Great Lakes Council

2012 STATE OF THE ENVIRONMENT REPORT

Great Lakes Council 2012 State of the Environment Report

Prepared by:

Great Lakes Council
Natural Systems and Estuaries Section

Enquires should be directed to:

Great Lakes Council
PO Box 450
Forster NSW 2428
telephone: (02) 6591 7222
fax: (02) 6591 7221
email: council@greatlakes.nsw.gov.au

Contents

Contents

1 Executive Summary

Located on the lower Mid North Coast of New South Wales the Great Lakes Local Government Area (LGA) of 3,373 km^2 in size supports a rapidly expanding population of approximately 36,000 residents. Containing a unique environment of immense natural, social and economic value the region relies heavily on the health of its natural surroundings and landscapes.

The integrity and management of our natural environment is threatened by numerous human impacts and without adequate protection we risk losing the uniqueness that makes this region a great place to live, work and play. The growing and widespread recognition during recent years of the potential consequences of global warming clearly demonstrates the link between the integrity of the environment and our economy and lifestyle.

Continuation of damaging land uses combined with significant growth in residential and visitor populations, as well as associated infrastructure provisions remain the greatest threat to the quality of our environment. As such water deterioration, land degradation and loss of biodiversity are amongst the major environmental issues facing the region. Appropriate management of these threats is required in order to avoid a continuing decline in the health of the local environment. Deterioration of the environment will inevitably impact on our economy, our way of life and the general aesthetics of the LGA.

This State of the Environment report forms the third of three annual reporting and data collection periods. This report provides further baseline data to enable monitoring of the health of the region's environment over the previous three year period. This will be the first comprehensive State of the Environment Report to address the new requirements of the NSW Local Government Amendment (Planning and Reporting) Act 2009.

Council's are required to prepare a comprehensive State of the Environment Report in 2012 following the ordinary election of councillors. This means that the annual report will include a report on how the council has met the environmental objectives in the Community Strategic Plan. This report on the State of the Environment will include progress against relevant performance indicators for the environmental objectives of the Community Strategic Plan and Delivery Program, report on and update trends for indicators, and identify all major environmental impacts.

For monitoring purposes, Council has established set indicators to assist with determining changes and trends within the environment. In line with current legislation these indicators fall under several themes which are Water, Biodiversity, Waste and Toxic Hazards, Land, Air, Noise and Heritage. For this report data for these themes has been collected from a number of stakeholder organisations which are Great Lakes Council, MidCoast Water, NSW Department of Primary Industries (Fisheries), Fire and Rescue NSW, Essential Energy, and the Office of Environment & Heritage.

Table 1.1 Summary of issues, pressures and responses associated with environmental indicators

Indicator	Issues and pressures	Council's response	Community response What you can do
		Water	
Water quality	• Deterioration of water quality impacts on environmental and human health as well as our economy and society • Water pollution occurs through point-source or diffuse-source pollutants entering stormwater systems and water ways. • Removal/disturbance of vegetation, increased use of impervious surfaces (e.g. roads and carparks), application of chemicals (e.g. fertilisers), disturbance of acid soils and disposal of treated human wastes are all activities that result in increased pollutants in our waterways	• Wallis Lake Catchment Management Plan • Wallis Lake, Smiths Lake and Port Stephens/ Myall Lakes Estuary Management Plans • Water Quality Improvement Plan for Wallis, Smiths & Myall Lakes - Coastal Catchments Initiative • Healthy Lakes Program • Darawakh Frogalla Wetlands Management Plan • WaterWatch community program • Structural stormwater Solutions (e.g. Gross Pollutant Traps) • Development Assessment and Strategic Planning • Sustainable Farming programs • Review Forster Stormwater Plan • Wallis Lake Wetland Strategy	• Avoid putting any substance down stormwater drains • Wash cars on lawn • Limit chemical & fertiliser use in the garden/farm • Pick up after your pets • Dispose of waste and litter in bins • Sweep leaves and debris away from stormwater drains and dispose of or mulch • Become involved in Council's WaterWatch program • Plant native plants to help stabilize soil and filter pollutants • Prevent stock from entering waterways • Undertake sustainable grazing including managing groundwater • Protect and enhance riparian vegetation and vegetation on steep slopes
Water usage	• Increasing population can place greater pressure on limited water resources • Damming/ diverting of rivers can have detrimental effects on the downstream environment and therefore, needs to be limited • New technologies have allowed the more efficient use of water and their use can reduce some of the pressure on water resources	• MidCoast Water is undertaking a Sustainable Water Cycle Management project, investigating options for improving water supply and educating the community through the WaterWise program • In cooperation with GLC, Midcoast Water is introducing a recycled water scheme in the Great Lakes, including the Forster/Tuncurry Golf Course and Tuncurry Playing fields.	• Fix leaking taps • Install a rainwater tank • Invest in water efficient showerheads, washing machine and dishwasher • Take short showers instead of baths • Plant drought tolerant natives

Indicator	Issues and pressures	Council's response	Community response What you can do
Algae blooms	• Algae blooms occur naturally but are often the result of human practices • Algae blooms can occur due to excessive nutrients being released into the water through fertiliser, detergents and other chemical use and from the alteration of water flows • Some algae blooms are dangerous to animal and human health, such as blue-green algae	• See 'Water Quality' section above	• See 'Water Quality' section above
Fish kills	• Reduction in water quality or changes in water temperature, oxygen levels and pH can cause fish kills • Many human activities influence water quality as noted above	• See 'Water Quality' section above	• See 'Water Quality' section above
Stormwater pollution	• Stormwater pollution is any pollution that is collected by rainwater and washes down natural and man made drains into our oceans and waterways. This includes loose sediment, litter, leaves and chemicals • Gross pollutant traps can trap large pollutants and stop them from reaching and polluting waterways. However, these structures only work for the small areas they can service and they do not remove chemicals (although constructed wetlands can reduce nutrients/chemicals)	• See 'Water Quality' section above	• See 'Water Quality' section above

Indicator	Issues and pressures	Council's response	Community response What you can do
Fish passage barriers	• Obstacles such as causeways, road crossings, dams, weirs and culverts can obstruct the natural migration and breeding of fish, thus reducing their numbers. • Where appropriate, structures that obstruct fish need to be removed or modified (e.g. with Fish Ways)	• The NSW Department of Primary Industries is undertaking a project to identify and progressively remove or modify fish passage barriers.	• The NSW Department of Primary Industries is undertaking a project to identify and progressively remove or modify fish passage barriers.
		Biodiversity	
Native vegetation	• A growing population and associated development has meant that vegetated areas are being reduced or fragmented by residential development or clearing for agriculture. • Native vegetation provides us with a number of services and resources (cleaner air and water, healthier more productive soil, wildlife habitat, shade and atmospheric regulation, carbon storage etc.) and its value is often underestimated	• Great Lakes Council is currently preparing a Vegetation Strategy to identify, prioritise, manage and protect native vegetation within the LGA • Tree Preservation Order • Revegetation works	• Plant native trees and plants wherever possible • Retain native trees, especially older and large habitat trees • Place a portion of your land under a conservation agreement • Work with neighbouring landowners to link up fragmented vegetation corridors
Conserved land	• Public and private conservation provides for the preservation of biodiversity and native vegetation	• There is a need to establish a Great Lakes Protected Area Network	• Place a portion of your land under a conservation agreement
Corridors	• Vegetated corridors have been identified as a way to link up fragmented vegetation and to aid the movement of fauna.	• There is a need to identify, protect and develop corridors as part of the Vegetation Strategy	• Work with neighbouring landowners, Council and National Parks to link up fragmented vegetation corridors by strategically planting native trees on your land

Indicator	Issues and pressures	Council's response	Community response What you can do
Noxious and environmental weeds	• Weed invasion displaces native plants and animals and costs millions of dollars to control. • Most noxious and environmental weeds are introduced plants that have escaped from people's gardens or fish ponds	• Council's Noxious Weeds Officer inspects and controls weeds and educates the community as resources allow • Member of Mid Coast Weed Advisory Committee • Support of Bushcare and Coastcare groups	• Remove and suppress noxious and environmental weeds on your land • Join a Bushcare or Coastcare group to help remove weeds from our parks, reserves and foreshore areas • Try to use locally native plants rather than exotics for your garden
Threatened species	• The number of threatened species, populations and endangered ecological communities is increasing as a direct result of human modification of natural areas (i.e. vegetation removal and degradation).	• Council is a partner in implementing actions of Recovery Plans for threatened species • Facilitation and support of Koala Working Group (Hawks Nest Tea Gardens Endangered Koala population) • Development Assessment/ Strategic Planning • Bulahdelah Waste Transfer Station EMS	• Plant native trees • Remove and suppress noxious and environmental weeds • Report sightings of endangered species to Council • Join a Bushcare or Coastcare group • Work with neighbouring landowners, Council and National Parks to link up fragmented vegetation corridors by strategically planting native trees on your land • Drive carefully in vegetated areas • Retain native trees, especially older and large habitat trees
		Waste and toxic hazards	
Waste	• Nationally, our increasing population and material wealth/ disposable lifestyle has resulted in an increase in waste produced • Ideally waste should be seen as a resource and can be reused, recycled or reduced • Reducing waste helps current landfill sites last longer (thus reducing the need to source further waste fill areas)	• Introduction of the 3 bin system (rubbish, recycling, greenwaste) to improve separation of waste and recycling • Waste education program • Active member of MidWaste • Development of Waste Strategy	• Avoid purchasing products with excess packaging • Buy in bulk • Use calico bags instead of plastic shopping bags • Recycle plastics, cans, cartons, paper and cardboard • Purchase items with recycled content (eg recycled paper) • Reuse items, buy second hand goods or borrow items where possible • Compost greenwaste or place food scraps in wormfarm

Indicator	Issues and pressures	Council's response	Community response What you can do
Sewage treatment and disposal	• Increasing population means increasing amounts of sewage to treat and dispose • Harder to regulate and monitor the quality of On-site Sewage Management Systems (OSMS)	• OSMS inspections • Development Assessment	• Maintain adequate and functioning on-site effluent systems • Be careful with what is disposed of in the sewer
Toxic spills	• One-off spills of certain chemicals can do a great deal of damage to wildlife, the environment and human health	• Monitoring the incidence and location of spills • Working with agencies	• Report spills and pollution
		Land	
Development pressures	• Increasing development, as a result of increasing population and affluence, threatens the quality of our local and global environment (through increase in vegetation removal, water and air pollution, biodiversity loss and consumption of natural resources) • Strategic planning allows the consideration and management of a number of conflicting land uses in a systematic manner	• Strategic planning and zoning • Review of DA's that effect environment	• Design, build, renovate or buy homes and land that are environmentally sensitive (e.g. north facing, water tanks, solar hot water, native gardens, limited lawns, energy and water efficient, use of sustainable materials) • Participate in public consultation process, including commenting on draft plans
Open space	• Open space has a number of social and environmental benefits	• Recreation and Open Space Strategy (draft)	• Avoid dumping garden clippings in parks and reserves • If you back onto a reserve consult Council before mowing or maintaining reserve boundaries • Join a Bush Care group • Recognise the value of parks and reserves

Indicator	Issues and pressures	Council's response	Community response What you can do
Roads	• Roads have a negative impact on the environment through chemical and noise pollution (from cars), vegetation removal, fragmentation of habitat, death of native animals through collision, increase in erosion and the spread of weeds. • Dirt roads near waterways that do not have adequate erosion control methods result in a reduction of water quality through sediment run-off.	• Erosion control works • Roadside Management Project (Hunter REMS) • EMS for sediment and erosion control on road construction projects.	• Try to limit car use (as demand for roads leads to supply)- cycle, walk, use public transport or carpool wherever possible as these are the most environmentally friendly forms of transport • Be aware of wildlife whilst driving, especially at dusk
		Air	
Electricity usage	• Electricity from coal-fuelled sources relies on an unsustainable resource and pollutes our atmosphere with greenhouse gases. This is contributing to global warming, which results in erratic weather patterns and conditions and added pressure to the survival of wildlife and humans.	• Energy Action Plan • BASIX • Sustainability projects • GLC's Sustainability Advisory Committee (S-Team) • Implementation and review of GLC's Sustainability Strategy.	• Buy energy efficient appliances (e.g. smaller televisions and computer screens, appliances and light globes with a high energy star rating) • Turn off appliances at wall when not in use • Reduce energy use in the home with insulation, natural lighting etc. • Purchase power sourced from renewable sources.
		Noise	
Noise pollution	• Noise pollution can lead to stress and is regulated through the DA process	• DA Process	• Avoid use of noisy equipment outside the hours of 8am-8pm
		Heritage	
Non-Aboriginal Heritage and Aboriginal Heritage	• Aboriginal, Cultural and natural heritage is subject to pressures from increasing development and urbanisation, tourism and ageing processes	• Consultation through strategic planning and DA process	• Increase knowledge of heritage items and report any findings

The Great Lakes unique and significant natural environment deserves protection to ensure its longevity for future generations whilst providing for appropriate and sustainable growth and development. Unless appropriate and effective action is taken now we stand to lose the very asset which makes the Great Lakes region a desirable and privileged place for us to live and enjoy.

Summary of Recommendations for Council's Management Plan

A consideration of environmental issues and needs recognised in the State of Environment Report is necessary in completing council's annual reporting cycle Figure 1.1. The issues raised in the State of Environment Report should be used by the council for developing its environmental strategies and for allocating resources (budgeting, work programs).

The 2011-12 SoE report as with previous reports, has identified a number of needs through analysis of the indicators in this report. In relation to these identified needs a list of key projects and actions has been recommended by the SoE for consideration in Council's review of the Community Strategic Plan. These recommended projects and actions are presented below under relevant council sections.

Figure 1.1
The Annual Reporting Cycle
Source: Division of Local Government

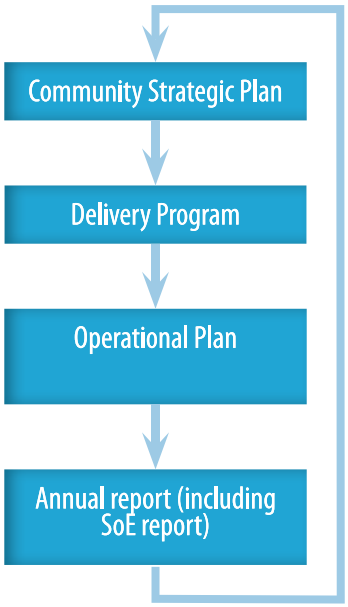


Figure 1.2 Wallis Lake at Forster

Natural Systems & Estuaries

- Wallis Lake Catchment Management (Review and progress implementation)
- Healthy Lakes Program (expand initiatives under new programs)
- Improved Stormwater Management (review and update plans)
- Implement actions identified in the Water Quality Improvement Plan
- Improve performance and management of stormwater treatment devices
- Work with other agencies to remediate Fish Passage Barriers
- Develop a Vegetation Monitoring Protocol
- Biodiversity Conservation Framework (develop and adopt)
- Vegetation Strategy (refine, update and implement)
- Develop a policy/direction for Development Assessment advice
- Acquire Satellite Imagery
- Assist in implementation of Threatened Species Recovery Plans and Priority Action Statements
- Biodiversity education (develop and expand initiatives)
- Implement and review Sustainability Strategy
- Develop Education for Sustainability strategy and environmental initiatives
- Implement water quality monitoring as detailed in the Water Quality Improvement Plan
- Align water quality monitoring sites and time with the NSW Shellfish Quality Assurance Program
- Implement Wallis Lake Wetland Strategy
- Darawakh Wetland rehabilitation plan implementation
- Estuary management plan implementation (Wallis, Smiths Myall/ Port Stephens

Engineering services

- Improve performance and management of stormwater treatment devices
- Review and Improve cleanout reporting procedures
- Roadside Environmental Management Plan (progress development)

Parks and Recreation

- Develop Landscaping Code
- Continue and improve weed management activities

Waste services

- Continue and improve waste education initiatives
- Develop and implement Waste Strategy

Council wide

- Acquire Satellite Imagery
- Expand implementation of Sustainable Purchasing Policy
- Collaborative Framework for consideration of Aboriginal Heritage
- Review and Implement GLC's Sustainability Strategy

2 Introduction

2.1 An overview of the Great Lakes

The Great Lakes Local Government Area (LGA) is 3,373 km^2 in size and is located on the lower Mid North Coast of New South Wales, approximately 320 km north of Sydney (Figure 2.1.1). For planning purposes it is considered part of the Hunter Region (Hunter Regional Environmental Plan) and is bounded by the local government areas of Port Stephens in the south, Greater Taree in the north and Gloucester in the west. It is 85 kilometres at its widest point, 62 kilometres north to south, and has a total coastline of 145 kilometres.

Great Lakes has a temperate climate, averaging a daily minimum of 17ºC and maximum of 27ºC during summer and daily minimum of 8ºC and maximum of 17ºC in winter, and has an average coastal rainfall of 1331mm.

The LGA supports a range of industries and commercial activities, which form the basis of the local economy. Tourism and primary production (oyster, commercial fishing and grazing/ timber production) are the most significant industries in the LGA.

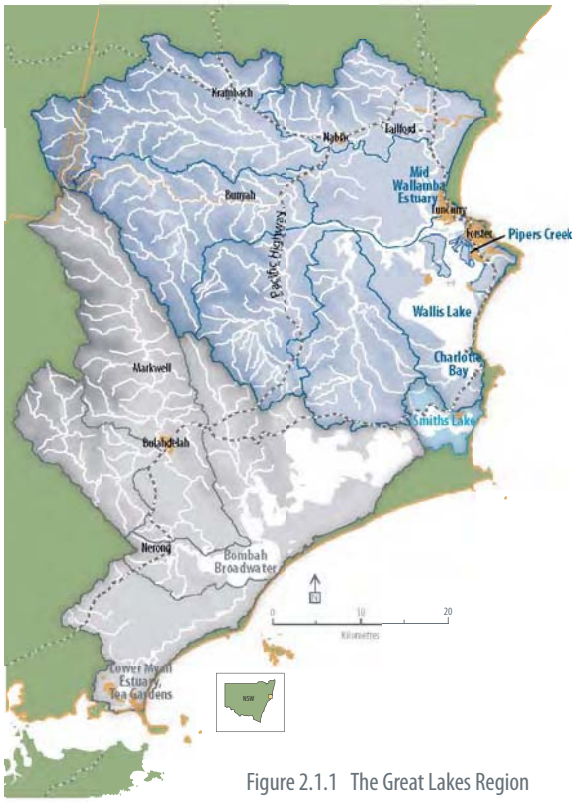


Figure 2.1.1 The Great Lakes Region

Figure 2.1.2 The Great Lakes natural environment

The viability and sustainability of all these industries critically relies upon a healthy and functioning local environment.

The Great Lakes possesses a unique environment of immense natural beauty, which includes extensive waterways, national parks, rural regions and mountain ranges. These landscapes provide habitat for an incredible diversity of native plant and animals. Vegetation communities include rainforest, moist and dry forests, wetlands and swamps, coastal heaths, seagrass beds, dunal formations and natural grasslands. To date, preliminary data suggests that over 500 fauna species and 1,200 native plant species inhabit the LGA. This includes rare, significant and threatened species.

The Great Lakes region is expanding; in large partly due to the "sea-change" phenomenon, which is a trend that has seen a population explosion in coastal towns on the eastern seaboard. The Great Lakes LGA supports a population of 36,054. The population growth, measured from June 2012, is at 1.41% per annum. The region also experiences population surges during holiday periods with between 100,000 and 150,000 tourists frequenting the area each year, placing considerable pressure on existing infrastructure and the local environment.

Over the past ten years a number of factors have been identified as placing an increased pressure on the Great Lakes environment. Continuation of damaging land uses combined with significant growth in residential and visitor populations, as well as associated infrastructure provisions, probably remains the greatest threat. Water deterioration, land degradation and loss of biodiversity are amongst the major environmental issues facing the region and unless these threats can be managed appropriately we will experience a continuing decline in the health of the local environment. The deterioration of the environment will inevitably impact on our economy, way of life and the general aesthetics of the LGA. Therefore, it is imperative that we protect and manage our Great Lakes environment for present and future generations, whilst providing for appropriate and sustainable growth and development.

Figure 2.1.3 Water quality testing in Wallis Lake

2.2 State of the Environment Reporting in NSW

State of the Environment (SoE) reporting provides an ongoing mechanism to monitor and to, in turn, implement steps to improve the condition of the local environment. The measurement of established indicators to determine changes and trends within the environment allows this report to document environmental change, both positive and negative, to assist in the management of our natural resources. Furthermore, SoE Reporting is intended to give an account of government, industry and community activities to protect and restore the environment. Finally, SoE Reporting provides a valuable education and awareness tool for the general community and all tiers of government.

Local Government plays a vital role in environmental management and is one of the primary land management authorities that is responsible for decision-making and regulation of land use development as well as environmental monitoring and management programs. As several areas of Council core business directly relates to or influences environmental management, environmental reporting within local government is an important process.

The State Government identified the need for environmental reporting at the local level and established that Councils be responsible for preparing SoE reports on an annual basis. Hence a legislative framework under the Local Government Act 1993 was established, which required:

- Council to prepare a Comprehensive SoE Report every four (4) years, coinciding with the end of the financial year following the general Council elections and the production of supplementary SoE reports every year in the interim;
- The SoE report to specifically investigate eight (8) environmental sectors: land, air, water biodiversity, waste, noise, Aboriginal heritage and non Aboriginal heritage;
- From 2012 Councils are required to prepare SoE Reports by reporting on the progress made in line with the environmental objectives of the Community Strategic Plan and specific actions identified in the Delivery Plan/ Operation Plan.
- That SoE reporting be tied to the development and documentation of Council's Community Strategic Plan;
- That the Comprehensive SoE Report be based on a "Pressure-State-Response" model (see below);
- That SoE reporting Include an emphasis on and commitment to implementing the principles and practices of Ecologically Sustainable Development (ESD);
- That the SoE reporting process consults and involves the community (including environmental groups) and produces the report in a format that is easily understandable by the community.

Furthermore, the Threatened Species Conservation Act 1995 requires that a Council that is identified within an approved Recovery Plan or approved Threat Abatement Plan as being responsible for the implementation of actions within such plans, shall report on the actions that it has undertaken within the SoE Report.

Pressure-State-Response Model

The pressure-state-response model for reporting on environmental sectors, includes:

- a pressure component, which identifies and describes the pressure that human activities put on their immediate environment and their natural surroundings,
- a state component, which identifies and describes the current and projected state of the environment, and
- a response component, which identifies and describes the response of councils, government agencies, industry and communities to the pressures on, and state of, the environment.

For example, when reporting on water quality, an increase in nutrients entering a local waterway may be monitored and identified. Increased nutrients may lead to algal blooms and declining aquatic health (thus is recognised as a pressure). The declining condition of the quality of the local waterway constitutes the state. Once identified and recognised, the issue might be addressed through an education program on stormwater pollution within the catchment or a structural solution (which is the response).

Whilst adopted by most NSW Councils, the model does have some identified shortcomings and limitations. In some cases indicators cannot be easily categorised as a state, pressure or response and some times a particular indicator may fall in all three categories. For example, the clearing of vegetation can be an indicator of the "state" of vegetation in the local environment, "pressure" for biodiversity issue, or "response" if the rate of clearance is arrested. Furthermore, there is not always a clear indication of cause and effect.

With these limitations in mind, this SoE report does not heavily utilise the PSR model. Rather, each sector (e.g. Water, Biodiversity etc) contains an introductory section that discusses the state and pressures of the sector in general terms. The results section of each indicator also provides information on the State component. The response of council and other groups is discussed specifically, where applicable. A special section, Environmental Plans and Strategies also provides an account of Council's response to environmental issues.

Ecological Sustainable Development (ESD)

Ecological sustainable development (ESD) means "using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased" (Commonwealth of Australia 1992).

Essentially, ESD is a means of effectively utilising resources with minimal environmental change to protect the natural environment and its resources/ services for future generations. An important part of ESD is the application of the Precautionary Principle. In essence, this suggests that where there are risks of serious environmental damage, that lack of scientific knowledge should not be used to postpone or defer environmental protection. As such, it requires adequate scientific knowledge to form the basis of all environmental decision-making.

Typically local government has traditionally undertaken natural resource management, economic development and provision of social services in isolation from each other. However it has since been recognised that these factors are related and that they interact in a complex manner. Subsequently, Councils are now required to undertake the management of their regulatory and service functions in an ecologically sustainable manner, as legislatively required under the Local Government Act.

Under the ESD Regulation, Councils must consider its most recent comprehensive SoE report when preparing the part of its draft management plan dealing with environmental protection activities (cl 6M(b)). As such SoE reports are a key mechanism in identifying and evaluating sustainability issues.

Figure 2.2.1 Ocean frontage at Forster

2.3 State of the Environment Reporting in the Great Lakes

In 2004, Great Lakes Council implemented a revised approach to SoE Reporting that aimed to develop an effective and useable document designed to feed more effectively into Councils Management Plan for the purpose of identifying resources and directing staff work programs in line with priority environmental projects. To achieve this, a SoE working group comprising of representatives of various Council sections was formed.

The report provides information on the state of the Great Lakes environment for the period of 1st July 2011 to 30th June 2012. It forms the third data collection period and ultimately provides for the preparation of a comprehensive report following the 2012 Local Government Elections. It is in this comprehensive report that a trend analysis of the data collected over the previous 3 reporting periods will be presented.

The report will also include updated information on Great Lakes Councils progress against the relevant performance indicators for the environmental objectives in the Community Strategic Plan (Great Lakes 2030).

Future Indicators for Subsequent SoE Reporting

There are presently a number of gaps in environmental reporting conducted as part of SoE for the Great Lakes LGA. This is despite considerable efforts in recent years to rationalise, enhance and refine appropriate indicators. Also, SoE reporting needs to continually evolve and improve as new environmental issues and management arises so that these are incorporated or represented.

Great Lakes Council has recently launched its Community Strategic Plan (CSP) as required under the Local Government Act (1993). The information presented in SoE reports will be useful to enable monitoring, evaluation and reporting on environmental objectives that are identified as "key directions" within the CSP.

3 Great Lakes 2030 Community Strategic Plan

The great Lakes 2030 Community Strategic Plan was prepared as a result of legislation enacted in October 2009 that required local Councils across NSW to develop a Community Strategic Plan as part of the new Integrated Planning and Reporting Framework. Great Lakes 2030 is the result of ongoing discussions and consultation with the community which commenced in October 2009 with the plan officially endorsed by Great Lakes Council on 19 April 2011.

The purpose of the Community Strategic Plan is to plan ahead for our community. Essentially the plan is Great Lakes Council's primary forward planning document and aligns our community's vision with a clear strategic direction for the Great Lakes long term future. This resulted in four key directions emerging that provided a focus for the development of objectives and strategies. The four key directions now provide a framework to plan social, environmental and economic outcomes to deliver and achieve our vision of a sustainable future.

This comprehensive State of the Environment Report will include a report on how Great Lakes Council has met the environmental objectives in the Community Strategic Plan. This will include Council's progress against the identified performance indicators for the environmental objectives of the Community Strategic Plan and Delivery Program/Operational Plan.

Great Lakes 2030 will be reviewed in 2012/13 following the NSW Local Government elections. Community input will once more be sought to ensure the communities priorities are reflected in the plan and also to make sure that no significant changes have occurred since the development of the plan. For SoE reporting purposes this report identifies the achievements Council has met regarding key direction 1 of the Great Lakes 2030 plan "Embracing and protecting our natural environment".

The following tables identify the strategies to be developed to achieve the key direction, the details of the activities to be undertaken in the Delivery Plan to achieve the strategy, and the specific activities of the Operational Plan undertaken in 2011/12, the performance indicators, responsibility and the current status of the activity.

Key Direction 1 Embracing and protecting our natural environment				
Strategy	1 Allowing for our increasing population and associated development without impacting on our natural environment			
Delivery Plan	Operational Plan (2011/12)			Progress Status - Comments
Details of activities to achieve this strategy	Details of activities undertaken in 2011/12	Performance Indicators	Responsibility	
1.1.1 Manage growth and development in the Great Lakes in a sustainable and efficient manner	Continue with preparation of new Principal Local Environmental Plan (LEP) with reference to Council's adopted land use planning strategies	Final LEP submitted to Department of Planning to be made by the Minister by end 2012	Manager Strategic Planning	Commenced & on schedule Draft LEP 2012 is on exhibition for nearly 3 months until 24 August 2012 with significant community engagement occuring during this period.
	Continue with preparation of Great Lakes consolidated DCP	To be completed concurrently with new principal LEP	Manager Strategic Planning	Commenced & on schedule Draft DCP is on exhibition for nearly 3 months until 24 August 2012 with significant community engagement occurring during this period.
	Review existing residential and subdivision Development Control Plans (DCPs), with reference to Council's adopted Housing Strategies to assess whether changes should be made to facilitate a greater range of housing types and residential densities	Council to endorse any changes to subdivision and residential controls	Manager Strategic Planning	Commenced & on schedule New provisions for larger lot sizes in green field medium density zones and prohibition of dwellings in high and medium density zones have been included in exhibited draft LEP 2012. Other provisions to encourage housing diversity have also been included.
	Prepare precinct DCPs for new release areas where further built form and environmental management guidelines are required	DCPs adopted by Council	Manager Strategic Planning	Commenced & on schedule DCP for release areas at Failford and Aquatic Rd came into effect. A Draft DCP for North Shearwater Release Area was exhibited for community input and Council is considering submissions from the community. Council also resolved to prepare a DCP for the area to be rezoned north of Alum Mountain at Bulahdelah.
	Implementation of Great Lakes Rural Living Strategy by rezoning priority rural residential, village release areas and appropriate environmental protection areas	Council to endorse priority areas for rezoning	Manager Strategic Planning	Commenced & on schedule Rezoning of all high priority areas complete, including rezonings at Failford and Aquatic Rd. A further village expansion area at Karuah has been included in the Karuah Growth Strategy. A Planning Proposal/ draft LEP for the rezoning of land at Bulahdelah, as identified in the Rural Living Strategy, for residential purposes has been submitted to the Minister for Planning to be made.

1.1.1 continued	Rezone land for urban expansion and environmental protection with reference to Council's adopted land use planning strategies	Council to endorse priority areas for rezoning	Manager Strategic Planning	Commenced & on schedule Land was rezoned for residential, industrial and environmental protection at Sweet Pea Rd and at Follyfoot Farm, South Forster. North Shearwater release area at Tea Gardens was rezoned for residential and environmental protection. The Dept of Planning and Infrastructure endorsed a Planning Proposal for exhibition for the rezoning of Myall River Downs (urban and environmental protection), Tea Gardens. Land at the end of Carmona Dr was rezoned for low density (rural residential) and environmental protection in accordance with the Forster/Tuncurry Conservation and Development Strategy.
	Biological diversity protected and conserved through implementation of existing conservation frameworks identified in Council's adopted natural resource and land use planning strategies	Council to endorse priority areas for rezoning	Manager Strategic Planning	Commenced & on schedule A proposed Planning Agreement for North Shearwater Release Area has been exhibited. This document will ensure the revegetation and protection, by dedication to Council, of over 40 ha of land. The mapping of Terrestrial Biodiversity and Wetlands across the LGA for inclusion in the first set of amendments to LEP 2012 is well advanced.
	Apply environmental protection and conservation zones and natural resource and sustainable management provisions, from the Department of Planning standard LEP template and from state and local strategies, to areas identified as high environmental value	Council to endorse priority areas for rezoning	Manager Strategic Planning	Commenced & on schedule These provisions have been included in the new comprehensive LEP where reliable mapping has been prepared in sufficient time for exhibition. An Environmental Management zone has been applied to the areas of SEPP 14 Wetland that were excluded from LEP 1996.

Strategy	2 Ensuring the development that does take place is sensitive to the natural environment			
Delivery Plan	Operational Plan (2011/12)			Progress Status - Comments
Details of activities to achieve this strategy	Details of activities undertaken in 2011/12	Performance Indicators	Responsibility	
1.2.1 Develop and implement a biodiversity conservation framework for the Great Lakes area	Commence local area conservation strategies	Conservation strategies drafted	Manager Natural Systems	Commenced & on schedule Barrington Tops to Myall & Wallis Lake corridor proposal commenced.
	Commence preparation of revised biodiversity conservation principles and objectives for the Great Lakes area	Biodiversity principles and objectives draft	Manager Natural Systems	Commenced & not on schedule Other competing priorities have delayed this project until 2nd quarter of 2012/13.
1.2.2 Monitor the state of the Great Lakes environment and ensure Council's programs and activities are responsive to identified environmental issues	Review and implement priority actions within the Wallis, Smiths, Myall and Port Stephens Estuary Management Plans	Actions implemented and reported	Manager Natural Systems	Commenced & not on schedule Wallis Estuary Plan review project commenced in 4th quarter and temporary officer engaged to assist with completion in 2012/13. Several implementation projects completed during the financial year including dredging in Wallis Lake, Wallamba Riverbank protection stage 5, and creek crossing repair in the Myall catchment.
	Review of the Wallis Lake Catchment Plan subject to funding	Plan reviewed and adopted	Manager Natural Systems	Commenced & not on schedule Project commenced in 4th quarter and temporary officer engaged to assist with completion in 2012/13.
1.2.3 Implement Stormwater Management Plans for Forster, Tuncurry, Bulahdelah, Hawks Nest and Tea Gardens	Review Forster Tuncurry Stormwater Management Plan	Plan reviewed and adopted	Manager Natural Systems	Commenced & not on schedule Plan reviewed but yet to be adopted. Draft Plan distributed internally for comment. Plan to be finalised 2012/13.
1.2.4 Implement the Great Lakes Water Quality Improvement Plan	Commence implementation of priority actions - Water quality improvements Pipers Creek/Bay Catchment	Identified actions implemented	Manager Natural Systems	Commenced & on schedule Designs completed for bioretention systems for Pipers Creek. Final site for system to be determined.

1.2.4 Continued	Develop environmental report card on Pipers Creek/Bay estuarine health condition.	Pipers Creek health report card completed	Manager Natural Systems	Completed Report card completed and launched in November 2011. Report card summarises condition of lakes and waterways and act ti vi ties undertaken during the last four years.
	Delivery of urban drainage construction program (drainage enhancements for management of water quality and quantity) as per adopted works plan.	Delivery of program within available budget	Manager Natural Systems	Completed Works completed on budget at Green Point and Nabiac Town Centre to resolve flooding issues.
1.2.5 Implement Council's Water Sensitive Design Policy	Determine development applications and land rezonings in accordance with policy	Policy consistently implemented	Manager Development Assessment, Manager Building Assessment	Commenced & on schedule Policy implemented progressively form January 2012. Commenced for large scale development (greater than 2000 sq metres) on 19 January 2012. Small scale developments (less than 2000 sq metres) to commence 1 July 2012. Amendments to the policy are currently on exhibition removing the exclusion of additions and other minor changes.
1.2.6 Develop an environmental management system (EMS) to mitigate the impacts of Council's activities	Stage 1 of EMS developed covering sediment and erosion management at the bulahdelah Waste Transfer Station and Tuncurry Depot	Stage 1 EMS completed	Manager Waste, Health and Regulatory and Manger Operations	Completed Stage 1 EMS completed. EMS action list developed and action list prioritised. Planning for implementation now commencing as funds become available. Waste Transfer Station dependant on completion of Depot EMS expected completion be December.
	Implement recommendations of internal review on erosion and sediment control. Incorporate review of environmental factors requirements and necessary checklists within project management plans for construction works.	Compliance with Protection of the Environment Operations Act and relevant guidelines. Impact of Council works on surrounding waterways and environment monitored and minimised	Manager Operations	Completed Erosion and sediment control management systems developed. Internal auditing commenced on erosion and sediment control to review performance of staff. An improved field guide for staff has been completed and is now ready for distribution. In addition the EMS for erosion and sediment control has been developed which is now in the implementation phase. REF's are included in PMP's for construction works as required.

Strategy	3 Planning for and minimising the potential impact of climate change			
Delivery Plan	Operational Plan (2011/12)			Progress Status - Comments
Details of activities to achieve this strategy	Details of activities undertaken in 2011/12	Performance Indicators	Responsibility	
1.3.1 Assess the impacts of climate change on the organisation and develop adaptation strategies to address such impacts through the Climate Change Coordination Group	Develop and implement climate change adaptation action plan	Plan developed and adopted	MANEX	Commenced & not on schedule Development of Plan not commenced. Awaiting regional report form Hunter Councils REM section on regional adaptation action plans to compare with Council plans and the completion of Council mapping to determine impact of climate change on Council infrastructure.
1.3.2 Develop Coastal Management Plan to address planning and adaptation to coastal erosion and climate change	Preparation of Coastal Management Plans for the Great Lakes	Undertake coastal management planning	Manager Design & Investigation	Commenced & not on schedule First draft study report has been received and reviewed by Council and OEH. Report is currently being amended by the consultant.
	Complete coastal hazard assessments and include coastal hazard mapping into Council's GIS system	Assessments and mapping completed	Manager Design & Investigation, Manger Natural Systems, Manager Information Technology	Commenced & on schedule Mapping is an ongoing process. Interim hazard mapping for Jimmys Beach area has been completed. Mapping for rest of the Great Lakes coastal area for planning is scheduled to be undertaken once the current Coastal Study is completed.
1.3.3 Identify and implement a long term, sustainable adaptation management strategy for the protection of Jimmys Beach, Winda Woppa	Commence development of a management strategy that is appropriate and sustainable	Strategy development commenced	Manager Parks & Recreation	Commenced & not on schedule The coastal hazard mapping has been completed however the management plan is still to be received in draft form. Delays in delivery are based on lag time associated with feed back from OEH. This has a flow on effect to the timeline of the project. New delivery date is November 2012.
1.3.4 Integrate adaptation strategies to identify, value, prioritise and invest in infrastructure and natural assets under threat from sea level rise	In consultation with Floodplain Risk Management and Coastal/ Estuary Management Committees and Climate Change Coordination Group, apply for funding (OEH, HCCREMS & IPWEA) to develop prioritisation & investment/action models using floodplain, estuary & coastal study results	Investigate funding sources, and priority program in place	Manager Design & Investigation, Manger Transport Assets, Manager Natural Systems	Commenced & on schedule Ongoing investigation of funding sources. No new funding opportunities have been identified.

1.3.5 Develop adaptation strategies to manage flood hazards in the Great Lakes area	Identify projects, update floodplain management program and apply for grant funding in consultation with GL Floodplain Management Committee and OEH	Update floodplain management program and apply for funding	Manger Design & Investigation	Commenced & on schedule Applications were submitted for funding under NSW Floodplain Management Program for 2012/13
1.3.6 Ensure Floodplain Risk Management adaptation strategies are in place for flood prone areas	Undertake flood studies and prepare risk management studies and plans (FRMS&P). Identified areas - Nabiac, Smiths Lake, Port Stephens, Lower Myall & Lakes, Karuah River and Stroud	Undertake flood studies and FRMS&P for identified and funded projects	Manager Design & Investigation	Commenced & not on schedule Lower Myall and Lakes Flood Study Review commenced. Port Stephens and Karuah River deferred due to resourcing of other priority projects.
1.3.7 Undertake identified Floodplain Risk Management adaptation measures	Upgrade Nabiac Town Creek culvert near the industrial area. Update flood maps	Complete contract documents and engage contractor. Investigate additional funding sources for other identified measures. Update flood maps	Manager Design & investigation, Manager Transport Assets, Manager Information Technology	Commenced & on schedule Construction of Nabiac Town Creek Culvert is complete. Mapping is an ongoing process.
1.3.8 Conduct and monitor energy, water, waste and greenhouse gas audits of Council facilities and operations to mitigate the impacts of climate change	Review planet footprint data and identify energy savings opportunities for Council managed assets (ie. water and energy saving devices) and undertake priority capital works to reduce consumption within allocated budgets	Annual reviews completed	Manager Natural Systems (via Sustainability Team)	Commenced & on schedule Retrofit Great Lakes Aquatic Centre and GLC Council Administration building, Breese Pde extends into 2012/13. Planet footprint data regularly reviewed by asset managers to inform opportunity for future improvements.
1.3.9 Incorporate sustainability initiatives in the management of the Council fleet to mitigate the impacts of climate change	Join the Office of Environment & Heritage's Fleetwise Program. Update Council's Fleet policies. Ensure environmental performance is incorporated in plant tender assessment and purchase of light vehicles	Overall plant and vehicle emissions. Overall fuel consumption of Council fleet and plant	Manager Operations	Completed Fleetwise program joined and all data entry completed. Council's fleet polices will be reviewed following assessment of data from the Fleetwise program and the recommendations from it. Light fleet selection considers environmental rating with Council's light fleet now being predominantly 4 cylinder vehicles. Environmental performance is utilised as an assessment criteria in all plant tender assessments. Data on consumption not readily available
1.3.10 Work with the community to further renewable energy projects to mitigate the impacts of climate change	Continue to encourage businesses to consider the benefits of renewable energy and encourage the establishment of renewable energy projects	Report to Economic Development Advisory Committee on activities	Manager Economic Development	Commenced & on schedule Council continues to encourage energy efficiency through programs such as the Small Business Sustainability Program. The program was highly commended at LGSA Awards, announced in December. Establishment of demonstration wind/solar powered street light in John Wright Park in partnership with local business.

1.3.11 Incorporate cycle facilities within all planning instruments	Make a provision for cycle facilities within the consolidated DCP process	Inclusion of bicycle facilities within the DCP	Manager Strategic Planning	Commenced & on schedule These provisions have been included in the new comprehensive LEP that is on exhibition until 24 August 2012. The draft DCP for the North Shearwater Release Area also identifies routes for cycle and pedestrian paths.

Strategy	4 Managing the impact of mining and agricultural industries on the natural environment			
Delivery Plan	Operational Plan (2011/12)			Progress Status - Comments
Details of activities to achieve this strategy	Details of activities undertaken in 2011/12	Performance Indicators	Responsibility	
1.4.1 Manage noxious and environmental weed infestations within the Council area	Continue the application of Noxious Weed Threat Abatement Plan targeting Bitou Bush and aquatic weeds.	Achievement of required deliverables of the Threat Abatement Plan	Manager Parks & Recreation	Completed This years round of activities has been completed with the past 6 months seeing Bitou eradication at Burgess Beach, Celito and joint ventures in National Parks. Outcomes of Plan met.
	Undertake private property inspections targeting noxious weeds with a focus on aquatic weed infestation	Annual reporting to Department of Industry and Investment in accordance with funding requirements	Manager Parks & Recreation	Completed This years round of inspections have been undertaken with 390 sites being visited exceeding the requirements from DPI.
	Monitor spread of noxious weed infestations and map new occurrences	All new infestations reported to Mid North Coast Weed Advisory Committee for regional action	Manager Parks & Recreation	Completed Attendance at the meeting has occurred on a regular basis and minutes have been reported to Council for consideration. Council has met its obligations under the Noxious Weeds Act with regard to attendance at this Advisory Committee. New infestations have been reported.
	Provide information and advice to the community through attendance at relevant community events	Annual reporting to the Department of Primary Industries in accordance with funding requirements	Manager Parks & Recreation	Commenced & on schedule The final report is currently being formulated, ready for presentation to the Department. A duplicate report will be presented to Council for information

1.4.2 Establish strategic research partnerships to investigate best practices for poultry and organics composting	Apply for funding for research partnerships	Partnerships established	Manager Natural Systems and Manager Waste, Health and Regulatory	Completed Report completed and Council notified. A regional approach is to be taken looking into organics processing. A trial is currently underway at Greater Taree and results are to be considered by GLC and the EPA.
1.4.3 Ensure mining activities contribute to improved catchment management through financial contribution to catchment management program	Catchment management improvements undertaken in accordance with priorities	Identified priorities actioned	Manager Natural Systems	Commenced & on schedule Karuah River ecological health assessment report due in Sep 2012. Application made for funding assistance for stage 2 being the development of the Karuah Catchment Plan
1.4.4 Implement the Wallis Lake Wetland Management Strategy	Acquisition of priority wetlands and zoning of wetland areas as part of environmentally sensitive areas	Identified priorities actioned	Manager Natural Systems	Completed Wetland acquisition completed at Darawank (20 ha), Bulahdelah and funds secured for restoration from NSW Environmental Trust and Federal Biodiversity Fund.

Strategy	5 Embracing our natural environment to develop a green economy			
Delivery Plan	Operational Plan (2011/12)			
Details of activities to achieve this strategy	Details of activities undertaken in 2011/12	Performance Indicators	Responsibility	Progress Status - Comments
1.5.1 Implement Sustainable Farming Program to deliver environmental outcomes and improve local farm productivity through the implementation of the Water Quality Improvement Plan and other natural resource management plans	Including training days for landholder groups, coordinate sustainable farming groups and coordinate incentive program to support water quality initiatives	Numbers of programs held and numbers attending programs reported	Manager Natural Systems	Commenced & on schedule Eight Sustainable Farming groups with 80 participants involved. Over 20 workshops/field days held. Program on track with grant milestones met. Grant project is due for completion June 2013.

Strategy	6 Ensuring we explore every opportunity to sustainably manage our waste			
Delivery Plan	Operational Plan (2011/12)			Progress Status - Comments
Details of activities to achieve this strategy	Details of activities undertaken in 2011/12	Performance Indicators	Responsibility	
1.6.1 Improve landfill and transfer station operations to reduce environmental impact	Groundwater monitoring will be undertaken at least annually at all Landfill sites	Reports received in a timely manner	Manager Waste Health & Regulatory	Commenced & on schedule Sampling completed in accordance with licence requirements.
	Increase recycling at landfills and transfer stations	Diversion reports are prepared	Manager Waste Health & Regulatory	Commenced & on schedule Monthly reports have been prepared and analysed with further diversion trials underway.
	Investigate new markets to recycle additional materials	Number of new markets	Manager Waste Health & Regulatory	Commenced & on schedule Pilot project for crushed glass completed with market investigation ongoing. Grant for polystyrene compactor successful.
	Leachate generation is reduced by design and capping and relevant approvals are obtained	Approvals received from OEH, leachate monitored	Manager Waste Health & Regulatory	Commenced & not on schedule Capping design for Tuncurry Landfill received from OEH (now EPA) and Closure Plan submission made for Bulahdelah Landfill. OEH have required changes to both plans. Consultants engaged to undertake the work.
	Construction of Minimbah Landfill in accordance with best environmental practice principles	Landfill constructed in accordance with project plan	Manager Waste Health & Regulatory, Manager Operations	Commenced & not on schedule Roads & Maritime Services have changed intersection design requirements at the Pacific Highway with a redesign potentially being required. Liaison with RMS continuing regarding options being available. Contract (if required) for works to be advertised on completion of design activities.
	Construction of Bulahdelah Transfer Station to accommodate the closure of Bulahdelah Landfill and to minimise the environmental impact by reducing the number of licensed landfills	Station constructed in accordance with project plan and landfill closed	Manager Waste Health & Regulatory	Completed Transfer Station officially opened on 4 August 2011. Landfill closed and final capping completed. National award received in September as part of the 2011 National Landfill & Transfer Station Excellence Awards.
	Construction of Tea Gardens Transfer Station to accommodate the closure of Tea Gardens Landfill and to minimise the environmental impact by reducing the number of licensed landfills	Station constructed in accordance with project plan and landfill closed	Manager Waste Health & Regulatory	Commenced & not on schedule Modification to the consent is being prepared to enlarge the greenwaste stockpile areas and new access. The Transfer Station project has been expanded to construct new access roads and provide for subdivision of Council owned land.

1.6.2 Improve the collection and processing of waste to reduce environmental impact	Increase quantities and quality of recycling collected from commercial and industrial businesses and undertake audit of commercial and industrial recycling system to identify areas for improvement	Number of premises inspected Audit undertaken and volume of recyclables collected compared to previous year	Manager Waste Health & Regulatory	Commenced & not on schedule Improvements to commercial recycling have not progressed due to other higher priority projects.
	Undertake a trial of collecting reusable items from bulky waste service	Results of trial reported	Manager Waste Health & Regulatory	Completed Trial completed and Council adopted to have this undertaken where feasible.
1.6.3 Deliver education programs regarding sustainable management of waste to raise awareness throughout the community	Coordinate Waste 2 Art competition with Greater Taree City Council and Gloucester Council	Number of entries received and media coverage	Manager Waste Health & Regulatory	Completed Competition held with GTCC from 26/8 - 9/9 with 115 entries received. Midwaste coordinated media coverage including coverage on Prime News.
	Improvements made to the school recycling program to maximise the amount of waste recycled	Number of schools inspected	Manager Waste Health & Regulatory	Deferred to a later date Staff have been required to focus on higher priority projects.
	Expand recycling program for public areas to minimise the amount of recyclable waste disposed of at landfill	Number of additional recycling bins provided	Manager Waste Health & Regulatory	Commenced & on schedule Public Place recycling systems installed in John Wright, Memorial and Palmgrove Parks, Tuncurry Rock Pool and Forster Keys waterfront. Additional Public Place recycling has been investigated with new facilities to be trialled in Forster & Tuncurry CBDs.
1.6.4 Provide services that align with the NSW State Strategy targets where possible	Provision of sustainable event waste management services for major events	Number of events serviced	Manager Waste Health & Regulatory	Deferred to a later date Staff have been required to focus on higher priority projects.
	Take appropriate action to combat the illegal dumping of waste including investigation and imposing of penalties for breaches	Number of incidents investigated	Manager Waste Health & Regulatory	Commenced & on schedule Covert surveillance cameras are being trialled in hot spot areas. All reported waste dumping incidents were investigated.
	Prepare a business case into the costs and benefits of collecting and processing organic waste	Report is prepared and presented to Council by 30/12/11	Manager Waste Health & Regulatory	Report finalised and reported to Council in April.
1.6.5 Ensure Waste and Sustainability Improvement Program (WaSIP) targets are achieved	Amend policies and/or services to meet WaSIP conditions	Number of conditions achieved and progress reported	Manager Waste Health & Regulatory	Completed Required standards have been met.
1.6.6 Increase the use of recycled material content in Council works	Trial use of recycled glass in asphalt and roadbase; continue to investigate use of waste concrete for gravel to use in road construction;	Quantity of recycled content used for roadworks and parks and gardens works	Manager Operations	Completed Recycled glass trials for asphalt and roadbase have been completed., with monitoring of performance to occur

1.6.6 continued	utilise concrete cobbles for road foundation treatments where practical; utilise recycled materials where possible for parks and gardens equipment; reuse mulch generated from construction jobs for other parks and gardens purposes			over coming years. Concrete cobbles have previously been used in road foundations where practical and this will continue to be considered as an option where such scenarios arise. Recycled materials are being considered as parks infrastructure is constructed or renewed. Mulch generated from construction and maintenance works is reused within Council's operational works.
1.6.7 Dispose of office waste, and waste materials from Council works in a responsible manner and reuse materials where possible	Ensure separation of waste materials prior to disposal at landfill and proactively recycle materials for use on future projects	Reduction in amount of material taken to landfill classified as general waste. Reduction in quantity of material where waste levy charge applies	Manager Operations, Manager Administration	Completed General waste classified material has been minimised through separation. Cost Clerk reviews data on a monthly basis. Applicable levies applied have been minimsed. Office waste continues to be separated into recyclable materials and waste. Waste levy applied to 454.11 tonnes of mixed waste from Operational works during 2011/2012 equating to $14,583.72
	Recycle toner cartridges and batteries	Number of items recycled	Manager Waste Health & Regulatory, Manager Information Technology	Commenced & on schedule 94 cartridges returned for recycling.
No action scheduled for 2011/12				
1.6.1 Improve landfill and transfer station operations to reduce environmental impact	Construction of Tuncurry Transfer Station to accommodate the closure of Tuncurry landfill and is association with construction of Minimbah Landfill		Manager Waste Health & Regulatory	Commenced & on schedule Master Planning completed and commencement of Development Application process underway.
	Upgrade of Stroud landfill to accommodate current demands on the service		Manager Waste Health & Regulatory	
	Greenhouse gas surface monitoring is undertaken at Tuncurry Landfill		Manager Waste Health & Regulatory	
1.6.2 Improve the collection and processing of waste to reduce environmental impact	Promote the reuse of materials through retail outlets		Manager Waste Health & Regulatory	This project commenced ahead of time due to the Tuncurry Landfill contractor receiving grant funding to pursue this initiative. A new display area was constructed at the Tuncurry Green Shop for resale of rejuvenated furniture items etc.
	Audit of business and household bulk waste services and development of programs to address deficiencies		Manager Waste Health & Regulatory	

1.6.2 Continued	Increasing diversion rates from development DCP		Manager Waste Health & Regulatory	
	Increasing diversion rates from development DCP		Manager Waste Health & Regulatory	

Results

As of June 30 2012 the status of the activities undertaken to achieve the environmental objectives of the Community Strategic Plan were as follows.

- 34 of the activities in the Operational Plan had commenced and are on schedule for completion.
- 18 activities had been completed
- 12 activities had commenced & were not on schedule for completion
- 2 activities had been deferred

Of the identified activities 6 in total had no actions scheduled for the 2011/12 period.

Summary and future directions

The actions to achieve Key Direction 1 Embracing and protecting our natural environment are well on track with 44 of the 66 activities in the Operational Plan either completed or on schedule for completion. Given the short period of time since the adoption of Great Lakes 2030 by Council, the progress made to achieve the environmental objectives of the plan is well advanced with the majority of activities scheduled to be completed on time.

The Great Lakes 2030 has only been active for a short time, being adopted in 2011, thus, the targeted actions have had minimal time to be assessed and reported on. It is anticipated that future SoE reports will identify more effectively and in greater detail the achievements and progress made in relation to the key objectives of the plan and actions set out in the Delivery and Operational Plans.

As the Community Strategic Plan will be used for future State of the Environment reporting, it will be necessary to effectively monitor the progress of the actions identified in the plan. With the Great Lakes 2030 set for review in 2012/13, there may be future changes to the Plan which will be reflected in future SoE reports prepared by Great Lakes Council.

4 Water

4.1 Water quality

Introduction

The Great Lakes region depends heavily on the health of local waterways and their catchments. The waterways form the basis of the region's economy (supporting tourism and primary production), contribute to our way of life and amenity, and provide habitat for extraordinary biological systems. The region's catchments are under increasing environmental pressure from pollution and impacts associated with catchment land use, development and tourism, potentially resulting in a decline in the health of our waterways.

In 2002, the majority of our waterways were classified as "generally healthy -modified" by the Healthy Rivers Commission (now the Natural Resources Commission).

Between 2005 and 2007, the Great Lakes Water Quality Improvement Plan ranked Wallis Lake as moderately disturbed with some areas as high conservation value, Smiths Lake as high conservation value; and, the Myall Lakes ranged between moderately disturbed and high conservation value.

All our local waterways are critically susceptible to increasing environmental pressures; a Hepatitis A event in oysters in Wallis Lake in 1997, reoccurring blue-green algae in Myall Lakes and episodic fish kills are all examples of what can go wrong.

Water quality results have been presented in this report in two sections, ecological and human health. A summary of management responses undertaken in each estuary is also presented in the ecological section.

Water Quality - Ecological Health

The health of the waterways in the Great Lakes region is fundamental for achieving the Vision set out in the community strategic plan 'Great Lakes 2030': "A unique, sustainable and enhanced environment with quality lifestyle opportunities created through clever development and appropriate infrastructure and services". Since 2008 the NSW Government Office of Environment and Heritage have undertaken an ecological health monitoring program in Wallis Lake as part of the state-wide Monitoring, Evaluation and Reporting Strategy (MER). As part of the Strategy, Wallis Lake was selected as one of seven estuaries across the state to be sampled each year to track inter-annual variability in two ecological health indicators; chlorophyll a (the amount of algae) and turbidity (the amount of sediment). In 2011, Great Lakes Council and the Federal Government (through their Caring for our Country Program) have provided funding to expand this monitoring program to cover additional sites across the Great Lakes Local Government area. The Office of Environment and Heritage have as a result, provided an independent scientific evaluation on the ecological health of Wallis Lake, Smiths Lake and the Bombah Broadwater in the Myall Lakes.

Ecological health does not refer to environmental health issues such as drinking water quality, safety for swimming, heavy metal contamination, disease, bacteria, viruses or our ability to harvest shellfish or fish.

> The Goal for our waterways is to maintain or improve their condition in order to protect biological diversity and maintain ecological processes

Figure 4.1.1 Myall Lake looking south

Ecological health results presented in easy to understand Report Card

The results of ecological health monitoring have been presented in a Catchment and Waterways Report Card which grades the health of the waterways in a similar way to school report cards with a grade ranging from A (excellent) to F (very poor). This Report Card documents how Great Lakes Council is tracking towards their 2030 Vision and is included in Appendix 1.

The information provided below includes the background details for the Report Card including the objectives, methods and a detailed description of the results.

Report Card objectives

The objectives for the Report Card are:

1. To report on ecological health
2. To track progress on management actions.

These objectives are specifically achieved by:

- Providing information to assist in the current and ongoing protection of "high conservation" areas that currently provide substantial water quality and biodiversity benefits to the rivers and estuaries.
- Providing information to guide and report on the remediation of areas that have high pollutant loads and highlight areas that may require further action
- Providing information to help protect all areas of Wallis, Smith and Myall Lakes against further declines in water quality.

In addition to the ecological results, management actions being undertaken in the catchments are also presented in the Report Card. A more detailed description of the management actions is provided in this report. These management actions have been developed to target specific environmental values which Council and the community have determined as important to the region.

Environmental values

The environmental values that management actions in the catchment are aiming to achieve are:

1. Minimal algal growth
2. Minimal sediment inputs and maximum clarity
3. Intact aquatic habitats like seagrass, macrophyte and riparian vegetation

Figure 4.1.2 Clear waters with minimal algal growth and maximum clarity support key habitats such as seagrass

Methods

Development of Report Card grades

The monitoring program has assessed the ecological health of Wallis and Smiths Lake, Bombah Broadwater and Lower Myall Estuary, Tea Gardens. There are a number of steps taken to deter mini ne the score for each zone and subsequent report card grade:

1. Selecting the indicators
2. Identifying the trigger levels
3. Collecting the data
4. Calculating the zone score
5. Allocating the report card grade

1. Selecting the indicators

In order to meet the objectives of the Report Card, indicators must report on ecological health but also be able to report on the outcomes of management actions. The management actions are linked to the environmental values set for the region (listed above), and the indicators selected have been shown to be responsive to catchment management actions.

Algal growth can be measured by assessing chlorophyll a levels in the water and sediment inputs assessed by measuring the turbidity (see side box). These indicators are easy to measure and directly relate to the environmental values.

While the extent of seagrass beds, macrophytes and riparian vegetation are not currently measured, low chlorophyll and turbidity levels are necessary to ensure healthy habitats. Expansion of the program in the future is likely to include assessment of these habitats.

There are many different estuary reporting programs world-wide, with indicators specifically chosen to suit local conditions or issues. Chlorophyll and turbidity are commonly used as they are proven to be very informative and responsive indicators Table 3.1.1.

Table 4.1.1 Indicators used in various estuarine monitoring programs

Monitoring Program	Chlorophyll a	Turbidity	Dissolved Oxygen	Nutrients	Riparian vegetation	Seagrass	Other critical habitats (e.g coral)
South East Queensland Ecosystem Health Monitoring Program	✓	✓	✓	✓	✓	✓	✓
Chesapeake Bay EcoCheck program	✓	✓	✓			✓	✓
Northern Rivers CMA Ecohealth	✓	✓	✓		✓		
NSW Monitoring, Evaluation and Reporting Program *	✓	✓	F		F	✓	
Great Lakes Council Report Card (this program)	✓	✓	F		F	F	

F - future

* NSW Monitoring, Evaluation and Reporting Program also samples fish in a limited number of sites

The NSW Monitoring, Evaluation and Reporting Program, based on the findings of Scanes et al. (2007) concluded that measurement of Chlorophyll A and turbidity provides an effective measure of the short term response of estuary health to management actions. Seagrass and other macrophytes provide a long-term integration of estuary health.

Dissolved oxygen has been widely used as an indicator of the amount of oxygen in the water column with many critical aquatic processes dependent on a healthy level and minimal variability. Great Lakes and NSW Monitoring, Evaluation and Reporting Program both acknowledge that dissolved oxygen is an important variable to measure but have not done so to date due to logistical reasons. There are plans to include this indicator in future monitoring activities.

2. Identifying the trigger levels

A healthy ecosystem refers to a system which has normal ranges of diversity and function. These 'normal' ranges have been established from extensive monitoring of estuaries across NSW as part of the NSW Monitoring, Evaluation and Reporting program. To establish these ranges, sites that represent a variety of ecological conditions from pristine (reference) sites to highly degraded have been sampled over a number of years. The data for pristine (reference) sites have been used to establish the trigger values which are fundamental for ranking the ecological health of a site.

The National Water Quality Management Strategy (ANZECC 2003) suggests that the suitable method for deriving a trigger value is to determine the 80th percentile value (i.e. the value that is met 80% of the time) for an indicator at reference sites. A trigger value is the value which indicates that a variable is outside the "normal range" and could trigger further investigation. In our context, we have used the trigger value to indicate conditions which are not desirable for continued waterway health.

Algae

Algae or microscopic plants are always present in waterways but if conditions change and are suited to algal growth, blooms can occur. Blooms may occurr if there is a lot of nutrients in the water which can come from urban stormwater, fertiliser runoff from farms and gardens and seepage from septic tanks. Algal blooms can reduce the amount of light reaching seagrass beds limiting their growth. When blooms of algae die and start to decay, the resulting bacterial activity can reduce oxygen concentrations in the water column, possibly leading to fish kills. Chlorophyll is a good measure of the amount of algae in the water as all alga have chlorophyll in their cells giving them their green colour.

Chlorophyll a

Chlorophyll a is a pigment found in plants and is an essential molecule for the process of photosynthesis (the conversion of light energy to chemical energy resulting in the consumption of carbon dioxide and the production of oxygen and sugars). In estuarine and marine waterways, chlorophyll a is present in phytoplankton such as cyanobacteria, diatoms and dinoflagellates. Because chlorophyll a occurs in all phytoplankton it is commonly used as a measure of phytoplankton biomass. (EHMP 2008)

Sediment

Sediment from the land can be washed into waterways when it rains. If land is not properly managed with trees and groundcover, large amounts of sediment can wash into our waterways. Sediment also comes from roads and pathways washing directly into the stormwater and then the estuaries.

Too much sediment in the water reduces the amount of light reaching the bottom and is detrimental to seagrass which require light for growth. Seagrass is critical for the health of estuaries as it provides essential habitat for fish and invertebrates which support bird life and subsequently influence the local tourism and aquaculture industries. Excess amounts of suspended particles can also smother benthic organisms like sponges and seagrass, irritate the gills of fish and transport contaminants. Turbidity provides a measure of sediment in the water.

Turbidity

Turbidity is the measure of light scattering by suspended particles in the water column, providing an indication of the amount of through the water column (EHMP 2008).

A trigger value is specific to different types of estuary, in this study, Wallis Lake, Pipers Creek, Charlotte Bay, Smiths Lake, Bombah Broadwater were all classified as "Lakes" and Wallamba River and the Lower Myall River, Tea Gardens as a "River estuary" (Roper et al. 2011).

Table 4.1.2 Trigger Values for NSW Estuaries (from Roper et al. 2011)

	Turbidity (NTU)	Chlorophyll (µg/L)
Lake	6.7	2.5
River estuary (mid)	1.9	2.2

3. Collecting the data

The Great Lakes region has been divided up into eight reporting zones. A zone is actually a broad area within the estuary rather than a discrete point (see maps in Results Section) and may be represented by a single sample or by multiple samples. Four zones were sampled in Wallis Lake estuary (Wallamba River, Pipers Creek, Wallis Lake, Charlottes Bay). There is one zone in Smiths Lake , and one Zone in Myall Lakes at the Bombah Broadwater. There is one zone at Tea Gardens in the Lower Myall Estuary.

Samples were collected on six occasions between summer and autumn from December to March. This represents the part of the year when the highest chlorophyll concentrations are expected.

Figure 4.1.3 Office of Environment and Heritage staff carry out the monitoring of the waterways in the Great Lakes Region

At each of the selected sites, samples were taken in accordance with the NSW Monitoring, Evaluation and Reporting protocols which are described in full in Roper et al. (2011). At each of the "Lake" sites, turbidity was measured using a calibrated probe suspended at a depth of 0.5 metres for 5 minutes as the boat drifted or was motored (generally covering a distance of at least 300 metres), logging data every 15 seconds. The final value for the "site" sampled was the average of all the logged data. During the drift, at least five samples of the top 1m of the water column were collected and combined in a bucket. At the end of the drift, a single 200 millilitre sample for Chlorophyll a analysis was taken from the composite in the bucket.

For the river estuary sites, an "underway sampler" is used to pass water past the probe whilst the boat travels at a regulated speed along a transect upstream from the middle to the upper part of the estuary. The turbidity is calculated as the mean of logged values for the transect. At two sites along the transect, composite water samples are collected for Chlorophyll a analysis.

Chlorophyll a samples are immediately filtered (within one hour) under mild vacuum and the filter frozen until analysis. Chlorophyll a is extracted into acetone and Chlorophyll a concentration determine by spectrometry.

4. Calculating the zone score

The measured values of all indicators need to be summarised into one value which can then be compared between different reporting zones.

Two basic calculations have been performed for each zone:

- Non-compliance score – are the indicator values non-compliant with the trigger value?
- Distance from the benchmark score – how far from the trigger value are the indicator values?

The distance measure is a recognition that the trigger values only allow for two possible states, compliant and non-compliant. The distance measure provides for more sensitivity for ecological condition along the gradient from good to poor.

Calculating the non-compliance score

The non-compliance score was simply calculated by taking the number of samples that are above the trigger value as a proportion of the total number of samples taken in the sampling period. The non-compliance score is then expressed as a value between 0 and 1 with 0 equal to none of the values being non-compliant (i.e. all compliant) and 1 equal to all values being non-compliant.

Non-compliance score = number of samples non-compliant with trigger value divided by the total number samples.

Calculating the distance from benchmark score

The distance score has been expressed as a proportion between 0 and 1 to be standardised with the non-compliance score. To do that the distance score is expressed as a proportion of the worst expected value (WEV) with a score of 0 equal to the benchmark value and 1 equal to the worst expected value for each of the indicators

The worst expected value has been determined by examination of a data set for all of NSW. The 98th percentile value was selected as the worst expected value Table 3.1.3. In the small number (2 %) of circumstances where measured values were greater than worst expected value, the distance measure became 1 (which is the highest possible value).

Table 4.1.3 Worst expected value for Condition Calculations

	Turbidity WEV (NTU)	Chlorophyll WEV (µg/L)
Lake	20	30
River (mid)	60	30
Lagoon	20	30

WEV = worst expected value

Distance of each non-compliant value = (measured value – trigger value) / (worst expected value – trigger value)

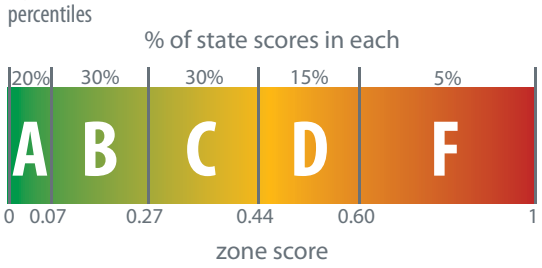
The distance score is calculated as the mean distance from the trigger of those values that are non-compliant for the reporting period.

Once the non-compliance and distance score have been calculated, the geometric mean of both scores is calculated to arrive at a single score that can be used to assess the condition of each indicator in that zone.

$$\text{Final Score for indicator} = \sqrt{(\text{non-compliance} \times \text{distance score})}$$

The final "zone score" for each reporting zone is then the simple average of the indicator scores.

Figure 4.1.4 Relationships between Grades, Zone scores and state percentiles



5. Allocating the Report Card Grade

Defining the report card grade is an important step in the development of the Report Card. The grade definitions below are linked to the environmental values outlined above and are structured to allow easy comparison between each system and over time. It is important that the cut-off values for each Grade reflect the condition of each Zone in comparison to a broader scale of condition across all NSW estuaries. (i.e. an "Excellent" grade represents an excellent condition for a NSW estuary). To assist with the derivation of cut-offs, scores were calculated for 130 zones across a wide range of NSW estuaries using the same triggers and worst expected values as the Great Lakes analyses. Cut-offs were then defined as representing a percentage of the scores for the state Table 3.1.4. For example, a zone score less than 0.07 defined the 20% of best zone scores in the state and this became our "Excellent" Grade (see Table 4 for other cut-offs). We did not use a score of 0 as excellent because, as a consequence of how the trigger values are calculated, we expect that even pristine reference sites will exceed trigger values 20% of the time. The definition of the grades and description are shown in Figure 3.1.4.

Table 4.1.4 Report Card results, definitions, descriptions and cut-off

Grade	Result	Definition	Description
A	Excellent	All environmental values met (The indicators measured meet all of trigger values for almost all of the year)	The best 20% of scores in the state
B	Good	Most environmental values met (The indicators measured meet all of the trigger values for most of the year)	Next 30 % of good scores
C	Fair	Some of the environmental values met (The indicators measured meet some of the trigger values for some of the year)	Middle 30% of scores
D	Poor	Few of the environmental values met (The indicators measured meet few of the trigger values for some of the year)	Next 15 % of poorer scores
F	Very Poor	None of the environmental values met (The indicators measured meet none of the trigger values for almost all of the year)	The worst 5 % of scores in the state

Summary of the process for calculating the zone score

In summary, the process for calculating the zone involved:

- Calculating the proportion of time that the measured values of the indicator are above the adopted guideline limits or Trigger Values
- Calculating the distance/departure from the guidelines for that indicator - the extent the data extends past the trigger value and approaches the worst expected value (WEV). for that indicator.
- Calculating the geometric mean of the non-compliance and distance scores to get a final score for that indicator for each zone
- Averaging the scores for the two indicators at each sites – this gives the "Zone Score"
- Grade the Zone based on the Zone Score as A, B, C, D, F

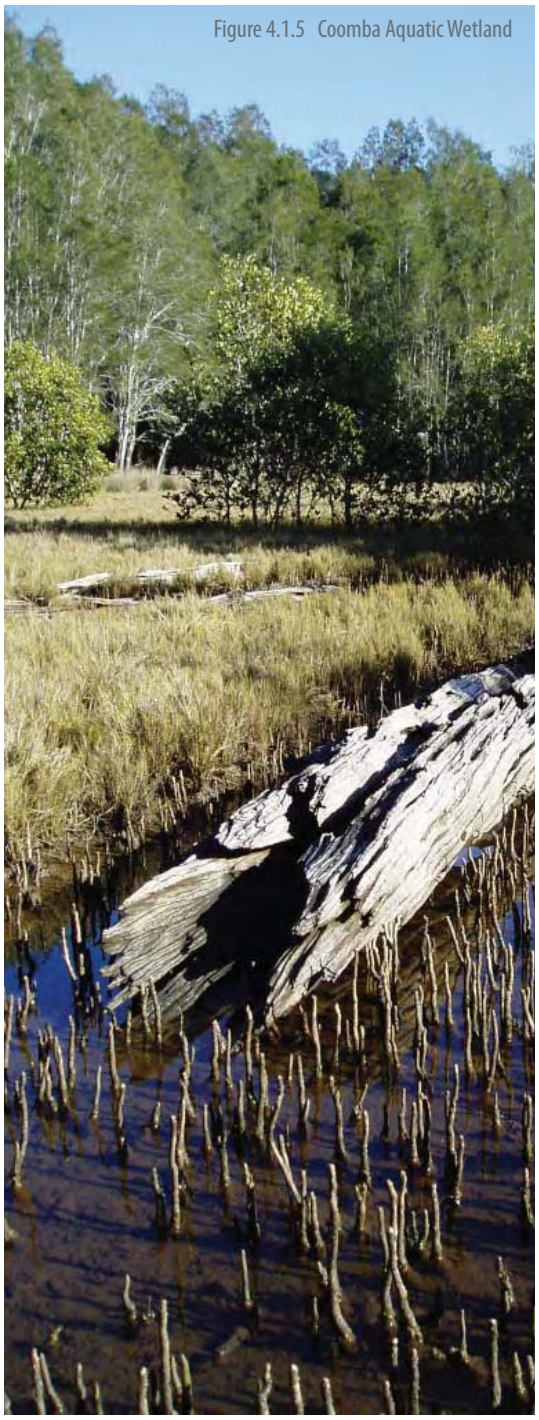


Figure 4.1.5 Coomba Aquatic Wetland

References

ANZECC (2003) Australian and New Zealand guidelines for fresh and marine water quality. Volume 1, The guidelines / Australian and New Zealand Environment and Conservation Council, Agriculture and Resource Management Council of Australia and New Zealand.

Roper T, Creese B, Scanes P, Stephens K, Williams R, Dela-Cruz J, Coade G, Coates B. (2011) Assessing the condition of estuaries and coastal lake ecosystems in NSW. Technical Report (19 September 2011). NSW State of the Catchments.

Scanes P, Coade G. Doherty M, Hill R (2007) Evaluation of the utility of water quality based indicators of estuarine lagoon condition in NSW, Australia. Estuarine, Coastal and Shelf Science.

EHMP (2008). Ecosystem Health Monitoring Program 2006-07 Annual Technical Report. South East Queensland Healthy Waterways Partnership, Brisbane.

Acknowledgements

The methodology presented here was developed by the Office of Environment and Heritage, Scientific Services Section with input from Hodge Environmental and the International Water Centre.

Background Information

The amount of rainfall that occurs when sampling for the report card influences the report card results. If there is more rain, there is more runoff in the catchment resulting in greater quantities of sediment and nutrients entering our waterways. The rainfall data from the Forster Bureau of Meteorology station has been presented to provide assistance with interpreting the results presented in the report card.

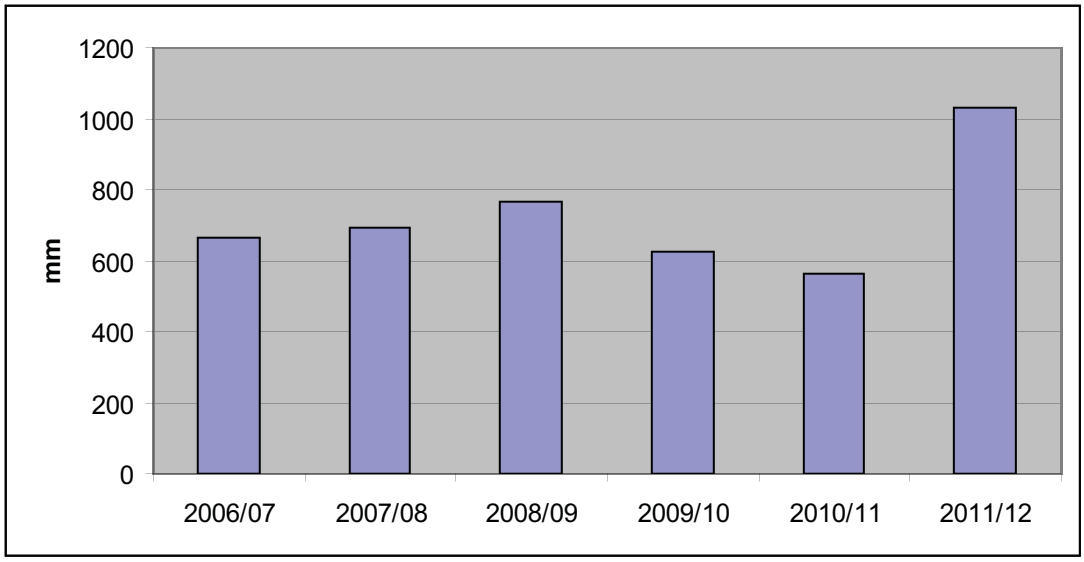


Figure 4.1.6 Average rainfall from September to March

Results from the data show that the average rainfall between September 2011 and March 2012 was considerably higher than the average of the previous 5 years. Between September 2011 and March 2012 the average rainfall was 1031mm compared to 662mm (range 563 to 768mm) between 2006 and 2010 which equates to 1.5 times the previous average rainfall during the sampling period.

Wallis Lake

Catchment description

The Wallis Lake catchment extends over 1400 square kilometres and is shared between the Great Lakes Council LGA (65%) and the Greater Taree City Council LGA (35%). This catchment includes the region's major urban centre of Forster-Tuncurry.

Wallis Lake is one of the most significant producers of Sydney Rock Oysters in Australia and is also central to the local tourism industry, valued at over $120m per year. The lake is one of NSW's top 3 producing estuarine fisheries and is utilised extensively for recreation including boating, fishing and swimming.

The Wallis Lake catchment contains habitat for threatened and international migratory species and contains 20% of the seagrass beds of NSW, the State's single largest concentration of seagrass.

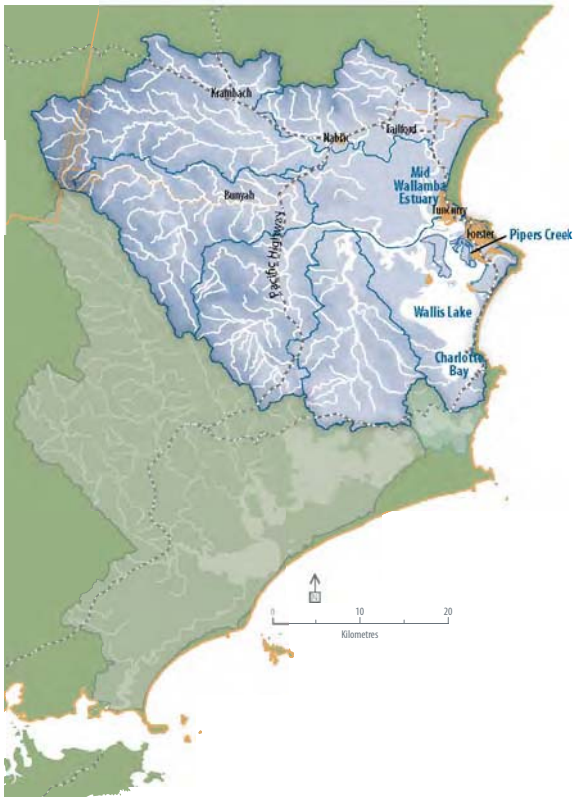


Figure 4.1.7 Wallis Lake Catchment

Management actions

A number of key management activities occur across the Wallis Lake Catchment influencing the overall health of the estuary, these are summarised below.

Sustainable Farming Program

The Great Lakes Sustainable Farming Program is a collaborative project between Great Lakes Council and Karuah Great Lakes Landcare. The program aims to facilitate sustainable, productive land use across the Great Lakes catchments. The objective is to involve rural land managers in action learning which involves using localised networking, participatory learning, on-farm trials and demonstrations sites to help empower land managers to develop locally adapted solutions for sustainable agriculture. The underlying goal of the program is 'landholders learning from landholders' as this creates true long term capacity building and community support.

In both 2008 and 2010 the Council-Landcare partnership was successful in securing funding through 'Caring for our Country' to deliver the Sustainable Farming Program in the Wallis and Myall Catchments.

A key element of the Sustainable Farming Program is the establishment of localised Sustainable Farming Groups. Since 2008, six (6) Sustainable Farming Groups have been established in the Wallis Lake Catchment, these being in the localities of Wallamba, Wang Wauk, Dyers Crossing, Topi Topi and Wootton, as well as a broader geographical group focusing on farm biodiversity. Since 2008 the groups have held a total of 62 meetings to discuss relevant topics such as soil health, farm dam water quality, sub-soil ploughing, electric fencing, and pasture species identification to name a few.

In addition to the these localised Sustainable Farming Groups, the Sustainable Farming Program incorporates a number of professional workshops, practical hands on field days, on-farm trials and demonstration sites. Since 2008, there have been 72 field days and workshops held, 39 on-farm trails established and five (5) Best Practice Farms initiated in the Wallis Catchment.

15 Best Practice Farm field days were accomplished in 2011/12.

Protection from development and re-development

Council have focussed on protecting all lakes in the Local Government Area through its application of water quality targets for development and re-development. These targets ensure that there is a neutral or beneficial effect on water quality which means nutrients are not allowed to increase above current levels . These targets are documented in a draft Development Control Plan which will apply right across the Wallis, Smiths and Myall Lakes Catchments.

Rubbish removal

During 2010 Great Lakes Council undertook a clean up project aimed at removing marine debris from 148km of the Wallis Lake foreshore and 68km of its island's foreshores. The clean up was the first coordinated clean up of Wallis Lakes foreshores on record.

The clean up resulted in 100 volunteers removing 7 tonnes of marine debris which consisted predominantly of plastic bottles, batteries, crab traps, car tyres, floats, cigarette lighters, bait bags, alcohol bottles/cans and foam boxes.

Council is currently pursuing additional funding when it becomes available in order to continue the removal of marine debris from foreshore areas within the Great Lakes in order to improve the ecological condition of our waterways and their foreshores.

Key Catchment Management Statistics

- Erosion control on 36ha of land
- 792ha of wetlands protected and enhanced
- 31.8km of stream bank protected
- 341ha of native vegetation protected and enhanced
- 240m of roadside stabilised to reduce erosion
- 10 ha of infested water treated for aquatic weeds

Mid Wallamba Estuary

C 2012

D 2011

D 2007

chlorophyll

turbidity

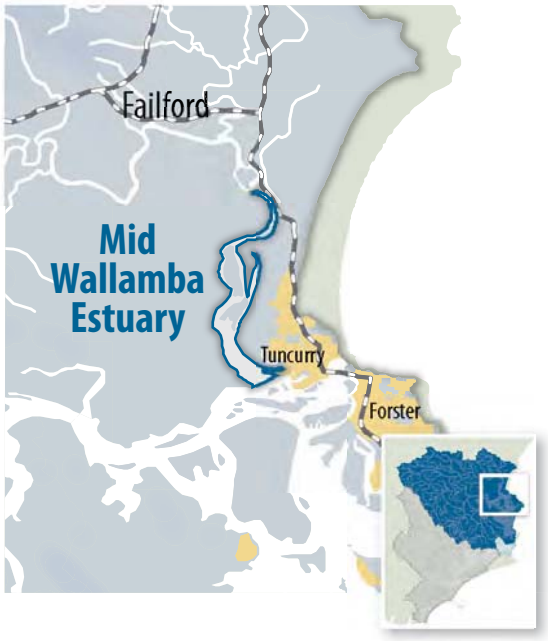
Ecological health is now fair

The Wallamba River estuary receives runoff from a large agricultural catchment. The water was murky with high algal levels. There has been a slight improvement in algae and water clarity from last year.

The majority of sediment particles in the water are fine soils and clays that have washed from bare earth in areas where vegetation cover has been removed, from unsealed roads and from eroding or collapsing stream banks. The turbidity levels exceeded the trigger value in just over half of the samples collected and with some samples greatly exceeding the trigger value.

Algal (chlorophyll) levels exceeded trigger values in 80% of samples collected and many exceedances were large. Unhealthy growth of small algae in the waters is stimulated by nutrients washed from urban areas and pastures, or from stock directly accessing waterways. If this continues, then algae may reach levels in the water which are detrimental to fish, humans and livestock.

Great Lakes Council has initiated actions to control sediments and nutrients from the catchment as part of the Water Quality Improvement Plan. The results for 2012 are a slight improvement on those from 2007 and a considerable improvement on 2011. The improvement may be a result of increased river flow leading to more of the algae being flushed out of the river before it could grow. It is too early to tell whether this represents a trend towards improvement. It is clear that more targeted work in the catchment is still required.



Estuary description

The Mid Wallamba Estuary sub catchment covers almost one third of the Wallis Lake catchment (550 km^2). The catchment is one of the most modified sub catchments in Wallis Lake. Agriculture is the dominant land use with a small urban centre at Nabiac. The Mid Wallamba Estuary faces additional localised pressures from the erosion and collapse of stream banks due to its popularity for water sports over the summer period.

The water quality sampling occurs in the estuarine reaches of the river from Wallamba Island to Failford.

Figure 4.1.8 Mid Wallamba Estuary

Management Actions

Protection and rehabilitation of key habitats

Acquiring and conserving 503ha of wetlands at Darawakh, Minimbah and Lower Wallamba / North Tuncurry to protect water quality and biodiversity

Restored pre-disturbance hydrology to over 90% of the Darawakh Creek / Frogalla Swamp through the infilling or decommissioning of 22.2km of artificial drains and removal of 1.5km of artificial levees to remediate a significant acid sulfate floodplain wetland system.

Figure 4.1.9 Acquiring and conserving 570ha of wetlands at Darawakh, Minimbah and Lower Wallamba / North Tuncurry to protect water quality and biodiversity.

Bush rehabilitation

Volunteers active in bush regeneration around Nabiac. 12 members of Nabiac Landcare meet weekly to tackle the weeds in a 6 hectare area of river flat sclerophyll forest at Bullock Wharf on the Wallamba River. The group have cleared vast areas of woody weeds such as lantana, small leaved privet and camphor laurel. Also present at the site are the more problematic madeira vine, asparagus fern and trad. The natural regeneration on this site is excellent but the group assists in some areas with planting of endemic species.

Bank Stabilisation

Stabilising 4.2km of the Wallamba River with rock protection, planting 8,000 native plants and bush regeneration to conserve 8.6km of streambank.

Rock walls that allow establishment of mangroves have been constructed to reduce bank erosion. The Wallamba river is exposed to severe bank erosion due to past vegetation clearance, ongoing cattle grazing and wash from boats. Monitoring from Great Lakes Council has indicated an erosion rate of up to 1m per year along 12km of river. Sedimentation downstream is impacting on the health of the Wallis Lake oyster and fishing industry. Sedimentation directly affects oyster leases and turbidity reduces the depth at which seagrass will grow, thus reducing fish habitat.

The Wallamba River Memorandum of Understanding brokered an innovative agreement to the management and remediation of these significant riverbank erosion issues affecting the banks of the lower Wallamba River. The MOU was amended in 2010 to address the increasing impact of wash from wake enhancing activities. The MOU amendments were negotiated with key stakeholders including caravan park businesses, landholders, waterway users and government agencies. Importantly the amendments provide a designated area for wakeboarding and other wake enhancing activities within Wallis Lake in an area on the western side of Wallis Island and maintains the exisiting ski zone within the Wallamba River. It enacted responsibilities on land management agencies and river users to adopt actions and protocols to care for and restore the riverbank landscape to maintain the health of the river and its responsibilities including management of the riparian zone, protection and restoration of the downstream estuary and consider and manage aquatic habitat. Great Lakes Council, with the support of other land management agencies, has been implementing activities that relate to riverbank protection and stabilisation and associated riparian enhancement. Outputs have included installation of several kilometres of riverbank armouring (rock fillets/revetment), enhancement and re-establishment of riparian vegetation and mangroves, and stock exclusion fencing.

Pipers Creek

B 2012

B 2011

B 2007

chlorophyll

turbidity

Algae still higher than desired

The ecological health in Pipers Creek was good, and similar overall to 2011. 2012 had a very wet summer and whilst Pipers Creek was very clear, the high nutrient loads from the urban catchment of Forster resulted in algal levels higher than desired, and greater than last year.

Ecological health in Pipers Creek is strongly influenced by inputs from the large urban catchment. Nutrients from houses, lawns and pets, wash into the creek through stormwater and continue to stimulate algal growth to levels which are higher than desired for this type of waterway. The trigger value for chlorophyll is exceeded in almost half the samples collected, though the exceedences were not large.

Water clarity was excellent with turbidity levels less than trigger values all of the time. There has been a slight improvement in turbidity levels between 2007 and 2011 and now to 2012. Low turbidity levels are critical for the protection of important habitats such as seagrass beds which enhance the biodiversity of the system. This was a good result for Pipers Creek and shows that with the additional efforts being made to control nutrient run-off from the catchment, it may be possible for Pipers Creek to achieve excellent water quality in the future. Recent improvements made to water quality should not be lost as a consequence of future development or re-development in this catchment. There should therefore be a continued emphasis on achieving water quality targets for all development and protection of existing native vegetation.

Estuary description

The majority of the Forster township is located in Pipers Creek Catchment. The rainfall that once infiltrated into the ground through native vegetation now meets impervious surfaces (roofs, roads and footpaths) and runs directly into stormwater drains and Pipers Creek. This stormwater runoff carries with it pollutants such as sediments and nutrients from houses, lawns and pets. In the past, Pipers Creek and Pipers Bay have experienced large algal blooms and shown signs of poor ecological health. Following large rainfall events, the water from Pipers Creek and Pipers Bay can reach Wallis Lake and Charlotte Bay areas. Reducing the impacts of stormwater from the Pipers Bay Catchment therefore has benefits across the whole of Wallis Lake.

The samples for this report card are taken next to Big Island adjacent to Forster Keys.

Figure 4.1.10 Pipers Bay with Pipers Creek on the right

Management Actions

Water Sensitive Urban Design

Over the past three years Great Lakes Council have been building water quality gardens in the Pipers Creek Catchment to filter the sediments and nutrients out of the stormwater prior to flowing out into Wallis Lake. Six gardens have been built in the Palms estate drainage reserve between Kularoo Drive and the Southern Parkway. One of these gardens was constructed in 2012. An additional garden was built out the front of Council on Breeze Parade. This garden was built as a demonstration and filters water from the road further protecting Pipers Creek.

The water quality gardens work by slowing down the stormwater so that large particles like soil drop out of suspension. The water then flows over a planted area and the microscopic alga (biofilms) which grow on the plant roots remove the nutrient nitrogen. The sandy loam soil that the plants grow in also acts as an additional filter removing other pollutants like heavy metals, petrochemicals and phosphorus. This cleaner water then flows into the stormwater drain prior to flowing into Wallis Lake.

Council are currently in the process of identifying priority locations for future water quality gardens.

Urban Engagement - Living Smart

In July 2012 Council initiated a Sustainable Gardening Program. The program was developed based on the feedback received from participants in the Living Smart Program. Modelled on the successful Sustainable Farming Program, this project engages with urban landholders to reduce their impact on water quality in urban areas.

The Sustainable Gardening Program has been established as a 12 month course with local gardening experts leading the program. There are 46 urban residents actively involved in the program with approximately half of these regularly attending monthly workshops. Great achievements have been made by participants involved in the program with many people establishing composts, saving seeds, designing their gardens on permiculture principles and reducing their nutrient inputs.

Figure 4.1.11 Local residents participating in the sustainable gardening program

Bush Rehabilitation

Three volunteer bush regeneration groups currently exist in the Pipers Creek Catchment, working on a variety of vegetation types and weeds.

At the southern end of Little Street, a single volunteer maintains a small (0.4ha) public reserve containing remnant floodplain rainforest that borders SEPP14 wetland (Saltmarsh) on Wallis Lake foreshore. The area was overrun with woody weeds, such as Lantana and Senna, but also contains vine weeds such as climbing asparagus and morning glory. Native vines are also present, and in this highly disturbed landscape, are over-growing old growth rainforest trees. The site is problematic and has had years of neglect, but is starting to show signs of resilience. On-going support is needed to complete meaningful restoration of the site.

The 10 volunteers actively working at the Community Gardens at Penenton Creek are mostly interested in growing their own food, but also take time to regenerate the banks of the creek adjacent to their gardens. Senna, camphor laurel and asparagus weeds are present, but also madiera vine. All of which require constant vigilance to control. Old growth remnant rainforest trees are scattered amongst mangroves and sclerophyll species along this urban creek, which is heavily impacted upon by urban pressures.

The Sanctuary is a 6ha remnant of swamp sclerophyll forest adjacent to the Golf course in Forster. Two volunteers have maintained this area since 2005, in which time the area has been transformed from a degraded camphor laurel forest with weed understorey, to an active regeneration site full of native regrowth. Garden escapes (from green waste dumping) are now the main focus of works here.

Wallis Lake

B 2012

A 2011

A 2007

chlorophyll

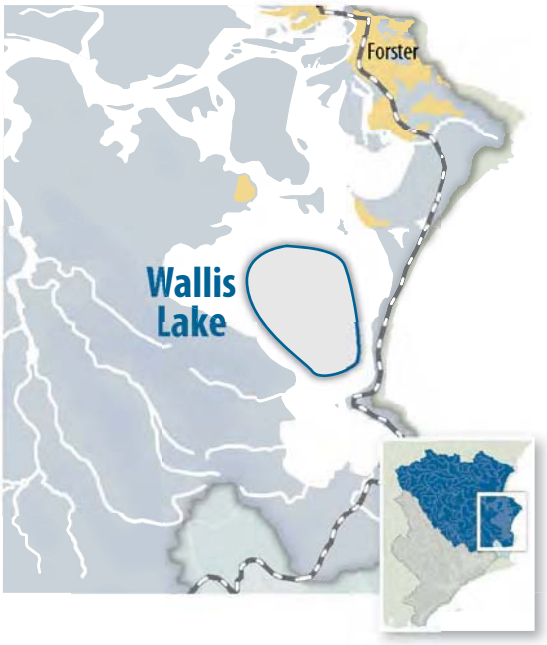
turbidity

Moderate algal growth means Wallis Lake scores as good

Wallis Lake has long been recognised as having high environmental values due to its extensive seagrass beds: seagrass beds are important estuarine habitats that not only support biodiversity but provide essential ecosystem services such as nursery areas for aquatic bugs , fish and many other species.. Seagrass beds in turn, support a healthy community of larger animals such as turtles, large bodied fish, crabs, birds and dolphins. Healthy seagrass beds depend on good ecological health to survive..

In 2012 ecological condition in Wallis Lake slipped slightly from excellent in 2011 to good. All turbidity samples remained below trigger values meaning the waters are very clear, allowing plenty of light to penetrate the water, which means that seagrasses can survive to greater depths and maintain a large area of coverage. Greater than desired growth of algae occurred in about half of the samples, but the levels were only just above the trigger levels. Spring/summer 2012 had rainfall over 50% higher than the average for the previous 5 years and this will have lead to greater nutrient inputs than in previous years. Nutrient inputs stimulate algal growth.

These results remind us that if there is not a continued effort to prevent of excessive nutrient inputs to the lake excessive algal growth could occur quickly.



Estuary description

Wallis Lake is in the centre of the estuary and receives runoff from a narrow catchment immediately surrounding the lake. Adjoining areas directly influencing Wallis Lake include Coomba Park, Green Point and the rural residential land on the western side of Wallis Lake. During large rainfall events, water from the major rivers and the Pipers Creek catchment flow into this area carrying pollutants with it.

Sampling in Wallis Lake takes place in the centre of the estuary between Yahoo Island in the north and Earps Island in the south.

Figure 4.1.12 Wallis Lake

Management Actions

Bush Rehabilitation

Four volunteer groups are actively regenerating their local bushland reserves in the Wallis catchment.

Green Point Coastcare has been meeting weekly since 1996 to reduce weeds along the foreshore of Wallis Lake. Their intial work involved clearing vast tracts of Lantana and Bitou Bush, now the remaining 4 members are tackling vine weeds, asparagus fern and invasive grasses. The group mainly focus on a 2 ha area that has Casuarinas fringing the lakes edge, with rainforest and Eucalypt canopy in some areas.

Two volunteer groups are active at Coomba Park. One group, with 6 volunteers, works on a 3ha site at Coomba Aquatic Gardens. This area contains a sclerophyll forest on the headland point, which was heavily infested with Lantana when the group commenced in 1994. The bulk of the site contains Saltmarsh that is fringed with Mangroves on the Lakes' edge, and Palm Forest on the landward edge. While the woody weeds (lantana and Senna) are mostly under control, vine weeds (Passionfruit, morning glory) are proving more problematic in the Palm forest area.

The Coomba Foreshore group has 12 members who meet weekly to work in a long foreshore reserve that contains both Sclerophyll Forest and Saltmarsh. Woody weeds, such as Lantana and Senna have been systematically removed, and the group is now working on Asparagus Fern, vine weeds, including morning glory, madeira vine and passionfruit vines (two species). The group works in a 7ha area along Wallis Lake.

A small group of locals at Wootton started working along creek banks of Carrington Creek in 2009. Large tracts of privet (both large and small-leaved varieties), as well as moth vine and annual pasture weeds over-ran the area. With the help of contract bush regenerators, the group have systematically regenerated a small section of the creek, revitalising the native stands of watergum and Waterhousia. Four volunteers now maintain the regenerated area with regular working bees.

Figure 4.1.13 56 volunteers active in bush regeneration at 9 sites

Charlotte Bay

A 2012

A 2011

A 2007

chlorophyll

turbidity

Charlotte Bay remains in excellent condition

Charlotte Bay was identified in the Water Quality Improvement Plan as having high environmental values primarily due to its extensive seagrass and macrophyte beds, which support possibly the highest diversity of sponges and associated animals in NSW estuaries. Good water quality, particularly clear water, were identified as being important in protecting this unique ecosystem.

The water quality results for Charlotte Bay have remained excellent, with no exceedences of trigger values for any samples in 2011. The waters are very clear, allowing plenty of light to reach the seagrasses and associated sponges.

Greater than desired growth of algae occurred in about one third of the samples, but the levels were only just above the trigger levels. These levels were ranked good, but were just low enough to retain an excellent overall rating. Spring/summer 2012 had rainfall over 50% higher than the average for the previous 5 years and this will have lead to greater nutrient inputs than in previous years. Nutrient inputs stimulate algal growth.

These results justify Councils position in relation to development targets to prevent further nutrient inputs to the lake. They also illustrate that if there is not a continued effort to prevent of excessive nutrient inputs to the lake, excessive algal growth could occur quickly

Estuary description

Charlotte Bay covers the southern most part of the Wallis Lake estuary. There is limited mixing between the northern and southern parts of Wallis Lake, therefore the condition of this area is influenced mainly by the surrounding catchment. The catchment is largely vegetated with a small amount of residential, commercial and rural residential land.

Sample collection in Charlotte Bay occurs in the middle of the water body south of Earps Island.

Figure 4.1.14 Charlotte Bay

Management Actions

Bush Rehabilitation

2 volunteers meet every other week at the wetland behind the Community Hall at Pacific Palms. The group commenced in 2009, with the help of an enthusiastic Green Corp team and professional bush regenerators, and have made big in-roads into the clearing of dense Senna, Lantana and Asparagus Fern on this site. Vine weeds, such as Passionfruit vine and morning glory are also present. The site contains a mixture of Saltmarsh species, old-growth mangroves and orchid-bearing Casuarinas; as well as dense stands of Cabbage-Tree Palms, Grey Gums and Swamp Mahoganies. Regeneration after preliminary clearing has been excellent, and the group are now working to reduce invasive grasses in the wetland.

This group received a grant to get contractor support on site in the past year.

The site is a functioning natural wetland, doing vital work in filtering water coming off the adjacent village and infrastructure. The removal of weeds by volunteers and contractors has an increase of native rushes and sedges, and the improved functioning of this important natural system.

Figure 4.1.15 Pacific Palms volunteers undertaking bush regeneration activities

Smiths Lake

A

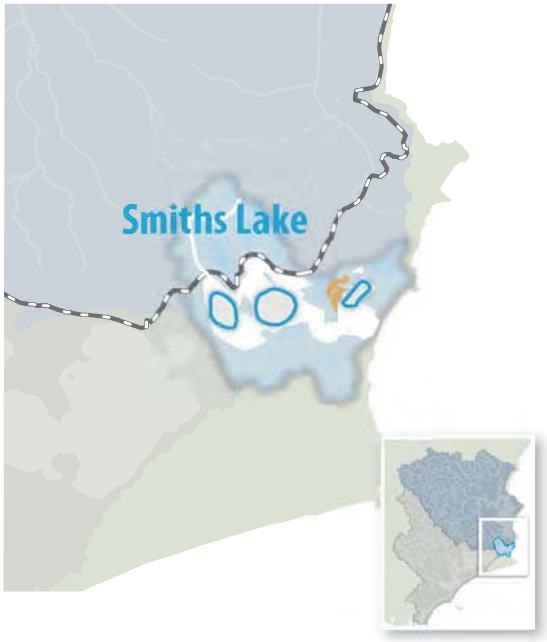
2011

chlorophyll

poor good

turbidity

poor good



Smiths Lake not sampled in 2012

Smiths Lake was not sampled this year due to it's excellent rating last year and the fact that being opened during the summer sampling period makes it difficult to compare this years results with last year. As the lake was opened during this period there is a reduced susceptibility to excessive algal growth.

Smiths Lake is recognised for its high biodiversity values and approximately half of the lake is protected within a Marine Park Sanctuary Zone.

Smiths Lake requires careful catchment management to ensure the number and severity of exceedances of chlorophyll A trigger levels do not increase and lead to a degradation of ecological health.

Figure 4.1.16 Smiths Lake

Estuary description

Smiths Lake has a catchment area of 35.89km^2. It is an intermittently closed and open coastal lagoon and the lake entrance is artificially opened when levels approach 2.1m above sea level to prevent flooding of low-lying areas. The catchment of Smiths Lake has good cover of native vegetation with a significant proportion of the catchment under conservation within the Wallingat and Myall Lakes National Parks. The Smiths Lake township and tourism facilities are situated near the lakes mouth, with impervious surfaces (roofs, roads and footpaths) increasing stormwater runoff into the lake. This stormwater runoff can carry with it pollutants such as sediments and nutrients from houses, lawns, unsealed roads and pets.

Three sites were sampled in 2011 in Smiths Lake, one in Wamwarra Bay West of Big Island, one to the East of Big Island and one in Symes Bay. These samples were combined to give an overall score for the health of the system.

Management actions

Volunteers active in bush regeneration

Smiths Lake foreshore group commenced in 2006 to formalise foreshore accessways and rehabilitate the surrounding vegetation. The group has had up to 20 members, but active members currently number 4 people. The group works weekly to remove woody weeds, such as Lantana and Bitou Bush, but also various scramblers and vines, such as Ground Asparagus and Coastal Morning Glory. The group has also attracted Federal funding to retro-fit the toilet block at John Debert Reserve with water saving cisterns, taps and water tank.

Figure 4.1.17 4 volunteers active in bush regeneration at 1 site

Stream and drainage Stabilisation

Stabilising 289 meters of roadside to reduce erosion and subsequently the amount of sediment reaching the lake.

In the Smiths Lake Catchment significant activity in the area of roadside erosion control has been undertaken over the past year. Amaroo Drive has had significant erosion control works including the rock lining of the roadside drains for approximately 200 meters. At Patsys Flat Road, erosion control has included installing curb and gutter along 109 meters of road.

Figure 4.1.18 289 meters of roadside stabilised reducing the amount of sediment reaching the lake

Protection from development and re-development

Council have focussed on protecting all lakes in the Local Government Area through its application of water quality targets for development and re-development. These targets ensure that there is a neutral or beneficial effect on water quality which means nutrients are not allowed to increase above current levels for new greenfield developments. These targets are documented in a draft Development Control Plan which will apply right across the Wallis, Smiths and Myall Lakes Catchments.

Myall Lakes

Catchment description

The Myall Lakes Catchment covers 440 square kilometres. Its major tributary is the Myall River, whose headwaters extend to Craven Nature Revere and the Kyle Range. The catchment is largely occupied by agricultural land, with forestry and protected vegetation in the steeper areas and a small amount of urban land in the townships of Bulahdelah and the well-known tourist destinations of Tea Gardens-Hawks Nest.

The Myall Lakes and Myall River in particular are part of a large tourism and recreation industry which includes Myall Lakes National Park, one of NSW's most visited National Parks with estimated annual visitor numbers of 250,000.

Major issues for the Myall Lakes system include the impacts of rural runoff on water quality including nutrients, noxious weeds and other pathogens. Urban runoff and the impacts from tourism and recreation uses of the lakes and estuaries are more prevalent in the lower reaches of the catchment.

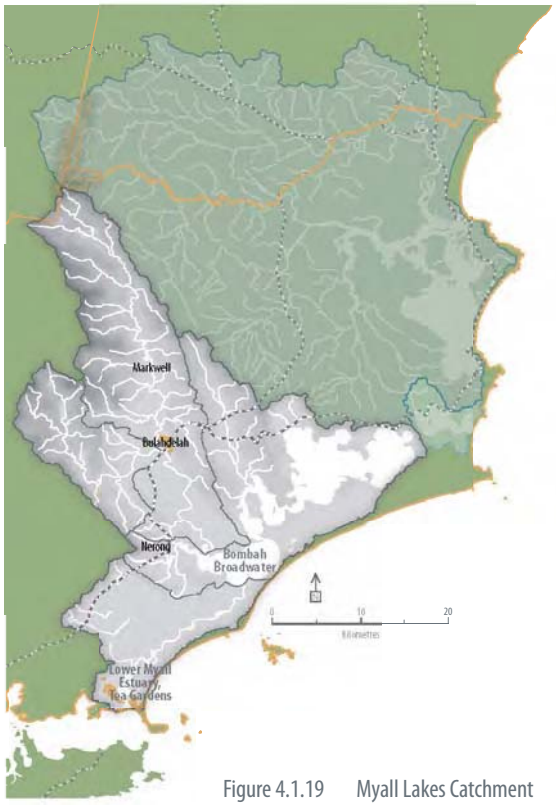


Figure 4.1.19 Myall Lakes Catchment

Management actions

Sustainable Farming Program

The Great Lakes Sustainable Farming Program is a collaborative project between Great Lakes Council and Karuah Great Lakes Landcare. The program aims to facilitate sustainable, productive land use across the Great Lakes catchments. The objective is to involve rural land managers in action learning which involves using localised networking, participatory learning, on-farm trials and demonstrations sites to help empower land managers to develop locally adapted solutions for sustainable agriculture. The underlying goal of the program is 'landholders learning from landholders' as this creates true long term capacity building and community support.

In both 2008 and 2010 the Council-Landcare partnership was successful in securing funding through 'Caring for our Country' to deliver the Sustainable Farming Program in the Wallis and Myall Catchments.

A key element of the Sustainable Farming Program is the establishment of localised Sustainable Farming Groups. Since 2008, two (2) Sustainable Farming Groups have been established in the greater Myall Lake Catchment, once in the Crawford Catchment and in the Myall Catchment. Since 2008 the groups have held a total of 24 meetings to discuss relevant topics such as soil health, farm dam water quality, sub-soil ploughing, electric fencing, and pasture species identification to name a few.

In addition to the these localised Sustainable Farming Groups, the Sustainable Farming Program incorporates a number of professional workshops, practical hands on field days, on-farm trials and demonstration sites. Since 2008, there have been 16 field days and workshops held, 22 on-farm trails established and one (1) Best Practice Farm initiated in the Myall Catchment.

Five (5) field day/workshops and the Best Practice Farm were accomplished in 2011/12.

Figure 4.1.20 26 landholders participating in 2 Sustainable Farming Groups

Protection from development and re-development

Council have focussed on protecting all lakes in the Local Government Area through its application of water quality targets for development and re-development. These targets ensure that there is a neutral or beneficial effect on water quality which means nutrients are not allowed to increase above current levels . These targets are documented in a draft Development Control Plan which will apply right across the Wallis, Smiths and Myall Lakes Catchments.

Key Catchment Management Statistics

- Erosion control on 18ha of land
- 396ha of wetlands protected and enhanced
- 10km of stream bank protected
- 203ha of native vegetation protected and enhanced
- 138 ha of infested water treated for aquatic weeds

Bombah Broadwater

D 2012

B 2011

B 2009

chlorophyll

turbidity

Algal growth still a problem in Bombah Broadwater

Excessive algal growth in Bombah Broadwater, as a consequence of nutrient inputs from the upper Myall River catchment, has been a concern in Bombah Broadwater for at least a decade. High levels of algae threaten the conservation values of the Broadwater and adjoining Myall River.

There was a marked decline in ecological health of the Broadwater in 2012, primarily as a consequence of the increased rainfall bringing excessive nutrients into the lake. The rainwater also reduced the salinity of the Broadwater to a level where the freshwater blue-green algae were able to bloom. Blue-green algal blooms resulted in a red alert for water users and an amber alert that has persisted through-out winter until the time of printing this report.

As a consequence of the bloom, every chlorophyll sample was greater than the desired level and exceedances were generally quite large. The presence of the algal bloom, combined with turbid water from the rivers, meant that 75% of turbidity samples were also greater than desired levels and exceedances were often quite large. This represents a considerable decline in ecological health from recent years.

The continuing high level of algal growth indicates that more needs to be done to control nutrient levels entering the Broadwater and the short-term target is to reduce the frequency and severity of these extended blooms.

Estuary description

The Bombah Broadwater is one part of the Myall Lakes system which is comprised of four linearly connected brackish to freshwater basins: Myall Lake, Two Mile Lake, Boolambayte Lake and the Bombah Broadwater. The Myall Lakes National Park surrounds the lakes and is listed as a Ramsar wetland of international importance.

While the Bombah Broadwater itself is surrounded by National Park, it receives the majority of its inflow from the Upper Myall River and Crawford River catchments which together drain an area of approximately 440km^2. These catchments are largely occupied by agricultural land with forestry and protected vegetation in the steeper areas and a small amount of urban land in the township of Bulahdelah.

Three samples were taken from the Bombah Broad water and were combined to give an overall score for the health of the system.

Figure 4.1.21 Bombah Broadwater

Management Actions

Erosion Control

Between 2008 and present the NSW National Parks and Wildlife Service have undertaken a program of track rationalisation and rehabilitation to reduce erosion and sediment reaching the Myall Lakes. In total, 74km of trails and roads have been treated with 39km closed and rehabilitated and the remaining 35km have been improved with erosion and sediment controls.

Sites for rehabilitation were identified based on the steepness, level of erosion and their location in the catchment. To rehabilitate the roads trails were re-shaped to match the contour of the land, where possible the natural drainage was reinstated and erosion and sediment controls were put in place to reduce sediment transport. Staff were trained in best practice erosion and sediment control to assist with future management of gravel roads.

In the areas where the roads were closed, signs, gates and bollards were constructed, trees were left across the track and the surface of the land was roughened to promote vegetation growth. These areas have begun to re-vegetate naturally.

Outside of the National Park, erosion hot spots on gravel roads in the Catchment have begun to be addressed. On Old Inn Road a concrete causeway was constructed across the Wild Cattle Creek along with sealing of the road on the approaches to the creek combined with geofabric and rock lining of the table drain significantly reducing sediment loads and turbity to the creek.

Protection from development and re-development

Council have focussed on protecting all lakes in the Local Government Area through its application of water quality targets for development and re-development. These targets ensure that there is a neutral or beneficial effect on water quality which means nutrients are not allowed to increase above current levels. These targets are documented in a draft Development Control Plan which will apply right across the Wallis, Smiths and Myall Lakes Catchments.

Protection and rehabilitation of key habitats

The Water Quality Improvement Plan recognised the critical role that wetland protection and restoration plays in the maintenance and improvement of water quality and aquatic health. Functional floodplain wetlands are particularly important in the stripping of nutrients and sediments from catchment run-off prior to entering receiving waterbodies. Given that algae concentrations remain an issue in the Myall Lakes system, it is important that Myall River Floodplain wetland systems are appropriately protected and managed. Consequently, in 2011, Council with the support of the Hunter/ Central Rivers Catchment Management Authority acquired a 366-hectare wetland system on the Bulahdelah Plain of the Myall River Floodplain. This wetland was in good ecological condition, but, whilst ever privately-owned, remained at risk from a change or intensification of production land use. The public acquisition of this wetland system will ensure that the important ecosystem services functions are protected and enhanced through conservation land management and restoration. The wetland also contains significant biodiversity values including populations of at least two threatened plants and stands of three endangered ecological communities. The biodiversity outcomes are ancillary and in addition to the preservation of the wetland for the ecosystem services provisions that it provides.

Figure 4.1.22 Acquiring 376ha of wetlands in the Bulahdelah area to protect water quality and biodiversity.

Myall Lake

B

2012

chlorophyll

turbidity

Algal growth a minor problem in Myall Lake this year

Myall Lake was identified in the Water Quality Improvement Plan as having very high environmental values primarily due to its extensive macrophyte beds and listing as an internationally significant wetland under the Ramsar convention. Good water quality, particularly clear water, were identified as being important in protecting this unique ecosystem.

The water quality results for Myall lake were good overall. The clarity was excellent with no exceedences of turbidity trigger values for any samples in 2011. The waters are very clear, allowing plenty of light to reach the macrophytes on the lake floor.

Greater than desired growth of algae occurred in all samples, but the levels were only just above the trigger levels. Previous studies have shown that in periods of high river flow, water moves from the Broadwater to Myall Lakes, carrying with it nutrients and algae. This phenomenon, along with nutrients in run-off from its local catchment are believed to have led to greater than desired levels of algae this year.

The higher than desired level of algal growth in Myall lake emphasises the on-going need to control nutrient levels entering the Myall lakes system via the upper Myall River.

Estuary description

Myall Lake along with the Bombah Broadwater is part of the Myall Lakes system which is comprised of four linearly connected brackish to freshwater basins: Myall Lake, Two Mile Lake, Boolambayte Lake and the Bombah Broadwater.

The Myall Lakes National Park surrounds the lakes and is listed as a Ramsar wetland of international importance.

Myall lake is directly influenced by a small fringing catchment which is contained within the Myall Lakes National Park. During times of high rainfall however, water from the Broadwater (and therefore the Upper Myall River and Crawford River catchments) influences Myall Lake carrying with it nutrients and algae.

At each time samples were taken from two sites in Myall Lake and were combined to give an overall score for the health of the system.

Management Actions

Protection and rehabilitation of key habitats

Council is a strategic partner in a project to establish connected habitat corridors and preserve and restore native vegetation over degraded farmland at Durness Station, Tea Gardens. The Durness – Borland Landcare Corridor project involves the establishment of corridors of native vegetation linking the northern foreshores of Port Stephens with habitats in Nerong State Forest and Myall Lakes National Park. The corridors protect 20ha of existing native vegetation and revegetate 70ha of currently cleared land with over 55,000 native plants. The project is associated with the establishment of stock exclusion fencing and riparian restoration on the trunk and tributaries of Kore Kore Creek as well as the remediation of active gully and sheet erosion sites. This is expected to deliver significant water quality benefits to Kore Kore Creek and the lower Port Stephens estuary. The project is being delivered as part of a major re-development of the agricultural production system on Durness to ensure greater sustainability including the establishment of a rotational grazing system and farm-scale off-stream watering network. The project site will be utilised for education and awareness activities. The Durness – Borland Landcare Corridor is being delivered by Landcare Australia and the landowner (Nepean Group) with funding provided by a bequest from the estate of the Late Raymond Borland. As a further contribution to this project, Council has acquired and conserved 120ha of land to protect water quality and biodiversity in the Kore Kore Creek catchment. This land is a core conservation node and protects a landscape important for water quality protection. Beneficial, low-intensity uses, shall be developed in the Kore Kore Creek Bushland Reserve, including walking trails and signage to encourage stewardship and awareness.

Figure 4.1.23 74km roads and trails closed or rehabilitated to reduce erosion and sedimentation in the Myall Lakes National Park

Figure 4.1.24 Creating a major wildlife corridor at Durness protecting 90-ha of land and revegetating 70-ha with 50,000 native plants

Protection and rehabilitation of key habitats (Lower Myall)

Council is a strategic partner in a project to establish connected habitat corridors and preserve and restore native vegetation over degraded farmland at Durness Station, Tea Gardens. The Durness – Borland Landcare Corridor project involves the establishment of corridors of native vegetation linking the northern foreshores of Port Stephens with habitats in Nerong State Forest and Myall Lakes National Park. The corridors protect 20ha of existing native vegetation and revegetate 70ha of currently cleared land with over 55,000 native plants. The project is associated with the establishment of stock exclusion fencing and riparian restoration on the trunk and tributaries of Kore Kore Creek as well as the remediation of active gully and sheet erosion sites. This is expected to deliver significant water quality benefits to Kore Kore Creek and the lower Port Stephens estuary.

The project is being delivered as part of a major re-development of the agricultural production system on Durness to ensure greater sustainability including the establishment of a rotational grazing system and farm-scale off-stream watering network. The project site will be utilised for education and awareness activities. The Durness – Borland Landcare Corridor is being delivered by Landcare Australia and the landowner (Nepean Group) with funding provided by a bequest from the estate of the Late Raymond Borland. As a further contribution to this project, Council has acquired and conserved 120ha of land to protect water quality and biodiversity in the Kore Kore Creek catchment.

This land is a core conservation node and protects a landscape important for water quality protection. Beneficial, low-intensity uses, shall be developed in the Kore Kore Creek Bushland Reserve, including walking trails and signage to encourage stewardship and awareness.

Figure 4.1.25 Durness landscape looking towards the corridor

Karuah Estuary

C

2012

A

2007

chlorophyll

poor good

turbidity

poor good

Karuah River only fair due to high turbidity

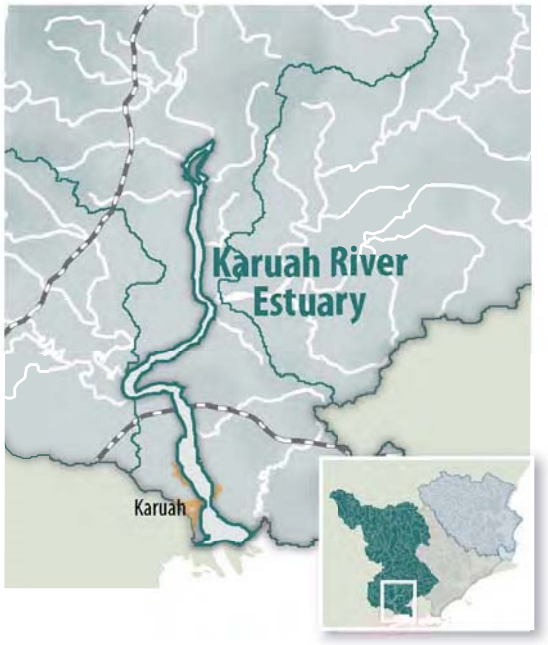
The Karuah River estuary receives runoff from a combination of forested and agricultural sub-catchments. The water was very murky, but with low to moderate algal levels.

The turbidity exceeded the trigger value in over 71% of samples. High turbidity arises from suspended fine sediment that is washed from areas of exposed earth, such as cleared land, unsealed roads and eroding or collapsing stream banks, during rain.

Chlorophyll a concentrations exceeded trigger values in 22% of samples. Unhealthy growth of algae is stimulated by nutrients washed from agricultural land, or from stock directly accessing waterways. If this continues, algae may reach concentrations which are detrimental to fish and humans.

Based on the percentage exceedences, the Karuah River received a score of F for turbidity, B for chlorophyll a concentrations and an overall score of C.

These chlorophyll a scores were a slight improvement on previous years, but the turbidity score remains very poor (see table below). The improvement in the chlorophyll a score may be a result of increased river flow leading to more of the algae being flushed out of the river before it could grow.



Estuary description

The Karuah River estuary discharges into the northwestern part of Port Stephens, and is the only significant source of sediment to this system.

There are substantial areas of mangrove and saltmarsh habitats in the Karuah River estuary, which provide food sources and nursery areas to fish.

The catchment is approximately 1,500 km2 and is comprised largely of forested and grazing land. Karuah and Stroud are the only substantial towns in the catchment. Sewage treatment plants in both towns now reuse treated effluent for irrigation, minimising discharges to the river.

Water quality sampling was carried out at sites between Karuah and Allworth. Samples were collected roughly monthly from November 2011 to May 2012.

Figure 4.1.26 Karuah River Estuary

Management Actions

Funding has been received to develop a catchment plan for the Karuah River Estuary and its Catchment. The catchment plan will be developed to guide future investment in the catchment.

Figure 4.1.27 Alligator weed removal in the Karuah

Results

A number of agencies and organisations have conducted water quality monitoring in this LGA during the reporting period. However this data is not currently available in a useable and manageable format. Subsequently such information will not be reported in SoE Reports until a coordinated approach to water quality monitoring is established and a means for data sharing and reporting has been developed. An overview of some of the monitoring programs conducted by agencies across the LGA has been presented below.

Figure 4.1.28 Lower Wallamba River

Table 14.1.5 Water quality monitoring programs conducted in the Great Lakes LGA

Great Lakes Council			
Program/Sites	Parameters	Monitoring frequency	Purpose (aims and objectives)
• Waterwatch – 12 Sites • Billabong, 180 Violet Hill Rd, Boolambayte • Ferny Creek, back paddock at "Narvik Pastoral", Wooton • Forster Keys #1 - Rear of 12 King George Pde • Forster Keys #3 - Entrance to Dolphin Passage (tip of western shoreline) • Forster Keys #4 - Tip of Harbour Shores Jetty, 14/7 Kenrose Street • Khoribakh Creek, "Tanundale", Krambach • Myall Lakes, Hearts Point campground, Neranie • Penenton Creek #3, Forster (Strand St –Townsend Wetland, upstream) • Penenton Creek #4, Forster (Strand St – • Townsend Wetland, downstream) • Pipers Creek, Elizabeth Reserve boatramp at end of Guy Ave, Forster Keys • Smiths Lake, John Debert Reserve below toilet block, Amaroo Drive • Wallamba River, near boat ramp at "River Side Park" Bradfords, Nabiac	Temperature, total dissolved oxygen, total dissolved solids, turbidity, pH	Testing is undertaken as often as volunteers are able to do so, (usually monthly)	Community education through on-ground action to provide a general indication of the quality of waterways within the Great Lakes

MidCoast Water			
Program/Sites	Parameters	Monitoring frequency	Purpose (aims and objectives)
13 Sites in Wallis Lake	FC, Temp, Density	Dependant on Oyster Growing Season average 30 runs/ year	Oyster quality assurance/ environment

Stormwater Monitoring Program • 9 sites in Tuncurry, 31 Sites in Forster, 1 site in Green Point	FC Temp	Bi-Monthly	Oyster quality assurance/ environmental
Frys Creek Environmental Monitoring Program • 2 sites Frys Creek Bulahdelah, 2 sites Myall River above Bulahdelah	DO, Salinity, Temp, pH, FC, Enterococci, BOD, Total P, Dissolved reactive Phosphorous, Nitrate, Nitrite, TKN, Ammonia, Total N, Oxidised Nitrogen, Suspended Solids, Chlorophyll a, Turbidity, Oil and Grease, Conductivity	Quarterly	Sewerage treatment plant licensing agreement/ environmental
Karuah River Stroud 2 sites 1 site Wallamba River at Clarksons Crossing 1 site Wang Wauk River at Pacific Highway 1 site Coolongolook River at Locketts Crossing	DO, Salinity, temp, pH, FC, Total P, Dissolved Reactive P, TKN, Ammonia, Total N, Oxidised N, Suspended Solids, Chlorophyll a, Turbidity, Conductivity	Quarterly	Environmental

NSW Shellfish Quality Assurance Program

Program/Sites	Parameters	Monitoring frequency	Purpose (aims and objectives)
• 23 water sampling sites • 10 oyster meat sample sites	• Algae & faecal coliforms from water sample • E. Coli samples of oyster meat	Fortnightly and following rainfall events	Oyster quality assurance for human health

Office of Environment and Heritage

Program/Sites	Parameters	Monitoring frequency	Purpose (aims and objectives)
2 zones in Wallis Lake, 1 in Pipers integrated sample zone	Chlorophyll - a, Turbidity	September - Jan, 5 times, 2 weekly intervals	MER Strategy

Community Water Quality Monitoring- Waterwatch

Great Lakes Council and the Catchment Management Authority facilitate a number of volunteer community and school groups who monitor water quality in local waterways using the Waterwatch techniques (Go to ww.waterwatch.org.au for more info).

A summary for each Waterwatch testing site that is tested regularly (i.e. every couple of months or more) is provided below. Some indication of water quality in these areas is given by outlining how often the tests show typical or desired levels of water quality and how often the tests show the site to be out of healthy range for that indicator. For example healthy waterways have a pH or acidity level of between 6 and 8 units. If a test showed the pH to be 9 this would be out of the healthy range.

Site	No. of tests	% time Dissolved oxygen fair or good	% time pH fair or good	% time turbidity fair or good
Ferny Creek,back paddock at "Narvik Pastoral", Wooton	2	0	50	100
Myall Lakes, Hearts Point campground, Neranie	2	n/a	100	100

Current response and future directions

Council recognises the enormous environmental, economic and social value that good water quality has for our local area. Thus, a number of important projects have been developed and are being implemented to help protect and improve water quality in the Great Lakes. These projects and initiatives include:

- Water Quality Improvement Plan - Wallis, Smiths and Myall Lakes
- The Healthy Lakes Program (a community education program helping business, residents and tourists reduce their impact on stormwater and water quality)
- Constructed Wetlands and Gross Pollutant Traps (to reduce stormwater pollution)
- Installation of WSUD devices - biofiltration systems
- DA Assessment and Strategic Planning (to reduce the impact of development on water quality)
- Darawakh and Frogalla Wetland Management plan and associated actions to reduce the effects of Acid Sulfate Soils
- Wallis Lake Catchment Management Plan and Wallis Lake Estuary Management Plan
- Smiths Lake Estuary Management Plan
- Port Stephens/ Myall Lakes Estuary Management Plan

Figure 14.1.1 Landholders participating in a 'Weed control without herbicides workshop'

Figure 14.1.2 Identified needs for action regarding water quality

Identified Need for Action	Recommended key projects or actions for consideration in next year's Management Plan	Relevant Council section	Are there existing resources for action	Commence by/timeframe
Continue to implement and expand programs aimed at improving water quality e.g. Water Quality Improvement Plan, Wallis Lake Catchment Management, Healthy Lakes Program, Water Quality Partnership etc.	• Water Quality Improvement Plan (implementation) • Wallis Lake Catchment Management (progress implementation), • Healthy Lakes Program (continue and expand initiatives)	Natural Systems	Y	Ongoing
Review Stormwater Management Plans	• Improved Stormwater Management (review and update plans)	Natural Systems	Partial	Immediate
Continue to implement a water quality monitoring program across the LGA	• Implement water quality monitoring as detailed in the Water Quality Improvement Plan • Ecological Health Assessment	Natural Systems	Partial	Ongoing
Review existing monitoring programs	• Implement water quality monitoring as detailed in the Water Quality Improvement Plan • Align water quality monitoring sites and time with the NSW Shellfish Quality Assurance Program	Natural Systems	Partial	Within 2 years

4.2 Water Usage

Introduction

Water usage and supply has become a contentious issue throughout Australia in light of global climate change, recurring and worsening drought situations and the increasing demand for domestic, agricultural and industrial water. To meet the ongoing future water requirements of residents, industry, agriculture and the environment it is essential that this natural resource be managed sustainably and appropriately. Water conservation is both a human resource issue, but also an environmental issue, as adequate flows in streams, floodplains and wetlands is critical for general environmental health.

Potentially the over-exploitation of water resources can have a significant effect on the local environment, depriving rivers, lakes and estuaries of natural water flows essential to their function and inherent quality. As such, monitoring water usage provides an indication of the pressure on the local environment. Within the Great Lakes, this information is available from the local water authority, MidCoast Water, who is responsible for managing water resources and infrastructure throughout the wider region.

The Great Lakes relies on a number of different water sources. The major towns, including Forster/ Tuncurry, Nabiac and Pacific Palms, receive water from Bootawa Dam (off-river storage of the Manning River), which is located in the Greater Taree City Council LGA. Hawks Nest/Tea Gardens draws its water supply from bore fields to the north of Tea Gardens on the Myall Lakes/ Viney Creek sand beds. The Stroud water supply is drawn from the Karuah River and Bulahdelah draws its water from the Crawford River. To secure future water supplies and meet predicted demand, the Nabiac borefield is under construction with all bores in place to supplement the Bootawa Dam supply from the Minimbah aquifer. The construction of the water treatment plant and the connection to the water supply is yet to start.

Monitoring

For this indicator, the total volume of water used and a breakdown of usage for residential, commercial, industrial, institutional and public use purposes provide information on the pressure placed on the local environment and attributes water demand to different sectors. This data is accessible from the local water authority, MidCoast Water, as water meters record the information for all properties connected to reticulated water systems.

Results

For the reporting period a total of 17,450 properties were connected to the water supply system within the Great Lakes area with 91 new connections during this period. The total volume of water consumed during this period was 3402 million litres, which is lower than the previous 2 reporting periods. A breakdown of water consumed by each sector of the community has been provided in Table 4.2.2.

Table 4.2.1 Number of existing and new water connections

	2009-10	2010-11	2011/12
Total number of properties connected to water supply system:	17246	17359	17450
New connections	100	113	91

Source: MidCoast Water

Table 4.2.2 Volume of water consumed by each community sector

Consumption category	Volume million litres (ML)	Volume million litres (ML)	Volume million litres (ML)
Residential	2344	2368	2354
Commercial	664	695	684
Industrial	288	267	261
Institutional	65	62	61
Public Use	51	39	42
Total	3412	3431	3402

Source: MidCoast Water

As mentioned above there has been wide promotion of the Water Wise program (including Whizzy the Water Drop), rebate programs and price incentives. Additionally, all new houses need to comply with the BASIX system to incorporate water sensitive design.

Whizzy the Water Drop helps to spread the word on water conservation

Current response and future direction

MidCoast Water is the responsible agency for ensuring effective and sustainable water use. Currently, MidCoast Water (MCW) is undertaking a number of projects to secure the provision of future water supply of the Great Lakes LGA. Updates against these projects are provided on the following table.

Nabiac Borefield Ecological Survey Groundwater Dependant Ecosystems

MidCoast Water is working towards a diversified water supply, by developing a borefield supply to supplement the Manning Water Supply Scheme (the supply for 90% of MidCoast Water customers). This will help protect environmental flows in the Manning River, but can be expected to have an environmental impact on the Nabiac Aquifer. MidCoast Water's ecological study into the effects of groundwater extraction on dependant ecosystems is ongoing, and is designed to allow for future management to minimise the impacts of water extraction.

Recycling Scheme Developments

MidCoast Water has a number of planned effluent reuse schemes currently in the detail design phase. There are planned recycling schemes which will see the use of highly treated effluent for irrigation of golf courses and some public grounds. Schemes are planned for Forster, Tuncurry, Bulahdelah and Hawks Nest. These reuse schemes will reduce the amount of treated effluent released into waterways, and will reduce demand on potable water supplies. The schemes are planned for completion in 2012-13.

WaterWise Rebate Scheme

MidCoast Water's rebate scheme is in its third year. Customers of MidCoast Water are able to access up to $1500 in a cash rebate scheme to help make their homes water smart. The Rebate Program allows customers in homes built before BASIX to access some assistance to refit things such as water efficient household appliances and rainwater tanks.

The program provides incentives to install water efficient appliances, which will have an effect in reducing overall water consumption, and therefore reduce the amount of water MidCoast extracts from and returns to the environment.

Water efficient devices covered by the program include water efficient showerheads, dual flush toilets, dishwashers and washing machines. Connecting a rainwater tank for use in the garden, toilet or laundry (or all three) also attracts a rebate under the system.

In 2011/12 MidCoast Water recieved 2367 applicants for the waterwise rebate scheme.

Smart Meter Program

A pilot program is underway to introduce electronic "smart meters" to residential properties in the area. The smart meters record when and where water is used in a home, providing information to householders which can be used to help identify ways for MidCoast water customers to reduce their overall water consumption, thereby reducing the need for MidCoast Water to extract water from the environment. The project was extended to include commercial customers.

Source: MidCoast Water

4.3 Fish Kills

Introduction

The term "fish kill" applies to the localised and specific death of a number of fish or associated marine or aquatic species, such as prawns and crabs. Fish kills may occur in marine, estuarine and inland waters and usually take place in a defined area over a defined period of time. Fish kills are typically (but not always) a result of human activities and especially actions that lead to declining environmental conditions such as low dissolved oxygen levels, pH stress, changes in water temperature and toxic pollution. False fish kills may result from throwbacks of dead fish from commercial fishing vessels.

Although currently not a common event within the Great Lakes, there is the potential for fish kill events to become more prevalent as development impacts increase. Unless these impacts are managed appropriately the regions fish stocks may be seriously depleted. Fish kills tend to be indiscriminate and can remove whole populations or specific recruitment/ breeding classes.

Monitoring

Council's Environmental Health section maintains records on fish kill events within the LGA. When a fish kill occurs, Council Officers or appropriate agency staff (NSW Department of Primary Industries - Fisheries) conduct an investigation and record detail of the location, extent, species affected and possible cause(s). Council also completes an investigation report, which is forwarded to the NSW DPI (Fisheries). Hence, there is often relatively detailed information on the number and extent of fish kills, including the number of individuals, affected species, location and extent. The NSW DPI (Fisheries) office located at Huskisson also maintains records, which are sourced for the purpose of SoE reporting.

Table 4.3.1 Number of fish kill events

Year	No. of fish kill events
2009/10	Nil Reported
2010/11	1
2011/12	Nil Reported

Source: Great Lakes Council & NSW DPI (Fisheries)

Summary

One fish kill incident was recorded by NSW DPI (Fisheries) in the previous 3 reporting periods. The kill occurred on the Wallamba River on the 14th of February 2011 and it was estimated that between 100 and 1000 fish had been killed.

4.4 Stormwater Pollution

Response and future directions

Education has been identified as an essential tool in reducing the quantity of stormwater pollution. Subsequently, Council has developed an education and awareness program to target stormwater pollution. Developed in 2001, the Healthy Lakes Program has been successful in raising awareness and educating the local community on a number of water quality issues. However, education needs to be ongoing in order to be effective. It also needs to lead to actual behavioural change and positive actions.

The tenets of the Healthy Lakes program have continued to be addressed through more recent programs such as the Environmental Trust funded Urban Sustainability project and Steps towards Sustainable Tourism projects.

It is also recommended that regular cleaning of GPT's should occur across the LGA.

Table 4.4.2 Identified needs for action regarding stormwater pollution

Identified Need for Action	Recommended key projects or actions for consideration in next year's Management Plan	Relevant Council section	Are there existing resources for action	Commence by/timeframe
Develop pollutant trap and litter basket cleaning, monitoring, performance assessment and reporting procedures	• Improve performance and management of stormwater treatment devices • Review and Improve cleanout reporting procedures	Natural Systems, Engineering Services	Y	Within 2yrs
Develop a constructed wetland cleaning and reporting procedure and allocate funding to improving the efficiency of one constructed wetland each year	• Improve performance and management of stormwater treatment devices	Natural Systems, Engineering Services	Y	Immediate
Expansion of Healthy Lakes Program into appropriate partnering programs in order to continue meeting targets.	• Implement Sustainable business program including steps to sustainable tourism.	Natural Systems	Y	Ongoing

4.5 Fish Passage Barriers

Introduction

A fish passage barrier is an obstacle that prevents fish from moving either upstream or downstream and can include structures such as dams, weirs, floodgates, roads, bridges, causeways and culverts. The natural behaviour of most native fish species requires the ability to move at least some distance and when restricted by the presence of a barrier these migrations are restricted or curtailed. Barriers can have the following effect on native fish species:

- restrict migration of fish for spawning;
- reduce dispersal of juvenile fish;
- create isolated populations and reduce gene flow between fish populations;
- limit passage of fish between feeding grounds;
- cause fish to congregate at a barrier leaving them open to over-fishing, disease or predators;
- create unsuitable living or breeding conditions (leading to fish kills);
- cause the extinction of upstream or downstream migrating species; and
- Alter species diversity because of the local disappearance of some species and changes to the abundance of remaining species.

There is increasing knowledge on the means to modify existing barriers to reduce their impact. For example, modifications of openings, crest levels and the installation of Fish ways/ ladders have been utilised successfully. Fishways can provide essential passage through or around barriers, reduce the energy of water flow and decrease stress to fish. Fishways can range from simple rockramps on small weirs to powerful lifts and locks on large dams. NSW DPI (Fisheries) can provide information on options for building fishways. Further, some structures that act as barriers are no longer operational or are obsolete. Depending on associated environmental issues, barriers such structures should be removed.

Monitoring

Under the *Fisheries Management Act 1994*, proposals that obstruct the free passage of fish; or require construction or modification of a dam, weir or floodgate; must be referred to the NSW Department of Primary Industries (Fisheries) for comment to determine whether a fishway is required. Further, NSW DPI (Fisheries) Port Stephens Research Centre maintains a record on the number, type, location and extent of some of the fish passage barriers within the LGA. However, this database is not comprehensive. There is no detailed catalogue of the type, nature, location and significance of fish barriers throughout the Great Lakes LGA. Recently, Industry and Investment NSW has produced a report to the NSW Environmental Trust titled "Reducing the impact of road crossings on aquatic habitat in coastal waterways- Hunter/Central Rivers, NSW". In this report a number of additional causeway barriers have been identified in our LGA and these have been included in the results for this indicator.

Figure 4.5.1Remediated Lockett's Crossing fishway. Source: Hunter Central Rivers CMA

Results

20 fish passage barriers have been identified to date within the Great Lakes LGA. These are listed below.

Table 4.5.1 Fish passage barriers

Location	Structure Name	Type of Structure
Bundacree Creek	Farm Dam	By/Wash Dam
Bundageree Creek	Unnamed dam (Nabiac)	Fixed crest dam/weir
Bangalow Creek	Bangalow Road	Causeway
Cromarty Creek	Private Road off Lemon Grove Road	Causeway
Booral Creek	Conger Road	Causeway
Booral Creek	Blue Gum Road	Causeway
Karuah River	Cherry Tree Road	Causeway
Telegherry River	Moores Creek Road	Causeway
Sugarloaf Creek	Private road off unnamed road off The Bucketts Way	Causeway
Mammy Johnson River	Tereel Road	Causeway
Telegherry River	Middle Road	Causeway
Curreeki Creek	Private Road off Curreeki Road	Causeway
Curreeki Creek	Private Road off Curreeki Road	Causeway
Curreeki Creek	Curreeki Creek Road	Causeway
Curreeki Creek	Curreeki Creek Road	Causeway
Curreeki Creek	Curreeki Creek Road	Causeway
Curreeki Creek	Curreeki Creek Road	Causeway
Wang Wauk River	Smedleys Cutting Road	Causeway
Lawless Creek	Cherry Tree Road	Ford
Penenton Creek	Macintosh St Forster	Floodgate

Source: NSW DPI (Fisheries), GLC

No fish passage barriers were remediated in the last reporting period. A total of three (3) fish passage barriers have been remediated since 2009/10 with two (2) farm dams on the Wallamba River and Koribakh Creek, and the Lockett's Crossing Road causeway on the Coolongolook River.

The fish passage barriers identified in Table 4.5.1 are unlikely to be the only structures of this nature within the Great Lakes LGA. There are likely to be other barriers to fish passage, particularly located on private land.

Summary and response

Over time it is hoped that progress on removing fish passage obstructions can be achieved in a prioritised and strategic manner. The work currently being done by Fisheries /Industry and Investment NSW will greatly assist in this undertaking as resources for this area is very limited.

The significant barriers identified in Table 4.5.1 will continue to impact natural processes unless they are redesigned to allow for fish passage and the restoration of natural flows. Environmentally it would be ideal to remove all barriers however this poses a number of social and economic concerns as some of these

barriers facilitate access, irrigation weir pools or domestic water supply. As such, the environmental, economic and social cost of management actions needs to be inherently considered.

Table 4.5.2 Identified needs for action regarding fish passage barriers

Identified Need for Action	Recommended key projects or actions for consideration in next year's Management Plan	Relevant Council section	Are there existing resources for action	Commence by/timeframe
Extensive ground truthing to comprehensively identify fish passage barriers with in the Great Lakes LGA	Work with other agencies to remediate Fish Passage Barriers	Natural Systems	Y	Within 2yrs