

LAKE ILLAWARRA AUTHORITY



**Lake Illawarra Entrance Works Project (Stage 2)
Northern Training Wall, Southern Spur Wall
and Channel Dredging**

**Representations Report on Responses to
the Environmental Impact Statement**

June 2005

Lake Illawarra Entrance Works Project (Stage 2) Northern Training Wall, Southern Spur Wall and Channel Dredging

- **Representations Report on Responses to
the Environmental Impact Statement**

This is the Lake Illawarra Authority's Representations Report into the proposed Lake Illawarra Entrance Works Project (Stage 2). It was prepared to assist the Lake Illawarra Authority in deciding whether to seek the approval of the Minister for Planning, to proceed with the proposal.

The Representations Report does not constitute an approval to the proposal. It is the Lake Illawarra Authority's report upon which its decision to seek approval is based. The approval to the proposal and the conditions that attach to that approval were issued by the Minister for Planning on 7 December 2005. The Minister's approval and conditions are being exhibited concurrently with this Representations Report. Also being exhibited concurrently is the report on the proposal from the Director-General of the Department of Planning to the Minister for Planning.

As a result, anyone reading this Representations Report needs to be aware that it might discuss proposed modifications, mitigation measures and other commitments that have been superseded by the approval of the Minister for Planning. The proposal will proceed in accordance with the Minister's conditions to approval.

Brian Dooley
Executive Officer, Lake Illawarra Authority

**Lake Illawarra Entrance Works Project (Stage 2)
Northern Training Wall, Southern Spur Wall
and Channel Dredging**

**Representations Report on Responses to
the Environmental Impact Statement**

This Representations Report was prepared by:

Garry Clarke
Senior Natural Resource Officer (Lake Illawarra)
Department of Infrastructure, Planning & Natural Resources
South Coast Region

with assistance from Mr Michael Wright (Patterson Britton & Partners), Mr Doug Treloar (Cardno Lawson & Treloar) and Mr Paul Anink (Marine Pollution Research).

Declaration

This Representations Report was prepared for the Lake Illawarra Authority under the supervision of:



Signature:

Name: Brian Dooley
Executive Officer, Lake Illawarra Authority

Date: 10 June 2005

TABLE OF CONTENTS

1.0 Introduction

1.1 Background

1.2 The EIS Proposal and the Preferred Activity

1.3 Purpose of a Representations Report

1.4 The Environment Impact Assessment Process

1.5 The Consultation Program

1.6 The Determination Process

2.0 Consideration of the Environmental Impact Statement (EIS)

2.1 Compliance Checklist

2.2 Statutory Compliance

2.3 Development of the Proposal in the EIS

2.4 General Description of the Proposed Works in the EIS

2.5 Consideration of the Assessment

3.0 Consideration of the Species Impact Statement (SIS)

3.1 Compliance Checklist

3.2 Statutory Compliance

3.3 Consideration of the Assessment

4.0 Consideration of Representations

4.1 General

4.2 Design

4.2.1 Breakwater Crest Levels (Height)

4.2.2 Breakwater Length

4.2.3 Breakwater Toe Apron

4.2.4 Channel Dredging

4.6.5 Justification of the Proposed Activity

5.0 Correspondence

5.1 Correspondence from Government Agencies

5.2 Correspondence to Government Agencies from the LIA

6.0 Additional Investigations Since the EIS Exhibition

7.0 Measures, Controls and Commitments for the Proposed Activity (the Preferred Activity)

8.0 Conclusion

8.1 Conclusion

9.0 References

Figures and Tables

Appendices

| | | |
|------------|----|--|
| Appendix A | A1 | Summary of Representations |
| | A2 | Summary of Issues |
| Appendix B | | Copy of Representations |
| Appendix C | | Commonwealth Department of the Environment & Heritage Determination under the Environment Protection & Biodiversity Conservation (EPBC) Act 1999 |
| Appendix D | | Report on “Open House” |
| Appendix E | | Additional Advice Since the EIS Exhibition |

1.0 Introduction

1.1 Background

Lake Illawarra is a shallow coastal lagoon located on the NSW South Coast some 8km south of Wollongong. The lake formed during the marine transgression associated with the last sea level rise, some 20,000 to 7,000 years ago. The lake is characterised by a coastal sand barrier and shallow flat bottomed bed that is connected to the ocean by a narrow shoaled channel that in the past has intermittently closed. The lake has an average depth of only 1.7m, with a maximum depth of 3.5m and 35% of the lake having a depth of less than 1m. The lake has a catchment area of 235km² and waterway area of approximately 35km² with foreshores stretching for 38km. The volume of the lake is 60 giga litres and normal lake level is elevated about 250mm above mean sea level.

There are 13 major streams and 190 stormwater drains (100 with diameters greater than 225mm) which discharge to the lake and there are 15 sewer pump stations located on the foreshores of the lake.

The water chemistry of the lake (mixture of fresh and seawater) forms an aquatic habitat where environmental conditions are extremely variable. The salinity of the lake is normally about 25 to 30ppt, but can range from 10 to 40ppt. The lake is highly productive and ecologically complex and the environmental health of the lake fluctuates due to seasonal variations, influxes of elevated catchment inputs of nutrients and sediments following rain and the condition of the entrance.

The environment of the lake has suffered from population pressures to develop the catchment for residential, industry and agriculture. Over the past 150 years about two thirds of the catchment has been cleared. Since the 1950s population growth greatly accelerated pollutant and nutrient inputs to the lake leading to a degraded environmental condition. Some 90,000 people now live in the catchment.

In 1988, the NSW Government established the Lake Illawarra Authority (LIA) under the LIA Act 1987 with the express aim of improving the environment of Lake Illawarra, its foreshores and related environs.

To achieve the aims of the LIA Act, the LIA developed amongst other things a works program to improve water quality within the lake. The works program included, amongst other things, the construction of stormwater controls on drains entering the lake, dredging of bays to remove organic material, harvesting of macro-algae and works to improve tidal flushing of the lake. The works program has been refined since 1988 through the findings of a number of reports including the Draft Strategy Plan for Improvements to Lake Illawarra (1990), Value Management Study (1992), Lake Illawarra Works Program Environmental Appraisal (1995) and more recently Draft Lake Illawarra Management Study and Plan (2004). All of these reports found that works to improve flushing of the lake should be undertaken.

Tidal penetration into the lake is restricted to the eastern side of the lake due to the shoaled condition of the entrance channel. Lake flushing times vary depending on the condition of the entrance channel from well over 100 days to less than 50 days.

In 2000, the LIA constructed a training wall on the southern side of the entrance channel connecting to Windang Island to help keep the entrance of the lake open more often than historically in the past. These works were aimed at amongst other things to increase tidal penetration and reduce the retention time of nutrients and pollutants in the lake body. Although these works reduced the potential for sand infeed from Warilla Beach to close the entrance,

during low rainfall periods and / or big seas, large volumes of sand can move into the entrance channel from Perkins Beach.

In February 2003, the NSW Government established an Independent Review Panel to examine and report on options to improve the entrance to Lake Illawarra.

The NSW Government announced its endorsement of the recommendations of the Panel's report in June 2003. The recommendations included amongst other things, the construction of a northern breakwater and major channel dredging at the entrance to Lake Illawarra at an estimated cost of \$4 million.

Further, the NSW Government committed \$2 million toward the project to allow the LIA to complete the necessary studies, including an Environmental Impact Statement (EIS) and commence works. The balance of \$2 million is to be provided equally by Wollongong and Shellharbour City Councils.

An EIS addressing the potential environmental impacts associated with proposed improvement works to the entrance of Lake Illawarra was prepared in January 2005 by Patterson Britton & Partners (PBP).

The LIA placed the EIS on public exhibition on 29 January 2005, with the exhibition period ending on 4 March 2005. Notices advising of the EIS were placed in the prescribed form and manner in the Sydney Morning Herald, Illawarra Mercury, Wollongong Advertiser and Lake Times.

The EIS was made available for public inspection at the offices of the LIA, Department of Infrastructure, Planning and Natural Resources (Wollongong and Sydney), Wollongong City Council, Shellharbour City Council, Government Information Service and the Nature Conservation Council.

During the EIS exhibition period, the LIA conducted an "open house" at the Windang Foreshore Park on Saturday 12 February 2005 to explain the design and EIS process to the public as well as answer any questions.

Forty one (41) representations were received.

The LIA furnished a copy of the representations to the Director General of the Department of Infrastructure, Planning and Natural Resources as well as the Department of Environment and Conservation (EPA) in accordance with s113(3) and s113(3A) of the EP&A Act respectively on 4 April 2005.

This Representations Report, prepared by the LIA satisfies the requirements of s112(1)(b) of the EP&A Act. It was prepared to assist the LIA in deciding whether to seek the approval of the Minister for Infrastructure and Planning to proceed with the proposal.

1.2 The EIS Proposal and the Preferred Activity

The EIS proposal involves construction of a northern breakwater, extension of the existing southern training wall, dredging of the entrance channel to Lake Illawarra, sand nourishment of Warilla Beach, construction of a sand island for bird habitat and extension of the groyne at the mouth of Elliot Lake.

The proposed activity has been budgeted to cost \$4 million.

The proposed activity outlined in the EIS included:

- Construction of a breakwater / training wall on the northern side of the entrance off Perkins Beach;
- Extension of the existing breakwater / training wall on the southern side of the entrance off Perkins Beach by way of a spur wall;
- Minor improvements to the existing southern training wall / breakwater connecting to Windang Island through the provision of spur wall extensions at the upstream and downstream gaps;
- Dredging a substantial channel within the lake's entrance;
- Creation of a small sand island on the north side of the entrance channel for bird habitat;
- Undertaking sand nourishment of Warilla Beach utilising the dredged material from the entrance; and
- The minor extension of the rock groyne on the northern side of the entrance to Elliot (Little) Lake.

Figure 1 shows the extent of the proposed activity.

Based on this Representations Report no modifications to the EIS proposal are proposed as a result of the representations made. Hence the proposed activity as outlined in the EIS is the preferred activity.

1.3 Purpose of a Representations Report

The LIA must examine and consider the Part 5 EIS and public submissions made during the exhibition period before deciding whether or not to proceed with the proposed activity.

The Representations Report documents and provides a public record of the LIA's examination and consideration of the EIS and public submissions.

Any modifications to the proposed activity to eliminate or reduce effects of the activity on the environment will be addressed in the Representations Report (the preferred activity).

1.4 The Environment Impact Assessment Process

The LIA determined early in the process that the proposed activity is likely to significantly affect the environment due to the scale and nature of the project.

In February 2004, a planning focus meeting was conducted by the LIA with key government stakeholders. Agency representatives were briefed on the proposed activity and agency requirements sought for the preparation of an EIS.

Agencies agreed that the LIA be nominated as the nominated determining authority for the proposed activity. The Department of Infrastructure, Planning & Natural Resources confirmed that on 14 May 1999 the then Minister for Urban Affairs and Planning made a blanket order under s110A of the EP&A Act, which nominates the determining authority which is the proponent of an activity (under Part 5 of the EP&A Act) as the 'nominated determining authority' for that activity.

The Director General (DIPNR) requirements for the preparation of an EIS was issued to the LIA on 12 May 2004. The Director General advised, amongst other things, that the proposal appears to be subject to Division 4, Part 5 of the EP&A Act.

Under Division 4, Part 5 of the EP&A Act, a determining authority is not to carry out an activity if it is the proponent of the activity unless the Minister has approved of the activity being carried out.

Patterson Britton & Partners (PBP) completed the EIS for the proposed activity in January 2005. The EIS was prepared in accordance with s111 and s112 of the Environmental Planning and Assessment (EP&A) Act 1979 and cls 72 and 73 of the EP&A Regulation 2000.

The LIA is the proponent for the activity and also a determining authority under s110 of the EP&A Act. The LIA was also nominated as the nominated determining authority pursuant to s110A of the EP&A Act.

The LIA placed the EIS on public exhibition on 29 January 2005, with the exhibition period ending on 4 March 2005. Notices advising of the EIS were placed in the prescribed form and manner pursuant to s113(1) of the EP&A Act and cls 233 and 234 of the EP&A Regulation in the Sydney Morning Herald, Illawarra Mercury, Wollongong Advertiser and Lake Times.

The EIS was made available for public inspection in accordance with s113(1) of the EP&A Act and cl 235 of the EP&A Regulation at the offices of the LIA, Department of Infrastructure, Planning and Natural Resources (Wollongong and Sydney), Wollongong City Council, Shellharbour City Council, Government Information Service and the Nature Conservation Council.

A letter and copy of the EIS was also sent to relevant government agencies on 3 February 2005. Agencies included Wollongong City Council, Shellharbour City Council, Department of the Environment and Conservation, Department of Lands, Department of Primary Industries, Department of Infrastructure, Planning and Natural Resources, NSW Maritime Authority and the Illawarra Local Aboriginal Land Council.

During the EIS exhibition period, the LIA conducted an "open house" at the Windang Foreshore Park on Saturday 12 February 2005 to explain the design and EIS process to the public as well as answer any questions.

Forty-one (41) representations were received following the exhibition period. A table summarising the key issues raised in the representations is in Appendix A and a copy of the representations is in Appendix B.

The LIA has furnished a copy of the representations to the Director General of the Department of Infrastructure, Planning and Natural Resources as well as the Department of Environment and Conservation (EPA) in accordance with s113(3) and s113(3A) of the EP&A Act respectively on 4 April 2005.

A Referral Form under the Environment Protection & Biodiversity Conservation (EPBC) Act 1999 was made to the Commonwealth Department of the Environment and Heritage (DEH) for the proposed activity on 10 February 2005. The DEH advised on 14 March 2005 that the proposed action is not a controlled action, provided it is taken in accordance with the manner described in the decision document. A copy of the DEH's decision document is in Appendix C.

1.5 The Consultation Program

Consultation with a wide range of government agencies, community interest groups and individuals was undertaken to identify the issues associated with the project, and define the scope of the EIS.

Government Consultation

Government agencies contacted by the LIA during the environmental assessment phase of the project included:

- Department of Infrastructure, Planning and Natural Resources;
- Shellharbour City Council;
- Wollongong City Council;
- Department of Environment and Conservation (*EPA and NPWS*);
- Department of Primary Industries (*Fisheries*);
- NSW Maritime Authority;
- Department of Lands;
- Illawarra Local Aboriginal Land Council; and
- Commonwealth Department of the Environment and Heritage.

A Planning Focus Meeting was held on 24 February 2004 to provide the opportunity for the LIA to brief representatives from the government agencies that have an interest in the project on the proposed Stage 2 works and to obtain each agency's requirements for the preparation of the EIS.

Following the Planning Focus Meeting, written responses were received from most of the agencies, which attended the meeting.

Community Consultation

The following community interest groups were identified for this project :

- Wollongong City Council Neighbourhood Committees #8, 9 and 10;
- Windang Beach Tourist Park;
- Local water-based business including Windang Boat Shed, Illawarra Aqua Centre, Deans Bait and Tackle Shop and United Divers;
- Clubs representing water based activities including Illawarra Yacht Club, Port Kembla Sailing Club, Windang Surf Life Saving Club;
- Save Lake Illawarra Action Group;
- Illawarra Bird Observers Club
- Southern Ocean Seabird Study Association;
- Commercial Fishers;
- Recreational fishers and boaters; and
- Local residents.

Public Meeting, April 2003

The community was involved in Stage 2 of the project early in the concept design phase through the Independent Review Panel Process. A public meeting was held on 2 April 2003, after which some 30 submissions from the public were received. All comments made during this consultation phase were considered when formulating the current proposal for improvements to the lake entrance.

Public Meeting, October 2004

A public meeting was held on 27 October 2004 at the Windang Senior Citizens Centre to present the design and explain the planning approval process to members of the community. The Executive Officer of the LIA, Mr Brian Dooley, chaired the meeting. Members of the Technical Working Group, which oversaw the design phase as well as the design team and

members of the peer review team, including Professor Bruce Thom (Chair of the Review Panel), were in attendance.

Members of the community were invited to ask questions to the LIA and design team following the presentation. It was evident that the public were overwhelmingly supportive of the project and would like the Stage 2 works to be realised as soon as possible.

Newsletters, Media Releases and Notice to Householders

In addition to the public meetings, consultation with regards to Stage 2 of the project was also undertaken through the following mediums:

- two newsletters informing the public on the progress of the project (distributed December 2003 and October 2004);
- print media and television releases; and
- a notice distributed to relevant householders informing them about the stockpiling of rock at the Lake Illawarra entrance.

Public Open House

On Saturday 12th February 2005 a Public Open House was held from 9.00am – 3.00pm at the Windang Foreshore Park, Windang. At the Open House, members of the design team and PBP were available to answer questions from the community and receive comments. Information about the design was on display as well as many historical photographs of the entrance and lake foreshore areas. Several copies of the EIS were available to view or purchase.

A total of 103 people attended which included members of the local community, tourists and residents from the Windang Caravan Park, surfers, people who have lived in the area previously and people who have purchased property and or plan to move to the Lake Illawarra Region.

The feedback from the Open House indicated a general positive attitude to the proposal, and a desire for the work to proceed as scheduled.

There was interest in both the general plans, and also the more specific detail. The level of confidence that the proposal will deliver a permanent lake opening was reported by those attending the Open House as medium.

The local media attended the Open House and reported the activity.

The community feedback was constructive and generally supportive of the comprehensive nature of the investigations, and that the information flow to the community was generally appropriate.

Twyford Consulting has prepared a report on the Open House. A copy of the report is in Appendix D.

1.6 The Determination Process

The determination process for the Proposal (following the exhibition of the EIS) is as follows:

The LIA decide whether to proceed with Proposal (subject to Minister's approval): The LIA considers the EIS, the representations received during exhibition, the possible mitigation of the environmental impacts of the Proposal, the possible modification of the Proposal, and a range of other matters set out in the EP&A Act and EP&A Regulation. The LIA makes decisions under the EP&A Act whether to proceed with the Project. If the decision is to

proceed with the Proposal with or without modifications from the Proposal as described in the EIS (“the Preferred Activity”), implementation of the decisions is subject to obtaining the Minister’s approval.

A Representations Report is prepared: To assist the LIA in making those decisions, this Representations Report sets out matters relevant to the decision above.

Minister’s Approval Sought: Copies of the LIA’s decision are sent to DIPNR to seek the Minister’s approval to the Proposal in accordance with Section 115A of the EP&A Act.

Preferred Activity Report made public: At the same time, by agreement between DIPNR and the LIA, a report prepared by the LIA concerning the Preferred Activity is made publicly available and is forwarded to DIPNR. The Preferred Activity Report is made available at the same locations as the EIS was exhibited. Advertisements advising of the availability of the Report are placed in the same papers as the EIS exhibition statutory advertisements.

DIPNR prepares Report to Minister: The Director General of the DIPNR considers the Representations Report, the decision of the LIA and all other relevant material, assesses the Preferred Activity and prepares an Assessment Report for the Minister for Infrastructure and Planning for his consideration to assist his decision as to whether to grant approval and upon so doing, determines any conditions or modifications.

Minister decides whether to grant Approval: After considering the Report, the Minister decides whether to grant approval in respect of the Preferred Activity and if so, on what terms and conditions. The Minister’s decision must be made within 21 days after he receives the Director General’s report.

Outcome: The LIA considers the terms and conditions of the approval of the Minister and determines whether to proceed with the Preferred Activity.

Release of Documents: The Minister’s approval, the report from the Director General of DIPNR to the Minister, and the LIA’s Representations Report are made public.

2.0 Consideration of the Environmental Impact Statement

2.1 Compliance Checklist

Volume 2, Appendices A & B of the EIS detail general and specific requirements for an EIS and lists the relevant sections in the EIS where each issue has been addressed.

2.2 Statutory Compliance

This section discusses whether or not the EIS has complied with relevant statutory planning instruments, policies and strategies.

The Director-General of the DIPNR requirements included a list of policies and strategies as well as State and Commonwealth legislation the EIS should consider including:

Policies and Strategies

- NSW Coastal Policy 1997
- State Environmental Planning Policy No.14 – Coastal Wetlands
- Illawarra Regional Environmental Plan No. 1
- City of Wollongong Local Environmental Plan
- Shellharbour Local Environmental Plan
- The Department of Land and Water Conservation's Soil and Landscape Issues in Environmental Impact Assessment Technical Publication No. 34; and
- National Water Quality Management Strategy guidelines

The EIS has considered all of the above policies and strategies – Volume 2, Appendix B of the EIS lists the sections where each policy and strategy was addressed.

NSW Legislation

- EP&A Act 1979
- EP&A Regulation 2000
- Threatened Species Conservation (TSC) Act 1995
- Fisheries Management (FM) Act 1997

Commonwealth Legislation

- Environment Protection and Biodiversity Conservation (EPBC) Act 1999

With regard to the above legislation the following is advised.

EP&A Act Part 5

s110: The matters referred to in Section 110 concerning determining authorities and nominated determining authorities have been complied with in the EIS.

s111: The matters referred to in Section 111 concerning the duty of determining authorities to consider the environmental impact of activities have been complied with in the EIS.

s112: The matters referred to in Section 112 concerning consideration to recovery plans and threat abatement plans, critical habitat, threatened species, populations or ecological communities or their habitats, have been complied with in the EIS.

s113: The matters referred to in Section 113 concerning publicity and examination of the EIS has been complied with in the EIS.

s114: Not applicable

Division 4: Applies to the proposed activity. The LIA will be seeking the approval of the Minister for Infrastructure & Planning under this Division.

EP&A Regulation 2000

Clause 229: The matters referred to in Clause 229 have been complied with in the EIS.

Further, the Director-General of the DIPNR issued requirements for the preparation of an EIS for the activity on the 12 May 2004. The Director General's requirements outlined matters that must be included in the EIS under Clause 229.

The EIS has addressed these matters – Volume 2, Appendix B of the EIS lists the Director General's requirements and the sections in the EIS where each matter or issue has been addressed.

Under Clause 229 (f) a declaration by the person by whom the EIS is prepared is to be included advising that the EIS has been prepared in accordance with Clauses 230 and 231. The EIS when exhibited, included a declaration by Michael Wright (PBP), however, it was made pursuant to Clauses 72 and 73 and not Clauses 230 and 231 of the EP&A Regulation as required. Clauses 72 and 73 relate to EIS's prepared pursuant to Part 4 of the EP&A Act, including designated development. The EIS was prepared pursuant to Part 5 of the EP&A Act. An amended declaration was issued on 7 March 2005 to the DIPNR's Major Infrastructure Assessments Branch (Ms Rebecca Newman). The amended declaration satisfies this clause.

Clause 230: The Director-General of the DIPNR issued requirements for the preparation of an EIS for the activity on the 12 May 2004. The Director General's requirements outlined matters that must be included in the EIS under Clause 230.

The EIS has addressed these matters – Volume 2, Appendix B of the EIS lists the Director General's requirements and the sections in the EIS where each matter or issue has been addressed.

Clause 231: The Director-General of the DIPNR issued requirements for the preparation of an EIS for the activity on the 12 May 2004. The Director General's requirements outlined key issues that the EIS specifically address under this clause.

The EIS has addressed the key issues – Volume 2, Appendix B of the EIS lists the Director General's requirements and the sections in the EIS where each matter or issue has been addressed.

Clause 231 (e) requires the EIS to be exhibited within 2 years after notice is given by the Director-General of the DIPNR or the applicant must consult further with the Director General in relation to the preparation of the EIS - The EIS was exhibited within the 2 years timeframe.

Clause 243: This clause is not applicable. The clause only applies where the approval of the Minister for Infrastructure and Planning is **not** required.

Schedule 2: The matters referred to in Schedule 2 have been complied with in the EIS. Volume 2, Appendix A of the EIS lists where each matter has been addressed.

Threatened Species Conservation Act

The EIS addressed the proposal with reference to impacts on biota (flora and fauna) listed as threatened or as migratory species under the TSC Act – Volume 1, Chapter 10 and Volume 2, Appendix G.

Fisheries Management Act

The EIS addressed the proposal with reference to impacts on biota (flora and fauna) listed as threatened or as migratory species under the FM Act – Volume 1, Chapter 10 and Volume 2, Appendix G.

Environment Protection and Biodiversity Conservation Act

The EIS addressed the proposal with reference to impacts on biota (flora and fauna) listed as threatened or as migratory species under the EPBC Act or listed under the JAMBA and CAMBA Conventions – Volume 1, Chapter 10 and Volume 2, Appendix G.

2.3 Development of the Proposal in the EIS

Historical references to previous development proposals for entrance works at Lake Illawarra are outlined in Chapter 7 of the EIS. Development of the proposal is outlined in Chapter 8 of the EIS.

Works to stabilise and / or create a permanent entrance to Lake Illawarra have been considered as far back as the late 1800s (Illawarra Harbour & Land Corporation Proposal).

A number of studies in the 1970s examined ways to improve the lake environment, which included entrance works.

In 1982, the then NSW Public Works Department completed a report, “Lake Illawarra Entrance Study”. The report developed a range of entrance management options.

When the LIA was established in 1988, works to stabilise the entrance to the lake, amongst other things, were seen as a high priority to achieve its aims of improving the environment of the lake.

Australian Water and Coastal Studies (AWACS) completed an options study in 1992 for entrance works. The preferred option involved the construction of a southern training wall and channel dredging. AWACS (1992) indicated that future periodic dredging of the entrance channel and / or the construction of a northern breakwater / training wall off Perkins (Windang) Beach might be desirable for the entrance to remain open for longer periods after completion of the southern training wall.

Mitchell McCotter completed an EIS for the work in 1994, and following approvals work began in late 1999. The works were completed in early 2001.

The works were aimed at amongst other things to increase tidal penetration and reduce the retention time of nutrients and pollutants in the lake body. Although these works reduced the potential for sand infeed from Warilla Beach to close the entrance, during low rainfall periods and / or big seas, large volumes of sand can move into the entrance channel from Perkins Beach.

Due to concerns about the performance of the works, particularly as a result of the drought in 2002/03 the LIA engaged Lawson & Treloar (L&T) to examine a number of northern training wall options to:

- Provide an entrance channel that will be essentially self scouring under tidal action so that the entrance remains open more often than it presently does;
- Provide an entrance channel that will be adequate to convey major flood flows without increasing existing flood levels in the lake or leading to scour risk at the training walls;
- Reduce the amount of sand being transported into the entrance channel from Perkins Beach, which could cause entrance closure; and
- Maintain a high level of public amenity.

It was not intended that a northern wall should provide safe navigation for small watercraft through the entrance.

A total of nine (9) options were considered. Options were assessed for:

- Structural stability;
- Beach changes;
- Hydraulic performance (tidal and flood conditions);
- Closure potential; and
- Cost

In February 2003, the NSW Government established an Independent Review Panel to examine and report on, amongst other things, the options developed by L&T to improve the entrance to Lake Illawarra.

The panel considered all 9 options from L&T plus a range of thoughtful ideas from community submissions. Option 9 stood out as the best option and received strong community support. Option 9 included construction of a northern wall extension of the southern wall and extensive channel dredging with disposal to Warilla Beach.

The panel concluded, amongst other things:

Recommendation 1: That the NSW Government provide in principle support for Option 9 on advice from the Review Panel recognising that it will cost an amount as estimated by Government for its completion over a two year period.

Recommendation 3: That the LIA commission consultants to undertake further modelling and design studies to optimise the location and alignment of walls, the design of walls and the costing of both structures and dredging required to complete Option 9 within the budget approved by the Government.

Recommendation 7: That the Government, if it agrees to support Option 9, use the services of the Review Panel in consulting with the two local councils with a view to attracting matching funds for necessary works and studies.

The NSW Government announced its endorsement of the recommendations of the Panel's report in June 2003. The recommendations included amongst other things, the construction of a northern breakwater and major channel dredging at the entrance to Lake Illawarra at an estimated cost of \$4 million.

A Technical Working Group was established by the LIA comprising of representatives from DIPNR, Wollongong and Shellharbour City Council to oversee the design. In addition, the design was peer reviewed by Prof Bruce Thom and Mr Mike Geary, members of the Independent Review Panel.

The general arrangement for the proposal in the EIS was based on Option 9, developed by L&T, with minor refinements.

The proposal was further developed by adopting the following approach:

- Establishment of the design parameters for the site including the existing coastal and estuarine processes;
- Development of the project proposal in association with L&T under the guidance of the Technical Working Group;
- Critical review by a peer review panel;
- Confirmation of the constructability of the proposal; and
- Estimation of costs associated with the proposal.

Design parameters assessed for development of the proposal included consideration of:

- Elevated ocean water levels;
- Wave climate;
- Geotechnical conditions;
- Entrance morphology;
- Existing entrance processes;
- Tidal hydrodynamics; and
- Freshwater flood events.

The final design formed the project proposal in the EIS.

2.4 General Description of the Proposed Works in the EIS

The project proposal is outlined in Chapter 6 of the EIS. The proposed works consist of:

- Construction of a breakwater / training wall on the northern side of the entrance off Perkins Beach;
- Extension of the existing breakwater / training wall on the southern side of the entrance off Perkins Beach by way of a spur wall;
- Minor improvements to the existing southern training wall / breakwater connecting to Windang Island through the provision of spur wall extensions at the upstream and downstream gaps;
- Dredging a substantial channel within the lake's entrance;
- Creation of a small sand island on the north side of the entrance channel for bird habitat;
- Undertaking sand nourishment of Warilla Beach utilising the dredged material from the entrance; and
- The minor extension of the rock groyne on the northern side of the entrance to Elliot (Little) Lake.

Northern and Southern Breakwaters / Training Walls

The northern and southern breakwaters would extend some 200m offshore in an east north-easterly direction into a water depth of 2.5m at mean tide. The breakwaters separated by a distance of 90m.

The breakwaters would comprise of a rock core, rock underlay and an rock armour layer of randomly placed basalt 2 rocks thick placed on a side slope of 1 in 1.5.

The northern breakwater would commence from the edge of the vegetated dune at the southern end of Perkins Beach. The total length of the northern breakwater being 350m with a crest level

ranging from 2.5m AHD at the shoreline to 4.0m AHD at the head of the breakwater offshore. The crest width would be 5m to facilitate access for construction plant and equipment.

The size of primary armour rock ranges from a median mass (M_{50}) 4.0 tonnes near the shoreline to 6.0 tonnes at the head.

The southern breakwater would commence from the end of the existing southern training wall. The total length of the southern breakwater being 250m with a crest level ranging from 3.0m AHD to 3.5m AHD at the head. The crest width would be 5m to facilitate access for construction plant and equipment.

The size of primary armour rock ranges from a median mass (M_{50}) 4.0 tonnes near the shoreline to 5.0 tonnes at the head.

Some 55,000 tonnes of rock would be used in the construction of the breakwater structures.

Minor works are also proposed to reduce the width of the upstream and downstream gaps in the existing southern training wall.

Channel Dredging

The main entrance channel is proposed to be widened and deepened by dredging to a depth of 2m at mean tide level over a width of 100m tapered to a width of 70m at the mouth.

Approximately 200,000m³ of clean marine sand is required to be removed to obtain the design channel profile.

Bird Habitat Island

The EIS recommends that a bird island be constructed for bird roosting and nesting. The bird island would be comprised of marine sand. The long dimension of the island would be 220m and the short dimension 50m in length. It is estimated that between 5,000m³ and 10,000m³ of marine sand is required.

The island would be shaped like a dome with a base level of 0.5m to 1.0m AHD and a crest level of 1.0m to 1.5m AHD. The island would be susceptible to flood flows and may require yearly maintenance.

The final location of the island would be subject to the location of shoals at the time of construction.

Warilla Beach Nourishment

The beach has a long history of problems associated with erosion primarily as a result of extensive and ongoing sand extraction from the entrance channel for three decades from the mid 1940s. It is proposed that the marine sand from the dredging of the entrance channel be used for the nourishment of the southern portion of Warilla Beach. Nourishment would be conducted over an 850m length of beach from a point 50m north of the entrance to Elliot Lake extending approximately 100m offshore.

The EIS suggests that to help stabilise the beach nourishment works a number of sand filled geotextile tubes (groynes) could be placed perpendicular to the beach extending to the seaward limit of nourishment.

Elliot Lake Groyne Extension

It is proposed to extend the existing rock groyne at the mouth of Elliot Lake by 20m to provide additional sand storage capacity and reduce the potential for sand from Warilla Beach to rework into the entrance of Elliot Lake under north easterly swell conditions. The groyne would comprise of rock armour of median mass of 3.0 tonnes and have a crest level of 3.5m AHD.

The EIS also suggests that to reduce or avoid the possibility of sand being reworked into the entrance of Elliot Lake, the sand nourishment works could be restricted to a distance of some 500m from the entrance to Elliot Lake.

Construction Methodology

Approximately 50% of the rock for use in the breakwaters has already been stockpiled on the northern side of the entrance channel (separate approval granted August 2004). The remaining rock is currently stockpiled at Shellharbour City Council's Waste Depot at Dunmore. The rock was sourced from the RTA's North Kiama Bypass project.

As part of the approval for stockpiling rock on the northern side of the entrance channel, the LIA has constructed a haul road along the edge of the channel directly behind the Perkins Beach dune. It is proposed to remove the haul road and reinstate the sandy pedestrian track on completion of the works.

Rock from both stockpile areas will require sorting before being loaded into trucks for placement in the breakwater structures.

It is proposed to construct the northern breakwater using rock from the existing stockpile on the northern side of the entrance channel as well as rock transported from the Dunmore site. It is proposed to construct the southern breakwater using rock transported predominantly from the Dunmore site. This will require the construction of a haul road from the eastern end car park of Reddall Reserve along the beach to the end of the existing southern training wall.

The rock walls would be constructed progressively in sections not exceeding 50m in length. Trucks would end tip rock within the designated breakwater areas and be positioned using excavators with bucket and grapple attachments.

Minor improvements to the existing southern training wall gaps and extension of Elliot Lake groyne would also be undertaken by excavators.

It is likely that two separate site compounds approximately 20m x 20m will be erected during construction - one at the entrance to the haul road at Windang and the other on Reddall Reserve.

Channel dredging would be undertaken using a cutter suction dredge. Dredged material would be pumped via a pipeline (floating, submerged and onshore) to the southern end of Warilla Beach a distance of approximately 2.5km. A booster pump station is proposed to be placed in front of either Woodford Avenue or George St, Warilla.

Sand would be placed along the beach and the sub-aerial material profiled using excavators and bulldozers. Sand placed in the sub-aqueous zone will be reworked by tides and wave action.

The bird island would be constructed using excavators and bulldozers.

Timing

The EIS indicates that the work should take about 61 weeks to complete.

2.5 Consideration of the Assessment

This section discusses the potential impact of the proposed activity on the environment in accordance with Clause 228 of the EP&A Regulation. Clause 228 lists the factors to be taken into account concerning the impact of an activity on the environment. For the purposes of Part 5 of the Act, the factors to be taken into account when consideration is being given to the likely impact of an activity on the environment include:

- (a) any environmental impact on a community,
- (b) any transformation of a locality,
- (c) any environmental impact on the ecosystems of the locality,
- (d) any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality,
- (e) any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations,
- (f) any impact on the habitat of protected fauna (within the meaning of the [*National Parks and Wildlife Act 1974*](#)),
- (g) any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air,
- (h) any long-term effects on the environment,
- (i) any degradation of the quality of the environment,
- (j) any risk to the safety of the environment,
- (k) any reduction in the range of beneficial uses of the environment,
- (l) any pollution of the environment,
- (m) any environmental problems associated with the disposal of waste,
- (n) any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply,
- (o) any cumulative environmental effect with other existing or likely future activities.

Consideration of each potential impact as listed above is discussed in the following arrangement:

- i. A statement as to the possible impact;
- ii. A referral to where this impact was addressed in the EIS;
- iii. A brief statement of the likely impact; and
- iv. A statement as to the measures being taken to minimise any potential adverse effects caused by the activity.

(a) Environmental impact on a community.

The entrance works is proposed to be located within the channel at the mouth of Lake Illawarra across Perkins Beach. The entrance will be formed by constructing twin rock

breakwaters on the northern and southern sides of the channel out to water depths of 2.5m below mean sea level. Existing gaps in the southern training wall will be reduced. Sand will be excavated from the channel and pumped to Warilla Beach and profiled. The existing groyne at Elliot Lake will be slightly extended.

The entrance works will disturb shoaled areas and the bed of the channel, the nearshore seabed and portions of Perkins and Warilla Beaches in the area. This disturbance has the potential to impact on human and ecological communities.

This was addressed in the EIS and specifically in Part C, Chapters 9, 10 and 11 and Appendices G, H, I and J.

Construction impacts consist mainly of direct habitat loss due to dredging and breakwater construction.

For the defined study area a total of 0.5ha of non-tidal sandy beach and 10.8ha of intertidal and sub-tidal sandy substratum will be directly lost to construction. The loss of benthos in the shallow submerged areas to be dredged should recolonise fairly rapidly. In addition a total of 10.5ha of estuarine and marine habitat will be created. Portions of these new habitats are likely to have similar habitat attributes to those lost. The remainder of the created habitats will provide different but nevertheless valuable additional marine and estuarine niches, which will be utilised by members of the available marine biota in the Perkins Beach embayment.

There will be no impact on benthic communities of the lake basin.

There will be minor disruption to human communities involved with surfing, swimming, boating, fishing and prawning activities.

Any adverse effects will be minimised by the Mitigation Measures set out in Part D, Chapters 13 and 14 of the EIS.

(b) Transformation of a locality.

The area at the mouth to Lake Illawarra will be transformed in terms of the presence of the breakwaters over the area of Perkins Beach. The entrance channel and seabed would still consist of sandy and shallow sandy areas. The northern breakwater will intercept and modify the movement of sand moving southwards along Perkins Beach. A sandy fillet would extend the shoreline against the northern breakwater. The breakwaters will form new habitats. The height of the breakwaters may change wind circulation patterns in the locality. The breakwaters will direct flood discharges further offshore. Flooding to local areas not changed. An entrance bar would form at the end of the breakwaters. The breakwaters will reduce the amount of sand reworking (shoaling) inside the entrance channel. The works will result in improved water quality in the entrance channel, swimming lagoon and lake body. Overall lake water levels and salinity levels will be within existing natural variation. Lake ecology should not change significantly. Works will result in extended commercial and recreational opportunities.

This was addressed in the EIS and specifically in Part B Chapters 6 and 8, Part C, Chapters 9, 10 and 11 and Appendix G.

The physical features of the entrance area and southern end of Perkins Beach will be changed by the works. Other than for the change in beach alignment to form a fillet of sand against the breakwaters and more permanent channel between the breakwaters there will be no significant changes elsewhere to coastal processes including nearshore

currents, wave climate and sand transport rates. Increased tidal flushing will reduce lake nutrient levels and the frequency of macro-algae blooms.

Any adverse effects will be minimised by the Mitigation Measures set out in Part D, Chapters 13 and 14 of the EIS.

(c) Environmental impact on the ecosystems of the locality.

The habitats in the entrance area will be slightly changed with the construction of the breakwaters and dredging of the channel. There will be no significant changes to nearshore and offshore current patterns. Any potential impacts on the aquatic ecology will be restricted to the immediate entrance area and ocean beach sands. The primary potential disturbance will be to existing aquatic bird habitat.

Salinity levels in the lake will rise slightly. Mean lake level changes are expected to be negligible.

This was addressed in the EIS and specifically in Part C, Chapters 9 and 10 and Appendix G.

There will be no significant impact on threatened aquatic bird species known from the study area or the locality provided the mitigation measures proposed are implemented.

Changes to salinity and mean lake levels will be within historic natural variation. Changes to the distribution of seagrasses and saltmarsh within the lake are expected to be insignificant. Fish and prawn populations within the lake are likely to be either neutral or marginally beneficial.

Any adverse effects will be minimised by the Mitigation Measures set out in Part D, Chapters 13 and 14 of the EIS.

(d) Reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality.

The environmental quality or value of the locality will be altered with entrance works. There will be an impact on aesthetics. There will be a direct loss of some 130m of beach due to the construction of the breakwaters and entrance channel. The breakwaters may also impact on surfing and wave sailing conditions offshore in the Perkins Beach embayment.

This was addressed in the EIS in Part C, Chapters 9, 10 and 11 and Appendices F & G.

During construction a number of recreation areas will be closed to the public for safety reasons. During channel dredging sections of the entrance will be restricted for boating.

To minimise impacts on wave sailing conditions the height (crest level) of the breakwaters could be slightly lowered.

The breakwaters and sediment pathways should create more formalised surfing conditions and provide a more consistent right hand surfing wave once the sand fillet establishes behind the northern breakwater.

Any adverse effects will be minimised by the Mitigation Measures set out in Part D, Chapters 13 and 14 of the EIS.

(e) Effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations.

The proposed activity could have an effect on the locality, which may have aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations.

There are many previously recorded Aboriginal sites located in the Windang area in general, and the Windang Surf Club/Windang Beach Tourist Park in particular. These sites include middens, burials and artefact scatters and an Aboriginal Keeping Place. Construction works for the breakwaters could disturb these sites.

Remains of wagon wheels in the locality (around Windang Island) from previous attempts to construct entrance works in the late 1890s are classified as 'relics' under the Heritage Act. The Heritage Office has previously advised (stage 1 works) that no approval will be required for their relocation and that burial of the items would be acceptable. The Heritage Office also indicated that there is one historic shipwreck potentially in the vicinity of the proposed works – the timber schooner Franz (1862-1879), which was wrecked a little north of Lake Illawarra on the beach. The wreck site could conceivably be located under the modern beach sands and potentially be impacted by disturbance works.

This was addressed in the EIS and specifically in Part C, Chapters 10 and 11 and Appendix H.

It is not expected that the proposed works will disturb any 'relic' wagon wheels within the locality.

The Aboriginal archaeological survey and assessment concluded that no Aboriginal site or objects are recorded in the area proposed for entrance works.

It is possible that subsurface Aboriginal cultural deposits may be present within the section of the haul road on the northern side of the entrance channel. The haul road has already been constructed in accordance with the findings of the recommendations of the Aboriginal Heritage Assessment.

Personnel working on the project will be made aware of the cultural sensitivity of the general area.

Should remains of unidentified structures, such as relic wagon wheels or historic shipwrecks be located during construction of the breakwaters or dredging in the area, it is proposed work will be stopped and the Heritage Office contacted. A qualified maritime archaeologist would be engaged to assess the significance of any identified remains in this case. It is considered that this approach is acceptable.

Any adverse effects will be minimised by the Mitigation Measures set out in Part D, Chapters 13 and 14 of the EIS.

(f) Impact on the habitat of protected fauna (within the meaning of the [National Parks and Wildlife Act 1974](#)).

The proposed activity could impact on the habitat of protected fauna listed as threatened or as migratory species under the Threatened Species Conservation Act 1995 and protected fish species, the Fisheries Management Act 1994, the Commonwealth

Environment Protection and Biodiversity Conservation Act 1999 or listed under the JAMBA and CAMBA conventions.

The broad sand flats and shoal areas on the northern side of the Lake Illawarra entrance channel and sections of the ocean beach around the entrance comprise one of the most important aquatic bird habitats on the southern NSW coast.

This was addressed in the EIS and specifically in Part C, Chapter 10 and Appendix G.

With regard to the TSC Act and EPBC Act threatened species lists for the locality, none of the recorded or observed reptile, mammal and bird species are listed as threatened and none of the listed threatened species for the general locality (with exception of the Swift Parrot and the Grey-headed Flying-Fox) occur or are expected to occur in the study area.

There are potentially 31 listed threatened fish species in the locality. Given the small likelihood of occurrence of the listed threatened species in the locality of the proposed works, it was concluded that eight part tests of significance are not required for the 6 threatened fish or shark species. The remaining listed 25 fish species (sea horse and pipe fish) are unlikely to occur on the mobile sands of the entrance channel except as transients and therefore an eight part test is similarly not required for these species.

A number of marine mammals and reptiles utilise the inshore coastal waters off the study area for feeding and/or breeding. There are 12 marine mammal species (whales and dolphins) plus 2 marine turtle species listed as threatened in the locality. However, none of the listed species are recorded or expected from Lake Illawarra entrance or Windang Island aquatic habitats except as possible infrequent and transient visitors. It was concluded that eight part tests of significance are not required for these species.

The EIS concluded that there would be nil or negligible impact on these fauna.

There are 9 aquatic bird species in the locality that are listed as threatened. Of these species, the Little Tern is known to breed (albeit with gaps of some 40 years) in the immediate vicinity of the site and the Hooded Plover could potentially breed at the entrance. The remaining threatened species are passage migrants, visitors or residents which utilise the entrance channel for feeding and roosting. It was concluded from the eight part tests that a Species Impact Statement is not required for the proposed activity.

Any adverse effects will be minimised by the Mitigation Measures set out in Part D, Chapters 13 and 14 of the EIS.

(g) Endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air.

It is possible that the proposed activity may endanger species of flora or fauna which exist in the area. Species could be endangered directly through habitat loss or changes to habitat types in the locality or indirectly through changes or disruptions to coastal processes determining the location and abundance of these species.

This was addressed in the EIS and specifically in Part C, Chapter 10 and Appendix G.

The EIS concluded that given the small scale of entrance works, there will be no significant impact on terrestrial or marine species listed as critically endangered, endangered or vulnerable under the EPBC Act, on migratory terrestrial and marine species listed under the EPBC Act or on terrestrial marine species from or overflying

Commonwealth waters, as listed under the Act. There will be no significant impact on birds listed under the JAMBA and CAMBA conventions.

Any adverse effects will be minimised by the Mitigation Measures set out in Part D, Chapters 13 and 14 of the EIS.

(h) Long-term effects on the environment.

The proposed activity could have long-term effects on the natural environment through increased tidal penetration into the lake and consequences of increased salinity, coastal processes such as littoral drift, nearshore currents and wave patterns, with consequential impacts on Perkins Beach and Warilla Beach and the entrance to Elliot Lake.

A small portion of the existing shoaling area immediately adjacent to the channel, which is used as a high tide roosting area for aquatic birds, would be lost as a result of entrance dredging.

This was addressed in the EIS and specifically in Part C, Chapters, 9,10 and 11 and Appendices G, H, I and J.

The ecological assessment found that there would be no significant impacts to the local ecology in the vicinity of the breakwaters and nourishment of Warilla Beach as these areas are not expected to be a habitat for significant populations of benthic biota due to the dynamic coastal environment.

There would be no impact on benthic communities within the lake basin.

There would be no change to the rocky reef biotic community and shore birds which utilise the reef of Windang Island.

As mean lake level changes will be small, changes to the distribution of seagrasses and saltmarsh within the lake is expected to be insignificant.

Although there will be increased tidal flushing of the lake as a result of the works, mean salinity levels in the lake would not change significantly. The concentration of nutrients in the lake would be expected to decrease.

Although the proposed activity will result in the entrance remaining open for longer periods than historically in the past, the impacts on fish and prawns of the lake are likely to be neutral or marginally beneficial, given that there would be no large changes in overall lake habitat and a more stable entrance would allow better access to and from the lake for both juveniles and adult fish.

There is a public perception that an open entrance yields more fish and prawns.

Any adverse effects will be minimised by the Mitigation Measures set out in Part D, Chapters 13 and 14 of the EIS.

(i) Degradation of the quality of the environment.

There is potential for degradation of the quality of the environment, due to the construction of the breakwaters and channel dredging. Areas of possible degradation include loss of habitat and pollution from equipment.

This was addressed in the EIS and specifically in Part C, Chapters 9, 10 and 11 and Appendices G, H, I and J.

Suitable management measures are proposed to control possible pollution of the air and waters from equipment.

Water quality in the lake is expected to improve following completion of the works.

Any adverse effects will be minimised by the Mitigation Measures set out in Part D, Chapters 13 and 14 of the EIS.

(j) Risk to the safety of the environment.

There could be an increased risk to the environment as a result of the works by making the entrance channel more navigable for recreational activities such as swimming and boating.

This was addressed in the EIS and specifically in Part C, Chapters 9 and 11 and Appendices F, G and J.

The proposed activity will provide a more stable entrance. Whilst it is not an objective of the project to make the entrance more navigable (or safer to navigate) users of small boats may attempt to navigate the entrance in the belief that it is safe. Suitable warning signs will be erected by Maritime NSW to warn boaters of the dangers in navigating the bar.

Any adverse effects will be minimised by the Mitigation Measures set out in Part D, Chapters 13 and 14 of the EIS.

(k) Reduction in the range of beneficial uses of the environment.

The proposed activity could lead to a reduction of beneficial uses of the environment such as natural habitats and recreational activities eg surfing and wave sailing.

This was addressed in the EIS and specifically in Part C, Chapters 10 and 11 and Appendices F and G.

Offshore wind patterns and wave climate will be slightly modified near the head of the breakwaters. The breakwaters could be lowered slightly to further minimise effects on wave sailing conditions.

Any adverse effects will be minimised by the Mitigation Measures set out in Part D, Chapters 13 and 14 of the EIS.

(l) Pollution of the environment.

The activity could contribute to air, noise and water pollution of the local environment.

This was addressed in the EIS and specifically in Part C, Chapter 9, 10 and 11.

Appropriate management measures are proposed to deal with any fuel leaks from machinery and / or smoke fumes from operation of machines. Providing these measures are in place there should be minimal pollution impact on the environment of the lake. Use of haul roads will be monitored and wetted down with a water cart (or

similar) if dust becomes a problem. Dust emissions during construction are not anticipated to result in significant air quality impacts.

An assessment of likely noise levels from machinery shows levels should be within accepted noise level criteria at the nearest residence. Users of the entrance area and adjacent beaches may experience slightly elevated noise levels above background. Noise management procedures have been developed to address any noise problems generated on the site.

No complaints were received during and transport and stockpiling of the 25,000 tonne of rock for the breakwaters.

Turbidity curtains will be used during dredging to minimise the dispersion of sediments mobilised by disturbance to the channel bed.

Any adverse effects will be minimised by the Mitigation Measures set out in Part D, Chapters 13 of the EIS.

(m) Environmental problems associated with the disposal of waste.

There could be environmental problems associated with the disposal of waste. Waste materials would be generated during construction of the haul roads, breakwaters and dredging as well as site disestablishment. This will consist mainly of rock fragments, roadbase etc.

This was addressed in the EIS and specifically in Part C, Chapter 11.

A low quantity of waste is likely to be generated by the works. Waste will be disposed of at an approved site and in an appropriate manner on a regular basis (weekly).

Any adverse effects will be minimised by the Mitigation Measures set out in Part D, Chapters 13 of the EIS.

(n) Increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply.

The demands which will be placed on resources, natural or otherwise, could result in a reduction in their supply.

This was addressed in the EIS and specifically in Part C, Chapter 6.

There will be no increase in the demand for rock for use in the breakwaters. Rock has already been sourced from the North Kiama Bypass project, which was made available from the road cuttings (waste). The ongoing need for resources associated with the activity eg maintenance of the rock structures will be negligible given access to quarries in the local area.

Any adverse effects will be minimised by the Mitigation Measures set out in Part D, Chapters 13 of the EIS.

(o) Cumulative environmental effect with other existing or likely future activities.

The proposed activity could exacerbate the cumulative environmental effects which are generated by other existing or likely future activities, due to the nature and location of this proposal.

This was addressed in the EIS and specifically in Part C, Chapters 9, 10 and 11 and Appendices G, H, I and J.

The chances of any further development of this kind in the vicinity are remote, although it is possible that the breakwaters could be extended in the future.

Any adverse effects will be minimised by the Mitigation Measures set out in Part D, Chapters 13 and 14 of the EIS.

Other considerations

In addition to the above, under s111 of the EP&A Act, a determining authority has a duty to consider the environmental impact of the proposed activity as follows.

(1) a determining authority in its consideration of an activity shall, ... examine and take into the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity.

This has been done as evidenced by this Representations Report.

(2) Without limiting subsection (1) a determining authority shall consider the effect of an activity on:

(a) any conservation agreement entered into under the National Parks and Wildlife Act 1974 and applying to the whole or part of the land to which the activity relates, and

No such conservation agreement exists

(b) any plan of management adopted under that Act for the conservation area to which the agreement relates, and

There is no plan of management.

(c) any joint management agreement entered into under the Threatened Species Conservation Act 1995

There is no joint management agreement.

(3) Without limiting subsection (1) a determining authority shall consider the effect of an activity on any wilderness area (within the meaning of the Wilderness Act 1987) in the locality in which the activity is intended to be carried on.

There is no Wilderness area in the locality.

(4) Without limiting subsection (1) a determining authority must consider the effect of an activity on:

(a) critical habitat, and

Critical habitat has been declared for the species found in the vicinity of the proposed activity listed as endangered or threatened under the Threatened Species Conservation Act or listed as protected under the Fisheries Management Act.

- (b) in the case of threatened species, populations and ecological communities, and their habitats, whether there is likely to be a significant effect on those species, populations or ecological communities, or those habitats, and

This has been investigated and given the scale of change caused by the activity, there will be nil or negligible impact on these species.

- (c) any other protected fauna or protected native plants within the meaning of the National Parks and Wildlife Act 1974.

Protected fauna including aquatic birds, marine mammals and reptiles, listed as threatened or as migratory species under the Threatened Species Conservation Act 1995 and protected fish species, under the Fisheries Management Act 1994, the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 or listed under the JAMBA and CAMBA conventions have been investigated.

Of the 31 listed threatened fish or shark species in the locality, none are recorded in the study area. Given the small likelihood of occurrence and scale of the proposed activity there will be nil or negligible impact on these fauna.

There are 12 marine mammal species (whales and dolphins) plus 2 marine turtle species listed as threatened in the locality. However, none of the listed species are recorded or expected from Lake Illawarra entrance or Windang Island aquatic habitats except as possible infrequent and transient visitors. Given the small likelihood of occurrence and scale of the proposed activity there will be nil or negligible impact on these fauna.

Of the 9 aquatic bird species in the locality that are listed as threatened only the Little Tern is known to breed in the immediate vicinity of the site and the Hooded Plover could potentially breed at the entrance. The remaining threatened species are passage migrants, visitors or residents which utilise the entrance channel for feeding and roosting. Given the scale of change caused by the proposed activity in relation to the habitat ranges of aquatic fauna species it is considered there will be nil or negligible impact on these fauna.

3.0 Consideration of the Species Impact Statement

Under s 112A of the EP&A Act, a determining authority, in considering a Species Impact Statement (SIS), must have regard to the terms of any recovery plan or threat abatement plan relating to the land referred to in the SIS for the purposes of assessing any effect on a threatened species, population or ecological community, or its habitat.

The EIS identified that only aquatic fauna, in particular aquatic bird life, would be significantly affected in an adverse way by the proposal.

A number of 'Eight Part Tests' were carried out for 9 threatened aquatic birds listed under the Threatened Species Conservation Act 1995, including:

- Little Tern, *Sterna albifrons*
- Hooded Plover, *Thinornis rubricollis*
- Large Sand Plover, *Charadrius leschenaultii*
- Sooty Oystercatcher, *Haematopus fuliginosus*
- Pied Oystercatcher, *Haematopus longirostris*
- Sanderling, *Calidris alba*
- Great Knot, *Calidris tenuirostris*
- Black-tailed Godwit, *Limosa limosa*
- Terek Sandpiper, *Xenus cinereus*

The eight part assessments are contained in Volume 2 - Appendix C of Appendix G. In each case, the eight part assessment concluded that a Species Impact Statement is not required for the proposal. Accordingly, no SIS was prepared for the proposed activity.

In addition, the impact of the proposal on saltmarsh was considered. Saltmarsh is declared an Endangered Ecological Community under the TSC Act. The EIS found that tidal and flood levels after the entrance works were in place would be well within the range of present natural variation levels experienced in the lake and entrance channel area. The EIS concluded that there would be no direct or indirect impact on saltmarsh within the area of proposed work or around the foreshores of the lake as a result of the proposed activity.

3.1 Compliance Checklist

Volume 1, Chapter 10 and Volume 2, Appendix G of the EIS details considerations for the need for a SIS.

3.2 Statutory Compliance

In assessing whether or not a SIS was required, consideration was given to the following legislation.

- Threatened Species Act 1995
- Fisheries Management Act 1997
- Environmental Protection and Biodiversity Conservation Act 1999

3.3 Consideration of the Assessment

As no SIS was prepared in relation to the activity, no assessment has been made.

4.0 Consideration of Representations

4.1 General

This section discusses the submissions received on the EIS. A summary of the submissions is presented in **Appendix A** and a copy of each submission is contained in **Appendix B** of this document.

Forty-one (41) submissions were received during the exhibition period:

- Four (4) from State Government agencies – Department of Primary Industries, Department of Infrastructure, Planning & Natural Resources, Department of Lands and the Department of Environment & Conservation;
- One (1) from the Commonwealth Government – Department of the Environment & Heritage;
- One (1) from Local Government - Shellharbour City Council;
- Two (2) from community, sports and lobby groups – NSW Wavesailing Association and the Save Lake Illawarra Action Group; and
- Thirty-three (33) from individuals, of which twenty-three (23) were from individuals supporting the view of the NSW Wavesailing Association.

- Key issues raised in the representations have been assessed and a summary is listed below.

- **Design**

- Breakwater Crest Levels (Height)
- Breakwater Length
- Breakwater Toe Apron
- Channel Dredging
- Nourishment of Warilla Beach
- Shape of Seawall
- Existing Training Wall Groyne
- Little Lake Entrance Rock Groyne

- **Construction**

- Bird Habitat Island
- Construction Program
- Budget/Costing
- Project Budget

- **Impact**

- Water Quality
- Lake Ecology
- Lake Flooding
- Coastal Processes
- Climate Change
- Commercial and Recreational Fishers
- Navigation
- Public access to entrance area
- Tourism and Recreation (surfing, swimming)
- Roads and Carpark Damage

- **Miscellaneous**

- Monitoring

- Healthy Rivers Commission Inquiry in Coastal Lakes
- Shallow Recreational Waterway
- Heritage Items
- Justification of the Proposed Activity

A response to each issue raised in the representations is provided below.

4.2 Design

4.2.1 Breakwater Crest Levels (Height)

The NSW Wavesailing Association and many individuals who wave sail and wind surf at Windang Beach complained that if the northern breakwater is constructed to its proposed height of 4m AHD, the wind patterns that occur around Windang Island and off Windang Beach would be adversely affected. Windang Beach is regarded as one of the best wave sailing breaks along the east coast of NSW and Australia in a southerly wind. It provides world class conditions. The proposed breakwaters would destroy wave sailing and windsurfing at Windang Beach.

Most submissions suggested the LIA consider reducing the breakwater height from 4m to 2m, to reduce or minimise the impact on wind circulation patterns at Windang Beach.

The submission(s) from the DIPNR about the breakwater crest level heights were conflicting. Advice from DIPNR's, Statewide Floodplain Management & Coastal Support Unit suggested that the proposed crest levels are low and would be overtopped during storm events, which may effect public access and safety along the walls. Impacts of climate change eg sea level rise within the design life of the rock structures may influence the long-term effectiveness of the proposal. But advice from DIPNR's South Coast Region suggested the walls could be lowered to 3.0m AHD.

Consideration

The impacts that the proposed rock structures would have on local wind behaviour is expected to be relatively minor. In 1987, a study was undertaken by Patterson Britton to establish which bays or parts thereof in the Sydney region are suitable for fore-and-aft moorings (Patterson Britton, 1987). As part of the study, wind tunnel testing was undertaken by the Sydney University to determine the extent of protection from wind (wind shadow) results from the landforms adjoining a bay. The wind tunnel results imply that for structures such as those proposed for the Stage 2 entrance works and at the proposed design heights above water, there is only about a 50 m zone of influence (wind shadow) that the structures would have on local wind conditions. It is understood that wind surfing and sailing would be primarily conducted outside this zone of influence, and therefore it is expected that the impacts on these activities from the construction of the rock structures would be minor and confined to activities conducted in the immediate vicinity of the structures. This assessment is supported by the fact that the existing training wall that connects the mainland to Windang Island with similar characteristics to those proposed does not affect local wind conditions and the wave sailing activities.

Adopting this model it should be noted that the suggestion to lower the crest of the rock structures by 0.5 to 1.0 m would have a negligible effect on reducing the zone of wind influence.

It should be also noted that the rock structures have been designed for overtopping and the crest level proposed for the northern breakwater at 4.0 m AHD (*at head*) has already been lowered from an initial level of 5.0 m AHD during the peer review process for the project. This crest level is relatively low by comparison to other similar structures located along the coast of NSW

(refer to Table below). In particular, it can be seen that at exposed river entrances the crest level at the head of these structures is typically between 5.5 m and 6.0 m AHD.

Typical Crest Levels for Rock Breakwater Structures along the NSW Coast

| Structure | Location | Crest Level on Head (relative to AHD) |
|------------------------|----------------------------|---------------------------------------|
| Tweed Breakwaters | Entrance to Tweed River | 5.5 |
| South Ballina | Entrance to Richmond River | 5.5 |
| Coffs Harbour Eastern | Entrance to Coffs Harbour | 6.0 |
| Harrington North | Entrance to Manning River | 5.5 |
| Newcastle North | Entrance to Hunter River | 5.5 |
| Shell Cove Boatharbour | Shell Harbour | 6.5 |
| Narooma Breakwaters | Entrance to Wagonga River | 6.0 |
| Boydton Boatharbour | Twofold Bay | 3.0 |

Based on the monitoring of the Stage 1 works, it is considered that a crest level of 3.0 m AHD is too low for sand storage at the northern wall and may result in leakage over the crest. However, it is considered on balance that a level of 4.0 m AHD offers a better sand storage potential for the trapping of sand.

In addition to performing its function, constructability is an important consideration in the selection of crest level. In particular, the structures would be built utilising conventional land based plant such as trucks and/or front end loaders bringing rock to long reach excavators which place the material. It is proposed that this plant would use the structure as a working platform, working from the crest. To ensure an efficient construction program with an acceptable down time, the minimum level of the working platform needs to accommodate a reasonably frequent wave and wave runup at high tide.

On this basis a minimum level of between 1.5 and 2.0 m AHD has been adopted for a working platform at the head (*i.e. mean high water of 0.5 m AHD with runup from a 1.0 m wave*). This level roughly corresponds to the level of the underlayer at the head of the structure (*ie 4.0 m AHD less 2.0m thick armour layer*). However, it would also require the core to be constructed from the finished level of the underlayer.

Patterson Britton have confirmed with the Contractor involved in the construction of the Stage 1 works, that this would be the lowest safe level of the working platform at which they would be prepared to operate. It should be noted that if the crest level is too low, in addition to OH&S issues, it would result in a higher proportion of downtime, reduced operational efficiency and therefore higher construction costs.

As mentioned in one submission from DIPNR, the proposed crest levels are already low enough to be overtopped during larger storm events, which may pose a public safety problem as the structures would be accessible.

To conclude, the issue of lowering the crest levels of the northern and southern rock structures has been considered in detail and it has been determined that there would be no net benefits from such a modification.

4.2.2 Breakwater Length

A small number of representations suggested the length of the breakwaters are not long enough and should be extended to a water depth of 3.5m below AHD. The end of the walls will still be

in the active zone of littoral transport. How will the entrance operate in 20 years as the beach system readjusts to the new entrance conditions.

Consideration

The proposed breakwaters will be positioned so that the heads of the northern and southern breakwaters extend to a depth of about 2.5 below AHD. This is consistent with the positioning of the northern breakwater at Swansea Channel, Lake Macquarie.

The EIS states that sediment transport modelling showed that longshore sediment transport along Perkins Beach occurs out to a depth of 8.0m below AHD, however the majority of transport takes place landward of the -3.5m AHD contour. It would therefore be desirable for the northern breakwater to extend to -3.5m AHD because this would reduce the amount of sand that would by-pass the northern breakwater from Perkins Beach and move into the entrance system. However, due to cost implications the location of the seaward extent of the northern breakwater was reduced to -2.5m AHD. The proposed northern breakwater could be extended at a future date following its construction if it is observed that unacceptable by-passing of the northern breakwater is occurring.

Extending the northern breakwater from -2.5m to -3.5m AHD requires an additional 70m of breakwater. The additional cost to extend the northern breakwater to -3.5m AHD is estimated to be \$315,000. This would then result in an offset between the heads of the two breakwaters. Although the original concept (Option 9) allowed for a similar offset, the EIS stated that by aligning the heads of the two breakwaters in equal water depth this arrangement would push the entrance bar further offshore than the case for unequal wall lengths. Accordingly, the cost would double if the proposed southern spurwall needs to be extended as well.

4.2.3 Breakwater Toe Apron

A small number of submissions queried whether or not the breakwaters would collapse as sand is washed away given the high flood velocities. In addition, one submission asked the question whether the rock structures will be effective without any excavation.

Consideration

The EIS has addressed the potential for scour against the breakwaters from waves and tidal / flood currents. Some slumping of the walls would be expected over time.

A toe apron has been incorporated into the design of the project proposal along the head of both the northern and southern structures and along the more exposed portion of the trunk, to prevent excessive scour, caused by currents (*tidal and freshwater flooding*) and/or extreme wave attack, from endangering the foundations of the breakwater/training wall as well as providing support to the lower edge of the armour layer. As foundation material is scoured/eroded from the toe by hydrodynamic processes the rock toe would settle/readjust to the new level and in doing so protect the integrity of the main structure.

It was considered that the rock structure could be placed directly on the existing bed surface as the potential for scour during construction would be minimal along a large portion of the structures length. In addition, during construction the more exposed sections of these structures (e.g. through the surf zone) the scour/erosion effects are localised and following construction the toe apron would be adequate to minimise a threat to the structural integrity of the foundations. This approach has been adopted for many of the existing structures along the NSW coastline.

4.2.4 Channel Dredging

A small number of representations indicated that the channel should be dredged over the full length of the blocked portion of the channel or to the deep channel near the Windang Bridge to ensure channel performs / functions more quickly than proposed.

One submission suggested the dredged sand should be placed on Perkins (Windang) Beach rather than Warilla Beach.

Consideration

The EIS states that the channel will be widened and deepened by dredging from the upstream limit of the existing training walls adjacent to Reddall Reserve to the -2.0m AHD contour over a width of 100m tapering to around 70m at the eastern mouth of the channel.

Approximately 200,000m³ of marine sand is required to be removed in order to obtain the desired entrance channel profile.

The proposed channel dredging footprint targets the more dynamic zone of the entrance where sediment is most active as a result of tidal and coastal processes (i.e. the main aim is to remove/lock up as much of this more active material as practicable.

The results of the numerical modelling study of sediment behaviour within the entrance after the implementation of the Stage 2 works shows that there would be a natural scouring of a channel between Windang Bridge and the upstream extent of the proposed dredging footprint due to tidal and coastal (wave) processes. As such, there would be little benefit in extending the dredging footprint over the full length of the currently blocked upstream portion of the channel.

The EIS states that Warilla Beach has a long history of problems associated with erosion primarily as a result of extensive and ongoing sand extraction over 3 decades from the 1940s (long before the LIA was formed). Some Warilla Beach sand will have also been transported into the Lake Illawarra entrance before closure of the gap between Windang Island and the mainland occurred. The Warilla Beach escarpment experienced a significant retreat landwards in response to the depleting sand reserves before construction of a seawall along the southern portion of the beach in the late 1960s held it to its current position. The southern portion of Warilla Beach is the most depleted of sand compared to its natural state and it was therefore considered appropriate that this section of the beach be targeted in the nourishment program.

It is possible that maintenance dredging of the channel may be necessary in the future to keep the entrance open. The LIA would need to consider suitable disposal options at this time, including Perkins (Windang) Beach.

4.2.5 Nourishment of Warilla Beach

A small number of submissions raised concerns about the impact proposed nourishment of Warilla Beach would have on recreational beach users as well as the entrance to Elliot Lake if the groyne is not extended as part of the proposed works.

Consideration

The EIS states to minimise the risk of large quantities of sand being reworked into the Elliot Lake entrance under coastal processes, it is proposed to bias the distribution of 200,000m³ of dredged sand to the northern section of the nourishment footprint. In particular, it is proposed to place 85% of the dredged sand along the beach between Woodford Avenue and Bucknell St. The remaining 15% would be placed between Bucknell St and 50m north of the existing rock groyne that defines the entrance to Elliot Lake. To further reduce the risk of sand being reworked into the entrance of Elliot Lake, there is the option of increasing the buffer zone from

the southern extreme of sand nourishment and the Elliot Lake groyne to a minimum distance that would avoid the possibility of sand reworking into the entrance. Based on an examination of aerial photographs this distance is estimated to be approximately 500m.

The LIA has discussed the proposed beach nourishment work and the extension of the groyne with Shellharbour City Council. Council has indicated a preference to proceed with the beach nourishment as proposed in the EIS even if the groyne at Elliot Lake is not extended as part of the proposed work. Council is prepared to wait and see what impact if any results to the entrance to Elliot Lake. In the interim, Council will pursue additional government grant funding for extending the groyne. If sand does rework into the entrance of Elliot Lake, then Council would consider sand removal as an interim measure.

During beach nourishment works, access to the southern portion of Warilla Beach will be restricted for public safety reasons.

The LIA confirms that the geosynthetic groynes highlighted as a possibility in the EIS will not be placed on the beach.

The availability of funds towards the end of the construction period, may well dictate just how far southwards down Warilla Beach, sand can be pumped.

4.2.6 Shape of Seawall

One submission suggested that the proposed alignment of the entrance rock structures is too straight and that the southern wall should be curved so that ocean swell would not propagate directly up the entrance channel and deposit sediment.

Consideration

The general arrangement of the northern breakwater and southern spur wall was developed with the assistance of analytic modelling and experience with similar structures along the NSW coastline, and verified by numerical modelling. The proposed alignment was chosen to optimise the ability of the entrance to self scour during tidal events and minimise the migration of sediment into the entrance channel from coastal processes.

The main cause of sediment build up within the current entrance is from the action of the dominant prevailing north-easterly swell moving sand southwards along Perkins (Windang) Beach and into the entrance. Analytical and numerical modelling results have shown that the proposed alignment of the northern and southern structures would adequately 'lock up' sand on the southern portion of Perkins Beach (preventing sand migration into the entrance) while also creating a permanent entrance that would be scoured of sediment during a flood event. The modelling also showed that while a portion (approximately 50% for a 5 year Average Recurrence Interval (ARI) event) of the sand bar formed some distance seaward of the breakwaters would be gradually worked back into the entrance, the remainder would be trapped behind the northern training wall or within the pocket beach created by the southern spurwall.

4.2.7 Existing Training Wall Groyne

One submission discussed the existing rock groyne that extends from the existing training wall out to Windang Island. There is still some sand bypassing around the groyne that is moving into the entrance and this bypassing of sand could be reduced if the groyne is completely extended to the Island.

Consideration

It should be also noted that the sand leakage into the entrance compartment would be significantly reduced by the construction of the southern spur wall and formation of the pocket

beach. However, it may be prudent that the groyne should be connected to the island to reduce the leakage of sand from Warilla Beach, and as this would sit on an existing rock platform it could be constructed with only a relatively small quantity of rock.

4.2.8 Little Lake Entrance Rock Groyne

One submission commented that the proposed 20 m extension of the Little (Elliot) Lake entrance rock groyne is not long enough to make it effective in preventing sand deposited on Warilla Beach for nourishment from migrating into the Little Lake entrance. It was also commented that the crest height of 3.5 m AHD is excessively high from a purpose and cost viewpoint.

Consideration

The proposed length of the rock groyne extension (20m) was chosen based on a concept design for the extension contained within a report prepared by the Australian Water and Coastal Studies (AWACS) in 1991 titled, *Warilla Beach Coastal Hazards Assessment Study*.

The study details management options for addressing the erosion problems along Warilla Beach and one of these options is to undertake a program of beach nourishment (with up to 300,000 m³ of sand) in conjunction with the extension of the Little Lake entrance rock groyne. Based on their investigations, it was recommended that the groyne be extended by 30 m. It was considered that since the current volume of sand proposed for nourishment is only 200,000 m³ and an additional buffer between the southern end of the nourishment zone and the entrance to Little Lake has been provided, a reduction of the extension length to 20 m in length could be justified.

The crest height of the existing groyne is 3.5 m AHD and as such the crest of the extension to the groyne was chosen at this level also. As discussed in Section 4.2.1, constructability is an important consideration in choosing the crest level of a rock structure situated within the active surf zone and it was determined that the crest level of the proposed extension could not be reduced without compromising its constructability. In addition, the additional quantity of rock needed to achieve the proposed level is not significant (i.e. only a minimal cost saving would be gained by reducing the crest) and maintaining the level to be consistent with the existing groyne enables combination of better sand storage and a neat transition from an aesthetics aspect.

4.3 Construction

4.3.1 Bird Habitat Island

It was suggested that the bird habitat island be constructed immediately following the commencement of dredging. There was concern that the bird habitat island would blow or wash away in a major storm or flood. In addition, one submission commented that it was not clear from the EIS if the bird habitat is to serve the purpose of providing compensatory 'roosting' or 'nesting' habitat for threatened bird species.

Consideration

The LIA will ensure the bird habitat island will be constructed immediately following the commencement of dredging. The LIA will also ensure that the island is not created during the summer breeding season, between mid November and end of February.

The EIS states the bird habitat island would be comprised of marine sand, be elliptical in shape and have a crest level of 1.0m AHD. The final location and extent of the island would be subject to the actual location and extent of the sand shoals at the time of construction. The LIA will maintain the island on an annual basis, most likely before the spring-summer bird breeding season.

The island could be significantly damaged or lost in a major flood due to its location. The LIA is committed to ensuring sufficient bird habitat is provided at the entrance for bird breeding. Annual renourishment including the provision of courser shell grit material on the crest of the island will be carried out by the LIA before mid November each year.

The bird island has been designed as an attractive area to encourage both roosting and nesting of threatened bird species. The island has been designed concurrently with other measures (e.g. fencing, provision of shell grit) to encourage the use of the island by bird species as much as practicable.

4.3.2 Construction Program

One submission (DIPNR) commented that the construction program as proposed in Section 6.10 in the EIS is unacceptable as the entire works should be completed in their entirety. In particular the extension to the Little Lake rock groyne should be a prerequisite to beach nourishment.

Consideration

This matter was discussed earlier, refer to **Section 4.2.5** for a discussion of the reasons it is preferred to delay the construction of the rock groyne until after the nourishment of Warilla Beach.

4.4 Budget/Costing

4.4.1 Project Budget

A small number of representations raised concern that the \$4 million budgeted for the project, may not be sufficient to ensure all works proposed in the EIS are carried out.

Consideration

The Independent Review Panel's (IRP) report to the NSW Government recommended amongst other things that the NSW Government provide in principle support for Option 9 ... recognising that it will cost an amount as estimated by Government for its completion over a 2 year period.

The cost for Option 9 was subsequently estimated at \$4 million. Option 9 involved the construction of a northern breakwater, extension of the southern spur wall and channel dredging. Based on this advice, the NSW Government has committed \$2 million toward the project and Wollongong and Shellharbour City Councils have each committed \$1 million.

The proposed work in the EIS is a refinement of the conceptual design supported by the IRP (Option 9). In addition, the proposed work includes provision for minor works on the existing southern training wall and extension of the groyne at the mouth of Elliot Lake, which were not included (or costed) in Option 9.

The LIA and / or respective Council intend pursuing additional funding opportunities eg government grants, as they arise, to ensure all the works in the EIS are eventually undertaken.

In addition, the LIA receives an annual allocation of about \$0.5 million each year from the NSW Government under the Estuary Management Program for restoration works. Wollongong and Shellharbour City Councils, match the NSW Government's allocation either in cash or 'work in kind' giving a total restoration program budget of about \$1 million pa. As an alternative to seeking additional funding opportunities as described above, it is possible the LIA would budget to complete proposed entrance works from its restoration program budget subject to other work priorities and availability of funds.

4.5 Impact

4.5.1 Water Quality

A small number of representations indicated that the water quality benefits of the proposed works have not been adequately defined in the EIS and remain poorly quantified. Others indicate that it would be more effective to control pollutant inputs from the catchment rather than undertake entrance works.

Consideration

The EIS states that the proposed works will not solely achieve improvements in water quality, but are part of a larger strategic plan developed by the LIA to implement total catchment management. The LIA has been working closely with Wollongong and Shellharbour City for the past 17 years to address a range of problems to improve the environment of the lake and its foreshores. More recently, the LIA has been working with the Southern Rivers Catchment Management Authority (SRCMA) to address catchment issues that affect water quality in the lake. Further, the chair of the SRCMA is a member of the LIA and is well aware of the huge task facing the LIA to address a range of issues, including water quality.

Data sets from recent and historical sampling of lake waters were reviewed in the EIS. Long term trends and historical trends in water quality were assessed and compared to ANZECC (2000) guidelines. Factors affecting water quality in the lake were also addressed in the EIS.

The EIS states that based on a number of data sets, the present water quality in the lake as represented by the median measured values exceeds the recommended guideline values for many of the water quality parameters. The parameters that most notably exceed the guidelines are phosphorus, nitrogen and sometimes chlorophyll-a. This indicates that Lake Illawarra is currently trending towards eutrophication at times, a term given to a water body which has an excessive concentration of nutrients and macroalgal growth. This observation is consistent with occasional visual sightings of algal blooms within shallow regions of the lake at times.

The EIS indicates that the numerical model set up to assess the impact of stage 1 works on water quality (pollutant concentrations) is still valid for the purposes of assessing water quality improvements for stage 2 works. Based on the assumptions used in the numerical modelling and the range of different entrance conditions modelled, it could be concluded that the proposed works would result in approximately a 30% reduction in pollutant concentration in the lake – based on an assessment of the relevant lake modelling (Lawson and Treloar, 1994). This is considered to be a significant improvement.

Given that the catchment area is about 7 times the size of the lake and two-thirds of the catchment has been cleared for urbanisation and agriculture, a significant amount of money would need to be spent to control and treat stormwater runoff. Current best management practice techniques to control and treat pollutants (nutrients and sediments) from stormwater runoff, include ‘Stormwater Quality Improvement Devices’ (SQIDS) and constructed wetlands. Provision of these measures is expensive - it would be expected that costs of the order of \$100 million would be required for the whole catchment, which is much greater than the \$4 million budgeted for the proposed works. In addition, to the capital cost of putting these measures in place, to ensure they operate at peak efficiency (say 50% to 80% removal), a program of regular maintenance must be provided. Assuming 2% of the capital cost per annum (not unreasonable) is required for long-term maintenance this equates to \$2 million pa. Further, the siting of these measures often requires a substantial land take and given that most of the catchment is in private ownership, the take up of the small amount of public land may be inappropriate in most cases.

Notwithstanding the above, the LIA has long recognised that a combination of catchment works and in lake works are required to meet its aims of improving the environment of the lake. Since

the LIA was established approximately 40% of the major drains (> 225mm diameter) have been treated with some form of pollutant control. The LIA will continue to address stormwater pollution inputs to the lake as part of its ongoing works program.

4.5.2 Lake Ecology

A small number of representations believe that increased salinity levels in the lake because of the proposed works would result in a significant change to the ecology in the lake.

Consideration

The EIS addressed this issue in detail in the Flora & Fauna Assessment Report, Appendix G.

The ecological assessment concluded amongst other things that:

- The terrestrial riparian ecology of the locality in the immediate vicinity of the proposed entrance works was not significantly changed to that reported in the EIS (1994) and there were no listed threatened terrestrial species of concern in the locality which would be likely to be impacted by the proposed works.
- The aquatic ecology of the locality in the immediate vicinity of the proposed entrance works was described by reference to the original EIS plus specific descriptions provided in a number of published studies from the lake, lake entrance and near-shore rocky reef ecosystems. It was concluded that there were no threatened species of concern in the locality which would be likely to be impacted by the proposed works.
- The proposed construction works would be confined to the entrance channel and ocean beach sands and no significant areas of terrestrial vegetation or habitat or of rocky shore or reef habitat would be impacted by the works.
- The proposed works would provide more stable entrance channel which would, over the long-term, stay open for longer periods than presently. The entrance would continue to shoal and scour and is expected to close from time to time. That is the lake will remain an ICOLL with all the aquatic characteristics of an ICOLL.

Whilst there are expected to be very minor changes to the long-term average entrance and lake water levels, and to long-term average salinity, the changes are well within the normal range of these parameters measured over the long-term and the lake and entrance channel would continue to experience water level plus salinity changes from other influences within the present range of these factors.

That is, whilst the lake is still expected to experience a range of water level and salinity variations in a manner similar to the way the lake has operated previously, the overall impact of the entrance works on water level and salinity is expected to be one of smoothing out the extent of the variation. That is, the entrance works are likely to result in an overall narrower long term range in water level and salinity variation with fewer hypersalinity events and less water level drawdown due to evaporation. This smoothing out of the range of variation would benefit the ecology of the lake by decreasing the risk of drought water drawdown on shallow water and marginal ecological communities such as seagrass beds and saltmarsh communities.

In this respect, the EIS also states that given that the modelled range for the proposed entrance works fall within the actual range of long-term lake level variation, little change in saltmarsh distribution arising from the proposed works would be predicted. Changes in the area and distribution of saltmarsh habitats would however, continue to occur as a response to natural climatic variation.

In addition, given that there is a high probability that the entrance will remain open during a prolonged period of dry weather, lake levels will be kept sufficiently high to cover seagrass areas and maintain the ecology of the lake. The drought of 2002/03 resulted in the closure of

the lake and a significant drop of 0.5m in lake water level due to evaporation. Monitoring studies indicated that the drop in water level exposed vast areas of sea grass and mud flats around the margin of the lake. Seagrass meadows damaged by the drought conditions are only now showing signs of recovery.

Whilst there are water quality, water level and aquatic ecology monitoring programs underway in Lake Illawarra, a specific water level, water quality and aquatic ecology monitoring program will be instigated once the EIS is approved to provide data from before, during and after Stage 2 entrance works with the aim of quantifying the changes predicted by the EIS.

4.5.3 Lake Flooding

One detailed submission was received raising concerns about the methodology used to model flood behaviour. A small number of representations indicated that the proposed works may result in an increase in flooding to surrounding foreshore areas.

Consideration

The EIS states Lawson & Treloar conducted a study on the tidal hydrodynamics and freshwater flood behaviour at the lake entrance as part of an investigation into the feasibility of a range of possible breakwater / training wall general arrangement options. Channel widths of 80m, 100m and 120m were considered during the investigation.

The flood investigations indicate the optimum wall separation distance is between 90m and 100m at mean sea level, taking into account self-scouring potential and the impact on peak flood levels. A separation width of 90m has been adopted.

Water level rise in the lake depends on a number of factors including rainfall duration, the volume of stormwater runoff and the degree of shoaling at the lake entrance. The investigation concluded that changes to peak flood levels within the lake would be negligible as a result of the proposed entrance works.

Additional Information

Entrance Hydraulic Numerical Modelling

In 1994, Lawson & Treloar completed a detailed hydraulic assessment of proposed Stage 1 entrance works. The model system used for the work was MIKE-11, which is composed of a number of modules – hydrodynamic, sediment transport, advection dispersion and water quality (amongst others). The assessment investigated a number of entrance options with different entrance conditions of 40m², 70m², 150m² and 300m² on lake tide and flood levels, sediment transport, tidal penetration and water quality (pollutant removal). The outcome for the 150m² and 300m² cases showed no effect on flood levels. The proposed entrance would have a cross-sectional area of 160m² and hence would not affect flood levels.

A ‘Breach Model’ was formulated for entrance shoaled conditions to provide physically realistic results. Unfortunately no reliable site specific quantitative data on rates of entrance development during floods was available. Breach model data from the Shoalhaven River was considered. The entrance erosion rates used in the design runs were adopted with a breach opening rate of the channel flow area ranging from 4.5m²/hr for the 1%AEP flood event to 2.5m²/hr for a 100% AEP event. The scour rates adopted were considered realistic.

Flood Study

In 2001, Lawson & Treloar completed a flood study on behalf of the LIA, Wollongong and Shellharbour City Councils. The study was undertaken by refining mathematical models

developed for the Lake Illawarra Entrance Improvements – Hydraulic Numerical Modelling (1994). The hydrologic model RAFTS was utilised to determine catchment runoff and for routing flows downstream to the lake body. Predicted hydrographs from RAFTS were then input to the hydraulic model MIKE-11 for the determination of peak flood levels and flooding extents. The hydrologic and hydraulic models were calibrated to the June 1991 flooding event (a major flood). The 36 hour storm was found to be the critical duration for peak lake water levels.

Peak lake flood level estimates for a range of design rainfall events, including the 1% AEP and extreme event, under existing catchment and lake conditions were determined. The 1% AEP flood level for the main body of the lake was determined to be 2.3m AHD. This level would not be increased by the proposed works (Lawson and Treloar, 2004).

Existing flood behaviour was assessed taking into account catchment rainfall, ocean water level, wave set-up and entrance conditions (including erosion rates).

Both Wollongong and Shellharbour City Councils have adopted the Flood Study (2001) findings.

Floodplain Risk Management Study & Plan

In 2005, the LIA, in conjunction with Wollongong and Shellharbour City Councils, completed a Floodplain Risk Management Study and Plan for Lake Illawarra (2005). The study examined a range of structural and non-structural solutions, including the proposed entrance works. The study recommended:

- Continued maintenance of the entrance channel;
- Continuation of the LIA's entrance opening policy should the entrance of the lake close, ie mechanically open the lake when water levels reach 0.8m AHD as measured at the Cudgeree Bay automatic water level station;
- Implementation of planning development controls (matrix) for different flood risk precincts;
- Further expansion of 'flood intelligence' for the State Emergency Service including information transfer from Councils to the SES, preparation of a flood evacuation plan showing flood free road routes and locations of flood free evacuation centres;
- Detailed consideration of expanding the current Caravan Park flood warning system to an email or SMS flood information service for all residents in the floodplain;
- Undertaking of regular public education and awareness campaigns; and
- Review of the adopted freeboard based on new estimates of climate change approximately every five years.

Mr Rudi Van Drie in his submission raised a number of questions concerning the modelling. Responses to the questions are given below.

1. Where are the plots of total inflow hydrograph and outflow hydrograph for the lake storage potential (Storage Routing)?

A: The inflow hydrographs for the flood flows used in the entrance morphological modelling were the same as those used in the Flood Study (Lawson and Treloar, 2001). They can be found in that document. The morphological modelling also included the astronomical tide and wave processes. No entrance area hydrographs were plotted. The assessments undertaken for the impact study was not a flood study in accordance with the NSW Floodplain Development Manual (2005) and therefore did not repeat the adopted flood study. Consequently outflow hydrographs were not needed and the key issue for the flood assessment is the impact on existing flood levels (and therefore extents).

2. Are these hydrographs an integral result of the new scour model for the entrance?

A: No, they are not. Hydrographs of discharge and sediment flux could be plotted at selected cross-sections. Output is assessed in terms of bed change and water level.

3. Has the 1994, 300m² entrance option configuration been evaluated utilizing the new scour model? If not, why not?

A: No, it was not. The 300m² entrance would be too wide to be consistent with the need to have some tidal scouring of the entrance. The concept of designing the entrance on the basis of cross-sectional area has been replaced by the tidal scouring and flood impacts issues, which set the hydrodynamic and morphological bounds for a new entrance. A larger entrance would be affected by entrance shoaling more than the proposed entrance.

4. What is the variation in scour rate for the entrance over the duration of the various flood events?

A: Scour rate depends on location in 'the entrance' – there is also deposition at some locations. The model was verified using observations and data from the entrance opening event of May, 2003. 'Scour rate' is not a term used in the Delft3D modelling system. It would be possible to describe depth change with time at selected locations, but entrance performance is an integrated process and single point outcomes are less important.

5. What is the range of scour in volumetric terms? That is m³/s material mobilized over time. A hydrograph of scoured material would be useful!

A: During the 100 Years ARI flood simulation described in Lawson and Treloar (2004), the entrance at cross-section 2 increases by approximately 170m² during the flood event. The average scour of the entrance at cross-section 2 is approximately 7m²/hr. It must be noted that this is the scour rate at a particular location within the entrance and that entrance scour has significant spatial variation. The rate of entrance scour in the model has been verified using data from a lake opening in May 2003.

6. Why has the storage routing capacity of the lake system not been evaluated in the light of the new scour model?

A: The entrance study was not a flood study. However, the proposed entrance works were shown not to increase the peak water level in the lake for the 100 years ARI inflow hydrograph. Storage routing procedures (such as those used for hydrological modelling where estimates of stage/storage function are commonly used as an approximation to evaluate the conveyance of flows through a 'basin' or 'storage' system such as the Lake) were not used in the flood (hydraulic) modelling as the hydraulic model explicitly considers the storage in the Lake system. The hydraulic models used for the study included the lake and entrance bathymetry in great detail and the correct storage was included in both the flood and morphological models.

7. Why is it not highlighted that the peak flood level of the lake could be reduced as recorded in the 1994 study to just below RL 2.0m AHD instead of at 2.3m AHD as has been adopted for this EIS.

A: It is not appropriate to construct a wider entrance because such an entrance would not be self-scouring. A deeper entrance within the proposed 90m entrance breakwaters gap would be less sustainable than the one proposed.

8. The 1:100 yr flood level of the lake is NOT 2.3m AHD!

A: The Lawson and Treloar (2001) flood study was based on calibrated, high-level hydrological and hydraulic modelling systems. A level of 2.3m AHD was determined for the main lake body and is considered to be a realistic estimate of that parameter.

9. Why has this level been adopted as being the gospel of the lake flood level?

A: This level has been adopted for flood planning purposes from the findings of the 2001 flood study in a similar manner to the majority of other areas in NSW where the 100 year ARI flood event has been adopted as the 'planning flood' for certain types of development. For other types of development the Probable Maximum Flood can be adopted for the planning level. The entrance simulations (Lawson and Treloar, 2004) showed only that the proposed works would not increase flood levels in the lake when simulations were undertaken with the 100 years inflow hydrograph.

4.5.4 Coastal Processes

A small number of submissions raised concerns about the impact the breakwaters would have on coastal processes on Perkins Beach over the longer-term.

Consideration

The EIS states that the longshore transport of sediment from Perkins Beach is predominantly in the northerly direction at an annual net rate of 24,000m³. However, there is a local reversal of long shore transport at the southern end of Perkins Beach producing a southerly sand feed estimated at 3,500m³ per year as a result of waves propagating from the east north-east direction. A conceptual model of sediment movement near the entrance was prepared. Sediment transport from Perkins Beach is also increased at present when the local beach plan-alignment is very curved.

The northern breakwater would intercept and modify the natural dynamic circulation of sand moving southwards along Perkins Beach in the local area of the entrance. The net impact on Perkins Beach will depend upon the plan position of the entrance bar and the relationship between the bar and potential onshore sand transport pathways. There would be no identifiable effect on Perkins Beach, other than very locally, because the volumes of sand moving past the proposed breakwater would be very small compared with the Perkins Beach itself. Note, though, that this entrance bar would be affected also by flood flows. It is expected that over time there would be some sand accumulation on the northern side of the breakwater forming a fillet and slight realignment of the beach in the locality.

DIPNR in their submission indicated that the EIS should have addressed the longer-term prospect of continued sand feed into the entrance. Questions that should have been considered include:

1. What will be the long-term changes to the beach morphology ie slope, alignment orientation, rotation and degree of variability with respect to the proposed entrance work?

A: The likely changes to the southern end of Perkins Beach will be very similar to those observable on the northern side of Swansea channel entrance. There would be a gradual widening of the beach near and north of the proposed wall, causing some local plan realignment. Beach variability will be no greater than it is at present.

2. How will the entrance currents change the wave climate and associated near shore sediment transport and deposition?

A: Entrance currents occurring during a major flood will remain as they occur at present, except that the training walls would prevent entrainment of sand from Perkins Beach. The entrance currents would have only a minor effect on local wave climate. There will be a gradual transport of sand from the entrance on to the beach areas south and north of the proposed entrance following flood events. Following a flood, some entrance sand will be transported by wave action back on to these beach areas rather than into the entrance.

3. What is the long-term littoral movement of sand within the beach compartment and around Windang Island and how will the new entrance works change this?

A: Windang Island and the groyne that connects it to the mainland separate Warilla and Perkins Beaches into individual beach compartments. They are essentially closed beach systems held within headlands at their southern and northern ends. Hence there is little or no gain or loss to/from these beaches. Some sand will be lost from Warilla Beach by wind-blown transport over the Windang Island groyne crest and leakage through the small gap that exists between the groyne and Windang Island during a significant storm event.

The DEC submission asked whether sand inundation of the rocky shores of Windang Island would affect the roosting of Sooty Oystercatchers. The Sooty Oystercatchers roost on both the intertidal and riparian rocky shores of Windang Island. For the most part the intertidal rocky shores around the island are kept free of sand buildup by tidal and wave scouring and there is no significant build up of drift sand on the riparian rocky shores. The sand tombolo which joins Windang Island to the mainland is all intertidal and the width and height of this tombolo varies with varying tidal, wave and wind drift behaviour. As a result the intertidal rocky reef on the western side of the island is intermittently covered and uncovered, exposing more or less rocky roosting habitat for use by Sooty Oystercatchers. Whilst the proposed entrance works are likely to have some impact on the overall longshore transport of beach sediments the build up of sand on the eastern Windang Island rocky shore would still fluctuate under the varying driving conditions of accretion and erosion. Accordingly the fluctuation in total rocky shore area available for Sooty Oystercatcher roosting around Windang Island is not expected to be significantly different to that currently available.

4.5.5 Climate Change

One submission indicated the EIS provides limited consideration of climate change issues. The impacts of climate change within the design life of the proposed entrance works may influence the long term effectiveness of the proposal and the diverse range of physical processes such as flooding, rainfall intensity / frequency, evaporation, wave climate, sea level and sediment transport. Clearly, predicted sea level rise will affect average water levels within the lake directly if the lake entrance remains open.

Consideration

The weight of scientific evidence available predicts accelerated Sea Level Rise (SLR) over the course of this century. The extent of SLR is not definitive and predictions rely on a range of global atmospheric models driven by various greenhouse gas emission scenarios.

The Inter-governmental Panel on Climate Change (IPCC), which was jointly established by the World Meteorological Organisation and the United Nations Environmental Program in 1988, remains the most authoritative source on global climate change predictions. The 2001 publication by the IPCC indicated a broad range of possible predictions of SLR over the period from 1990 to 2100 ranging from a low of 9 centimetres to a high of 88 centimetres. The different SLR estimates were derived based on various emission scenarios, covering a wide

range of the main driving forces of future green house gas and sulphur emissions. For a mid range A1B scenario, the SLR at 2100 was 0.4 m. For the A1F1 scenario (which gave the highest SLR for six illustrative emission scenarios) the SLR at 2100 was 0.5 m. In effect, the predicted result of an increase in MSL is that the active nearshore profile (and by consequence, ambulatory boundaries such as those defined by reference to the MHW), will readjust to a more landward position over time.

A mean sea level rise of 50 centimetres would result in a higher mean lake level and consequently higher flood levels. The current mean lake level is about 0.25m AHD, so a 50cm rise in mean sea level should equate to a similar increase in mean lake level (i.e. up to 0.75m AHD when the entrance is open). Such an increase would occur regardless of proposed entrance works. However, the lake setup level of 0.25 m may change slightly with a higher MSL.

The design of the rock structures, including the size of rock required from a hydraulic stability aspect, has taken into account sea level rise by way of the conservative approach undertaken in the design.

4.5.6 Commercial and Recreational Fishers

One submission raised concerns that the proposal will change the ecology of the lake with consequent impacts upon commercial and recreational fishers.

Consideration

The EIS states during construction there is a potential to disrupt both commercial and recreational fishing and prawning activities in the entrance channel.

As previously stated above, changes to lake water level and salinity are likely to be small and certainly within historic natural variation. There is not expected to be any significant change to the ecology of the lake as a result of the proposal. Potential impacts on commercial and recreational fishers are therefore likely to be negligible.

There may in fact be beneficial impacts for fishers arising from the entrance being open for longer periods on average than the current situation. Under the current opening regime, during periods of prolonged drought the entrance channel may be closed for long periods during which fish and prawns cannot make their run to sea and larvae plus juveniles of fish and invertebrate marine biota cannot be brought back into the lake. This can lead to changes in fish and invertebrate stocks in the lake which do not benefit either fishers or the overall estuarine ecology. The problem of impediments to fish passage is recognised by the Department of Primary Industries Fish Habitat Management Guidelines as a major problem for fish ecology.

4.5.7 Navigation

A small number of submissions raised concerns about the safety of navigating through the new entrance.

Consideration

The EIS states the objectives of the proposal is not necessarily to make the entrance more navigable, however it is acknowledged that some boat users of the entrance channel may attempt to navigate through the new entrance. A bar will form at the entrance, which could make navigation dangerous.

The LIA will be consulting with the NSW Maritime Authority about entrance safety provisions such as warning signs etc.

4.5.8 Public Access to Entrance Area

A small number of submissions indicated public access to Windang Island and the swimming areas south of the southern breakwater not be restricted during construction works.

Consideration

The EIS states that public access to Reddall Reserve (near the proposed compound), and the northern side of the entrance channel (where the haul road and stockpile site is located) would be restricted during construction.

Access to Windang Island and the swimming area south of the southern breakwater would be available during construction.

4.5.9 Tourism and Recreation (surfing, swimming)

A small number of responses highlighted the fact that tourism is an important industry for the region. Some indicated that the expected improvement in surfing and swimming at the entrance are not supportable and that the Stage 2 works will turn the whole entrance into a stormwater drain which will render it unusable for recreation.

Consideration

The impact the proposed Stage 2 entrance works will have on tourism to the region is discussed in Section 12.1 of the EIS. In summary, it is expected that the works will attract additional visitors to the Lake Illawarra region and coastline.

As discussed in Section 11.8 of the EIS, at present the entrance area is typically comprised of a sand delta, whose shape and extent are constantly changing in response to prevailing freshwater flood and coastal processes. As such, surfing and swimming conditions in the vicinity of the entrance are unpredictable and often dangerous. The proposed Stage 2 entrance works should result in a more permanent entrance channel and therefore create more formalised surfing and swimming conditions. In particular, the sand fillet that would establish to the north of the northern breakwater would provide a more consistent right hand surfing wave.

4.5.10 Roads and Carpark Damage

One submission from Shellharbour City Council, raised concerns that the transportation of rock to the site could cause road and carpark damage.

Consideration

A condition survey of the road and carpark areas will be undertaken prior to the commencement of work. Any damage caused to the roads and carpark during the transport of rock to the site will be repaired to pre-construction condition.

4.6 Miscellaneous

4.6.1 Monitoring

A small number of responses indicated that the monitoring proposed in the EIS is supported or should be modified.

The DEC advised that monitoring of the water should commence as soon as possible (before the entrance works begin) and continue for 2 years after completion of the entrance. The frequency of monitoring should be at least monthly and preferably 3 weekly. At least 3 sites should be monitored including a poorly flushed site such as Griffins Bay, a moderately flushed site such

as Kanahooka and a well flushed site such as Bevans Island. Measures should include chlorophyll-a, clarity (secchi depth or turbidity or light profile) and salinity. A systematic observation and recording of macroalgae growth should be made at specific locations in conjunction with this. Photographic records could also be considered. The water height/salinity/temp/DO loggers should continue at the three current sites. The monitoring should be publicised and results reported in the local media or on the LIA website as they are produced.

The DPI advised that the proposed monitoring of seagrass, aquatic birds, water quality and fish and benthic communities in Lake Illawarra is made a condition of consent in the approval. The DPI's concurrence be sought for the design of the monitoring program prior to its commencement.

Consideration

The EIS states a monitoring program will be established after the proposed works are completed to monitor its effectiveness. The program will involve the monitoring of the following:

- ecology
- coastal/estuarine processes
- flood levels
- water quality

The LIA is committed to carrying out monitoring of the works and will consider including the comments made by the DEC and DPI. Water quality monitoring proposed by DEC commenced in May 2005.

4.6.2 Healthy Rivers Commission Inquiry in Coastal Lakes

One response suggested that there should be a discussion of how the proposal in the EIS fits into the management framework for coastal lakes established by the Healthy Rivers Commission Inquiry in Coastal Lakes (2002).

Consideration

In April 2002, the Healthy Rivers Commission presented the final Report of its independent inquiry into Coastal Lakes to the NSW Government. The HRC recommended a management framework to guide public authorities in their decision making processes relating to four classes of coastal lake – Comprehensive Protection, Significant Protection, Healthy Modified Conditions and Targeted Repair. Lake Illawarra was classified for targeted repair.

The management framework included a list of indicative actions – those most likely to be necessary and effective to achieve intended outcomes. Indicative actions included:

- Design rehabilitation measures for nominated areas and modified ecosystem values (such as protecting selected species, **opening a lake entrance**, aerating a lake water body, implementing stormwater controls.
- Apply and enforce controls for any new development to keep their impacts on lake / catchment health within tolerable limits.

The LIA is working with Wollongong and Shellharbour City Councils to implement actions appropriate for Lake Illawarra as well as the Southern Rivers Catchment Management Authority.

Proposed entrance works are consistent with the LIA's draft strategy and management plans to achieve amongst other things an improved lake environment.

4.6.3 Shallow Recreational Waterway

A small number of submissions asked if when the Stage 2 works are completed, would the causeway/weir be opened to allow better flushing of the shallow recreational waterway adjacent to Reddell Reserve.

Consideration

This is outside of the scope of work for this stage of the project. A determination to whether action needs to be taken such as partially or fully removing the causeway will be made after the entrance has adequately adjusted to the Stage 2 entrance works.

However, it is noted that there is often a significant difference in water levels upstream and downstream of the weir. This suggests that the weir may be contributing to water quality problems within the lagoon (*by preventing adequate flushing*) and drainage surcharge experienced near Reddall Reserve during heavy rains.

It is proposed that some information on upstream/downstream water level variation and current velocity be obtained once the entrance has adjusted to the Stage 2 works to determine if improvements to the weir need to be undertaken. Improvements to increase the permeability of the weir might include the installation of a culvert through the weir, or the total or partial removal of a portion of the weir and replacement with a bridge structure.

4.6.4 Heritage Items

One submission made the comments that the EIS states that there are no non-Aboriginal heritage items listed within the works area. However, previous archaeological studies have found relic railway line and train wheels in and around Windang island (a left over of the Island's quarrying works). These were originally earmarked from the Stage 1 works to be relocated away from the development area should they get in the way (which they did not). It is not clear whether the Stage 2 works will affect these relics.

Consideration

The area required for the construction of the Stage 2 works does not include Windang Island or the immediate vicinity of the island and therefore the construction is not expected to disturb (or require relocation) of any non-Aboriginal heritage items. However, the selected contractor for the works will be given appropriate instructions to follow if a heritage item (Aboriginal or non-Aboriginal) is encountered during the construction phase and the Heritage Office notified.

4.6.5 Justification of the Proposed Activity

A small number of submissions suggested the proposal could not be justified.

Consideration

Section 15 of the EIS sets out the justification for the proposal. Issues examined included:

- The costs and benefits of the proposal and any feasible alternatives; and
- Alternative strategies that may be used to achieve project objectives.

The following principles of ecological sustainable development (ESD) were also considered:

- Precautionary principle;
- Social equity including inter-generational equity;
- Conservation of biological diversity and ecological integrity; and

- Improved valuations pricing and incentive mechanisms.

In addition, the economic appraisal carried out for entrance works by Sloane, Cook and King (1995) concluded entrance works would:

- Reduce the frequency of algal harvesting, improve water quality and create more stable and sustainable ecological conditions;
- Provide significant recreational and tourism benefits due to increased water based activities;
- Provide increased protection to public assets and private properties along Warilla Beach fronting the seawall;
- Reduce the risk of flood damage to low lying properties around the lake; and
- Increase commercial and recreational fish and prawn catch.

The average economic life of the major capital works was assumed to be 40 years.

A major justification for the works is that there would be a high probability that the entrance will remain open during a prolonged period of dry weather, keeping lake levels sufficiently high to cover seagrass areas and maintain the ecology of the lake. Drought periods in the past have resulted in mean lake levels dropping by up to 0.5m, exposing vast areas of mud flats, damage to seagrass meadows and associated habitat areas.

After re-examining the above reasons, and the additional information it is concluded that the project is justified.

5.0 Correspondence

5.1 Correspondence from Government Agencies

Six (6) submissions were received from Government agencies. Of these, four (4) submissions were received from State Government agencies, one (1) from a Commonwealth Government agency and one (1) from a Local Government agency.

Submissions were received from:

NSW Government Agencies

- Department of Environment and Conservation (EPA, NPWS)
- Department of Infrastructure, Planning and Natural Resources
- Department of Lands
- Department of Primary Industries (Fisheries)

Commonwealth Government Agencies

- Department of the Environment and Heritage

Local Government Agencies

- Shellharbour City Council

A copy of each agency response is contained in **Appendix B**.

Issues raised by the government agencies have been addressed in **Section 4** of this report.

In addition to the above, government agencies in their correspondence indicated that if the proposal is approved then the following conditions be considered.

Department of Environment and Conservation

Dredging

- The LIA's dredging contractor must apply to the DEC for an Environment Protection Licence under the Protection of the Environment Operations Act prior to commencement of dredging work.

Water Quality

- That a detailed water monitoring program with rationale, precise objectives, a sampling schedule and a reporting strategy be prepared in consultation with DEC (Water & Catchment Science Section). It should be anticipated that water monitoring will begin as soon as approval is obtained and before works commence.

Migratory Bird Habitat

- A qualified ornithologist should be consulted by the LIA prior to the creation of the bird roosting island and annual renourishment to facilitate the likelihood of success of the island as supplementary habitat for migratory sea birds.
- The bird roosting island be created immediately following the commencement of dredging works but not between mid November and the end of February.

- Annual renourishment of the island should occur prior to the summer breeding season before mid November. This condition should be incorporated into the long term management plan for predator control and habitat enhancement.
- To improve the likelihood of success of the habitat island the LIA is to:
 - Provide coarser shell grit on the crest of the island to make it more attractive for Little Terns;
 - Install fencing and sign posts to limit human disturbance and incorporate Little Tern nesting management with respect to predation / disturbance in the same manner as was undertaken for the main-land nesting sites in 2003/04 and 04/05 including the fox management program; and
 - Monitoring of aquatic bird populations plus intense monitoring of nesting birds as undertaken to date and expanded as proposed in Section 4.2 of the aquatic ecology appendix.
- In addition to the above steps, the long term management plan for predator control and habitat enhancement should be prepared by an appropriately qualified person in consultation with a qualified ornithologist. The management plan should incorporate innovative ways to encourage nesting and successful fledglings of the threatened shorebirds as well as the Little Tern within the protected areas and should also address the following issues:

Signage

- Ample interpretative and warning signage for the Little Tern and threatened shorebirds should be installed prior to each summer breeding season in the vicinity of access points to the northern side of the lakes entrance where the Little Tern nested during 2003/04 and 04/05 breeding seasons.
- Signage should also be installed prior to each summer breeding season on the proposed habitat island advising that trespassers will be prosecuted and that dogs are prohibited.
- The DEC has prototypes of appropriate warning and interpretative signage that should be used as a reference. Please contact DEC's Shorebird Recovery Co-ordinator, (Mike Jarmon tel: 4454 9516) in this regard. Furthermore, signage would need to have a regard to sections 118A and 118D of the National Parks and Wildlife Act that provide the basis for prosecution. Please refer to Attachment 1 for an extract of the legislation.
- It would be of additional benefit if the LIA can work with Wollongong City Council to make the northern entrance to the lake a dog prohibited area, as well as work towards ensuring that appropriate signage is installed to, at the very least, prohibit dogs and unauthorised vehicles over the breeding season.

Education Programs

- Given that some loss of Little Tern nests in the last breeding season occurred due to surf lifesaving club vehicles driving through the nesting area, it is advised that the LIA liaise closely with the surf club and other recreation clubs to ensure they understand the significance of the area as habitat for the Little Tern and threatened water birds. It is also advised that these clubs be encouraged to work with Council, the LIA and the DEC in maximising the potential for successful breeding in future seasons.

Fox Abatement Program

- A fox abatement program should be funded and administered by the LIA annually between September and November before the breeding season commences.

Fencing

- The habitat island should be temporarily fenced prior to the commencement of each summer breeding season to inhibit people and dogs from approaching the island.

- The nesting area on the northern side of the lake entrance should also be fenced each breeding season with a reasonable buffer as soon as the Little Tern indicates where it will be nesting that year.

Bird predators

- Bird predators such as seagulls and pelicans should be monitored and measures should be investigated to deterred them from the breeding and roosting areas if they are threatening the success of the breeding and roosting areas for the migratory birds.

Avifauna Monitoring Plan

- The Monitoring plan for wader birds, the Little Tern and other relevant avifauna should be prepared by a qualified ornithologist before works commence.
- The plan should be designed to be able to determine the success of the predator management and habitat enhancement measures in the short and long term as well as the impacts of the proposed works.
- The monitoring program should not only monitor bird numbers, behaviour, nests, eggs and the number of successful fledgings, but also predator and changes in food resources and habitat.
- It should also regularly inform the management program to ensure that timely responses can be made to maximise the potential for successful breeding, feeding and roosting.
- The annual results of the monitoring and management program should be analysed in an annual report and provided to the DEC each year. Such a process would benefit from the involvement of Wollongong University or a consultant ornithologist to thoroughly analyse the impacts.
- In relation to the Sooty Oystercatcher, it is noted that the main roosting habitat for this species in the locality of the works is the rocky reef around Windang Island. The potential for this rocky reef to be inundated by sand as a result of the proposed works needs to be understood along with the implications of any change in habitat in this location on endangered avifauna. The possibility of this occurring should be addresses in the monitoring and management programs.

Saltmarsh

- Although it is acknowledged that no saltmarsh will be directly impacted by the works, indirect impacts could occur following the proposed works. It would be of benefit to the LIA if a monitoring program was developed by a qualified saltmarsh expert to monitor saltmarsh distribution and health in the lake and to better understand the implications of the proposed works on saltmarsh.

Aboriginal Heritage

- Given the cultural sensitivity of the area, personnel working on the project should be made aware of the culturally sensitive environment.
- Should an Aboriginal object be discovered during project works, all work should cease immediately and notification given to the DEC. (Contact Lou Ewins, Manager, Conservation Planning Unit Tel: 9585 6674)
- The proposed haul road should be constructed according to the methodology provided to Navin Officer Heritage Consultants by the LIA.
- In order to avoid inadvertent churning of (possible) cultural deposits, vehicles should remain on formed surfaces eg sealed asphalt road and the haul road and should be excluded from locations that have been identified as having potential cultural deposits.
- If an Aboriginal object is discovered during the activity, work should cease immediately in the subject are and notification given to the Department of Environment and Conservation (Lou Ewins, Manager Conservation Planning Unit Tel: 9585 6674).

The LIA is agreeable to these conditions.

Department of Infrastructure, Planning & Natural Resources

Coastal Processes

- The LIA undertake a detailed monitoring program of erosion deposition patterns within the entrance and the surrounding offshore area by regular surveying. In addition, the dispersion of the nourishment sand at Warilla Beach be monitored by regular survey of beach profiles.

The LIA is agreeable to this condition.

Department of Lands

Northern and Southern Breakwaters

- For construction of the northern and southern breakwaters outside the boundary of the area under the control of the LIA, the LIA should seek acquire the Crown land from the Department of Lands under the Land Acquisition (Just Terms Compensation) Act 1991. The LIA will need to comply with the requirements of the Native Title legislation in relation to the acquisition of the area.

Warilla Beach Nourishment and Elliot Lake Groyne

- A licence will be required to be obtained from the Department of Lands for the sand nourishment of Warilla Beach and extension of the groyne at Elliot (Little) Lake prior to commencement of the works.

The LIA is agreeable to these conditions.

Department of Primary Industries

Dredging

- A Works Method Statement is to be supplied to the Department of Primary Industries for approval prior to the commencement of the works.

Monitoring

- The LIA is to implement a monitoring program following completion of the works, in particular the monitoring of seagrass, aquatic birds, water quality, fish and benthic communities in Lake Illawarra. The LIA is to seek the concurrence of the Department of Primary Industries for the design of the monitoring program prior to its commencement.

The LIA is agreeable to these conditions.

Commonwealth Department of the Environment & Heritage

The Commonwealth DEH considered the LIA's referral (EPBC 2005/1997) under the EPBC Act, and the DEH decided that the proposed action, pursuant to section 75 of the EPBC Act is not a controlled action. However, the DEH has specified that the proposal is to be taken in a specified manner, pursuant to section 77(3) of the EPBC Act.

Manner in which the proposed action is to be taken:

1. Construction works of the inner portion (from chainage 0m to 150m as indicated in Figure 6.1 of the EIS) of the northern training wall, adjacent to the known breeding areas of Little Tern, will be completed before 1 November, prior to the start of the breeding season of the Little Tern.

2. The inner portion of the northern training wall will be buried with no change to beach profiles in the locality so that sight lines from Perkins Beach (for bird species) will not be altered.
3. A sand island, with a height of 1 to 1.5m AHD, will be created adjacent to the dredged entrance channel to provide an alternative breeding / roosting area for Little Tern.
4. The sand island (as described in 3 above) will be fenced and signed posted to prevent predation / disturbance to migratory birds, particularly the Little Tern, from people, foxes, dogs and cats.
5. The monitoring program established with the Illawarra Bird Observers Club by the LIA to undertake aquatic bird surveys, including observations of aquatic bird behaviour, for the haul road construction and rock storage proposal will be extended for a minimum period of two years (until summer 2007/08). This survey will include observations of disturbance impacts on nesting Little Terns.

The LIA has already agreed to implement the works in accordance with the specified manner set out in the DEH 'Determination Notice'.

Shellharbour City Council

Construction Hours

- The construction hours as indicated in the EIS should be adhered to. That is:
 - Monday to Friday – 7:00am to 6:00pm
 - Saturday – 8:00am to 1:00pm; and
 - No work to take place on Sundays and public holidays

The LIA is agreeable to this condition.

5.2 Correspondence to Government Agencies from the LIA

The LIA sent letters dated 3 February 2005 to the following government agencies advising of the EIS and EIS exhibition.

- Department of Infrastructure, Planning and Natural Resources
- Department of Environmental Conservation (EPA and NPWS)
- Department of Primary Industries (Fisheries)
- NSW Maritime Authority
- Department of Lands
- Shellharbour City Council
- Wollongong City Council
- Local Aboriginal Land Council

The LIA sent a letter dated 10 February 2005 including a 'Referral Form' under the EPBC Act for the proposed action to:

- Commonwealth Department of the Environment and Heritage

The LIA sent additional correspondence to the DEC and DEH on 14 March 2005 clarifying questions raised by these agencies about the EIS.

6.0 Additional Investigations Since the EIS Exhibition

There has been no additional investigations carried out since the EIS exhibition, however, additional correspondence was provided to the following agencies to clarify a number of issues.

- NSW Department of Environment and Conservation concerning protected habitats and species; and
- Commonwealth Department of the Environment and Heritage concerning the DEH's proposed Conditions of Consent under the EPBC Act.

A copy of the additional advice provided to each agency is in Appendix E.

The Department of Primary Industries recommended that further modelling studies of likely water quality and salinity changes be undertaken to confirm the predicted outcome of the new entrance works and assist the decision making process.

The LIA has reviewed the water quality modelling referred to in the EIS and determined that further modelling studies of likely water quality and salinity changes is not necessary as the modelling undertaken and referenced in the EIS is considered adequate to predict outcomes of the proposed works.

7.0 Measures, Controls and Commitments for the Proposed Activity (the Preferred Activity)

Section 13 of the EIS details a number of measures to mitigate against potential adverse impacts on the environment. The EIS states, provided these mitigation measures are adopted, the adverse impacts to the environment will be minimised.

Mitigation measures have been adopted for the following key issues:

- Ecology;
- Recreation;
- Noise and vibration;
- Air quality;
- Traffic;
- Visual; and
- Waste.

The recommended mitigation measures for the proposed activity are given below.

Ecology

- The construction program has been designed to minimise disturbance to aquatic biota, with the major concern to limit disturbance on the northern side of the entrance channel shoal over the Little Tern breeding season. It is therefore proposed to cease construction work on the northern breakwater/training wall during the summer nesting/breeding season (between October to March inclusive) if there is evidence that construction is impacting upon bird breeding.
- The construction program would utilise an expanded consultation protocol based on the protocol devised for the construction of the haulage road and stockpile of rock on the northern side of the entrance. If there is a need for any other possible construction related disturbances to the study area (e.g. temporary closure of the entrance for dredging) then the main stakeholders would be informed (including the DEH-NPWS, IBOC, commercial fishers and the Windang SLSC) and any issues would be negotiated under the coordination of the LIA.
- The project proposal allows for the seaward section of the northern training wall to be built so as not to alter the present contours and sight-lines from Perkins Beach (for bird species).
- A buffer zone of greater than 50m would be maintained between any channel dredging or construction works and the existing seagrass beds.
- A cutter suction dredge and turbidity curtains would be applied during the entrance channel dredging to minimise disturbance to both fish and crustacean movements through the channel.
- An aquatic bird roosting island would be constructed in conjunction with the start of the channel dredging component for use by wading bird populations as compensation for the removal of the existing sand shoal currently used as a high-tide roosting area.
- The LIA would continue the management of aquatic bird species visiting the entrance (in particular the Little Tern) by providing people fencing, fox control (ie. traps) and suitable signs to minimise disturbance to the bird populations and nests.

Recreation

- During construction access will be restricted to Reddall Reserve. However, access to the entrance swimming area and Reddall Reserve Beach and the remaining amenities will essentially not be impacted.

- During the channel dredging, the waterway area available for recreational activities will be generally reduced, however some of these activities may be relocated to nearby waters such as the northern foreshore or suitable areas within Lake Illawarra.
- Public access to the portion of the dune within the rock stockpile and haul road footprint will be restricted. However, access to the waterway will still be accessible from nearby locations and as this area is not a heavily used recreational area the impacts will be minimal.

Noise and Vibration

- Employing the principles of Best Management Practice (BMA) and using the best available technology economically achievable;
- Ensuring construction work adheres strictly to the set working hours;
- Scheduling the use of particularly noisy equipment at the least sensitive time of day;
- Where there are several noisy pieces of equipment, scheduling operations so they are used separately rather than concurrently;
- Keeping equipment well maintained;
- Employing quiet practices when operating equipment – for example, positioning idling trucks in appropriate areas;
- Informing workers on the effects of noise and the use of quiet work practices; and
- Where it is established that a particular component of the works is causing a particularly unacceptable noise level, this works should be ceased until it is satisfied that measures have been taken to control the offensive noise.

Air Quality

- Machinery would be kept to well defined areas and truck loading/unloading areas would be confined;
- Truck movements would be controlled by restricting movements to designated roadways; and
- Existing unsealed haulage roads would be upgraded to gravel/ballast covered roads or similar to ensure all weather access.

Traffic

- The transportation of rock to the entrance should adhere to the recommended transportation routes and should not be conducted outside the recommended work hours (ie. between 7:00am and 5:00pm Monday to Friday only and no transportation on Saturdays, Sundays or public holidays). In addition, the truck drivers would obey all existing intersection controls and speed limits, thereby ensuring maximum safety for all road users.

Visual

- Minimal adverse impacts to vistas across the entrance during the construction period have been identified, the most affected being some residents of Reddall Parade; and
- Opportunities for mitigating these impacts are minimal.

Waste

- Avoid waste generation;
- Reuse wastes generated where possible;
- Recycle wastes; and
- Where the above options are not possible, dispose of wastes at appropriately licensed waste management facilities.

The LIA is committed to implementing the above measures and controls to mitigate against any potential adverse environmental impacts that the proposed activity may have.

8.0 Conclusion

8.1 Conclusion

Based on the EIS, and this Representations Report, it is concluded the proposed activity under Part 5 of the EP&A Act could proceed and all the potential impacts which were identified in the EIS and this report, can be appropriately managed through the recommended measures and controls outlined.

Further the LIA is agreeable to conditions recommended by government agencies if the proposed activity is approved. This includes undertaking an extensive monitoring program that will assess the effectiveness of the Stage 2 entrance works and verify the resulting environmental impacts expected.

It is therefore recommended the LIA seek the Minister for Infrastructure and Planning approval under Part 5 Division 4 of the EP&A Act for the proposed activity as outlined in this report.

9.0 References

1. Lake Illawarra Entrance Improvements, Environmental Impact Statement, ERM Mitchell McCotter (1994).
2. Lake Illawarra Entrance Improvements, Clause 91 Report on Responses to EIS, WBM Oceanics (1995).
3. Lake Illawarra Entrance Improvement Options, Economic Appraisal, Sloane Cook & King (June 1995)
4. Lake Illawarra Entrance, Report to the Hon. Craig Knowles MP, Minister for Infrastructure & Planning, Minister for Natural Resources, Independent Review Panel (April 2003).
5. Lake Illawarra Entrance Improvements, Proposed Northern Training Wall off Perkins (Windang) Beach, Lawson & Treloar (September 2004).
6. Lake Illawarra Entrance Works Project (Stage 2), Environmental Impact Statement, Volumes 1 and 2, Patterson Britton & Partners (January 2005).
7. Draft Strategy Plan for Improvements to Lake Illawarra, NSW Public Works (1990).
8. Lake Illawarra Value Management Study, NSW Public Works (1992).
9. Lake Illawarra Works Program Environmental Appraisal, WBM Oceanics (1995).
10. Draft Lake Illawarra Management Study & Plan, WBM Oceanics (2004).
11. Lake Illawarra Entrance Improvements, Hydraulic Numerical Modelling, Lawson & Treloar (1994).
12. Lake Illawarra Flood Study, Lawson & Treloar (2001).
13. Lake Illawarra Floodplain Risk Management Study & Plan, Lawson & Treloar (2005).
14. Sydney Metropolitan Area – Fore-and-Aft Moorings Study, Patterson Britton and Partners (1987).
15. Warilla Beach Coastal Hazards Assessment Study, Australian Water and Coastal Studies (AWACS) (1991).

Figures



Appendices



Appendix A



Appendix B



Appendix C



Appendix D



Appendix E

