Coastal Zone Management Plan for Brisbane Water Estuary

Prepared for Gosford City Council*

July 2012

LJ2717/R2683/V7

Cardno (NSW/ACT) Pty Ltd
ABN 95 001 145 035
Level 9, 203 Pacific Highway
St Leonards NSW 2065
Australia
Telephone: 02 9496 7700
Facsimile: 02 9439 5170
International: +61 2 9496 7700
sydney@cardno.com.au
www.cardno.com.au

Report No:_____

Document Control

Version	Status	Date	Author		Reviewer	
0	Draft ToC	November 2010	Tanja Mackenzie	TJM	David van Senden	DVS
1	Preliminary Draft	December 2010	Tanja Mackenzie & Jacqui Druce	TJM JGD	Louise Collier	LCC
2	Draft for Public Exhibition	April 2011	Tanja Mackenzie & Daniel Strickland	TJM DS	David van Senden	DVS
3	Final	September 2011	Tanja Mackenzie	TJM	Louise Collier	LCC
4	Revised Draft for Public Exhibition	December 2011	Jacqui Druce	JGD	Tanja Mackenzie	TJM
5	Final Draft	March 2012	Tanja Mackenzie & Jacqui Druce	TJM JGD	Louise Collier	LCC
6	Final Draft	April 2012	Caroline Bathje	CMB	Tanja Mackenzie	TJM
7	Final	July 2012	Christina Chiu	CC	Tanja Mackenzie	TJM

*Gosford City Council has prepared this document with financial assistance from the NSW Government through the NSW Office and Environment and Heritage. This document does not necessarily represent the opinions of the NSW Office and Environment and Heritage.

Executive Summary

The *Coastal Zone Management Plan for Brisbane Water Estuary* (referred to throughout this document as 'the Plan') has been prepared by Cardno for Gosford City Council (GCC) and the NSW Office of Environment and Heritage (OEH). The Plan has been prepared under the NSW Coastal Management Process and in accordance with the NSW Rivers and Estuaries Policy (see **Section 1.2**). It aims to deliver actions that achieve the management objectives for the Brisbane Water Estuary as identified through the preparation of the *Brisbane Water Estuary Management Study* (Cardno, 2010).

The objective of this Coastal Zone Management Plan is to promote estuary management for coastal ecosystem health and community uses of the coastal zone, as opposed to private benefit or for development purposes.

The Plan was adopted by Council at its Ordinary Meeting on 3 July 2012.

This Plan supersedes the *Brisbane Water Plan of Management* (GCC, 1995).

Area to which the Plan Applies

The area to which this Plan applies includes the tidal waterway, foreshore and adjacent land of Brisbane Water, including the entrance area and tidal tributaries covering the whole region of Brisbane Water from the channel connecting the estuary to Broken Bay at the eastern end of Ocean Beach in the south; to Gosford in the north, and associated tributaries and catchments (**Figure 1.1**).

Context for the Plan

In accordance with the *Guidelines for Preparing Coastal Zone Management Plans* (DECCW, 2010b), the purpose of the CZMP is to manage and monitor ecosystem health and sustainable human usage of the estuary. It is therefore concerned with regularly occurring, day to day or seasonal processes that impact on ecosystem function. It is focussed on the existing scenario, but provides some consideration of the potential implications of future sea level rise.

Council is preparing a separate report, the *Brisbane Water Floodplain Risk Management Study* and the associated *Floodplain Risk Management Plan* (also referred to as the *Brisbane Water Foreshore Coastal Floodplain Risk Inundation Management Study and Plan*) in accordance with the *Floodplain Development Manual* (NSW Government, 2005). This process focuses on the risk to life and property from coastal inundation, and hence it has a very different intent to the ecological focus of this CZMP. It seeks to manage flood events that occur irregularly, such as the 100 year ARI flood. It also seeks primarily to address the risk from flooding in the existing scenario, but also considers the potential implications of sea level rise for future risk.

Stakeholder and Community Consultation

The key consultation activities in relation to the development of this Plan have been undertaken during the preparation of the *Estuary Management Study* (Cardno, 2010). The Plan has been informed by these activities and has been founded on the understanding of

the values of the community, gained through a range of consultation forums (including information sessions, completed feedback forms, workshops and the like).

The Plan itself has been subject to review by Council, OEH and Council's Coastal and Estuary Management Committee. The draft Plan has been placed on public exhibition twice (13 June to 29 July 2011 and 12 December 2011 to 27 January 2012), with a public forum held to discuss the Plan during the first exhibition period.

The Plan

The Plan adopts the recommendations of the *Estuary Management Study* (Cardno, 2010). It includes a list of 183 actions for implementation. In recognition of the fact that resources are limited, and that some actions are dependent upon the implementation of other actions, it is recommended that in the first instance the implementation strategy contains the top 73 highest priority management actions.

Appendix B of this Plan is the **Implementation Strategy** and forms the core of the Plan and should be referred to for the details of actions to be implemented.

This Plan should be regarded as a 'living' document requiring review and modification over time. Following adoption of the Plan by Council, it is recommended that the Plan be reviewed in detail once every 5-10 years. The catalysts for change could include legislative change, alterations in the availability of funding, reviews of the Council planning strategies and, importantly, the outcome of the monitoring and evaluation of the Plan. Some actions may not remain relevant in the long term (e.g. due to ecological change or new scientific information) and may need to be reconsidered. In addition, this review process also provides an opportunity to remove those 'one-off' actions that have been implemented since the last review and to update the implementation strategy (**Section 3.3**).

A program of monitoring and evaluation is incorporated in this Plan (**Section 3.4**) that establishes performance indicators and makes recommendations on general monitoring activities. The purpose of the monitoring and evaluation program is to assess the progress of implementation of the Plan against the goals for management, but also to obtain more general information on trends in estuarine condition or 'health'.

Table of Contents

List of Tables

List of Figures

Appendices

Glossary and Abbreviations

Amenity	Those features of an area that foster its use for various purposes.
Animal	Any animal, whether vertebrate or invertebrate, and at whatever stage of development.
Beach Nourishment	The supply of sediment, generally by mechanical means, to supplement sand on an existing beach or to build up an eroded beach.
CAMBA	China Australia Migratory Bird Agreement.
Catchment	The area of land that drains to a common location or watercourse. This always relates to a particular location and may include the catchments of tributary streams as well as the main stream.
CCCEN	Central Coast Community Environment Network.
CCT	Central Coast Tourism
CDS Unit	Continuous Deflective Separation unit, type of gross pollutant trap.
CLAM	Coastal Lake Assessment and Management Tool.
CMA	Hunter-Central Rivers Catchment Management Authority.
CSIRO	Commonwealth Scientific and Industrial Research Organisation.
DCP	Development Control Plan.
DECCW	Former Department of Environment, Climate Change and Water; now incorporated into the Department of Premier and Cabinet as the Office of Environment and Heritage.
Depuration	The process by which shellfish metabolise and/or flush chemicals from their organs.
DLALC	Darkinjung Local Aboriginal Land Council.
DP&I	Department of Planning and Infrastructure; formerly the Department of Planning.
DPI	Department of Primary Industries; formerly Industry and Investment NSW. Divisions include Fisheries and Crown lands.
EEC	Endangered Ecological Community as identified under the TSC Act or the EPBC Act.
EPBC Act	Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999*.
ESD	Ecologically Sustainable Development.
GCC	Gosford City Council.
GPT	Gross Pollutant Trap.
Habitat	The places in which an organism or community lives.
HCCREMS	Hunter Central Coast Regional Environmental Management Strategy.
I&I NSW	Former Industry and Investment NSW; now Department of Primary Industries.
IPCC	Intergovernmental Panel on Climate Change.
JAMBA	Japan Australia Migratory Bird Agreement.
KPIs	Key Performance Indicators.
LALC	Local Aboriginal Land Council.
LGA	Local Government Area.
LPMA	Former Land and Property Management Authority; Crown lands management now falls under the Crown lands Division under the new Department of Primary Industries.
MER	Monitoring, Evaluation and Reporting.
MUSIC	Model for Urban Stormwater Improvement Conceptualisation; a computer program used to model stormwater quality.

NOW	NSW Office of Water under the Department of Premier and Cabinet; formerly under the Department of Environment, Climate Change and Water.
NSW	New South Wales.
OEH	NSW Office of Environment and Heritage under the Department of the Premier and Cabinet; incorporates the former Department of Environment, Climate Change and Water.
QA/QC	Quality Assurance / Quality Control.
Riparian Vegetation	Vegetation growing along banks of rivers.
ROKAMBA	Republic of Korea Australia Migratory Bird Agreement.
RTA	NSW Roads and Traffic Management Authority.
Runoff	That proportion of rainfall that drains off the lands surface.
Seawall	Wall built parallel to the shoreline to limit shoreline recession.
Sedimentation	The act or process of depositing sediment, including by mechanical means, of matter suspended in a liquid.
SEPP	State Environmental Planning Policy.
SEWPAC	Commonwealth Department of Sustainability, Environment, Water, Population and Communities; administers the EPBC Act.
Shoaling	The influence of the seabed on wave behaviour. Such effects only become significant in water depths of 60m or less. Manifested as a reduction in wave speed, a shortening in wavelength and an increase in wave height.
Shoreline Recession	A net long-term landward movement of the shoreline caused by a net loss in the sediment volume.
SWOT	Strengths, weaknesses, opportunities, threats.
TSC Act	*NSW Threatened Species Conservation Act, 1995.*
TSS	Total Suspended Solids.
WSUD	Water Sensitive Urban Design.

1 Introduction

This *Coastal Zone Management Plan for Brisbane Water Estuary* (the Plan) has been prepared by Cardno for Gosford City Council (GCC) and the NSW Office of Environment and Heritage (OEH; formerly the NSW Department of Environment, Climate Change and Water or DECCW).

The Plan has been prepared under the NSW Coastal Management Process and in accordance with the NSW Rivers and Estuaries Policy (see **Section 1.2**). This Plan outlines a range of actions and an implementation strategy aimed at achieving the management objectives identified through the preparation of the *Brisbane Water Estuary Management Study* (Cardno, 2010).

The objective of this Coastal Zone Management Plan is to promote estuary management for coastal ecosystem health and community uses of the coastal zone, as opposed to private benefit or for development purposes.

This Plan supersedes the previous *Brisbane Water Plan of Management* (Gosford City Council, 1995).

1.1 NSW Coastal Management Program

One of the NSW Coastal Policy's strategic directions is the preparation and implementation by local Councils of detailed management plans for estuaries in accordance with the NSW Rivers and Estuaries Policy. Up until 2010, the guidelines for preparing management plans for estuaries were outlined in the *Estuary Management Manual* (NSW Government, 1992). The manual outlined a structured management process leading to the implementation of an Estuary Management Plan. In developing the Plan all values and uses of the estuary are considered. The Plan aims to provide a balanced long-term management framework for the ecologically sustainable use of the estuary and its catchment.

The *Estuary Management Manual* (NSW Government, 1992) recommends an eight step process in order to implement an Estuary Management Plan, as follows:

1. Form an Estuary Management Committee;
2. Assemble existing data (data compilation study);
3. Undertake an Estuary Processes Study;
4. Undertake an Estuary Management Study;
5. Prepare a draft Estuary Management Plan;
6. Review Estuary Management Plan;
7. **Adopt and implement the Estuary Management Plan; and**
8. Monitor and review the management process as necessary.

In compliance with steps 1 to 3, GCC has formed an Estuary Management Committee through their Coastal and Estuary Management Committee and the data compilation study, estuary processes study and management study have been completed (SMEC Australia and Umwelt (Australia), 2002; Cardno, 2008; and Cardno, 2010; respectively). Further detail on the content of the *Brisbane Water Estuary Management Study* (Cardno, 2010) is provided in **Section 1.3.2**.

The draft Coastal Zone Management Plan for Brisbane Water Estuary, which was publicly exhibited from 13 June to 29 July 2011, fulfilled the fifth stage of the estuary management planning process for Brisbane Water estuary. The Final Plan has now been reviewed (Stage 6) based on consideration of the submissions received during the public exhibition period and has been adopted by Council as of 3 July 2012.

Subsequent to the commencement of preparation of this Plan, the NSW Government released new *Guidelines for Preparing Coastal Zone Management Plans* (DECCW, 2010b), which supersede the NSW Government (1992) *Estuary Management Manual*. In accordance with the requirements of the new guidelines, this document has been re-named a Coastal Zone Management Plan for Brisbane Water Estuary. A further requirement of the new guidelines is to identify how the Plan addresses the Coastal Management Principles outlined in the guidelines. This has been addressed in **Table 1.1**.

Table 1.1: Coastal Management Principles (DECCW, 2010)

Coastal Management Principle	Comment
Principle 1 Consider the objects of the *Coastal Protection Act 1979* and the goals, objectives and principles of the *NSW Coastal Policy 1997* and the *NSW Sea Level Rise Policy Statement* (DECCW, 2009)	The objectives and goals for management developed for the Brisbane Water Estuary are consistent with the Act, the NSW Coastal Policy 1997 and the NSW Sea Level Rise Policy Statement (DECCW, 2009). The sea level rise benchmarks were used to the assess future intertidal zone in the study area (Cardno, 2010), and the actions in the Plan provide for ongoing monitoring and management of the estuarine ecosystem in relation to the sea level rise projections.
Principle 2 Optimise links between plans relating to the management of the coastal zone.	This Plan has been prepared with due consideration of the forthcoming *Brisbane Water Foreshore Coastal Floodplain Risk Inundation Management Study and Plan* (currently in preparation), and an effort has been made to provide cross references between the two Plans and ensure to the fullest extent possible that the actions identified in each plan are not inconsistent with each other
Principle 3 Involve the community in decision-making and make coastal information publicly available.	The community was invited to a series of workshops to the identify management issues and to develop the management actions identified in this Plan (see **Sections 1.4 and 2**). In addition, submissions made by the community after the two public exhibition periods have been considered in the preparation of the Final Draft Plan.

Coastal Management Principle	Comment
Principle 4 Base decisions on the best available information and reasonable practise; acknowledge the interrelationship between catchment, estuarine and coastal processes; adopt a continuous improvement management approach.	The management framework and implementation strategy outlined in this Plan have been developed based upon the scientific information contained in the *Data Compilation Study* (SMEC and Umwelt (Australia), 2002) and the *Estuary Processes Study* (Cardno, 2008). The need to monitor the effectiveness of implementation of the Plan is acknowledged, as is the need to update the Plan in accordance with the principles of adaptive management.

As a result of the change to the name of the Plan, and in order to provide opportunity for summer residents, visitors and users of the estuary to provide comment on the Plan, Council determined to place the Draft Plan on public exhibition again over summer, from 12 December 2011 to 27 January 2012.

The Plan was then updated and was adopted by Council at its Ordinary Meeting on 3 July 2012.

The development of the *Estuary Management Study* (2010) and the *Coastal Zone Management Plan for Brisbane Water Estuary* has been overseen by Council's Coastal and Estuary Management Committee. The Coastal and Estuary Management Committee is chaired by Council and has a membership that includes a range of State Government agencies, non-Government organisations, special interest groups and community representatives. The Terms of Reference for the Coastal and Estuary Management Committee are to:

- Provide advice and recommendations as to an integrated, balanced, responsible and ecological sustainable use of the City's estuaries, coastal and aquatic environments, including foreshore areas.
- Promote cooperation between the State Government, Local Government and estuary users in the development and implementation of Coastal Zone Management Plans.
- Advise and recommend on how to improve the management of the City's estuaries, coastal and aquatic environments through environmental planning frameworks.
- Advise and recommend on how to implement Estuary, Coastal and Aquatic Environment Management Plan actions.

1.2 Principal Management Aims for Brisbane Water

The overarching aims for the management of the Brisbane Water estuary are to:

- Protect, rehabilitate and improve the natural estuarine environment;
- Manage the estuarine environment in the public interest to ensure its health and vitality;
- Improve the recreational amenity of estuarine waters and foreshores;
- Recognise and accommodate natural processes and climate change; and
- Ensure ecologically sustainable development and use of resources.

In summary, this CZMP aims to provide a framework to assist Council and the other key stakeholders in the day to day, ecologically sustainable management of the estuary.

1.3 Area to Which This Plan Applies

The area to which this Plan applies includes the tidal waterway, foreshore and adjacent land of Brisbane Water, including the entrance area and tidal tributaries covering the whole region of Brisbane Water from the channel connecting the estuary to Broken Bay at the eastern end of Ocean Beach in the south; to Gosford in the north, and associated tributaries and catchments.

A locality map of the study area is shown in **Figure 1.1**.

For the purposes of this Plan, the estuary has been divided into a total of six management 'zones'. These management zones are functional units that have been derived from data on biological connectivity and ecological function within the estuary. The six zones are shown in **Figure 1.2** and include:

- ***Zone 1*** – Fagan's Bay;
- ***Zone 2*** – The Broadwater, encompassing Noonan's Point, Koolewong, Green Point, Rocky Point, Caroline Bay and Point Frederick;
- ***Zone 3*** – The Woy Woy Reach, encompassing Woy Woy Bay, Phegans Bay, Horsfield Bay and Correa Bay;
- ***Zone 4*** – The Central Reach, encompassing Woy Woy Channel, Pelican Island, Blackwall Point, St Huberts Island, Rileys Island, Lintern Channel and Paddys Channel;
- ***Zone 5*** – Kincumber/Cockle Bay, encompassing Cockle Channel, Cockle Bay and Kincumber Broadwater; and
- ***Zone 6*** – The Entrance Reach, including Booker Bay, Ettalong Beach, Lobster Beach, Wagstaff Point, Half Tide Rocks, Pretty Beach, Hardy's Bay and Rileys Bay.

These zones, as depicted in **Figure 1.2**, effectively encompass those portions of the waterbody and foreshore within each zone, as well as the sub-catchments draining to the zone. The zones have been delineated for management purposes only, and it is important to consider each zone in the context of the larger Brisbane Water catchment.

1.4 The Estuary Management Study

The *Brisbane Water Estuary Management Study* was completed by Cardno on behalf of Council in November 2010. The *Estuary Management Study* (Cardno, 2010) report provides an overview of the management context for the Brisbane Water estuary, including consideration of:

- Community and stakeholder consultation undertaken to develop the Management Study;
- The regulatory and management context;
- Overview of estuary processes (sourced from Cardno, 2008);
- Summary of values associated with the estuary and their significance;
- Management issues;

- Objectives and goals for management;
- A list of management options; and
- A detailed options assessment, including supporting analyses.

Finally, the *Estuary Management Study* (Cardno, 2010) contains a series of recommendations that have been used to inform this Plan. The following sections (**1.4.1 to 1.4.4**) of the Plan provide an overview of the key findings and recommendations of the *Brisbane Water Estuary Management Study* (Cardno, 2010) which should be read as a comprehensive supporting document to this Plan. For further detail on how management actions were developed the reader is referred to this document.

1.4.1 Values and Significance

The Brisbane Water estuary and foreshores are utilised by a number of different user-groups for a wide and varied range of activities. Different attributes or features of the estuary are valued by these various user-groups and other visitors to the estuary. In addition, there are also natural and cultural features that are inherently significant at a local, regional, national or international level (as identified in the *Estuary Processes Study*; Cardno, 2008).

During the *Estuary Management Study* (Cardno, 2010) the community was invited to identify the key values they associated with the estuary. The community responses are summarised in **Table 1.1**, along with some other important features of the estuary that hold significance for the community.

Table 1.2: Significance and Values of the Brisbane Water Estuary

Scale	Significance	Values
Local	› Significance for the Gurringa Aboriginal people and the Darkinjung LALC, including Aboriginal heritage items; › Extensive usage of the estuary and foreshores by local people on a regular basis; › Place for various water-based activities for clubs and other organisations; › A range of non-Aboriginal heritage items which exist in the area; and › Mangroves, seagrasses and saltmarsh are associated with high rates of diversity and abundance of fish, birds and invertebrate fauna.	› Estuary water quality for the purposes of recreation; › Access to the estuary foreshores and waterbody; › Safe use of the waterways and minimisation of user-group conflicts on the estuary; › Maintenance of the visual character and aesthetics of the estuary via controlled, uncluttered and appropriate waterfront and foreshore development; › Minimisation, where practicable, of the impacts of natural processes (such as wave inundation, flooding, erosion and sea level rise) on human uses of the estuary; › Transport operators and vessels providing public transport for use on a regular basis; › Managing pollution and sedimentation associated with creeks and stormwater outlets;
Regional	› Attractive destination for tourists, such as day-trippers from Sydney and visiting recreational users (boaters and fishers); › The annual Brisbane Water Oyster Festival attracts people from other areas in NSW; › Gosford and Brisbane Water are becoming increasingly important as a	

Scale	Significance	Values
	transportation hub; and › Regionally significant fauna species include the Pied Oystercatcher (*Haematopus longirostris*), the Bush Stone-curlew (*Burhinus grallarius*), the Osprey (*Pandion haliaetus*) and the Brown Honeyeater (*Lichmera indistincta*) (Robinson, 2006).	› Water quality suitable for environmental conservation and aquatic health; › Native fauna species and biodiversity conservation; and › Estuarine habitat conservation (e.g. saltmarsh, mangroves and seagrass).
State	› Several bird species are listed under the NSW *Threatened Species Conservation Act* 1995, including two in the endangered category (the Bush Stone-curlew (*Burhinus grallarius*) and the Little Tern (*Sterna albifrons*)) (Robinson, 2006); › The *Fisheries Management Act* 1994 identifies species, habitats and populations that are threatened, including populations of Posidonia australis seagrass present in Brisbane Water estuary; › The *Fisheries Management Act* 1994 also identifies protected species or habitats, such as mangroves; › Wetland habitats within Brisbane Water estuary also hold State significance and are protected under the *National Parks and Wildlife Act 1974* (Cockle Bay & Pelican Island Nature Reserve) and SEPP No. 14 (Coastal Wetlands); and › Gosford has also been declared a potential State Significant Site.	
National	› National Parks located in the vicinity include Brisbane Water National Park and Bouddi National Park; › Pelican Island and Rileys Island Nature Reserves are listed on the Register of the National Estate; and › Various flora and fauna species are listed under the Commonwealth EPBC Act 1999.	
International	› Important migratory species are listed under bilateral and multilateral agreements (e.g. JAMBA, CAMBA and ROKAMBA). A number of these species are not threatened at the State or National level and are therefore primarily afforded protection under these international agreements.	

As part of a related but separate project on the revitalisation of Gosford City Centre to create the Central Coast Regional City, an extensive and intensive community consultation

process has been undertaken. This consultation and planning process has identified a community desire, and economic need, to develop and activate Gosford City's waterfront in an environmentally sustainable manner. *Our City, Our Destiny – The Gosford City Centre Masterplan 2010* is a blueprint for achieving these goals. An important outcome of the *Our City, Our Destiny* project has been the NSW Department of Planning's (now known as the Department of Infrastructure and Planning or DP&I) recommendation that the Gosford Waterfront be gazetted as a State Significant Site under the *State Environmental Planning Policy (Major Projects) 2005*. In addition, the Central Coast Regional Development Corporation has been formed with a mandate to develop and activate the Gosford Waterfront.

State Significant Sites are sites that the Minister for Planning and Infrastructure considers have wider social, economic or environmental significance for the community of NSW. Classification as a site of State Significance has a range of implications for development and re-development proposals, which would need to be considered within the State planning objectives.

1.4.2 Management Issues

Management issues associated with the Brisbane Water estuary were identified via:

- Ongoing consultation with a range of stakeholders, including Council staff and the Coastal and Estuary Management Committee;
- A community workshop on management issues and objectives held on 4 April 2009; and
- A review of the technical studies comprising the *Estuary Processes Study* (Cardno, 2008).

The issues identified covered a range of different estuary processes and uses, including water quality issues, conflicts between different recreational users, navigational issues, erosion and sedimentation of the waterway, loss or degradation of riparian/foreshore vegetation, public access to the foreshore and a lack of (or poor maintenance of) recreational facilities.

A total of 252 management issues were identified, which were then ranked on the basis of the frequency of reporting/magnitude of the issue and the known or likely consequences associated with the issue. Many of the management issues identified were quite localised in scale, affecting a limited number of people or groups, and when of low significance were allocated a 'low' to 'medium' ranking. There were also, however, a number of management issues identified that were considered to have a 'high' level of importance because these issues impact on a large number of people or user groups, and are known or likely to have significant consequences. Some of the high ranking management issues are:

- Degradation and loss of estuarine vegetation (saltmarshes and mangroves) due to a range of factors including boat wash, soil compaction due to off-road driving, weed invasion, unauthorised removal by members of the community, and water pollution.
- Safety and access issues around use of different parts of the estuary by power boats, particularly in relation to vessel speeds and wakes.

- Observed impacts on the ecology of the estuary (i.e. plants and animals) and concerns about the future protection of the estuarine biodiversity (i.e. ensuring there is the same or greater range of plants and animals).
- Concerns about the potential impacts of climate change, primarily in relation to human uses of the estuary, but also in relation to the estuarine ecology.
- Management of the estuary foreshores, uncontrolled foreshore development, and limitations on public access.
- The potential impacts of poor water quality on both human and ecological health.

The full list of management issues can be found in the *Estuary Management Study* (Cardno, 2010).

1.4.3 Management Options Development and Assessment

An initial list of over 200 management options was developed by a team of environmental specialists from Cardno. This list was then presented to Council, OEH and the Coastal and Estuary Management Committee for review. The next step in the options development phase was to hold a series of workshops with the community to obtain their suggestions for management options. These workshops were held in May 2009. Once all the options identified during this consultation process had been collated and consolidated, the list comprised a total of 248 management options for the Brisbane Water Estuary (Cardno, 2010).

In many cases, a management option was developed to address a specific management issue observed by the study team, Council or the community (**Section 1.4.2**). In other cases, a management option may have been developed to assist in the implementation of the Plan, or to address remaining gaps in the data, and thereby further enhance the understanding of estuarine processes (as described in the *Estuary Processes Study*; Cardno, 2008). An effort has been made to identify a number of site specific activities, whilst also ensuring the options provide for a total catchment management approach for the estuary, as advocated by Council and the State Government. In all cases, however, the options were considered with respect to the management goals and objectives identified for the Brisbane Water estuary (**Section 3.1**).

The assessment of management options incorporated the following key components:

- Multi-criteria matrix-based assessment;
- Catchment modelling (for stormwater management options only); and
- Evaluation using a decision support system (for dredging related options only).

This options assessment framework is detailed in full in the *Estuary Management Study* (Cardno, 2010). It was developed in order to make sound comparisons between each option and to compare options in a transparent and unbiased manner so as to identify those having the greatest overall benefit for the estuary and the community (i.e. on a catchment-wide or estuary-wide basis). In recognition of the fact that the resources for implementation of these options are limited, the process of assessing management options has also been used to assist in prioritising actions for implementation (**Section 3.3**).

Following public exhibition of the *Estuary Management Study* (Cardno, 2010), the list of 248 management options was subject to further review based on submissions provided by the public, and comment provided by Council, OEH and the Coastal and Estuary Management Committee. The review identified the following:

- Opportunities where two or more options could be combined into a single option;
- Opportunities to re-word an option to provide a better description of the proposed activity;
- Some options that were considered inconsistent with State or Local Government policies or plans; and
- A small number of options that had recently been implemented by Council.

The *Brisbane Water Estuary Management Study* (Cardno, 2010) was revised in response to the submissions received during public exhibition, which resulted in further consolidation of the list to a total of 185 management options.

1.4.4 Recommendations

The *Estuary Management Study* (Cardno, 2010) recommended that the full list of 185 management options be adopted as actions for implementation in this Coastal Zone Management Plan.

In recognition of the fact that resources are limited, and that some options are dependent upon the implementation of other options, it was recommended that in the first instance the management strategy examine the highest ranking management options. To this end, a priority list of 70 management options was identified, comprising the top 10 highest ranking management options for each management 'category' (planning, compliance, works, education, research/monitoring; **Section 3.2**) and the top 5 highest ranking management options for each management 'zone' (**Figure 1.2**).

Subsequent to preparation of the *Estuary Management Study* (Cardno, 2010), the study team identified the need to provide greater emphasis within the management strategy on the catchment-wide (or estuary-wide) approach, and 10 management options were identified for inclusion in the strategy. This led to the development of a final list of 73 priority actions for inclusion in the management strategy that provide a combination of site specific actions and more holistic, catchment- or estuary-wide actions (**Appendix B**).

A final recommendation of the Study was to ensure that this Plan retains sufficient flexibility to implement any of the management options at any time as funds become available and priorities evolve.

1.5 Context for the Plan

This Plan seeks to adopt the recommendations of the *Estuary Management Study* (Cardno, 2010). It includes an implementation strategy comprising a prioritised list of actions developed to achieve the overarching management objectives and the more specific management goals for the estuary, consistent with a total-catchment management approach.

It has been developed with due consideration of the:

- *Guidelines for the Preparation of Coastal Zone Management Plans* (DECCW, 2010b);
- NSW *State Rivers and Estuaries Policy* (1992) and *Estuary Management Manual* (1992);
- Related statutory and non-statutory policies, plans and other instruments;
- Existing studies, including the *Brisbane Water Estuary Management Study* (Cardno, 2010) and the *Brisbane Water Estuary Processes Study* (Cardno, 2008); and
- Input provided by the Coastal and Estuary Management Committee, key stakeholders and the community.

As stated earlier, this Plan will supersede the *Brisbane Water Plan of Management* (GCC, 1995).

As indicated in **Section 1.4.1**, parallel to the development of this Management Study and Plan for Brisbane Water, Council has also been undertaking a strategic planning process for the Gosford City Centre to create the Central Coast Regional City. This process has led to the development of *The Gosford City Centre Masterplan 2010*. An effort has been made to ensure consistency between these parallel projects. This has been achieved by providing data from the *Brisbane Water Estuary Processes Study* (Cardno, 2008) to the Gosford Challenge Team to assist in the masterplanning process, and also by ensuring that the actions identified in the Brisbane Water CZMP complement and support (where relevant) *The Gosford City Centre Masterplan 2010*.

1.6 Structure of the Plan

The structure of this Plan is as follows:

- **Section 2** provides details of the consultation undertaken in relation to the Plan;
- **Section 3.1** summarises the management goals and objectives;
- **Section 3.2** provides details on the management actions adopted for the Plan;
- **Section 3.3** outlines an implementation strategy for the highest ranking actions; and
- Monitoring and evaluation has been considered in **Section 3.4**.

Appendix B of this Plan is the ***Implementation Strategy*** and forms the core of the Plan and should be referred to for the details of priority actions for implementation.

2 Consultation

2.1 Overarching Approach

The key consultation activities in relation to the development of this Plan have been undertaken during the development of the *Estuary Management Study* (Cardno, 2010), and a comprehensive overview of the consultation program is contained in Section 2 of that document.

The approach adopted for the program of consultation was to:

- Obtain feedback from key stakeholders and the community on:
  - How they use the estuary and the values they associate with both the foreshores and estuarine waterbody,
  - What management issues they have observed,
  - Suggestions on different options that might be suitable to address these issues, and
  - How they would like to see the estuary managed into the future;
- Seek advice and input from the relevant agency stakeholders to assist in implementation of the Plan; and
- Improve the awareness and understanding of the estuarine system by the local community.

The input provided by the community and stakeholders has been considered in the *Estuary Management Study* (2010) and the recommendations outlined therein have been adopted in this Plan. The consultation approach adopted in relation to this Plan focuses on:

- Explaining how the recommendations made have been adopted in the Plan; and
- Providing detail on how the Plan will be implemented.

2.2 Consultation with Council and the Coastal and Estuary Management Committee

The Preliminary Draft Plan was presented to key Council staff and members of the Coastal and Estuary Management Committee to provide an opportunity to ask questions or provide direct feedback. The feedback received during this process has been considered in the preparation of the Final Draft Plan for public exhibition.

Further consultation was then undertaken with Council and the Coastal and Estuary Management Committee following the public exhibition period (see **Section 2.3**) in a meeting held on 23 August 2011. All parties reviewed the responses the submissions compiled by Council and Cardno, and agreed to endorse the Plan as amended in accordance with the submissions in reply for adoption by Council.

Council subsequently determined that the Draft Coastal Zone Management Plan should be placed on public exhibition again over the summer holiday period in order to provide an opportunity for non-permanent residents and visitors to Brisbane Water to provide comment on the Plan.

2.3 Public Exhibition of the Plan

The community was provided with an opportunity to view the Draft Plan over the period 13 June to 29 July 2011, both online and at Council's libraries. During the public exhibition period, a community forum was held to review the process followed in the development of the Plan and discuss the Plan contents.

The public exhibition period for the Draft Plan was promoted by Council and submissions invited via post or email.

The submissions received during the public exhibition period were collated and summarised by Council. Council and Cardno prepared a response to each submission, which answered the respondents question, provided further information as required, and identified if any changes to the draft Plan were considered necessary as a result. This is documented in a 'Submissions in Reply Report' (Cardno/GCC, 2011). The outcome of this process was the preparation of this final Management Plan.

Due to the NSW Government releasing new *Guidelines for Preparing Coastal Zone Management Plans* (DECCW, 2010d), which supersede the NSW Government's (1992) *Estuary Management Manual*, the *Draft Coastal Zone Management Plan for Brisbane Water Estuary* was placed on public exhibition again over the period 12 December 2011 to 27 January 2012. Any submissions received during the public exhibition period were reviewed prior to finalisation of this *Coastal Zone Management Plan for Brisbane Water Estuary*, and amendments have been made as required.

The *Coastal Zone Management Plan for Brisbane Water Estuary* was subsequently adopted by Council at the Ordinary Meeting of 3 July 2012.

2.4 Endorsement with Agencies Responsible for Implementation

Prior to presentation of the final Draft Coastal Zone Management Plan to Council for final adoption, Section 1.3 of the NSW Government's *Guidelines for Preparing Coastal Zone Management Plans* (DECCW, 2010d) requires that '*A council submitting a draft CZMP to the Minister for certification is to also provide to the Minister copies of written correspondence from public authorities supporting any actions contained in the draft CZMP which they are responsible for or that affect their land or asset*'.

A number of key public authorities were represented on Councils Coastal & Estuary Management Committee for the duration of the planning process and provided input at the various stages of the project. Additionally, each authority was directly contacted to confirm their support of the Draft Plan prior to progressing with Council adoption, NSW Government certification and implementation. These authorities included:

- NSW Trade & Investment, Regional Infrastructure & Services (Crown Lands Division);
- NSW Office of Environment and Heritage (National Parks & Wildlife);
- NSW Primary Industries (Fisheries and Aquaculture);
- NSW Roads and Maritime Services (Maritime); and
- Hunter Central Rivers Catchment Management Authority.

3 The Management Plan

3.1 Management Goals and Objectives

3.1.1 Vision for Brisbane Water Estuary

During the development of the *Estuary Management Study* (Cardno, 2010), Council and the Coastal and Estuary Management Committee worked with Cardno to articulate a vision statement representing an aspirational goal for the future of Brisbane Water. It should be noted that the original vision statement has been subject to some minor refinement by the Coastal and Estuary Management Committee since originally presented in the *Brisbane Water Estuary Management Study* (Cardno, 2010).

The agreed vision statement for the Brisbane Water Estuary is:

"To seek to preserve and enhance those physical, ecological and social features and uses of Brisbane Water estuary that are valued and sought after by the community, by maintaining and improving (where possible) the estuary condition through the application of sustainable and adaptive development and management."

More specific objectives and goals for management are provided in **Sections 3.1.2 and 3.1.3** respectively.

3.1.2 Overarching Management Objectives

The overarching management objectives for the Brisbane Water estuary are as follows:

- To provide a strategic framework for the future management of the Brisbane Water estuary, now and into the future.
- To improve community awareness and understanding of the estuarine system through their involvement in the development and implementation of the Plan.
- To prepare a management plan that is consistent with the NSW *State Rivers and Estuaries Policy* (1992) and the principles of Ecologically Sustainable Development.
- To provide a framework for implementation of the Plan such that all objectives and desired goals set for the estuary may be achieved.

These management objectives represent the overarching principles developed by Council and under which both the *Estuary Management Study* (2010) and this Plan have been prepared. Consistent with these overarching objectives for Brisbane Water estuary, Council and the Coastal and Estuary Management Committee have promoted the adoption of a total-catchment management approach within the Plan.

3.1.3 Management Goals

In addition to the overarching management objectives, a series of more specific management goals were developed in consultation with the Committee. These goals represent the specific, desired outcomes for the Brisbane Water estuary. They have been used to guide the development of the Plan.

The full list of management goals are provided in **Table 3.1**.

Table 3.1: Management Goals for Brisbane Water

Category	Goal
Water and Sediment Quality	To achieve a standard of water and sediment quality that protects and promotes a healthy aquatic ecosystem, and allows aesthetic enjoyment and appropriate recreational use.
Sedimentary Processes	To seek to: ▪ Minimise catchment generated sedimentation and erosion of creeklines and the foreshore caused by the effects of human activities; ▪ Maintain access and amenity, as well as the navigability of the waterway, while recognising the natural sedimentary processes and the natural depth constraints that occur in the estuary; and ▪ Minimise (where possible) erosion and sedimentation where natural sedimentary processes are impacting on public or private property.
Foreshore Flooding	To minimise the impact of flood management measures on estuarine processes.
Habitat and Species Conservation	To protect, retain and rehabilitate existing habitat for estuarine species, rehabilitate degraded habitat and provide for ecological connectivity throughout the Brisbane Water catchment.
Cultural Heritage	To acknowledge, conserve and commemorate (as appropriate) the Aboriginal and European heritage of the estuary and its foreshores.
Visual Amenity and Landscape Character	To maintain or enhance the visual experience of the landscape from vantage points on the waterway and in the catchment.
Recreational Usage	To encourage and provide facilities which support appropriate recreational usage of the estuary waterways and foreshores while maintaining ecosystem viability.
Foreshore Development	To undertake strategic planning for development adjacent to the Brisbane Water foreshore, taking into account: ▪ The potential impacts of climate change; ▪ Access and amenity; ▪ The preservation of important foreshore habitats; ▪ The successful implementation of those aspects of *Our City, Our Destiny – The Gosford City Centre Masterplan*, that relate to the waterfront and that impact on Brisbane Water. This includes, but is not limited to, foreshore development containing retail, commercial and residential activity; a city playground; intersection upgrades and water recycling. With respect to existing foreshore development, the aim is to: ▪ Seek opportunities to implement environmentally

Category	Goal
Foreshore Development (cont.)	sustainable modifications during the course of ongoing maintenance and repair. ▪ Recognise and report on inappropriate foreshore development and take action to remedy where possible.
Commercial Development	To promote the Ecologically Sustainable Development of commercial activities and tourism within the estuary, recognising the finite capacity of estuarine ecosystems.
Governance	To establish an appropriate organisational framework within the responsible agencies to ensure the Coastal Zone Management Plan is implemented, and to seek funding in order to facilitate ongoing implementation of the Plan.
Information, Communications and Education	To regularly provide information to the public about the estuary, including details of: ▪ Current estuarine health (including aquatic ecosystem and human health indicators); ▪ Current planning and development activities; ▪ The impact that current and future land and waterway usage has on estuarine values; and ▪ The contributions that the community can make toward reducing adverse impacts on, and enhancing the condition of, the estuary. To facilitate the active involvement of the community in implementation of the Plan wherever possible.

3.2 Management Actions

As identified in **Section 1.4.4**, the *Estuary Management Study* (Cardno, 2010) recommended that the full list of 185 management options be adopted as management actions for implementation in this Plan. However, in the process of developing this Plan, the options were subjected to further review with the result that the full list of 185 management options was refined to a final list of 183 actions for adoption in the Plan. The review process was undertaken in consultation with Council and the Coastal and Estuary Management Committee, with due consideration of the submissions received during the public exhibition periods. A small number of management actions were removed from the list for the following reasons:

- In some cases an action has recently been initiated by Council and therefore the action was removed;
- Some actions were subject to further re-wording/refinement such that there was an opportunity to combine two actions; and/or
- Some actions have been deleted after additional ground-truthing indicated that they were not feasible or would not achieve the stated objective(s).

The recommended management actions range from specific works to more overarching and long-term strategic actions. To aid implementation, each management action has

been categorised according to the following five management 'categories', which correlate generally with Council's organisational structure and are consistent with other estuary management plans to which Council is a stakeholder:

- ***Planning (P)*** – This type of action may include development of a planning instrument, regulation, policy or guideline, or plan of management;
- ***Compliance (C)*** – This type of action relates to enforcement of a planning instrument, regulation, or policy;
- ***Works (W)*** – This type of action describes actual 'on-the-ground' works or maintenance activities;
- ***Education (E)*** – This type of action targets information dissemination to increase public awareness of estuary issues and management approaches; and
- ***Research/Monitoring (R)*** – This type of action may include a further study, survey, or investigations.

The following details are provided for the 183 management actions listed in **Appendix A**:

- A unique action identification number;
- Key management goal addressed;
- The relevant management category;
- A strategy outline or description of the action;
- Location for implementation and the relevant management zone (where applicable);
- Primary and secondary responsibilities for implementation;
- A cross-reference to related management actions, or other actions upon which implementation is dependent;
- Cost of implementation, including an estimate of capital cost and annually recurrent maintenance costs (or revenue generated);
- Net present value of implementation over a 20 year period (a measure of the total actual cost of the action, taking into account both the capital cost and the maintenance costs or revenue generated); and
- Potential funding streams (where readily identifiable).

The actions in **Appendix A** have been listed in numerical order and do not reflect a priority or program for implementation. The implementation strategy (**Appendix B**), where implementation timeframes are identified, is discussed in **Section 3.3**.

The implementation of this Plan creates opportunities to enhance efficiencies for the management of the estuary, both through Councils internal collaboration and through partnerships with various stakeholders and interest groups. Should all of the management actions be implemented, the total capital cost at current prices is estimated to be approximately $16.65 million, with annually recurring costs of approximately $5.02 million.

It is important to note that there are a range of agencies identified as having responsibility for implementation of the actions identified in the Plan (i.e. contingent on the availability of funding or resources for project delivery). Several of these agencies are represented on the Coastal and Estuary Management Committee and so have been involved in the preparation of the Plan. Neither Council nor the Coastal and Estuary Management Committee have the authority to require these agencies to meet the responsibilities identified in the action list (**Appendix A**). However, an effort has been made throughout the development of the *Estuary Management Study* (Cardno, 2010) and the *Coastal Zone*

Management Plan for Brisbane Water Estuary to seek voluntary commitments from these agencies to assist in the implementation of the Plan.

Additionally, it is noted that all the management actions identified in this Plan may be subject to further detailed investigation prior to implementation and may therefore become subject to modification or further consideration (including the estimate of costs which can be expected to change in light of the outcomes of detailed investigations).

3.3 Implementation Strategy

As recommended in the *Estuary Management Study* (Cardno, 2010), a subset of the highest ranking management actions has been prioritised for implementation, comprising the:

- Top 10 highest ranking actions under each management 'category';
- Top 5 highest ranking management actions for each management 'zone' (except Zone 1, for which less than five actions were identified); and
- Top 10 highest ranking management actions on an estuary- or catchment-wide scale.

This approach has been adopted in order to capture a cross-section of management actions that include a combination of both site-specific and broad scale (estuary- or catchment-wide) activities. Once collated, this sums to a total of 73 priority management actions, as listed in **Appendix B (the core of this Plan)**.

The actions listed in this Plan are not intended to be detailed and would be subject to further refinement and/or investigation prior to implementation.

Each action has been allocated an approximate timeframe for implementation as follows:

- ***Short-term (S)*** – aim to initiate implementation within 3 years of adoption of the Plan;
- ***Medium-term (M)*** – aim to initiate implementation within 3-5 years of adoption of the Plan; or
- ***Long-term (L)*** – aim to initiate implementation within 5-10 years of adoption of the Plan.

The actions comprising the **Implementation Strategy** in **Appendix B** have been sorted on the basis of these timeframes for implementation. However, within each of these timeframes, the actions are not presented in any particular order.

Based on estimates of cost provided in **Appendix B**, the indicative capital cost of implementing the top 73 management actions is approximately $4.96 million and the recurring cost is estimated at $1.96 million per annum.

The estimated capital and recurring costs have also been broken down based on the proposed implementation schedule and the works category.

Costs of implementation for each management category are estimated as follows:

- ***Planning*** - $852,500 capital cost, $366,000 recurring costs;

- ***Compliance*** - $145,000 capital cost, $322,500 recurring costs;
- ***Works*** - $3.37 million capital cost, $957,500 recurring costs;
- ***Education*** - $290,000 capital cost, $127,500 recurring costs; and
- ***Research/Monitoring*** - $310,000 capital cost, $182,500 recurring costs.

This information assists in assessing the allocation of resources amongst the various sections within Council.

Costs of implementation for each implementation timeframe are estimated as follows in order to provide an indication of budgetary requirements over time:

- ***Short-term activities*** - $1.08 million capital cost, $730,000 recurring costs;
- ***Medium-term activities*** - $2.54 million capital cost, $1.02 million recurring costs;
- ***Long-term activities*** - $1.34 million capital cost, $202,500 recurring costs.

In terms of staging of works, the order in which the actions are shown in the implementation strategy should be viewed as a guide to the order in which works or studies could be undertaken. Priorities were assigned to actions based not only on ranking, but also on ease of implementation, budgeting considerations and overall impact in terms of achieving the corresponding management objective.

While these top 73 management actions have been identified as a priority for implementation, it is recognised that the Plan needs to retain sufficient flexibility such that Council (or any other responsible agencies) may implement any of the management actions listed in **Appendix A** at any time. Such an instance may arise where, for example, funding becomes available through a specific grant or other funding program.

Additional conceptual details to assist the implementation process are provided for the top 10 catchment- or estuary-wide actions in **Section 3.3.1**. Concept details have also been provided for the top 5 management actions for each management zone in **Section 3.3.2**.

3.3.1 Concept Details – Highest Priority Catchment-wide Management Actions

As previously discussed, Council and the Coastal and Estuary Management Committee have identified the importance of adopting a holistic approach to management of the estuary that emphasises total catchment management. In line with this approach, 10 management actions developed for implementation on a catchment-wide or estuary-wide basis. These actions have been prioritised for implementation as part of the Plan and are identified in the implementation strategy (see **Appendix B**). This section provides (in no particular order) concept details to guide implementation of these high priority actions.

Action P43: Prepare a Climate Change Adaptation Plan

Section 4.10 and **Appendix D** of the *Brisbane Water Estuary Management Study* (Cardno, 2010) provide an overview of climate change considerations as they relate to the Brisbane Water Estuary and the NSW Estuary Management Process. They include information on:

- NSW Sea Level Planning Benchmarks;
- Observed changes in mean estuarine water levels;
- Preliminary overview of potential impacts on estuarine vegetation resulting from a shift in the intertidal zone under climate change conditions; and

- Local planning for sea level rise.

Further discussion on the potential impacts of climate change on the Brisbane Water Estuary (in relation to foreshore flooding and property protection) is provided in the *Brisbane Water Foreshore Coastal Floodplain Risk Inundation Management Study and Plan* (currently in preparation by Cardno). The *Foreshore Coastal Floodplain Risk Inundation Management Study and Plan* primarily considers how climate change will impact on extreme flood events. However, the report also provides mapping of estuarine water levels and identifies locations around the estuary foreshores that will likely be subject to tidal inundation under climate change conditions, and for which further investigation is required.

Action P43 aims to build on this knowledge base by undertaking further and more detailed investigation into the ecological impacts of sea level rise within Brisbane Water. This information, when combined with other research projects being undertaken by Council, will deliver land use zoning and development controls for the Estuary that are based on the most up-to-date and reliable sea level rise projections. This action has been identified by Council as their highest priority for implementation under the *Coastal Zone Management Plan for Brisbane Water Estuary*.

Reference should be made to linked Actions P44, P45, P54 and R40.

It is recommended that the ecological investigations be scoped in detail by Council; however, an effort has been made to identify key considerations for the study:

- Provide greater definition of the extent of affectation by sea level rise by considering indirect impacts (e.g. loss of access) as well as direct impacts. Reference should be made to various research projects currently underway including:
  - Foreshore Coastal Floodplain Risk Inundation Management Study and Plan (GCC and Cardno),
  - Identifying Risk Levels, Significant Triggers and Appropriate Responses for Adaptive Management (GCC and CSIRO), and
  - Spatial Tools for Assessing and Managing Climate Risk in the Gosford LGA (GCC and HCCREMS);
- Compile an inventory of coastal, foreshore and near-foreshore wetlands within Brisbane Water;
- Undertake an assessment of the wetlands to identify the important attributes of each;
- Assess the ecosystems services of the wetlands and make an appraisal of their economic value;
- Assess the impacts of sea level rise on wetlands by type;
- Assess the capability of wetlands to retreat and adapt to sea level rise and other climate change impacts, identifying locations with high potential for wetland retreat. This process should consider factors such as current and proposed future land use, nearby wetland vulnerability, rarity and condition and the capacity of a site to support wetland vegetation;

- Prioritise the most vulnerable wetland types for management, focussing on larger wetland complexes and those with greatest habitat value while maintaining interconnectivity;
- Develop planning mechanisms to protect the retreat areas identified as high priority, including site specific management plans for wetland retreat areas and actions to facilitate retreat;
- Review the role of existing and proposed infrastructure in wetland protection and coastal squeeze (i.e. bike tracks, roads, seawalls); and
- Develop a communications strategy for communication of the study findings to the community and key stakeholders.

Agency stakeholder and community consultation will be a key component of this activity.

Action E08: Consider methods of detecting and informing the community of changes to sea levels and other potential climate change impacts

Council has recognised that climate change, and sea level rise in particular, represents a significant challenge to the ongoing management of the Brisbane Water estuary. This action involves the development of a communication strategy that provides for consultation with the community on climate change related issues.

The implementation of this action is dependent upon ongoing monitoring of water levels (see Action R40) to inform the consultation process. Reference should also be made to the linked Action P43.

Some recommendations have been provided below for inclusion in the communications strategy:

- Consider the key messages that Council wishes to communicate to the community.
- Identify existing reports and education materials, including those prepared by the IPCC and State and Federal Governments for incorporation into the communication strategy.
- Regularly review of the latest climate change science and projections from reputable, peer reviewed sources. Key sources of up to date projections include research presented by the IPCC and the State and Federal Governments. Observations of trends in local sea level based on locally derived data should also be considered.
- Establish partnerships with the State Government, climate change experts, education institutions or other natural resource managers to assist in development and implementation of the communication strategy.
- The strategy should include specific actions for implementation, a timeline and costings. It should, however, remain sufficiently flexible to respond to emerging issues or adapt to community needs.
- The strategy should consider how to make the available climate change projections relevant to the community. This may require consideration of how the projections would manifest for the Gosford LGA. This may include consideration as to how climate change will impact on the local environment, and the flow on effects on the community's use and enjoyment of the local area. This may also include providing the community will tools

- Rather than focussing on negative impacts, the strategy should identify any opportunities arising out of climate change. The strategy should also give consideration to providing the community with tools that allow them to take action on climate change issues.
- The communications strategy should also feed back into Council's other programs and activities (e.g. the Climate Change Adaptation Plan) where relevant.
- Resources will be required for the ongoing implementation of the communication strategy.

Action P23: Develop a conservation strategy for the birds of the Brisbane Water Estuary

The *Brisbane Water Estuary Processes Study* (Cardno, 2008) identified the importance of the estuary for avifauna. There are a number of important bird species that utilise estuarine habitats and resources, either as permanent or temporary residents. For example, some bird species that undertake long range migrations may spend part of the year in the region, or might transit the area while migrating between points. A number of bird species known to occur in the estuary are currently threatened at the regional, State, Federal and/or international level.

This action was developed in recognition of the need to provide a coordinated strategy for the ongoing conservation and protection of birds in and around Brisbane Water Estuary.

Reference is made to linked Actions E03 and P27.

Some recommendations have been made regarding development of the strategy:

- The strategy should in the first instance identify key species or umbrella species of bird occurring in the Brisbane Water Estuary. Once these have been identified, consider their life cycles and resource requirements to identify elements of the environment that require conservation to support bird populations. This should include nesting, roosting, and feeding and refugia requirements.
- Assess the existing impacts on birds within the study area. This should be informed by the *Brisbane Water Estuary Processes Study* (Cardno, 2008) and Robinson (2006).
- Assess the potential impacts on birds under climate change conditions.
- Consider activities that provide for the ongoing protection and enhancement of the resources required by birds. The strategy should include goals/objectives for management and should include a program of activities that have been costed.
- Identify potential sources of funding. It is likely that there are a number of grants available for bird conservation (e.g. Australian Bird Environment Foundation Grant). Volunteers should be also utilised where possible. There may also be opportunities to partner with the State Government or other organisations in developing and implementing the strategy.
- Undertake a review of Council's existing policies and plans for management of natural resources and identify any potential conflicts or inconsistencies.
- Consider the need to develop additional mechanisms to protect birds or their habitat, or dedicate new Reserves to protect key habitat areas.

- Some provision should be made for ongoing data collation, analysis and reporting to identify trends and inform adaptive management. It is recommended that a partnership be established with local bird watching organisations to collect data on birds occurring in the estuary and how they use estuarine resources (e.g. for foraging, nesting, roosting and refugia).
- Use the strategy to inform the development of the Plan of Management for the Bush Stone-curlew, as identified under Action P27.

Action P41: Prepare a 'Brisbane Water Estuary Users Plan'

The outcome of this action would be a Brisbane Water Estuary Users Plan which addresses such issues as equity of access, boat storage, conflicts of usage, mooring types and caps, number and type of public access points (wharves and jetties), coverage and consistency of foreshore Plans of Management with priority areas identified for new Plans of Management, estimation of an estuary carrying capacity with respect to development intensity, fishing/fisheries and boating.

Reference should be made to the Brisbane *Water Estuary Processes Study* (Cardno, 2008), particularly Appendix N, for further details on existing recreational patterns, conflicts and future opportunities, as well as details of where recreation may be impacting on other estuarine processes (e.g. on ecological processes).

It is noted that implementation of this action is also dependent upon the provision of supporting information via the implementation of Action R31, which would involve the updating of the recreational study (KBR, 2005) and filling any data gaps on foreshore infrastructure. Reference is also made to linked Actions C12, P55 and W81.

Some recommendations regarding the implementation process are provided below:

- Develop a consultation strategy to ensure that the Plan captures the necessary input from the full range of stakeholders (including the Brisbane Water Users Group, NSW Maritime and Crown Lands Division within DPI) and provides them with opportunity to contribute feedback on the Plan as it is developed.
- Identify the full range of uses of the estuary waterway for both commercial and recreational purposes, and collate information on existing management issues.
- In consultation with the community and stakeholders, develop more specific goals for how the estuary waterway and foreshores should continue to be managed for recreational and commercial uses, consistent with the goals for management outlined in this document, the *Coastal Zone Management Plan for Brisbane Water Estuary*.
- Review the full list of policies and plans of management for recreational and commercial use of the estuary waterway and foreshores, a number of which are referenced in the *Management Study* (Cardno, 2010). The Users Plan should ideally supersede these documents, bringing management of recreational and commercial uses of Brisbane Water under a single, comprehensive framework.
- Discuss with NSW Maritime the need to update the Brisbane Water Boating Map in line with recommendations in the Plan.

- The Plan should seek opportunities to improve equity of recreational access and amenity, and reduce conflict between different uses and the environmental values of the estuary.

It is important to note that there is a substantial amount of information available within the Estuary Processes and Management Studies (Cardno, 2008, 2010), and also that the Users Plan should be consistent with this Management Plan. The key outcome of this action will likely be the amalgamation of the range of existing policies, plans and guidelines into a single Users Plan.

Action P53: Promote the Brisbane Water estuary for ecotourism

The potential for the development of an ecotourism industry in the Gosford area, and centred on the Brisbane Water Estuary, was identified during the community consultation process. Ecotourism is ecologically sustainable tourism with a primary focus on experiencing natural areas that fosters environmental and cultural understanding, appreciation and conservation and improves the welfare of the local people.

Reference should be made to *Central Coast Destination Management Plan for Tourism 2010-2013* (CCT, 2010). The cost of implementation should provide for the GCC to be involved in brand development, establishing strategic partnerships/alliances, developing and distributing advertising materials, and developing/hosting events related to eco-tourism.

Reference is also made to linked Actions P54 and P55.

Recommendations for implementation are as follows:

- Consult with the Chamber of Commerce, Tourism NSW and the Central Coast Tourism Board on a strategy to develop and promote ecotourism in the Gosford area.
- Analyse available visitor statistics and conduct a SWOT (Strengths-Weaknesses-Opportunities-Threats) analysis on ecotourism.
- Consult with local businesses and other organisations (e.g. Darkinjung LALC) that already work in the ecotourism sector and/or are interested in expanding into that realm. Provide incentives or other mechanisms for businesses to develop ecotourism.
- Work with the stakeholders to identify ecotourism opportunities and points of difference (i.e. from other tourism locations) based on consideration of the natural features and cultural heritage of the Brisbane Water Estuary.
- Consider opportunities to attract the existing visitor/tourist market to ecotourism activities.
- Consider opportunities to incorporate volunteering on conservation works into the ecotourism experience.
- Assess existing events and investigate development of events with links to eco-tourism.

Action R36: Establish an annual reporting mechanism to communicate progress towards achieving the goals and objectives of the Management Plan and Estuary Monitoring Plan

This *Coastal Zone Management Plan for Brisbane Water Estuary* includes a monitoring and evaluation component that considers performance indicators for implementation of actions under the Plan (**Section 3.4.1**) and monitoring of estuary health (**Section 3.4.2**). This action provides for establishment of a reporting mechanism to provide progress updates to the stakeholders and the community. Annual reporting would also assist in facilitating adaptive management (as required) and regular review of the Plan.

There is also opportunity within the annual report to report on compliance matters that affect the estuary, such as:

- Accidental spills or breaches of environmental conditions (e.g. under an Environmental Protection licence);
- Speeding infringements or other complaints relating to watercraft; and/or
- Non-compliant developments or failure to implement required environmental controls during construction.

Any compliance matters recorded could also be reported on in the annual report, and would be useful in linking back to the KPIs in **Section 3.4.1**. The type of breach, agency responsible for follow-up action, and potential impact on the estuary should be recorded.

This action is dependent upon Action R37, which provides for the development of a comprehensive Estuary Monitoring Plan. Reference is also made to linked actions E08, R39, R40 and R41.

Implementation of this action should consider:

- The target audience for the report and how best to communicate results to them (e.g. comprehensive report or report card format).
- Any reporting requirements of Council or other funding bodies (e.g. any reporting requirements associated with grants), and how such a report for the Brisbane Water Estuary could complement or support these reporting requirements.
- Roles and responsibilities for preparing the report should be clearly delineated.
- The structure of the annual report should include as a minimum:
  - Actions implemented (complete or ongoing) during that year,
  - A summary of trends in estuarine condition/health focussing on key indicators, and
  - An assessment of the success of implementation of the Plan against the objectives for management (as measured by the performance indicators).
- Effective means of disseminating information to both key stakeholders and the public, and promoting the achievements made in implementing the Plan.

Action R37: Design a comprehensive 'Estuary Monitoring Plan'

This action will produce a comprehensive Estuary Monitoring Plan that evaluates the success in meeting the objectives and goals outlined in the *Coastal Zone Management Plan for Brisbane Water Estuary*. The Monitoring Plan should draw together all those

individual monitoring activities listed in the actions list into a single overarching framework in line with the NSW Monitoring, Evaluation and Reporting (MER) Framework (DECCW, 2010a and c). The Plan should provide for monitoring of compliance issues, in addition to the more general estuarine health monitoring reporting.

The cost of this action (detailed in **Appendix A**) includes development of the Plan and implementation. It is noted that some individual monitoring components are costed separately (e.g. water quality monitoring).

Design of the Plan will be dependent on the outcomes of Actions R01, R05, R22 and R25. Reference is also made to linked Actions R36, R40 and R41.

Recommendations for implementation include:

- Compile information on the monitoring activities currently undertaken by Council, the CMA, the Central Coast Community Environment Network (CCCEN) and other relevant stakeholders. Develop a detailed list of parameters monitored, sampling methodologies, sampling equipment available, and analyses and reporting undertaken.
- Consider the full range of reporting requirements that Council currently has in relation to the Brisbane Water Estuary. This may relate to a range of activities, including water quality monitoring for recreational usage, State of the Environment Reporting, and MER reporting.
- Collate a list of all monitoring activities identified in the action list. This should include discrete monitoring programs (e.g. R01), as well as audits (e.g. C01, R04) that provide useful information on estuarine health and support the performance indicators. Identify any outstanding monitoring requirements and develop relevant activities accordingly.
- Compare the existing and proposed monitoring activities for consistency. Identify gaps.
- In consultation with the key stakeholders, develop a comprehensive monitoring program for the estuary. This should identify the full suite of monitoring activities and provide sufficient details for implementation, including:
  - Parameters to be monitored,
  - Sampling methodologies,
  - Equipment required for sampling,
  - Sampling locations,
  - Sampling frequencies,
  - Field QA/QC procedures,
  - Directions for sending samples to laboratories (as required), including handling times and storage methods,
  - Roles and responsibilities should be allocated amongst the various organisations that have a role in monitoring.
- Consider the Occupational Health and Safety aspects of each monitoring activity and ensure adequate guidance is provided. Include provision for training as required.
- Consider the need to develop guidelines or practice notes for key monitoring activities.

- Identify opportunities to train and utilise volunteers.
- Calculate a likely cost of implementation and discuss funding with the key stakeholders. Seek additional funding opportunities where possible. It may be necessary to scale back the proposed program commensurate with the available resources. In this case, the stakeholders should work together to identify the key monitoring activities that should be implemented.

Action R38: Research possible sources of funding and secure ongoing funding for implementation of the Plan

This action was developed based on a recognised need by the Coastal and Estuary Management Committee to ensure there was sufficient resources for implementation of the Plan. As outlined in **Sections 3.2 and 3.3**, significant financial resources will be required to provide for implementation of the Plan. Therefore, there is a need to actively seek funding.

The following activities have been listed in relation to this action:

- Undertake further consultation with the range of Government and non-Government organisations with an interest in the Brisbane Water Estuary and identify opportunities to obtain financial or in-kind resources for implementation of the Plan.
- Undertake a review of the available grants and other funding opportunities every 3-6 months.
- Negotiate a budgetary allocation within Council's annual budget for implementation of the Plan.

Action W01: Investigate options for implementing catchment based WSUD features in the catchment

In accordance with Council's focus on holistic catchment management practices, this action provides for development of a comprehensive strategy for WSUD for the Brisbane Water Catchment. Studies undertaken for the *Estuary Processes Study* (Cardno, 2008) identified that the Narara and Erina Creek sub-catchments, followed by the Kincumber Creek sub-catchment, were the dominant sources of pollutants for the Brisbane Water Estuary. These three sub-catchments are more heavily urbanised than the other sub-catchments draining to Brisbane Water, although it is noted that the larger size of some of these sub-catchments also explains the larger pollutant loads originating in these parts of the larger catchment.

There are a number of discrete actions identified in the Plan (**Appendix A**) that could be included for implementation within Action W01. Reference is made to linked Actions P05, R04-R06, R10, R24, W04, W06, W07, W10, W13 and W14.

This action effectively provides for the development of a comprehensive and coordinated WSUD strategy for the Brisbane Water Estuary catchment as a whole. A series of activities have been recommended to assist in development of this strategy:

- Liaise with the relevant stakeholders (e.g. the CMA) to compile the available reports, studies, plans and strategies relating to all aspects of WSUD for the Brisbane Water Estuary. This may include:
  - Stormwater management or catchment management/action plans,

  - Existing water quality models,
  - Planning instruments (development controls and policies),
  - Data on the location, type, functioning and maintenance requirements of existing WSUD features,
  - Data from any complaints registers for stormwater issues,
  - Rivercare or riparian management plans (e.g. HCRCMA, undated; PBP, 2003a and b),
  - Council's Sewage Enhancement Program and associated capital works program, and
  - Floodplain risk management plans should also be considered, but more so from the perspective of consistency.
- Develop a collated list of WSUD activities identified in the existing strategies and plans. The list should identify:
  - The proposed activity,
  - The location for implementation,
  - Roles and responsibilities,
  - Cost of implementation and potential funding sources,
  - Source of origin and supporting information (i.e. the relevant source document/plan and any other supporting studies).
- Identify any data gaps and develop identify new activities for the collated WSUD strategy as required.
- Assess each of these WSUD against a set a standard criteria to prioritise activities on a catchment-wide basis. It may be necessary to conduct a workshop within Council and/or with the relevant stakeholders to assist in this task.
- Implement the WSUD strategy.

Action W34: Address bank erosion along the estuary foreshores and tributaries

This action provides for the identification of locations of bank erosion along creekline corridors and the estuary foreshore. The intent is to then design and implement remediation measures to address these issues, with re-establishment of native vegetation being the preferred option where feasible.

Reference is made to linked Actions P14, R10, R17, W38, W41, W45, W46, W48, W49, W53, W55.

The following activities would be required in implementing this action:

- Compile existing information on bank condition for the estuary foreshores and tributaries. Reference should be made to Appendix H of the *Estuary Processes Study* (Cardno, 2008) and existing geomorphic studies, such as the *Narara Creek Rivercare Management Study and Plan* (PBP, 2003a & b) and the *Erina Rivercare Plan* (HCRMA, undated).
- Collate bank erosion remediation actions identified for implementation in the existing plans. In a similar process to that recommended for Action W01, the collated list should include details of:
  - The condition of the subject site,
  - The proposed bank remediation activity,

  - The location for implementation,
  - Roles and responsibilities,
  - Cost of implementation and potential funding sources,
  - Source of origin and supporting information (i.e. the relevant source document/plan and any other supporting studies).

- Identify locations for which information on bank condition is lacking and geomorphic assessments may be required.
- Identify any data gaps and develop identify new activities for the collated bank erosion remediation strategy as required.
- Assess each of these actions against a set a standard criteria to prioritise activities on a catchment-wide basis. It may be necessary to conduct a workshop within Council and/or with the relevant stakeholders to assist in this task.
- Implement the strategy.

3.3.2 Concept Details – Highest Ranked Actions by Zone

This section of the Plan provides some additional guidance to aid implementation of the top 5 management actions identified for each zone. The exception is Zone 1, for which only one management action has been proposed. These actions are site-specific actions that have typically been developed to address a specific issue observed by the community, Council, the Committee or the study team.

Where possible, the location of implementation for each of the top 5 actions in each of the six management zones has been mapped in **Figures 3.1 to 3.6.**

Management Zone 1 – Fagans Bay

The management actions proposed for implementation in Zone 1 has been mapped in **Figure 3.1**. The implementation process for the actions is provided below.

Action W122: Investigate the feasibility of increasing the capacity of the culvert under the rail line

Action W122 proposes assessing the feasibility of increasing the capacity of the existing culvert under the rail line at Fagans Bay to enhance flushing and thereby improve water quality. Investigations to determine optimal culvert size are also recommended.

This action is currently being assessed as an option under the *Brisbane Water Foreshore Coastal Floodplain Risk Inundation Management Study and Plan* to confirm its suitability for flood mitigation purposes and the recommendations of that study should be considered in the feasibility assessment. The action may be undertaken through the Gosford Challenge and City Centre re-development.

The implementation process should include the following steps:

- Review available water quality data and other information to confirm the nature of the water quality issue in Fagans Bay. This should include consideration of the physical processes flushing the Bay. Consider the rate and volume of historic sedimentation that may have occurred within the bay and consider the need for

sediment removal to restore hydraulic capacity. At this stage it should be confirmed that poor flushing is a key issue.
- Identify options available to improve flushing. Consider also the 'do nothing' option.
- Conduct an assessment that considers likely benefits and costs associated with each option. Potential flood impacts should be included in this process (refer to the *Brisbane Water Foreshore Coastal Floodplain Risk Inundation Management Study and Plan*). Identify the preferred option.
- Consider the need to undertake further detailed investigations (e.g. hydraulic modelling).

Action W124: Improve access and enhance riparian vegetation in Dell Road Reserve, West Gosford

Action W124 proposes working with the NSW Recreational Fishing Alliance to enhance the recreational amenity of Dell Road Reserve on Narara Creek. The proposal centres around the construction of a recreational fishing platform with disabled access, lighting, interpretive signage and bank restoration works. Ancillary works that could also be included within the proposal include a soft launching area for passive watercraft such as kayaks, public amenities (seating and benches) and a sealed parking area with appropriate traffic controls. Potential environmental benefits associated with the project include reduction in impacts on the EEC located in Dell Reserve, bank stabilisation and a reduction in erosion and sedimentation from both the banks and unsealed/exposed areas.

The implementation process would involve the following steps:

- Undertake liaison with relevant stakeholders and select a preferred proposal.
- Seek grant funding for the works.
- Develop a concept design and prepare preliminary costings.
- Consider the need for any environmental approvals, permits or licences.
- Seek landowner consent from the Crown Lands Division.
- Develop detailed design.
- Engage a contractor to undertake the work.

Management Zone 2 – The Broadwater

The top 5 actions proposed for implementation in Zone 2 have been mapped in **Figure 3.2**. The implementation process for each action is provided below.

Action P05: Investigate the need for sediment traps and other stormwater management measures opposite Byalla Lane, Saratoga

During the preparation of the *Estuary Management Study* (Cardno, 2010), Council staff identified that there was a risk of erosion from sloping lands draining to the stormwater outlet opposite Byalla Lane in Saratoga.

This action was subject to a more detailed assessment via catchment modelling (MUSIC) as described in Appendix G of the *Estuary Management Study* (Cardno, 2010). Action P05 was modelled as a GPT (CDS Unit). The modelling showed that, based on the catchment characteristics, the system had the potential to retain 1,862 kg of Total Suspended Solids

per year from its 8ha sub-catchment. The modelling showed that it was unlikely to be effective at reducing nutrient loads in stormwater runoff. The installation of this GPT would not likely have a significant impact on water quality in the estuary, but may provide local benefits in terms of sedimentation, particularly for *Posidonia* and *Zostera* seagrass beds that occur in this area.

This action would be dependent on the outcomes of Actions R24 and W01. This action should be identified within the WSUD strategy being prepared under Action W01, and should be prioritised for implementation under that activity (see **Section 3.3.1**)

The implementation process would be as follows:

- Conduct a site inspection to assess site constraints and opportunities.
- Conduct ground level survey (as required).
- Consider the need to refine the existing catchment modelling to optimise the design of the chosen WSUD feature.
- Develop a concept design and prepare preliminary costings.
- Consider the need for any environmental approvals, permits or licences.
- Develop a detailed design.
- Engage a contractor to install the GPT.
- Incorporate the GPT into Council's program of maintenance.

Action R14: Investigate options for upgrading the seawall along Mason Parade and Dane Drive, Gosford

Issues associated with the seawall running along Mason Parade and Dane Drive include:

- Overtopping by waves,
- Collapse and/or scouring behind the seawall,
- Obstruction of access to the waterway.

This action proposes an investigation of options for upgrading (either in part or in full) the seawall to address these issues. This should be undertaken in line with the Gosford Challenge/City Centre re-development. The investigation should also consider ways in which to incorporate environmentally friendly design features in accordance with the guidelines for *Environmentally Friendly Seawalls* (DECC, 2009), and to incorporate features (e.g. stepped revetment) to provide public access or improve amenity (where possible).

Reference should be made to the linked Actions P48 and W69.

The implementation process should be undertaken by a suitably qualified coastal engineer:

- Conduct an audit of the existing structure to ground-truth the reported issues.
- Conduct ground level survey to pick up all existing infrastructure (incl. stormwater).
- Undertake stakeholder consultation to identify issues and consider community needs.
- Identify suitable design parameters and conduct preliminary assessment of options.
- Identify the preferred option on the basis of technical feasibility, potential environmental impacts and cost of implementation.

- Consider the need for any permits, licences or environmental approvals to undertake the works.

Action W41: Undertake foreshore stabilisation works in the Punt Bridge area, Central Coast Highway, East Gosford

One of the issues identified in the *Estuary Management Study* (Cardno, 2010) was an observed loss of vegetation and shoreline erosion near Punt Bridge, along the Central Coast Highway in East Gosford. This action provides for further investigation of the issue and development of works to stabilise the foreshore where erosion is occurring, preferably through revegetation.

Reference is made to Action W34 (see **Section 3.3.1**), under which this action would be prioritised.

The implementation process should include:

- Provide information to the local residents on the project and its objectives.
- Conduct an assessment of the foreshore condition.
- Assess processes impacting on the shoreline.
- Consider options to address the erosion, preferably stabilisation with vegetation.
- Select suitable locally endemic species for any bank stabilisation or any revegetation works required.
- Work with volunteers (e.g. Bushcare group) to plant the vegetation.
- Provide for ongoing maintenance of the bank stabilisation works and replanting of the vegetation as required.
- Brief Council's parks maintenance staff on suitable vegetation management techniques for this site, including guidance on acceptable mowing practices.

Action W77: Investigate alternative dinghy storage arrangements, Mason Parade, Gosford

One of the issues identified during the *Estuary Management Study* (Cardno, 2010) was that dinghies are currently being stored inappropriately near the Scout Hall on Mason Parade, Gosford. This action could be implemented as a priority site under Action P35, which relates to Council's Foreshore Reserves Dinghy Storage Implementation Plan.

The implementation of this action should be in accordance with Council's Plan, but may include:

- Conduct a site inspection to assess site constraints and opportunities.
- Select preferred location for dinghy storage.
- Conduct ground level survey (as required).
- Develop a concept design and prepare preliminary costings.
- Seek community input on the proposed design.
- Consider the need for any environmental approvals, permits or licences.
- Develop detailed design.
- Engage a contractor to undertake the work.
- Provide for ongoing enforcement of use of the facility.
- Provide for ongoing maintenance of the facility.

Action W104: Improve public access along the foreshore reserve between Ironbark Point and Rocky Point, Green Point

There is need to improve public access along the foreshore in the reserve between Ironbark Point and Rocky Point, at Green Point. In particular, there is a section of the shoreline located behind the houses on Asca Drive that is quite narrow. The feasibility of installing a boardwalk, undertaking foreshore stabilisation works and/or creating a public path in this location was therefore suggested as an Action in the Plan.

Reference is made to linked Action W82, which provides for a strategic approach to providing access along the estuary foreshores.

The implementation process for this action would be as follows:

- Conduct a site inspection to assess site constraints and opportunities.
- Consider the available options for improving public access along this section of the foreshore. At this stage, the feasibility of the preferred option should be considered.
- Conduct ground level survey (as required).
- Develop a concept design and prepare preliminary costings.
- Seek community input on the proposed design.
- Consider the need for any environmental approvals, permits or licences.
- Develop detailed design.
- Engage a contractor to undertake the work.

Management Zone 3 – The Woy Woy Reach

The top 5 actions proposed for implementation in Zone 3 have been mapped in **Figure 3.3**. The implementation processes for each action are provided below.

Action R16: Identify the cause of erosion under the bridge near Lara Street, Koolewong, and undertake measures to address this issue

During the *Estuary Management Study* (Cardno, 2010) a section of shoreline erosion under the bridge near Lara Street was identified. This action provides for investigation of the cause of the observed erosion and development of a suitable measure to address this issue.

Reference is made to Action W34 (see **Section 3.3.1**), under which this action would be considered.

Implementation should involve:

- Conduct a condition audit of the foreshore under the bridge.
- Assess processes impacting on the shoreline and establish design parameters.
- Consider the available options for stabilisation of the foreshore.
- Recommend a preferred option(s).
- Consider the need for any environmental approvals, permits or licences.
- Develop detailed design.
- Engage a contractor to undertake the work.
- Develop program for ongoing maintenance of the chosen option (as required).

Action W04: Investigate appropriate stormwater control measures to reduce sedimentation in Correa Bay

There have been observations of large sediment loads in catchment flows draining from Woy Woy Creek into Correa Bay after wet weather. This action provides for an investigation of potential stormwater control measures aimed at providing some pre-treatment of stormwater flows before they reach Correa Bay.

One potential activity for implementation under this action was subject to a more detailed assessment via catchment modelling (MUSIC), as described in Appendix G of the *Estuary Management Study* (Cardno, 2010). A bio-retention system of approx. 12,000m^2 was modelled to assess the potential to treat flows from that portion of the catchment draining to Correa Bay that contains the Bulls Hill Quarry. The modelling showed that such a system had the potential to retain a significant portion of Total Suspended Solids (estimated at nearly 70,000kg TSS per year). This was considered likely to result in a significant local water quality benefit, and indicates the potential to improve stormwater treatment for the sub-catchment(s) draining to Correa Bay.

This action should be implemented as part of a larger WSUD strategy for the estuary catchment (Action W01, see **Section 3.3.1**).

The implementation process for this site would involve:

- Conducting a site inspection to identify sediment sources, and assess site constraints and opportunities.
- Considering the need to conduct additional catchment modelling to assess potential sediment sources and options to reduce sediment loads in stormwater runoff.
- Identification of a preferred stormwater control measure.

Action W07: Provide for maintenance of existing sediment traps in Horsfield Bay catchment

This action provides for the ongoing maintenance of existing sediment traps located within the sub-catchment draining to Horsfield Bay. This action was suggested by the community in an effort to reduce sedimentation issues that are thought to be impacting on navigation.

Consider implementing as part of a larger WSUD strategy for the estuary catchment (Action W01, see **Section 3.3.1**).

The implementation process would involve:

- Review the existing maintenance arrangements for the sediment traps.
- Consider the need to modify the maintenance program via increasing the frequency or modifying the methods.
- Establish more rigorous visual inspection schedules to inform this process.

Action W21: Dredge from the Correa Bay boat ramp to the entrance of Woy Woy Creek, to extend 300 m up the creek channel

Issues identified during the *Estuary Management Study* (Cardno, 2010) included references to sedimentation in Correa Bay and resultant impacts on boating access in

Correa Bay. It is thought that this issue is caused by high sediment loads being delivered to the estuary from Woy Woy Bay. Stormwater management to address the cause of the sedimentation would be undertaken under Action W01, whereas this action provides for some dredging works to improve drainage in the creek and improve access.

The implementation process would involve:

- Assess the need to obtain up to date hydrosurvey of the area of investigation.
- In consultation with the community and OEH, consider the navigation requirements, drainage requirements and the desired channel configurations.
- Consider the need for additional studies (e.g. of sediment quality).
- Consider suitable means of disposal or re-use of dredge spoils.
- Develop concept options.
- Conduct modelling of the concept options to assess the sustainability of the option and identify a suitable disposal site for the dredge spoils.
- Select the preferred option.
- Obtain the necessary environmental approvals, permits and licences.
- Engage a contractor to undertake the work.
- Undertake post-dredge/works as executed survey.

Action W59: Investigate the feasibility of decommissioning the dam at the former abattoir site

The community has raised concerns over the effects of the dam located at the site of the former abattoir on flows in Woy Woy Creek. It is considered that the dam may have reduced flows in the creek, with the effect of contributing to sedimentation in the creek channel. This action aims to decommission the dam, thereby restoring these flows to the creek.

It is recommended that a feasibility study be undertaken against the project objectives prior to proceeding. The feasibility study should consider:

- Confirming current ownership of the site.
- Sourcing design drawings of the existing dam.
- The potential hydraulic and geomorphic impacts.
- Any other impacts associated with decommissioning the dam.

Management Zone 4 – The Central Reach

The top 5 actions proposed for implementation in Zone 4 have been mapped in **Figure 3.4**. The implementation process for each action is provided below.

Action W35: Investigate appropriate sediment control works to address sediment accretion issues at St Huberts Island

The foreshores and canals of St Huberts Island are affected by sediment erosion and accretion in different locations. To a large extent this is due to the impact on sediment transport processes of various foreshore structures, such as seawalls and boat ramps. This action allows for further investigation of these processes and consideration of suitable measures to address these issues.

This action originally provided for implementation of the preferred sediment management measures. However, it is considered that further investigation is required prior to implementation, particularly with regard the technical feasibility or sustainability of the recommended measure and potential environmental impacts. Cost estimates for implementation are also difficult to derive without further consideration of the desired approach.

Reference should be made to linked Actions P08 and W19.

The implementation process would involve:

- Conduct an audit of the entire foreshore of St Huberts Island to identify existing foreshore structures and assess the shoreline condition/alignment.
- Quantify the local sediment transport processes for each location.
- Conduct ground level/hydrosurvey (as required).
- Develop a series of concept options for consideration of technical feasibility, cost and potential environmental impacts.
- Identify preferred option(s) and provide recommendations for implementation.

Action W43: Upgrade/repair the currently failing seawall in Memorial Park, Brick Wharf Road

The seawall located along Memorial Park on Brick Wharf Road is currently collapsing. It is thought the seawall has been in place for 30 years or more and it is understood that a number of repairs have been made over this period. An action to repair or upgrade the seawall has been developed. This action should consider opportunities to incorporate environmentally friendly features in the seawall.

These works would be dependent upon the outcome of Action W34.

The implementation process would involve:

- Conduct a condition audit of the existing seawall.
- Establish design parameters for the seawall.
- Conduct ground level survey to pick up all existing infrastructure (incl. stormwater).
- Develop a series of concept options for consideration of technical feasibility, source materials, cost and potential environmental impacts. The concept options should also consider environmentally friendly features where possible.
- Recommend a preferred option and consult with the community.
- Consider the need for any environmental approvals, permits or licences.
- Develop detailed design.
- Engage a contractor to undertake the work.
- Develop program for ongoing maintenance of the structure.

Action W45: Stabilise the foreshore of Palermo Reserve, Empire Bay Drive, Daleys Point

This issue was identified during the *Estuary Management Study* (Cardno, 2010) and relates to the shoreline recession along Palermo Reserve, Empire Bay Drive, Daleys Point. There is a large stormwater outlet located roughly in the middle of Palermo Reserve shoreline.

Concrete sheets have been constructed in a revetment or retaining wall formation south of the stormwater outlet, and this structure appears to be failing in places. The northern shoreline of the reserve is not formally protected and a small erosion scarp is visible.

This action proposes stabilisation of the foreshore where erosion is occurring. An assessment of the existing structure, which is understood to be located on public land, has also been incorporated.

These works would be dependent upon the outcome of Action W34.

The implementation process would involve:

- Conduct a condition audit of the foreshore and the existing structure.
- Assess processes impacting on the shoreline (incl. the stormwater outlet) and establish design parameters.
- Assess the potential impacts of the stormwater outlet on the shoreline.
- Consider the available options for stabilisation of the foreshore, including removal of the existing structure and stabilisation with vegetation.
- Recommend a preferred option.
- Consider the need for any environmental approvals, permits or licences.
- Develop design.
- Undertake the work.
- Develop program for ongoing maintenance of the chosen option.

Action W46: Investigate the cause of erosion around the Blackwall Point boat ramp

During the *Estuary Management Study* (Cardno, 2010) a section of shoreline erosion around the Blackwall Point boat ramp off Orange Grove Road was identified. The road accessing the boat ramp is also being impacted by the erosion. This action provides for investigation of the cause of the observed erosion and development of a suitable measure to address this issue.

Reference should be made to linked Action W34.

The following activities should be considered for implementation:

- Conduct a condition audit of the foreshore and road adjacent to the boat ramp.
- Assess processes impacting on the shoreline and establish design parameters.
- Consider the available options for stabilisation of the foreshore and repairing the access road.
- Recommend a preferred option(s).
- Consider the need for any environmental approvals, permits or licences.
- Develop detailed design.
- Remove any waste material (road base, concrete, etc) for recycling or disposal.
- Engage a contractor to undertake the work.
- Develop program for ongoing maintenance of the chosen option.

Action W49: Implement foreshore stabilisation works near Rip Road Reserve, Blackwall

Shoreline erosion has been observed near Rip Road Reserve, Blackwall. This action provides for stabilisation of the foreshore where erosion is occurring.

Reference is made to Action W34 (see **Section 3.3.1**), under which this action would be considered.

The implementation process would involve:

- Provide information to the local residents on the project and its objectives.
- Conduct an assessment of the foreshore condition.
- Assess processes impacting on the shoreline.
- Consider options to address the erosion, preferably stabilisation with vegetation.
- Based on a cost:benefit assessment, select a preferred option, or suite of options, to stabilise the eroding foreshore.
- Consider the need for any environmental approvals, permits or licences.
- Engage a contractor to undertake the work.
- Provide for ongoing maintenance activities as required.

Management Zone 5 – Kincumber/Cockle Bay

The top 5 actions proposed for implementation in Zone 5 have been mapped in **Figure 3.5**. The implementation process for each action is provided below.

Action C03: Improve stormwater management practices in the industrial estate near Hawk Street

It is understood that Council experiences difficulty in maintaining the stormwater pipes in the region of the Hawk Street due an accumulation of pollution/debris thought to be originating from the industrial estate. Council is seeking an opportunity through implementation of this action to work with the owners and tenants occupying the industrial estate to improve their stormwater management practices. It provides primarily for education and liaison rather than any structural options or other engineering works.

Implementation process:

- Collate information on (or conduct an audit of) the types of pollution/materials currently affecting the functioning of the stormwater system near Hawk Street.
- Seek to confirm the source of the material based on the catchment for the relevant portion of the stormwater network and types of activities undertaken on the estate.
- In consultation with OEH, compile information on the Environment Protection Licences issued for premises located within the industrial estate. Consider the need to audit any licensed premises.
- Work with OEH to develop a consultation strategy.
- Prepare or compile any materials on best practice stormwater management for industrial sites and provide advice on their legal obligations with respect to pollution.
- Work with OEH to undertake a compliance audit of each of the properties located within the industrial estate. This need not necessarily comprise an audit against the

conditions of an Environment Protection Licence, but may be viewed as an education exercise or information session about best practice measures for stormwater management.

- On the basis of the previous exercise, make recommendations to the owners/occupiers about specific measures they may wish to consider. This should include consideration of maintenance requirements for any new or existing measures.
- Allow for follow up visits to assess whether any specific measures have been implemented and, if so, how successful they have been.
- Conduct ongoing audits of the operation of Council's stormwater system (e.g. volumes/types of pollutants observed at periodic maintenance intervals) and report the results to residents of the estate.

Action W15: Seal the Hawk Street car parks

Material from unsealed car parks located along Hawk Street has been observed washing into Kincumber Creek. This action aims to seal the car parks in order to minimise the mobilisation of sediments and other material into the creek. The use of permeable pavement is recommended.

Reference should be made to linked Actions W01 and R26.

Implementation process:

- Conduct site assessment including ground level survey.
- Develop conceptual design for the car park pavement incorporating WSUD features.
- Consider the need for any environmental approvals, permits or licences.
- Develop detailed design.
- Remove and dispose of existing car park surface.
- Engage a contractor to undertake the work.

Action W47: Investigate appropriate and cost effective method to remediate any scouring currently occurring of the existing seawall at Illoura Reserve, Davistown

Scouring is currently occurring behind the seawall in Illoura Reserve. Furthermore, it is considered that the design of the existing structure permits vandalism/tampering, which is thought to be contributing to the erosion issue. The seawall is actually comprised of two different types of structures along approx. 1km of shoreline. This action provides for an assessment of the existing structure(s) and assessment of the current maintenance regime to address any observed issues.

These works would be dependent upon the outcome of Action W34.

This action should include the following activities:

- Conduct a condition audit of the existing seawall.
- Review the existing maintenance regime for this structure and identify any required modifications.
- Consider the need for any further works to stabilise the structure.

Action W48: Enhance foreshore vegetation to prevent further erosion of Illoura Reserve between Lintern Street and Malinya Road, Davistown, and along the western/northern foreshore of Kincumber Broadwater.

Shoreline erosion has been observed behind Malinya Road south of Lintern Street. This action provides for works to enhance the foreshore vegetation at the affected locations. It is understood that the open space adjacent to this section of foreshore is periodically inundated by higher tides, which suggests there is an opportunity to establish saltmarsh vegetation in this location.

Reference is made to the linked Action W47 (see above). It is recommended that this site be assessed at the same time as Action W47 is being implemented, if possible.

Reference should also be made to linked Action P14 and these works would be dependent upon the outcome of Action W34.

The following activities are recommended for implementation:

- Provide information to the local residents on the project and its objectives.
- Conduct an assessment of the condition of the foreshore and foreshore vegetation.
- Assess opportunities to enhance the condition of the existing vegetation and increase its extent. The use of salt tolerant vegetation, preferably saltmarsh species is recommended.
- Identify opportunities to promote the project for public education purposes, such as via interpretive signage or by involving volunteers in the works.
- Provide for ongoing maintenance and replanting of the vegetation as required.
- Brief Council's parks maintenance staff on suitable vegetation management techniques for this site, including guidance on acceptable mowing practices.

Action W116: Dredge to improve navigation and access to boat ramps in Cockle Channel, Davistown

There are a number of dredging scenarios available that may achieve the action objectives, and these were considered in some more detail in the Brisbane Water Dredging CLAM, which was discussed in Appendix H of the *Estuary Management Study* (Cardno, 2010). The scenarios considered include:

- *Dredging of the western portion of Cockle Channel*. Cockle Channel is the only waterway access passage to Kincumber Broadwater and Cockle Bay. Bar migration across the western end of Cockle Channel has been identified as resulting in a navigational hazard. Dredging of this area would require approximately 8,500m^3 of sediment removal to achieve the design depth.
- *Dredging to improve access to the Davistown boat ramp*. Continuing siltation has been identified in the vicinity of the Davistown boat ramp. This has restricted boat access and utilisation of the facility. Dredging down to the desired depth would require 1,000m^3 of sediments to be removed. Seagrass beds are located within the proposed dredging footprint, which may limit the amount of dredging that could be undertaken. The presence of *Posidonia* and *Zostera* seagrass beds should be confirmed for this location.

- *Dredging of the eastern portion of Cockle Channel*. Community consultation identified that medium sized craft (1m draft) cannot pass through the eastern end of the channel below half tide. Dredging of this area would be required to re-establish full time long-term navigability of the channel. Approximately 6,000m^3 of dredging would be required to establish a 30m wide channel.

Reference is made to linked Actions R09 and P07.

Implementation of this action would involve:

- Conduct hydrosurvey of the area of investigation.
- In consultation with the community, OEH and DPI (Fisheries), confirm the navigation requirements and the desired channel configurations.
- Consider constraints (e.g. sediment quality) and opportunities (pot. link with nourishment works).
- Refine the concept options presented in Appendix H of Cardno (2010) as required.
- Consider the need to update the existing modelling of the concept options to assess the sustainability of the option and identify a suitable disposal site for the dredge spoils.
- Obtain the necessary environmental approvals, permits and licences.
- Engage a contractor to undertake the work.
- Undertake post-dredge/works as executed survey.
- Undertake regular hydrosurvey of the channel and relocate the navigation markers and required.

Management Zone 6 – The Entrance Reach

The top 5 actions proposed for implementation in Zone 6 have been mapped in **Figure 3.6**. The implementation process for each action is provided below.

Action R11: Investigate sedimentary processes to determine appropriate long term management strategies for the foreshore between Ferry Road Ettalong and eastern most point of Booker Bay foreshore.

Shoreline recession has been an issue at Ettalong Beach for a number of years and it is understood that this can impact on public access and recreational amenity for beach users. Shoreline erosion along the stretch of Ettalong Beach to the southwest of Ferry Road is currently being addressed by Council. Therefore, this action has been refined to involve an investigation of sedimentary processes to determine appropriate long term management strategies to maintain property protection and public access along the foreshore between Ferry Road, Ettalong, and the eastern-most point of Booker Bay foreshore. In some locations the shoreline appears to have eroded back to the property line, threatening the property and impacting on public access along the foreshore. There are some small sections of foreshore for which it protection works have been established.

The investigation should be undertaken by a suitably qualified engineer and should consider:

- Review the existing reports and other relevant documents relating to coastal processes at this location.
- Consider the need to obtain up to date survey of the beach and nearshore area.

- Consider the need to update any existing computer models or undertake additional model in order to obtain an improved understanding of physical processes in this location.
- The investigation should also consider the potential impacts of climate change on the shoreline.
- Develop a series of preliminary concept options to improve shoreline stability and public access along the shoreline.
- Undertake a cost:benefit analysis of the concept options. This process should be undertaken in consultation with the relevant stakeholders and the community.
- Identify the preferred option, or suite of options, on the basis of technical feasibility, potential environmental impacts and cost of implementation (including environmental approvals).

Action W18: Periodically dredge the navigation channel

Navigation through the entrance to the estuary can at times be difficult due to the propagation of a flood tide delta. The navigation channel markers are periodically relocated by NSW Maritime as required, but navigation can become difficult due to the strong currents in this region. This leads to issues with boating safety and access can be restricted for some tidal conditions.

The community is also concerned that sedimentation at the entrance has impacts on the tidal flushing of the estuary upstream of this point, and also that tidal velocity in the main channels decreases resulting in reduced scour, thereby exacerbating the sedimentation issues throughout the channels in the estuary.

Reference is made to linked Actions R09 and W28, which relate to the need to obtain regular hydrosurvey and potential for beach nourishment with the dredge spoils (respectively).

A more detailed assessment of coastal processes in this part of the estuary is provided in Cardno (2007). It is understood that the propagation of these flood tide shoals is an ongoing process and therefore regular maintenance dredging of the entrance channel would be required. There are a number of dredging scenarios available that may achieve the action objectives, and these were considered in some more detail in the Brisbane Water Dredging CLAM, which was discussed in Appendix H of the *Estuary Management Study* (Cardno, 2010).

The concept details for this action are for a generic dredging scenario involving the removal of approximately 50,000m^3 of material from the entrance channel, although the optimal volume to be dredged is highly dependent upon the chosen dredge campaign. Furthermore, it is noted that the cost of implementation is highly dependent upon the volume dredged.

The implementation process is as follows:

- Conduct hydrosurvey of the area of investigation.
- In consultation with the community and OEH, consider the navigation requirements and the desired channel configurations.

- Consider constraints (e.g. sediment quality) and opportunities (potential to link with nourishment works).
- Develop concept options.
- Conduct modelling of the concept options to assess the sustainability of the option and identify a suitable disposal site for the dredge spoils.
- Conduct cost:benefit analysis.
- Select the preferred option.
- Obtain the necessary environmental approvals, permits and licences.
- Engage a contractor to undertake the work.
- Undertake post-dredge/works as executed survey.
- Undertake regular hydrosurvey of the channel and relocate the navigation markers and required.

Action W26: Rehabilitate the eroding eastern foreshores of Hardys Bay with vegetation

The eastern shore of Hardy's Bay near Hardys Bay Parade is currently affected by shoreline erosion and local residents have observed trees falling into the water. This action seeks to stabilise the foreshore via the establishment of vegetation.

Reference is made to linked Actions E09 and P49.

The implementation process is:

- Provide information to the local residents on the project and its objectives.
- Conduct an assessment of the foreshore condition and assess processes causing erosion.
- Select suitable locally endemic species.
- Work with volunteers (e.g. Bushcare group) to plant the vegetation.
- Provide for ongoing maintenance and replanting of the vegetation as required.
- Brief Council's parks maintenance staff on suitable vegetation management techniques for this site, including guidance on acceptable mowing practices.

Action W28: Undertake beach nourishment works at Ettalong Beach

As identified in relation to Action R11, Ettalong Beach experiences shoreline recession. Should the outcome of Action R11 identify it as an activity for implementation, Action W28 would involve nourishment of the beach with sand. As with the dredging activity (Action W18 above), the works would require ongoing maintenance.

Reference should also be made to Actions P12, W29, W55 and W112.

The implementation process is:

- Review available reports, photogrammetry and other relevant information.
- Consult with Council, OEH, the Crown Lands and Fisheries Divisions within the DPI, and the community about the desired beach characteristics.
- Conduct any additional detailed investigations of morphological processes at the beach as required.
- Develop design profiles for the beach.

- Identify a suitable source of sand (reference is made to Action W18 in this regard).
- Obtain the relevant environmental approvals, permits and licences as required.
- Obtain a pre-works survey.
- Engage a contractor to undertake the works.
- Obtain a works as executed survey.
- Undertake periodic monitoring of the beach volume as required.

Action W29: Implement structural shoreline protection works at Ettalong Beach

As identified in relation to Action R11, Ettalong Beach experiences shoreline recession. Action W29 would involve construction of an engineered structure to protect the shoreline from further erosion.

Reference should also be made to Actions P12, W28, W55 and W112.

The cost of implementation is highly dependent upon the length of seawall constructed and the design details. For the purposes of this report, the proposal has been assumed to consist of a seawall/revetment of approx. 520m in length between Ferry Road and Picnic Parade, with a second seawall of approx. 400m to replace the existing stone seawall located between the Beach Street stormwater drain and the Lemon Grove stormwater drain.

The implementation process for these works would involve:

- Consult with Council, OEH, the Crown Lands and Fisheries Divisions within the DPI and the community about the form and features of the proposed structure.
- Conduct any additional investigations of morphological processes at the beach as required, including consideration of potential climate change impacts.
- Develop concept designs.
- Identify potential sources of materials and consider the implications for cost of implementation and maintenance requirements.
- The materials used to form the existing seawalls/revetments should be reused where possible, or sent to a suitable disposal/recycling facility. Consider the implications for the cost of implementation.
- Select a preferred concept design, to be informed by a cost:benefit analysis.
- Develop detailed design.
- Obtain the relevant environmental approvals, permits and licences as required.
- Engage a contractor to undertake the works.
- Obtain a works as executed survey.
- Develop guidelines for ongoing monitoring and maintenance of the structures.

3.4 Monitoring and Evaluation

The *Estuary Management Manual* (NSW Government, 1992) espouses an adaptive management approach that identifies the need to monitor and review the management process during the implementation of the Plan, and this is included as Stage 8 of the Estuary Management Process (**Section 1.1**). It is recommended that the monitoring and implementation of the Plan be reported on an annual basis as outlined in Action R36 (**Appendix B**).

For the purposes of the Plan, this has been interpreted as relating to both:

- Monitoring of the outcomes of implementation of the Plan; and
- Ongoing monitoring of the general condition (or 'health') of the estuary, use of the estuary and its foreshores by the community, including the impacts of climate change on the estuary.

Section 3.4.1 provides an overview of how the implementation of the Plan will be monitored and includes performance indicators for each of the management goals. **Section 3.4.2** provides a more general discussion of estuarine monitoring in relation to the estuary condition or estuarine 'health'.

3.4.1 Performance Indicators for Implementation of the Plan

A series of Key Performance Indicators (KPIs) have been developed to allow the Coastal and Estuary Management Committee to measure whether the actions implemented under the Plan have been successful in working towards achievement of the management goals (**Table 3.2**). Some KPIs rely on indicators that would be informed by the estuarine health monitoring program (**Section 3.4.2**), whereas others are either qualitative, or rely on other sources of information.

It is important to note that reference conditions may require refinement for some of these KPIs, and where this is the case, it has been indicated in **Table 3.2**. In some cases, the data that is used to inform the reference condition may be available, but may not have been subjected to the necessary analysis (e.g. data on recreational fish catches). Additional analysis may be required, or an existing monitoring program modified, to assist in establishing suitable reference conditions for the purposes of applying these performance indicators.

These KPIs should be assessed after a period of 5 years, and a decision made by the Coastal and Estuary Management Committee as to whether it is necessary to update Plan. This process will assist the Committee in determining whether the actions list needs to be updated, and additional actions translated over from the larger actions list (**Appendix A**) to the implementation strategy (**Appendix B**) for the forthcoming implementation period. This process should also be informed by the findings of the estuarine health monitoring program, particularly with respect to any emerging issues.

Table 3.2: Performance Indicators

Issue	Key Performance Indicators
Water and Sediment Quality	
Aquatic ecosystem health	▪ Reference conditions for the estuary are established for chlorophyll a concentrations. This should be undertaken in accordance with the ANZECC/ARMCANZ (2000) guidelines and should meet the requirements of the NSW MER program. ▪ Monitoring data from representative sites within the estuary complies with the ANZECC/ARMCANZ (2000) guidelines for physical and chemical stressors for south-east Australian estuaries for 90% of dry weather samples collected. It may be necessary to validate these

Issue	Key Performance Indicators
	performance indicators against baseline conditions for the estuary. ▪ Reduction in the number of samples collected annually that exceed the ANZECC/ARMCANZ (2000) guidelines for toxicants.
Aquatic recreation	▪ Monitoring data collected at representative sites within the estuary complies with the ANZECC/ARMCANZ (2000) guidelines for primary and secondary contact recreation, and for aesthetic values.
Aquaculture	▪ Oyster depuration requirements (i.e. total no. of days) are reduced due to an improvement in estuarine water quality.
Accidental spills	▪ The incidence of accidental spills occurring in the estuary and its catchment are reduced (as recorded by OEH via the Pollution Line).
Sedimentary Processes	
Sedimentation	▪ Background sedimentation rates are established for key sites affected by sedimentation based on analysis of sediment cores. ▪ There is a reduction in suspended sediment loads in stormwater runoff (measured as concentrations of TSS) from those catchments identified as having elevated loads in the *Estuary Processes Study* (Cardno, 2008).
Foreshore erosion	▪ There is a reduction in the extent of eroding shoreline along the estuary foreshores and tributaries. ▪ Existing foreshore protection structures are maintained to their design criteria.
Navigation	▪ The community has a greater appreciation of natural sedimentary processes and how they impact on the navigability of the waterway. ▪ Channel markers are relocated and up to date information on the status of key navigation channels is provided in a timely fashion to the community to avoid any boating safety issues. This results in a decrease in the number of complaints/issues relating to navigation recorded by NSW Maritime and Council.
Foreshore Flooding	
Maintenance of ecosystem viability	▪ A triple bottom line approach is adopted in the assessment of any measures proposed to mitigate foreshore flooding or inundation that explicitly incorporates consideration of impacts on estuarine processes (physical, water quality and ecological). This may be evidenced though cost:benefit analyses.

Issue	Key Performance Indicators
Habitat and Species Conservation	
Habitat loss and degradation	▪ There is an increase in the overall extent and percentage cover of foreshore, aquatic and riparian vegetation particularly along the major tributaries. ▪ The characteristic suite of vegetation types found in and around the estuary (and along the riparian zones of the major tributaries) is maintained into the future. ▪ Aquatic habitats such as intertidal mudflats and rock platforms are recognised as important habitats and conserved (within relevant development control plans or other Council policies or plans).
Ecological connectivity	▪ Ecological connectivity is increased via the linking of discrete patches of habitat. ▪ Environmental flows/tidal exchange is maintained (and restored where possible).
Biodiversity conservation	▪ Protected vegetation communities (such as SEPP14 Wetlands and EECs) continue to be afforded protection. ▪ Fishing activities do not place undue pressure on fish populations, as evidenced by monitoring of fish populations. ▪ Occurrences of introduced animal species are reduced. ▪ There is a reduction in weed coverage in foreshore and riparian vegetation. ▪ There is a reduction in the number of observations/extent of *Caulerpa taxifolia* and other aquatic pest species in the estuary. ▪ Council adopts a strategic approach to biodiversity conservation taking into account the potential impacts of climate change (as evidenced within strategic plans etc.).
Cultural Heritage	
Heritage Conservation	▪ Ongoing protection is provided for sites and places of Aboriginal and European cultural heritage. ▪ The history of Aboriginal and European use and occupation of the estuary and its catchment is commemorated.
Visual Amenity and Landscape Character	
Landscape Character	▪ The landscape character of the estuary and its catchment are maintained through strategic land use planning. ▪ The visual character of the estuary and its catchment is promoted.
Visual Amenity	▪ The potential visual impacts of any development proposals are considered as part of a comprehensive triple bottom line assessment.

Issue	Key Performance Indicators
Recreational Usage	
Conflicts between users	▪ Reported incidences of conflicts (to Council, NSW Maritime or the NSW Police) between different recreational users are reduced.
Impacts on estuarine ecology	▪ Recreational facilities are provided at strategic locations around the estuary that do not unduly impact on the biodiversity values of the estuary.
Access	▪ There is an increase in the extent of foreshore that is publically accessible. ▪ There is an increase in the extent and continuity of the existing network of pedestrian pathways and cycleways.
Foreshore Development	
Impacts on estuarine processes	▪ Non-compliant or inappropriate foreshore developments are identified and reported on. ▪ Development applications for foreshore land explicitly consider the objectives of this Plan. ▪ Foreshore residents have improved awareness of estuarine processes and how these may potential impact on their land.
Access	Opportunities to improve public access to the foreshore are realised through the planning and development assessment process. There is a reduction in the extent of foreshore that is inaccessible to the public.
Commercial Development	
Sustainability	▪ Commercial development explicitly considers the principles of Ecologically Sustainable Development in the Development Assessment process.
Ecotourism	▪ The natural heritage of the estuary is promoted to attract tourists to the region.
Governance	
The Plan	▪ Council and the membership of the Coastal and Estuary Management Committee work collaboratively to implement this Coastal Zone Management Plan. ▪ The Plan is updated on a regular basis every 5-10 years to reflect changing conditions in estuary health/processes, uses of the estuary by the community, and progress with implementation.

Issue	Key Performance Indicators
Information, Communications and Education	
Community Involvement	▪ The community has a greater appreciation of the biodiversity values associated with the estuary. ▪ The community are involved in monitoring of the estuary condition and implementation of the Plan.
Reporting	▪ The progress of implementation of the Plan is reported on periodically.

3.4.2 Estuarine Monitoring

Monitoring may also be undertaken for the purposes of assessing trends in estuarine health/condition, and for assessing the effectiveness of management actions implemented under the Plan. Further discussion on each of these two different types of monitoring is provided below.

Estuarine Condition

The key objectives for monitoring of estuarine condition are to:

- Establish baseline conditions for the estuarine condition;
- Track trends in estuarine condition; and
- Compliance reporting (e.g. for aquatic recreational usage).

There is currently a range of information available on estuarine condition, such as the *Brisbane Water Estuary Processes Study* (Cardno, 2008), which includes high quality data on various aspects of estuary health and function in terms of physical, biological and human user processes. This should be used to benchmark estuarine condition at that time, and assist in detecting future trends.

Monitoring of estuarine condition should seek to obtain data that may be assessed against these objectives. It is noted, however, that compliance monitoring serves a different function than monitoring of estuarine condition. This is generally reflected in the different kinds of sampling regimes proposed for these two types of activities and compliance monitoring may not be useful for understanding estuarine processes.

Those activities that are important in understanding estuarine condition have been identified as actions in the Plan. These include, for example:

- Action R40: Monitor estuarine water levels (undertaken by OEH); and
- Action R22: Monitor the extent of estuarine vegetation (undertaken by DPI).

There are a number of monitoring activities currently undertaken by Council, such as water quality monitoring. Action R01 provides for a review of this program and updating of the sampling methodology (as required) to meet the three objectives for monitoring outlined above. Other activities important for collating and analysing monitoring data include Action R39, which relates to the establishment of a database for the monitoring data.

NSW Monitoring, Evaluation and Reporting Strategy

Any monitoring undertaken should consider the relevant components of the *NSW Natural Resources Monitoring, Evaluation and Reporting Strategy 2010-2015* (DECCW, 2010a; known as the MER). The purpose of the Strategy is to re-focus and coordinate the efforts of the various organisations undertaking natural resource management in NSW, including agencies (such as OEH and DPI), catchment management authorities and local Councils. The Strategy aims to establish a system of monitoring, evaluation and reporting on natural resource condition. It will be supported by guideline documents that provide detailed sampling protocols for specific indicators.

The MER Strategy is supported by an Implementation Plan (DECCW, 2010c) that details the range of environmental indicators monitored under a series of 13 'themes'. The relevant theme for this Plan is the 'estuaries and coastal lakes' theme. OEH is the lead agency for this theme, with support provided by DPI (Fisheries). The 'current' program details activities that are currently undertaken using dedicated resources, however, the Implementation Plan (DECCW, 2010c) also details an 'essential' program which lists the activities that would need to be undertaken in order to meet the essential elements of the MER Strategy for 2010-2015 (DECCW, 2010a). The essential indicators for monitoring include chlorophyll a, turbidity, estuarine macrophytes (seagrass, saltmarsh and mangrove) and fish.

It is recommend that Council liaise with OEH, the CMA and DPI (Fisheries) on the proposed monitoring plan for Brisbane Water Estuary and confirm the respective roles and responsibilities for collection of data on different indicators.

State of the Environment Reporting

Council has historically undertaken State of the Environment reporting in accordance with the requirements of 428(2)(c) of the *Local Government Act 1993*. The reporting structure adopted the following framework:

- ***State:*** description or analysis of the current condition; may also include projections for the future condition of the environment.
- ***Pressure:*** human activities that impact either positively or negatively on the environment.
- ***Response:*** identifies the activities undertaken by Council, the community or other agencies or organisations to alleviate the pressures on the environment.

The report was divided into five sections: Atmosphere, Land, Water, Biodiversity and Towards Sustainability.

From 2005, however, Council adopted a revised program based on feedback provided by the community and a desire to improve upon the State of the Environment framework. The new reporting program is called Sustainability Reporting. It seeks to provide a more holistic assessment of sustainability for the LGA by incorporating an additional three sections into the report: Governance and Leadership, Economy, and Society and Culture. The Sustainability Report feeds into Council's Corporate Planning process.

In October 2009, the NSW Division of Local Government introduced new planning and reporting requirements for all NSW Councils. The *Local Government (Planning and Reporting) Amendment Act* 2009 (the Act) will replace current Management Plan and Social Plan requirements with an integrated framework linked to the Council election cycle.

The Integrated Planning and Reporting Framework sets out a hierarchy of plans including:

- A long-term Community Strategic Plan (to cover a minimum period of 10 years),
- Delivery Program (4 yearly cycle),
- An annual Operational Plan, and
- An Annual Report to the Community.

A long-term Resourcing Strategy is also required. The Strategy should outline financial, asset and human resource requirements to support planning activities.

The Act provides transitional provisions for phasing in the new legislative requirements over a three year period, with all councils being required to operate under the new legislation by the next Local Government election in September 2012. Gosford City Council has resolved to commence under the new framework at the beginning of the 2011/12 financial year.

Work commenced on the preparation of the Community Strategic Plan, which will be known as *Gosford 2025, the Delivery Program and the Operational Plan*, in 2010. To ensure that community's concerns and aspirations are understood, a Community Engagement Strategy was prepared by Council to guide community engagement activities in the development of the Community Strategic Plan.

Whilst the new planning and reporting legislation represents an improvement in the way these activities are currently undertaken, it is important to note that Council's current long-term plan, *Vision 2025*, provides a strong platform for future planning. As such, engagement with the community has focussed on reviewing Vision 2025 and updating this document as required.

The Integrated Planning and Reporting Framework will demonstrate how the long-term aspirations outlined in the Community Strategic Plan are translated into projects within more detailed Council plans. Importantly, the Annual Report to the Community will report on Council's progress in implementing the Delivery Program and Operational Plan, as these plans are wholly the Council's responsibility.

Any monitoring in relation to this *Coastal Zone Management Plan* should also seek to provide information to feed in Councils Integrated Planning and Reporting Framework and sustainability reporting processes.

Management Actions

Due to the large number of management actions listed in the Plan specific monitoring activities have not been developed for each Action proposed for implementation. It is, however, recommended that Council consider the need to monitor the success of implementation or effectiveness of Actions implemented under this Plan. In some cases, this may be achieved via a review of the data collected as part of regular estuarine

monitoring activities. In other cases, a specific monitoring activity may need to be developed. This process can be useful in acting as a feedback loop to management.

4 Conclusion

This *Coastal Zone Management Plan for Brisbane Water Estuary* has been prepared in accordance with the requirements of the NSW *Estuary Management Policy*. It represents the seventh of eight stages in the Estuary Management Process outlined in the *Estuary Management Manual* (NSW Government, 1992).

The draft Plan was placed on public exhibition and reviewed with due consideration of the submissions received. The proposed changes to the draft Plan were endorsed by the Coastal and Estuary Management Committee, and the final Management Plan (this document) adopted by Council in July 2012.

This Plan adopts the recommendations of the *Estuary Management Study* (Cardno, 2010). It includes a list of 183 actions for implementation. In recognition of the fact that resources are limited, and that some options are dependent upon the implementation of other options, it was recommended that in the first instance the implementation strategy examine the top 73 highest ranking management actions (**Section 3.3**).

This Plan should be regarded as a living document requiring review and modification over time. Following adoption of the Plan by Council, it is recommended that the Plan be reviewed in detail once every 5-10 years. The catalysts for change could include legislative change, alterations in the availability of funding, reviews of the Council planning strategies and, importantly, the outcome of the monitoring and evaluation of the Plan. Some actions may not remain relevant in the long term and may need to be reconsidered. In addition, this review process also provides an opportunity to remove those 'one-off' actions that have already been implemented and to update the implementation strategy (**Appendix B**).

5 References

ANZECC/ARMCANZ (2000) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, pp. 317.

Cardno (2007) *Brisbane Water Entrance Proposed SEPP35 Dredging – Coastal Processes Investigations*. Prepared for Gosford City Council, pp. 13.

Cardno (2008) *Brisbane Water Estuary Processes Study*. Prepared by Cardno for Gosford City Council and the Department of Environment and Climate Change, pp. 137.

Cardno (2010) *Brisbane Water Estuary Management Study*. Prepared by Cardno for Gosford City Council and the Department of Environment, Climate Change and Water, pp.97.

Cardno/GCC (2011) Brisbane Water Estuary Management Plan Submissions in Reply Report. Prepared by Gosford City Council and Cardno, pp. 31.

CCT (2010) *Central Coast Destination Management Plan for Tourism 2010-2013.* Prepared by Central Coast Tourism and Industry and Investment NSW.

DECC (2007) *Environmental Action for Marinas, Boatsheds and Slipways*. Prepared by the Department of Environment and Climate Change, June 2007.

DECC (2009) *Environmentally Friendly Seawalls. A Guide to improving the environmental value of seawalls and seawall-lined foreshores in estuaries.* Prepared by the Department of Environment and Climate Change, pp. 27.

DECCW (2009) *NSW Sea Level Rise Policy Statement*. Prepared by the Department of Environment, Climate Change and Water, pp. 6.

DECCW (2010a) *NSW Natural Resources Monitoring, Evaluation and Reporting Strategy 2010-2015.* Prepared by the NSW Department of Environment, Climate Change and Water, pp. 40, December 2010.

DECCW (2010b) *NSW Wetlands Policy*. Prepared by the Department of Environment, Climate Change and Water, March 2010.

DECCW (2010c) *NSW Natural Resources MER Strategy 2010-2015 Implementation Plan (Version 1.1).* Prepared by the Department of Climate Change and Water, pp. 69, October 2010.

DECCW (2010d) *Guidelines for Preparing Coastal Zone Management Plans.* NSW Department of Environment, Climate Change and Water. December 2010.

DoP (2008) *Central Coast Regional Strategy 2006-31*. NSW Department of Planning, pp. 61.

GCC (1995) *Brisbane Water Plan of Management.* Prepared by Gosford City Council and as amended in April 2000, pp. 67.

GCC (2007) *Water Cycle Management Guidelines.* Prepared by Gosford City Council, pp. 57.

HCRCMA (undated) *Erina Rivercare Plan (incl. Erina Creek, Fires Creek and Maddens Creek).* Prepared by the Hunter-Central Rivers Catchment Management Authority, pp. 94.

I&I NSW (2009) *NSW Control Plan for the Noxious Marine Alga Caulerpa taxifolia*. Prepared by Industry & Investment NSW, August 2009.

I&I NSW (2010) *NSW Recreational Saltwater Fishing Guide 2011*. Prepared by Industry & Investment NSW, 2010.

KBR (2005) *Brisbane Water Estuary Processes Study. Recreational Activities and Foreshore Land Uses.* Prepared for Cardno Lawson Treloar, pp. 44.

NSW Government (1992) *Estuary Management Manual*. NSW Government, October 1992.

NSW Maritime (2006) *Don't Make Waves*. Prepared by NSW Maritime, July 2006.

PBP (2003a) *Narara Creek Manns Road to Deane Street Rivercare Management Study*. Prepared by Patterson, Britton and Partners for Gosford City Council, pp. 112.

PBP (2003b) *Narara Creek Manns Road to Deane Street Rivercare Management Plan*. Prepared by Patterson, Britton and Partners for Gosford City Council, pp. 67.

Robinson, M. V. (2006). *The Birds of Brisbane Water Estuary*. Prepared by Bioregen Ecological Assessment and Restoration for Bio-Analysis Pty Ltd, pp. 83.

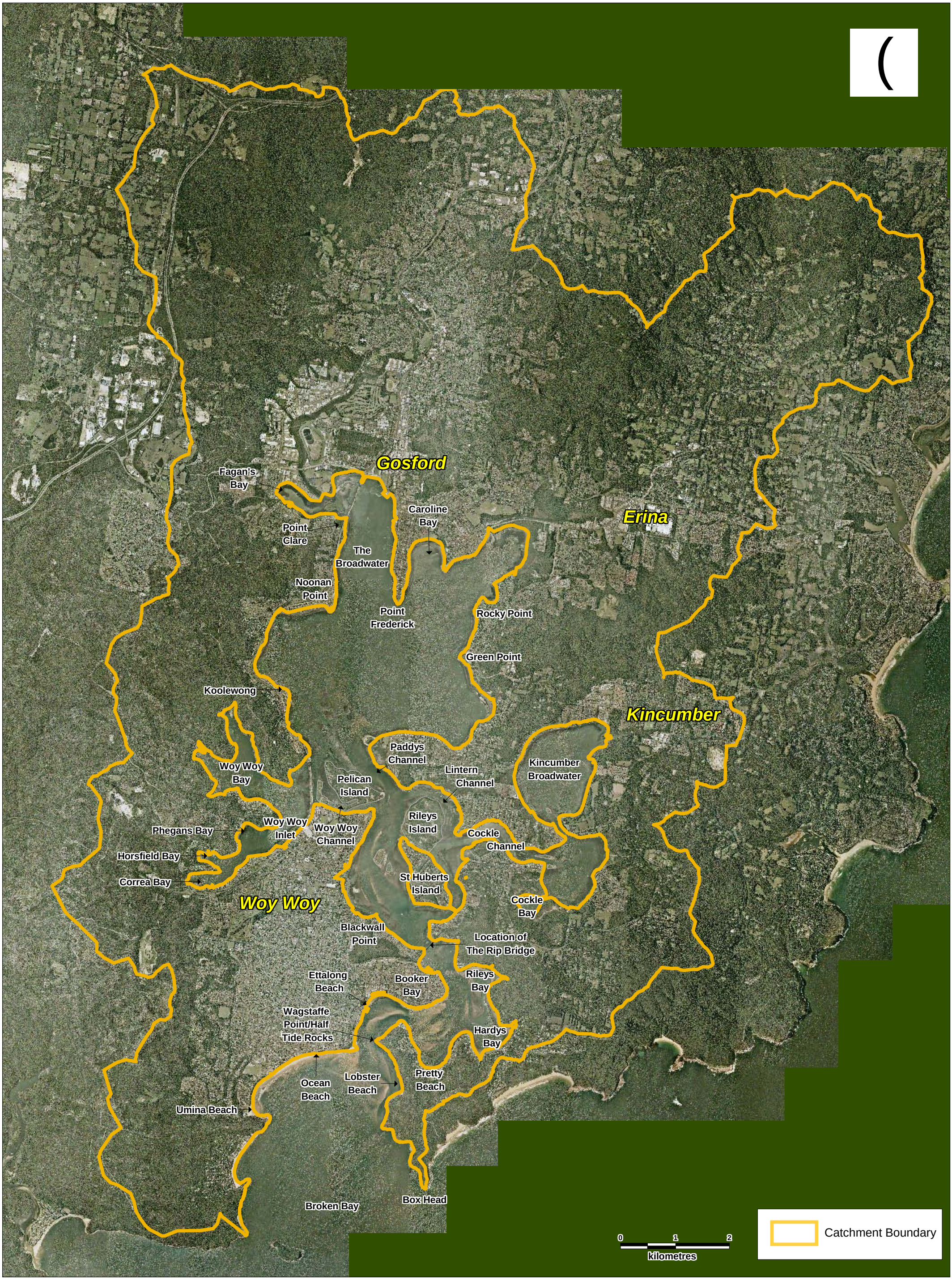
SMEC Australia and Umwelt (Australia) (2002) *Brisbane Water Data Compilation Study*. Prepared for Gosford City Council, pp. 104.

6 Qualifications

The following qualifications apply to this Plan:

- The assessment of likely impacts associated with each action is preliminary in nature and it is assumed that the appropriate level of environmental impact assessment will be undertaken prior to the initiation of any physical works and that appropriate mitigation measures will be implemented to ensure minimal impacts during works.
- It has also been assumed that the relevant consents, permits and approvals will be obtained for any works undertaken.
- The feasibility and sustainability of the actions identified in this study have not been subject to detailed investigation.
- It should be noted that the cost estimates are indicative and have been used for comparative purposes only. Detailed cost estimates should be obtained prior to implementation and these may vary from the estimates provided.

Figures



Cardno

Coastal Zone Management Plan
for Brisbane Water Estuary

FIGURE 1.1
LOCALITY MAP

LJ2717/R2683/V7
July 2012

LJ2717/Figures/Plan Report Figures/Figure 1.1 - Study Area.wor

N
W E
S

Gosford

Erina

Kincumber

Woy Woy

Fagan's Bay
Point Clare
Caroline Bay
The Broadwater
Noonan Point
Point Frederick
Rocky Point
Green Point
Koolewong
Paddys Channel
Lintern Channel
Kincumber Broadwater
Woy Woy Bay
Pelican Island
Rileys Island
Woy Woy Inlet
Woy Woy Channel
Phegans Bay
Horsfield Bay
Correa Bay
Cockle Channel
St Huberts Island
Cockle Bay
Blackwall Point
Location of The Rip Bridge
Ettalong Beach
Booker Bay
Rileys Bay
Wagstaffe Point/Half Tide Rocks
Hardys Bay
Ocean Beach
Lobster Beach
Pretty Beach
Umina Beach
Broken Bay
Box Head

Management Zones

- Zone 1 - Fagan's Bay
- Zone 2 - The Broadwater
- Zone 3 - The Woy Woy Reach
- Zone 4 - Central Reach
- Zone 5 - Kincumber/Cockle Bay
- Zone 6 - The Entrance Reach
- Catchment Boundary

0 1 2
kilometres

Note: Zone boundaries are indicative only and there are substantial interactions between zones.

Cardno

Coastal Zone Management Plan
for Brisbane Water Estuary

FIGURE 1.2
MANAGEMENT ZONES

Cardno

Coastal Zone Management Plan
for Brisbane Water Estuary

FIGURE 3.1
ZONE 1 - FAGANS BAY
MANAGEMENT ACTIONS

LJ2717/R2683/V7
July 2012

J:\ENV\LJ2717 - Brisbane Water EMS&P\Figures\Plan Report Figures

Gosford
East Gosford
Fagans Bay
Point Clare
Tascott
Koolewong
Green Point
Yattalunga
Saratoga
Davistown
N
W
E
S
0
400
800
metres

Zone 2 Boundary

Action P05 - Stormwater measures, Byalla Ln, Saratoga

Action R14 - Upgrade seawall

Action W41 - Foreshore stabilisation works

Action W77 - Provide alternative dinghy storage

Action W104 - Improve public access

Action R14 - Existing seawall (left)

Cardno

Coastal Zone Management Plan
for Brisbane Water Estuary

FIGURE 3.2
ZONE 2 - THE BROADWATER
MANAGEMENT ACTIONS

LJ2717/R2683/V7
July 2012

J:\ENV\LJ2717 - Brisbane Water EMS&P\Figures\Plan Report Figures

Zone 3 Boundary

Action R14 - Identify source of erosion under Lara St Bridge

Action W04 - Stormwater controls for the Woy Woy Ck catchment

Action W07 - Maintain existing sediment traps in locations draining to Horsfield Bay (various locations)

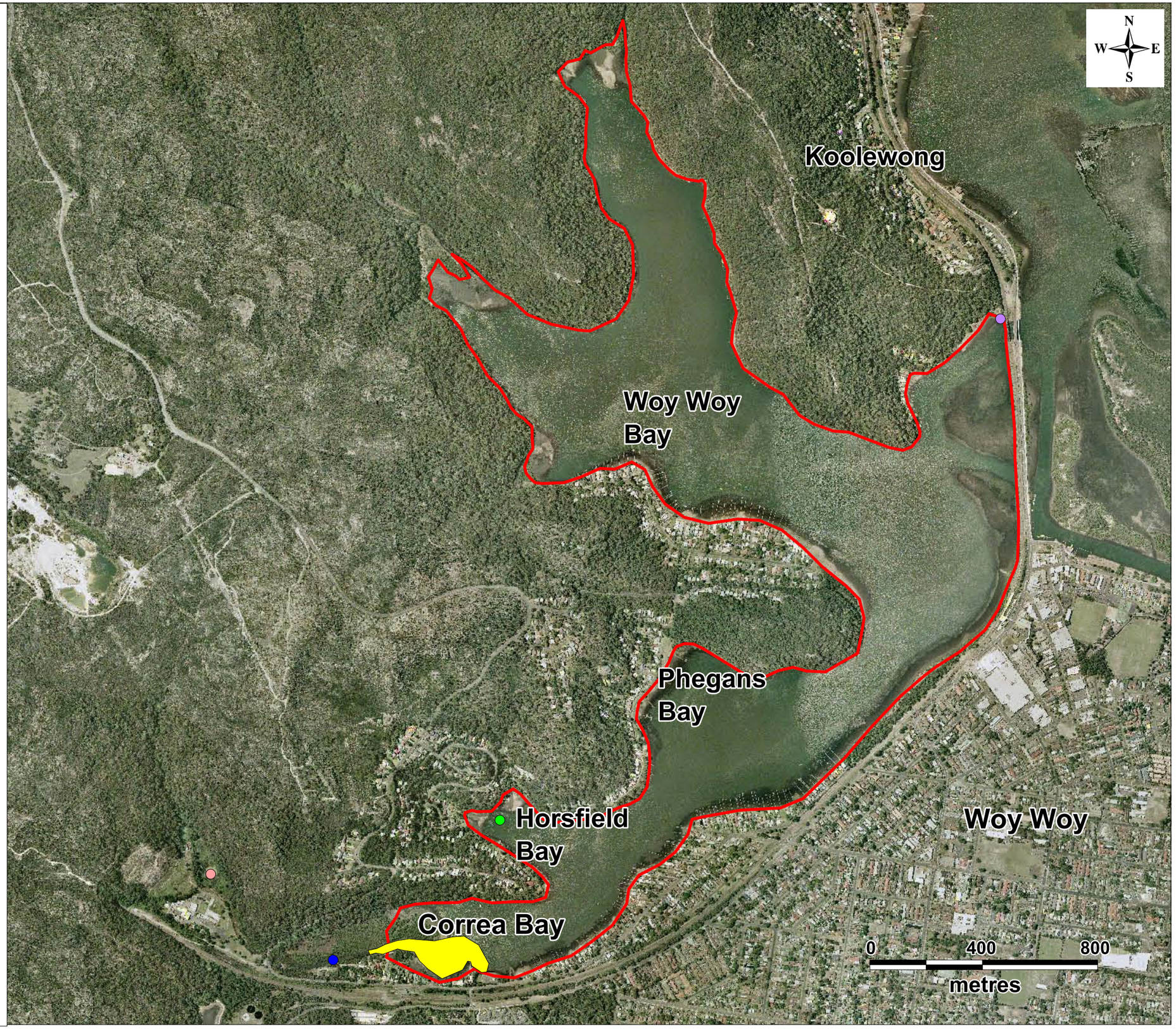
Example: Sediment trap as part of a stormwater treatment train

Example: Sediment basin

Action W21 - Dredge to improve access and drainage

W59 - De-commission dam to restore flows to Woy Woy Creek

W21: Outlet of Woy Woy Creek into Correa Bay



Cardno

LJ2717/R2683/V7
July 2012

Coastal Zone Management Plan
for Brisbane Water Estuary

FIGURE 3.3
ZONE 3 - WOY WOY REACH
MANAGEMENT ACTIONS

J:\ENV\LJ2717 - Brisbane Water EMS&P\Figures\Plan Report Figures

Davistown

N
W E
S

Pelican Island

Rileys Island

Woy Woy

St Huberts Island

Daleys Point

Blackwall

0 450 900

metres

Zone 4 Boundary

Action W35 - Investigate suitable controls for sediment accretion issues at St Huberts Island

Action W43 - Upgrade/repair failing seawall in Memorial Park

Action W45 - Undertake foreshore stabilisation works in Palermo Reserve

Action W46 - Investigate cause of erosion around Blackwall Point boat ramp

Action W49 - Implement foreshore stabilisation works at Rip Road Reserve

W43 - Existing seawall (left)

Example of environmentally friendly sea wall (left) (DECC, 2009)

W45 -Existing foreshore at Palermo Reserve (right)

Cardno

LJ2717/R2683/V7
Juky 2012

Coastal Zone Management Plan
for Brisbane Water Estuary

FIGURE 3.4
ZONE 4 - THE CENTRAL REACH
MANAGEMENT ACTIONS
J:\ENV\LJ2717 - Brisbane Water EMS&P\Figures\Plan Report Figures

Yattalunga

Kincumber

Davistown

Daleys Point

Bensville

N
W E
S

0 400 800
metres

Zone 5 Boundary

Action W15 - Seal the Hawk Street car parks

Action W48 - Enhance foreshore vegetation, Illoura Reserve & Kincumber Broadwater

Action C03 - Improve stormwater management practices

Action W47 - Remediate scouring occurring behind existing seawall

Action W116 - Dredge to improve access to Cockle Channel & boat ramps

W48 - Existing foreshore Illoura Reserve (left)

W48 - Existing foreshore Kincumber Broadwater (left)

Cardno

Coastal Zone Management Plan
for Brisbane Water Estuary

FIGURE 3.5
ZONE 5 - KINCUMBER/COCKLE BAY
MANAGEMENT ACTIONS

LJ2717/R2683/V7
July 2012

J:\ENV\LJ2717 - Brisbane Water EMS&P\Figures\Plan Report Figures

Blackwall

Daleys Point

Booker Bay

Wagstaffe

Pretty Beach

Killcare

N
W E
S

0 400 800
metres

Zone 5 Boundary

Action W18 - Periodically dredge navigation channel

Action W28 - Beach nourishment works, Ettalong

Action R11 - Assess sedimentary processes

Action W26 - Rehabilitate eastern foreshores of Hardy's Bay

Action W29 - Implement shoreline protection works

W28 - Current beach profile, Ettalong Beach (left)

W26 - Current condition eastern foreshores at Hardys Bay (left)

Cardno

Coastal Zone Management Plan
for Brisbane Water Estuary

FIGURE 3.6
ZONE 6 - THE ENTRANCE REACH
MANAGEMENT ACTIONS

LJ2717/R2683/V7
July 2012

J:\ENV\LJ2717 - Brisbane Water EMS&P\Figures\Plan Report Figures

Appendix A

List of Management Actions

Action ID	Management Goal Addressed	Management Category	Strategy Outline	Location	Zone	Issue(s) Addressed	Primary Responsibility	Secondary Responsibility	Cross Reference with Action:	Dependency on Action:	Net Present Value	Water & Sediment Quality	Sedimentary Processes	Ecological Processes	Foreshore Flooding / Inundation	Cultural Heritage	Visual Amenity	Recreational Usage	Development	Governance	Information, Communications and Education	Raw Benefit Index	Council / OEH Response	Adjusted Benefit Index
C01	Water and Sediment Quality	Compliance	Continue program of auditing to ensure best management practices for marinas around Brisbane Water Estuary. DECC's brochure *Environmental Action for Marinas, Boatsheds and Slipways* (2007) should be provided to marine operators.	All marinas	All	73	OEH, NSW Maritime	GCC			$337,820	3	2	3	0	0	1	3	0	0	2	14	0	14
C02	Water and Sediment Quality	Compliance	Provide additional resources for Council officers to undertake audits of properties to ensure enforcement of policies and conditions of consent relating to water quality during both the construction and operational phases.	Catchment-wide	All	109	GCC		C13, P04		$741,581	3	3	3	0	0	0	0	0	0	0	9	2	11
C03	Water and Sediment Quality	Compliance	Work with private land holders / tenants to improve stormwater management practices in the industrial estate near Hawk Street.	Kincumber	5	237	GCC	OEH			$77,970	1	1	1	0	0	1	1	0	0	0	5	1	6
C04	Habitat and Species Conservation	Compliance	Ensure ongoing enforcement of fishing regulations.	Waterway-wide	All	99, 100, 159	DPI (Fisheries)	Fishcare Volunteers	E01		$317,820	1	0	3	0	0	0	3	0	0	3	10	1	11
C05	Habitat and Species Conservation	Compliance	Ensure the ongoing enforcement of Council's *Tree Vandalism Policy*. Reference should also be made to *D6.44 Landscape and Vegetation Management Policy*.	LGA-wide	All	71, 251	GCC				$264,850	1	1	2	1	1	2	0	0	0	2	10	1	11
C08	Recreational Usage	Compliance	Enforce boating regulations (particularly speed restrictions and zoning of activities) within Brisbane Water.	Waterway-wide	All	14,20,26,44, 169	NSW Maritime		E01, E11, W05, C12		$529,701	2	3	1	0	0	0	3	0	0	3	12	0	12
C10	Recreational Usage	Compliance	Enforce on-leash dog walking in restricted areas in line with Council's Dog Policy Review.	Catchment-wide	All	193	GCC				$317,820	-2	0	2	0	0	0	2	0	0	2	4	2	6
C12	Recreational Usage	Compliance	Investigate options for either banning or further limiting the use of jet skis in Brisbane Water Estuary.	Waterway-wide	All	17,69, 163	NSW Maritime	GCC	C08		$12,500	1	1	1	0	0	0	0	-1	0	0	2	1	3
C13	Foreshore Development	Compliance	Provide additional resources for enforcement of compliance with foreshore development controls.	LGA-wide	All	114, 119, 133, 150, 184, 209,	GCC		C02, C14		$794,551	2	3	3	3	1	1	0	0	0	2	15	1	16
C14	Foreshore Development	Compliance	Audit existing foreshore development (including property boundaries, fences and other structures, boat houses, boat ramps, jetties, etc.) and identify illegal or non-conforming development for retrospective enforcement of development controls. This should be undertaken in accordance with the Conditions of Consent and relevant policy in force at the time of Development Approval. Where foreshore structures are negatively impacting on estuarine processes (e.g. causing erosion or accretion on adjacent lands), investigate opportunities to mitigate these issues. This may be achieved through the Crown lands lease/licensing mechanism (where relevant).	Estuary Foreshores	All	114, 119, 133, 150, 184, 209, 248	DPI (Crown Lands Division)	GCC	C02, C13, P14, P44	R31	$90,000	1	3	1	2	1	1	0	0	0	2	11	1	12
C15	Information, Communications and Education	Compliance	Enforce littering restrictions and undertake parallel education programs about littering.	LGA-wide	All	79, 186	GCC		E02, E07, E11, R05, W91, W93		$89,455	2	0	1	1	0	2	0	0	0	4	10	1	11
E01	Habitat and Species Conservation	Education	Distribute NSW Maritime's Brisbane Water Boating Map to ensure waterway users are aware of the regulations relating to navigational safety, permissable activities and their responsibilities as boat users.	Registered Boat Owners	All	48,55,62,146	NSW Maritime		C08, E11, E14, R22		$41,485	0	0	2	0	0	0	1	0	0	3	6	2	8
E02	Information, Communications and Education	Education	Label stormwater drain inlets in problematic areas "This drains to ……".	Catchment-wide	All	12	GCC		C15, E07, R05		$46,485	3	2	3	0	0	-1	0	0	0	4	11	1	12

Action ID	Management Goal Addressed	Management Category	Strategy Outline	Location	Zone	Issue(s) Addressed	Primary Responsibility	Secondary Responsibility	Cross Reference with Action:	Dependency on Action:	Net Present Value	Water & Sediment Quality	Sedimentary Processes	Ecological Processes	Foreshore Flooding / Inundation	Cultural Heritage	Visual Amenity	Recreational Usage	Development	Governance	Information, Communications and Education	Raw Benefit Index	Council / OEH Response	Adjusted Benefit Index
E03	Information, Communications and Education	Education	Develop a public awareness and education program relating to the Estuary and its biodiversity. Elements for inclusion in this program may include: - Key habitat types and their ecological function (e.g. saltmarshes, seagrasses), - Biodiversity and threatened and protected species (e.g. migratory birds), - Marine pests and other threats to estuarine ecology, and - The important underlying ecological processes of the Estuary and their relationship with human uses of the Estuary. This program may include different educational elements such as targeted activities, information days, the preparation of literature and/or interpretive signage.	LGA-wide	All	34, 41, 50, 51, 90, 218 and 250	GCC	CMA	E08, E09, P19, P20, P23, P28, P53, R20, R22, R25	E03, R39	$417,820	2	1	4	0	0	-1	1	0	0	5	12	1	13
E07	Information, Communications and Education	Education	Establish a 'Clean Up Brisbane Water Day' with the dual objectives of removing rubbish from the Estuary foreshores and waterways, and of educating the public about the Estuary.	Waterway-wide	All	54	GCC	CMA, NSW Maritime, OEH	C15, E02, E11, R05, W91, W93		$579,701	3	2	4	0	0	2	0	0	0	4	15	1	16
E08	Information, Communications and Education	Education	Give consideration to methods of detecting and informing the community of changes to sea levels and other potential climate change impacts. These methods should not result in a sense of panic or alarm, instead they should empower the community to act in a well considered and informed manner and where possible, encourage the community to become engaged in Council's decision making processes. The information provided to the public should be supported by research presented by the IPCC and the State/Federal government, as well as observed trends in local sea levels.	LGA-wide	All	92	GCC	OEH, CMA	P43	R40	$67,970	1	2	0	5	0	0	0	4	0	5	17	2	19
E09	Information, Communications and Education	Education	Provide foreshore property owners with information/guidelines about what constitutes good and bad practice with respect to foreshore management (e.g. limits of mowing, stabilisation works, etc.). This should include information on environmentally friendly seawall options to both the community and those individuals assessing development applications for these structures. Reference should be made to DECC's *Environmentally Friendly Seawalls: A Guide to Improving the Environmental Value of Seawalls and Seawall-lined Foreshores in Estuaries* (2009).	Foreshore Property Owners	All	198,	GCC	OEH	C02, C05, C14, P14, P44, P45, P46, P47, P48, P49, P50		$109,455	2	2	3	3	0	1	0	0	0	3	14	2	16
E11	Information, Communications and Education	Education	Conduct an education program for the boating community on: - Their responsibilities with respect to the disposal of ballast, sewage and rubbish, - The location of existing sewage pump-out and rubbish disposal facilities, and - How to safeguard against leaks and spills, and what to do if a leak or spill occurs. This should include a distribution of a copy of NSW Maritime's Don't Make Waves (2006) brochure.	LGA-wide	All	54,70,79,88, 96, 104, 189	NSW Maritime	CMA	C08, C15, P02, P46, P47, W05	P41	$130,940	2	0	3	0	0	0	0	0	0	3	8	2	10
E14	Habitat and Species Conservation	Education	Distribute I&I NSW's *NSW Recreational Saltwater Fishing Guide 2011* (2010), which provide advice about fishing regulations, responsible fishing and safety tips.	Registered Boat Owners and locally-registered Fishing Licence Holders	All	48,55,62,147	DPI (Fisheries)	Fishcare Volunteers	C08, E01, E11, R22		$41,485	0	0	2	0	0	0	1	0	0	3	6	2	8
E15	Information, Communications and Education	Education	Provide for improved communication of on the ground works implemented under the *Estuary Management Plan* .	All	All		GCC				$79,455	0	0	0	0	0	0	0	0	0	3	3	1	4

Action ID	Management Goal Addressed	Management Category	Strategy Outline	Location	Zone	Issue(s) Addressed	Primary Responsibility	Secondary Responsibility	Cross Reference with Action:	Dependency on Action:	Net Present Value	Water & Sediment Quality	Sedimentary Processes	Ecological Processes	Foreshore Flooding / Inundation	Cultural Heritage	Visual Amenity	Recreational Usage	Development	Governance	Information, Communications and Education	Raw Benefit Index	Council / OEH Response	Adjusted Benefit Index
E16	Information, Communications and Education	Education	Provide opportunity for community members to become involved in the implementation of on the ground works (where possible).	All	All		GCC	CMA			$52,970	0	0	0	0	0	0	0	0	0	4	4	1	5
E17	Information, Communications and Education	Education	Enhance the understanding of Council staff on the potential impacts of maintenance activities on the ecological values of the Estuary.	All	All		GCC				$36,782	1	1	1	0	0	0	0	0	0	1	4	1	5
E18	Information, Communications and Education	Education	Undertake a stormwater education program highlighting impacts of human activities on ecological values.	All	All		GCC	CCCEN			$152,425	2	0	1	0	0	1	1	0	0	3	8	1	9
P01	Water and Sediment Quality	Planning	Provide for the development, implementation and regular re-assessment of Riparian Zone and Bank Management Plans for the major tributaries draining into the Estuary, including Narara Creek River care Plan, Erina Rivercare Plan, Kincumber Creek Riparian Plan, Woy Woy Creek, Currumbine Creek and Ettalong Creek.	Catchment-wide	All	122, 195	GCC	NOW	W34, W53		$1,839,102	4	3	4	1	0	2	0	0	0	0	14	2	16
P02	Water and Sediment Quality	Planning	Develop and implement a pollution response strategy to address major pollution events. *Policy D1.02 - Oil Spillages in Navigable Waters* should be updated accordingly.	Waterway-wide	All		GCC	OEH, NSW Maritime	C01, E11		$25,000	2	0	5	0	0	0	2	0	0	0	9	1	10
P03	Water and Sediment Quality	Planning	Support State government proposal to prohibit 2 stroke outboard motors.	Waterway-wide	All	163	NSW Maritime	GCC			$0	2	0	2	0	0	0	-3	0	0	0	1	0	1
P04	Water and Sediment Quality	Planning	Review the *Water Cycle Management Guidelines* (2007) and ensure that they reflect best practice WSUD and appropriately support the new DCP.	LGA-wide	All		GCC		C02, C13, P43, W58		$40,000	4	2	4	4	0	0	2	1	0	0	17	2	19
P05	Water and Sediment Quality	Planning	Investigate the need for sediment traps and other stormwater management measures to control any erosion and sedimentation from sloping lands draining to the stormwater outlet opposite Byalla Lane.	Saratoga	2	238	GCC			R24, W01	$17,500	1	1	1	0	0	0	1	0	0	0	4	1	5
P07	Sedimentary Processes	Planning	Develop formal standard designs for key navigational channels in Brisbane Water that identify the desired channel profile and likely maintenance dredging requirements to maintain these configurations for the purposes of recreational and commercial boating. The purpose of this action is to provide clear information to users of Brisbane Water and manage community expectations in relation to maintenance of navigation channels, while acknowledging natural rates of sediment transport in these locations and likely environmental impacts. This process should be informed by the Sediment Management Plan provided in the *Brisbane Water Estuary Management Stud* y (Cardno, 2010) and the findings of the *Brisbane Water Estuary Processes Study* (Cardno, 2008). It is acknowledged that additional investigations may be required to develop the standard designs.	Waterway-wide	All	8, 9, 16, 27, 29, 32, 38, 40, 42, 45, 46, 47, 60, 72, 80, 85, 106, 129, 130, 233	NSW Maritime, DPI (Crown Lands Division)		R09, W18, W19, W20, W25		$75,594	0	4	3	0	0	0	4	1	2	2	16	0	16
P08	Sedimentary Processes	Planning	Review and revise *DCP 145 Boating Facilities in St Huberts Island Canals* to ensure consistency with the goals and objectives of the Estuary Management Study and Plan. In particular, explicit consideration of sedimentary processes should form part of the assessment process for all development applications.	St Huberts Island	4	29, 32	GCC		W19, W35		$15,000	0	1	2	0	0	0	-1	0	0	0	2	2	4
P09	Sedimentary Processes	Planning	Implement tighter erosion and sedimentation controls to minimise risks to seagrass, with a priority for catchments adjacent to areas of seagrass of high value for species.	Catchment-wide	All	28,55,91,144	GCC	DPI (Fisheries)	C13, P20, R20, W35		$264,850	2	3	4	0	0	0	0	0	0	0	9	2	11

Action ID	Management Goal Addressed	Management Category	Strategy Outline	Location	Zone	Issue(s) Addressed	Primary Responsibility	Secondary Responsibility	Cross Reference with Action:	Dependency on Action:	Net Present Value	Water & Sediment Quality	Sedimentary Processes	Ecological Processes	Foreshore Flooding / Inundation	Cultural Heritage	Visual Amenity	Recreational Usage	Development	Governance	Information, Communications and Education	Raw Benefit Index	Council / OEH Response	Adjusted Benefit Index
P14	Sedimentary Processes	Planning	Continue to enforce prohibition of mowing to the waters edge in both public and private foreshore areas in order to minimise foreshore erosion and impacts on estuarine vegetation and Endangered Ecological Communities.	Estuary-wide	All	198	GCC		E09, E17, R22		$894,551	2	3	2	1	0	2	0	0	0	1	11	2	13
P16	Habitat and Species Conservation	Planning	Investigate opportunities to purchase saltmarsh areas for incorporation into Council's reserve system in accordance with Policy *R0.15 - Acquisition of Wetlands* .	Estuary Foreshores	All	51	GCC	DPI (Crown Lands Division)	R19		$5,297,007	1	1	4	2	0	0	1	0	0	0	9	2	11
P19	Habitat and Species Conservation	Planning	Develop a strategy for the conservation of areas important for the biodiversity of invertebrates. Particular attention should be paid to priority sites that represent the greatest proportion of species, including Ettalong, Narara Creek, Koolewong, and Woy Woy Bay-Pelican Island.	Ettalong, Narara Creek, Koolewong, and Woy Woy Bay-Pelican Island	All	90, 142, 143, 151	GCC	DPI (Fisheries), OEH, University of Newcastle			$283,068	1	0	5	0	0	0	-2	0	0	3	7	1	8
P20	Habitat and Species Conservation	Planning	Develop a conservation and education strategy for seagrass beds, as identified in the *Estuary Processes Study* (Cardno, 2008), that: - Support the highest abundance and diversity of fish, - Are known to be important for sponges and ascidians, and - Are known to be important for biological connectivity.	Estuary-wide	All	55,91,100,101, 111	DPI (Fisheries)	GCC, University of Newcastle, Fishcare Volunteers	E01, R20, W65		$140,940	1	0	5	0	0	0	1	0	0	3	10	1	11
P23	Habitat and Species Conservation	Planning	Develop a conservation strategy for the birds of Brisbane Water Estuary that addresses the main issues of disturbance by pedestrians, dog-walkers and watercraft, predation by feral and domestic animals, and habitat loss/degradation. This should include consideration of threatened and protected species, such as the Bush Stone Curlew, and the habitats that support them.	Waterway-wide / Catchment-wide	All	51, 160, 161	GCC	CMA, OEH, local bird watching clubs	E03, P27		$135,940	0	0	5	0	0	0	1	0	0	0	6	2	8
P27	Habitat and Species Conservation	Planning	Develop a Plan of Management to provide protection for the Bush Stone Curlew populations occurring around the Estuary. In addition, provide for ongoing implementation of the Plan of Management for Green and Golden Bell Frogs.	LGA-wide	All	51, 232	GCC	OEH, University of Newcastle	E03, P23		$55,000	1	0	5	0	0	0	0	0	0	1	7	2	9
P28	Habitat and Species Conservation	Planning	Provide adequate resources within Council to provide for ongoing management of Bushcare volunteers.	LGA-wide	All	249	GCC		W71, W73		$847,521	1	1	5	0	0	1	1	0	0	3	12	2	14
P30	Habitat and Species Conservation	Planning	Develop a DCP for Wetlands aimed at maintaining and restoring natural biological and physical processes of wetland function by minimising changes to wetland hydrology from land uses in the catchment. This should be undertaken in line with DECCW's *NSW Wetlands Policy* (2010b).	LGA-wide	All	110	GCC		C13, P04		$40,000	2	1	2	0	0	1	0	-1	0	0	5	1	6
P31	Cultural Heritage	Planning	Provide ongoing protection for sites of Indigenous and non-Indigenous heritage significance for the local community.	LGA-wide	All		OEH, DP&I	GCC		W34	$476,731	0	0	0	2	5	1	0	0	0	0	8	2	10
P33	Recreational Usage	Planning	Provide linkages between different portions of publicly accessible foreshores by linking with other foot or cycle paths and public transport linkages in line with Council's Cycleway Strategy.	Catchment-wide	All	165, 167	GCC		W41, W82, W84, W94, W104		$20,000	0	0	0	0	0	0	4	0	0	0	4	2	6

Action ID	Management Goal Addressed	Management Category	Strategy Outline	Location	Zone	Issue(s) Addressed	Primary Responsibility	Secondary Responsibility	Cross Reference with Action:	Dependency on Action:	Net Present Value	Water & Sediment Quality	Sedimentary Processes	Ecological Processes	Foreshore Flooding / Inundation	Cultural Heritage	Visual Amenity	Recreational Usage	Development	Governance	Information, Communications and Education	Raw Benefit Index	Council / OEH Response	Adjusted Benefit Index
P35	Recreational Usage	Planning	Finalise Council's Dinghy Storage Policy and progress through implementation of the Foreshore Reserves Dinghy Storage Implementation Plan.	Estuary Foreshores	All	175	GCC	NSW Maritime	W77	R31	$1,000,000	0	2	3	0	0	1	3	0	0	0	9	2	11
P39	Recreational Usage	Planning	Assess options for relocation of the Pretty Beach pool such that it will be suitable for swimming under all tidal conditions and is not subject to sediment build-up.	Pretty Beach	6	102, 168	GCC		W30, W31, W32		$5,000	1	1	0	1	0	0	1	0	0	0	4	1	5
P40	Recreational Usage	Planning	Consider the need to develop a Wrack Management Policy that clearly identifies: - The regulatory requirements that must be addressed in order to remove seagrass wrack from foreshore areas, - The manner in which this should be undertaken, and - Suitable secondary uses for wrack.	Estuary Foreshores	All		GCC				$7,500	0	0	3	0	0	0	0	0	0	0	3	0	3
P41	Recreational Usage	Planning	Prepare a Brisbane Water Estuary Users Plan which addresses such issues as equity of access, boat storage, conflicts of usage, mooring types and caps, number and type of public access points (wharves and jetties), coverage and consistency of foreshore Plans of Management with priority areas identified for new Plans of Management, estimation of an estuary carrying capacity with respect to development intensity, fishing/fisheries and boating. Reference should be made to the *Brisbane Water Estuary Processes Study* (Cardno, 2008), particularly Appendix N, for further details on existing recreational patterns, conflicts and future opportunities, as well as details of where recreation may be impacting on other estuarine processes (e.g. on ecological processes). It is noted that implementation of this action is also dependent upon the provision of supporting information via the implementation of other management actions (as indicated).	Estuary Foreshores / Waterway-wide	All	17,19,20,85, 162, 180	GCC		C12, P55, W81	R31	$60,000	2	2	5	0	0	2	5	5	0	5	26	2	28
P43	Foreshore Development	Planning	Prepare a Climate Change Adaptation Plan that will deliver land use zoning and development controls for the Estuary that are based on the current IPCC projections of 0.9m sea level rise by 2100. The preparation of this study should be closely linked to the *Brisbane Water Foreshore Coastal Floodplain Risk Inundation Management Study and Plan* , anticipated to be drafted by 2011.	Estuary Foreshores	All	126,128	GCC	OEH	P44, P45, P54, R40		$100,000	0	3	2	5	4	0	-1	3	0	5	21	2	23
P44	Foreshore Development	Planning	Develop a guiding policy regarding the water boundary determination for foreshore properties consistent with Clause 55N of the *Coastal Protection Act 1979* .	Estuary Foreshores	All		DPI (Crown Lands Division)	GCC		R40	$20,000	1	4	0	4	0	0	-1	-2	0	0	6	2	8
P45	Foreshore Development	Planning	Undertake a review of the existing foreshore development policies and plans for the Gosford LGA and assess the need to amend development controls to provide for controlled, sustainable development of the foreshore.	LGA-wide	All	133, 184, 119	GCC		P08, P09, P30, P54 , W82	P43	$60,000	1	4	3	4	1	3	0	-2	0	0	14	1	15
P46	Foreshore Development	Planning	Review existing *DCP 119 - Wharves and Jetties* with a view to ensuring the policy is in accordance with the goals and objectives of the Estuary Management Study and Plan. In addition, sea level rise projections should also be considered where facilities are to be upgraded.	LGA-wide	All	128	GCC	DPI (Crown Lands)	P45	P43, R40	$12,500	0	2	2	0	0	1	0	0	0	0	5	2	7
P47	Foreshore Development	Planning	Encourage jetty sharing arrangements via the leasing mechanism such that each jetty services 2-3 properties. This will involve review of applications for new leases as well as license/lease renewals.	Waterway-wide	All	114, 133	DPI (Crown Lands Division)		P33, P46		$25,000	2	1	1	0	1	2	-1	0	0	0	6	2	8

Action ID	Management Goal Addressed	Management Category	Strategy Outline	Location	Zone	Issue(s) Addressed	Primary Responsibility	Secondary Responsibility	Cross Reference with Action:	Dependency on Action:	Net Present Value	Water & Sediment Quality	Sedimentary Processes	Ecological Processes	Foreshore Flooding / Inundation	Cultural Heritage	Visual Amenity	Recreational Usage	Development	Governance	Information, Communications and Education	Raw Benefit Index	Council / OEH Response	Adjusted Benefit Index
P48	Foreshore Development	Planning	Develop environmentally friendly design and construction guidelines for foreshore infrastructure such as jetties, boat ramps, seawalls/retaining walls and foreshore protection works. This should include advice on retro-fitting existing structures to be more environmentally friendly. The guidelines should be made publicly available and distributed to all foreshore property owners. (Note: Seawalls addressed in DECC's Environmentally Friendly Seawalls guidelines (2009)).	LGA-wide	All	118,133	GCC	NSW Maritime, OEH, DPI (Fisheries)	R11, W29, W38		$93,564	2	3	3	0	0	0	0	0	0	2	10	1	11
P49	Foreshore Development	Planning	Develop guidelines (or compile existing guidelines where available) for foreshore stabilisation via the establishment of locally native estuarine plant species. The guidelines should provide details of the benefits of soft stabilisation works, advice on the species to be used and how to establish plantings. Seedlings may be cultivated at Council's nursery for supply to interested parties.	LGA-wide	All		GCC	CMA, OEH	W34, W41, W45, W48, W49, W104		$559,701	2	5	4	2	0	0	0	0	0	2	15	0	15
P50	Foreshore Development	Planning	Review *D6.47 - Setback Policy: Creeks, Rivers and Lagoon* s. The review should in the first instance widen the definition of applicable waterbodies to incorporate 'estuaries', and in the second instance be re-assessed to incorporate the likely impacts of climate change. In particular, the setbacks applied should be re-assessed to take into account processes relating to both catchment flooding and foreshore inundation.	LGA-wide	All	49,126	GCC		P44	P43, R40	$15,000	0	4	3	5	0	0	0	0	0	0	12	2	14
P53	Commercial Development	Planning	Promote the Brisbane Water Estuary for eco-tourism and support relevant local commercial development in this area.	Estuary Foreshores / Waterway-wide	All	185, 250	GCC	DPI (Crown Lands Division), Central Coast Tourism, Gosford Chamber of Commerce	P54, P55,		$1,259,401	0	0	5	0	4	2	5	5	0	0	21	1	22
P54	Commercial Development	Planning	Promote the sustainable commercial development of the Estuary and its foreshores in accordance with Council's Corporate Strategy, Gosford City Centre Masterplan and the principles of Ecologically Sustainable Development.	Catchment-wide / Waterway-wide	All	185	GCC	DPI (Crown Lands Division)	P53, P55, P56, P57		$582,671	-1	-1	4	-1	4	3	4	5	0	0	17	2	19
P55	Commercial Development	Planning	Investigate options for constructing new (and/or expanding existing) boating facilities.	Waterway-wide	All	65,70	DPI (Crown Lands Division), Private Developers	GCC	P54		$100,000	-2	-2	-1	0	0	-1	4	4	0	0	2	0	2
P56	Commercial Development	Planning	Develop a strategy to promote and enhance the connection between the Gosford city centre and the Brisbane Water Estuary.	Gosford	2		GCC	DP&I	P57		N/A													
P57	Commercial Development	Planning	Use the findings of the *Estuary Processes Study* (Cardno, 2008) to inform the masterplanning process for the Gosford city centre.	Gosford	2		GCC	DP&I	P56		N/A													
P59	Governance	Planning	Adopt the Vision Statement for the Brisbane Water Estuary provided in the *Estuary Management Plan* .	Catchment-wide / Waterway-wide	All	164	GCC		W114		N/A	0	0	3	0	1	1	1	1	5	5	17	1	18
P60	Information, Communications and Education	Planning	Ensure that climate change considerations are incorporated into all relevant Plans of Management for locations around the Estuary.	LGA-wide	All		GCC	OEH, CMA	E8, W60, R40	P43	$55,000	0	0	2	4	4	0	0	0	0	3	13	2	15

Action ID	Management Goal Addressed	Management Category	Strategy Outline	Location	Zone	Issue(s) Addressed	Primary Responsibility	Secondary Responsibility	Cross Reference with Action:	Dependency on Action:	Net Present Value	Water & Sediment Quality	Sedimentary Processes	Ecological Processes	Foreshore Flooding / Inundation	Cultural Heritage	Visual Amenity	Recreational Usage	Development	Governance	Information, Communications and Education	Raw Benefit Index	Council / OEH Response	Adjusted Benefit Index
R01	Water and Sediment Quality	Research / Monitoring	Conduct a review of the design and methodology employed in the existing water quality monitoring program. Ideally the program should be a comprehensive, scientifically rigorous and ongoing program of water and sediment quality monitoring for the Brisbane Water Estuary, incorporating dry weather and event monitoring of both the tributary mouths and main waterbody. Sampling in the main waterbodies should incorporate vertical profiling.	Catchment-wide / Waterway-wide	All		GCC	OEH	R37, R38, R40		$35,000	4	0	3	0	0	0	3	0	0	1	11	2	13
R03	Water and Sediment Quality	Research / Monitoring	Calculate a nutrient budget for the Estuary to assess the potential for eutrophication of the more enclosed portions of the waterway. The analysis should assess current conditions and conditions under climate change scenarios. Reference should be made to the water quality modelling undertaken for the Estuary as a whole, as outlined in Appendix E of the *Estuary Processes Study* (Cardno, 2008).	Waterway-wide	All		OEH	GCC	W24	R03	$20,000	4	0	4	0	0	0	1	0	0	0	9	1	10
R04	Water and Sediment Quality	Research / Monitoring	Audit the performance of existing stormwater quality improvement devices and assess the need for modifications.	Catchment-wide	All	64,67,73,77, 83,105,108, 111,117,127, 130,131,137, 140, 154,	GCC		R05, R10, R24, W01		$32,000	3	3	4	0	0	0	0	0	0	0	10	2	12
R05	Water and Sediment Quality	Research / Monitoring	Keep a log of the volumes and types of material removed from GPTs during routine maintenance and incorporate this information into the water quality monitoring program.	Catchment-wide	All		GCC		R06, R04		$63,564	3	0	3	0	0	0	0	0	0	0	6	2	8
R06	Water and Sediment Quality	Research / Monitoring	Undertake ongoing monitoring and maintenance of Council owned stormwater quality improvement devices.	Catchment-wide	All	64,67,73,77, 83,127,131,137, 140, 154, 191	GCC		R04, R05		N/A													
R09	Sedimentary Processes	Research / Monitoring	Conduct ongoing monitoring (by survey) of key navigation channels, including: - Entrance Channel, - Paddy's Channel, - Lintern Channel, - Woy Woy Channel, - Wagstaffe Channel, - Cockle Channel, and - Saratoga Channel.	Waterway-wide	All	123,124,129	NSW Maritime		P07, W18, W19, W20, W21, W23, W24, W25		$79,455	0	3	0	0	-1	0	4	3	0	0	9	2	11
R10	Sedimentary Processes	Research / Monitoring	Conduct a condition assessment of existing stormwater outlets draining into the Estuary focusing on assessing impacts on natural sedimentary processes (e.g. erosion, accretion) and adjacent habitats.	All foreshore areas	All	57,58,135	GCC		R04, W27, W51, W63, W64		$80,000	3	3	3	3	0	0	0	0	0	0	12	1	13
R11	Sedimentary Processes	Research / Monitoring	Investigate sedimentary processes to determine appropriate long term management strategies to maintain property protection and public access along the foreshore between Ferry Road, Ettalong and the eastern most point of Booker Bay foreshore.	Ettalong Beach	6	247	GCC	DPI (Crown Lands Division)	P43, W28, W29		N/A	0	3	2	2	1	0	3	1	0	0	12	1	13
R14	Sedimentary Processes	Research / Monitoring	Investigate options for upgrading the seawall along Masons Parade and Dane Drive, Gosford, in line with the Gosford Challenge/City Centre Redevelopment to consider environmentally friendly design.	Gosford	2	11,18,136, 200, 201	GCC		P48, W69		$45,000	1	2	2	1	0	1	1	0	0	0	8	1	9
R15	Sedimentary Processes	Research / Monitoring	Investigate options for addressing/managing subsidence currently occurring near Erina Creek.	Muloora Rd, Springfield	2	207	GCC		W34		$55,000	1	1	0	0	0	0	1	0	0	0	3	2	5
R16	Sedimentary Processes	Research / Monitoring	Identify the cause of erosion under the bridge near Lara Street and outline measures to address this issue.	Park Bay	3	213	GCC		W34		$35,000	1	1	1	0	0	0	0	0	0	0	3	2	5
R17	Sedimentary Processes	Research / Monitoring	Investigate options for implementation to address the erosion of the seawall on the sourthern shore of Hardys Bay.	Killcare	6	244	GCC		W34		$299,455	1	1	1	0	0	0	0	0	0	0	3	2	5

Action ID	Management Goal Addressed	Management Category	Strategy Outline	Location	Zone	Issue(s) Addressed	Primary Responsibility	Secondary Responsibility	Cross Reference with Action:	Dependency on Action:	Net Present Value	Water & Sediment Quality	Sedimentary Processes	Ecological Processes	Foreshore Flooding / Inundation	Cultural Heritage	Visual Amenity	Recreational Usage	Development	Governance	Information, Communications and Education	Raw Benefit Index	Council / OEH Response	Adjusted Benefit Index
R18	Habitat and Species Conservation	Research / Monitoring	Conduct a survey of recreational fishing catches and analyse recreational fishing trends to characterise both the impact on the fish populations of Brisbane Water Estuary and the value of recreational fishing as a local industry.	Waterway-wide	All	99, 100	GCC	University of Newcastle, Fishcare Volunteers / DPI (Fisheries)	R18		$55,000	0	0	2	0	0	0	3	4	0	0	9	1	10
R19	Habitat and Species Conservation	Research / Monitoring	Investigate options for the landward migration of intertidal habitats such as saltmarsh under climate change scenarios.	Estuary Foreshores	All		GCC	CMA, OEH	E8, W60	P43, R19, R40	$60,000	0	2	3	3	0	0	-2	0	0	0	6	2	8
R20	Habitat and Species Conservation	Research / Monitoring	Investigate opportunities to monitor indicator organisms within the Estuary to assess effectiveness of management measures to protect biodiversity and maintain the ecological health of the Estuary.	Waterway-wide / Catchment-wide	All	103,142, 145, 151	DPI (Fisheries), GCC	CMA, OEH	R36, R37		$920,491	0	0	4	0	0	0	0	0	0	3	7	1	8
R22	Habitat and Species Conservation	Research / Monitoring	Monitor the extent of riparian, foreshore and aquatic vegetation around the Brisbane Water Estuary. Trends in vegetation condition and extent should be reported every five years. Reference should be made to the NSW Government's NSW Monitoring, Evaluation and Reporting Strategy for estuaries to assess extent of mangrove, saltmarsh and seagrass (the latter to species).	Waterway-wide / Catchment-wide	All	71, 122, 142, 143, 151	DPI (Fisheries)	CMA, OEH	R19, R20, R36, R37, R40		$139,628	0	1	4	1	0	1	0	0	0	3	10	2	12
R24	Habitat and Species Conservation	Research / Monitoring	Investigate the use of constructed wetlands, sediment, and detention basins and other WSUD options to minimise the effect of freshwater and sediment inflows, with particular reference to areas of high biodiversity value around entrances to creeks. Consideration should be given to both current and future meteorological conditions.	Catchment-wide	All		GCC	CMA	W01		N/A	3	4	3	5	0	0	2	0	0	0	17	1	18
R25	Habitat and Species Conservation	Research / Monitoring	Manage Caulerpa taxifolia in accordance with I&I NSW's *NSW Control Plan for the Noxious Marine Alga Caulerpa taxifolia* (2009).	Waterway-wide	All		DPI (Fisheries)				$283,068	0	0	2	0	0	0	0	0	0	2	4	2	6
R26	Habitat and Species Conservation	Research / Monitoring	Develop a research partnership with universities to continue the scientific focus on Brisbane Water Estuary and support this with annual research grants.	LGA-wide	All		GCC	Universities	E03, P19, P20, P27		$453,761	2	2	3	1	1	0	0	2	1	5	17	1	18
R27	Cultural Heritage	Research / Monitoring	Identify the likely location and condition of ship wrecks near the old bar via a maritime archaeological survey.	Entrance	6	192	DP&I	DPI (Crown Lands Division)	W18		$80,000	0	2	0	0	5	0	1	0	0	0	8	2	10
R28	Cultural Heritage	Research / Monitoring	Assess the potential impacts of climate change on heritage items located around the Estuary and along its foreshores.	Waterway-wide / Catchment-wide	All		DP&I	GCC, OEH, DLALC	P60	P43	$50,000	0	0	0	3	5	1	0	0	0	0	9	1	10
R29	Cultural Heritage	Research / Monitoring	Recognise the historic Aboriginal ownership and use of the area by undertaking research into local languages, customs and significant sites.	LGA-wide	All		GCC	OEH, DLALC	P31		$100,000	0	0	0	0	5	0	0	0	0	0	5	2	7

Action ID	Management Goal Addressed	Management Category	Strategy Outline	Location	Zone	Issue(s) Addressed	Primary Responsibility	Secondary Responsibility	Cross Reference with Action:	Dependency on Action:	Net Present Value	Water & Sediment Quality	Sedimentary Processes	Ecological Processes	Foreshore Flooding / Inundation	Cultural Heritage	Visual Amenity	Recreational Usage	Development	Governance	Information, Communications and Education	Raw Benefit Index	Council / OEH Response	Adjusted Benefit Index
R31	Recreational Usage	Research / Monitoring	Conduct an audit of existing land-based and water-based infrastructure for boating (e.g. picnic tables, playgrounds, BBQs, jetties, boat ramps, dinghy storage areas, moorings, trailer parking areas, car parking, garbage bins, toilets, shared pathways, etc.) focusing on: - Patterns in patronage/usage, - Condition and maintenance requirements, - Characterisation of neighbouring land uses, - Proximity to key habitat, heritage items and other environmentally sensitive areas, - Proximity to key locations (e.g. pump out stations, marinas, popular fishing spots, etc.), and - Safety. Based on the outcome of the audit, assess the need to upgrade, maintain or de-commission existing infrastructure. The purpose of this audit is primarily to rationalise recreational access and amenity. The findings may be used to inform Action P41, the Users Plan.	Estuary Foreshores / Waterway-wide	All	3,28,52,61,65, 81, 82,93,95,97, 166, 169, 170, 172, 179, 181, 182	GCC	DPI (Crown Lands Division), NSW Maritime	P35, P41, P47, P55, W69, W77, W81, W93, W94, W96	P41, P43	$172,970	1	1	0	1	1	1	5	2	0	0	12	2	14
R35	Recreational Usage	Research / Monitoring	Investigate options for providing safe public access over/under the rail line to the foreshore adjacent to Railway Street.	Woy Woy	3	212	GCC	RailCorp			$50,000	0	0	-1	0	0	-1	1	0	0	0	-1	2	1
R36	Governance	Research / Monitoring	Establish an annual reporting mechanism to communicate progress towards achieving the goals and objectives of the *Estuary Management Pla* n and Estuary Monitoring Plan. The annual report should consider the need for adaptive management as required.	Catchment-wide / Waterway-wide	All	252	GCC		E08, R39, R40, R41	R37	$158,910	3	3	3	3	2	1	1	0	5	5	26	1	27
R37	Governance	Research / Monitoring	Design a comprehensive Estuary Monitoring Plan to include elements of the physical, social and biological environment to evaluate the success in meeting the objectives and goals outlined in the Estuary Management Plan. The Monitoring Plan should draw together all those individual monitoring activities listed in the actions list into a single overarching framework in line with the NSW Government's NSW Monitoring, Evaluation and Reporting Strategy. The Plan should include reporting on compliance matters, in addition to more general estuary health monitoring activities.	Catchment-wide / Waterway-wide	All	92	GCC		R36, R40, R41	R01, R05, R22, R25	$607,671	4	4	4	3	2	1	1	0	5	5	29	2	31
R38	Governance	Research / Monitoring	Research possible sources of funding and secure ongoing funding for implementation of the Estuary Management Plan. It is anticipated that responsibility and funding for these studies/plans may be shared across State, Federal and local government agencies.	Catchment-wide / Waterway-wide	All	89, 252	GCC		R38		N/A	2	3	3	3	3	1	1	0	5	0	21	1	22
R39	Information, Communications and Education	Research / Monitoring	Develop and maintain a database of all environmental and ecological data available for the Brisbane Water Estuary with a view to providing a comparison between present and historic Estuary conditions. This database should be regularly updated with the results of any monitoring undertaken. Long term trends should be identified and this information communicated directly to the public on a regular basis.	Catchment-wide / Waterway-wide	All		GCC	CMA, OEH	R38, R40, R04		$152,425	3	3	3	3	0	0	0	0	0	4	16	1	17
R40	Information, Communications and Education	Research / Monitoring	Provide for ongoing monitoring of estuarine water levels to provide a continuous long term data set. This is key for monitoring the potential impacts of climate change and initiating appropriate adaptive management responses. The need to install additional water level gauges should be considered.	Waterway-wide	All	128	OEH		E08, P16, P31, P43, P46, P50, P60, R41		$264,850	0	0	1	2	1	0	0	0	3	5	12	3	15

Action ID	Management Goal Addressed	Management Category	Strategy Outline	Location	Zone	Issue(s) Addressed	Primary Responsibility	Secondary Responsibility	Cross Reference with Action:	Dependency on Action:	Net Present Value	Water & Sediment Quality	Sedimentary Processes	Ecological Processes	Foreshore Flooding / Inundation	Cultural Heritage	Visual Amenity	Recreational Usage	Development	Governance	Information, Communications and Education	Raw Benefit Index	Council / OEH Response	Adjusted Benefit Index
R41	Information, Communications and Education	Research / Monitoring	Develop a policy or guideline document detailing specific trigger levels for implementing an adaptive management response to observed climate change impacts on key estuary processes. The trigger levels should be based on observations arising from the Estuary Monitoring Plan (R37) and should (where possible) be explicitly defined. A corresponding adaptive management response should be developed for each trigger. The policy should be reviewed as climate change projections are updated or as additional data/information becomes available.	Waterway-wide	All	128	GCC	OEH, DPI		R38, R40	$71,188	0	0	1	1	1	0	0	0	2	2	7	3	10
R42	Sedimentary Processes	Research / Monitoring	Undertake an estuarine shoreline vulnerability assessment (based on shoreline geomorphology) to assist in planning for sea level rise.	Waterway-wide	All		GCC	OEH			$40,000	0	3	1	0	0	0	0	0	0	3	7	3	10
R43	Sedimentary Processes	Research / Monitoring	Undertake a comprehensive geomorphological study of historic and current sedimentation rates at the estuarine outlet areas of the major creeks (Narara, Erina, Kincumber and Woy Woy Creeks).	Waterway-wide	All		GCC	OEH			$100,000	0	3	0	0	0	0	2	2	0	0	7	2	9
R44	Water and Sediment Quality	Research / Monitoring	Work with Oyster Growers to develop an Environmental Management Strategy, along with improved water quality monitoring and project collaboration.	Waterway-wide	All		GCC	Oceanwatch	R01, R37		$317,820	3	0	3	0	0	0	2	0	2	3	13	2	15
R45	Water and Sediment Quality	Research / Monitoring	To identify primary sources of contamination, especially in the Narara Creek catchment, consider remedial strategies and undertake follow up investigations of sediment in the northern part of the estuary to improve assessment of possible sediment toxicity.	Catchment-wide	All		GCC		W01		$75,000	3	4	2	0	0	0	1	0	0	0	10	1	11
W01	Water and Sediment Quality	Works	Investigate options for implementing catchment based WSUD features in the catchment in order to manage stormwater quality and quantity, with a priority focus on the Narara and Erina Creek catchments, followed by Kincumber Creek catchment.	Catchment-wide	All	117	GCC		P05, R04-R06, R10, R24, W04, W06, W07, W10, W14		$748,611	5	4	5	0	0	1	2	1	0	0	18	2	20
W02	Water and Sediment Quality	Works	Install additional sewage pump-out facilities to reduce water pollution. These should be situated at locations accessible by a range of vessels.	Waterway-wide	All	70	NSW Maritime		E11, P55, W81		$629,701	4	0	3	0	0	0	4	0	0	0	11	1	12
W03	Water and Sediment Quality	Works	Provide for continued implementation of Council's Sewerage Enhancement Program and associated capital investments.	Catchment-wide	All	59,63,107, 120	GCC				N/A													
W04	Water and Sediment Quality	Works	Investigate appropriate stormwater treatment and control measures to reduce sedimentation into Correa Bay.	Correa Bay	3	30,31,141	GCC		W01		$20,000	2	1	2	0	0	0	1	0	0	0	6	1	7
W05	Water and Sediment Quality	Works	Advertise and provide signage for boat pump-out facilities.	Gosford, Hardys Bay	2, 6	88	NSW Maritime		E11, P55, W02, W81		$70,470	3	0	2	0	0	0	2	0	0	0	7	0	7
W06	Water and Sediment Quality	Works	Install and maintain as required sediment traps targeting stormwater flows draining from the escarpment at Hardys Bay.	Hardys Bay	6	191	GCC		W01		$163,564	2	1	2	0	0	0	1	0	0	0	6	1	7
W07	Water and Sediment Quality	Works	Provide ongoing maintenance of existing sediment traps in the catchment draining to Horsfield Bay.	Horsfield Bay Catchment	3	27,30,31	GCC		W01		$79,455	2	1	2	0	0	0	1	0	0	0	6	1	7

Action ID	Management Goal Addressed	Management Category	Strategy Outline	Location	Zone	Issue(s) Addressed	Primary Responsibility	Secondary Responsibility	Cross Reference with Action:	Dependency on Action:	Net Present Value	Water & Sediment Quality	Sedimentary Processes	Ecological Processes	Foreshore Flooding / Inundation	Cultural Heritage	Visual Amenity	Recreational Usage	Development	Governance	Information, Communications and Education	Raw Benefit Index	Council / OEH Response	Adjusted Benefit Index
W09	Water and Sediment Quality	Works	Investigate appropriate WSUD features for those roads that are currently unsealed/unfinished in order to reduce the impact of erosion and sedimentation from these roadways.	Woy Woy, Blackwall	All	108	GCC				$1,570,790	2	2	-4	-1	0	1	0	1	0	0	1	1	2
W10	Water and Sediment Quality	Works	Remediate (or pipe) open drains and install sediment traps for those drains running from Wilkie King and Mundoora Avenues.	Yattalunga	2	241	GCC		W01		$143,861	2	1	1	0	0	0	0	0	0	0	4	1	5
W14	Water and Sediment Quality	Works	Develop and implement measures to address stormwater quality issues associated with runoff from the access road and fire trails near Fisherman's Parade.	Daleys Point	6	83, 222	GCC	OEH	W01, R25		$138,564	1	2	1	0	0	0	0	0	0	0	4	1	5
W15	Water and Sediment Quality	Works	Seal the Hawk Street car park to prevent erosion into Kincumber Creek. The use of permeable pavement is recommended over impermeable surfaces.	Kincumber	5	234	GCC		W01, R26		$172,970	1	1	1	0	0	1	0	0	0	0	4	1	5
W16	Water and Sediment Quality	Works	Investigate and implement measures to improve flow/drainage in the open channel near Mundoora Avenue.	Yattalunga	2	12, 240	GCC				$150,000	1	1	1	1	0	0	0	0	0	0	4	1	5
W17	Water and Sediment Quality	Works	Implement a program of maintenance to address the accumulation of litter in the open drain near Beach Street. Long term management of this issue should also be considered, for example, public education and/or the implementation of additional GPTs.	Ettalong	6	245	GCC		C15, W01		$138,564	1	0	1	0	0	1	1	0	0	1	5	1	6
W18	Sedimentary Processes	Works	Periodically dredge the navigation channel up to 50,000m3 in the Estuary entrance to ensure safe navigation.	Entrance	6	21,38,80, 106	NSW Government		R09, W28		$2,074,252	-1	4	0	0	-1	0	4	3	0	0	9	2	11
W19	Sedimentary Processes	Works	Undertake an ongoing program of maintenance to restore the drainage canals of St Huberts Island to their original design criteria.	St Huberts Island	4	29,32	DPI (Crown Lands Division)	GCC	R09		$2,074,252	-1	2	-2	0	0	0	1	0	0	0	0	2	2
W20	Sedimentary Processes	Works	Dredge the sand bars in the channel between Blackwall Point and Allfield Road, Woy Woy, with a view to improving navigation.	Woy Woy	3	23	NSW Government				$360,000	-1	1	-2	0	0	0	1	0	0	0	-1	1	0
W21	Sedimentary Processes	Works	Dredge from the Correa Bay boat ramp to the entrance of Woy Woy Creek, to extend 300m up the creek channel, with a view to improving drainage and access at this location.	Woy Woy	3	24,43	NSW Government				$500,000	-1	1	1	1	0	0	1	0	0	0	3	1	4
W23	Sedimentary Processes	Works	Deepen and widen the outlets of Mudflat and RSL Creeks in Hardys Bay so that both creeks restore tidal flushing. The efficacy of this option in improving flushing should be assessed prior to undertaking the works.	Mudflat and RSL Creeks	6	74,157	NSW Government		W06, W27, W34		$160,000	-1	1	1	1	0	0	0	0	0	0	2	1	3
W24	Sedimentary Processes	Works	Deepen and widen the entrance to Hardys Bay to permit greater tidal flushing. The efficacy of this action in improving flushing should be assessed prior to undertaking the works. In addition, the environmental aspects must also be considered.	Hardys Bay	6	112	NSW Government				$500,000	-1	2	-2	0	0	0	1	0	0	0	0	0	0
W25	Sedimentary Processes	Works	Dredge in the Saratoga (Paddy's and Lintern) Channel(s) and around the boat ramps to permit better access.	Saratoga and Green	2	1,8,9,129, 178, 233	NSW Government		R09		$600,000	-1	1	-1	0	0	0	1	0	0	0	0	1	1
W26	Sedimentary Processes	Works	Rehabilitate the eroding foreshores on the eastern shores of Hardys Bay with natural vegetation typical of that naturally occurring in the area. Where this is not feasible, investigate environmentally friendly seawall options.	Eastern shores of Hardys Bay	6	246	GCC	Volunteers	E09, P49		$94,455	2	4	3	2	0	2	0	0	0	0	13	1	14
W27	Sedimentary Processes	Works	Undertake regular maintenance to remove sediments from the outlets of stormwater drains.	Catchment-wide	All	74, 191	GCC		R10, W01		$529,701	2	3	2	3	0	0	0	0	0	0	10	0	10
W28	Sedimentary Processes	Works	Undertake beach re-nourishment works at Ettalong Beach for the purposes of beach amenity and foreshore protection.	Ettalong Beach	6	78	GCC	DPI (Crown Lands Division)	W29, W55, W112	R11	$1,374,252	-1	4	0	0	-1	0	4	3	0	0	9	2	11
W29	Sedimentary Processes	Works	Implement shoreline protection works which incorporate environmentally friendly design features.	Ettalong Beach	6	78	GCC	OEH, DPI (Crown Lands Division)	W28, W55, W112	R11	$1,309,401	0	3	2	2	1	3	3	1	0	0	15	1	16

Action ID	Management Goal Addressed	Management Category	Strategy Outline	Location	Zone	Issue(s) Addressed	Primary Responsibility	Secondary Responsibility	Cross Reference with Action:	Dependency on Action:	Net Present Value	Water & Sediment Quality	Sedimentary Processes	Ecological Processes	Foreshore Flooding / Inundation	Cultural Heritage	Visual Amenity	Recreational Usage	Development	Governance	Information, Communications and Education	Raw Benefit Index	Council / OEH Response	Adjusted Benefit Index
W30	Sedimentary Processes	Works	Remove the sandstone and cement abutments from the Pretty Beach jetty and adjacent to the pool.	Pretty Beach	6		GCC		P39, W31		$100,000	0	1	1	0	0	1	1	0	0	0	4	2	6
W31	Sedimentary Processes	Works	Investigate options to address the accretion of sediments along the eastern shoreline along Pretty Beach, including those that have built up in the swimming pool.	Pretty Beach	6	79, 168	GCC		P39, W30, W32		$30,000	-1	1	2	0	0	0	1	0	0	0	3	0	3
W32	Sedimentary Processes	Works	Dredge sediments around the boat launching pontoon at Pretty Beach to enable boats to tie up on both sides of the pontoon.	Pretty Beach	6	95	NSW Government		W31, W33		$1,326,282	-1	1	2	0	0	0	1	0	0	0	3	0	3
W33	Sedimentary Processes	Works	Reinstate a vegetated, sandy shoreline at Pretty Beach similar to that present prior to the construction of Pretty Beach Road. The use of mangroves for revegetation works is discouraged due to their potential to outcompete and displace saltmarsh.	Pretty Beach	6		GCC	Volunteers	P49, W31, W32		$288,564	1	2	2	0	0	2	1	0	0	0	8	2	10
W34	Sedimentary Processes	Works	Identify locations of bank erosion along creekline corridors and the Estuary foreshore. Design and implement remediation measures to address these issues, with re-establishment of native vegetation being the preferred option where feasible. Reference should be made to the shoreline assessment provided in Appendix H of the *Estuary Processes Study* (Cardno, 2008) along with the Narara Creek and Erina Rivercare Plans.	Erina Creek, Narara Creek, Woy Woy Creek, Hardys Bay and Kincumber Creek as a priority	All	23, 121, 234,	GCC	NOW, OEH	P14, R10, R17, W38, W41, W45, W46, W48, W49, W53, W55		$2,053,952	3	4	4	1	1	1	2	0	0	0	16	2	18
W35	Sedimentary Processes	Works	Investigate appropriate sediment control works to address sediment accretion issues at St Huberts Island.	St Huberts Island	4	22,29,32	GCC		P08, W19		$50,000	2	2	3	0	0	0	0	0	0	0	7	2	9
W38	Sedimentary Processes	Works	Implement shoreline protection works (to include plantings) to address the erosion and foreshore inundation along the foreshore at Yattalunga Reserve.	Yattalunga	2	12,134	GCC			W34	N/A													
W39	Sedimentary Processes	Works	Rehabilitate eroded foreshore near 29 Araluen Drive, Killcare.	Killcare	6		GCC			W34	$80,000	1	1	2	1	0	0	1	0	0	0	6	2	8
W41	Sedimentary Processes	Works	Undertake foreshore stabilisation works in the Punt Bridge area incorporating revegetation to address erosion issues.	East Gosford	2	205	GCC	Volunteers		W34	$205,940	1	1	1	0	0	1	1	0	0	0	5	1	6
W43	Sedimentary Processes	Works	Develop and implement a long term solution to replace the currently failing seawall in Memorial Park on Brick Wharf Road. Any option identified should wherever possible incorporate environmentally friendly features.	Woy Woy	4	216	GCC	OEH		W34	$308,910	1	1	1	0	0	1	1	0	0	0	5	0	5
W44	Sedimentary Processes	Works	Replace the collapsed stormwater drain running between the two ovals in Austin Butler Reserve and remove accreted sediments. There is a preference for the use of a natural vegetated swale and/or small wetland.	Woy Woy	4	217	GCC				$100,000	1	1	-1	1	0	0	1	0	0	0	3	1	4
W45	Sedimentary Processes	Works	Undertake foreshore stabilisation works to address erosion currently occurring in Palermo Reserve, Empire Bay Drive.	Daleys Point	4	220	GCC			W34	$102,970	1	1	1	0	0	0	1	0	0	0	4	1	5
W46	Sedimentary Processes	Works	Investigate the cause of erosion around the Blackwall Point boat ramp and develop measures to address this issue. Any necessary repairs to stabilise the foreshore and the adjacent roadway should be undertaken.	Blackwall	4	134,221	GCC		W34		$255,940	1	1	1	0	0	0	1	0	0	0	4	2	6
W47	Sedimentary Processes	Works	Investigate appropriate and cost effective methods to remediate any scouring currently occurring of the existing seawall at Illoura Reserve, Davistown.	Davistown	5	223	GCC			W34	$67,970	1	2	1	0	0	0	1	0	0	0	5	1	6
W48	Sedimentary Processes	Works	Enhance foreshore vegetation to prevent further erosion of Illoura Reserve between Lintern Street and Malinya Road, Davistown, and along the western/northern foreshore of Kincumber Broadwater.	Davistown	5	225	GCC	Volunteers	W47, P14	W34	$104,455	1	1	1	0	0	0	1	0	0	0	4	1	5
W49	Sedimentary Processes	Works	Implement foreshore stabilisation works to prevent further erosion of the shoreline near Rip Road Reserve.	Blackwall	4	134, 224	GCC	Volunteers		W34	$132,970	1	1	1	0	0	0	1	0	0	0	4	1	5
W50	Sedimentary Processes	Works	Undertake minor dredging works to improve access to the Centennial Street boat ramp.	Saratoga	4	178, 226	NSW Government				$80,000	-1	1	-1	0	0	0	1	0	0	0	0	1	1

Action ID	Management Goal Addressed	Management Category	Strategy Outline	Location	Zone	Issue(s) Addressed	Primary Responsibility	Secondary Responsibility	Cross Reference with Action:	Dependency on Action:	Net Present Value	Water & Sediment Quality	Sedimentary Processes	Ecological Processes	Foreshore Flooding / Inundation	Cultural Heritage	Visual Amenity	Recreational Usage	Development	Governance	Information, Communications and Education	Raw Benefit Index	Council / OEH Response	Adjusted Benefit Index
W51	Sedimentary Processes	Works	Implement measures to dissipate the energy of stormwater flows and prevent scour associated with the stormwater outlet near the corner of Jirramba and Mimosa Avenues.	Saratoga	2	239	GCC		W01	R10, W34	$55,000	1	1	1	0	0	0	0	0	0	0	3	2	5
W52	Sedimentary Processes	Works	Investigate and implement measures to address siltation currently occurring in the open drain along the foreshore between Mundoora Access and Wilkie King Avenue. Both removal of the accreted sediments and measures to address sediment sources should be considered. There is a preference for the use of a natural vegetated swale and/or small wetland.	Yattalunga	2	241	GCC		W01	R10	$132,970	1	1	1	0	0	0	0	0	0	0	3	1	4
W53	Sedimentary Processes	Works	Undertake bank stabilisation works to address the erosion occurring in the creek in the region of Avoca and Sun Valley Drives.	Green Point	2	243	GCC			W34	$212,970	1	1	1	0	0	0	0	0	0	0	3	2	5
W54	Sedimentary Processes	Works	Investigate and implement measures to address the eroding seawall located near Araluen Drive on the southern side of Hardys Bay. Preferred options include re-establishment of native vegetation or an environmentally friendly seawall.	Hardys Bay	6	244	GCC			W34	$425,940	0	1	1	0	0	0	0	0	0	0	2	1	3
W55	Sedimentary Processes	Works	Identify the cause of foreshore erosion in Lance Webb Reserve and develop and implement measures to stabilise the foreshore.	Ettalong	6	247	GCC		W112	R11	$279,455	1	1	1	0	0	0	1	0	0	0	4	2	6
W58	Foreshore Flooding/Inundation	Works	Control mangrove growth where they are affecting key drainage channels. This should be undertaken (where permissable) under the relevant permit or licence.	Catchment Tributaries	All	73,77	GCC	DPI (Fisheries), Volunteers			$288,068	-1	1	-2	3	0	0	0	0	0	0	1	1	2
W59	Foreshore Flooding/Inundation	Works	Investigate the benefits of decommissioning the Woy Woy Creek dam at former abattoir site.	Woy Woy Creek	3		GCC				$25,000	1	1	1	1	0	0	0	0	0	0	4	2	6
W60	Foreshore Flooding/Inundation	Works	Where possible, provide for managed retreat of infrastructure from foreshore areas likely to be affected by sea level rise on a regular basis.	Estuary Foreshores	All	92, 128	GCC, Asset Owners	OEH		P43, R40	$2,648,504	0	3	3	5	-3	0	-3	-3	0	0	2	2	4
W63	Foreshore Flooding/Inundation	Works	Investigate and implement options to address the issue of drainage from private properties along Mundoora Avenue onto the public reserve.	Yattalunga	2	12, 236	GCC				$132,970	1	1	1	0	0	0	1	-1	0	0	3	2	5
W64	Foreshore Flooding/Inundation	Works	Undertake to improve drainage in the creek by dredging accreted sediments near Avoca and Sun Valley Drives.	Green Point	2	242	GCC		W01		$55,000	0	1	-1	1	0	0	0	0	0	0	1	1	2
W65	Habitat and Species Conservation	Works	Replace existing swing moorings within the Estuary with more appropriate, seagrass friendly moorings.	Waterway-wide	All	55,62,95,116, 144,147	NSW Maritime		R31		$79,455	0	3	2	0	0	0	0	0	0	0	5	2	7
W66	Habitat and Species Conservation	Works	Provide fish friendly structures where new instream structures are being constructed.	Catchment Tributaries	All		GCC, RTA	DPI (Fisheries)	W67		$635,641	0	0	1	0	0	0	0	0	0	0	1	2	3
W67	Habitat and Species Conservation	Works	Identify existing instream infrastructure (e.g. weirs and culverts) for replacement or retrofitting to fish friendly status.	Catchment Tributaries	All		GCC, RTA	DPI (Fisheries)	W66		$645,641	0	0	1	0	0	0	0	0	0	0	1	2	3
W69	Habitat and Species Conservation	Works	Review condition of existing sea walls in Council's foreshore parks to investigate possibility of returning natural foreshore and/or use of alternative materials in line with DECC's Environmentally Friendly Seawalls guidelines (2009).	Estuary Foreshores	All		GCC	DPI (Crown Lands Division), OEH, CMA	R15, W43, W47, W54	W41	$579,701	1	3	5	-1	-1	1	0	0	0	0	8	2	10
W70	Habitat and Species Conservation	Works	Fence existing saltmarshes to prevent access by vehicles, bikes and domestic animals and provide information on the importance of saltmarsh habitat to estuary health.	Estuary Foreshores	All	34,41,155	GCC	CMA, Bushcare Volunteers	W71		$662,126	2	3	4	1	0	-1	-1	0	0	3	11	1	12

Action ID	Management Goal Addressed	Management Category	Strategy Outline	Location	Zone	Issue(s) Addressed	Primary Responsibility	Secondary Responsibility	Cross Reference with Action:	Dependency on Action:	Net Present Value	Water & Sediment Quality	Sedimentary Processes	Ecological Processes	Foreshore Flooding / Inundation	Cultural Heritage	Visual Amenity	Recreational Usage	Development	Governance	Information, Communications and Education	Raw Benefit Index	Council / OEH Response	Adjusted Benefit Index
W71	Habitat and Species Conservation	Works	Where appropriate, rehabilitate saltmarsh habitats on an Estuary-wide basis. Rehabilitation works should be prioritised with due consideration of habitat connectivity, and the potential for ongoing conservation in both the medium-term and long-term (i.e. under a climate change scenario).	Estuary-wide	All	34,218,149	GCC	OEH, CMA, Bushcare Volunteers	W69, W70		$324,850	2	3	5	1	0	1	0	0	0	1	13	1	14
W73	Habitat and Species Conservation	Works	Continue weed control activities in Council's foreshore reserves.	Estuary Foreshores	All	49, 156, 208	GCC	Bushcare Volunteers			$79,455	0	0	5	0	0	0	0	0	0	0	5	2	7
W77	Habitat and Species Conservation	Works	Investigate alternative dinghy storage options/locations to provide suitable storage facilities located near the Scout Hall on Mason Parade, Gosford.	Mason Parade, Gosford	2	206	GCC		P35		$132,970	1	1	2	0	0	0	1	0	0	0	5	2	7
W81	Recreational Usage	Works	Seek to provide additional facilities for the boating community to include slipways, shipwright services, travel lifts, re-fuelling areas and hard stand areas. The form and location of these additional facilities should be such that they are accessible by a range of vessels over the full tidal cycle.	Estuary Foreshores / Waterway-wide	All	70, 177	DPI (Crown Lands Division)	GCC	P35, W02, W85	R31, P41	$2,330,683	-3	-2	-2	0	0	-2	4	4	0	0	-1	0	-1
W82	Recreational Usage	Works	Seek to provide a publicly accessible pathway along the entire Estuary foreshore. This should be approached in a strategic fashion incorporating: a) Linkages with existing cycleways, pathways and public transport in the wider catchment, b) Safety by Design (e.g. through the provision of lighting), and c) Consideration of environmental constraints (e.g. gridded/light permeable boardwalks may be more suitable in ecologically sensitive areas).	Estuary Foreshores	All	165, 167	GCC	DPI (Crown Lands Division)	P50, W83, W84, W94		$1,324,252	-1	-1	0	0	1	2	5	0	0	0	6	0	6
W83	Recreational Usage	Works	Identify priority, privately owned/managed parcels of foreshore land for acquisition and/or incorporation into publicly accessible foreshore land.	Estuary Foreshores	All	165	GCC	DPI (Crown Lands Division)	P50, W94	W81	$5,826,708	0	1	2	1	1	2	3	0	0	0	10	1	11
W84	Recreational Usage	Works	Provide boardwalks at sensitive foreshore locations to permit public access.	Estuary Foreshores	All	165	GCC		P50, W94	W81	$1,079,401	2	1	2	1	1	2	3	0	0	0	12	1	13
W85	Recreational Usage	Works	Enforce the replacement of fixed public jetties with floating pontoons (where feasible) with transparent or mesh deck materials to permit light penetration in areas containing seagrass habitat.	Waterway-wide	All	15	DPI (Crown Lands Division)	GCC	P46, W94		$2,330,683	0	2	0	0	-2	2	2	0	0	0	4	1	5
W87	Recreational Usage	Works	Ensure that the navigation markers are moved, or new markers put in place as required, in accordance with movement of the associated shoals.	Waterway-wide	All	44	NSW Maritime				$158,910	0	0	0	-1	0	0	4	0	0	0	3	1	4
W89	Recreational Usage	Works	Provide additional off-leash dog walking areas in areas which do not impact upon threatened and protected flora and fauna.	Catchment-wide	All		NSW Government		C10, W91		N/A													
W91	Recreational Usage	Works	Provide bins and bags for the disposal of animal faeces by dog walkers.	Catchment-wide	All		GCC		C10, W89		$120,940	3	0	1	0	0	1	3	0	0	0	8	2	10
W93	Recreational Usage	Works	Provide additional rubbish and recycling bins along the foreshore, focusing on access points and targeting heavily utilised foreshore reserves as a priority.	Estuary Foreshores	All	54	GCC			R31	$183,910	2	0	2	0	0	0	3	0	0	0	7	1	8
W94	Recreational Usage	Works	Provide additional facilities for disabled and less mobile people, to include access ramps, seating, disabled parking, etc.	Fagans Bay, Woy Woy, Ettalong	All	165	GCC		W84, W85	R31	$1,235,641	0	0	0	0	0	0	3	0	0	0	3	2	5
W96	Recreational Usage	Works	Provide short-term 'loading zones' for recreational users (un)loading bikes or other equipment immediately adjacent to heavily utilised recreational sites.	Estuary Foreshores	All		GCC			R31	$25,000	0	0	0	0	0	0	3	0	0	0	3	1	4
W98	Recreational Usage	Works	Provide additional public open space areas incorporating walking tracks in the Woy Woy area (to the waterfall and through the former abattoir site).	Woy Woy	3		GCC		W82		$461,880	0	-1	0	0	0	1	1	0	0	0	1	1	2
W101	Recreational Usage	Works	Provide improved, safe access for recreational users accessing the foreshore and waterway near Victory Parade, Tascott, via re-configuration of the existing rock wall.	Tascott	2	4,183	GCC				$275,000	0	-1	0	1	0	1	1	0	0	0	2	2	4

Action ID	Management Goal Addressed	Management Category	Strategy Outline	Location	Zone	Issue(s) Addressed	Primary Responsibility	Secondary Responsibility	Cross Reference with Action:	Dependency on Action:	Net Present Value	Water & Sediment Quality	Sedimentary Processes	Ecological Processes	Foreshore Flooding / Inundation	Cultural Heritage	Visual Amenity	Recreational Usage	Development	Governance	Information, Communications and Education	Raw Benefit Index	Council / OEH Response	Adjusted Benefit Index
W104	Recreational Usage	Works	Improve public access along the foreshore reserve between Ironbark Point and Rocky Point. Assess the feasibility of installing a boardwalk, undertaking foreshore stabilisation works and/or creating a public path in front of houses between 36-40 Asca Drive, Green Point.	Green Point	2	2, 196	GCC		W82		$280,940	0	1	1	0	0	1	1	0	0	0	4	2	6
W105	Recreational Usage	Works	Extend the Orana Street boat ramp to permit access at low tide.	Green Point	2	197	GCC				$75,000	0	-1	-1	0	0	0	1	0	0	0	-1	1	0
W107	Recreational Usage	Works	Provide dedicated parking for users of the boat ramp near Punt Bridge. This would require some initial consideration of feasibility prior to implementation.	Central Coast Hwy	2	204	GCC			P41	$132,970	0	0	-1	0	0	0	1	0	0	0	0	1	1
W108	Recreational Usage	Works	Undertake review of need requirements for the tidal baths located near Brisbane Water Drive.	Woy Woy	4	227	GCC			P41	$355,940	0	-1	-1	0	0	0	1	0	0	0	-1	-1	-2
W109	Recreational Usage	Works	Investigate and implement suitable options for improving drainage of the oval located near Willaroo Road.	Saratoga	4	229	GCC				$355,940	0	0	0	1	0	0	1	0	0	0	2	1	3
W112	Recreational Usage	Works	Identify measures to improve public access to Lance Webb Reserve and the beach in this location.	Ettalong	6	247	GCC		W82		$50,000	0	0	1	0	0	0	1	0	0	0	2	2	4
W114	Sedimentary Processes	Works	Investigate options to improve access to the Volunteer Coastal Patrol sufficient to permit access over the full tidal cycle.	Point Clare	2	5	NSW Maritime				$170,000	-1	1	0	0	0	0	3	0	0	0	3	2	5
W115	Sedimentary Processes	Works	Dredge to improve access to the boat pump-out and other facilities in Gosford Harbour. The dredging should be sufficient to permit access over the full tidal cycle.	Gosford Harbour	2	10,130	NSW Government				$170,000	-1	1	0	0	0	0	3	0	0	0	3	1	4
W116	Sedimentary Processes	Works	Dredge to improve navigation and access to boat ramps in Cockle Channel.	Davistown	5	1, 45, 46, 47,53, 60, 178, 228	NSW Government		R09	P07	$647,276	-1	1	0	0	0	0	1	0	0	0	1	1	2
W117	Sedimentary Processes	Works	Dredge to improve navigation in Woy Woy Channel near Pelican Island.	Woy Woy	4	42,129,130	NSW Government		R09	P07	$647,276	-1	1	0	0	0	0	1	0	0	0	1	1	2
W118	Sedimentary Processes	Works	Dredge to improve navigation in Woy Woy Bay.	Woy Woy Bay	3	130	NSW Government				$200,000	-1	1	0	0	0	0	1	0	0	0	1	0	1
W120	Sedimentary Processes	Works	Dredge to improve access to the boat pump-out and other facilities in Hardys Bay. The dredging should be sufficient to permit access over the full tidal cycle.	Hardys Bay	6	74,86,130	NSW Government				$200,000	0	1	0	0	0	0	1	0	0	0	2	1	3
W121	Sedimentary Processes	Works	Investigate options to address access and amenity issues associated with the blockage of the entrance to Riley's Bay and sediment accretion in this area.	Riley's Bay	6		NSW Government				$50,000	-1	1	0	0	0	0	1	0	0	0	1	0	1
W122	Water and Sediment Quality	Works	Investigate the feasibility of increasing the capacity of the culvert under the rail line at Fagans Bay to enhance flushing and thereby improve water quality. This investigation should also consider the influence of any historic sedimentation that may have occurred.	Fagans Bay	1		GCC				$20,000	2	1	1	1	0	0	0	0	0	0	5	0	5
W123	Habitat and Species Conservation	Works	Investigate the feasibility of utilising artificial reef structures to provide habitat diversity and/or minimise foreshore erosion/recession.	Waterway-wide	All		GCC	DPI (Fisheries), OEH	R26		$75,000	-1	2	3	0	0	0	2	0	0	0	6	2	8
W124	Recreational Usage	Works	Work with the NSW Recreational Fishing Alliance to achieve access and riparian vegetation enhancement to Dell Road Reserve, Narara Creek.	West Gosford	1		GCC		P41, R31		$50,000	1	2	2	0	0	1	2	0	0	0	8	1	9
W125	Recreational Usage	Works	Provide improved access between foreshore and the waterway for people launching/retrieving small watercraft from Goodaywang Reserve, Point Clare.	Point Clare	2		GCC		P41, R31		$75,000	0	0	0	0	0	0	3	1	0	0	4	1	5

Appendix B

Implementation Strategy

Action ID	Management Goal Addressed	Management Category	Strategy Outline	Location	Zone	Primary Responsibility	Secondary Responsibility	Cross Reference with Action:	Dependency on Action:	Comments	Preliminary Estimate of Capital Cost	Preliminary Estimate of Annual Maintenance / Recurrent Cost / Revenue (-ve values)	Net Present Value	Potential Funding Stream	Implementation Timeframe
P43	Foreshore Development	Planning	Prepare a Climate Change Adaptation Plan that will deliver land use zoning and development controls for the Estuary that are based on the current IPCC projections of 0.9m sea level rise by 2100. The preparation of this study should be closely linked to the Brisbane Water Foreshore Coastal Floodplain Risk Inundation Management Study and Plan, anticipated to be drafted by 2011.	Estuary Foreshores	All	GCC	OEH	P44, P45, P54, R40			$100,000	$0	$100,000		S
E08	Information, Communications and Education	Education	Give consideration to methods of detecting and informing the community of changes to sea levels and other potential climate change impacts. These methods should not result in a sense of panic or alarm, instead they should empower the community to act in a well considered and informed manner and where possible, encourage the community to become engaged in Council's decision making processes. The information provided to the public should be supported by research presented by the IPCC and the State/Federal government, as well as observed trends in local sea levels.	LGA-wide	All	GCC	OEH, CMA	P43	R40		$15,000	$5,000	$67,970	National Natural Disaster Mitigation Program	S
P23	Habitat and Species Conservation	Planning	Develop a conservation strategy for the birds of Brisbane Water Estuary that addresses the main issues of disturbance by pedestrians, dog-walkers and watercraft, predation by feral and domestic animals, and habitat loss/degradation. This should include consideration of threatened and protected species, such as the Bush Stone Curlew, and the habitats that support them.	Waterway-wide / Catchment-wide	All	GCC	CMA, OEH, local bird watching clubs	E03, P27		The CMA advises it is in partnership with the University of Western Sydney on a knowledge project entitled 'Identification of key sites for protection and habitat enhancement for the endangered Bush Stone-Curlew'. The final report and associated GIS modelling nominates sites and recommends actions for on-ground works in Gosford LGA and is available for use by Gosford City Council.	$30,000	$10,000	$135,940	Australian Bird Environment Foundation Grant	S
P41	Recreational Usage	Planning	Prepare a Brisbane Water Estuary Users Plan which addresses such issues as equity of access, boat storage, conflicts of usage, mooring types and caps, number and type of public access points (wharves and jetties), coverage and consistency of foreshore Plans of Management with priority areas identified for new Plans of Management, estimation of an estuary carrying capacity with respect to development intensity, fishing/fisheries and boating. Reference should be made to the *Brisbane Water Estuary Processes Study* (Cardno, 2008), particularly Appendix N, for further details on existing recreational patterns, conflicts and future opportunities, as well as details of where recreation may be impacting on other estuarine processes (e.g. on ecological processes). It is noted that implementation of this action is also dependent upon the provision of supporting information via the implementation of other management actions (as	Estuary Foreshores / Waterway-wide	All	GCC		C12, P55, W81	R31		$60,000	$0	$60,000		S
P53	Commercial Development	Planning	Promote the Brisbane Water Estuary for eco-tourism and support relevant local commercial development in this area.	Estuary Foreshores / Waterway-wide	All	GCC	DPI (Crown Lands Division), Central Coast Tourism, Gosford Chamber of Commerce	P54, P55,		Reference should be made to *Central Coast Destination Management Plan for Tourism 2010-2013*. Cost of implementation provides for GCC to be involved in brand development, establishing strategic partnerships/alliances, developing and distributing advertising materials, and developing/hosting events related to	$200,000	$100,000	$1,259,401		S

Action ID	Management Goal Addressed	Management Category	Strategy Outline	Location	Zone	Primary Responsibility	Secondary Responsibility	Cross Reference with Action:	Dependency on Action:	Comments	Preliminary Estimate of Capital Cost	Preliminary Estimate of Annual Maintenance / Recurrent Cost / Revenue (-ve values)	Net Present Value	Potential Funding Stream	Implementation Timeframe
R37	Governance	Research / Monitoring	Design a comprehensive Estuary Monitoring Plan to include elements of the physical, social and biological environment to evaluate the success in meeting the objectives and goals outlined in the Estuary Management Plan. The Monitoring Plan should draw together all those individual monitoring activities listed in the actions list into a single overarching framework in line with the NSW Government's NSW Monitoring, Evaluation and Reporting Strategy. The Plan should include reporting on compliance matters, in addition to more general estuary health monitoring activities.	Catchment-wide / Waterway-wide	All	GCC		R36, R40, R41	R01, R05, R22, R25	Cost includes development of the Plan and implementation. It is noted that some individual monitoring components are costed separately (e.g. Water Quality Monitoring). Regarding compliance matters, the issues/non-compliances (and subsequent action) should be summarised and responsibility for further action/follow up allocated to the appropriate authority.	$25,000	$55,000	$607,671		S
R36	Governance	Research / Monitoring	Establish an annual reporting mechanism to communicate progress towards achieving the goals and objectives of the Estuary Management Plan and Estuary Monitoring Plan. The annual report should consider the need for adaptive management as required.	Catchment-wide / Waterway-wide	All	GCC		E08, R39, R40, R41	R37		$0	$15,000	$158,910		S
R38	Governance	Research / Monitoring	Research possible sources of funding and secure ongoing funding for implementation of the Estuary Management Plan. It is anticipated that responsibility and funding for these studies/plans may be shared across State, Federal and local government agencies.	Catchment-wide / Waterway-wide	All	GCC		R38			Currently underway	$0	N/A		S
W01	Water and Sediment Quality	Works	Investigate options for implementing catchment based WSUD features in the catchment in order to manage stormwater quality and quantity, with a priority focus on the Narara and Erina Creek catchments, followed by Kincumber Creek catchment.	Catchment-wide	All	GCC		P05, R04-R06, R10, R24, W04, W06, W07, W10, W14		Capital cost is associated with developing a catchment-wide strategy and annual budget provide for the implementation of the strategy (i.e. for designing and constructing a WSUD features such as a SQID). Reference should be made to Erina and Narara Creek Rivercare Management Plans that include some WSUD recommendations (e.g. for GPTs and trash racks).	$60,000	$65,000	$748,611		S
W34	Sedimentary Processes	Works	Identify locations of bank erosion along creekline corridors and the Estuary foreshore. Design and implement remediation measures to address these issues, with re-establishment of native vegetation being the preferred option where feasible. Reference should be made to the shoreline assessment provided in Appendix H of the *Estuary Processes Study* (Cardno, 2008) along with the Narara Creek and Erina Rivercare Plans.	Erina Creek, Narara Creek, Woy Woy Creek, Hardys Bay and Kincumber Creek as a priority	All	GCC	NOW, OEH	P14, R10, R17, W38, W41, W45, W46, W48, W49, W53, W55		Staged implementation over time.	$200,000	$175,000	$2,053,952	Rivercare National Heritage Trust GCC's Environmental Levy Works by landowners	S
C15	Information, Communications and Education	Compliance	Enforce littering restrictions and undertake parallel education programs about littering.	LGA-wide	All	GCC		E02, E07, E11, R05, W91, W93			$10,000	$7,500	$89,455	Butt Littering Trust	S
E09	Information, Communications and Education	Education	Provide foreshore property owners with information/guidelines about what constitutes good and bad practice with respect to foreshore management (e.g. limits of mowing, stabilisation works, etc.). This should include information on environmentally friendly seawall options to both the community and those individuals assessing development applications for these structures. Reference should be made to DECC's *Environmentally Friendly Seawalls: A Guide to Improving the Environmental Value of Seawalls and Seawall-lined Foreshores in Estuaries* (2009).	Foreshore Property Owners	All	GCC	OEH	C02, C05, C14, P14, P44, P45, P46, P47, P48, P49, P50			$30,000	$7,500	$109,455		S
P01	Water and Sediment Quality	Planning	Provide for the development, implementation and regular re-assessment of Riparian Zone and Bank Management Plans for the major tributaries draining into the Estuary, including Narara Creek Rivercare Plan, Erina Rivercare Plan, Kincumber Creek Riparian Plan, Woy Woy Creek, Currumbine Creek and Ettalong Creek.	Catchment-wide	All	GCC	NOW	W34, W53			$250,000	$150,000	$1,839,102	Rivercare National Heritage Trust GCC's Environmental Levy Works by landowners	S

Action ID	Management Goal Addressed	Management Category	Strategy Outline	Location	Zone	Primary Responsibility	Secondary Responsibility	Cross Reference with Action:	Dependency on Action:	Comments	Preliminary Estimate of Capital Cost	Preliminary Estimate of Annual Maintenance / Recurrent Cost / Revenue (-ve values)	Net Present Value	Potential Funding Stream	Implementation Timeframe
P59	Governance	Planning	Adopt the Vision Statement for the Brisbane Water Estuary provided in the *Estuary Management Plan* .	Catchment-wide / Waterway-wide	All	GCC		W114			No cost implications .	$0	N/A		S
R14	Sedimentary Processes	Research / Monitoring	Investigate options for upgrading the seawall along Masons Parade and Dane Drive, Gosford, in line with the Gosford Challenge/City Centre Redevelopment to consider environmentally friendly design.	Gosford	2	GCC		P48, W69		To be implemented with Waterfront Re-development Plan within 24 months. Cost of implementation provides for investigation only.	$45,000	$0	$45,000	NSW Coastal Management Program	S
R11	Sedimentary Processes	Research / Monitoring	Investigate sedimentary processes to determine appropriate long term management strategies to maintain property protection and public access along the foreshore between Ferry Road, Ettalong and the eastern most point of Booker Bay foreshore.	Ettalong Beach	6	GCC	DPI (Crown Lands Division)	P43, W28, W29			Currently underway	$0	N/A	NSW Coastal Management Program	S
R26	Habitat and Species Conservation	Research / Monitoring	Develop a research partnership with universities to continue the scientific focus on Brisbane Water Estuary and support this with annual research grants.	LGA-wide	All	GCC	Universities	E03, P19, P20, P27			$30,000	$40,000	$453,761	Australian Research Council Grants	S
W48	Sedimentary Processes	Works	Enhance foreshore vegetation to prevent further erosion of Illoura Reserve between Lintern Street and Malinya Road, Davistown, and along the western/northern foreshore of Kincumber Broadwater.	Davistown	5	GCC	Volunteers	W47, P14	W34		$25,000	$7,500	$104,455		S
W70	Habitat and Species Conservation	Works	Fence existing saltmarshes to prevent access by vehicles, bikes and domestic animals and provide information on the importance of saltmarsh habitat to estuary health.	Estuary Foreshores	All	GCC	CMA, Bushcare Volunteers	W71		Assume implemented over a five year time frame at a total cost of $250,000.	$0	$62,500	$662,126	Fish Habitat Action Program, Caring for Our Country Grant	S
R44	Water and Sediment Quality	Research / Monitoring	Work with Oyster Growers to develop an Environmental Management Strategy, along with improved water quality monitoring and project collaboration.	Waterway-wide	All	GCC	Oceanwatch	R01, R37		Provides for an annual salary equivalent to 0.4 full time staff.	$0	$30,000	$317,820		S
C01	Water and Sediment Quality	Compliance	Continue program of auditing to ensure best management practices for marinas around Brisbane Water Estuary. DECC's brochure *Environmental Action for Marinas, Boatsheds and Slipways* (2007) should be provided to marine operators.	All marinas	All	OEH, NSW Maritime	GCC				$20,000	$30,000	$337,820		M
C02	Water and Sediment Quality	Compliance	Provide additional resources for Council officers to undertake audits of properties to ensure enforcement of policies and conditions of consent relating to water quality during both the construction and operational phases.	Catchment-wide	All	GCC		C13, P04			$0	$70,000	$741,581		M
C03	Water and Sediment Quality	Compliance	Work with private land holders / tenants to improve stormwater management practices in the industrial estate near Hawk Street.	Kincumber	5	GCC	OEH				$25,000	$5,000	$77,970		M
C04	Habitat and Species Conservation	Compliance	Ensure ongoing enforcement of fishing regulations.	Waterway-wide	All	DPI (Fisheries)	Fishcare Volunteers	E01			$0	$30,000	$317,820		M
C05	Habitat and Species Conservation	Compliance	Ensure the ongoing enforcement of Council's *Tree Vandalism Policy* . Reference should also be made to *D6.44 Landscape and Vegetation Management Policy* .	LGA-wide	All	GCC					$0	$25,000	$264,850		M
C08	Recreational Usage	Compliance	Enforce boating regulations (particularly speed restrictions and zoning of activities) within Brisbane Water.	Waterway-wide	All	NSW Maritime		E01, E11, W05, C12			$0	$50,000	$529,701		M
C10	Recreational Usage	Compliance	Enforce on-leash dog walking in restricted areas in line with Council's Dog Policy Review.	Catchment-wide	All	GCC					$0	$30,000	$317,820		M
C13	Foreshore Development	Compliance	Provide additional resources for enforcement of compliance with foreshore development controls.	LGA-wide	All	GCC		C02, C14			$0	$75,000	$794,551		M

Action ID	Management Goal Addressed	Management Category	Strategy Outline	Location	Zone	Primary Responsibility	Secondary Responsibility	Cross Reference with Action:	Dependency on Action:	Comments	Preliminary Estimate of Capital Cost	Preliminary Estimate of Annual Maintenance / Recurrent Cost / Revenue (-ve values)	Net Present Value	Potential Funding Stream	Implementation Timeframe
C14	Foreshore Development	Compliance	Audit existing foreshore development (including property boundaries, fences and other structures, boat houses, boat ramps, jetties, etc.) and identify illegal or non-conforming development for retrospective enforcement of development controls. This should be undertaken in accordance with the Conditions of Consent and relevant policy in force at the time of Development Approval. Where foreshore structures are negatively impacting on estuarine processes (e.g. causing erosion or accretion on adjacent lands), investigate opportunities to mitigate these issues. This may be achieved through the Crown lands lease/licensing mechanism (where relevant).	Estuary Foreshores	All	DPI (Crown Lands Division)	GCC	C02, C13, P14, P44	R31		$90,000	$0	$90,000		M
E01	Habitat and Species Conservation	Education	Distribute NSW Maritime's Brisbane Water Boating Map to ensure waterway users are aware of the regulations relating to navigational safety, permissable activities and their responsibilities as boat users.	Registered Boat Owners	All	NSW Maritime		C08, E11, E14, R22			$15,000	$2,500	$41,485		M
E02	Information, Communications and Education	Education	Label stormwater drain inlets in problematic areas "This drains to ……".	Catchment-wide	All	GCC		C15, E07, R05			$20,000	$2,500	$46,485		M
E03	Information, Communications and Education	Education	Develop a public awareness and education program relating to the Estuary and its biodiversity. Elements for inclusion in this program may include: - Key habitat types and their ecological function (e.g. saltmarshes, seagrasses), - Biodiversity and threatened and protected species (e.g. migratory birds), - Marine pests and other threats to estuarine ecology, and - The important underlying ecological processes of the Estuary and their relationship with human uses of the Estuary. This program may include different educational elements such as targeted activities, information days, the preparation of literature and/or interpretive signage.	LGA-wide	All	GCC	CMA	E08, E09, P19, P20, P23, P28, P53, R20, R22, R25	E03, R39		$100,000	$30,000	$417,820		M
E11	Information, Communications and Education	Education	Conduct an education program for the boating community on: - Their responsibilities with respect to the disposal of ballast, sewage and rubbish, - The location of existing sewage pump-out and rubbish disposal facilities, and - How to safeguard against leaks and spills, and what to do if a leak or spill occurs. This should include a distribution of a copy of NSW Maritime's *Don't Make Waves* (2006) brochure.	LGA-wide	All	NSW Maritime	CMA	C08, C15, P02, P46, P47, W05	P41		$25,000	$10,000	$130,940		M
E14	Habitat and Species Conservation	Education	Distribute I&I NSW's NSW *Recreational Saltwater Fishing Guide 2011* (2010), which provide advice about fishing regulations, responsible fishing and safety tips.	Registered Boat Owners and locally-registered Fishing Licence Holders	All	DPI (Fisheries)	Fishcare Volunteers	C08, E01, E11, R22			$15,000	$2,500	$41,485		M
E16	Information, Communications and Education	Education	Provide opportunity for community members to become involved in the implementation of on the ground works (where possible).	All	All	GCC	CMA			Assume some safety equipment and training is required, in addition to effort spent in attracting volunteers.	$0	$5,000	$52,970		M
E18	Information, Communications and Education	Education	Undertake a stormwater education program highlighting impacts of human activities on ecological values.	All	All	GCC	CCCEN			Develop a program, including materials, and deliver on an annual basis (e.g. via schools).	$20,000	$12,500	$152,425		M
P04	Water and Sediment Quality	Planning	Review the *Water Cycle Management Guidelines* (2007) and ensure that they reflect best practice WSUD and appropriately support the new DCP.	LGA-wide	All	GCC		C02, C13, P43, W58			$40,000	$0	$40,000		M

Action ID	Management Goal Addressed	Management Category	Strategy Outline	Location	Zone	Primary Responsibility	Secondary Responsibility	Cross Reference with Action:	Dependency on Action:	Comments	Preliminary Estimate of Capital Cost	Preliminary Estimate of Annual Maintenance / Recurrent Cost / Revenue (-ve values)	Net Present Value	Potential Funding Stream	Implementation Timeframe
P05	Water and Sediment Quality	Planning	Investigate the need for sediment traps and other stormwater management measures to control any erosion and sedimentation from sloping lands draining to the stormwater outlet opposite Byalla Lane.	Saratoga	2	GCC			R24, W01		$17,500	$0	$17,500		M
P07	Sedimentary Processes	Planning	Develop formal standard designs for key navigational channels in Brisbane Water that identify the desired channel profile and likely maintenance dredging requirements to maintain these configurations for the purposes of recreational and commercial boating. The purpose of this action is to provide clear information to users of Brisbane Water and manage community expectations in relation to maintenance of navigation channels, while acknowledging natural rates of sediment transport in these locations and likely environmental impacts. This process should be informed by the Sediment Management Plan provided in the *Brisbane Water Estuary Management Study* (Cardno, 2010) and the findings of the *Brisbane Water Estuary Processes Study* (Cardno, 2008). It is acknowledged that additional investigations may be required to develop the standard designs.	Waterway-wide	All	NSW Maritime, DPI (Crown Lands Division)		R09, W18, W19, W20, W25		Capital costs include stakeholder and community consultation, review of planning and approvals framework, provision of engineering advice and development of the Plan. Assume review every 10 years.	$65,000	$1,000	$75,594		M
P45	Foreshore Development	Planning	Undertake a review of the existing foreshore development policies and plans for the Gosford LGA and assess the need to amend development controls to provide for controlled, sustainable development of the foreshore.	LGA-wide	All	GCC		P08, P09, P30, P54 , W82	P43		$60,000	$0	$60,000		M
P49	Foreshore Development	Planning	Develop guidelines (or compile existing guidelines where available) for foreshore stabilisation via the establishment of locally native estuarine plant species. The guidelines should provide details of the benefits of soft stabilisation works, advice on the species to be used and how to establish plantings. Seedlings may be cultivated at Council's nursery for supply to interested parties.	LGA-wide	All	GCC	CMA, OEH	W34, W41, W45, W48, W49, W104		Recurrent cost for nurseries. Assume some costs could be offset by purchase.	$30,000	$50,000	$559,701		M
P54	Commercial Development	Planning	Promote the sustainable commercial development of the Estuary and its foreshores in accordance with Council's Corporate Strategy, Gosford City Centre Masterplan and the principles of Ecologically Sustainable Development.	Catchment-wide / Waterway-wide	All	GCC	DPI (Crown Lands Division)	P53, P55, P56, P57		This action provides for the allocation of additional resources within Council to assist in assessing Development Applications and to attract investment in commercial development of foreshore lands.	$0	$55,000	$582,671		M
R01	Water and Sediment Quality	Research / Monitoring	Conduct a review of the design and methodology employed in the existing water quality monitoring program. Ideally the program should be a comprehensive, scientifically rigorous and ongoing program of water and sediment quality monitoring for the Brisbane Water Estuary, incorporating dry weather and event monitoring of both the tributary mouths and main waterbody. Sampling in the main waterbodies should incorporate vertical profiling.	Catchment-wide / Waterway-wide	All	GCC	OEH	R37, R38, R40			$35,000	$0	$35,000		M
R16	Sedimentary Processes	Research / Monitoring	Identify the cause of erosion under the bridge near Lara Street and outline measures to address this issue.	Park Bay	3	GCC		W34			$35,000	$0	$35,000		M
R24	Habitat and Species Conservation	Research / Monitoring	Investigate the use of constructed wetlands, sediment, and detention basins and other WSUD options to minimise the effect of freshwater and sediment inflows, with particular reference to areas of high biodiversity value around entrances to creeks. Consideration should be given to both current and future meteorological conditions.	Catchment-wide	All	GCC	CMA	W01			Refer to linked action.	$0	N/A		M

Action ID	Management Goal Addressed	Management Category	Strategy Outline	Location	Zone	Primary Responsibility	Secondary Responsibility	Cross Reference with Action:	Dependency on Action:	Comments	Preliminary Estimate of Capital Cost	Preliminary Estimate of Annual Maintenance / Recurrent Cost / Revenue (-ve values)	Net Present Value	Potential Funding Stream	Implementation Timeframe
R31	Recreational Usage	Research / Monitoring	Conduct an audit of existing land-based and water-based infrastructure for boating (e.g. picnic tables, playgrounds, BBQs, jetties, boat ramps, dinghy storage areas, moorings, trailer parking areas, car parking, garbage bins, toilets, shared pathways, etc.) focusing on: - Patterns in patronage/usage, - Condition and maintenance requirements, - Characterisation of neighbouring land uses, - Proximity to key habitat, heritage items and other environmentally sensitive areas, - Proximity to key locations (e.g. pump out stations, marinas, popular fishing spots, etc.), and - Safety. Based on the outcome of the audit, assess the need to upgrade, maintain or de-commission existing infrastructure. The purpose of this audit is primarily to rationalise recreational access and amenity. The findings may be used to inform Action P41, the Users Plan.	Estuary Foreshores / Waterway-wide	All	GCC	DPI (Crown Lands Division), NSW Maritime	P35, P41, P47, P55, W69, W77, W81, W93, W94, W96	P41, P43	Cost relates to an initial audit and establishment of internal supporting mechanisms (e.g. updating via DA system), and then updating of information on an annual basis as required.	$120,000	$5,000	$172,970		M
R39	Information, Communications and Education	Research / Monitoring	Develop and maintain a database of all environmental and ecological data available for the Brisbane Water Estuary with a view to providing a comparison between present and historic Estuary conditions. This database should be regularly updated with the results of any monitoring undertaken. Long term trends should be identified and this information communicated directly to the public on a regular basis.	Catchment-wide / Waterway-wide	All	GCC	CMA, OEH	R38, R40, R04			$20,000	$12,500	$152,425		M
R40	Information, Communications and Education	Research / Monitoring	Provide for ongoing monitoring of estuarine water levels to provide a continuous long term data set. This is key for monitoring the potential impacts of climate change and initiating appropriate adaptive management responses. The need to install additional water level gauges should be considered.	Waterway-wide	All	OEH		E08, P16, P31, P43, P46, P50, P60, R41		Cost is based on maintenance of five gauges in Brisbane Water at $5,000 per year. Cost does not allow for the installation of any new gauges.	$0	$25,000	$264,850		M
W02	Water and Sediment Quality	Works	Install additional sewage pump-out facilities to reduce water pollution. These should be situated at locations accessible by a range of vessels.	Waterway-wide	All	NSW Maritime		E11, P55, W81		Allows for the establishment of two additional pump outs and assumes boat owners are charged for their use.	$100,000	$50,000	$629,701	NSW Maritime Better Boating Program (up to 50%)	M
W04	Water and Sediment Quality	Works	Investigate appropriate stormwater treatment and control measures to reduce sedimentation into Correa Bay.	Correa Bay	3	GCC		W01			$20,000	$0	$20,000		M
W07	Water and Sediment Quality	Works	Provide ongoing maintenance of existing sediment traps in the catchment draining to Horsfield Bay.	Horsfield Bay Catchment	3	GCC		W01			$0	$7,500	$79,455		M
W18	Sedimentary Processes	Works	Periodically dredge the navigation channel up to 50,000m3 in the Estuary entrance to ensure safe navigation.	Entrance	6	NSW Government		R09, W28		Assume needs to be re-done on average every 5 years.	$750,000	$125,000	$2,074,252		M
W28	Sedimentary Processes	Works	Undertake beach re-nourishment works at Ettalong Beach for the purposes of beach amenity and foreshore protection.	Ettalong Beach	6	GCC	DPI (Crown Lands Division)	W29, W55, W112	R11	Assume cost of obtaining sand is absorbed by cost of dredging the entrance. Assume to be done every 4 years.	$50,000	$125,000	$1,374,252		M
W29	Sedimentary Processes	Works	Implement shoreline protection works which incorporate environmentally friendly design features.	Ettalong Beach	6	GCC	OEH, DPI (Crown Lands Division)	W28, W55, W112	R11	Capital cost includes design and construct.	$250,000	$100,000	$1,309,401	NSW Coastal Management Program	M
W43	Sedimentary Processes	Works	Develop and implement a long term solution to replace the currently failing seawall in Memorial Park on Brick Wharf Road. Any option identified should wherever possible incorporate environmentally friendly features.	Woy Woy	4	GCC	OEH		W34		$150,000	$15,000	$308,910		M
W49	Sedimentary Processes	Works	Implement foreshore stabilisation works to prevent further erosion of the shoreline near Rip Road Reserve.	Blackwall	4	GCC	Volunteers		W34		$80,000	$5,000	$132,970		M
W71	Habitat and Species Conservation	Works	Where appropriate, rehabilitate saltmarsh habitats on an Estuary-wide basis. Rehabilitation works should be prioritised with due consideration of habitat connectivity, and the potential for ongoing conservation in both the medium-term and long-term (i.e. under a climate change scenario).	Estuary-wide	All	GCC	OEH, CMA, Bushcare Volunteers	W69, W70			$60,000	$25,000	$324,850	Caring for Our Country Grant	M

Action ID	Management Goal Addressed	Management Category	Strategy Outline	Location	Zone	Primary Responsibility	Secondary Responsibility	Cross Reference with Action:	Dependency on Action:	Comments	Preliminary Estimate of Capital Cost	Preliminary Estimate of Annual Maintenance / Recurrent Cost / Revenue (-ve values)	Net Present Value	Potential Funding Stream	Implementation Timeframe
W77	Habitat and Species Conservation	Works	Investigate alternative dinghy storage options/locations to provide suitable storage facilities located near the Scout Hall on Mason Parade, Gosford.	Mason Parade, Gosford	2	GCC		P35			$80,000	$5,000	$132,970		M
W116	Sedimentary Processes	Works	Dredge to improve navigation and access to boat ramps in Cockle Channel.	Davistown	5	NSW Government		R09	P07	Assume has to be re-done every 5 years.	$250,000	$37,500	$647,276		M
E07	Information, Communications and Education	Education	Establish a 'Clean Up Brisbane Water Day' with the dual objectives of removing rubbish from the Estuary foreshores and waterways, and of educating the public about the Estuary.	Waterway-wide	All	GCC	CMA, NSW Maritime, OEH	C15, E02, E11, R05, W91, W93			$50,000	$50,000	$579,701		L
W15	Water and Sediment Quality	Works	Seal the Hawk Street car park to prevent erosion into Kincumber Creek. The use of permeable pavement is recommended over impermeable surfaces.	Kincumber	5	GCC		W01, R26			$120,000	$5,000	$172,970		L
W21	Sedimentary Processes	Works	Dredge from the Correa Bay boat ramp to the entrance of Woy Woy Creek, to extend 300m up the creek channel, with a view to improving drainage and access at this location.	Woy Woy	3	NSW Government				Assume one-off.	$500,000	$0	$500,000		L
W26	Sedimentary Processes	Works	Rehabilitate the eroding foreshores on the eastern shores of Hardys Bay with natural vegetation typical of that naturally occurring in the area. Where this is not feasible, investigate environmentally friendly seawall options.	Eastern shores of Hardys Bay	6	GCC	Volunteers	E09, P49			$15,000	$7,500	$94,455		L
W35	Sedimentary Processes	Works	Investigate appropriate sediment control works to address sediment accretion issues at St Huberts Island.	St Huberts Island	4	GCC		P08, W19			$50,000	$0	$50,000		L
W41	Sedimentary Processes	Works	Undertake foreshore stabilisation works in the Punt Bridge area incorporating revegetation to address erosion issues.	East Gosford	2	GCC	Volunteers		W34		$100,000	$10,000	$205,940		L
W45	Sedimentary Processes	Works	Undertake foreshore stabilisation works to address erosion currently occurring in Palermo Reserve, Empire Bay Drive.	Daleys Point	4	GCC			W34		$50,000	$5,000	$102,970		L
W46	Sedimentary Processes	Works	Investigate the cause of erosion around the Blackwall Point boat ramp and develop measures to address this issue. Any necessary repairs to stabilise the foreshore and the adjacent roadway should be undertaken.	Blackwall	4	GCC		W34			$150,000	$10,000	$255,940		L
W47	Sedimentary Processes	Works	Investigate appropriate and cost effective methods to remediate any scouring currently occurring of the existing seawall at Illoura Reserve, Davistown.	Davistown	5	GCC			W34		$15,000	$5,000	$67,970		L
W59	Foreshore Flooding/Inundation	Works	Investigate the benefits of decommissioning the Woy Woy Creek dam at former abattoir site.	Woy Woy Creek	3	GCC					$25,000	$0	$25,000		L
W84	Recreational Usage	Works	Provide boardwalks at sensitive foreshore locations to permit public access.	Estuary Foreshores	All	GCC		P50, W94	W81	Assume construction in segments.	$20,000	$100,000	$1,079,401		L
W104	Recreational Usage	Works	Improve public access along the foreshore reserve between Ironbark Point and Rocky Point. Assess the feasibility of installing a boardwalk, undertaking foreshore stabilisation works and/or creating a public path in front of houses between 36-40 Asca Drive, Green Point.	Green Point	2	GCC		W82			$175,000	$10,000	$280,940		L
W122	Water and Sediment Quality	Works	Investigate the feasibility of increasing the capacity of the culvert under the rail line at Fagans Bay to enhance flushing and thereby improve water quality. This investigation should also consider the influence of any historic sedimentation that may have occurred.	Fagans Bay	1	GCC				Allows for preliminary feasibility study only. Prior to implementation of this action, reference should be made to the *Brisbane Water Foreshore Coastal Floodplain Risk Inundation Management Study and Plan* .	$20,000	$0	$20,000	RailCorp (assoc. with any future rail upgrades)	L
W124	Recreational Usage	Works	Work with the NSW Recreational Fishing Alliance to achieve access and riparian vegetation enhancement to Dell Road Reserve, Narara Creek.	West Gosford	1	GCC		P41, R31		Assumes some time for a staff member's liaison and coordination; assumes some funding input from Council (dependent on final form of the proposal).	$50,000	$0	$50,000		L