BRISBANE WATER OYSTER FARMERS ENVIRONMENTAL MANAGEMENT SYSTEM

A VOLUNTARY, INDUSTRY-DRIVEN ENVIRONMENTAL INITIATIVE

BRISBANE WATERS OYSTER FARMERS COMMITMENT

It is the policy of the Brisbane Water Oyster Farmers to conduct all aquaculture activities in an environmentally responsible manner, appropriate to the nature and scale of operations.

The Brisbane Water Oyster Farmers recognise that they have a responsibility to cultivate oysters on behalf of the community as sustainably as current technology and techniques allow, and to continually improve as new methods develop.

Oyster farmers have a vested interest in maintaining and improving the local environment, with their livelihoods dependant on the health and productivity of the estuary. The oyster growers are demonstrating their commitment by voluntarily participating in this industry-driven Environmental Management System.

To achieve this Brisbane Water Oyster Farmers will:

- Comply with relevant laws and regulations and implement industry best practice (e.g. Oyster Industry Sustainable Aquaculture Strategy)
- Plan for environmental hazards and work towards mitigating their potential impacts and respond to emergency situations working with the appropriate authorities
- Recognise and protect the cultural and aesthetic values of Brisbane Waters and its catchment
- Cultivate oysters in a manner that minimises: resource consumption; waste production; pollution
- Communicate openly with relevant stakeholders on environmental matters
- Contribute to scientific research and innovation relevant to oyster cultivation and estuarine environments
- Strive for continual improvement

Brisbane Water Oyster Farmers provide healthy sustainable local seafood to the community

Oysters have been consumed by Aboriginal Australians for thousands of years with shell middens dating back as far as 6,000 B.C.

Oyster leases provide structure and valuable sheltered habitats for fish and other important estuary animals and aquatic organisms

Each year, oysters grown in Brisbane Water filter the equivalent of 80,000 Olympic swimming pools of estuary water

In 2012/13, 150,000 dozen oysters were produced in Brisbane Water with a value of $800,000

Nature's own wonder food, oysters are nutritionally complete, rich in minerals zinc, selenium, magnesium and vitamins A, B1, B2 and C

Local oyster farmers self fund water quality testing, contributing valuable scientific data to help monitor the health of the estuary

In NSW, annual oyster production is worth over $35 million

Oysters are the "canaries" of our estuary systems

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This project is supported by Brisbane Water oyster farmers, OceanWatch Australia, Gosford City Council and Greater Sydney Local Land Services. OceanWatch Australia is the national marine NRM organisation recognised and supported by the Australian Government.

1. INTRODUCTION

An Environmental Management System (EMS) is a step-by-step process to identify and manage environmental impacts, risks and opportunities. The model is based on a philosophy of **continual improvement** – that is, recognising current performance against certain requirements, and then working towards realistic and achievable improvements in the future.

An EMS helps ensure the long term sustainability of oyster farming by reducing or preventing identified negative impacts on the environment

The benefit for oyster farmers to develop an estuary-wide EMS is that it:

- **Provides an organised, documented and coordinated approach to both improving and demonstrating environmental sustainability**

Other benefits that can be gained from having an EMS include:

- Avenue to engage with stakeholders and to improve catchment conditions;
- Ability to portray a positive public image of the industry;
- Reduced operating costs;
- Higher product prices from having a clean, green image;
- Ensure compliance levels across operators.

1.1. HOW TO USE THIS EMS

How to use this EMS to …	**… explain oyster farming practices**

An introduction to the oyster industry is provided from page 9. This discusses farming methods used in Brisbane Waters, species grown, and provides a brief explanation of the comprehensive water quality monitoring program that oyster farmers undertake to ensure a safe and premium quality product.

How to use this EMS to …	**… highlight the high risk activities to the local oyster industry**

High risk activities to oyster farming in Brisbane Waters have been identified through a risk analysis. This allows potential risks to be identified and ranked as low, moderate, significant or high depending on the likelihood of a risk occurring and the severity of the consequence. A summary of these risks are provided on page 20 and 21.

Risks have been split into two groups:

- External risks: May arise from other people's activities, or from natural events such as extreme weather conditions
- Internal risks: May arise as a result of oyster farming operations

How to use this EMS to …	**… improve environmental performance of the industry & environmental conditions in Brisbane Water**

An Environmental Improvement Plan (page 22) provides background information on how the risks may impact on the oyster industry. This plan also outlines how oyster growers and other stakeholders can work to protect the estuary and the future of this important local industry.

How to use this EMS to …	**… demonstrate that oysters farmers are continually improving their environmental performance**

Every year (or biennially) it is encouraged that oyster farmers, or a nominated organisation such as OceanWatch Australia, review the environmental performance of the industry against the Improvement Plan. A review form has been included in this document on page 37.

Undertaking this review allows farmers to see how successfully they are working towards the Improvement Plan. A summary of the year's achievements should be added to the back of this document, and can be used as the basis of a media release promoting the actions of the local industry.

1.2. RELATIONSHIP TO OTHER PLANS & REGULATIONS

An EMS is designed to complement existing laws, guidelines and strategies that control and guide environmental management and best-practice marine resource use. These include:

Crown Land Act	1989
Fisheries Management Act	1994
NSW Threatened Species Conservation Act	1995
Environmental Protection & Biodiversity Conservation Act	1999
Environmental Protection & Biodiversity Conservation Regulations	2000
Fisheries Management (General) Regulation	2002
Review of Environmental Factors. Maintenance Dredging of Tuross Estuary	2003
New South Wales Oyster industry – Sustainable Aquaculture Strategy	2006
Brisbane Water Estuary Processes Study	2008
Brisbane Water Estuary Management Study	2010
NSW Shellfish Industry Manual	2011
State Environmental Planning Policy (SEPP) 62 – Sustainable Aquaculture	2011
Coastal Zone Management Plan for Brisbane Water Estuary	2012
Hunter Central Rivers CMA – Catchment Action Plan	2013
NSW Oyster Industry Sustainable Aquaculture Strategy (v2)	2014

1.3. SCOPE

The scope of this EMS is limited to:

- The environmental aspects of aquaculture operations undertaken by Brisbane Water Oyster Framers (BWOF)
- The most significant environmental aspects of activities and processes within the catchment that may impact upon oyster farming in Brisbane Water

1.4. DEVELOPMENT

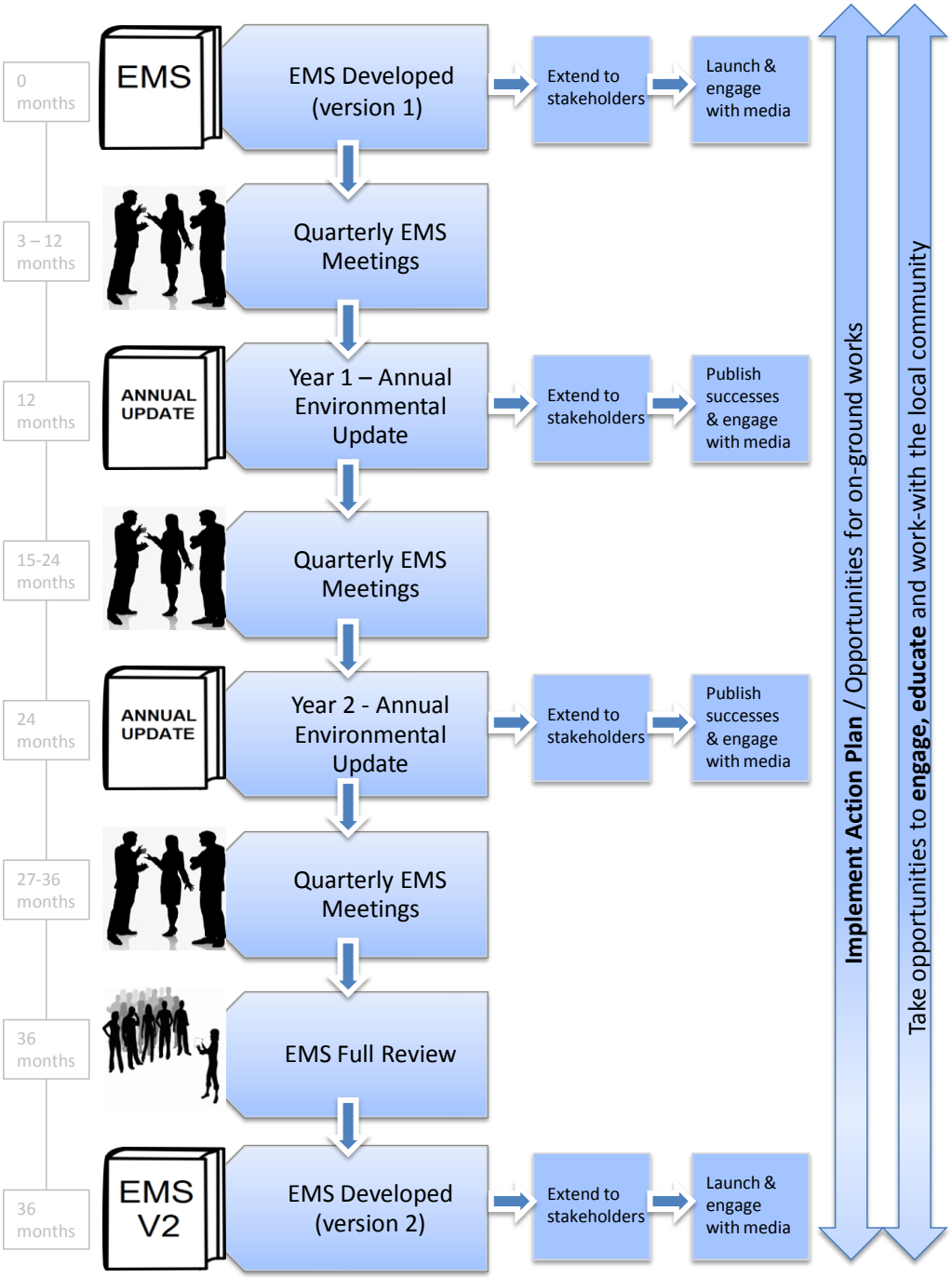
As an industry driven initiative, this EMS was developed by oyster farmers operating in the Brisbane Water estuary through a series of workshops, with facilitators, Andy Myers and Carl Bevilacqua from OceanWatch Australia, and Tim Macdonald from Gosford City Council. Funding support has been provided by the Australian Government and Greater Sydney Local Land Services.

The EMS is based on a risk analysis approach to oyster farming in Brisbane Water. Potential risks are identified and ranked as low, moderate, significant or high depending on the likelihood of a risk happening and the consequence if the risk does occur. An Environmental Improvement Plan outlines actions to reduce or remove these risks.

Whilst this EMS was compiled with regards to International Standard, ISO 14001:2004 (Environmental Management Systems), it is not fully compliant with the standard in its current form. The ISO standard describes the general requirements for documenting and implementing environmental management.

1.5. PATHWAY TO IMPLEMENTATION

An EMS is based on the philosophy of **continual improvement**. Below is a suggested model for implementation of this EMS, incorporating both review processes and communication.



Extend to stakeholders: The EMS and *Environmental Updates* provide an opportunity to educate the local community and engage with key stakeholders (e.g. NSW DPI, NSW Food Authority, Greater Sydney Local Land Services and Gosford City Council). These organisations should be sent a copy of the EMS, and asked for comment. Specific questions raised in this document should be directed to the appropriate organisation, and a written response requested.

EMS launch: It is recommended that oyster farmers use the EMS launch to engage with key stakeholders. Consider organising an open-day or similar engagement event where people can be taken out to lease areas and learn about the industry. This provides an ideal opportunity to discuss cultivation practices and the challenges that oyster farmers face.

Quarterly EMS meetings: It is important to continue driving environmental improvements following launch of the EMS. Quarterly meetings provide a good forum in which farmers can discuss environmental issues, and delegate actions to be pursued. To build networks and encourage communication with other organisations, consider inviting external representatives to talk about their work, and any projects that might be of interest.

Annual environmental update: This documents the progress that has been achieved by the industry. A meeting of all oyster farmers should be organised (or tied into the QAP-AGM), and achievements against the *Environmental Improvement Plan* (pg 22) should be recorded. This information is then used to generate an estuary-wide *Environmental Update*. The update should be added to the back of the EMS, and circulated to key stakeholders. Consider using the key achievements to promote the activities of the industry (e.g. in a media release or other promotional material).

This process also allows farmers to discuss incidents where the provisions of this EMS were not met. Failures may be:

- intentional or unintentional;
- an indication of inappropriate actions;
- due to highly unusual circumstances;
- some combination of the above.

Possible responses may include:

- adapting actions plans;
- a full review of the EMS;
- training;
- no action.

Full EMS review: Every 3-4 years it is recommended that oyster farmers reassess the environmental risks to oyster farming, and update this EMS to reflect the changing condition of the estuary and catchment. New risks may have emerged and farmers may need to consider a new approach to protect their interests. On the other hand, old risks may have been sufficiently addressed and may be downgraded or removed.

2. INDUSTRY DESCRIPTION

2.1. SYDNEY ROCK OYSTERS *(Saccostrea glomerata)*

The Sydney rock oyster is endemic to Australia and is found in bays, inlets and sheltered estuaries between Hervey Bay (QLD) and Wingan Inlet (VIC). It is capable of tolerating a wide range of salinities and occupies the intertidal zone to 3 metres below low water. Within this range they are common on hard rocky substrates.

Sydney rock oysters generally spawn in Brisbane Water between February and June, typically coinciding with a full moon. Oysters are 'broadcast spawners', meaning that both male and female gametes are released into open water for fertilisation. Within hours of fertilisation the eggs develop into free-swimming planktonic larvae that remain in estuarine and coastal waters for up to 3 weeks. During this time the larvae develop clear shells and a retractable foot, before settling on a suitable substrate, using the foot to find an appropriate site. The foot is reabsorbed once larvae are attached, the shell darkens and the small animal takes on the appearance of an adult oyster. Settled, footless oyster larvae are known as 'spat'. They remain settled in that location for the rest of their life.

Growth rates vary with local conditions, but generally wild Sydney rock oysters reach 40–60 grams in 3-4 years. They are capable of spawning after 1 year, and have the peculiar trait of changing sex from males to females as they grow older. A later sex reversal is possible, but around 75% of prime eating oysters are female.

All oysters are filter feeders, straining organic material (mainly plankton) from the surrounding water. Mortality is highest in the free swimming & early settlement phases, and at this stage oysters are subject to prey from a variety of fish species. Once the shell has hardened they are less vulnerable to fish predation, but stingrays, mud crabs, whelks and starfish all feed on adult oysters.

Commercial hatcheries (e.g. the Select Oyster Company - SOCo) now selectively breed select oysters with a fast growth rate so that quick-growing spat can be derived. These hatchery-reared oysters can grow to market size in half the time of wild-caught spat (i.e. 2 years instead of 4). These oysters may also be bred to provide some resistance to disease, particularly Qx and winter mortality.

2.2. FARMING METHODS

BWOF use many different systems to cultivate oysters. Techniques range from the traditional tray / rack and rail method, to more recently developed cultivation techniques incorporating long-lines. Each method has advantages and disadvantages, and the choice of a particular method depends on personal preference as well as the location and features of the lease.

While some local farmers collect oyster larvae themselves from catching leases in Brisbane Water, the waterway is not recognised as a good catching estuary (i.e. natural spatfall is fairly low). Most farmers therefore catch oyster larvae in other estuaries, or buy oysters off other farmers elsewhere in NSW. Sydney rock oysters are generally caught between June and October.

The primary method of spat self-collection used by BWOF, and commonly used in NSW, utilises thin strips of arched PVC plastic or ‘slats’. Numerous slats are then arranged horizontally on a frame. The frame and attached slats are then stacked on top of one another and laid flat on racks within leases exposed to the most natural spatfall. The structure provides the maximum amount of surface area for settlement, whilst providing juvenile oysters with protection from predators such as fish. Some slats have fine ribs to encourage settlement, and to harvest spat the slats are removed and twisted.

Spat collected off plastic slats or brought in from catching leases in other estuaries are required to be grown individually. Such oysters are known as single seed.

Most oyster farmers will use trays at some point during the cultivation process. Plastic trays require very little maintenance and are gradually being introduced to replace treated timber and wire trays. Tray divisions prevent oysters from clustering from wind or wave action, which would otherwise result in uneven growth. Snap on lids provide added protection from the elements and predation.

Trays are secured to a rack and rail system that is built in the estuary (within approved oyster lease areas). The height of the rack is calculated so that oysters are positioned in the intertidal zone, remaining underwater for the majority of the tidal cycle, but then fully exposed at low water. Exposing / drying oysters is not only a technique used to manage biofouling, but is also used to toughen the oyster, strengthening the abductor muscle prolonging shelf life post-harvest.

Some farmers in Brisbane Water have also adapted this traditional rack and rail system for use with plastic cylinders or tumblers that run perpendicular to the supporting rail.

Long-lines are an increasingly popular system for growing single-seed oysters. Tumblers, bags and a variety of hard-plastic baskets can be attached to the line, and move with changing wind and tide. This movement reduces the tendency for oysters to clump together, and produces oysters with the desired and marketable cupped shape shell. The line is supported intermittently with vertical uprights, and has a very small physical footprint in the estuary. In the example shown below, floating bags are arranged on opposite sides of a length of polyurethane rope. To dry the oysters, the pillows on one side of the rope can be flipped over and rested on top of the neighbouring bag, with the height of the combined floatation enabling the top bag to rest clear of the water.

Oysters are also graded at frequent intervals. This allows farmers to keep similar sized stock together and to select appropriate on-growing cultivation methods. As oysters grow they are moved to cylinders, bags, trays with a larger mesh size and progressively thinned to provide more growing room. This promotes water flow, giving oysters increased access to food.

Despite the increasing popularity of long-lines, oyster farming in Brisbane Water was historically built on rack and rail infrastructure. The old practice of stick cultivation relied on the rack and rail support, and with the introduction of trays, these too utilised the racking system installed in the estuary. This rack system was traditionally built using tarred and treated timber (copper, cadmium, arsenic components), as a means to combat wood boring organisms, however this is now being phased out in many estuaries in NSW. Common replacement products include composite posts (wood / recycled plastic amalgam) and untreated wood sheathed in plastic.

2.3. LAND BASED ACTIVITIES

Oyster farmers operating in Brisbane Water currently have no lease arrangements with the Department of Lands for occupancy of waterfront land. Such a lease arrangement would allow BWOF to establish a much needed centralised depot and storage site. Most oyster farming operations in NSW have negotiated long term tenures for their land-based facilities. This allows farmers to operate efficiently through gaining better access to the waterway and eliminates the necessity for farmers to access their leases and conduct their day to day operations from public launching sites. This current situation is seen by the BWOF as a major impediment for the ongoing development of the Brisbane Water oyster industry providing limited security for any future business investment.

Oyster farming requires the use of a variety of different machinery to help them manage their day to day operations. Sheds are required to store surplus cultivation equipment (including trays, cylinders, bags, etc.), to clean, grade and depurate oysters, and to maintain equipment. Other machinery required for oyster cultivation can include forklifts, tractors, cranes and sophisticated oyster grading machines.

The images below illustrate the scale and kind of infrastructure required to operate a successful oyster farming enterprise.

2.4. WATER QUALITY MONITORING

Due to a wide variety of activities and processes that can impact estuary health, Brisbane Water oyster farmers maintain a Quality Assurance Program (QAP). Through this program, water and meat quality is assessed every two weeks, with additional bio-toxin assessments conducted once a month. This rigorous sampling regime ensures that immediate action can be taken should pollution levels threaten the health of the river and the viability of oyster stocks.

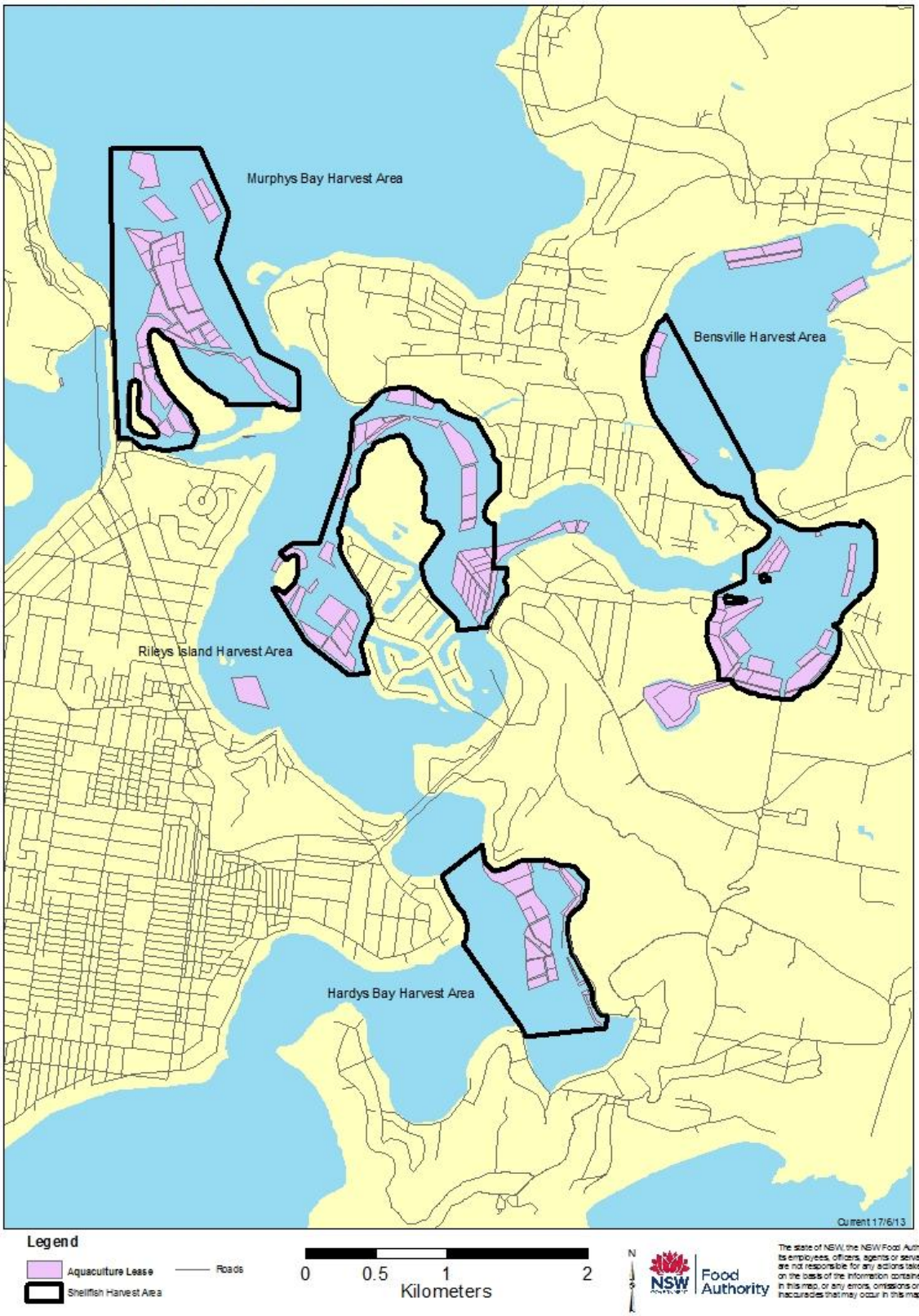
The water and meat quality samples validate each farmers licence issued by the NSW Food Authority and all growers are required to pay a substantial levy to fund this local QAP. The program greatly benefits the wider community by providing an indication of catchment health. The long-term, standardised dataset also provides an invaluable record of changing environmental conditions. In this way, the BWOF contribute significantly to the scientific understanding of the waterway and its management.

There are four areas in Brisbane Water that are classified by the NSW Food Authority for the harvest of oysters (see map on next page). These areas are classified in accordance with the 'Australian Shellfish Quality Assurance Program'. All four of these areas (Bensville, Hardys Bay, Murphys Bay, Rileys Bay) are classified as **conditionally restricted**.

All harvest areas must meet strict water quality criteria. If criteria are not met, then the area closes and oyster farmers are unable to sell oysters until there is an improvement in environmental conditions.

The **conditionally restricted** status recognises that there may be some local issues with water quality, but at levels low enough to be removed from shellfish via depuration. Depuration is a statutory process that requires oysters to be placed in a sterilised recirculation tank for 36 hours. During this process the oysters self cleanse in recirculated water, which is sterilised using ultraviolet light.

Brisbane Water Classified Shellfish Harvest Areas



Harvest Area	Conditionally restricted (Area remains open depuration required)	Closed (Proceed with sample collection)
Bensville	Rainfall < 40 mm in 48 hrs AND Salinity > 21ppt	Rainfall > 40mm in 48 hrs OR Salinity < 21ppt
Hardys Bay	Rainfall < 40 mm in 24 hrs AND Rainfall < 60 mm in 48 hrs AND Rainfall < 80 mm in 7 days	Rainfall > 40 mm in 24 hrs OR Rainfall > 60 mm in 48 hrs OR Rainfall > 80 mm in 7 days
Murphys Bay	Rainfall < 40 mm in 48 hrs AND Salinity > 21ppt	Rainfall > 40 mm in 48 hrs OR Salinity < 21ppt
Rileys Island	Rainfall < 40 mm in 48 hrs AND Salinity > 21ppt	Rainfall > 40 mm in 48 hrs OR Salinity < 21ppt

3. ENVIRONMENTAL REVIEW

3.1. Brisbane Water

Brisbane Waters is located on the central coast of New South Wales (NSW) being one of two bodies of water (the other is the Hawkesbury River) that separate greater Metropolitan Sydney from the NSW Central Coast. The estuary is surrounded on its western side by the Brisbane Water National Park and is characterised by its particularly high scenic value. This includes areas of pristine vegetation with extensive views of the water and surrounding countryside from numerous locations.

The estuary and its catchment host a large variety of important plant and animal communities with an estimated 870 hectares of mangroves, 160 hectares of saltmarsh and 620 hectares of seagrass. Over 110 bird species have been recorded within the estuary, sixty vulnerable and fourteen endangered animal species, and sixteen vulnerable and eight endangered plant species. An area of 2,277 hectares of Brisbane Water has been classified by Birdlife International as an important bird area supporting an isolated population of up to ten breeding pairs of bush stone-curlews and occasionally flocks of the endangered regent honeyeater and swift parrot during the autumn and winter months.

The total catchment area that drains into Brisbane Water is approximately 165 km^2, with Narara Creek its primary tributary. Its mouth is located on the northern side of Broken Bay between Wagstaffe point and Ettalong Beach. There are also many other tributaries flowing into the estuary including Erina Creek, Kincumber Creek, Woy Woy Creek and Ettalong Creek.

The area is densely populated with large centres such as Gosford city located toward the northern extremity and Woy Woy toward the south western end and numerous smaller suburbs and towns located around all of its shores.

The Local Government Area (LGA) of Gosford City Council currently supports approximately 170,500 residents and is expected to grow to around 182,000 by 2031, (2014 data). This rise in population is expected to be accommodated by an additional 10,000 residential dwellings. The region is also a popular tourist destination with a large number of visitors annually. The increasing residential and tourist population has resulted in increasing pressures on the natural environment.

There are over 180 sewage pumping stations across the Gosford LGA with the main urban centres around Brisbane Water being serviced by two sewage treatment plants (Woy Woy & Kincumber). Kincumber Waste Water Treatment Plant (WWTP) is the region's main facility, and services around 140,000 residents across most of Gosford City. The WWTP located at Woy Woy services approximately 40,000 residents across the Woy Woy Peninsula including Woy Woy Bay, Pearl Beach and Patonga. The LGA still has many on-site sewage management systems (OSMS) in operation in particular in the region of Cockle Bay (Empire Bay, Bensville and Kincumber south). Of particular relevance to the oyster industry is the high concentrations of these OSMS along the foreshore of the estuary and its tributaries.

3.2. RISK ASSESSMENT PROCESS

Risk is the chance of something happening that will have an impact on the environment, community and / or the industry

An EMS is based on a risk analysis approach. Potential risks are identified and ranked as low, moderate, significant or high depending on the ***likelihood*** of a risk happening and the ***consequence*** if the risk does occur. Each specific risk is ranked, based upon the tables below:

LIKELIHOOD OF A RISK HAPPENING

1. Rare	May occur in exceptional circumstances
2. Unlikely	Uncommon, but has been known to occur
3. Possible	Some evidence to suggest this may possibly occur
4. Likely	May occur
5. Almost certain	Expected to occur in most circumstances

CONSEQUENCE IF THE RISK DOES OCCUR

1. Negligible	Minimal impact, unlikely to be measureable from natural variability
2. Minor	Possible detectable but minimal impact on structure / function
3. Moderate	Maximum acceptable level of impact on the environment, time frame for recovery more months than years
4. Major	Will result in wider and long term impacts
5. Severe	Very serious impacts with relatively long time frame for recovery to an acceptable level, includes irreversible damage

RISK MATRIX

		Consequence				
		Negligible	Minor	Moderate	Major	Severe
Likelihood	Rare	Low	Low	Moderate	Significant	Significant
	Unlikely	Low	Low	Moderate	Significant	High
	Possible	Low	Moderate	Significant	High	High
	Likely	Moderate	Significant	Significant	High	High
	Almost certain	Significant	Significant	High	High	High

RISK CATEGORY & MANAGEMENT RESPONSE

Low	No further procedures or action required to address issue
Moderate	Appropriate action required to address issue May include continuation of current arrangements
Significant	Management attention required Action to address issue needs to be taken
High	Strong and immediate action required New or further risk control measures needed

Potential risks that are considered may be split into:

1) External risks: Risks that arise from other people's activities, or from natural events such as extreme weather conditions;

2) Internal risks: Risks that arise as a direct result of oyster farming operations.

3.3. SUMMARY OF ENVIRONMENTAL RISKS

Internal Risks Risks that arise as a direct result of oyster farming practices, as well as issues of disease

		Consequence				
		Insignificant	Minor	Moderate	Major	Severe
Likelihood	Rare	K, M				
	Unlikely					
	Possible		H, J	I		
	Likely	F		E		A
	Almost certain		G, L	D		B, C

A. Loss of stock through disease outbreaks and / or poor oyster resilience
B. Biosecurity protocols restricting movement of stock & infrastructure
C. Dispersed industry operations and storage of equipment as no central depot site
D. Legacy oyster infrastructure in the estuary and surrounding catchment
E. Environmental impacts & poor public perception resulting from infrastructure that washes off leases due to floods, strong winds etc
F. Visual and noise pollution as industry operates near residential areas
G. Visual pollution associated with brightly coloured bread baskets
H. Wild Pacific oysters competing with native, cultivated stock
I. Inefficient outboards resulting in high emissions
J. Potable water used to clean equipment
K. Fuel / oil spills in the estuary from oyster punts
L. Leaching of contaminants from tarred & treated timber infrastructure in estuary
M. Damage to seagrass through lease building and maintenance activities

External Risks	Risks that arise from other people's activities, or from natural events such as extreme weather conditions

		Consequence				
		Insignificant	Minor	Moderate	Major	Severe
Likelihood	Rare					
	Unlikely	E,				
	Possible	L	K			
	Likely		H		B, C, D,	
	Almost certain			G, M,	A, F, I, J	

A. Faecal contamination of waterway from failing septic tanks (especially Palmers Lane nr. Bensville, Hardy's Bay & Meadow Creek)
B. Faecal contamination of waterway from sewage spills during dry periods and damaged infrastructure (request channel for timely incident reporting)
C. Faecal contamination of waterways as a result of water-users (especially house-boats) discharging effluent into the waterway
D. Faecal contamination of waterways from wet-weather overflows, aggravated by illegal connections (note – some residents lift man-hole covers to drain water from gardens)
E. Faecal contamination of waterways as a result of effluent run-off from agricultural (incl. horses & cattle) - Bensville
F. Discharges from recreational vessels (e.g.emptying contaminated water on slipways / oil or fuel spills in the estuary)
G. Boatwash from recreational vessels damaging estuary banks and oyster farm infrastructure
H. Variety of contaminants entering the waterway from urban stormwater run-off (especially Kincumber Creek)
I. Public accessing lease areas resulting in oyster theft & infrastructure damage
J. Marina development and operation
K. Exposure of acid sulphate soils through disturbance or drainage
L. Sedimentation of the estuary from soils derived from the catchment
M. Freshwater flows

4. ENVIRONMENTAL IMPROVEMENT PLAN
Addressing Internal Risks:

Diseases & Parasites:

Background:
Disease outbreaks are largely influenced by environmental factors, which impact both on the ability of the pathogen to infect the oyster, and on the oysters' ability to defend itself. Oysters growing in a healthy ecosystem are more resilient to disturbance than those growing in an unhealthy system.

Oyster disease in Sydney rock oysters: Sydney rock oysters in Brisbane Water are potentially susceptible to two seasonal diseases:

- *Qx* - caused by the parasite *Marteilia sydneyi*, impacts on stocks over summer
- *Winter mortality* - caused by the parasite *Bonamia roughleyi*, which may occur over winter / spring

The Qx parasite has been identified in many NSW estuaries, with some suffering notable outbreaks (e.g. Hawkesbury & Clarence Rivers). The parasite destroys the digestive gland of the oyster so that it can no longer take up nutrients, and effectively starves to death.

Winter mortality may occur over winter months in small amounts, although infected oysters don't tend to die until spring. In recent years the incidence of winter mortality has been low, and not many farmers have suffered notable mortalities. In other areas out-breaks have also been linked to oyster stress and overstocking.

Despite, the potential for these parasites to impact stocks of Sydney rock oysters in Brisbane Water, local farmers report very few mortalities. Farmers suggest the oceanographic conditions in the estuary are not favourable for parasite infections to take hold.

Mudworm: Where high levels of silt persist in the water column, this can affect the sensitive feeding apparatus of oysters. This can lead to infestations of mudworm, a parasite that can severely impact on the health of oysters and in many cases results in mortalities.

Risks to be reduced by the actions below:	**Initial Risk:**
• Loss of stock through disease outbreaks and / or poor oyster resilience	High

Actions (see review form on page 37 for how performance can be recorded)	
1.	Continue to engage with researchers and authorities working on oyster disease and parasites
2.	Report mortalities above 5% to NSW DPI
3.	Continue working to improve estuary & catchment health to increase oyster resilience
4.	Consider / Investigate potential for diversification, of associated infrastructure and cultivation methods to mitigate disease and pest outbreaks

Land Based Infrastructure:

Background:

The nature of commercial oyster cultivation not only requires significant water based infrastructure but also a functional land base from which operations can be conducted. Moderate to large scale oyster farming requires the use of tractors, fork-lifts and other machinery to process oysters, store infrastructure and to conduct routine maintenance.

In most NSW oyster producing estuaries farmers have collectively negotiated a tenure arrangement with the Department of Lands or council for occupancy of a parcel of land next to the waterway. This allows farmers easy access to the estuary, and the centralised nature of the site allows farmers to interact, share equipment and to pool resources.

In Brisbane Water, oyster farmers are dispersed throughout the region, and very few operate from waterfront sheds. This means oyster punts are constantly being launched and retrieved, and all activities involving stock and infrastructure require road transport. This is inefficient, logistically challenging and an extra financial burden on farmers. Space for the storage of cultivation equipment and farming machinery is a constant battle and the lack of industry interaction makes it difficult for oyster farmers to respond as a collective to issues as they arise.

Recently, the discovery of the POMS (Pacific Oyster Mortality Syndrome) virus in Brisbane Water has resulted in a quarantine order on the movement of any oyster stock and infrastructure material to other estuaries. The Department of Primary Industry is managing the response, and require the purification of product before it is moved to other estuaries. There is not currently a local purification facility large enough to cater for the number of oysters being produced, and *highway* farmers have indicated they have no choice but to leave Brisbane Water unless this issue is resolved. Such an exodus would have a major impact on local growers, significantly increasing the cost of quality assurance programs and water quality monitoring regimes.

There are several sites in Brisbane Water that have been identified as suitable for the development of a centralised land depot. These offer deepwater access and land suitable for a large depuration facility and equipment storage.

Many years ago, local farmers purchased some waterfront land, intent on creating a centralised depot from which the local industry could operate efficiently. Unfortunately, the site location was not agreeable with local community members who were concerned that their visual enjoyment of the waterway would be impacted. As such, approval for development of the centralised depot site was not given, and the farmers were forced to sell the land.

Risks to be reduced by the actions below:	**Initial Risk:**
• Biosecurity protocols restricting movement of stock and infrastructure	High
• Dispersed industry operations and storage of equipment as no central depot site	High

Actions **(see review form on page 37 for how performance can be recorded)**	
5.	Continue to identify suitable locations for a centralised land based depot
6.	Continue to negotiate tenure arrangements with authorities for a centralised land based depot

Visual and Noise Pollution:

Background:

In 2006, NSW Department of Primary Industries developed the NSW Oyster Industry Sustainable Aquaculture Strategy (OISAS) that includes criteria for acceptable lease materials & maintenance as well as their visual amenity. NSW DPI has now updated this strategy and the NSW Oyster Industry Sustainable Aquaculture Strategy 2nd edition (2014) is now available online www.dpi.nsw.gov.au/fisheries/aquaculture/publications/oysters/industry/industry-strategy.

The criteria outlined in OISAS are complemented by a series of best practice guidelines that include:

- Best Practice Guidelines for Oyster Raft Construction
- Floating Basket Long-line Oyster Cultivation

BWOF take pride in the appearance of their farms, and are constantly maintaining and upgrading infrastructure, not only for visual amenity, but also for productivity. Where the aesthetics of oyster leases are questioned, these concerns are usually directed towards derelict leases which have been abandoned and therefore deteriorate over time. Local farmers have been working with NSW DPI to identify and rehabilitate these derelict areas.

Projects to remove derelict farming infrastructure are usually offered through an open tender process. BWOF would like to see this process have greater consideration of local oyster farmers. For example, where projects encourage local farmer involvement, provisions should be made to renumerate them for their time and equipment use. Remuneration should not be limited to the contractor, on the expectation of free local support.

Where the aesthetics of active leases are called into question, farmers should use these opportunities to educate the community on industry practices and infrastructure requirements. Communication and transparency are key components of this EMS, and farmers will endeavour to engage with the local community to demystify the industry. The first step is the distribution of this EMS.

Noise issues are particularly relevant to shed sites which use a variety of equipment & practices that emit noise. Oyster farmers take common sense steps towards minimising noise to avoid annoying others. Leases are normally only worked between 7am-6pm.

Risks to be reduced by the actions below:	Initial Risk:
• Legacy oyster infrastructure in the estuary and surrounding catchment	High
• Environmental impacts & poor public perception resulting from infrastructure that washes off leases due to floods, strong winds etc.	Significant
• Visual and noise pollution as industry operating near residential areas	Moderate
• Visual pollution associated with brightly coloured bread baskets	Significant

Actions (see review form on page 37 for how performance can be recorded)	
7.	Maintain leases for visual amenity as outlined in the NSW Oyster Industry Sustainable Aquaculture Strategy (OISAS)
8.	Work with NSW DPI to identify and rehabilitate derelict leases
9.	Launch & distribute EMS to educate community & local authorities
10.	Utilise opportunities to engage & educate community about farming practice
11.	Follow NSW DPI best practice guidelines for noise as outlined in the NSW Oyster Industry Sustainable Aquaculture Strategy (OISAS)

Marine Pests:

Background:

Marine pests: Translocation of marine pests is an increasing risk in Australian waters as populations become more mobile and exposure to potential sources increase (e.g. contaminated bilge from merchant vessels etc.). Introduction of such species can have severe impacts on native species and lead to a total deterioration of ecological processes.

Identification of pest species and correct reporting will greatly assist in early identification of such species. This is important to prevent the spread of marine pests. A national system for prevention and management of marine pests has been developed and is available online: www.marinepests.gov.au

BWOF have identified significant outbreaks of the marine pest *Caulerpa taxifolia* in the shallows around Bensville and have reported this to NSW DPI (Biosecurity).

Risks to be reduced by the actions below:	Initial Risk:
• Wild Pacific oysters competing with native, cultivated stock	Moderate

Actions (see review form on page 37 for how performance can be recorded)	
12.	All farmers to have a copy of marine pest identification cards
13.	Report, with a sample if possible, detection of unusual plants or animals

Air Quality:

Background:

Engines: There are currently no Australian regulations or standards that limit air or water emissions from marine outboard engines. However, as all marine engines sold in Australia are imported mainly from the US or Japan, many do comply with emission standards applicable to the country of origin. On the other hand overseas manufactures produce marine outboard engines that emit high emissions to sell in unregulated markets such as Australia.

There are moves for Australian emissions standards to be enacted, which are likely to be modelled on the 2010 USA standards for rating the environmental performance of outboards. Motors meeting these standards have significantly lower air and water emissions than conventional outboard motors and are also more fuel efficient.

Risks to be reduced by the actions below:	Initial Risk:
• Inefficient outboards resulting in high emissions	Significant

Actions (see review form on page 37 for how performance can be recorded)	
14.	Progressively upgrade machinery and outboards to increase efficiency and to reduce emissions

Water Resources

Background:

After 15 years of below average rainfall, Gosford City Council and Wyong Shire Councils undertook extensive research and community consultation to develop a strategy, *WaterPlan 2050*, to ensure a sufficient and long-term water supply for the future. This plan is supported by a website, Living Water Smart (http://www.gwcwater.nsw.gov.au/), which provides information, tools and resources to encourage the community to make water conservation a normal part of everyday life.

Key objectives of WaterPlan 2050 are to:

- deliver early benefits by further improving the existing water supply system and gradually easing water restrictions;
- continue to change the way people value and use water;
- maintain flexibility and opportunities for future generations so they can effectively meet their water needs.

No single action, by itself, is considered to be the ideal solution. Rather, a mix of actions should be implemented over time to adapt and respond to circumstances as they continue to change and evolve.

These actions can be categorised into three key areas:

i. Enhancing the existing water supply system
ii. Using water efficiently
iii. Accessing additional sources of water.

Risks to be reduced by the actions below:	**Initial Risk:**
• Potable water used to clean equipment	Moderate

Actions **(see review form on page 37 for how performance can be recorded)**

15	Look into rainwater storage and water recycling technologies for operational use

Chemicals, Fuel and Oil:

Background:

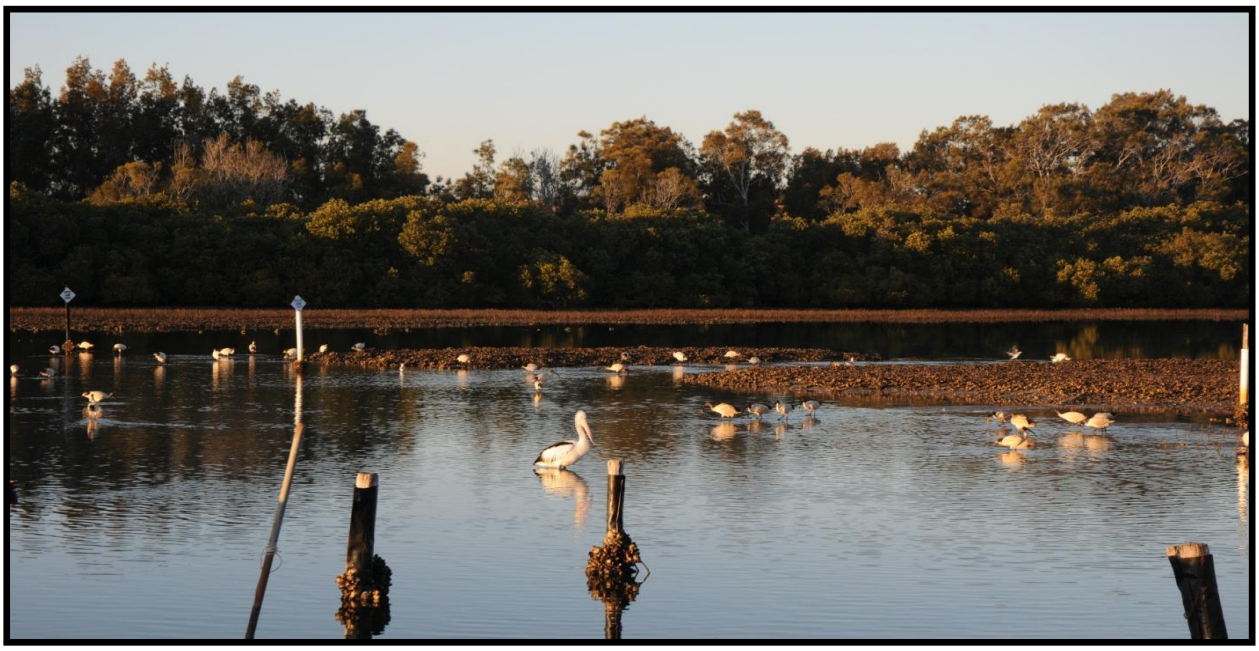
BWOF maintain a regular water & meat quality monitoring regime to ensure that prompt action can be taken should pollution levels threaten the health of the river and oyster stocks. Anecdotal evidence suggests that the oyster industry is often the first to detect local pollution events such as toxic algae, sewage, chemicals and fuel spills. Such events not only threaten the oyster industry, but have severe implications on public & ecological health.

As oyster farming involves the use of a variety of machinery, including outboard engines, it is important for farmers to maintain their equipment to protect against spills of oil and other fluids. Such maintenance is built into everyday farming activities, and is fundamental to maintain productivity. Very few chemicals are used in oyster farming, with the most commonly used being chlorine. Chlorine is used to disinfect depuration tanks, and should be stored as directed on the associated *Safety Data Sheet*. Chlorine is corrosive & potentially hazardous to health, and all oyster farmers & employees should have appropriate levels of training and access to suitable protective equipment when handling these liquids. The correct *Safety Data Sheet* should be stored with the chemical at all times.

Growers are also encouraged to work with appropriate authorities to develop Emergency *Response Plans*. Such plans will enable suitable preparation and planning, and a quick reaction in the event of an emergency. These actions will help to mitigate the negative impacts on the environment and the industry. Emergency response plans may include: fires, explosions, fuel & oil spills, release of hazardous chemicals, natural disasters, oyster mortality & disease, effluent spill / release.

Risks to be reduced by the actions below:	**Initial Risk:**
• Fuel / oil spills in the estuary from oyster punts	Low

Actions (see review form on page 37 for how performance can be recorded)	
16.	Alert and work with RMS and other authorities to aid contaminant of any fuel or oil spills
17.	Develop an *Emergency Response Plan* to manage emergency situations



Tar & Treated Timber Infrastructure:

Background:

For many years, tarred & treated timber has been used to increase the durability of cultivation infrastructure, protecting it from marine borers. There is no evidence indicating that this contaminates the oysters or neighbouring species (White, 2001), however over time the potential exists for chemicals in these wood preservatives to leach into the surrounding waters.

Oyster farmers throughout NSW are now phasing out the use of tarred & treated timber by converting to polyurethane trays, plastic sleeved timber posts, or adopting alternative farming methods using plastic cylinders and floating pillows (see Section 2.2 *Farming Methods*). Converting to these new products will reduce ongoing maintenance requirements and associated costs, and also eliminate potential contaminants entering the estuary. There is one derelict tar pit remaining in the area, however the local oyster farmers are committed to its eventual removal.

Many farmers are working towards the exclusive use of re-useable plastic products, but this is a costly, time consuming and labour intensive task. While conversion to these products will ultimately save time and money, the logistics of such an operation means the change will not occur overnight.

Risks to be reduced by the actions below:	**Initial Risk:**
• Leaching of contaminants from tarred & treated timber infrastructure in estuary	Significant

Actions (see review form on page 37 for how performance can be recorded)	
18.	Decommission and remove tar pits
19.	Continue phase out of treated and tarred timber infrastructure
20.	Where no environmental harm may result, adopt principles of reuse and recycle
21.	Other material to be tipped at licensed EPA approved waste management facilities

Seagrass and Benthic Communities:

Background:

Oyster farming may affect seagrasses and benthic communities (i.e. groups of plants and animals living on the floor of a water body) via the placement of infrastructure, the shade that infrastructure casts on the floor of the water body, and the waste products produced by the oysters.

Tray farming has been used in Brisbane Waters for many years. The potential impacts on seagrass and benthic communities are therefore expected to be similar to those reported in studies of other estuaries. This farming method has not lead to any widespread impacts on seagrasses and benthic communities, with any dieback or community change strictly localised to the immediate vicinity of the oyster leases.

It should be noted that while seagrass dieback is a major concern in NSW, oyster farming is very rarely identified as one of the causes. The National Oceans Office (1997) states, "*increased sedimentation and nutrients from catchments have been linked with massive die-back of seagrasses in many areas.*"

The use of long-line and floating bags in the grow-out phase significantly reduces shading, as these tend to move with the wind and tide.

Risks to be reduced by the actions below:	**Initial Risk:**
• Damage to seagrass through lease building and maintenance	Low

Actions (see review form on page 37 for how performance can be recorded)	
22.	Explore farming methods that minimise affects on seagrass and benthic communities
23.	Implement best practice methods that minimise affects on seagrass and benthic communities
24.	Report significant changes or damage to seagrass beds to DPI

Addressing External Risks

Effluent:

Background:
Effluent contamination of waterways is one of the main concerns of the oyster industry. Pollution of this nature contaminates shellfish & closes harvest areas as a means to protect food safety. This can lead to loss of income for farmers, and there are cases where ongoing issues of contamination have effectively driven oyster farmers from the river (e.g. Kalang River). Effluent contamination also lowers oyster immunity making them susceptible to disease. Not only does effluent impact oysters, but can also damage wider estuarine ecosystems and have severe implications on public health.

Although council has an active inspection program for on-site sewerage management systems (OSMS) and are expanding the reticulated network, failing septic systems within the Brisbane Waters catchment are a big concern to the local oyster industry.

Wastewater treatment plants and associated pump-stations pose a variable risk. Sewage overflows and by-passes typically occur during wet weather events, at which point the estuary is closed to oyster harvesting in any case. Of much greater concern is the unexpected release of effluent during dry spells. Gosford City Council has recently invested $85m to upgrade the sewerage network and treatment plants, and works are currently underway.

Of the reticulated network, there is particular concern about an aging sewer line that runs under the estuary from Woy Woy Lions Club to the Saratoga Veterans Hall. If this line were to be punctured (e.g. from anchoring), the result be would be catastrophic, resulting in widespread effluent contamination of the estuary. This issue was first raised with council in 2000.

There are five marine pump-out facilities within Brisbane Waters; however anecdotally, these facilities are rarely used. The inconsiderate actions of some waterway users may result in effluent being released directly into the estuary.

Risks to be reduced by the actions below:	**Initial Risk:**
• Faecal contamination of waterway from failing septic tanks (especially Palmers Lane nr. Bensville, Hardy's Bay & Meadow Creek)	High
• Faecal contamination of waterway from sewage spills during dry periods and damaged infrastructure (request channel for timely incident reporting)	High
• Faecal contamination of waterways as a result of water-users (especially house-boats) discharging effluent into the waterway	High
• Faecal contamination of waterways from wet-weather overflows, aggravated by illegal connections (note – some residents lift man-hole covers to drain water from gardens)	High
• Faecal contamination of waterways as a result of effluent run-off from agricultural (incl. horses & cattle) - Bensville	Low

Actions (see review form on page 37 for how performance can be recorded)	
25.	Communicate with council about the importance of oyster harvest areas and the value of the on-site sewerage management system inspection program
26.	Report unexpected water test results to council
27.	Encourage council to increase capacity of sewerage system and pump-station holding tanks
28.	Support applications for maintenance & implementation of effluent management best-practice
29.	Encourage operator to allow easier access to pump-out facilities
30.	Work with stakeholders to improve signage relating to pump-outs, toilet locations and the importance of the local oyster industry
31.	Take opportunities to educate the local community about responsible waterway use

Recreational vessels:

Background:
Brisbane Waters is used by a variety of user-groups, many of which utilise boat launching ramps. These are typically recreational vessels, with bungs at the base of the transom that enable owners to clean the interior of the boat and to discharge water that collects on-board. Upon picking up their vessels, many owners open the bungs on the slipway, utilising the slope to drain any on-board water. This practice however, discharges any effluent or other contaminants that have concentrated in the pooled water, straight into the waterway.

BWOF have raised concerns in the past to Roads and Maritime Service (RMS) relating to vessels that have sunk and the potential for oil spills. BWOF are concerned that no return communication was received, and that no action appears to have been taken despite timely reporting by industry.

It is possible that wash from recreational vessels travelling through lease areas and other parts of Brisbane Water contribute to river bank erosion and damage to farm infrastructure. This normally would be associated with recreational users operating vessels without regard to the local environment and weather conditions, and where knot limits are not followed.

Risks to be reduced by the actions below:	**Initial Risk:**
• Discharges from recreational vessels (e.g. emptying contaminated water on slipways and oil/fuel spills in the estuary)	High
• Boatwash from recreational vessels damaging estuary banks and oyster farm infrastructure	High

Actions **(see review form on page 37 for how performance can be recorded)**	
32.	Work towards establishing educational signage at slipways about emptying contaminated water
33.	Take opportunities to educate the local community about responsible waterway use

Urban development:

Background:

Many activities within the catchment have the potential to pollute the estuary, and most are addressed elsewhere in this document. The issue of urban development and the risks associated with increased run-off have yet to be examined. As the rainwater runs through the streets it mobilises a variety of contaminants including fertilisers, pesticides, dog faeces, oil residue etc. Whilst the stormwater system and gross pollutant traps may collect some of the physical littered items, many of the soluble contaminants will be discharged to the adjacent waterway.

Educating local residents is very important, raising the awareness of appropriate catchment practices. Communication is a key component of the EMS, and farmers will endeavour to engage with the local community to stress the importance of water quality to the local industry and overall estuarine health.

Oyster health is largely influenced by water quality, with their capacity to tolerate disturbances and disease linked to the health of the estuary. Oysters growing in a healthy ecosystem are more resilient to disturbance than those growing in an unhealthy system.

Oyster leases in Brisbane Waters are classified as Priority Oyster Aquaculture Areas. It is legislated that these areas must be shown on Local Environmental Plans (LEP) and council must have regard for these areas in preparing new LEPs. The Director-General of NSW DPI may object to the terms of the draft LEP on the grounds of deleterious effects on an oyster aquaculture area. Furthermore, in determining applications for development approval the consent authority must consider the potential impacts of the activity on oyster aquaculture areas.

Risks to be reduced by the actions below:	**Initial Risk:**
• Variety of contaminants entering the waterway from urban stormwater run-off (especially Kincumber Creek)	Significant

Actions (see review form on page 37 for how performance can be recorded)	
34.	Educate community about land-water interactions and the needs of industry
35.	Remain vigilant, and report developments that negatively impact on water quality
36.	Make submissions to development applications and participate in community consultations to ensure the oyster industry is considered in land-use planning decisions

Public Access to Oyster Leases (Theft and Damage):

Background:
The market demand and limited supply of oysters has led to an increase in the occurrence of theft in recent times. The unregulated sale of oysters can pose serious health threats to consumers as the product may have been stolen during times when water quality was poor.

By 2007, the scale of the problem prompted three key Government agencies (NSW DPI, NSW Food Authority & NSW Police Force) to join forces & launch a high-tech initiative, 'Operation Trident', to tackle thefts and address the growing black market trade in oysters. Fines of up to $275k and/or imprisonment apply. To compound stock losses, cultivation infrastructure is often destroyed / stolen.

Damage to infrastructure may also occur as a result of navigational error, or inadequate signage of lease areas. This includes unintentional damage created by recreational vessels tying up to farm infrastructure. Targeting fish around oyster leases is common practice by recreational anglers as the leases provide habitat to many fish species and can hold quantities of target species.

Risks to be reduced by the actions below:	**Initial Risk:**
• Public accessing lease areas resulting in oyster theft & infrastructure damage	High

Actions (see review form on page 37 for how performance can be recorded)	
37.	Report all incidences of oyster theft to Operation Trident (T: 1800 333 000)
38.	Improve signage around lease areas
39.	Take opportunities to educate the local community about responsible waterway use around oyster leases

Marina Development:

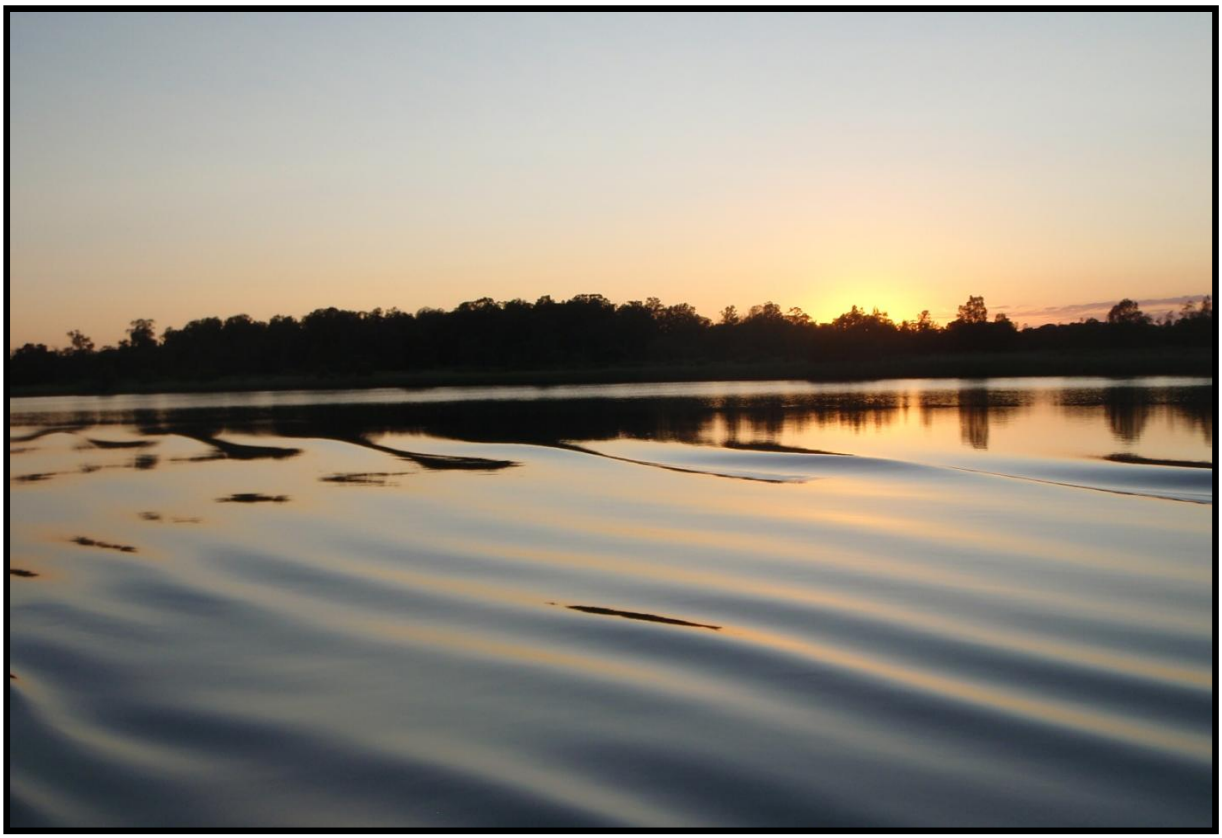
Background:
The potential environmental impact of a new marina development at Murphy's Bay is of great concern to Brisbane Water oyster farmers. It is the responsibility of the developer and the regulatory bodies to ensure that its construction and operation is carried out with full consideration of the natural environment and other industries.

As all marinas are located on the water's edge, there is potential for the waterways to be affected negatively in some way. In the short-term, risks relate to marina construction (e.g. sediment disturbance, exposure of acid sulphate soils etc), while in the mid- to long-term, risks relate to site operation (e.g. oil spills, effluent discharge etc.).

New marina development must involve safeguarding the surrounding waterways and land to mitigate any potential impact to seafood producers that rely on the health of the estuary for their livelihood. This includes protecting the recreational value of the estuary for the wider stakeholder population including residents and all sectors of recreational water user groups.

Risks to be reduced by the actions below:	**Initial Risk:**
• Marina development	High

Actions (see review form on page 37 for how performance can be recorded)	
40.	Farmers to stay informed in regard to the development of the new marina
41.	Remain vigilant, and report developments that negatively impact on water quality and the surrounding environment
42.	Communicate to the developers the potential short-term and long-term threats to the oyster industry



Low pH / Acid Sulphate Soils:

Background:

Acid sulphate soils (ASS) are naturally occurring soils and sediments that contain iron sulphides. Under most conditions, where the soil remains waterlogged, ASS remain harmless. When iron sulphides are exposed to air – by drainage, drought or excavation of the soil, they react with oxygen in the air or water, and can produce large quantities of sulphuric acid. This acid is stored in the soil, and is usually released after rain, or after flood waters have drained away.

Acidification of waterways severely degrades estuarine ecosystems; it can cause fish kills and disease, and impacts on oysters by increasing mortality, reducing growth, dissolving shells, reducing feeding activity & damaging soft tissue.

Considering the risk that earthworks may pose in the mobilisation of acid, oyster farmers are particularly diligent to excavations in the catchment. In the past oyster farmers have noticed the mechanical clearing of trees in areas that are prone to the formation of acid sulphate soils. Such activities should be reporting to council immediately.

Whilst there is little direct action that oyster farmers can take to address the risk posed by acid sulphate soils, farmers will continue to engage with stakeholders and support projects that improve catchment management.

Risks to be reduced by the actions below:	**Initial Risk:**
• Exposure of acid sulphate soils through disturbance or drainage	Moderate

Actions (see review form on page 37 for how performance can be recorded)	
43.	Engage with, and support Gosford City Council, Greater Sydney Local Land Services, OceanWatch and other organisations to improve catchment health
44.	Report all earthworks of concern to Gosford City Council

Erosion and Sedimentation:

Background:
Erosion and downstream sedimentation is a natural process in many areas, however erosion of banks may be exacerbated through riparian vegetation removal and boat wash destabilising banks.

Suspended sediments affect water clarity and light penetration through the water column, which is an essential requirement for phytoplankton and seagrass growth. Significant erosion not only impacts on estuary health, but can also affect the feeding apparatus of oysters and lead to mudworm infestations. This can severely impact on oyster health and can result in significant mortalities.

Oyster farmers have a unique knowledge of the estuary. They are in a prime position to advise and work with authorities and other organisations to identify erosion hot-spots and sources of sediment. If key sites can be identified and location details forwarded to stakeholders, this is the first step to develop erosion control / bank stabilisation projects. Such initiatives may involve construction of erosion control structures (e.g. rock filleting) and riparian revegetation.

Where earthworks in the catchment are undertaken without appropriate controls, these activities should be reported to council immediately so that preventative / corrective measures may be taken.

Risks to be reduced by the actions below:	**Initial Risk:**
• Sedimentation of estuary from soils derived from the catchment	Low

Actions (see review form on page 37 for how performance can be recorded)	
45.	Report all earthworks of concern to Gosford City Council
46.	Identify erosion hot-spots for remediation and forward to key stakeholders
47.	Support applications for riverbank fencing, riparian revegetation and other erosion control works

Freshwater flows:

Background:
Freshwater can pose a number of threats to oysters and large salinity changes in the estuary can shock ecosystems. Oyster farmers monitor salinity closely, and in extreme circumstance increases in environmental flows can even result in the closure of harvest area.

A sudden and prolonged freshwater flow can result in salinity levels dropping precipitously, stressing and sometimes killing oysters held on the lease. Studies have also revealed that prolonged lowered salinity levels can affect oyster spat settlement.

Risks to be reduced by the actions below:	**Initial Risk:**
• Freshwater flows	High

Actions (see review form on page 37 for how performance can be recorded)	
48.	Monitor and plan for freshwater flows and prolonged immersion of oysters in freshwater

5. REVIEW FORM

Reviewed by: .....
Date of review: .....
Review period: .....

Actions:		Measured Improvement:	Measure:
1.	Continue to engage with researchers and authorities working on oyster disease and parasites	Number of engagements with researchers and authorities working on oyster disease and parasites	……..
2.	Report mortalities above 5% to NSW DPI	No. of instances where suspected disease or unusual mortalities (above 5%) were reported to NSW DPI	……..
3.	Continue working to improve estuary & catchment health to increase oyster resilience	No. of catchment projects oyster farmers have engaged in to improve estuary health	……..
4.	Consider / Investigate potential for diversification, of associated infrastructure and cultivation methods to mitigate disease and pest outbreaks	Were any new technologies identified and adapted or implemented into current infrastructure	Yes / No
5.	Continue to identify suitable locations for a centralised land based depot	Where any extra suitable locations identified	Yes / No
		Where any meetings conducted with the lands department in regard to continuing negotiations to establish a centralised land based depot	Yes / No
6.	Continue to negotiate tenure arrangements with authorities for a centralised land based depot	Was Gosford City Council and the Lands department contacted in this regard	Yes / No
		Was any arrangement negotiated	Yes / No
7.	Maintain leases for visual amenity as outlined in the NSW Oyster Industry Sustainable Aquaculture Strategy (OISAS)	All BWOF have copies of the 2014 Oyster Industry Sustainable Aquaculture Strategy	Yes / No
		No .of reasonable complaints received regarding the visual aspects of oyster leases	……..
8.	Work with NSW DPI to identify and rehabilitate derelict leases	Where derelict leases identified and NSW DPI informed	Yes / No
		No. of derelict leases in the estuary (target = 0)	……..
9.	Launch & distribute EMS to educate community & local authorities	Was the EMS officially launched and distributed to relevant stakeholders	Yes / No

Actions:		Measured Improvement:	Measure:
10.	Utilise opportunities to engage & educate community about farming practice	No. of publicity / promotional opportunities utilised to discuss oyster farming practices	……..
11.	Follow NSW DPI best practice guidelines for noise as outlined in the NSW Oyster Industry Sustainable Aquaculture Strategy (OISAS)	All BWOF have copies of the 2014 Oyster Industry Sustainable Aquaculture Strategy	Yes / No
12.	All farmers to have a copy of marine pest identification cards	Marine pest information and guides distributed	Yes / No
13.	Report, with a sample if possible, detection of unusual plants or animals	No. of reported incidences of unusual plants / animals. to government agencies to combat marine pest incursions	……..
14.	Progressively upgrade machinery and outboards to increase efficiency and to reduce emissions	% of machinery and outboards upgraded to increase efficiency and to reduce emissions	……%…..
15.	Look into rainwater storage and water recycling technologies for operational use	Were any new technologies identified and implemented	Yes / No
16.	Alert and work with RMS and other authorities to aid contaminant of any fuel or oil spills	No. of spill incidence alerted to authorities	……..
		No. of spill incidence where active assistance was provided to authorities	……..
17.	Develop an Emergency Response Plan to manage emergency situations	Emergency Response Plan to manage emergency situations developed and distributed amongst BWOF	Yes / No
18.	Remove any residual tar that remains in areas	No. of incidence where tar was completely removed	……..
		Amount of residual tar deposits remaining	……..
19.	Continue phase out of treated and tarred timber infrastructure	Quantity of treated and tarred infrastructure removed and / or replaced	……t…..
20.	Where no environmental harm may result, adopt principles of reuse and recycle	% Estimate of oyster infrastructure removed that has been re-used / recycled	……%…..
21.	Other material to be tipped at licensed EPA approved waste management facilities	Amount of oyster infrastructure that has been disposed of at licensed waste depots	……t…..
22.	Explore farming methods that minimise affects on seagrass and benthic communities	Were any new technologies identified	Yes / No
23.	Implement best practice methods that minimise affects on seagrass and benthic communities	Were any new technologies adapted or implemented into current infrastructure	Yes / No

Actions:		Measured Improvement:	Measure:
24.	Report significant changes or damage to seagrass beds to DPI	Were any significant changes to seagrass beds Identified	Yes / No
		If there was were these reported to the DPI	Yes / No
25.	Communicate with council about the importance of oyster harvest areas and the value of the on-site sewerage management system inspection program	Was the council actively engaged to communicate the importance of oyster harvest areas, the value of the on-site sewerage management system inspection and infrastructure to improve access to pump out facilities for users	Yes / No
26.	Report unexpected water test results to council	No. of reported unexpected water test results to council	……..
27.	Encourage council to increase capacity of sewerage system and pump-station holding tanks	Was the council actively engaged to commission pump-station holding tanks with an increased holding capacity	Yes / No
28.	Support applications for maintenance & implementation of effluent management best-practice	No. of applications submitted or supported for projects to facilitate riverbank fencing, riparian revegetation and for maintenance & implementation of effluent management best-practice	……..
29.	Encourage operator to allow easier access to pump-out facilities	Was the council actively engaged to develop infrastructure to improve access to pump out facilities for users	Yes / No
30.	Work with stakeholders to improve signage relating to pump-outs, toilet locations and the importance of the local oyster industry	Were stakeholders actively engaged to cooperatively improve pump-out signage & toilet awareness	Yes / No
		No. of improvements made to signage around lease areas	……..
31.	Take opportunities to educate the local community about responsible waterway use	No. of promotional opportunities utilised to educate community about land-water interactions and the needs of industry	……..
32.	Work towards establishing educational information at slipways about emptying contaminated water	Was the RMS approached to request inclusion of information detailing the hazards of emptying contaminated water into existing information signage	Yes / No
33.	Take opportunities to educate the local community about responsible waterway use	No. of promotional opportunities utilised to educate community about land-water interactions and the needs of industry	……..

Actions:		Measured Improvement:	Measure:
34.	Educate community about land-water interactions and the needs of industry	No. of promotional opportunities utilised to educate community about land-water interactions and the needs of industry	……..
35.	Remain vigilant, and report developments that negatively impact on water quality	No. of developments that negatively impact water quality reported to the appropriate management agency	……..
36.	Make submissions to development applications and participate in community consultations to ensure the oyster industry is considered in land-use planning decisions	No. of submissions made representing industry interests	……of……..
37.	Report all incidences of oyster theft to Operation Trident (T: 1800 333 000)	No. of oyster theft incidences reported to Operation Trident (T: 1800 333 000)	……..
38.	Improve signage around lease areas	No. of signage improvements around lease areas implemented	……..
39.	Take opportunities to educate the local community about responsible waterway use around oyster leases	No. of promotional opportunities utilised to educate community about land-water interactions and the needs of industry	Yes / No
40.	Farmers to stay informed in regard to the development of the new marina	Were lines of communication opened with the marina developers and council to stay informed on any progress or developments that could impact BWOF	Yes / No
41.	Remain vigilant, and report developments that negatively impact on water quality and the surrounding environment	Were an reports made in regard to any marina development negative impacts	Yes / No
42.	Communicate to the developers the potential short-term and long-term threats to the oyster industry	Were lines of communication opened with the marina developers and council to detail threats or concerns that could impact BWOF	……..
43.	Engage with, and support Gosford City Council, Greater Sydney Local Land Services, OceanWatch and other organisations to improve catchment health	Were BWOF involved in any projects or activities that contribute to improving catchment health	Yes / No
44.	Report all earthworks of concern to Gosford City Council	Were any earthworks of concern reported / communicated to Gosford City Council	Yes / No ……..
45.	Report all earthworks of concern to council	No. of earthwork activities of concern reported to Gosford City Council	……..
46.	Identify erosion hot-spots for remediation and forward to key stakeholders	No. of erosion hot-spots Identified for remediation and forward to key stakeholders	……..

Actions:		Measured Improvement:	Measure:
47.	Support applications for riverbank fencing, riparian revegetation and other erosion control works	No. of applications submitted and supported for riverbank fencing, riparian revegetation and other erosion control works	……..
48.	Monitor and plan for freshwater flows and prolonged immersion of oysters in freshwater	Response Plan to manage prolonged freshwater flow situations developed and distributed amongst BWOF	Yes / No

Notes

6. SUPPORT FOR OYSTER FARMERS

6.1. RURAL SUPPORT PROGRAM

The Rural Support Program works with rural communities to improve their attributes of resilience through greater knowledge, skills and practices and the development of plans to face future adverse climatic events. Rural communities and individuals are also assisted during dry periods and to recover following other emergencies, such as Natural Disasters.

The program interfaces with existing programs within NSW DPI, such as climate adaptation and emergency management and networks with other agencies to develop human skills that contribute to the attributes of resilience. Existing programs are strengthened by integrating initiatives focused on climate variability and natural disasters, within NSW Primary Industries and the other providers of support to rural communities.

The primary audience is individuals, farm businesses and the rural communities in which they reside. Particular attention is given to disaster risk identification and reduction through planning and management at the prevention, preparation and recovery phases of natural disaster management

Your local rural support worker can be contacted via the details below:

Location	Rural Support Worker	Office number	Mobile	Email
ORANGE	Cheryl Pope (Team Leader)	6391 3948	0428 435 593	cheryl.pope@dpi.nsw.gov.au
GOULBURN	Dick Kearins	4828 6600	0427 781 514	dick.kearins@dpi.nsw.gov.au

6.2. USEFUL CONTACTS

OceanWatch Australia OceanWatch Australia Ltd is a national not-for-profit national marine natural resource management organisation that works to advance sustainability in the Australian seafood industry. Works on water quality, fish habitat and industry best-practice.	
02 9660 2262	Environmental advice and project support

NSW Department of Primary Industries (NSW DPI) The key regulatory agency for the NSW Oyster Industry. The department administers leases and permits, collates production data, develops policy and also has an industry development role. The department is also a key NSW aquatic habitat protection and compliance agency and develops policies and guidelines for the industry that are consistent with habitat protection objectives.	
(02) 4982 1232	Port Stephens Fisheries Centre
1300 550 474	Reporting illegal fishing activity
1800 043 536	Reporting illegal fishing activity (Fishermen's Watch – 24hr service)

Gosford City Council Local government has a diverse role covering town planning, building approvals, local roads, parking, public libraries, public toilets, water and sewerage, approval and inspection of septic systems, waste removal domestic animals and community facilities. Of particular importance to the NSW oyster industry is council's park in managing estuarine water quality and resolving land and water use conflicts through estuary management planning, land use planning and development control. Council may also provide waste management services to the industry. Council's also assist the oyster industry with water quality monitoring and have a role in investigating water pollution incidents.	
02 4325 8222	Main line (24 hours)
13 25 00	SES (State Emergency Service)

Roads & Maritime Services (RMS) – NSW Maritime State government's maritime regulator responsible for providing safe and sustainable ports and waterways. The authority helps to establish aquaculture lease marking requirements and helps to determine if a lease area will adversely affect navigation. NSW Maritime also has responsibilities for pollution from vessels.	
13 12 56	General info line & environmental emergencies (oil spills)
13 12 36	Phone payments
(02) 9563 8511	Head office (Rozelle)
1800 658 784	Water Police (24hr line to report marine crime)

NSW Food Authority The NSW Food Authority provides regulatory framework for safe and correctly labelled food to be produced in NSW. Of particular importance to the oyster industry, the NSW Food Authority has responsibility for implementing the NSW Shellfish Program that classifies and establishes management plans for oyster harvest areas. The NSW Food Authority also licences oyster depuration, processing and handling facilities.	
1300 552 406	Main line
(02) 6552 3000	Licensing enquiries and invoicing

Greater Sydney Local Land Services (LLS) Local Land Services (LLS) coordinate natural resource management at the catchment scale. The LLS is responsible for involving regional communities in catchment planning and identification of natural resource management priorities for their region, and are the primary means for the delivery of funding from the NSW and Commonwealth Governments to help land managers improve and restore the natural resources of the state. Key roles include preparing Catchment Action Plans, and managing investment programs to implement the plans, and promoting community participation in regional natural resource management action and decision making. Implementation of the Catchment Action Plans in the coastal LLS regions will lead to favourable outcomes for the oyster industry.	
1300 795 299	Main number
(02) 6551 8994	Local office (Taree)

NSW Office of Environment and Heritage (NSW OEH) OEH has responsibility for protected and threatened wildlife throughout NSW. Of particular relevance to oyster aquaculture leases is the OEH's role in the protection of marine mammals and reptiles, such as dolphins and sea turtles which may swim into shallow water, and shorebirds or waders which often forage in the intertidal zone and roost nearby. OEH leads the implementation of the Diffuse Water Pollution Management Strategy which provides a framework for natural resource and environment agencies, including local government and LLS to better manage pollution from non-licensed activities. OEH works with local councils and communities to maintain or improve the health of our estuaries. OEH supports local government through the Coastal Zone Management Program which provides guidance and support for both coastal and estuary management planning and actions. OEH works with the oyster industry to provide estuary process information when available to help resolve issues such as dredging.	
131 555	Environment emergency line (Environmental Protection Authority)
1300 361 967	National Parks

Marine Estate Management Authority Marine Estate Management Authority manages the NSW Marine Parks estate. These parks are large marine and estuarine protected areas that are designed to conserve all forms of marine plant and animal species (biodiversity). The Marine Estate Management Authority is responsible for the declaration, management, selection and zoning of marine parks and the regulation of ecologically sustainable use of these areas.	
1300 550 474	General enquiries

Crown Lands – Trade and Investment The Crown Lands Division is the primary administrator for Crown land tenures and unallocated Crown land across NSW. The division leases land to the oyster industry for land-based activities and also gives owners consent to lodgement of development applications for new aquaculture lease areas where development consent is required. Future management of land based sites located on Crown Land will be driven by the need for both the grower and the Crown Lands Division to maintain an environmentally sensitive and professional well managed land base. This will be achieved through the process of a long term lease agreement and an associated work plan that is developed in partnership with the grower to achieve sound environmental and social outcomes.	
1300 052 637	Main line

NSW Department of Planning and Infrastructure The Department of Planning and Infrastructure's key role for the oyster industry is in ensuring that the OISAS is integrated into the state land use planning and development control framework. The department ensures that strategies such as OISAS integrate the government's social, economic and environmental agendas to promote sustainability.	
(02) 9228 6111	Head office
(02) 9228 6333	Information centre

NSW Environmental Protection Authority (NSW EPA) The EPA is tasked with making those subject to environmental regulation aware of Government and community expectations about the protection of our environment and the health of local communities, by raising general awareness of regulatory requirements and delivering strong compliance and enforcement programs. The EPA shares responsibility for regulating pollution of waters in NSW with local government and the Roads and Maritime Services. The EPA is responsible for regulating state and local government agencies and those premises holding an environmental protection license. Roads and Maritime regulate water pollution from vessels and local government regulates most other sources.	
131 555	Main number and to report pollution

Sydney rock oyster *(Saccostrea glomerata)*

CONTACT & FEEDBACK:

This EMS is an ongoing process of environmental improvement, and the Brisbane Water Oyster Farmers welcome any comments or suggestions. Please forward correspondence to:

Denise Whitten / Tammy Lewis
whittensoysters@gmail.com

This project is supported by Brisbane Water oyster farmers, OceanWatch Australia, Gosford City Council and Greater Sydney Local Land Services. OceanWatch Australia is the national marine NRM organisation recognised and supported by the Australian Government.