actions need to be prioritised.

The oyster industry priorities for action are based on achieving a continual improvement in the classification and/or management regime of their harvest zones, improved oyster health and growth and reduced costs in operating the NSW Shellfish Program.

The priority of works to improve estuarine water quality that will benefit the oyster industry are:

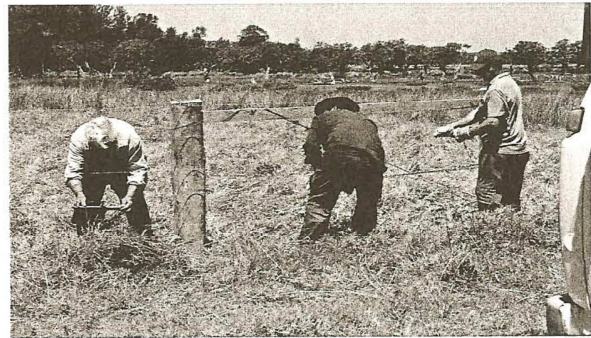
1. Works to prevent an imminent threat to downgrade classification to 'Prohibited';  
Under this scenario the Incident Response Protocol: Aquaculture Estuaries in NSW is triggered and a government led response activated;
2. Works in areas where there is high 'Potential' to upgrade the classification to 'Approved';
3. Works in areas where there is a low risk of a downgrade to 'Prohibited' and high potential to ameliorate the risk; and
4. Works in areas where there is a risk of downgrade to 'Restricted' and high potential to ameliorate the risk and maintain 'Approved' status.

NSW DPI and the NSW Food Authority have prepared a risk assessment of all oyster harvest zones in NSW (NSW Food Authority, 2009 & 2017). This assessment includes recommendations for prioritising works based on this hierarchy.

## **ESTUARY PROTECTION IN ACTION**

### **SHOALHAVEN OYSTER-DAIRY CO-OPERATION**

*The Shoalhaven Dairy – Oyster Partnership project was just one of the many on-ground projects undertaken as part of Southern Rivers CMA and South East Local Land Services Oyster Partnerships Program. In the Shoalhaven estuary alone, over 30 km of stock exclusion fencing along the lower Crookhaven River adjacent to local oyster leases has been erected. This has resulted in improvements in local water quality, oyster harvest conditions and the protection of valuable mangrove and saltmarsh communities.*



*As well as the on-ground works associated with the project, constructive dialogue between the two primary producer groups has been initiated and is on-going. This has come as a result of field days, on-site meetings and working bees where oyster farmers have assisted the property owners in erecting the stock proof fences. Each industry now has a greater awareness and appreciation of the impacts of certain practices on the livelihoods of others.*

## 5. References

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## Appendix 2 – Planning Circulars (PS07-13 and PS07-14)

*Planning Circular PS07-13: Amendment No. 3 to SEPP 62 – Implications for oyster aquaculture development.*

Available at:

<http://www.planning.nsw.gov.au/~media/Files/DPE/Circulars/planning-circular-amendment-no-3-to-sepp-62-implications-for-development-that-may-affect-oyster-aquaculture-2007-08-22.ashx>

*Planning Circular PS07-14: Amendment No. 3 to SEPP 62 – Implications for development that may affect oyster aquaculture.*

Available at:

<http://www.planning.nsw.gov.au/~media/Files/DPE/Circulars/planning-circular-amendment-no-3-to-sepp-62-implications-for-development-that-may-affect-oyster-aquaculture-2007-08-22.ashx>