BROOKLYN ESTUARY MANAGEMENT PLAN

DECEMBER 2006

Hugh Boylan
Brooklyn Public School

HORNSBY SHIRE COUNCIL

WBM

Brooklyn Estuary Management Plan

- December 2006 -

Prepared for	Hornsby Shire Council	
Prepared by	WBM Pty Ltd	

DOCUMENT CONTROL SHEET

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Synopsis:	This document is an Estuary Management Plan for the Brooklyn Estuary prepared under the provisions of the NSW Government's Estuary Management Program. It outlines a series of management strategies aimed at maintaining the environmental values of the estuary, whilst addressing particular issues of concern.

REVISION/CHECKING HISTORY

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INTRODUCTION

Amanda O'Connell – Brooklyn Public School

1 Introduction

The Brooklyn Estuary comprises of a section of the lower Hawkesbury River, located north of Sydney. The Estuary includes the Hawkesbury River waterway between Croppy Point and the F3 Freeway Bridge, Sandbrook Inlet, Brooklyn Harbour, Parsley Bay, Mooney Mooney and Mullet Creeks to their tidal limits. The study area also includes the catchments of these waters in so far as they impact on the condition of the estuary. Figure 1 shows a map of the Brooklyn Estuary and surrounding catchment, while Figure 2 shows an aerial of the lower Brooklyn Estuary.

Figure 1 The Brooklyn Estuary Study Area

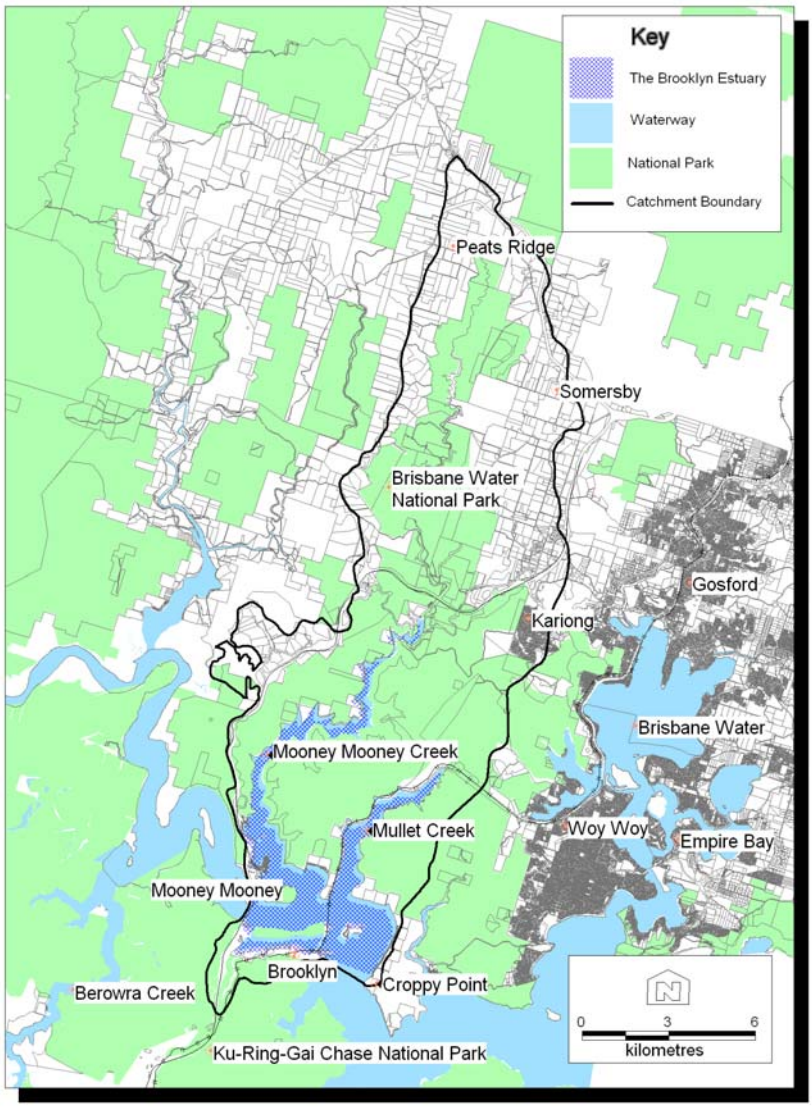


Figure 2 The Lower Brooklyn Estuary

The greater Hawkesbury-Nepean River catchment has a total area of about 22,000km^2. In comparison, the local catchment of the Brooklyn Estuary is approximately 185km^2. The estuary is characteristic of a drowned river valley estuary, carved into Hawkesbury sandstone bedrock during historic ice ages, when ocean levels were much lower than present.

The Brooklyn Estuary has been valued by residents and visitors for a long time. Both Aboriginal and European heritage around the estuary is significant. Presently, oyster farming, commercial fishing and tourism are important local industries. Oyster farming has been affected recently by an outbreak of QX disease. The area's accessibility to the population of Sydney and the Central Coast, the open waterway with sheltered bays and harbours, and its scenic quality make it a very popular destination for a large number of recreational visitors. Recreational boating is a popular pursuit within the area with approximately 500 boats being moored in the estuary (WRL, 2003). The township of Brooklyn is also an important launching point for those accessing the many offshore villages both within and beyond the study area.

The ecology of the Brooklyn Estuary is diverse. It contains mangroves, seagrass, saltmarshes, soft sediments and rocky foreshores. The surrounding nature reserves and National Parks are important for providing provisions for habitat, nature conservation, research and recreational opportunities.

Significant changes to the Brooklyn Estuary have resulted from the construction of the rail causeway across Sandbrook Inlet, construction of dams within upper catchment

areas, and from general development and landuse changes that have occurred around the estuary foreshores and within the greater catchment area.

This report is the last in a series of documents (refer to Figure 3) that have been prepared for the Brooklyn Estuary under the provisions of the NSW Governments Estuary Management Framework as described in Figure 4. Many studies have been carried out on different aspects of the Brooklyn Estuary and the Hawkesbury River in general over the past 20 – 30 years. These studies have been utilised, where relevant, during the preparation of this report, as well as the preceding reports. Detailed references lists are provided in the background documents, particularly the Estuary Processes Study (WRL, 2003).

Figure 3 Previous reports in the Brooklyn Estuary Management Plan Series

- **The University of New South Wales (UNSW) Water Research Laboratory (WRL), (2002). *Brooklyn Estuary Process Study*. WRL, Sydney, NSW.**
- **WBM (2005). *Brooklyn Estuary Management Study and Plan: Review and Consideration of Estuary Processes Information*. WBM Oceanics, Newcastle, NSW.**
- **WBM (2005). *Brooklyn Estuary Management Study and Plan: Progress Report on Community Consultation*. WBM Oceanics, Newcastle, NSW.**
- **WBM (2006). *Brooklyn Estuary Management Study*. WBM Oceanics, Newcastle, NSW.**

2 The NSW Government Estuary Management Framework

In 1992, the NSW State Government introduced the draft *Estuary Management Policy*, aimed at managing the growing pressures on estuarine ecosystems. The policy is implemented through an Estuary Management Program (Figure 4), which is

co-ordinated by the Department of Natural Resources (DNR) in co-operation with local government and the community.

The process of managing an estuary, in accordance with this Policy, is initiated by the establishment of an Estuary Management Committee. This Committee is then responsible for the development of an Estuary Processes Study, followed by an Estuary Management Study.

From the findings of the Management Study, an Estuary Management Plan is prepared. The Plan describes how the estuary will be managed in the future and gives recommended solutions to management problems, with details of activities for implementation of the recommendations. Once the Plan has been accepted by both the Community and the relevant Government Departments, the Plan can be implemented through planning controls, works programs, monitoring and education.

2.1 Brooklyn Estuary Processes Study

The Brooklyn Estuary Processes Study (WRL, 2003) outlines all the hydraulic, sedimentation, water quality and ecological processes within the estuary, and the impacts of human activities on these processes. It provides the necessary understanding of physical, chemical and biological processes for the preparation of an Estuary Management Study.

The Estuary Processes Study included numerical modelling of the waterway to determine the hydrodynamic processes of the estuary, and the impacts of the causeway on these processes. The Study also incorporated a review and interpretation of available scientific data regarding the estuary.

The Estuary Processes Study (WRL, 2003) was complemented by a supplementary report on estuary processes (WBM, 2004) as a precursor to the preparation of the Estuary Management Study. The supplementary report provided a critical review of WRL (2003) and provided additional information that became available after the preparation of the Estuary Processes Study. Further, the supplementary report provides an enhanced appreciation of the interactions between the various estuarine processes, as well as listing further studies that need to be completed in the future that will assist with the management of the Brooklyn Estuary.

2.2 Brooklyn Estuary Management Study

The Estuary Management Study (WBM, 2006) identifies the essential features and the current uses of the estuary, and determines the overall objectives required for management of the estuary. The Management Study also identifies options for meeting these objectives, and determines hydraulic and ecological impacts of the proposed options. The Estuary Management Study incorporated consultation with stakeholders of the Brooklyn Estuary, as well as local community members. An extensive list of potential management options was assessed as part of the Study. Multi-criteria analysis (including consideration of outcomes, costs, responsibilities, community acceptance and environmental impacts), and consultation with community

and stakeholders were used to develop a final prioritised short-list of recommended future management strategies.

The Brooklyn Estuary Management Study was on public exhibition during the second half of 2005, and was finalised in May 2006.

2.3 Brooklyn Estuary Management Plan

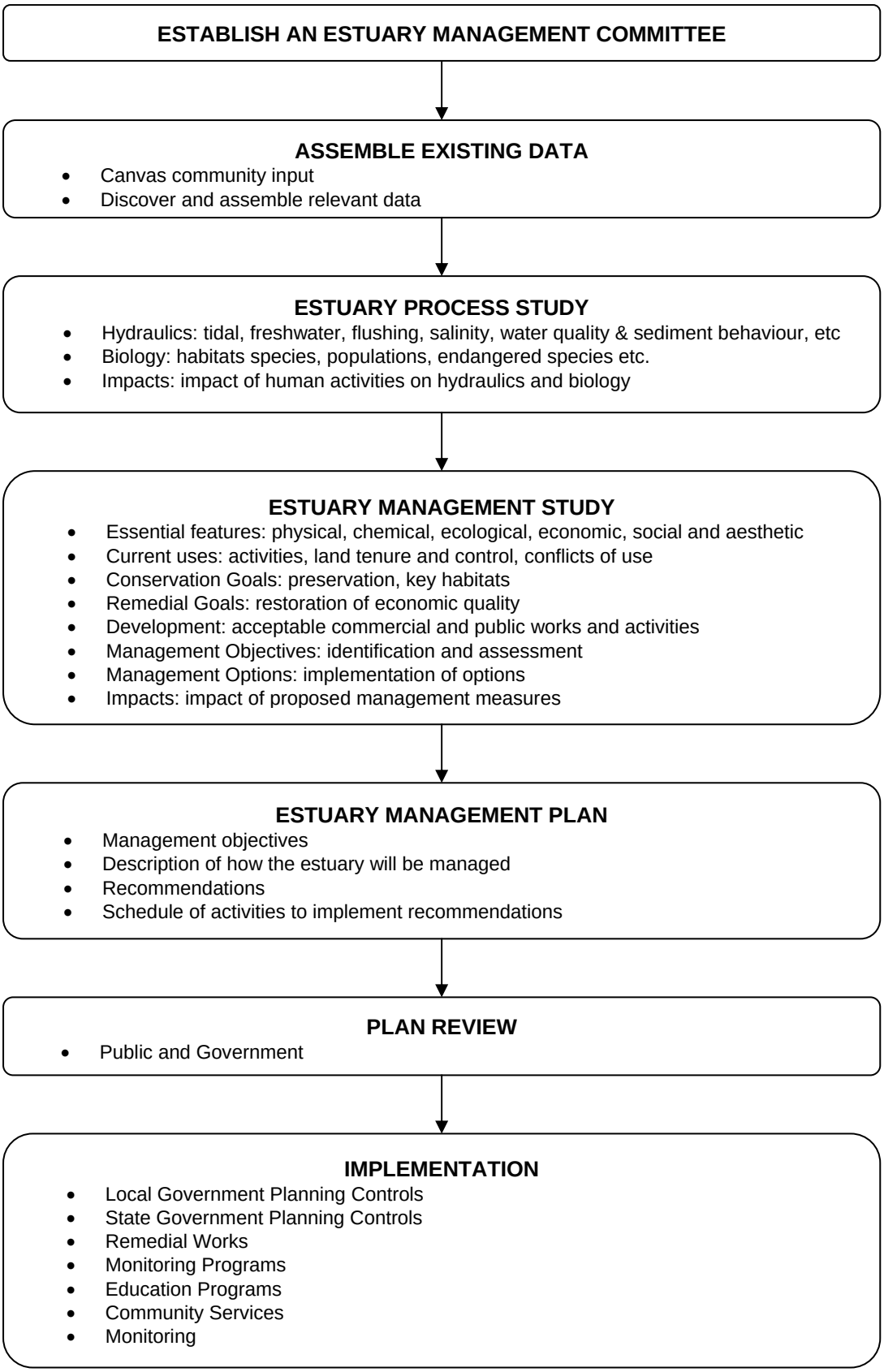
This document outlines the Estuary Management Plan for the Brooklyn Estuary to fulfil the requirements of the *NSW Estuary Management Policy 1992* and the *NSW Coastal Policy 1997*. It contains a list of recommended strategies that have been designed and prioritised according to the goals and objectives for the future of the Brooklyn Estuary, as agreed to by the Brooklyn Estuary Management Committee. The implementation process for these strategies is outlined in Section 5. Implementation Tables include timeframes, costs, responsibilities, measurables and other information related to each of the strategies.

The Estuary Management Plan also provides a mechanism for future monitoring and evaluation of the success of the Plan implementation, along with contingencies in the event that specific targets and/or overarching goals and objectives are not met.

Implementation of this Estuary Management Plan will be co-ordinated jointly by Hornsby Council and Gosford City Council, subject to available funding. The Brooklyn Estuary Management Committee will continue to oversee the implementation of the Plan, and will assist with identifying and obtaining funding and necessary resources.

The Brooklyn Estuary Management Plan is an advisory document only. There is presently no statutory obligation by Council or Government agencies to implement the strategies contained herein, however, Council and State agencies are committed to the Plan and to its strategic intent in achieving long-term environmental, social and economic sustainability of the Brooklyn Estuary. The Brooklyn Estuary Management Plan was adopted by Hornsby Shire Council and Gosford City Council in December, 2006.

Figure 4 NSW Government Estuary Management Framework



GOALS AND OBJECTIVES

Ruby Hughes – Brooklyn Public School

3 Goals and objectives

The primary goal of the NSW Estuary Management Policy is to encourage the integrated, balanced, responsible and ecologically sustainable use of the State's estuaries (NSW Government, 1992). With regard to the Brooklyn Estuary, this involves maintaining the existing balance between a sustainable estuarine habitat and a viable recreational, commercial and social resource.

To ensure that this balance is maintained over the long term, the Estuary Management Plan should identify works and prioritise actions aimed at conserving existing values and addressing existing (and future) issues and problems.

In meeting the principles of the *NSW Coastal Policy 1997*, the Brooklyn Estuary Management Plan needs to incorporate the principles of Ecologically Sustainable Development (ESD) and in time, the Hawkesbury Nepean Catchment Action Plan (HNCAP), which is being prepared by the Hawkesbury Nepean Catchment Management Authority. It is envisaged that the HNCAP will espouse many of the overarching goals and objectives of Brooklyn Estuary Management Plan, as well as other Estuary Management Plans developed for the remaining estuarine areas of the Hawkesbury River. Further, the Lower Hawkesbury Estuary Management Plan is currently being developed and will incorporate these strategies within the Brooklyn Estuary Management Plan. The Lower Hawkesbury Estuary Management Plan will firstly review the Berowra Creek Estuary Management Plan and secondly, develop a Lower Hawkesbury Estuary Management Plan that includes all estuarine areas within the Hornsby Shire local government area and associated catchments. Adopted actions contained within the Brooklyn Estuary Management Plan will be reviewed and incorporated into the Lower Hawkesbury Estuary Management Plan. This Plan is due for completion in December 2007.

Goals and objectives for the future management of the Brooklyn Estuary were developed on the basis of information received through community and stakeholder consultation, input from the Brooklyn Estuary Management Committee and a sound appreciation of estuarine processes and human interactions. Six (6) overarching goals have been defined for the future management of the Brooklyn Estuary. For each Goal, a series of specific objectives have been defined, which describe the requirements for specific aspects of the estuary, necessary to achieve the goals.

The goals and their related objectives for the Brooklyn Estuary are presented below. Each objective has been assigned an individual identifier, or reference, and also a rank (as either High-H, Medium-M or Low-L). The relative rank was determined through consultation with the Brooklyn Estuary Management Committee (BEMC).

The management objectives essentially provide the "goal posts" for which future management of the estuary should be targeted towards.

Goal 1: For the Brooklyn Estuary to contain healthy, diverse and viable ecosystems

Reference	Objective	Rank
1-1	Conserve, and where possible increase, the total areas of estuarine habitat (beyond natural variability)	H
1-2	Reduce the transport of weeds and pests throughout the estuary	H
1-3	Develop a better understanding of ecological indicators through monitoring and research to help guide management decisions	M
1-4	Re-establish native vegetation where appropriate along foreshores and to protect existing remnants on public land	M
1-5	Establish and maintain buffer zones between development and the foreshore	M
1-6	Minimise land clearing within the catchment including no new development on green field sites	M
1-7	Establish an appropriate regime of environmental flows	M
1-8	Ensure that foreshore structures are designed with consideration towards intertidal habitat requirements	M

Goal 2: For the Brooklyn Estuary to provide opportunity for a range of ecologically and commercially sustainable estuary based industries

Reference	Objective	Rank
2-1	Ensure that existing and future tourism development is consistent with the character and ecological capacity of Brooklyn	H
2-2	Provide support to the commercial fishing and oyster industry to help ensure their long term viability.	M
2-3	Provide appropriate infrastructure for the boating and tourism industry	M
2-4	Provide adequate parking for visitors to support the estuary based industries	M
2-5	Ensure boating access to existing marinas (for appropriate sized vessels)	M
2-6	Maintain and, if possible, improve the navigability of Sandbrook Inlet, Brooklyn Harbour, Parsley Bay and other navigation channels.	L
2-7	Alleviate vessel congestion in Brooklyn Harbour, Sandbrook Inlet and Parsley Bay.	L

Goal 3: For the Brooklyn Estuary to be a place of great recreational value, with minimum impacts on the natural environment.

Reference	Objective	Rank
3-1	Ensure there is sufficient solid and liquid waste management facilities for the volume of users of the Brooklyn Estuary and foreshore areas	H
3-2	Ensure that public wharves and other facilities are safe and accessible to all	H
3-3	Determine the maximum number of moorings that can be sustained by the estuary	H
3-4	Provide adequate infrastructure for passive recreational activities	H
3-5	Remove derelict oyster producing infrastructure (eg racks and sticks) from the estuary.	M
3-6	Minimise noise pollution generated from boats	L
3-7	Remove abandoned and derelict vessels from the Brooklyn Estuary	L

Goal 4: For the Brooklyn Estuary to have good sediment and water quality which is compatible with aquaculture, ecosystem and human health requirements

Reference	Objective	Rank
4-1	Ensure that the water quality of the Brooklyn Estuary is considered in regional management plans	H
4-2	For bacterial counts to meet requirements for aquaculture (shellfish and fish) harvesting areas and ANZECC recreational water requirements	H
4-3	Assess temporal trends and variability in water and sediment quality in the estuary	H
4-4	Eliminate boat sources of pollution by providing adequate infrastructure and controls, such as pump out facilities	H
4-5	Identify, quantify and manage sources of sediment and pollutant loads to the estuary (including stormwater inputs)	H
4-6	For the potential impacts on estuarine processes to be considered when assessing proposed developments within the catchment	H
4-7	Prevent illegal permanent residency on moored boats	L

Goal 5: For the riverside village atmosphere, scenic beauty and character of the Brooklyn Estuary to be enjoyed by residents and visitors now and in the future

Reference	Objective	Rank
5-1	Ensure that future development is consistent with the nature, scale and scenic quality guidelines in SREP 20	H
5-2	Provide and maintain foreshore open space for passive recreation	H
5-3	Involve the local and wider community in future management and decision making	H
5-4	Prevent further erosion and degradation of foreshores, including the railway causeway	H
5-5	Prevent car parking from monopolising open space in the study area	M
5-6	Ensure that the Aboriginal and non-indigenous heritage and spiritual aspects of the study area can be appreciated and enjoyed by current and future generations	M
5-7	Investigate and plan for the mooring and car parking needs of river access only residents on a regional basis	M
5-8	Ensure that adequate space is provided for dinghy storage	L

Goal 6: For existing and future regulations and policies to be known, understood and adhered to by visitors and residents of the Brooklyn Estuary

Reference	Objective	Rank
6-1	For recreational fishers to comply with fisheries legal size and bag limits	H
6-2	Ensure compliance with marine/boating legislation	H
6-3	Better educate the community to improve compliance with legislation and policies	H
6-4	Ensure land use zonings are consistent with the principles of sound environmental management and the goals and objectives of this Estuary Management Plan	H
6-5	Ensure waterfront land owners appreciate and adhere to legislation pertaining to estuarine habitat ecosystems	M
6-6	Ensure all future development proposals consider the goals and objectives of this Estuary Management Plan (through the EPIC assessment)	M

COMMUNITY CONSULTATION

Callie Johnson – Mooney Mooney Public School

4 Community Consultation

The aspirations and values of the community were canvassed through an extensive program of consultation. This program included:

- A community newsletter and questionnaire mailed to 1600 ratepayers, residents and mooring lessees in May 2004;
- A dedicated internet website (www.brooklyn-ems.com.au) activated in April 2004;
- Media releases in May 2004;
- Onsite meetings and discussions with community members upon request, during June 2004;
- Consultation with a broad ranges of stakeholder groups during June 2004;
- Telephone interviews and follow up meetings with the Brooklyn Estuary Management Committee, during June 2004 and throughout the project;
- A second community newsletter outlining the results of consultation mailed to over 100 residents and ratepayers that had registered interest after the questionnaire in July 2004;
- A workshop with the BEMC to confirm issues and rank objectives in October 2004;
- A third community newsletter outlining the management objectives mailed out in October 2004;
- A community education stall at the Brooklyn Spring Fair;
- Public Exhibition of the Draft Estuary Management Study during August and September 2005;
- A public meeting regarding the Draft EMS in September 2005; and
- Public Exhibition of this Draft Estuary Management Plan (undertaken during 2006).

Outcomes from initial consultation activities were documented in an earlier report titled *Brooklyn Estuary Management Study and Plan: Progress Report on Community Consultation* (WBM, 2004).

4.1 School Art Cover Competition

In December 2005, primary school students from Brooklyn and Mooney Mooney Public Schools were invited to participate in an artwork competition to design a cover for the final Brooklyn Estuary Management Plan. Students involved in the competition participated in half day environmental education sessions, covering topics such as the importance of estuaries, the water cycle, water pollution, and how students can help to improve our environment.

Individual student activities included identifying where and how students use water. They identified many different ways that water can become polluted, and what actions can be taken to help reduce pollution. This was achieved through story-telling and discussion where students adopted a character in the story and each character contributed to the pollution in the catchment.

Students were also given an opportunity to use their imagination to think about what they would like their catchment and waterways to look like in the future. This visioning exercise enabled students to identify what qualities are important to them. Students were provided with paints, craft materials and magazines to illustrate their visions. Many students developed messages to encourage positive environmental behaviour. A selection of the students' artwork is provided throughout this document.

Activities such as these enable students to identify with environmental problems making them relevant to their own lives. When accompanied with positive actions it can empower students to take positive steps towards improving their environment.

4.2 Comments on Draft Brooklyn Estuary Management Plan

The Draft Brooklyn Estuary Management Plan was placed on Public Exhibition by Hornsby Shire Council between 24 July 2006 and 1 September 2006, and by Gosford City Council between 9 October 2006 and 17 November 2006.

Five responses from the community were received, in addition to internal responses from different divisions within Hornsby Council. No comments were received following public exhibition through Gosford City Council. Most responses to the public exhibition expressed concern regarding draft strategies associated with car parking. In response to these concerns, substantial changes have been made to the final version of this Estuary Management Plan, including removal of strategies aimed at redressing the parking issues at Brooklyn (Strategies 19, 24 and 26). These strategies were removed as it is recognised that whilst car parking provisions are of concern, it was not appropriate for the Estuary Management Program to address these issues. Appropriate processes for addressing and facilitating car parking issues are established within the Planning and Works divisions of Hornsby Shire Council.

STRATEGIES FOR FUTURE MANAGEMENT

Jay Mark – Brooklyn Public School

5 Strategies for Future Management

A wide range of possible options were formulated in order to address the management objectives listed in Section 3. Many of these options were developed by community members and stakeholders through the consultation process. A total of 81 individual management options were identified. These were documented in the Brooklyn Estuary Management Study (WBM, 2006).

A multi-criteria assessment of the 81 management options was adopted in order to refine the number of options recommended for implementation in the Brooklyn Estuary Management Plan (this document). The assessment of options was documented in Brooklyn Estuary Management Study WBM (2006) and considered the following key criteria:

- Effectiveness of the options in addressing the specific management issues;
- Acceptance of the options by the community and stakeholders;
- The number of specific objectives addressed by each individual management option; and
- Ensuring all specific objectives were addressed by at least one of the management options.

Following the multi criteria assessment and also the amalgamation of a number of options to provide new hybrid alternatives, the total number of options was short listed to 31. These 31 short-listed options are characterised by a range of different approaches to address the stated objectives, including administration, environmental planning, education, on-ground works, further investigation and future monitoring.

The 31 short-listed options were prioritised to guide the order of implementation. Prioritisation considered the relative timeframes for implementation (immediate, short-term, medium term), the dependence of the options on the prior successful implementation of preceding options (ie dependent options) and input from the Brooklyn Estuary Management Committee. Options that were not short-listed should still be considered in the future as part of proposed Plan review (refer Section 9). A listing of the options that were not short-listed is provided in Appendix B.

Following public exhibition of the draft EMP, it was decided that three of the strategies (Nos. 19, 24 and 26) be removed from the final Plan. These strategies all relate to car parking within Brooklyn. Whilst it is acknowledged that the estuary is impacted by some land-based actions, the issue of parking in Brooklyn is complex, and one that has been previously considered on a number of occasions in recent years, with mixed success. It was therefore recommended that these strategies be removed from the Plan to ensure that the focus of the Plan is not distracted from the issues associated with achieving long-term sustainability of the waterway and its related environments.

5.1 Overview of Recommended Strategies

The 28 short-listed options (originally 31, less the 3 parking options) were developed into individual strategies to protect and enhance existing values of the Brooklyn Estuary, and to remediate issues that have been identified through scientific assessments and consultation with the local community and relevant stakeholder organisations. The 28 recommended strategies are listed in Table 1 in priority order and are also shown in Section 3.

Table 1 Prioritised strategies for future management of the Brooklyn Estuary

Strategy No.	Description	Proposed Timeframe
1*	Review mooring limits to ensure consistency with estuary capacity.	2007
2*	Liaise further with HNCMA to ensure integration with the Catchment Action Plan and associated strategies	2007
3*	Initiate a program for the removal of rubbish (including derelict boats) from riparian areas. The clean up program should focus on larger items such as derelict boats and dumped construction materials, with input and assistance from industry groups. Volunteers from the general public could also be encouraged to assist in the clean up of dumped tyres, plastics, food wrappings and other dumped materials.	2007
4*	Liaise with the Metropolitan LALC and other indigenous groups to assess if the current level of protection of aboriginal sites is appropriate and to develop opportunities for educational programs	2007
5*	Promote the EPIC framework for use by Council Planners when assessing development applications by converting the requirements of the EPIC framework into a new or existing DCP. The Estuary Processes and Issues Checklist (EPIC) is a tool prepared as a part of this Estuary Management Study, which has been designed to assist the Brooklyn Estuary Management Committee (BEMC) and Council planning staff assess the likely impacts of future proposals on the natural processes and existing values of the Brooklyn Estuary	2007
6*	Review effectiveness of existing planning frameworks such as Hornsby and Gosford LEPs and DCPs to protect the estuary values. This strategy would include an audit of the types of developments that are	2007

Strategy No.	Description	Proposed Timeframe
	being approved for these areas and an assessment of the existing planning documents in ensuring such development fits with the goals for the area described in Sydney Regional Environmental Plan 20 and does not impact significantly on the natural processes of the Brooklyn Estuary.	
7*	Enhance current program of auditing and enforcing sediment and erosion controls at all development sites, including rail and road projects.	2007
8*	Continue discussions with Sydney Water regarding consideration and assessment of alternatives for management of sewage at Brooklyn, including effluent reuse.	2008
9	Develop a numerical catchment and receiving water model, to identify areas where ecological health may be vulnerable. The model will be used to inform data collection and monitoring programs then be used for future model calibration and verification. Once calibrated, the model could be used to assess future strategic landuse management options.	2008
10	Develop an Estuary Health Monitoring Program. Indicators of ecological health for the Brooklyn Estuary could include seagrass distribution and condition, nutrient levels, faecal coliform data and higher trophic level indicator organisms, such as fish. The program could include monitoring by community members and other estuary users.	2008
11	Employ a River Keeper for the lower Hawkesbury to assist with implementation of this EMP including community education.	2008
12	Prepare a brochure “Living on the Brooklyn Estuary” and disseminate to residents through an interactive website regarding how the general public can contribute to the long term ecological sustainability of the Brooklyn Estuary.	2008
13	Rehabilitate public foreshore land through programs such as Landcare or Bushcare, the Hawkesbury Nepean Riverbank Management Program and by promoting the Hornsby Council native plant list. Priority areas for rehabilitation include Seymour Creek, sections of Mooney Mooney and Mullet Creeks, the railway causeway, Dangar Island and areas of railway land at the eastern end of Long	2008

Strategy No.	Description	Proposed Timeframe
	Island.	
14	Improve existing community education programs regarding water pollution, including boat discharges. Seek out opportunities to set up an estuary research and education facility and to integrate this option with the suggested Environmental Health Monitoring Program (Strategy #10).	2008
15	Monitor the ecological impact of the proposed STP outfall using a BACI (before, after, control, impact) approach. In order to obtain as much pre-construction ('before') data as possible, this program should be established immediately.	2008
16	Ensure all seagrass, saltmarsh and mangrove habitats are recorded accurately in HSC, GCC and DPI Fisheries mapping systems. This strategy would involve a review of all existing Council mapping and comparison with recent habitat identification as presented in the Estuary Processes Study	2008
17	Develop and implement oyster lease decommissioning plan	2008
18	Investigate further and implement appropriate options for pump out facilities accessible to larger vessels east of the rail bridge. A recent economic appraisal of 6 options has been undertaken (Roylat, 2005). Further investigations focussing on the key recommendations of the Economic evaluation report, including environmental and social investigations should be undertaken.	2009
19	Strategy removed after public consultation period **	
20	Monitor recreational fishing in the Brooklyn Estuary. Data should be collected over the entire Hawkesbury River Estuary and combined with information from commercial fishing returns to identify impacts on fish stocks.	2009
21	Prepare and implement creek rehabilitation plans for tributaries to the Brooklyn Estuary	2009
22	Ensure that road and rail infrastructure within the catchment has sufficient stormwater management controls	2009
23	Identify significant seagrass beds on boating charts and by using navigation markers and undertake an education program to promote the protection of these	2010

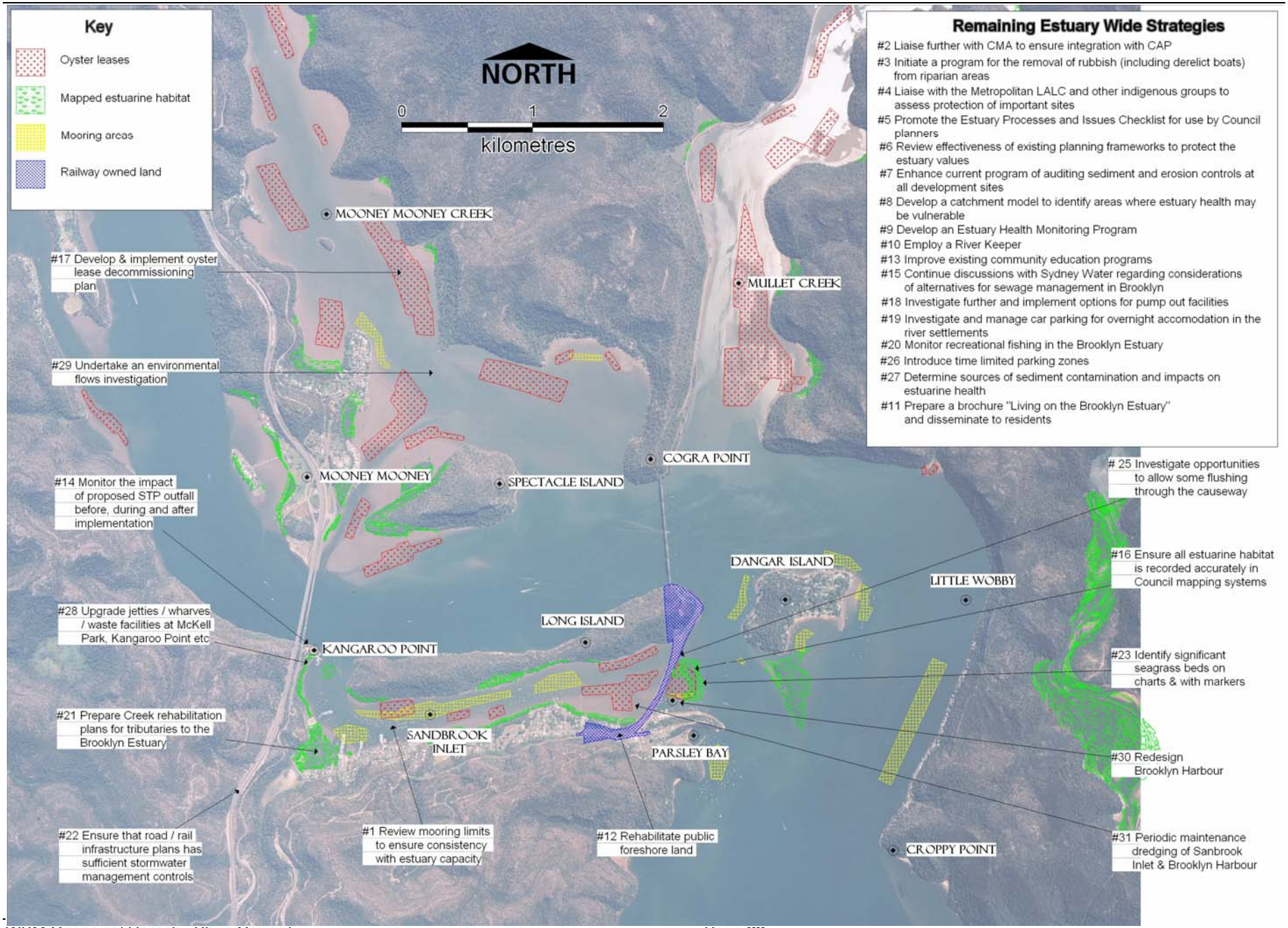
Strategy No.	Description	Proposed Timeframe
	area	
24	Strategy removed after public consultation period **	
25	Investigate opportunities for allowing some flushing under the causeway	2010
26	Strategy removed after public consultation period **	
27	Determine sources of sediment contamination and impacts of contaminants on estuarine health, through a program of targeted sediment and water quality monitoring. Results could be compared to other locations where metals contamination is much more significant than within the study area (such as the southern end of Pittwater).	2010
28	Upgrade public jetties, wharves and waste facilities at Mc Kell Park, Brooklyn Park, Parsley Bay, Kangaroo Point and Saltpan Reserve	2010
29	Undertake an environmental flows investigation for the tributaries of the Brooklyn Estuary	2010
30	Redesign Brooklyn Harbour. Brooklyn Harbour is highly congested during busy times such as weekends and public holidays. The harbour could benefit from a redesign, within the existing land based footprint. A design should be prepared in consultation with existing users and businesses and implemented through a place based DCP.	2011
31	Periodic maintenance dredging of Sandbrook Inlet and Brooklyn Harbour.	2011

***** *Although originally ranked as a lower priority within the Estuary Management Study, these options have been fast tracked as they have low implementation costs and have the potential for immediate benefit for the estuary.*

****** *These strategies, focused on addressing car parking facilities and demand within Brooklyn, were removed following review and comments on the draft EMP. They were removed as it is recognised that whilst carparking provisions are of concern, it was not appropriate for the Estuary Management Program to address these issues. Appropriate processes for addressing and facilitating carparking issues are established within the Planning and Works divisions of Hornsby Shire Council.*

5.2 Implementation Tables

The implementation tables provide information on specific actions or steps required to carry out each strategy, as well as costs, timeframes, responsibilities for implementation and comments relevant to implementation.


Key
Oyster leases
Mapped estuarine habitat
Mooring areas
Railway owned land
NORTH
0
1
2
kilometres
Remaining Estuary Wide Strategies
#2 Liaise further with CMA to ensure integration with CAP
#3 Initiate a program for the removal of rubbish (including derelict boats) from riparian areas
#4 Liaise with the Metropolitan LALC and other indigenous groups to assess protection of important sites
#5 Promote the Estuary Processes and Issues Checklist for use by Council planners
#6 Review effectiveness of existing planning frameworks to protect the estuary values
#7 Enhance current program of auditing sediment and erosion controls at all development sites
#8 Develop a catchment model to identify areas where estuary health may be vulnerable
#9 Develop an Estuary Health Monitoring Program
#10 Employ a River Keeper
#13 Improve existing community education programs
#15 Continue discussions with Sydney Water regarding considerations of alternatives for sewage management in Brooklyn
#18 Investigate further and implement options for pump out facilities
#19 Investigate and manage car parking for overnight accomodation in the river settlements
#20 Monitor recreational fishing in the Brooklyn Estuary
#26 Introduce time limited parking zones
#27 Determine sources of sediment contamination and impacts on estuarine health
#11 Prepare a brochure "Living on the Brooklyn Estuary" and disseminate to residents
MOONEY MOONEY CREEK
MULLET CREEK
COGRA POINT
MOONEY MOONEY
SPECTACLE ISLAND
DANGAR ISLAND
LITTLE WOBBY
LONG ISLAND
KANGAROO POINT
SANDBROOK INLET
PARSLEY BAY
CROPPY POINT
#17 Develop & implement oyster lease decommissioning plan
#29 Undertake an environmental flows investigation
#14 Monitor the impact of proposed STP outfall before, during and after implementation
#28 Upgrade jetties / wharves / waste facilities at McKell Park, Kangaroo Point etc
#21 Prepare Creek rehabilitation plans for tributaries to the Brooklyn Estuary
#22 Ensure that road / rail infrastructure plans has sufficient stormwater management controls
#1 Review mooring limits to ensure consistency with estuary capacity
#12 Rehabilitate public foreshore land
25 Investigate opportunities to allow some flushing through the causeway
#16 Ensure all estuarine habitat is recorded accurately in Council mapping systems
#23 Identify significant seagrass beds on charts & with markers
#30 Redesign Brooklyn Harbour
#31 Periodic maintenance dredging of Sanbrook Inlet & Brooklyn Harbour

Strategy # 1	Review mooring limits to ensure consistency with estuary capacity				
Objectives addressed	2.6, 2.7, 3.3, 5.1			**EMS Option Reference**	WU 4
Actions	**Timing**	**Costs**	**Responsibilities**	**Measurables**	**Comments**
1.1 Identify aspects for consideration in establishing the estuary mooring capacity. Assign responsibilities for determining the mooring capacity.	Immediate (2007)	Staff time only	BEMC	Meeting minutes with aspects that need to be considered in determining estuary capacity for mooring numbers	Aspects for consideration of mooring capacity should include : • Physical capacity (contributed through NSW maritime- consider bathymetry, navigation channels and recreational areas), • Ecological capacity (contributed by DPI Fisheries – consider seagrass areas, fish habitat), • Scenic capacity (contributed through Councils – consider heritage and view aspects) This review should take into consideration the values and objectives identified through the Estuary Management Study Process, that have the potential to be threatened by moored vessels.
1.2 Utilise GIS mapping and existing scientific and planning information to determine limits to mooring numbers for each of the aspects.	Immediate (2007)	Staff time only	NSW Maritime / DPI / Gosford Council / Hornsby Council Environment Division, with advice from the Planning Division	Short memorandum describing the estuary capacity for each of the aspects. Mapping detailing limits to mooring numbers	
1.3 Determine an upper limit to moorings in Brooklyn Estuary. Incorporate upper limit of moorings into appropriate management plans and policies	Immediate (2007)	Staff time only	NSW Maritime / Gosford Council / Hornsby Council Environment Division with advice from the Planning Division	Plans / Policies modified to include new mooring numbers	

Strategy # 2	Liaise further with CMA to integrate with the Catchment Action Plan and other strategies				
Objectives addressed	1.6, 1.7, 4.1, 4.2, 4.5, 4.6			**EMS Option Reference**	R 8
Actions	**Timing**	**Costs**	**Responsibilities**	**Measurables**	**Comments**
2.1 Invite the recently appointed Estuary and Coastal Officer to participate in the development and implementation of the Brooklyn Estuary Management Plan by: •Asking the ECO to review the draft EMP •Requesting that he/she identify strategies which could be applied to the whole estuary •Inviting him/her to attend BEMC meetings	Immediate (2007) and Ongoing	Staff time only	BEMC	ECO regularly attending BEMC meetings and is familiar with the implementation schedule of the EMP	Opportunities to integrate with existing programs include: • Rehabilitation works under the Hawkesbury Nepean Rivercare project •Oyster lease and other rubbish clean up through Catchment Investment Funds • Saltmarsh rehabilitation through the Catchment Investment strategy Funds
2.2 Prepare a discussion paper outlining the management practices in the upper catchment that impact on the Brooklyn Estuary. The paper document should be based on the relevant information in the EPS and EMS. Include discussions of catchment inputs and environmental flows, and any mitigation measures identified to date.	Immediate (2007)	Staff time only	Gosford Council / Hornsby Council Environment Division and Planning Division / CMA	Discussion paper	
2.3 Provide the discussion paper to the CMA for consideration of appropriate catchment based strategies within the CAP	Immediate (2007)	Staff time only	Gosford Council / Hornsby Council Environment Division	CAP to include strategies that could benefit the Brooklyn Estuary	
2.4 Actively participate in all stakeholder consultation being undertaken by the CMA in developing their CAP and Investment strategies	Immediate and Ongoing	Staff time only	Gosford Council / Hornsby Council Environment Division / BEMC	Submissions to all calls for stakeholder input from the CMAs	

Strategy # 3	Initiate a program for the removal of rubbish (including wrecked boats) from riparian areas				
Objectives addressed	3.1, 5.2, 5.4, 6.3, 6.5			**EMS Option Reference**	FL 8
Actions	**Timing**	**Costs**	**Responsibilities**	**Measurables**	**Comments**
3.1 In consultation with the existing *Clean Up Australia* initiative, NSW Maritime, Department of Lands and DEC, select an appropriate date for a clean up day for the Brooklyn Estuary focussing on: • dumped tyres, •plastics and food wrappings, •derelict boats, and •dumped construction materials	Immediate (2007) *and ongoing*	Staff time only	Hornsby Council Environment Division / Gosford Council	Date selected	Coordination would benefit from the River keeper position NSW Maritime and the Department of Environment and Conservation (DEC) have already recently removed one vessel from this area. Examples of other waterways involved in the Clean Up Australia Day "Clean Water Campaign" can be viewed at http://www.cleanup.com.au
3.2 Contact relevant agencies and industry groups to canvass support for the day including: Financial sponsorship, Labour and Equipment (including trailers etc)	Immediate (2007)	Staff time only	Hornsby Council Environment Division / Gosford Council / CMA	Relevant agencies and industry groups contacted	
3.3 Carry out a publicity campaign to encourage participation by community groups and individuals	Immediate (2007)	$10,000	Hornsby Council Environment Division / Gosford Council / CMA	Promotional material in local press	
3.4 With advice and support from the Clean up Australia Initiative, organise logistics for cleanup day (including safety equipment, waste management practices, bags disposal etc)	Immediate (2007)	$10,000	Hornsby Council Environment Division / Gosford Council / CMA	Receipt of appropriate equipment including gloves, plastic bags, information sheets for volunteers etc)	
3.5 Hold Brooklyn Estuary Clean up day	Immediate (2007)	$10,000	Hornsby Council Environment Division / Gosford Council / CMA	Tonnes of rubbish removed from estuary	
3.6 Evaluate the program and consider holding on an annual basis	Short Term (2008)	Staff time only	Hornsby Council Environment Division / Gosford Council / CMA	Evaluation report and future recommendations.	

Strategy # 4	Liaise with Metropolitan LALC and other relevant Aboriginal groups to assess if current level of protection of Aboriginal sites is appropriate and promote educational programs				
Objectives addressed	2.1, 5.1, 5.6			**EMS Option Reference**	H1
Actions	**Timing**	**Costs**	**Responsibilities**	**Measurables**	**Comments**
4.1 Liaise with DEC (National Parks), the Metropolitan LALC and other representatives of the Aboriginal community and the Town Planning Services Branch to confirm adequacy of EMP strategies and to assess level of protection to existing sites and to identify opportunities for enhancing educational programs.	Immediate (2007)	Staff time only	Hornsby Council Environment Division / Gosford Council / River Keeper	Meeting notes, reports on any vandalism or weathering of sites.	Interpretative signage to be designed in consultation with LALC and relevant Aboriginal groups. Opportunities for local Aboriginal people to participate in environmental management and rehabilitation works should be sought.
4.2 Actively encourage visitors to the Brooklyn Estuary to appreciate the cultural heritage of the area by handing out brochures from the *Aboriginal Sites and Culture in the Hornsby Shire* series and discussing the information discussed in the brochures	Immediate (2007) and ongoing	$10,000	Hornsby Council Environment Division / Gosford Council / River Keeper	Brochures handed out to visitors and the community	
4.3 Undertake periodic inspections of heritage sites to identify disturbance / damage etc the popular sites on an annual basis to establish rates of vandalism / weathering.	Short Term (2008) and ongoing	Staff time only	Hornsby Council Environment Division / Gosford Council / River Keeper	Reports on damage to heritage sites	
4.4 If disturbance of heritage sites is noted, engage a specialist consultant to advise on management options in close consultation with LALC and DEC (NPWS)	as required	$10,000	Hornsby Council Environment Division / Gosford Council / DEC (National Parks) / Metropolitan LALC	Consultant engaged and report	

Strategy # 5	Promote the EPIC framework for use by Council Planners when assessing development applications				
Objectives addressed	1.1, 2.1, 4.1, 4.6, 5.4, 6.6			EMS Option Reference	R7
Actions	**Timing**	**Costs**	**Responsibilities**	**Measurables**	**Comments**
5.1 Update EPIC based on the various audits described in strategies of this EMP, and relevant permissible activities	Immediate (2007) and ongoing	Staff time only	Hornsby Council Environment Division and Planning Div. / Gosford Council	Updates and improvement in the EPIC framework	The Estuary Processes and Issues Checklist (EPIC) is a tool prepared as a part of this Estuary Management Study. It helps assess the likely impacts of future proposals on the processes and valued aspects of the Brooklyn Estuary. EPIC has four key areas: Contaminant inputs; Waterway encroachment; Social issues, and Biological impacts. A copy of the EPIC is provided in Appendix A.
5.2 Based on the outcomes of the Waterways Review, incorporate the EPIC framework into the Consolidated DCP (which amalgamates Council's 30 existing DCPs into one document)	Negotiations already underway in Hornsby	Staff time only	Hornsby Council Environment Division and Planning Div. / Gosford Council	EPIC framework incorporated into formal planning framework	
5.3 Use the EPIC Framework within the Consolidated DCP to assess development applications	Ongoing	Staff time only	Hornsby Council Environment Division and Planning Divi. / Gosford Council	Number of development assessments to which EPIC has been applied	
5.4 Develop a GIS platform that displays all appropriate EPIC information for specific parcels of land on an individual basis to assist with application of the Consolidated DCP	Short Term (2008)	Staff time only	Hornsby Council Environment Division and Planning Div. / Gosford Council	GIS based platform being used by planning staff	
5.5 Use the EPIC GIS Platform attached to the Consolidated DCP to help assess development applications	As appropriate	Staff time only	Hornsby Council Environment Division and Planning Division / Gosford Council	Development assessments assessed against GIS based EPIC Framework	

Strategy # 6	Review effectiveness of existing planning frameworks such as Hornsby and Gosford LEPs and DCPs to protect the estuary values				
Objectives addressed	1.5, 2.1, 4.1, 5.1, 6.4, 6.6			**EMS Option Reference**	R2 (combination of strategies E5 and R2)
Actions	**Timing**	**Costs**	**Responsibilities**	**Measurables**	**Comments**
6.1 Similar to the Hornsby Waterways Review and River Settlements and Foreshores Review, Gosford Council to conduct an audit of approved developments around the Brooklyn Estuary within the last 5 years and determine impacts of development on estuarine processes and issues, as well as overall goals and objectives of the EMP	Immediate (2007)	Staff time only	Gosford Council	List of approved developments inconsistent with estuary management objectives	In determining impacts, reference should be made to the EPIC Framework (see Strategy #5). Hornsby Council has already undertaken a Waterways Review for lands below MHWM and a River Settlements and Foreshores Review for lands above MHWM. A similar level of assessment should be carried out by Gosford Council.
6.2 Where impacts of previously approved developments are determined or are inconsistent with the goal and objectives of the EMP, identify possible changes to existing planning instruments (LEPs, DCPs etc) to ensure that such developments do not continue to be approved in the future.	Immediate (2007)	Staff time only	Gosford Council	List of planning instruments to be changes	
6.3 In concert with the outcomes of the Waterways Review and the River Settlements and Foreshores Review, make appropriate changes to planning instruments that would prevent continuation of inappropriate development approvals	Short Term (2008)	Staff time only	Hornsby Council Planning Division / Gosford Council	Revised planning instruments	

Strategy # 7	Enhance current program of auditing sediment and erosion controls at all development sites				
Objectives addressed	1.1, 2.1, 4.5, 5.4, 6.6, 6.5			**EMS Option Reference**	DN 7
Actions	**Timing**	**Costs**	**Responsibilities**	**Measurables**	**Comments**
7.1 Conduct an audit of all active development sites around the Brooklyn Estuary to determine compliance with development consent requirements for sediment and erosion control	Immediate (2007)	Staff time only	Hornsby Council Environment Division and Planning Division / Gosford Council	Initial audit report	The mechanism for rapid and more efficient assessment could be adopted throughout the LGAs. Current best practice for sediment and erosion control should be considered if modifying Council requirements.
7.2 Based on observed non-compliances, prepare and implement a mechanism for rapid and more efficient assessment of development sites.	Immediate (2007) and on-going	Staff time only	Hornsby Council Environment Division and Planning Division / Gosford Council	Number of audits on development sites around Brooklyn	
7.3 For common or on-going non-compliances, modify the development assessment process to better define requirements for sediment and erosion control.	Short Term (2008)	Staff time only	Hornsby Council Environment Division and Planning Division / Gosford Council	Reduction in number of non-compliances regarding sediment and erosion control requirements	

Strategy # 8	Continue discussions with Sydney Water regarding alternatives to the preferred option for management of sewage at Brooklyn				
Objectives addressed	2.2, 3.1, 4.1, 4.2			**EMS Option Reference**	WQ 4
Actions	**Timing**	**Costs**	**Responsibilities**	**Measurables**	**Comments**
8.1 BEMC to champion the issue of effluent treatment and disposal and continue discussions with Sydney Water regarding community concerns and viable alternatives, including effluent reuse.	Immediate (2007)	Staff time only	Hornsby Council Environment Division / Gosford Council	Dialogue with Sydney Water	On 15 March 2006, Hornsby Council adopted a draft LEP to rezone land for the purposes of STP construction on the “Old Dairy” site.

Strategy # 9	Develop a numerical catchment and receiving water model, to identify areas where ecological health may be vulnerable.				
Objectives addressed	1.1, 1.3, 2.2, 4.1, 4.2, 4.3, 5.3, 6.3			**EMS Option Reference**	R9
Actions	**Timing**	**Costs**	**Responsibilities**	**Measurables**	**Comments**
9.1 Prepare and distribute brief for developing a 'whole-of-catchment' model of the Brooklyn Estuary catchment, including Mooney Mooney and Mullet Creeks	Immediate (2007)	Staff time only	Hornsby Council Environment Division / Gosford Council	Suitably qualified consultants in receipt of brief	The catchment and receiving water model should utilise current best practice methods and software, such as the recently released E2 model from the e-Water CRC, or equivalent. A range of past, existing and future development scenarios should be simulated in the model to gain a better appreciation of pollutant loads to the estuary and to help guide future development. Model should also be used to identify the best locations for environmental health monitoring.
9.2 Engage consultant for modelling project	Immediate (2007)	Staff time only	Hornsby Council Environment Division / Gosford Council	Signed consultancy agreement with preferred consultant	
9.3 Set up and calibrate catchment model utilising relevant and available environmental data	Immediate (2007)	$100,000	Hornsby Council Environment Division / Gosford Council	Hand-over of fully calibrated and documented catchment model	
9.4 Use calibrated and verified model to guide catchment management actions and to direct future environmental health monitoring	Immediate (2007)	$20,000	Hornsby Council Environment Division / Gosford Council	Model integrated with environmental health monitoring strategy (refer to strategy # 10)	
9.5 Set up and calibrate receiving water model utilising available data, which covers the whole of the estuary	Short Term (2008)	$150,000	Hornsby Council Environment Division / Gosford Council / Consultant	Model integrated with catchment model and informing EHMP	
9.6 Modify and extend model as new data becomes available	Short Term (as required)	$50,000	Hornsby Council Environment Division / Gosford Council / Consultant	New data from environmental health monitoring program added to model	
9.7 Use model to assess strategic landuse management options	Short Term (as required)	$40,000	Hornsby Council Env Division / Gosford Council / Consultant	Catchment model used in land use management options	

Strategy # 10	Develop an Estuary Health Monitoring Program				
Objectives addressed	1.1, 1.3, 2.2, 4.1, 4.2, 4.3, 5.3, 6.1, 6.3			**EMS Option Reference**	E1
Actions	**Timing**	**Costs**	**Responsibilities**	**Measurables**	**Comments**
10.1 Prepare a pilot monitoring program for assessing estuary health of the Brooklyn waterways	Immediate (2007)	Staff costs only	Hornsby Council Environment Division / Gosford Council / River Keeper	Documented pilot monitoring program	Monitoring program should build on data already being collected (eg monthly returns by commercial fishermen), and data gaps identified through the Estuary Processes Study (eg. recreational fishing effort and occurrence of nuisance algae blooms) Program should assess a range of physical, chemical, geochemical and biological indicators, as per current best practice (eg see Scheltinga *et al*, 2004). This option should be undertaken in consultation with the CMA Estuary Theme Team who are currently looking at developing indicators of ecosystem function for the entire Hawkesbury Estuary.
10.2 Implement the pilot environmental health monitoring program for a minimum of 12 months	Immediate (2007)	$50,000	Hornsby Council Environment Division /Gosford Council / River Keeper / Others	Documented results of pilot monitoring program	
10.3 Refine monitoring program based on results of pilot program and outputs from the catchment model (see Strategy #9)	Short Term (2008)	Staff costs only	Hornsby Council Environment Division / Gosford Council	Documented revised monitoring program	
10.4 Carry out refined environmental health monitoring program and provide periodic reporting (say quarterly) on outcomes with reference to guidelines, targets etc	Short Term (2008) and on-going	$50,000 per year	Hornsby Council Environment Division / Gosford Council / River Keeper / Others	Periodic reporting and uploading of monitoring program results to website	
10.5 Actively seek opportunities for specific environmental investigations to be carried out by universities or similar, and for adoption of whole-of-estuary monitoring, to be facilitated through the CMA	Short Term (2009)	Staff costs only	Hornsby Council Environment division / Gosford Council / River Keeper / CMA	Universities and/or support organisations undertaking further investigations	

Strategy # 11	Employ a River Keeper for the lower Hawkesbury Estuary				
Objectives addressed	1.1, 1.3, 1.8, 4.2, 4.4, 4.7, 5.3, 5.5, 6.1, 6.2, 6.3, 6.5			**EMS Option Reference**	Refer Section 9.3 of EMS
Actions	**Timing**	**Costs**	**Responsibilities**	**Measurables**	**Comments**
11.1 Develop a Memorandum of Understanding for the employment of a River Keeper	Already underway	Staff time only	HSC Environ. Division / GCC / Pittwater Council / NSW Maritime / CMA	Finalisation of MoU	A Draft MoU has already been prepared for this position. Costs will be shared by NSW Maritime, Gosford, Hornsby and Pittwater Councils and the CMA. **Costs shown here cover the Brooklyn Estuary portion of overall costs.** The River Keeper position will be administered by NSW Maritime. The River Keeper will provide assistance to the Councils through pollution and water quality monitoring, prevention and identification of foreshore run-off and siltation, compliance surveillance and community education. Assistance to NSW Maritime will involve specific boating related programs and reviews in conjunction with existing Boating Service Officers
11.2 Purchase equipment for the River Keeper position (incl. Vessel, vehicle, mobile phone, portable GRN radio, digital camera, uniform, protective clothing and safety equipment)	Immediate (2007)	$25,000	NSW Maritime / HSC Environ. Division / GCC / Pittwater Council / HNCMA	Equipment purchased and ready for use	
11.3 Prepare an annual work program for the River Keeper based on this Estuary Management Plan. The work plan should include a range of field work and administrative work	Immediate (2007)	Staff time only	HSC Environ. Division / GCC / Pittwater Council / NSW Maritime / HNCMA	Annual work program prepared and signed off	
11.4 Prepare selection criteria and employ River Keeper as instructed by the draft MoU and relevant HR policies, legislation and guidelines	Immediate (2007)	$250	HSC Environ. Division / GCC / Pittwater Council / NSW Maritime / HNCMA	Employment of River Keeper	
11.5 Adhere to the requirements of the Memorandum of Understanding for the River Keeper Position	Immediate (2007) and ongoing	$30, 000 per year	HSC Environ. Division / GCC / Pittwater Council / NSW Maritime / HNCMA	Annual position review	
11.6 Provide a bimonthly update report on the progress and implementation of the annual Work Program	Immediate (2007) after employed and ongoing	Staff time only (included in above estimate)	River Keeper	Bimonthly reports tabled at BEMC meetings	

Strategy # 12	Prepare and distribute an education brochure "Living on the Brooklyn Estuary"				
Objectives addressed	1.1, 1.2, 1.4, 1.5, 1.6, 2.2, 5.4, 6.3, 6.5			**EMS Option Reference**	FL4
Actions	**Timing**	**Costs**	**Responsibilities**	**Measurables**	**Comments**
12.1 With assistance from Councils' media and education services, and in consultation with Councils' Planning Divisions, prepare a brochure outlining important environmental information for residents living near the estuary	Short term (2008)	$20,000	Hornsby Council Environment Division / Gosford Council / BEMC	Brochure that is relevant and comprehendible by all in the community	Brochure should espouse the goals and objectives of the EMP, and be based on similar educational documents used elsewhere, in Australia and overseas Additional hard copies of the brochure should be distributed via tourism operators, the River Keeper, libraries and other locations that are used by the community as well as visitors to the estuary. Periodical updates of the brochure should document progress of EMP and EHMP results.
12.2 Develop an interactive website for the Brooklyn Estuary that provides information to the community, including regularly updated results of the EHMP (see Strategy #10), as well as opportunity for community feedback and comments	Short term (2008)	$10,000	Hornsby Council Environment Division / Gosford Council	Number of times web-site is accessed by community	
12.3 Upload brochure to web-site, and print and distribute hard copy brochures to all foreshore land owners in the Brooklyn Estuary, with reference to the web-site	Short term (2008)	$10, 000	Hornsby Council Environment Division / Gosford Council	Number of brochures distributed and downloaded	
12.4 Periodically prepare updates to the brochure, update web-site with additional brochures and other relevant information, such as monitoring results, and distribute to the community	Short Term (2009) and on-going	$10,000 per year	Hornsby Council Environment Division / Gosford Council	Number of periodical updates of brochure and revisions / updates to web-site	

Strategy # 13	Rehabilitate public foreshore land through programs such as Bushcare, the Hawkesbury Nepean Riverbank Management Program and by promoting the Hornsby Council plant list				
Objectives addressed	1.1, 1.2, 1.4, 1.5, 5.1, 5.4			**EMS Option Reference**	FL2
Actions	**Timing**	**Costs**	**Responsibilities**	**Measurables**	**Comments**
13.1 Liaise with Council Bushcare facilitator, CMA and RIC to identify opportunities to rehabilitate foreshore land including the Hawkesbury Nepean Riverbank Management Program	Short term (2008)	Staff time only	Hornsby Council Environment Division / Gosford Council / CMA / RIC	Maps of areas to be rehabilitated, agreed by CMA, Council and RIC Table of funding opportunities for works	This strategy would benefit from the River Keeper Position. Typically, an assigned Riverbank Officer works with the property owner to develop a Riverbank Management Plan (RMP). The RMP is then implemented using about 50% contract labour paid for by the CMA and 50% volunteer labour supplied by the landholder. This is consistent with the Draft Management Action Target for Riverbank Health developed by the HNCMA for inclusion in the CAP:
13.2 In consultation with RIC and the CMA and in close reference to the Catchment Action Plan, develop a foreshore land rehabilitation plan	Short term (2008) and on-going	Staff time only	Hornsby Council Environment Division / Gosford Council / CMA / RIC	Documentation of foreshore rehabilitation plan	
13.3 Implement the rehabilitation plan through Councils existing Bushcare program.	Short term (2008) and on-going	Start up costs of $40,000+ maintenance of $10,000 per year	Hornsby Council Environment Division / Gosford Council / CMA / RIC	Rehabilitation plans implemented. Visual improvement in foreshore land. Proportion of trees surviving 1 year after planting.	
13.4 Ongoing support of the Bushcare program and associated volunteers	Short term (2008) and on-going	$20,000 per year	Hornsby Council Environment Division / Gosford Council / CMA	Increase in the area of foreshore land undergoing regeneration	

Strategy # 14	Continue and improve community education programs regarding water pollution including boat discharges				
Objectives addressed	4.2, 2.1, 6.3			**EMS Option Reference**	R3
Actions	**Timing**	**Costs**	**Responsibilities**	**Measurables**	**Comments**
14.1 Develop a logo for education programs related to the Brooklyn Estuary	Immediate (2007)	Up to $10,000	Hornsby Council Environment Division / Gosford Councils	Use of logo on estuary based publications	Consider running a community based competition to design the logo.
14.2 Councils to liaise with NSW Maritime and DEC (NPWS) regarding a more effective regulatory regime for controlling effluent and other forms of pollution from vessels using the waterway	Immediate (2007)	Staff time only	Hornsby Council Environment Division / Gosford Councils	Report to Council on outcomes of discussions	These actions could be expanded to include the wider Hawkesbury Estuary and Brisbane Water.
14.3 Develop new education tools based on the Estuary Management Plan to facilitate the move from information dissemination to greater public participation in environmental management	Short term (2008) and on-going	$20,000 to $30,000 per year.	Hornsby Council Environment Division / Gosford Council	Program tools and changes in behaviour	There is also potential to integrate this option with the suggested Environmental Health Monitoring Program. Implementation would be greatly enhanced through the service of the proposed River Keeper.
14.4 Establish an estuary research and education facility at an appropriate location.	Short term (2009)	$250,000	Hornsby Council Environment Division and Planning Division	Visitation rates at established facility.	Consider basing River Keeper at this location
14.5 Investigate opportunities to integrate with university research and undergraduate coursework programs to help inform the integrated nature of processes and issues.	Short term (2009)	Staff time only	Hornsby Council Environment Division / Gosford Council	University based programs initiated to increase knowledge about estuarine processes and interactions	University based programs operating through the estuary research and education facility.

Strategy # 15	Monitor the ecological impact of the proposed STP outfall-before, during and after construction				
Objectives addressed	1.3, 1.8, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 4.5			**EMS Option Reference**	WQ 11
Actions	**Timing**	**Costs**	**Responsibilities**	**Measurables**	**Comments**
15.1 Establish a baseline monitoring program measuring water quality parameters such as: faecal indicators (faecal coliforms, sterols, antibiotics and/or enterococci), nutrients, salinity, temperature, turbidity, chlorophyll-a, BOD, COD and DO; and ecological indicators such as oyster toxicology and fish diversity. This should be implemented as soon as possible to ensure that some baseline data is available prior to plant commissioning.	Immediate (2007)	$20,000 to $30,000	Hornsby Council Environment Division / Gosford Council / Sydney Water	Monitoring program in place	Monitoring sites should be set up throughout the estuary both upstream and downstream of the proposed outfall location plus control sites. Sites should also be established to allow the identification of any beneficial impacts associated with removal of existing onsite systems would be required.
15.2 Request that Sydney Water continue to fund this monitoring as part of development consent conditions.	As appropriate	staff time only	Hornsby Council Environment Division / DEC	Annual reports on monitoring data and cumulative statistical analyses comparing baseline data to post STP implementation data.	

Strategy # 16	Ensure all seagrass, saltmarsh and mangrove areas are mapped accurately in HSC and GCC GIS systems				
Objectives addressed	1.1, 1.3, 1.4, 1.8, 2.2, 3.4, 4.1, 4.6, 6.3			**EMS Option Reference**	E9
Actions	**Timing**	**Costs**	**Responsibilities**	**Measurables**	**Comments**
16.1 Acquire the most recent GIS mapping of estuarine communities available from DPI (Fisheries) and estuarine vegetation maps presented in the Brooklyn Estuary Processes Study. Review the GIS layers and compare with Councils and/ or Fisheries GIS layers	Immediate (2007)	$10,000	Hornsby Council Environment Division / Gosford Council	Mapping of gaps between Council GIS and EPS/ DPI Fisheries seagrass areas	Methods to map and assess vegetation would most likely include air photo interpretation followed by ground truthing or video and sidescan sonar mapping
16.2 If additional mapping has not been undertaken in the past 2 years, engage a consultant to update estuarine vegetation mapping.	Short term (2008)	$40,000	Hornsby Council Environment Division / Gosford Council	Updated mapping	
16.3 Prepare new GIS layers based on the revised and appropriate offsets from habitats for development assessment considerations (incorporate into the EPIC GIS Framework	Short term (2008)	$10,000	Hornsby Council Environment Division / Gosford Council	GIS layers updated and applied to Development Applications	

Strategy # 17	Develop and implement oyster lease decommissioning plan				
Objectives addressed	2.2, 2.3, 3.1, 3.5, 6.2			**EMS Option Reference**	WU5
Actions	**Timing**	**Costs**	**Responsibilities**	**Measurables**	**Comments**
17.1 Liaise with the Coasts and Estuary Officer of the CMA and Pittwater Council to identify opportunities to undertake this option at an estuary wide level	Immediate (2007)	Staff time only	Hornsby Council Environment Division / Gosford Council	Agreement on extent of application for oyster lease decommissioning plan	This strategy is somewhat being implemented already following the recent QX outbreak and subsequent demise of oyster industry. The plan should identify areas for remediation and relative priorities of work. Options may include provision of labour from the oyster industry with reduced tipping fees and other funds provided by government agencies. The plan should also include value-added works, such as seagrass rehabilitation and improved public facilities. Following remediation, oyster leases would be surrendered by the lessees. Funds may be available through the Catchment Investment Strategy. While not yet finalised, a draft management action target is for the implementation of Estuary Management Plans
17.2 Prepare a disused oyster lease decommissioning plan with input from the oyster industry, DEC (EPA), Council, Maritime Authority and the CMA.	Short term (2008)	$25,000	DPI Fisheries / oyster industry / CMA / Hornsby Council Environment Division / Gosford Council	Formal plan for decommissioning disused oyster leases	
17.3 Implement the disused oyster lease decommissioning Plan	Short term (2008)	$100,000 + in kind contributions	DPI Fisheries / oyster industry / CMA / Hornsby Council Environment Division and Works Division / Gosford Council	Tonnage of oyster sticks removed for the Brooklyn Estuary	

Strategy # 18	Further investigate and then implement options for pump out facilities accessible to larger vessels east of the rail bridge				
Objectives addressed	2.2, 2.3, 3.1, 4.2, 4.4			**EMS Option Reference**	WQ1
Actions	**Timing**	**Costs**	**Responsibilities**	**Measurables**	**Comments**
18.1 Carry out further investigations focussing on the key recommendations of the economic evaluation report (Taylor and Hincks, 2005).	Short term (2008)	$50,000	NSW Government	Comprehensive report completed and preferred option nominated	Aspects to be further investigated include: • availability and conditions of funding; • the existing Myall Lakes mobile pump out operation; • feasibility of using a mobile pump-out barge to collect wastewater from riverside developments; • transport and treatment capacity for the Brooklyn Sewerage Scheme design to receive and process highly saline wastewater from future pump out facilities; and • environmental and social impacts Service is of State significance, so responsibility is with State Government. Assistance to be provided by Hornsby Council Environment Division and Planning Division, Gosford Council and NSW Maritime
18.2 Detailed design and environmental assessment of preferred option	Short term (2008)	$50,000	NSW Government	Design completed and agreed to by Council and Maritime NSW	
18.3 Submission of development application and assessment of proposal	Short term (2008)	Staff time only	NSW Government	DA Approval	
18.4 Construct preferred option	Short Term (2009)	Implementation costs in excess of $300,000 with maintenance and operation costs of up to $300,000 per year	NSW Government	Total volume of effluent passing through facility.	

Note, Strategy 19 removed from final version of Brooklyn EMP

Strategy # 20	Monitor recreational fishing in the Brooklyn Estuary				
Objectives addressed	1.3, 2.1, 2.2, 6.1, 6.2, 6.3			**EMS Option Reference**	E2
Actions	**Timing**	**Costs**	**Responsibilities**	**Measurables**	**Comments**
20.1 Prepare project proposal for recreational monitoring program and submit to NSW DPI Fisheries Recreational Fishing Trust for funding consideration	Short Term (2009)	Staff time only	Hornsby Council Environment Division / Gosford Council / DPI Fisheries	DPI Fisheries in receipt of funding application	To be eligible the application must demonstrate benefit to recreational fishing
20.2 Prepare and distribute brief for monitoring recreational fishing in the Brooklyn Estuary	Short Term (2009)	Staff time only	Hornsby Council Environment Division / Gosford Council / DPI Fisheries	Proposals received from suitably qualified consultants	If possible this strategy should be implemented as part of a total estuary program. Monthly returns on commercial fish takes also need to be considered. For this reason, the study should be undertaken in consultation with the Catchment Management Authority and opportunities to extend the scope to the rest of the Hawkesbury Estuary. The survey should also seek to establish if there is sufficient infrastructure to encourage non boat based recreational fishing (as a passive activity)
20.3 Undertake recreational fishing survey. Methodologies used could include site audits or diary based system of a selected sample of fishers.	Short Term (2010)	$30,000 to $50,000	Consultant / River Keeper	Receipt of report on recreational fishing survey.	
20.4 Incorporate results into the Estuary Health Monitoring Program	Short Term (2011)	Staff time only	Hornsby Council Environment Division / Gosford Council	Incorporation of data into the Estuary Health Monitoring Program	
20.5 Follow up monitoring results with appropriate actions	Short Term (2011)	Variable	Hornsby Council Environment Division / Gosford Council / DPI Fisheries / River Keeper.	Evidence of corrective actions	This is an adaptive management action that requires a response consistent with the objectives of this EMP

Strategy # 21	Prepare and implement creek rehabilitation plans for tributaries of the Brooklyn Estuary				
Objectives addressed	1.1, 1.4, 1.5, 1.6, 2.2, 4.1, 4.3, 4.5, 4.6, 5.4			**EMS Option Reference**	WQ2
Actions	**Timing**	**Costs**	**Responsibilities**	**Measurables**	**Comments**
21.1 Prepare and distribute brief for developing creek rehabilitation plans for the tributaries to Sandbrook Inlet including Seymour, and Saltpan Creeks	Short Term (2009)	Staff time only	Hornsby Council Environment Division	Proposals from suitably qualified consultants	Rehabilitation plans for all tributaries could also incorporate filtering of storm flows through artificial wetlands and fringing vegetation. The plans should be integrated with the other plans in the area, including the National Parks Plan of Management, Estuary Management Plan and the Catchment Action Plan. Funding may be available from the RTA or RIC to implement strategies related to road and rail runoff issues. Funding for saltmarsh rehabilitation for these creeks may be available through the CMA's latest NHT grants once the Investment Strategy is finalised.
21.2 Develop creek rehabilitation plans for tributaries to Sandbrook Inlet including revegetation of banks and riparian areas, removal of the sand slug from Seymour Creek (from the rail line collapse in the 1990's), identifying sources of sediment and preventing them from reaching the streams, artificial erosion control measures and other sediment control devices	Short Term (2010)	$20,000-$30,000	Consultant	Receipt of Plan	
21.3 Implement the creek rehabilitation plans for tributaries to Sandbrook Inlet	Short Term (2011) and on-going	$100,000	Hornsby Council Environment Division / Gosford Council Bushcare / DEC (NPWS)	Number of strategies implemented and objectives met	
21.4 Prepare and distribute brief for developing creek rehabilitation plans for Mullet Creek and Mooney Mooney Creek	Short Term (2010)	Staff time only	Gosford Council	Proposals from suitably qualified consultants	
21.5 Develop Creek rehabilitation plans for Mullet Creek and Mooney Mooney Creek – ensure that these are consistent with those prepared for the tributaries of Sandbrook Inlet.	Short term (2011)	20,000-$30,000.	Gosford Council	Receipt of plans	
21.6 Implement the creek rehabilitation plans for Mooney Mooney and Mullet	Medium Term (2012)	upwards of $100,000	Gosford Council Bushcare /	Number of strategies implemented	
21.7 Evaluate the success of the creek rehabilitation plans	Medium Term (2012)	Staff time only	Hornsby Council Environment Division / Gosford Council	Report on monitoring and evaluation of plans	

Strategy # 22	Ensure that road and rail infrastructure within the catchment has sufficient stormwater management controls				
Objectives addressed	1.1, 1.4, 1.5, 1.6, 2.2, 2.6, 4.1, 4.5, 4.6			**EMS Option Reference**	WQ 6
Actions	**Timing**	**Costs**	**Responsibilities**	**Measurables**	**Comments**
22.1 Review and update existing catchment GIS layer/s indicating locations where road and rail infrastructure may drain to Brooklyn Estuary.	Short Term (2009)	Staff time only	Hornsby and Gosford Councils	GIS mapping and quantification of road/rail runoff	In particular consider the sediment control to Seymours Creek. Include consideration of emergency response plans for addressing spills (from an estuarine pollution perspective) – this may already exist in relevant Environmental Management Systems.
22.2 Using the catchment model, estimate loads from road and rail infrastructure and identify critical control points for runoff	Short Term (2009)	$10,000	Hornsby and Gosford Councils		
22.3 Assess / audit any existing controls at these points	Short Term (2010)	$10,000	RTA and RIC	Audit report for existing runoff controls	
22.4 Upgrade or implement if they are found to potentially impact on the Brooklyn Estuary	Short Term (2011)	Up to $50,000	RTA and RIC	New and or upgraded stormwater controls	

Strategy # 23	Identify significant seagrass beds on boating charts and by buoys and undertake an education program to promote the protection of these areas				
Objectives addressed	1.1, 2.1, 2.2, 3.4, 6.2, 6.3			**EMS Option Reference**	E8
Actions	**Timing**	**Costs**	**Responsibilities**	**Measurables**	**Comments**
23.1 Investigate opportunities to approach this option as an Estuary wide strategy with the CMA	Short Term (2009)	Staff time only	HSC Env Div./ Gosford Council / NSW Maritime	Directions from CMA on opportunities to apply this option holistically across the estuary	This strategy should also include promotion of DPI Fisheries information on seagrass areas, their significance and the regulations that protect them. Notation should be included on charts indicating that indicative locations of seagrass beds. Funding may be sourced from the Recreational Fishing Trust. Maps should be clearly displayed near the helm of all charter vessels (ie houseboats) within the Brooklyn Estuary.
23.2 Following mapping undertaken for Strategy # 16 EMP, investigate opportunities to chart seagrass areas on NSW Maritime boating charts and to include information regarding the potential to damage seagrass beds through anchoring and propeller wash.	Short Term (2009)	Staff time only	Hornsby Council Environment Division / Gosford Council / NSW Maritime / DPI Fisheries	Decision on including seagrass areas on NSW Maritime mapping	
23.3 Prepare additional maps of Brooklyn Estuary showing seagrass areas and distribute through marinas and other businesses- as well as at boat ramps	Short Term (2010)	$10,000	Hornsby Council Environment Division / Gosford Council / NSW Maritime / DPI Fisheries	Initial print run of maps	
23.4 Based on mapping undertaken for strategy number 23 of this EMP, identify particularly vulnerable seagrass beds in the waterway with markers and signage	Short Term (2010)	$5,000	HSC Env Div./ Gosford Council / NSW Maritime / Dept. of Lands / DPI Fisheries	Markers and signage in place	
23.5 Evaluate success of markers and mapping. In particular assess complaints/safety incidents reported to NWS Maritime associated with markers and changes to seagrass distribution.	Medium Term (2012)	Staff time only	HSC Env Div./ Gosford Council / NSW Maritime / Dept. of Lands / DPI Fisheries	Evaluation and future directions	

Note, Strategy 24 removed from final version of Brooklyn EMP

Strategy # 25	Investigate opportunities for reinstating tidal flushing under the Causeway				
Objectives addressed	1.8, 2.1, 2.6, 4.2, 4.6			**EMS Option Reference**	WQ 5
Actions	**Timing**	**Costs**	**Responsibilities**	**Measurables**	**Comments**
25.1 Building on investigations previously carried out, prepare a discussion paper outlining the history of the causeway and the impacts on estuarine processes. Include a discussion of the significance of this issue as reflected through the community consultation undertaken in developing this EMP.	Short Term (2010)	Staff time only	Hornsby Council Environment Division and Works Division, / Gosford Council	Completed discussion paper	To be considered in concert with dredging strategies for Sandbrook Inlet and Brooklyn Harbour to facilitate tidal flows under causeway. Culverts or bridge may be limited in size and location depending on the current proposals for the rail upgrade This is a matter for State Government and RailCorp / RIC. Commitment is required from RailCorp / RIC for this to be successful.
25.2 Present Discussion Paper to RIC and request consideration for the construction of culverts or a bridge under the existing infrastructure on the causeway.	Short Term (2010)	Staff time only	Hornsby Council Environment Division, and Works Division / Gosford Council / RIC	Dialogue with RIC	
25.3 Continue to liaise with RIC during planning stages for any rail infrastructure upgrades and identify and present any opportunities to reinstate flushing through the causeway	Ongoing	Staff time only	Hornsby Council Works Division, and Environment Division / Gosford Council / RIC	Continued dialogue with RIC	

Note, Strategy 26 removed from final version of Brooklyn EMP

Strategy # 27	Monitor sediment quality and determine sources of sediment contamination				
Objectives addressed	1.3, 4.1, 4.3, 4.5			**EMS Option Reference**	DN 9
Actions	**Timing**	**Costs**	**Responsibilities**	**Measurables**	**Comments**
27.1 Based on existing and historical land use and development activities, identify possible sources of heavy metals in the estuary (include marinas and industrial areas)	Short Term (2010)	$20,000	Hornsby Council Environment Division / Gosford Council / DNR / DEC (EPA) / HNCMA,	List of potential point / diffuse sources for heavy metals and other pollutants	The Estuary Processes Study (WRL, 2003) found: • Slightly elevated concentrations of mercury, copper, lead and zinc within the surface sediments of Sandbrook Inlet; • Slightly elevated concentrations of a few metals including mercury, cadmium and lead in surface sediments adjacent to Spectacle Island, downstream of the road bridges. No trace metals were at concentrations that warrant significant concern. Sources of these trace levels of contamination were not identified. Monitoring and assessment should be considerate of existing investigations in Pittwater Estuary
27.2 Based on the location of possible sources, knowledge of tidal currents and bathymetry and existing information on heavy metals – design and implement an appropriate water and sediment monitoring program to assess potential impact on estuarine health.	Short Term (2010)	Upwards of $50,000	Hornsby Council Environment Division / Gosford Council	Monitoring data collected and entered into data base	
27.3 Analyse the data and if possible identify sources	Short Term (2010) and Ongoing	$10,000	Hornsby Council Environment Division / Gosford Council (or consultant)	Report analysing data	
27.4 Incorporate monitoring results into the Estuary Health Monitoring Program and report as part of the Estuary Health Monitoring program	Short Term (2010) and Ongoing	$5,000 per year	Hornsby Council Environment Division / Gosford Council (or consultant)	Results incorporated into EHMP	
27.5 If impacts identified, undertake corrective action at sources	Short Term (2010) and Ongoing	Staff time only	Hornsby Council Environment Division / Gosford Council / DEC (EPA)	Corrective action detailed and implemented.	

Strategy # 28	Upgrade public jetties, wharves and waste facilities at McKell Park, Brooklyn Park, Parsley Bay, Kangaroo Point and Saltpan Reserve				
Objectives addressed	2.3, 3.1, 3.2, 3.4, 4.2, 4.4, 5.2			**EMS Option Reference**	FL1
Actions	**Timing**	**Costs**	**Responsibilities**	**Measurables**	**Comments**
28.1 Review the existing masterplans for the remaining public foreshore space not considered in the Kangaroo Point Master Plan. The review should ensure consistency with this EMP and that there are plans for adequate facilities, including, rubbish bins and toilets. Include upgrading wharves and jetties to allow disabled access.	Short Term (2011)	Staff time only	Hornsby Council Planning Division Works Division, and Environment Division / Gosford Council / Department of Lands / NSW Maritime / RIC	Master plans reviewed and ready for implementation	Masterplans for McKell Park, Brooklyn Park, Saltpan Reserve and the Old Dairy Site are contained within the Brooklyn DCP. The plans should outline an implementation strategy that prioritises works that can be implemented as funding becomes available. Opportunities to fund works based on developer contributions and or visitation should be considered.
28.2 Implement the master plans for public foreshore space prioritising the upgrading of wharves and jetties to allow disabled access and to encourage passive recreation (for example wharf based fishing, sitting etc)	Medium to Long Term (2012) and ongoing	$200,000	Hornsby Council Works Division, Planning Division and Environment Division /Gosford Council	Master plans implemented	

Strategy # 29	Undertake an environmental flows investigation for tributaries to the Brooklyn Estuary				
Objectives addressed	1.3, 1.7, 2.1, 2.2, 4.1, 4.3, 4.6			**EMS Option Reference**	E12
Actions	**Timing**	**Costs**	**Responsibilities**	**Measurables**	**Comments**
29.1 Prepare and distribute brief for an environmental flows investigation	Short Term (2011)	Staff time only	Gosford Council / Hornsby Council Environment Division	Suitably qualified consultants in receipt of brief	Should include establishing extraction rates, impacts of reduced environmental flows for estuarine areas and a discussion of implications for the water quality, flushing and ecology. The study should also include consultation with the Gosford and Wyong Council to identify opportunities to modify flows for environmental benefit. Where possible the findings of the study should be integrated with the catchment model. The review should make recommendations to mitigate impacts of environmental flows (including modifying extraction rates, release procedures or further monitoring). Assessment of Environmental Flows should be consistent with best practice following the methods of Pierson et al (2002), Gippell (2002) or Queensland DPI
29.2 Engage consultant	Short Term (2011)	Staff time only	Gosford Council / Hornsby Council Environment Division	Signed consultancy agreement with preferred consultant	
29.3 Undertake a desktop environmental flows study focussing on extraction from Mooney Mooney and Mullet Creeks.	Short Term (2011)	$40,000	Gosford Council / Hornsby Council Environment Division	Consultant report	
29.4 Implement recommendations based on information review	Medium Term (2012)	Up to $100,000	Gosford Council / Hornsby Council Environment Division	Recommendations implemented	

Strategy # 30	Redesign Brooklyn Harbour				
Objectives addressed	2.3, 2.6, 2.7, 3.23.4, 5.2, 5.4			**EMS Option Reference**	DN 3
Actions	**Timing**	**Costs**	**Responsibilities**	**Measurables**	**Comments**
30.1 Prepare a brief for the conceptual design of Brooklyn Harbour.	Medium Term (2012)	Staff time only	Hornsby Council Planning Division / NSW Maritime	Suitably qualified consultants in receipt of brief	Through appropriate consultation, the design is to consider requirements for detailed consultation with existing business owners, ferry operators, the water police, government agencies and the wider community.
30.2 Engage consultant	Medium Term (2012)	Staff time only	Hornsby Council Planning Division / Gosford Council	Signed consultancy agreement with preferred consultant	
30.3 Prepare design for Brooklyn Harbour	Medium to Long Term (2012)	$30,000 to $50,000	Consultant	Design documentation	
30.4 Update Brooklyn DCP accordingly	Medium Term (2012)	Staff time only	Hornsby Council Planning Division	Changes to Brooklyn DCP and Hornsby LEP as appropriate	

Strategy # 31	Periodic Maintenance dredging of Sandbrook Inlet and Brooklyn Harbour				
Objectives addressed	2.3, 2.5, 2.6, 3.2			**EMS Option Reference**	DN 2
Actions	**Timing**	**Costs**	**Responsibilities**	**Measurables**	**Comments**
31.1 Once external funding is identified and secured, prepare a brief for the preparation of a maintenance dredging plan for Brooklyn Harbour and Sandbrook Inlet	Short Term (2011)	Staff time only	Hornsby Council Works Division / NSW Maritime / DPI (Fisheries)	Suitably qualified consultants in receipt of brief	Council is supportive of dredging within navigation channels in Sandbrook Inlet, where external funding is made available. Note that SEPP 35 does not apply as the area is covered by SREP 20
31.2 Engage Consultant	Short Term (2011)	Staff time only	Hornsby Council Works Division / Gosford Council	Signed consultancy agreement with preferred consultant	
31.3 Prepare a maintenance-dredging plan for Brooklyn Harbour and Sandbrook Inlet	Short Term (2011)	$30,000	Consultant	Receipt of plan	
31.4 Prepare environmental impact assessment and submit DA for dredging as required with licensing on a fixed term basis (say 10 years)	Medium Term (2012)	Staff time only	Hornsby Council Works Division and Environment /Gosford Council	Development assessment and provision of licences	
31.5 Undertake dredging as required	Medium term (2012) and ongoing	$1.5m (assuming a tentative volume of ~30,000m^3)	Hornsby Council Works Division /Gosford Council	Navigable channels	

5.3 Implementation Program

The implementation program for the Estuary Management Plan spans an initial period of 5 years and should be incorporated into Hornsby Council's annual Principal Activity Service Plan and both Council's annual Management Plan to help ensure that funding and resources are available. Table 2 summarises the timing for implementation for each of the strategies.

Table 2 Strategy implementation program

Strategy	Year 0 2007	Year 1 2008	Year 2 2009	Year 3 2010	Year 4 2011	Year 5 2012
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19	Not used					
20						
21						
22						
23						
24	Not used					
25						
26	Not used					
27						
28						
29						
30						
31						

Indicates a one off action

Indicates ongoing implementation

Given the lag time for funding opportunities within Council (ie. the need to set up budgets 12 months ahead of works programs), there will be a delay in implementing some of the strategies that are dependent on Council budget allocations (including matching funding to other grants received externally). Consequently, 2007 has been assigned as 'year 0' of the EMP. There is, however, opportunity to commence implementation on a number of strategies that do not require significant funding or can

be carried out by existing staff within Councils and other Government agencies. Implementation of these strategies in 2007 (year 0) would ensure a responsive and proactive start to the EMP.

5.4 Ongoing role of the community

Community involvement is an essential component of integrated estuary management. The Brooklyn Estuary Management Plan has been designed to encourage and foster ongoing community participation. This includes capacity building within the community, through involvement in strategies such as the Estuary Health Monitoring Program and continued support for existing volunteer based programs such as Bushcare. Strategies that include community involvement are summarised in Table 3.

Table 3 Strategies requiring direct input from the community

Strategy	Role of the Community
3	Involvement in cleanup program for the removal of rubbish throughout the Estuary
10	Collection of environmental data as part of the Estuary Health Monitoring Program
11	Regular interaction with the River keeper
12	Use of the interactive website and provision of feedback
13	Continued provision of volunteer labour for foreshore rehabilitation projects
14	Involvement in environmental education programs and potential involvement in the proposed “Estuary Research and Education Facility”

Achievements of the EMP should be publicised in the local press. The Estuary Community Database developed by WBM through the Estuary Management Study process should be maintained by Council and used for the distribution of information pertaining to the estuary, and specifically to the implementation of the EMP. This could include, for example, outcomes of the annual review (refer to Section 6) which could also be forwarded to the industry and stakeholder groups that responded to the consultation request.

5.5 Funding Requirements

While a large number of strategies can be implemented primarily by Councils and other stakeholders as part of normal day-to-day duties, most strategies require some financial contribution. A breakdown of expenditure for all strategies is provided in Table 4.

Table 4 Annual Funding Requirements

Strategy #	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
	2007	2008	2009	2010	2011	2012
1	No External Funding Required					
2	No External Funding Required					
3	$30000					
4	$10000					
5	No External Funding Required					
6	No External Funding Required					
7	No External Funding Required					
8	No External Funding Required					
9	$120000	$150000	$90000			
10	$50000	$50000	$50000	$50000	$50000	$50000
11	$55250	$30000	$30000	$30000	$30000	$30000
12		$40000	$10000	$10000	$10000	$10000
13		$60000	$30000	$30000	$30000	$30000
14	$10000	$25000	$275000	$25000	$25000	$25000
15	$25000					
16	$10000	$50000				
17		$125000				
18		$100000	$300000	$300000	$300000	$300000
19	Not used					
20				$40000		
21				$25000	$75000	$150000
22			$10000	$10000	$50000	
23				$15000		
24	Not used					
25	No External Funding Required					
26	Not used					
27				$80000	$5000	$5000
28						$200000
29					$40000	$100000
30						$40000
31					$30000	$1500000
Total	**$310,250**	**$630,000**	**$895,000**	**$615,000**	**$645,000**	**$2,440,000**
GRAND TOTAL						**$5.535 million**

Approximately **$5.5 million** will be required to fully implement the Brooklyn Estuary Management Plan. A general breakdown of the key areas of expenditure for the next 6 years is as follows:

- $560,000 for further investigations and studies,
- $480,000 for community and visitor education (~ $200,000 for setting up estuary research and education facility),
- $455,000 for various ongoing monitoring strategies,
- $1.53 million for dredging works,
- $1.3 million for accessible pump out facilities,
- $585,000 for rehabilitation works (includes $125,000 towards oyster lease decommissioning and $250,000 towards rehabilitation of tributaries to the estuary),
- $70,000 for stormwater works,
- $205,250 for the employment of a River Keeper to assist with the implementation of the strategies (note that this strategy will be implemented across the Hawkesbury Estuary), and
- $200,000 for upgrading jetties, wharves and other infrastructure.

5.6 Recommended Capital Works

The implementation tables include a variety of capital works to be carried out as part of the Estuary Management Plan. The total cost of recommended capital works over the six year implementation period is almost **$2.4 million**. The capital works recommended in the strategies are summarised in Table 5.

Table 5 Summary of Capital works

Strategy #	Capital Works	Estimated Cost	Year of Expenditure
13	Foreshore land rehabilitation works	$40,000	2008
17	Decommissioning of oyster leases	$100,000	2008
18	Pump out facilities	$300,000	2009
21	Rehabilitation of tributaries to the Brooklyn Estuary	$200,000	2011 / 2012
22	Rail and road stormwater management works	$50,000	2011
28	Upgrading of public jetties, wharves and waste facilities	$200,000	2012
31	Maintenance dredging of Sandbrook Inlet and Brooklyn Harbour	$1,500,000	2012
Total cost of capital works	$2,390, 000		

5.7 Funding Opportunities

Hornsby and Gosford Councils are expected to fund some of the works detailed in the Estuary Management Plan through environmental budget allocations of general revenue (including use of levies such as the Hornsby Council Catchment Remediation Rate). Given the high costs for overall implementation, however, the Plan will still be reliant upon receiving external grants and funding, some of which will require matching funding from Councils.

There are a number of state and federal government grant programs that should be explored for potential funding of various strategies outlined within this Estuary Management Plan. These grant programs include:

- Australian Government NHT Envirofund grants, for activities that fit within:
    - Landcare;

  - Bushcare;
  - Rivercare; and
  - Coastcare.

- Australian Government Natural Heritage Trust funding, assessed and distributed regionally through the Hawkesbury Nepean Management Authority (HNCMA);
- The Australian Government Water Fund will support practical on-ground water projects to improve Australia's water efficiency and environmental outcomes;
- National Landcare Program, also to be assessed as regional funding through the HNCMA;
- Department of Natural Resources (DNR) Estuary Management grants (note that works outlined in this Estuary Management Plan are eligible for part funding under the State Government's Estuary Management Program);
- DEC's Environment Trust Grants for:
  - Restoration and Rehabilitation;
  - Research; and
  - Education.
- NSW Maritime Authority's Infrastructure Grants Program (previously known as WADAMP grants); and
- DPI (Fisheries) Recreational Fishing Trust.

In-kind contributions for completion of some of the elements of this Estuary Management Plan could also come from various educational institutions (such as universities), who could use the estuary for specific data collection or research projects. In-kind contributions could also come from volunteer community groups, such as Landcare, Creekcare, and schools.

Opportunities should also be explored to utilise environmentally-oriented volunteer teams, such as Greening Australia, Green Corps and Work for the Dole, to assist with physically demanding elements of the Plan, such as revegetation works.

EVALUATION AND REVIEW

Cameron Mead – Brooklyn Public School

6 Evaluation and Review

The condition, scientific knowledge, planning frameworks and public aspirations specific to the Brooklyn Estuary are all expected to change with time. It is therefore essential that as these elements change, management decisions are adjusted or modified within an adaptive framework. The Brooklyn Estuary Management Plan will therefore be subject to ongoing review to ensure continuing validity and relevance. This review process will include annual performance reviews and a detailed review after five years. To gain a better appreciation for the relative success of the Plan, a series of performance measures can be assessed on a periodic basis. Different types of performance measures are discussed in more detail below. An indication of the information to be sort through the annual and five year reviews is presented in Table 6.

Table 6 Framework for future review of the Brooklyn Estuary Management Plan

Review Period	Review tasks	Responsibility
Annual	• Assess primary, secondary and tertiary performance measures, and determine appropriate contingencies if performance measures do not meet targets • Review funding arrangements and allocations for current and future management strategies • Review resourcing and staffing allocations for current and future management strategies • Provide report on progress of Estuary Management Plan implementation, results of annual review, and any modifications required to the Plan coming out of the review • Provide newsletter to the Brooklyn Estuary Community Database	Estuary Management Committee or appointed external consultant To be coordinated through Council Officers and reported to Councils, relevant stakeholders and government agencies
5 Yearly *(first review to be completed by end 2011)*	• Review latest information to determine potential changes to the condition or understanding of the Estuary Processes; • Determine changes to community values, issues and aspirations; • Assess the consistency of the plan with contemporary government policies and plans; • Assess the continuing relevance of the goals and management objectives (based on first three points); • Determine the appropriateness of the implementation plan to meet these objectives; • Assess the overall effectiveness of each management strategy implemented to date; • Identify opportunities to integrate the plan across a larger area; • For strategies requiring on-going commitment, assess the value in maintaining implementation of those strategies; • Assess the overall effectiveness of each management strategy implemented to date • Reconsider the management options that were not short-listed and included in the original Plan • Update the Estuary Management Plan document to reflect proposed strategies for implementation over the next 5 year period, and seek endorsement by stakeholders, government agencies and the community.	Estuary Management Committee or appointed external consultant To be coordinated through Council Officers and reported to Councils, relevant stakeholders, government agencies and the general community

The outcome of the review should include either completely revising the document or simply updating some aspects of the existing EMP.

6.1 Performance measures, targets and contingencies

The success of the Estuary Management Plan should be gauged through its ability to achieve the designated targets. The overarching targets are the Management Objectives, as described in Section 3. However, the timeframe for achieving some of these objectives is long (given the slow rate of vegetation establishment and growth, for example).

6.1.1 Primary performance measures

The first set of performance measures should ascertain whether the strategies are being implemented within the timeframe designated in the Plan. As such, the primary performance measures are simply a *measure of implementation*. Assuming that the Plan can be adopted by Councils midway through 2006, and that the Council funding for next year is likely to be limited as the details of this EMP were not finalised prior to the closing of funding application deadlines, eight low cost, high return strategies have been identified and fast tracked for implementation within 2006, while a further twelve (12) strategies need to commence during or before 2007 (refer to Table 1).

Organisations responsible for implementation will need to review the Plan carefully and ensure that adequate resources are allocated to the various strategies to ensure that the timeframe for implementation is achieved.

Clearly, a high degree of co-ordination will be required to manage the successful implementation of all the strategies within the designated timeframe. This co-ordination should be facilitated by the Estuary Management Committee, who would be required to meet regularly to discuss and manage the implementation of the estuary management strategies.

If it is determined that the strategies are not being implemented to the nominated timeframe then one or both of the following *contingencies* should be adopted:

- Determine the cause for the delay in implementation. If delays are funding based, then seek alternative sources of funding, including a formal request to Councils to increase contributions to the Plan. If delays are resource-based, seek additional assistance from stakeholder agencies and/or consider using an external consultancy to coordinate implementation of the Plan;
- Modify and update the Estuary Management Plan to reflect a timeframe for implementation that is more achievable. The revised Plan would need to be endorsed by all relevant stakeholders and agencies responsible for implementation.

6.1.2 Secondary performance measures

The second set of performance measures relate to *measuring specific outputs* from the individual strategies, as appropriate. The specific outputs from each action, or step, of each strategy, are provided within the Implementation Schedules (refer Section 5) under the ‘measurables’ column. These measurables define what the specific outcome from

each action should be. If these outputs are delivered as defined, then the action (or strategy) is considered to have been successful.

In some cases, the nominated 'measurable' also identifies a specific tool for gauging the rate of implementation of specific actions. For example, the rate of implementation of the Brooklyn Estuary Cleanup Day can be 'measured' by determining the "tonnage of waste removed from the estuary" (refer Strategy 3). In other cases, a one-off output is identified as the 'measurable', such as a specific report.

If specific outputs, as defined by the 'measurables', are not generated from implementation of the Plan then the following *contingencies* need to be adopted:

- Determine the reason for not producing the specified output. If the reason involves a lack of funding or resources, then similar contingency measures to those described for the primary performance measures should be adopted. If the reason is of a technical nature, then expertise in the area should be consulted to overcome the technical problem. DNR and other government agencies should have the necessary in-house expertise to assist in most cases.
- Review the appropriateness of the specific output of the management strategy, and if necessary, modify the output described in the Plan to define a more achievable product.

6.1.3 Tertiary performance measures

The third set of performance measures are aimed at *measuring the outcomes of the Plan*, and as such relate to the specific management objectives of the Plan (as described in Section 3), and how implementation of the Plan has made a difference to the biophysical and social environments of Brooklyn Estuary (eg reduction in pollutant loads, improvement in swimming conditions, increase in biodiversity etc). The main mechanism for gauging whether these objectives have been achieved, or not, is monitoring. Therefore, monitoring of various elements of the physical, biological and social environment is an essential component of assessing the overall success of the Estuary Management Plan.

Monitoring itself forms a crucial element of the Estuary Management Plan, as specified in Strategy 10 (Develop and Implement an Estuary Health Monitoring Program), as well as Strategy 15 (STP outfall before and after monitoring), Strategy 20 (recreational fishing monitoring), and Strategy 27 (sediment quality monitoring).

If, after a reasonable period of time, the specific objectives of the Plan are not being achieved by the strategies being implemented, then the following contingencies should be adopted:

- Carry out a formal review of the implemented management strategies, identifying possible avenues for increasing the effectiveness of the strategy in meeting the Plan objectives;

- Commence implementation of additional management strategies that may assist in meeting Plan objectives (possibly 'fast-track' some longer term strategies as necessary);
- Reconsider the objectives of the Plan to determine if they set impossible targets for future estuary conditions, and adjust the Plan, as necessary. Any such changes to the Plan would need to be endorsed by the stakeholders and relevant government agencies, as well as the public.

6.2 Factors for Success

The success of the Brooklyn Estuary Management Plan is dependent on the following factors:

- Agreement on the objectives, strategies and implementation schedules by all state and local government agencies, stakeholders and the general community;
- Understanding and acceptance of responsibilities for the implementation of the various aspects of the Plan;
- Commitment by those involved to dedicate appropriate time and resources to achieve the objectives and timeframe of the Plan;
- Sourcing of appropriate funds, through grants, user contributions, and in-kind commitments from community.

Possibly the most important of these is acceptance and agreement by the local community. Without significant support by the local community, Councils and the other agencies will not receive the pressure to ensure that the long-term sustainable management of Brooklyn Estuary remains a high priority. In this regard, community education programs associated specific strategies of this Plan (refer Strategies 12 and 14), as well as the annual newsletter outlining progress of the Plan (refer Table 6) can be used to keep interest within the community, and to empower the community with the capacity to ensure that the objectives of the management plan are achieved. That is, the regular reporting of Plan implementation progress to the community will enable the community to question delays in implementation, or to question the outcomes of specific actions.

6.3 Performance Reporting

An annual performance report will be prepared. Annual performance reporting will be included in the Estuarine Management Program Annual Report. An annual newsletter will also be prepared and distributed to the Community Estuary Database and stakeholders. This will assist in encouraging ongoing community support and interest.

REFERENCES

Shannon McGhee – Brooklyn Public School

7 References

- GHD 2004 Kangaroo Point Community Masterplan Prepared for Hornsby Shire Council
- Roylat, 2005 Economic Evaluation of lower Hawkesbury River boat pump out options Report prepared for Hornsby Shire Council
- WBM Oceanics Australia 2004(a) Brooklyn Estuary Management Study and Plan: Review and Consideration of Estuary Processes Information
- WBM Oceanics Australia 2004(b) Brooklyn Estuary Management Study and Plan – Issues and Options Discussion Paper: Background Reading for the Brooklyn Estuary Management Committee Workshop
- WBM Oceanics Australia 2006 Brooklyn Estuary Management Study. Prepared for Hornsby Shire Council.
- WRL 2003 Brooklyn Estuary Processes Study. Water Research Laboratory, University of New South Wales

8 Appendix-A Estuary Processes and Impacts Checklist (EPIC)

The Estuary Processes and Issues Checklist (EPIC) is a tool designed to assist the Brooklyn Estuary Management Committee (BEMC) and Council planning staff assess the likely impacts of future proposals on the processes and valued aspects of the Brooklyn Estuary. It could be used to consider future development proposals, management strategies and other activities proposed within or around the estuary.

EPIC has four key areas: Contaminant inputs; Waterway encroachment; Social issues, and Biological impacts. Once the Brooklyn Estuary Management Plan (BEMP) has been developed, a fifth key area will be added to assess the impacts of proposed development or activities on the goals, objectives and actions outlined in the BEMP. As with any information presented on the estuary, there will be overlap and interrelation between the categories presented.

EPIC is based on the technical information presented in the Brooklyn Estuary Processes Study, the information collected during the community consultation and the knowledge and experience of the study team.

EPIC has been designed as a checklist style document, using plain English to give a basic level of understanding of potential impacts. It is hoped that the simple nature of the document will allow a rapid method for assessing proposals against known processes, issues and values.

Step 1: Assess Contaminant Inputs

Criteria	Examples	Impact	Assessment	Action Required
Does the proposal involve a change in land use, or a significant change in development footprint (including land-based and water-based developments)?	• Low density housing to medium or high density housing • Small cottage to large house • Open water to marina development • Subdivision of single or multiple lots	If yes, then the proposal may increase the overall pollutant loads to the estuary, including TN, TP, sediments, metals etc	The proposal should provide information on predicted pollutant generation (including surface runoff) and present mitigative measures, such as WSUD, buffer strips etc, to ensure that there is no net increase in pollutant loads to the receiving waters	
Does the proposal involve industrial or commercial activities?	• Marinas • Oyster farming • Tourist development	If yes, then there is a potential for additional pollutants to be discharged to the estuary associated with these activities, including metals, petro-chemicals and litter	The proposal should provide information on the likely pollutant generation from the proposed activities and methods proposed to mitigate these pollutant to ensure that they are not released to the estuary	
Does the proposal incorporate appropriate sediment erosion and control measures for construction?	• Sediment basins • Filter strips • Silt curtains / booms	If no, then additional sedimentation of the receiving waters may result	The proposal should provide details of how sediment erosion is to be controlled on-site during construction so that there is no release of sediment to the downstream receiving water	
Is the activity likely to increase human waste (treated or otherwise) being discharged into the estuary?	• Boat based tourism • STPs • Onsite treatment systems	The proposal may result in the introduction of human specific viruses, bacteria and other disease causing pathogens into the estuary. This would increase the chance of recreational users becoming ill.	The proposal should outline waste treatment and disposal options which comply with EPA, Waterways and ANZECC standards.	
If the proposal encourages increased visitation, does it incorporate appropriate waste management facilities such as rubbish and recycling	• Tourist developments • Picnic areas • Jetties	If no, then littering of the foreshore and waterways may result	The proposal should provide details of the likely volumes of waste generated and a waste management plan to ensure that littering of the estuary foreshores	

bins?			and waterway does not occur.	
	• Dredging • Reclamation	If yes, the development may result in changes to tidal dynamics, which could affect sedimentation, scouring, aquatic ecology and water quality.	The proposal should provide details of the likely impacts on flow sediment transport, water quality and ecological processes.	
Does the proposal involve disturbance of bed sediments?	• Dredging • Pile driving	If yes, then contaminants contained within the sediments may be released to the water	The proposal should provide details of the physical and geochemical characteristics of the sediment, the potential for contaminant release, and proposed mitigation measures to prevent associated impacts on the waterway	

Step 2 Consider Waterway encroachments

Criteria	Examples	Impact	Assessment	Action Required
Does the proposal involve reclamation of existing waterways?	• Seaward encroachment of foreshore	If yes, then the proposal may affect the tidal flushing patterns of the estuary, which may affect water quality and sedimentation patterns.	The proposal should include details of the existing tidal circulation patterns and flushing times and outline the likely impact on the surrounding waters. It should also outline measures to ensure no detrimental impacts on estuary water quality.	
Does the proposal involve the construction of physical structures within the waterway?	• Wharves • Pontoons • Marina	If yes then the proposal may affect the sediment deposition and transport patterns within the estuary	The proposal should include details of sediment transport mechanisms, the likely influence of the proposed structure and mitigative measures to ensure that existing sedimentation issues are not exacerbated	
Will the proposal result in an increase in the number of vessels within Sandbrook Inlet or Brooklyn Harbour?	• Marina • Boat hire • Additional Moorings	If yes then the proposal may exacerbate existing issues with waterway congestion in areas used for navigation and recreation.	The proposal should include details of known navigation channels and recreational areas. It should also contain details of times and numbers of boats using these areas to demonstrate no impact on existing congestion problems.	

Step 3: Consider Social issues

Criteria	Examples	Impact	Assessment	Action Required
Will the proposal increase demand for foreshore car parks?	• Boat based tourism • Water access only tourist developments • Boat ramp facilities	If yes, then the proposal may exacerbate existing parking issues for Brooklyn.	The proposal should include sufficient parking allocation for a "full house"	
Is the proposal likely to result in a change in the management and use of foreshore land?	• Marina • Private development • Car parks	If yes, then the proposal may hinder foreshore access to the general public	The proposal should outline strategies to ensure ongoing access to foreshore land	
Does the proposal involve a significant change to the existing visual characteristics of the development site?	• Open water to marina or moorings • Low profile single storey house to multilevel dwelling	If yes, the activity may interfere with the visual amenity experienced by those on or near the estuary	The proposal should consider visual impacts.	
Will the proposal encroach on land currently used for dinghy storage or commuter berthing?	• Reclamation • Marina	If yes then the activity may impact on *water access only* residents, such as those from Dangar Island	The proposal should consider alternate dinghy storage and commuter berthing facilities.	
Will the activity encroach on an area of potential historical significance?	• Car park • Private development	If yes, the development may interfere with future opportunities to enjoy the heritage aspects of Brooklyn	The proposal should consider the heritage significance of the development site and provide details on measures to ensure that heritage items are retained and preserved.	
Will the proposal involve activities that will generate higher than background noise levels?	• Construction activities • Recreational boating activities	The proposal may impact on the values of peace and tranquillity of the estuary	The proposal should include an assessment of the likely noise generated and measures to ensure that that noise pollution is minimised	
Does the proposal include ongoing regulation of the general public?	• On site sewage treatment • Moorings	If yes, it is possible that these regulations will not be adhered to.	The proposal should include an implementation schedule including both education and compliance monitoring.	

Step 4: Assess likely biological impacts

Criteria	Examples	Impact	Assessment	Action Required
Does the proposal encroach into areas currently vegetated by seagrasses, salt marsh or mangroves?	• Wharves • Marina • Dredging • Reclamation • Boating	If yes, then the proposal may result in the loss of important habitat areas.	The proposal should include details of existing salt marsh, seagrass and mangrove areas that will be disturbed and outline mitigation and rehabilitation measures.	
Will the proposal result in the introduction of animals or plants from outside the area into the estuary	• Landscaping • Aquaculture • Boating	If yes, then the proposal could possibly result in the introduction of invasive species or disease into the estuary?	The proposal should consider the use of indigenous plants for rehabilitation and landscaping aspects. In the case of the introduction of aquatic animals or plants, the proposal should demonstrate that the risk of disease introduction has been addressed.	
Does the proposal encourage the harvesting of wild species	• Commercial fin fishing • Recreational fishing based tourism	If yes then the proposal may impact on food chain and ecosystem dynamics	The proposal should demonstrate that impacts on wild stocks and harvesting rates will be adequately monitored	
Does the proposal involve the removal of existing vegetation	• Clearing of trees and shrubs for construction or access	If yes the proposal may result in the loss of native plants and animals.	The proposal should outline specific trees to be removed and rehabilitation plans for revegetation if appropriate.	

9 Appendix-B Shortlisted strategies not included in the Brooklyn Estuary Management Plan

Refer Brooklyn Estuary Management Study (WBM, 2006)

EMS ref.	Strategy description
FC1	Overnight accommodation providers to supply private parking / contributions to public parking - DCP
FC2	Parking zones with time limits
FC3	Public carpark near Saltpan Reserve with associated commuter berthing
FC4	Investigate deck parking options for Saltpan Reserve, McKell Park, Parsley Bay
FC5	Time limited weekend parking in Baden Powell Ave
FL3	Discuss with RIC railway rehabilitation
FL5	Fill the western side of causeway
FL6	Promote plant list for council foreshore projects
FL7	Continue Bushcare program in the area.
FL9	Prepare a development control plan for new foreshore structures to include intertidal habitat
FL10	Develop rehabilitation plans for any saltmarsh communities degraded by noxious weeds.
DN 1	Dredge Parsley Bay
DN 4	Support and expedite the McKell Park Proposal
DN 5	Move commuter boating facility from McKell Park to Parsley Bay
DN 6	Adopt no dredging policy
DN 8	Ensure that the Water Sensitive Development Control Plan and the Best Management Practices continue to be implemented.
DN 10	Determine the sources of heavy metal contamination.
DN 11	Monitor sediment quality in association with any dredging proposal – before, during and after dredging.
DN 12	Sea level rise and climate change should be considered.
E3	Modify recreational bag limits
E4	Prepare a management plan for saltmarsh near the old dairy site
E6	Baseline fish stock study
E7	Clearly mark seagrass beds in Sandbrook Inlet to prevent damage.
E10	Implement an ecological monitoring program in the Brooklyn Estuary
E11	Monitor the health of estuarine communities including but not limited to seagrass beds, saltmarsh, mangroves, mudflats and rocky shores.
T1	Include old dairy site and adjacent wetland into National Parks
T2	Encourage passive recreation-Improve foreshore access
T3	Develop small scale boat hire opportunities
T4	Regular forum between tourism industry and community
T5	Provide better signage for access to the National Park/Great North Walk.
T6	Ensure adequacy of all infrastructure before approving new tourism developments.
R1	Investigate physical and scenic impacts of boats on Sandbrook Inlet- limit numbers

EMS ref.	Strategy description
R4	Enhance onsite sewage treatment system management program
R5	Audit compliance with sediment/erosion regulations on building sites
R6	Investigate mangrove offences under Fisheries Management Act by residents
WU1	More channel markers for the entrance to Sandbrook Inlet
WU2	Convert all Waterways managed moorings to commercial facilities
WU3	Redevelop Mooney Ramp
WU6	Prohibit people from permanently living onboard boats
WU7	Revise jetty limits in Sandbrook Inlet
WQ3	Install a public pump out facility in Brooklyn Harbour
WQ7	Continue to enforce the POEO Act in relation to water pollution.
WQ8	Ensure all DEC pollution licenses are adequate
WQ9	Continue education to reduce water pollution and improve water quality.
WQ10	Monitor pre and post installation of the proposed sewage outfall at the road bridge to determine impacts
WQ12	Continue and improve existing water quality monitoring programs.
WQ13	Undertake specific monitoring to determine the impacts from marinas and industrial areas (Somersby).
WQ14	Undertake further oyster bioaccumulation studies with appropriate spatial and temporal variation.
H2	Conduct post European heritage assessment