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16 February, 2004

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«City» «State» «PostCode»

Our Ref: J2255/L8890

Dear Sir/Madam,

**Re: Brisbane Water Estuary Processes Study**

Lawson and Treloar, in association with Bio-Analysis, KBR, GHD Longmac and HLA Envirosiences have been commissioned by Gosford City Council to undertake an estuary processes study for the Brisbane Water Estuary. The Gosford Council Coastline Management, Lagoon Management and Coastline Planning Committee (CLP) has resolved to prepare an Estuary Management Plan for the Brisbane Water Estuary. The Estuary Processes Study is an integral step leading towards the preparation of such a plan. The intent of the Study is to provide an analysis of estuary processes, and to clearly identify any ongoing studies that are necessary to facilitate sound decisions about sustainable estuary management. This study builds on the findings of the *Brisbane Water Data Compilation Study* commissioned by Council and completed in 2002.

An important part of this process is to inform key stakeholders who have an interest in the management of the Brisbane Water catchment, of the nature and findings of the Study. The study is broad in its coverage and will include assessments of:-

- catchment processes
- flora and fauna (including field studies of aquatic ecology)
- hydrodynamic processes (water movement)
- water quality processes
- geomorphological processes (such as sand shoal movement, mud siltation and foreshore erosion)
- recreational use
- cultural heritage
- the interactions amongst all of the above processes.

This work is being undertaken under the direction of Gosford City Council's CLP Committee. Discussions are underway between the Study Team, Gosford City Council, State agencies and other community groups in order to identify key issues for the Study.

Due to the extensive nature of the investigations, the study will be conducted over a three-year period. During this time, periodic updates on the progress of the study will be posted on Gosford City Council's website:-

[www.gosford.nsw.gov.au/information/environment/index.htm](http://www.gosford.nsw.gov.au/information/environment/index.htm).

Your input to the Study as a valued stakeholder of the Brisbane Water Estuary is greatly appreciated. If you have any questions or have information that you think is relevant to the study, please do not hesitate to forward your query or information to [BrisbaneWatersEPS@lat.com.au](mailto:BrisbaneWatersEPS@lat.com.au) or contact the undersigned.

Yours faithfully,

Louise Howells  
Associate, Senior Project Engineer

# BRISBANE WATER ESTUARY PROCESSES STUDY



## February 2004 Project Status

As part of the Estuary Management Process administered by the Department of Infrastructure, Planning and Natural Resources (DIPNR), the Brisbane Water Estuary Processes Study is in preparation to determine key processes in the estuary.

A multi-disciplinary team led by Lawson and Treloar is preparing this study for Gosford City Council and DIPNR.

Location: Central Coast, NSW  
Client: Gosford City Council  
Services: To identify and assess key processes for the estuary.



(Photograph: DIPNR)

Brisbane Water, located near the mouth of the Hawkesbury Nepean River system connects to the northern side of Broken Bay, a major estuary junction that also drains Pittwater to the south and the Hawkesbury-Nepean River and its tributaries to the west.

Complex interactions occur within the waterway. They are governed by the entrance and the estuary's capacity for exchange with ocean water. The waterway is intensively used for recreational purposes.

In terms of current project status, the project commenced in January 2004. At present, hydrographic survey of some of the bay areas is being undertaken by the Department of Infrastructure, Planning and Natural Resources. Following this, a DELFT3D model for estuarine processes will be prepared to aid the assessment of the hydrodynamics of the estuary including currents, waves and advection-dispersion processes and siltation.

The model will be used to consider both day to day tidal conditions as well as the effect of rainfall-runoff events in the catchment.

Catchment modelling will be undertaken to provide inputs to the DELFT-3D model.

Other studies such as ecological investigations and recreational studies will commence shortly.



The Rip Bridge

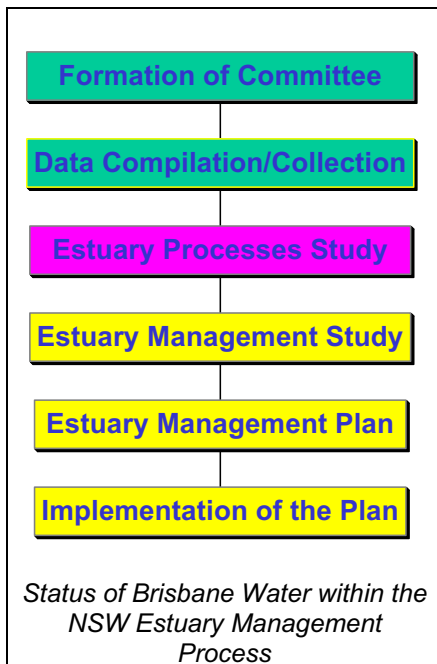
The study will investigate the following processes:

- catchment processes and runoff
- flora and fauna (including field studies of aquatic ecology)
- hydrodynamic processes (water movement, waves)
- water quality processes
- geomorphological processes (such as sand shoal movement, mud siltation and foreshore erosion)
- recreational use
- cultural heritage
- the interactions amongst all of the above processes



Waterfall Bay

If you would like to be added to the contact database for the project, or have information on the estuary that may be helpful, please forward your details by email to: [BrisbaneWatersEPS@lat.com.au](mailto:BrisbaneWatersEPS@lat.com.au)



## PROGRAM

The information evening commences at 7.30pm

7:30 Welcome and introduction (Louise Gee, Director Environmental Planning, GCC)

7:35 Background to Brisbane Water Estuary Processes Study (Dr Peter Freewater, Natural Resources Officer, GCC)

7:45 Overview of the Brisbane Water Estuary Processes Study (Louise Howells, Lawson & Treloar)

8:00 Recreational aspects (Tom Holden, Kellog Brown & Root)

8:15 Overview of ecological investigations (Dr Danny Roberts, Bio-Analysis)

8:30 Saltmarshes (Geoff Sainty, Sainty & Associates)

8:45 Benthic invertebrates (Dr William Gladstone, Newcastle University)

9:00 Plankton (Dr Anna Redden, Newcastle University)

9:15 Seagrasses (Tenielle Boyland and Mandy Cox - Newcastle University)

9:30 Conclusion (Louise Howells, Lawson & Treloar)

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**Plankton and their use as indicators of estuarine health (Dr Anna Redden, Newcastle University)**

Understanding how estuaries respond to rainfall events, associated nutrient and sediment inputs and various physical and biogeochemical processes is critical for their successful management. It requires a comprehensive assessment of the hydrodynamics, how water quality varies spatially and temporally and how these variables impact on the distribution and abundance of planktonic forms (phytoplankton cells and zooplankton grazers). The plankton community not only reflects the nutrient status and water quality of the system, it also represents a critical food source for larval and juvenile fishes and filter feeding shellfish (e.g. oysters).

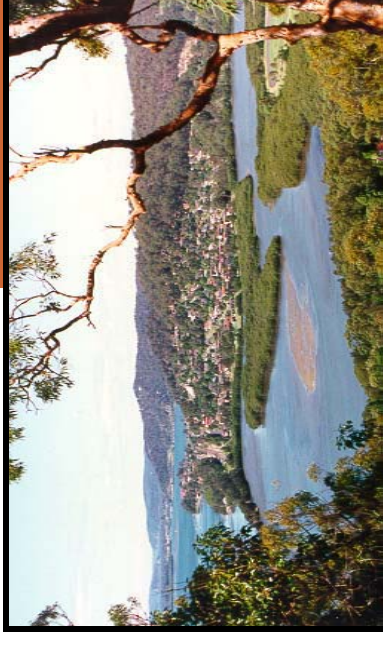
**Seagrasses (Tenielle Boyland and Mandy Cox - Newcastle University)**

Quantitative data on seagrasses is being collected at a number of spatial scales within the estuary to assess aspects such as density, cover, shoot length and the cover of epiphytes attached to the leaves. The seagrass data will also be used to select appropriate locations to sample assemblages of fish within the estuary.

## INFORMATION EVENING

### Brisbane Water Estuary Processes Study

Date: 1 July 2004  
Venue: Erina Room,  
Erina Centre  
Time: 7.30pm-9.30pm



On Thursday 1<sup>st</sup> July Gosford City Council will be hosting the Brisbane Water Estuary Processes Study Information Evening in the Erina Room at the Erina Centre, Erina Fair.



## Information Evening

**The Brisbane Water Estuary Processes Study** is a cutting edge research project that will guide the future management of the estuary and its catchments. The Information Evening will provide an opportunity to come and learn about Brisbane Water and the fascinating research currently underway. A team of scientists and other researchers will be presenting their work on Brisbane Water in plain English for the benefit of all. You will learn about the different fish, animals and plants and how natural and human processes influence their health and survival.

The speakers will also answer your questions and provide an opportunity for you to have your say about how Brisbane Water should be managed. For example, how do we balance commercial and development interests with conservation?



## Background to Study (Dr Peter Freewater, Natural Resources Officer, GCC)

The processes study is based on a holistic framework incorporating three distinct components:

- 1 land use in the catchment and associated impact to waterways
- 2 linking land-use with catchment hydrology
- 3 linking catchment hydrology with ecological phenomena

The overarching objective is to address the impact of land-use and waterways management with estuarine ecology and develop guidelines for sustainable management.

## Overview of the Brisbane Water Estuary Processes Study (Louise Howells, Lawson & Treloar):

The Brisbane Water Estuary Processes Study was commissioned in December 2003 and is scheduled for completion in December 2006. The main objective is to provide a comprehensive report on the existing physical, chemical and biological condition of the Estuary and those processes and interactions that influence its condition.



## Overview of ecological investigations (Dr Danny Roberts, Bio-Analysis)

General introduction to the aquatic ecology of Brisbane Water estuary, which will include a summary of each of the projects. In general these will be saltmarshes, mangroves, seagrasses, fish and invertebrates. Preliminary information on the saltmarshes within the estuary and the methods being used to quantify them will also be presented.

## Saltmarshes (Geoff Sainty, Sainty & Associates)

The Brisbane Water estuary has had significant modifications to its natural foreshores since European colonisation and the extent of this modification has not previously been quantified. A rapid assessment method was developed for assessing the ecological disturbance of the foreshores. The aim was to obtain an assessment of the ecological value of sections of foreshores and obtain semi-quantitative data on the fringing vegetation.

## Benthic invertebrates (Dr William Gladstone, Newcastle University)

The goal of this project is to describe the variation that occurs among invertebrate communities of Brisbane Water estuary and its relationship to environmental variables (eg. water and sediment quality).

For further details about the Brisbane Water Estuary Processes Study, contact  
Dr Peter Freewater on 4325 8935 or visit  
Council's website [gosford@nsw.gov.au](mailto:gosford@nsw.gov.au)





# Brisbane Water Estuary Processes Study



# BRISBANE WATER ESTUARY PROCESSES STUDY



## July 2004 Project Status

As part of the Estuary Management Process administered by the Department of Infrastructure, Planning and Natural Resources (DIPNR), the Brisbane Water Estuary Processes Study is in preparation to determine key processes in the estuary. A multi-disciplinary team led by Cardno Lawson Treloar is preparing this study for Gosford City Council and DIPNR.

**Location:** Central Coast, NSW  
**Client:** Gosford City Council  
**Services:** To identify and assess key processes for the estuary.



(Photograph: DIPNR)

Brisbane Water, located near the mouth of the Hawkesbury Nepean River system connects to the northern side of Broken Bay, a major estuary junction of Pittwater to the south and the Hawkesbury-Nepean River and its tributaries to the west.

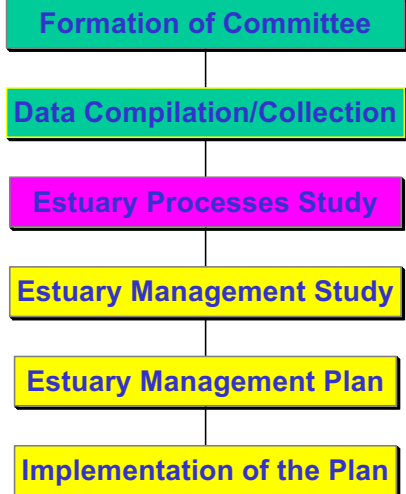
Complex interactions occur within the waterway. They are strongly influenced by the entrance and the estuary's capacity for exchange with ocean water. The waterway is intensively used for recreational purposes.

This model will be used to consider both day to day tidal conditions as well as the effect of rainfall-runoff events in the catchment.

Computer modelling of the catchment is nearing completion and will provide inputs to the DELFT-3D model.

Ecological investigations have commenced and include a range of field investigations within the estuary. Recreational studies have commenced and input from the community will be sought in the coming months for these aspects of the study.

Concurrent studies are also being undertaken by the University of Newcastle, which will assist the overall management of the estuary.



Status of Brisbane Water within the NSW Estuary Management Process



Looking toward the Estuary from President Hill

The study will investigate the following processes:

- catchment processes and runoff
- flora and fauna
- hydrodynamic processes
- water quality processes
- geomorphological processes
- recreational use
- cultural heritage
- interactions amongst processes.

In terms of status, the project commenced in January 2004. Additional hydrographic survey of some of the bay areas has been completed since this time by DIPNR. A DELFT3D computer model for estuarine processes is currently being prepared using this data to aid the assessment of currents, waves, siltation, and transport and mixing processes.



Jetties at Woy Woy Inlet

## Project Partners:



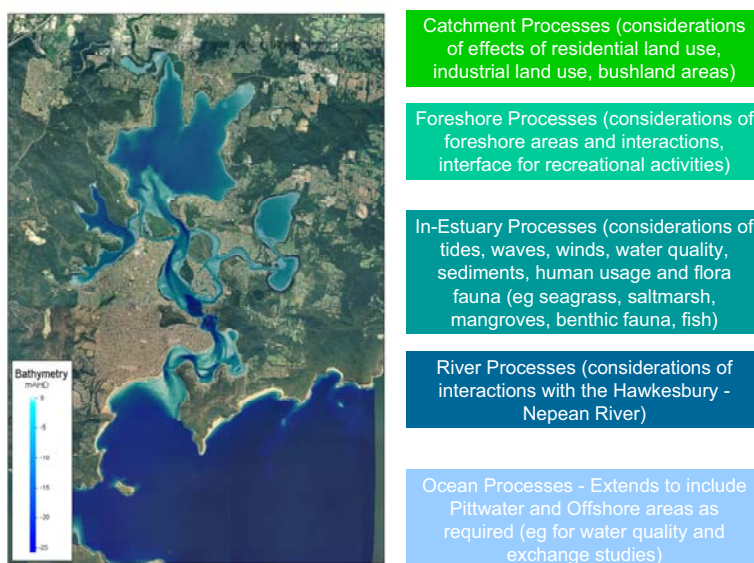
If you would like further details or to be added to the contact database please forward your details by email to: [BrisbaneWatersEPS@lat.com.au](mailto:BrisbaneWatersEPS@lat.com.au) or contact Dr Peter Freewater at Gosford City Council on 4325 8945 or Louise Howells at Cardno Lawson Treloar on 9499 3000.

# Brisbane Waters Estuary Processes Study

*Progress Report – 17 August 2006*

## *Overview*

The Brisbane Water Estuary Processes Study is in its third year and is being undertaken by a team of consultants led by Cardno Lawson Treloar. The key components of the study are summarised below.



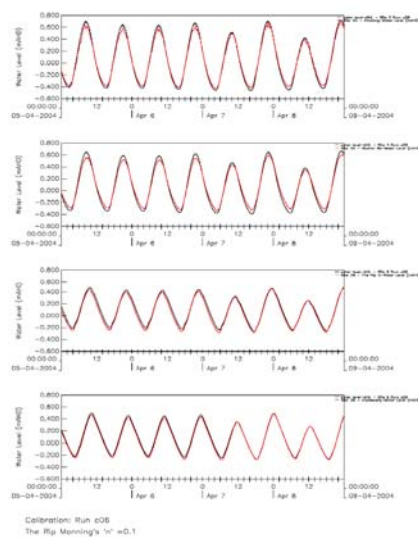
## *Project Status*

The project is nearing completion and final reporting is underway. A summary of the key components of the project is contained below.

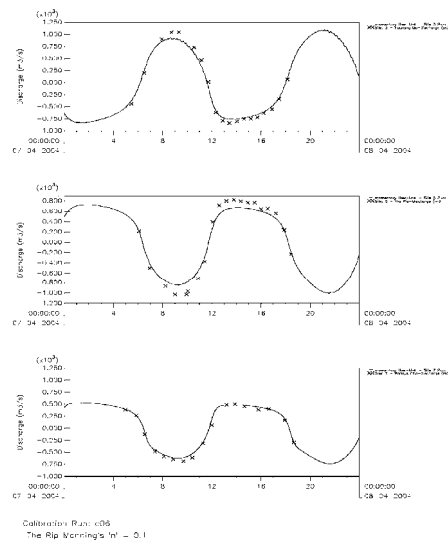
Component	Status
Aboriginal and Cultural Heritage	Complete
Recreational Foreshore Study	Complete
Estuarine Ecology	Reporting being Completed
Potential Acid Sulphate Soils	Complete
Hydraulic and Wave Processes	Complete
Estuarine Morphology/Siltation	Scenarios being Completed
Water Quality Processes	Scenarios being Completed

## *Hydraulic Modelling (Delft3D)*

A 2D/3D Delft3D hydraulic model of Brisbane Water has been developed and achieved a high level of calibration. The following figures illustrate the water level and discharge calibration of the model at a number of sites.



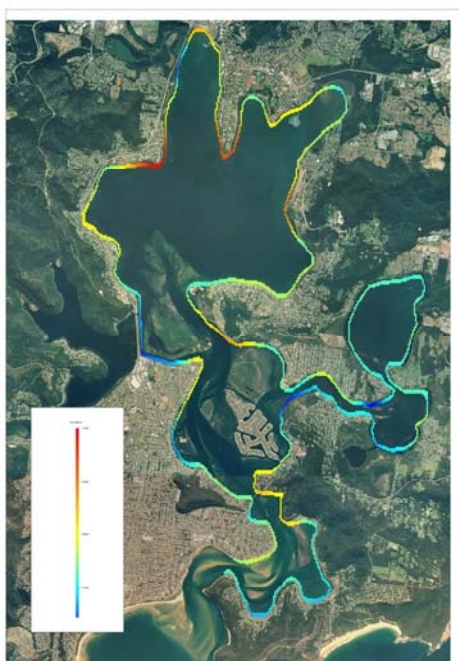
**Water Level Calibration**



**Discharge Calibration**

## *Wave Processes (SWAN)*

Detailed investigations into wave processes have been completed using the SWAN wave model. Wave climate information for local sea and ocean swell conditions have been prepared in a GIS format.



**Local Sea Conditions**

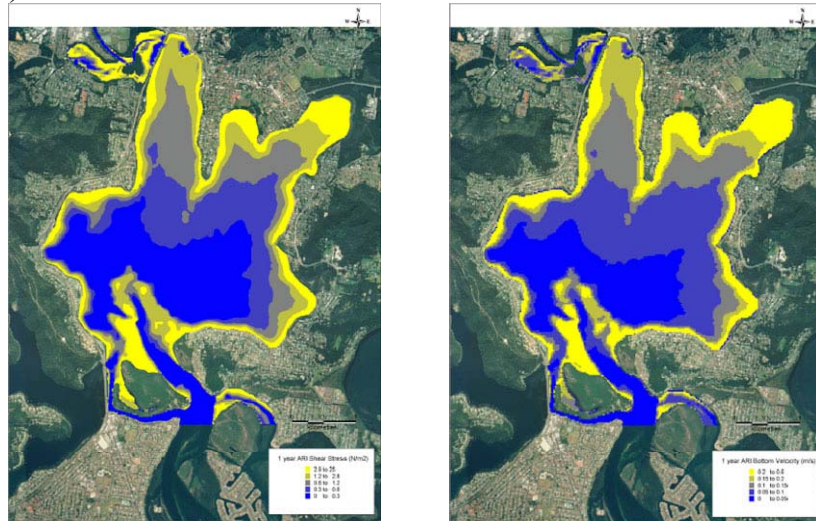


**Local Swell Conditions**



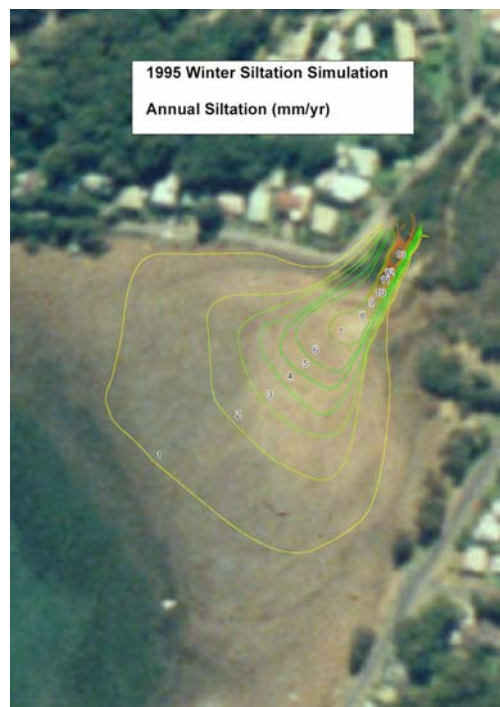
## *Sediment Transport / Estuarine Morphology*

Sediment transport and estuarine morphology have been investigated using the integrated hydrodynamic, wave and sediment transport capabilities of Delft3D. A MUSIC catchment model developed for in this study has been used to estimate sediment loads into the estuary. The following figures detail areas where sand and / or mud will be subject to transport (indicated by yellow regions) during the 1-Years ARI wind conditions (integrated over all wind directions).



**1-Years ARI Bed Shear Stress    1-Years ARI Bed Current Velocity**

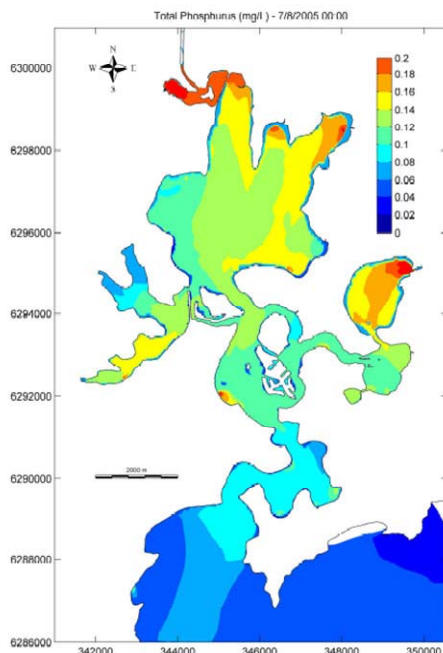
Estuarine morphology has been investigated at a number of sites where siltation has been identified as a potential issue. The following plot indicates the potential siltation rate (mm/yr) at the entrance to Mudflat Creek (Hardy's Bay) for a scenario included in this study.



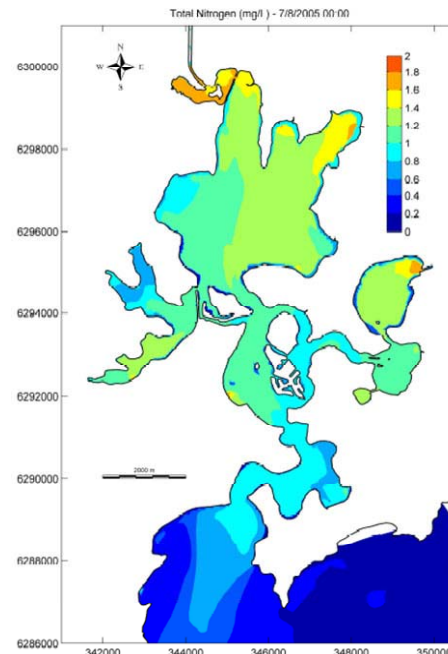
**Example of Siltation Rate Investigations near the Entrance to Mudflat Creek**

## Water Quality Processes

Water quality processes have been investigated using the integrated hydrodynamic and water quality capabilities of Delft3D. The MUSIC catchment model has been used to estimate nutrient loads into the estuary. Investigations have included ambient and episodic conditions. Flushing times for various branches of the estuary have been calculated. The following plots detail peak TP and TN concentrations during the 20-Years ARI event.



**20-Years ARI Peak TP Concentrations**



**20-Years ARI Peak TN Concentrations**



# BRISBANE WATER ESTUARY PROCESSES STUDY

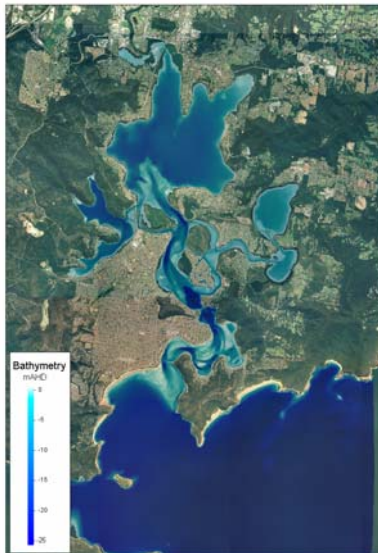
## December 2006 Project Status

As part of the Estuary Management Process administered by the Department of Natural Resources (DNR), the Brisbane Water Estuary Processes Study is in the final stages of preparation. The study's key objective has been to determine the key processes in the estuary.

A multi-disciplinary team led by Cardno Lawson Treloar is preparing this study for Gosford City Council and DNR.



Brisbane Water, located near the mouth of the Hawkesbury-Nepean River system connects to the northern side of Broken Bay, a major estuary junction of Pittwater to the south and the Hawkesbury-Nepean River and its tributaries to the west.



*Depths of the Estuary ('Bathymetry')  
Superimposed over an Aerial Photograph*

The *Brisbane Water Estuary Processes Study* is currently being completed by Cardno Lawson Treloar for Gosford City Council in accordance with the *NSW Estuary Management Manual* (1992). The study is investigating the following processes:

- Catchment processes and runoff
- Flora and fauna
- Hydrodynamic processes
- Water quality processes
- Geomorphological processes
- Recreational use
- Cultural heritage
- Interactions amongst processes.

This project commenced in January 2004 and the issue of draft reports is

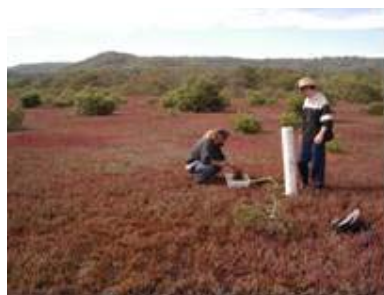
scheduled for the end of 2006. The majority of the studies are nearing completion. Examples of some of the findings to be reported are outlined below.

### *Hydrodynamic Processes*

Hydrodynamic processes were investigated in detail using computer modelling. Overall, the modelling completed provides a comprehensive assessment of currents, waves, siltation and transport and mixing of substances within the estuary and supports an analysis of the effects that these factors have on various environments such as seagrasses, the benthic environment and other estuarine ecosystems.

### *Flora and fauna*

Flora and fauna studies for the study have been extensive. Examples of images from the studies are below.



*Saltmarsh Investigations - Cockle Bay*



*Numb Fish Over Seagrass - Near Mouth*

### *Recreational Usage*

Recreational user studies including foreshore usage mapping and water usage mapping have been completed. An example of foreshore usage is shown below for Koolewong.



*Example of Foreshore Usage Mapping*

Specialist research investigations have been conducted concurrently with the Estuary Processes Study, including studies of:

- Sediment Quality (University of Sydney)
- Larval dispersal from Saltmarsh (UNSW)
- Benthic macrofauna studies (University of Newcastle).

Where available, the findings of these complex research projects will be utilised to further understand the processes occurring in the estuary.

If you would like further details or to be added to the contact database please forward your details to:  
[BrisbaneWatersEPS@lat.com.au](mailto:BrisbaneWatersEPS@lat.com.au)

Or contact:

- Gosford City Council - Dr Peter Freewater on 4325 8945
- Cardno Lawson Treloar - Louise Collier on 9499 3000.