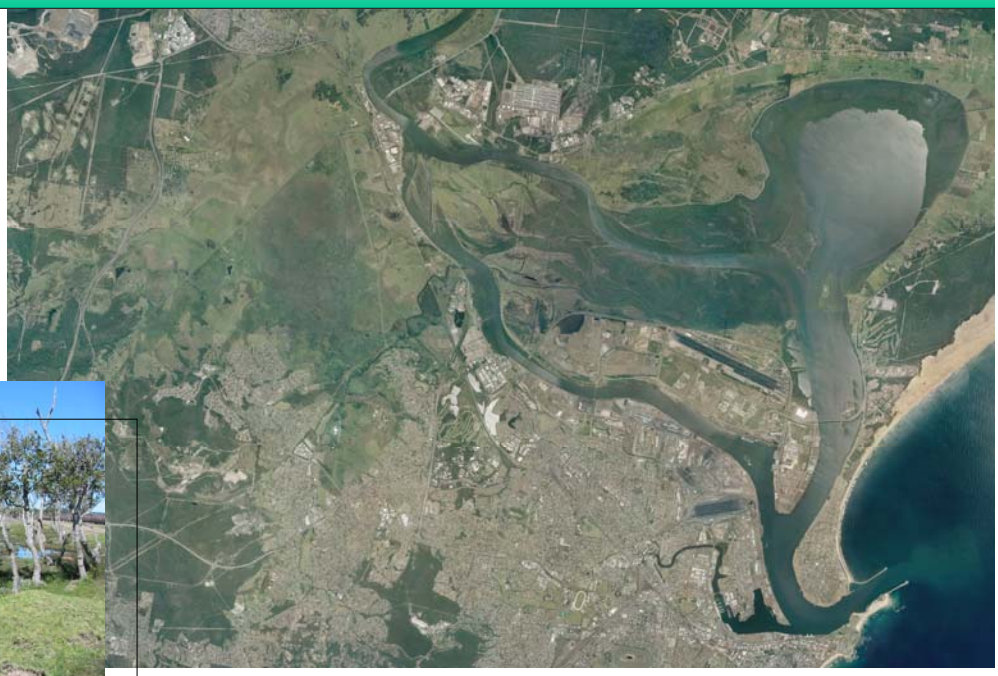
ENVIRONMENTAL ASSESSMENT

ENVIRONMENTAL ASSESSMENT (*SUPPLEMENT*)

HEXHAM SWAMP
REHABILITATION PROJECT

April 2006



Disclaimer:
This Environmental Assessment (Supplement) is to be read in conjunction with the previously prepared Hexham Swamp Rehabilitation Project EIS, which is adopted as the Environmental Assessment for the Project under Part 3A of the EP&A Act.

Hunter - Central Rivers CMA CATCHMENT MANAGEMENT AUTHORITY

WBM OCEANICS AUSTRALIA

Environmental Assessment Supplement

Hexham Swamp Rehabilitation Project

Prepared For:	Hunter-Central Rivers Catchment Management Authority
Prepared By:	WBM Oceanics Australia

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DOCUMENT CONTROL SHEET

WBM Oceanics Australia

Newcastle Office:

126 Belford Street
BROADMEADOW NSW 2292
Australia

PO Box 266
Broadmeadow NSW 2292

Telephone (02) 4940 8882
Facsimile (02) 4940 8887
www.wbmpl.com.au

ACN 010 830 421

Document:	R.N0310.003.00.EA_supplement
Title:	Environmental Assessment Supplement: Hexham Swamp Rehabilitation Project
Project Manager:	Philip Haines
Author:	Philip Haines, Geoff Winning (HWR Ecological)
Client:	Hunter and Central Rivers Catchment Management Authority
Client Contact:	Sharon Vernon / Brett Peterkin
Client Reference:	
Synopsis:	This document is a supplement to a previously prepared Environmental Impact Statement for proposed works associated with the rehabilitation of Hexham Swamp. The information contained in this supplement addresses additional requirements specified by the Department of Planning for consideration under Part 3A of the EP&A Act 1979.

REVISION/CHECKING HISTORY

REVISION NUMBER	REVISION DESCRIPTION	DATE	CHECKED BY		ISSUED BY	
0	final	April 2006	PEH		PEH	

DISTRIBUTION

DESTINATION	REVISION										
	0	1	2	3	4	5	6	7	8	9	10
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EXECUTIVE SUMMARY

Hexham Swamp is an internationally recognised wetland, located on the outskirts of Newcastle, NSW (refer **Figure E1**). Hexham Swamp is currently dominated by freshwater wetland vegetation (mostly *Phragmites australis*), however, some 30 years ago, it contained a much more diverse suite of habitats.

The installation and operation of floodgates in the early 1970s as part of the Hunter Valley Flood Mitigation Scheme has significantly reduced tidal inundation within Ironbark Creek and its tributaries throughout Hexham Swamp. Previous saltmarsh and mangrove areas have been replaced by meadow and reed communities, which have subsequently improved opportunities for grazing by cattle and horses.

A decline in estuarine habitat within the swamp is still being observed some 30 years after the construction of the gates. The loss of estuarine habitat has resulted in a corresponding decline in visitation by migratory waders and waterbirds, while the abundance of local fish, prawns and other marine organisms has also been affected by the loss of nursery areas.

The Hexham Swamp Rehabilitation Project aims to restore some of the previous estuarine habitats and their associated values by opening the existing floodgates at the mouth of Ironbark Creek. Opening the gates will reinstate tidal flows to the swamp, resulting in saline inundation of some existing freshwater reed and pasture habitats. Opening of the floodgates during non-flood times was first recommended less than two years after the construction of the gates, when the first signs of habitat degradation began to manifest. Unfortunately significant action was not taken at that time, or in the 30 years since then, and the estuarine wetlands have subsequently degraded to their present condition.

Privately owned lands that will be directly impacted by the Project have been purchased by the Hunter-Central Rivers Catchment Management Authority (HCRCMA). A number of low level earthen bunds are also proposed to restrict saline intrusion onto other private property that has not been purchased by the HCRCMA. These bunds, as well as a series of other ancillary works, are included in the scope of the rehabilitation project.

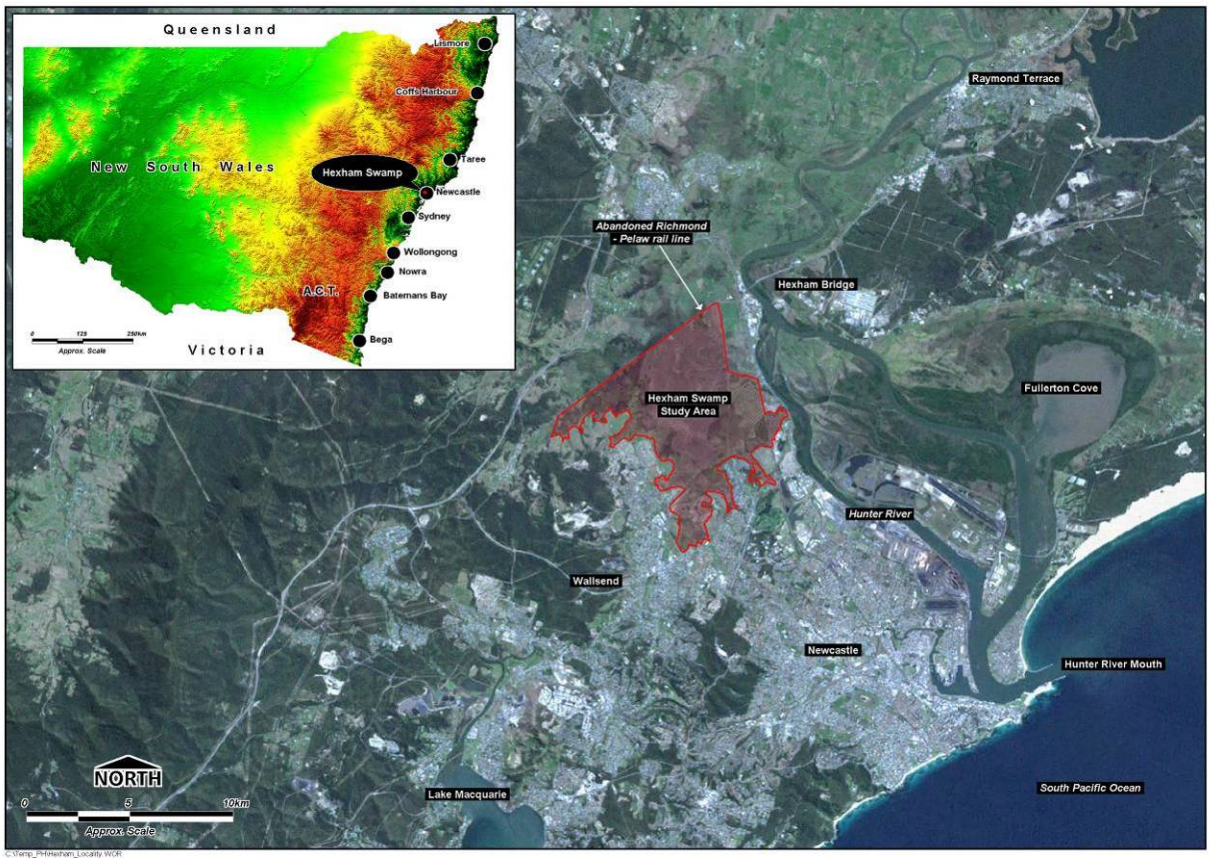

Figure E1 – Hexham Swamp Locality

The new Part 3A of the Environmental Planning and Assessment Act 1979 applies to the Project, by virtue of the Minister for Natural Resources being both a proponent for the works, and having a consent role under the provisions of the Water Management Act 2000. Consent under Part 3A of the Act rests with the Minister for Planning.

At present, one of the eight floodgates is open 300 mm, which allows a small tidal variation within Ironbark Creek. The current mean spring tidal range inside Hexham Swamp reduces from 0.44m upstream of the gates to 0.28m near Minmi Road (at the upstream end of the swamp). This is much smaller than the equivalent tidal range of 1.18m in the Hunter River adjacent to the swamp. High spring tides in the swamp currently reach a level of approximately 0.05m AHD near the floodgates, reducing to -0.03m AHD near Minmi Road, while king tides currently reach 0.20m AHD at the gates, reducing to 0.10m AHD at the upstream end of the swamp. Due to the unidirectional operation and design of the floodgates, the mean water level within Hexham Swamp is approximately 0.16 metres lower than the mean water level in the Hunter River (i.e. -0.16m AHD).

Opening of the floodgates will result in a much more dominant tidal regime within Hexham Swamp. Mean spring tides within the swamp are expected to reach a maximum level of 0.54m AHD at the gates, reducing to 0.41m AHD at Minmi Road, while the king tides within the Swamp are expected to reach 0.67m AHD at the gates, reducing to 0.56m at Minmi Road (i.e. an increase of up to almost 0.5m in both cases). The mean water level in the swamp is also predicted to increase, by approximately 0.3m, to a level of 0.15m AHD (which will be about 0.15m higher than the mean level in the adjacent section of the Hunter River).

The change to the tidal hydraulics of Hexham Swamp will have a range of consequences to an array of chemical and biological processes and characteristics. With regard to water quality, the opening of the gates will increase salinity of waters within the swamp. The works will also increase the degree of tidal flushing of the swamp, with greater interaction between the swamp and the adjacent Hunter River. However, the die-off of saline intolerant vegetation may add a new short-term biochemical oxygen demand to the waters of Hexham Swamp and the adjacent Hunter River.

Given the predicted rise in mean water level within Ironbark Creek, the groundwater levels in Hexham Swamp could also be expected to rise. However, the timeframe to recharge the groundwater reserves and increase groundwater tables is likely to be long (in the order of years to decades).

With regard to vegetation, large areas of Phragmites will be periodically inundated by saline water, which will result in the gradual replacement of this species with more salt tolerant saltmarshes and sedges. Mangroves should also re-establish along tributaries and main channel fringes, where tidal inundation will be regular. It is important to note that not all of the freshwater wetlands at Hexham Swamp will be inundated with saltwater. Large areas within the upper reaches of Hexham Swamp will remain freshwater habitat, including several areas of open freshwater (which are important habitats for freshwater waterfowl).

Table E1 presents the areas of current vegetation types (based on mapping by Morrison, 2000) that are predicted to be inundated by king tide and spring tide conditions when all eight (8) floodgates are open. As seen in this table, the majority of inundation will occur within Phragmites swamp, pasture / grasslands, and freshwater swamp complexes.

Table E1 – Vegetation types to be inundated

Habitat	*King tide inundation (ha)*	*Spring tide inundation (ha)*
Casuarina woodland	26.8	16.0
Freshwater swamp	102.2	26.1
Mangroves	12.3	5.9
Melaleuca woodland	2.0	0.0
Pasture / grassland	80.1	57.5
Phragmites swamp	526.0	227.9
Saltmarsh	5.0	1.2
Typha	0.5	0.0
Urban / industrial	2.7	1.8
TOTAL	***757.5 ha***	***336.3 ha***

If all of the area that is predicted to be inundated by the king tide is returned to estuarine-based habitat (i.e. either mangroves or saltmarsh), then the total area of Phragmites swamp would be reduced by 57%, to 392 ha, and the total area of Freshwater swamp would be reduced by 18%, to 473 ha. However, the increased groundwater levels that are expected to accompany the saltwater inundation are likely to be more favoured by freshwater swamp vegetation, at the expense of Phragmites. Thus in the long term (as groundwater effects are not expected to manifest for many years or even decades), the extent of Phragmites is likely to reduce further, while freshwater swamp habitat is likely to increase in the non-tidal, non-saline sections of the swamp.

Saline intrusion of private lands at Marsden and Alister Streets, Shortland, will be prevented through the construction of a low level tidal-exclusion bund. Exclusion of saltwater from these properties will

prevent a change in vegetation, and thus will not significantly affect the manner is which the land is currently utilised.

The change in vegetation within the swamp is likely to have follow-on habitat changes for a range of fauna, including birds, fish and mosquitoes. An increase in the amount of saltmarsh within Hexham Swamp is likely to result in a return of waders and waterbirds that formerly utilised the estuarine wetlands. Increased areas of mangroves and saltmarshes will also benefit fish and other aquatic species through increased nursery habitat. It is reported that prior to the construction of the floodgates, Hexham Swamp was a major nursery for the Hunter River prawns.

The existing freshwater wetlands environment provides habitat to a number of threatened flora and fauna species, including *Zannichellia palustris*. An eight part test has been prepared to determine the impacts of opening the floodgates on these threatened species (refer ***Appendix H: Volume 2** of the EIS*).

With regard to mosquitoes, the changed hydrology of Hexham Swamp is likely to impact more on species type rather than actual mosquito numbers. The relative abundance of saltwater mosquito species is predicted to potentially increase, while the numbers of freshwater mosquitoes are predicted to decrease within the Hexham Swamp area. Hexham Swamp is a minor contributor to mosquito numbers in the lower Hunter River estuary, as most mosquitoes breed at Kooragang Island or Tomago Wetlands and travel throughout the area.

Some minor engineering works will be required in addition to the opening of the floodgates to minimise the impacts of the inundation on private assets and infrastructure around the swamp. These works will include construction of exclusion bunding at Marsden Street and around the Broadcast Australia Limited (BAL) radio towers, raising the level of the private Wallsend airstrip, improving access along Hunter Water pipeline access track, ARTC rail access track, and The Wetlands Centre tracks, and some minor filling of private lands to prevent potential inundation.

Opening of the floodgates will have a net positive long-term economic impact. The loss of revenue associated with reduced land for grazing will be more than offset by the increase in revenue that is expected from commercial and recreational fishing due to improved quality and extent of fish and prawn nursery grounds. Re-establishment of the estuarine wetlands will also increase local tourism, particularly tourism associated with The Wetlands Centre.

The floodgates are proposed to be opened sequentially. Initially, one floodgate will be opened, followed by approximately 3 - 6 months of monitoring. If no major irregularities in the Swamp's response are recorded, then two (2) gates will be opened. Significant overbank inundation is expected from a two gates open condition, and therefore, the timing of this should occur prior to the winter solstice (king) tides, to allow maximum inundation without the threat of substantial mosquito impacts. Approximately 12 months of monitoring should precede any further opening of the gates to ensure that tidal inundation remains within expected extents. Four (4) gates will then be opened, followed by a further 12 months of monitoring before all eight gates are opened. Intensive monitoring will continue for at least 12 months following opening of all eight gates, after which time a lesser amount of monitoring may be considered until new habitats have established and community structures stabilised.

A detailed monitoring program is proposed before, during and after the gate openings. The before-opening monitoring is currently underway, with available results incorporated into this EIS, as appropriate. The monitoring program includes assessment of water quality, benthic macroinvertebrates, fish, vegetation, birds, amphibians and mosquitoes. Most monitoring will be carried out in the field at a range of spatial and temporal frequencies that take into account the natural variability of the wetlands environment. Where necessary, control (reference) monitoring will also be carried out to quantify the extent of impact.

AUTHOR CERTIFICATION

I, Philip Edward Haines, of WBM Oceanics Australia certify that to the best of my knowledge this Environmental Assessment (comprising a previously prepared Environmental Impact Statement (WBM, 2005) and this Supplement document), contains information that is neither false nor misleading.

Signed: .....

Philip Haines
BE (Hons), MEngSc
MIEAust (member no. 440170), NPER

ENVIRONMENTAL ASSESSMENT REQUIREMENTS *(MODIFICATIONS TO PREVIOUS DIRECTOR-GENERAL REQUIREMENTS)*

Project	A project to rehabilitate the Hexham Swamp by: • opening the existing floodgates located at the mouth of Ironbark Creek in stages so as to restore tidal flows to the wetland; and • carrying out certain works, including filling and the construction of bunds, to minimise the impact of the increased tidal flows on private property owners.
Site	The Project Area includes all of the Hexham Swamp to the south-east of the Richmond-Pelaw railway embankment, covering an area of approximately 1 946 hectares. A list of properties located within the Project Area is provided in Attachment 1 (*refer Appendix J of the EIS (WBM, 2005)*).
Proponent	Minister for Natural Resources
Date of Expiration	These modified Environmental Assessment Requirements expire two years from the date of issue.
General Requirements	The Environmental Assessment must include: • an Executive Summary; • a description of the current statutory processes that apply to this project; • a description of the proposal, including construction, operation, and any staging; • details of the location of the project and environmental planning provisions applicable to the site and the project; • consideration of alternatives to the project; • an assessment of the environmental impacts of the project, with particular focus on the key assessment requirements specified below; • proposed mitigation/ management measures of residual environmental impacts; • justification for undertaking the project with consideration of the benefits/ impacts of the proposal, and proposed management/ mitigation/ monitoring; • a draft Statement of Commitments for environmental mitigation, management and monitoring for the project; and • certification by the author of the Environmental Assessment that the information contained in the Assessment is neither false nor misleading.
Key Assessment Requirements	The Environmental Assessment must address the following key issues: • The issues specified in the Director-General's requirements previously issued to you on 27 July 2004. • Impacts on wetland flora and fauna as a result of the change to Hexham Swamp from a freshwater wetland to an estuarine wetland incorporating information from: (a) recent specific surveys (eg. latest results from baseline monitoring data) and databases such as the Atlas of NSW Wildlife, Australian Museum, Royal Botanic Gardens, and Hunter Bird Observers Club records; (b) revised impact assessment and mitigation measures that may be suggested by any additional records/information obtained in (a) above; • Investigate biodiversity offset strategies as potential mitigation measures where impacts on threatened species or endangered ecological communities have been predicted. (Principles for biodiversity offsets and banking schemes are currently under development by the Department of Environment and Conservation, and can be found at http://www.environment.nsw.gov.au/threatspec/biobankscheme.htm) • The management of actual and potential occurrence of Acid Sulfate Soils with particular regard to discharges of acidified waters to adjacent waterways; • The source(s) of all bund materials, method(s) for transporting bund material to bund sites, and methods for constructing bunds;

	• Changes to the local drainage and the potential to affect flooding behaviour; • Consistency with the Hexham Swamp Nature Reserve Plan of Management 1998 prepared by the National Parks and Wildlife Service (now part of the Department of Environment and Conservation); • Consistency with the aims and objectives of State Environmental Planning Policy No. 14 – Coastal Wetlands; and • The institutional arrangements for managing the construction and operation of the project.
Relevant Guidelines	• Australian and New Zealand Environment and Conservation Council - National Water Quality Management Strategy: Australian Water Quality Guidelines for Fresh and Marine Waters; and Guidelines for Groundwater Protection in Australia. • Acid Sulphate Soil Manual (ASSMAC) • draft *Guidelines for Threatened Species Assessment* (July, 2005), prepared by the Department of Environment and Conservation and the Department of Primary Industries • draft *Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (July, 2005), prepared by the Department of Environment and Conservation
Consultation Requirements	You must consult with the following parties during the preparation of the Environmental Assessment: • Department of Environment and Conservation; • Department of Primary Industries; • Newcastle City Council; • Commonwealth Department of Environment and Heritage regarding the application of the *Environment Protection and Biodiversity Conservation Act;* • Local Aboriginal community; and • Shortland Wetlands Centre.
Exhibition of EA and notification requirements	Pursuant to Section 75H(3) of the EP&A Act, the EA must be exhibited for a minimum of 30 days.
Deemed refusal period	Not applicable. However, consistent with clause 8E(2) of the EP&A Regulations, the Department's indicative assessment period will be 120 days.

CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION

On 25 November 2005, a project application (**PA**) was submitted to the Director-General for Planning for the Hexham Swamp Rehabilitation Project (the **Project**) under Part 3A of the *Environmental Planning and Assessment Act, 1979* (**EP&A Act**).

A development application for the Project had previously been submitted to Newcastle City Council under Part 4 of the EP&A Act. However, Part 3A of the EP&A Act has now become applicable to the Project by virtue of the Minister of Planning's Order gazetted under section 75B(1) of the EP&A Act on 29 July 2005 (see Section 2.1 for more details.)

Director-General's requirements for the Project were previously issued to the Hunter-Central Rivers Catchment Management Authority (**CMA**) on 7 July 2004 when the Project was to be assessed under Part 4 of the EP&A Act. In accordance with clause 8J of the EP&A Regulation 2000, the Director-General has adopted those same requirements under Part 3A of the EP&A Act subject to certain modifications issued on 25 February 2006 (a copy of the requirements is attached in Appendix A.)

The Environmental Assessment report (**EA Report**) for the Project, as required for assessment under Part 3A of the EP&A Act, comprises:

- the *Hexham Swamp Rehabilitation Project Environmental Impact Statement* (**EIS**) (WBM, 2005) (including Volumes 1 and 2), which was prepared for the purpose of the original development application and addresses the Director-General's requirements of 7 July 2004 (a copy of which is provided in Appendix A of the EIS); and
- this EA Supplement, which has been prepared as a supplement to the EIS and addresses the additional Director–General's requirements of 25 February 2006.

The Director-General has taken the EIS to be the EA Report submitted in accordance with section 75H(1) of the EP&A Act. The EIS must therefore be read together with this EA Supplement to meet the requirements of Part 3A of the Act.

The EIS contains the majority of information required for assessment under Part 3A of Act. In particular, it contains:

- A description of the proposal, including construction, operation and staging of the works (*refer Chapter 2 of the EIS*);
- Details of the location of the Project (*refer Section 3.1.1 of the EIS*) and environmental planning provisions applicable to the site and the Project (*refer Section 2.7 of the EIS*);
- Consideration of alternatives to the Project (*refer Section 5.1 of the EIS*);
- An assessment of the environmental impacts of the Project (*refer Chapter 4 of the EIS*);
- Proposed mitigation/ management measures of residual environmental impacts (*refer Chapter 6 of the EIS*);
- Justification for undertaking the Project with consideration of the benefits/ impacts of the proposal, and proposed management/ mitigation/ monitoring (*refer Section 5.3 of the EIS*); and
- Consultation with relevant government agencies and stakeholders (*refer Section 2.8 of the EIS*).

In addition to the above, this EA Supplement provides further information regarding:

- The current statutory processes that apply to the Project (specifically, the application of Part 3A of the EP&A Act);
- A draft Statement of Commitments for environmental mitigation, management and monitoring of the Project;
- Certification by the author that the information contained in the Assessment is neither false nor misleading;
- Assessment of environmental impacts on key areas of concern, including proposed flora and fauna changes, biodiversity offsets, acid sulphate soils, fill material sourcing, and local drainage and flooding;
- Consistency of the proposal with the Hexham Swamp Nature Reserve Plan of Management, and SEPP-14; and
- Institutional arrangements for managing the construction and operation of the Project.

An Executive Summary of the Project is provided both in the EIS and in this EA Supplement.

2 CURRENT STATUTORY PROCESS THAT APPLIES TO THE PROJECT

2.1 Application of Part 3A of the EP&A Act

Prior to the commencement of Part 3A of the EP&A Act on 1 August 2005, part of the Project would have required consent under Part 4 of the EP&A Act, and part of the Project would have required assessment under Part 5 of the EP&A Act.

A development application for the Project was submitted to Newcastle City Council on 20 April 2005 under Part 4 of the EP&A Act. However, due to the commencement of Part 3A of the EP&A Act, the development application was never withdrawn.

On 1 August 2005, by Order gazetted on 29 July 2005[1] the Minister for Planning declared that activities for which the proponent is also the determining authority (within the meaning of Part 5 of the EP&A Act) are projects to which Part 3A of the EP&A applies, so long as the proponent is also be of the opinion that the activity would (but for Part 3A of the EP&A Act) require an environmental impact statement to be obtained under Part 5 of the EP&A Act.[2]

The Minister for Natural Resources has confirmed that it is the proponent for the Project and that the CMA will be carrying out the Project on the Minister's behalf, in accordance with its authorised functions under the *Catchment Management Authorities Act 2003 (NSW)*.

In order to carry out the Project, a flood works approval will be required under section 90 of the *Water Management Act 2000 (NSW)*. As the Minister administering that Act, the Minister of Natural Resources is both the proponent and the determining authority for the Project, within the meaning of Part 5 of the EP&A Act.

Furthermore, the Minister for Natural Resources considers that the Project would (but for Part 3A of the EP&A Act) require an environmental impact statement to be obtained under Part 5 of the EP&A Act.

Accordingly, Part 3A of the EP&A Act applies to the Project.

2.2 Director-General's requirements

The EIS was prepared in accordance with the Director-General's requirements issued on 7 July 2004. In accordance with clause 8J of the EP&A Regulation 2000, the Director-General adopted its requirements of 7 July 2004 under Part 3A of the EP&A Act, subject to certain modifications issued on 25 February 2006.

The EIS has been accepted by the Director-General as the EA Report for the Project, submitted in accordance with section 75H(1) of the EP&A Act. This EA Supplement has been prepared to address the additional requirements issued by the Director-General on 25 February 2006. The EIS and this EA Supplement will together form the EA Report.

[1] Government Gazette 29 July 2005 page 4054.

[2] EP&A Act section 75B(2)(b).

2.3 Clarification of legislative regime in EIS

The EIS was prepared prior to the commencement of Part 3A of the EP&A Act, in accordance with the legislative regime summarised in section 2.7 of the EIS. The EIS has **not** been amended to reflect the current application of Part 3A of the EP&A Act. Accordingly, references in the EIS to the previous legislative regime at the time are no longer relevant.

The EIS must be read together with this EA Supplement, and this section 2 should be considered as an amendment to the legislative regime described in the EIS.

2.4 Approval process under Part 3A of the EP&A Act

A general overview of the approval process is set out below. This summary should not be substituted for a complete reading of the EP&A Act.

Step 1: Proponent submits a project application. An application for the Project was submitted on 25 November 2005, together with an outline of the Project.

Step 2: The Department of Planning seeks comments from relevant agencies and councils. The Department has consulted all relevant agencies, including the Department of Environment and Conservation, and the Department of Primary Industries.

Step 3: The Director-General issues environmental assessment requirements detailing the level of assessment required, key issues to be addressed and community consultation requirements. Requirements were issued on 25 February 2006 and are attached in Appendix A.

Step 4: The proponent prepares an EA Report in accordance with the Director-General's requirements. The EIS and this EA Supplement constitutes the EA Report for the Project.

Step 5: The Director-General will determine if the EA Report is consistent with its requirements and if it contains adequate information. The Director-General may request additional information or refuse to exhibit the Project if the EA Report is insufficient.

Step 6: The Director-General will place the EA on public exhibition for at least 30 days and invite submissions from the public.

Step 7: The proponent will respond to submissions and may be required to modify the project to address issues raised.

Step 8: The Director-General will assess the project and prepare an assessment report, taking into account the views of relevant government agencies, councils and the community. The report may include recommended conditions of approval.

Step 9: The Director-General submits its assessment report to the Minister for determination.

Step 10: The Minister may refuse the project or approve it with any conditions considered appropriate. The determination and the Director-General's report will be published on the Department of Planning's website following determination.

3 DRAFT STATEMENT OF COMMITMENTS BY THE HCRCMA

Item	Commitment	Timing
1. Environmental Assessment	Carry out the Hexham Swamp Rehabilitation Project generally in accordance with the project description in the Environment Impact Statement (WBM, 2005) and Environmental Assessment supplement	Throughout project
2.Flood Risk and Floodgate Operation	Implement Flood Risk & Floodgate Operation Action Plan in accordance with Section 5.2 of the Hexham Swamp Rehabilitation Project Management Plan (refer ***Appendix L: Volume 2*** of the EIS)	Various
3. Tidal Inundation	Implement Tidal Inundation Action Plan in accordance with Section 5.3 of the Hexham Swamp Rehabilitation Project Management Plan (refer ***Appendix L: Volume 2*** of the EIS)	Various
4. Water Quality	Implement Water Quality Action Plan in accordance with Section 5.4 of the Hexham Swamp Rehabilitation Project Management Plan (refer ***Appendix L: Volume 2*** of the EIS)	Various
5. Creek Erosion & Sedimentation	Implement Creek Erosion & Sedimentation Action Plan in accordance with Section 5.4 of the Hexham Swamp Rehabilitation Project Management Plan (refer ***Appendix L: Volume 2*** of the EIS)	Various
6. Habitat Management	Implement Habitat Management Action Plan in accordance with Section 5.6 of the Hexham Swamp Rehabilitation Project Management Plan (refer ***Appendix L: Volume 2*** of the EIS)	Various
7. Pest & Weed Management	Implement Pest & Weed Management Action Plan in accordance with Section 5.7 of the Hexham Swamp Rehabilitation Project Management Plan (refer ***Appendix L: Volume 2*** of the EIS)	Various
8. Fire Management	Implement Fire Action Plan in accordance with Section 5.8 of the Hexham Swamp Rehabilitation Project Management Plan (refer ***Appendix L: Volume 2*** of the EIS)	Various
9. Access and Infrastructure	Implement Access and Infrastructure Management Action Plan in accordance with Section 5.9 of the Hexham Swamp Rehabilitation Project Management Plan (refer ***Appendix L: Volume 2*** of the EIS)	Various
10. Community Education, Involvement & Research	Implement Community Education, Involvement & Research Action Plan in accordance with Section 5.10 of the Hexham Swamp Rehabilitation Project Management Plan (refer ***Appendix L: Volume 2*** of the EIS)	Various
11. Grazing Management	Implement a grazing management regime, in accordance with the Environmental Management System, to achieve net positive environmental outcomes for the wetland.	Various
12. Environmental Management System	Develop and implement an Environmental Management System in accordance with ISO 14001, to guide the day-to-day management of Hexham Swamp, and ensure project objectives are met and continual improvement of environmental conditions.	Throughout project

4 TIMING FOR OPENING OF THE FLOODGATES

Section 2.4 of the EIS states that the initial opening of the first floodgate is to occur in Nov / Dec 2006, with subsequent gates opened in June 2007 (2 gates), June 2008 (4 gates) and June 2009 (8 gates).

The timing of the first floodgate opening was previously based on ensuring maximum dispersal of *Zannichellia palustris* seeds. As outlined in Section 5.1.7 of this EA Supplement, this coincident timing is no longer regarded as critical to the survival of this endangered herbaceous plant. Consequently, the initial gate opening can occur at any time of the year, particularly as increased tidal levels are expected to remain mostly within the confines of existing waterway channels.

Subsequent gate opening should remain staged for successive winter periods, to take advantage of reduced Phragmites stock and non-breeding period for mosquitoes, as discussed in Section 2.4 of the EIS, as well as non-seeding time for grey mangroves, as discussed further in Section 5.1.7 of this EA Supplement.

A minimum period of 3 months is still recommended between the first and second stages of gate opening, thus enabling water levels in the swamp to 'set-up' in response to one gate open before a second gate is modified.

The proposed timing for opening of the floodgates, as adjusted from the EIS, is therefore as follows:

- Prior to March 2007: Open one gate
- June 2007: Open two gates
- June 2008: Open four gates
- June 2009 Open eight gates

5 ADDITIONAL ASSESSMENT OF ENVIRONMENTAL IMPACTS

The assessment of environmental impacts has generally been described in Chapter 4 of the EIS (WBM, 2005). A number of additional assessments have been requested by the Department of Planning, for consideration under Part 3A of the EP&A Act, which are described in this Chapter.

5.1 Flora and Fauna

5.1.1 Introduction

The Department of Planning has requested additional information within respect to determining impacts on wetland flora and fauna as a result of the change to Hexham Swamp from a freshwater wetland to an estuarine wetland in relation to:

- recent specific surveys (eg. latest results from baseline monitoring data) and database searches such as the Atlas of NSW Wildlife, Australian Museum, Royal Botanic Gardens, and Hunter Bird Observers Club records; and
- revised impact assessment and mitigation measures that may be suggested by any additional records/information obtained in the point above;

The baseline ecological survey of Hexham Swamp, undertaken on behalf of the Hunter-Central Rivers Catchment Management Authority (CMA), and specified in Chapter 6 of the EIS, records quantitative data on vegetation, birds and basic water quality parameters (ph and salinity), as well as qualitative and opportunistic data on frogs and other biota. The study commenced in 1997 and, since 2002, surveys have been undertaken at approximately every three months and continue to be undertaken at that frequency. The EIS includes reference to data that were collected and reported upon up to 2003 (Winning & King 2002-2003). Data collected since 2003 have been covered in brief reports to the CMA, and a recently completed Masters thesis on vegetation changes in Hexham Swamp subsequent to the construction of the floodgates (Winning 2006). Relevant data on observed changes in ecological aspects of Hexham Swamp since 2003 are discussed below.

5.1.2 Vegetation

An analysis of the vegetation data up to the end of 2004 by Winning (2006) indicates a gradual but continual change in vegetation. A number of sample sites have been observed to change from relic saltmarsh vegetation to brackish grassland, dominated by *Paspalum vaginatum*, and/or sedgeland, dominated by *Bolboschoenus caldwellii*, in the eight years from the beginning of 1997 to the end of 2004.

The most noticeable change in the vegetation is the increase in the distribution of *Phragmites australis.* An analysis of historical aerial photography by Winning (2006) revealed an approximately linear increase in the distribution of *Phragmites australis* from 170ha in 1966 to 1005ha in 2004 (r^2=0.972). The spread of *Phragmites australis* has continued with a number of sampling sites having been taken over by *Phragmites australis* in the past few years (G. Winning, pers. obs.). Also notable, is the establishment of *Casuarina glauca* within *Phragmites australis* stands, suggesting a

successional trend that would ultimately see the *Phragmites australis* reedswamp being displaced by *Casuarina glauca* forest (Winning 2006).

As stated in the EIS, it is evident that Hexham Swamp is still undergoing successional change initiated by the construction of the floodgates on Ironbark Creek in the early 1970s.

5.1.3 Zannichellia palustris

The endangered plant species *Zannichellia palustris* (Schedule 1 of the *Threatened Species Conservation Act 1995*) was identified as being present in Ironbark Creek and its tributaries within Hexham Swamp. It has also been identified during the baseline ecological monitoring study to occur in shallow, brackish, seasonal ponds within Hexham Swamp. However, as an annual plant species, it is not persistent at any particular location - instead its occurrence in any growing season is dependent on a mix of factors including rainfall (i.e. pond inundation), competition with other plants for a germination substrate, and presence of seeds (which in turn is determined by the previous season's distribution).

Although not always at vegetation sampling sites, *Zannichellia palustris* has been observed in ponds in Hexham Swamp through the baseline survey period, except in years of exceptional drought when the ponds are dry for much of the growing season. Observations of *Zannichellia palustris* at sample sites during the baseline survey are summarised in Table 1. The species has also been observed in ponds at culverts under the Chichester trunk gravity main, and in the '2HD swamp. While systematic surveys for *Zannichellia palustris* with Ironbark Creek and its tributaries have not been made, it has not been observed at previously known locations during casual inspections (in 2002 and 2003).

Table 5-1 Records of *Zannichellia palustris* during the baseline survey

Sample Site	Months *Zannichellia palustris* recorded
13	Sep 1998, Nov 1998, Nov 2000
17	Sep 2002, Jul 2005
18	Sep 2002
61	Nov 2005

5.1.4 Australasian Bittern

The vulnerable bird species Australasian Bittern (Schedule 2 of the *Threatened Species Conservation Act 1995*), was noted in the EIS to occur in Hexham Swamp. As described in the EIS, Australian Bittern is most commonly encountered in shallowly inundated, open areas adjacent to and, preferably, surrounded by reeds (most *Phragmites australis*).

Such habitat was presumably abundant in Hexham Swamp during the period when *Phragmites australis* was expanding into areas of brackish swamp. As can be seen from Figure 5-1, the 1987 and 1993 aerial photographs show a patchy distribution of brackish swamp among Phragmites reedswamp, but this mosaic of habitat has virtually disappeared by 2004 with the expanding Phragmites reedswamp replacing many areas of brackish swamp.

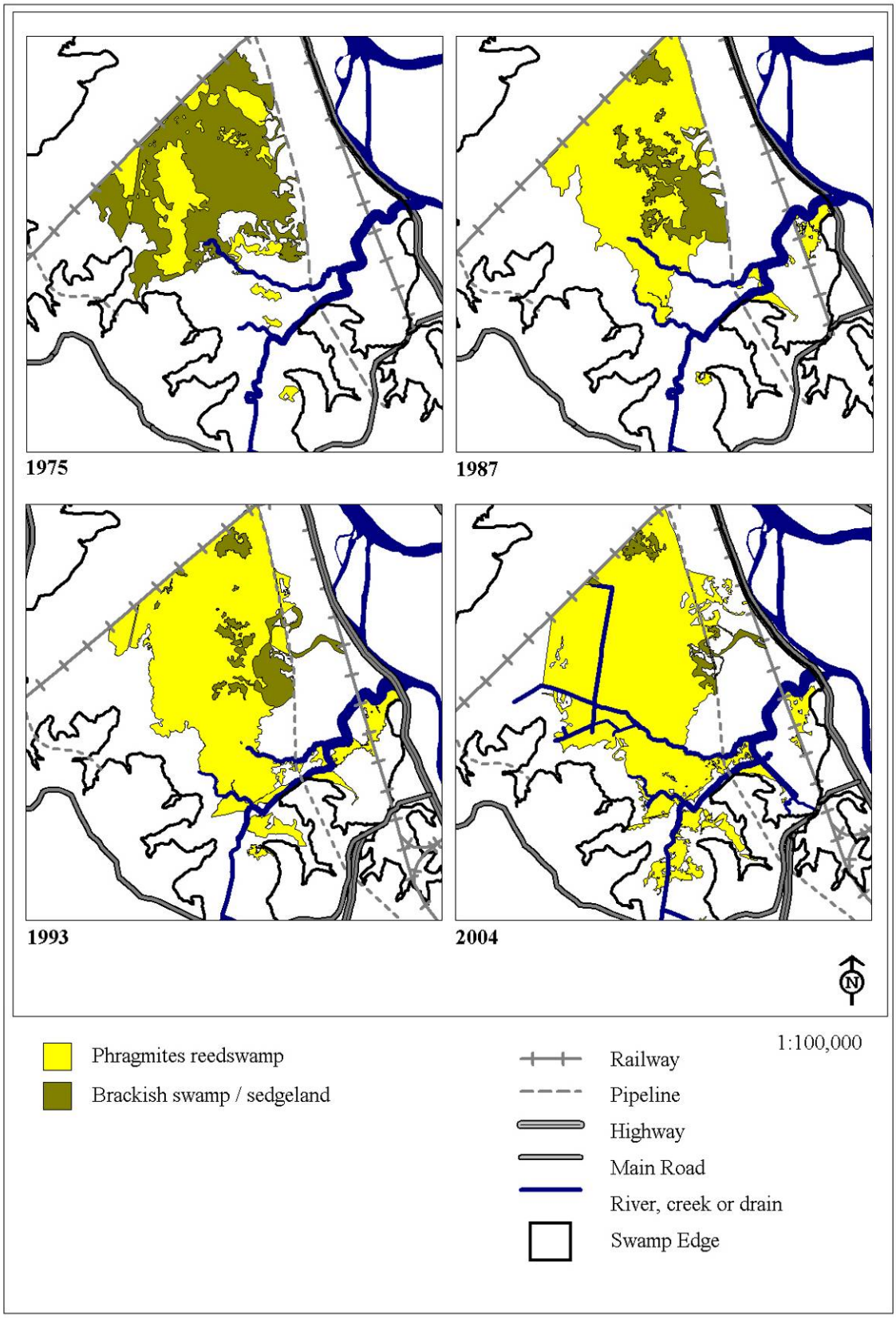

Figure 5-1 Temporal change in the relative distributions of Phragmites reedswamp and brackish swamp (adapted from Winning 2006)

Data on Australasian Bittern observations have been recorded since 2002 along the approximately 7000m of transects in Hexham Swamp traversed during each sampling event. The observations over this period are summarised in Table 5-2. The small number of bitterns observed and the relatively short period over which observations have been made makes identification of any trends difficult, using either statistical or qualitative analyses.

Table 5-2 Records of Australasian Bittern during the baseline survey

Month	No. of Bitterns Sighted
Jun 2002	6
Aug 2002	1
Apr 2004	2
Jul 2005	3

It was noted that Australasian Bittern is more likely to be observed during the winter months, which possibly reflects the presence of surface water (surface water persists longer during the cooler months due to lower evapotranspiration rates). However, an analysis of the data did not reveal any significant correlation between water depth and observations of Australasian Bittern (r^2=0.25). Figure 5-2 presents a graphical comparison of water depth and bittern observations.

Although the observational data do not support analyses of trends, it is evident that habitat for Australasian Bittern is declining and it is likely that usage of Hexham Swamp by Australasian Bittern is also declining.

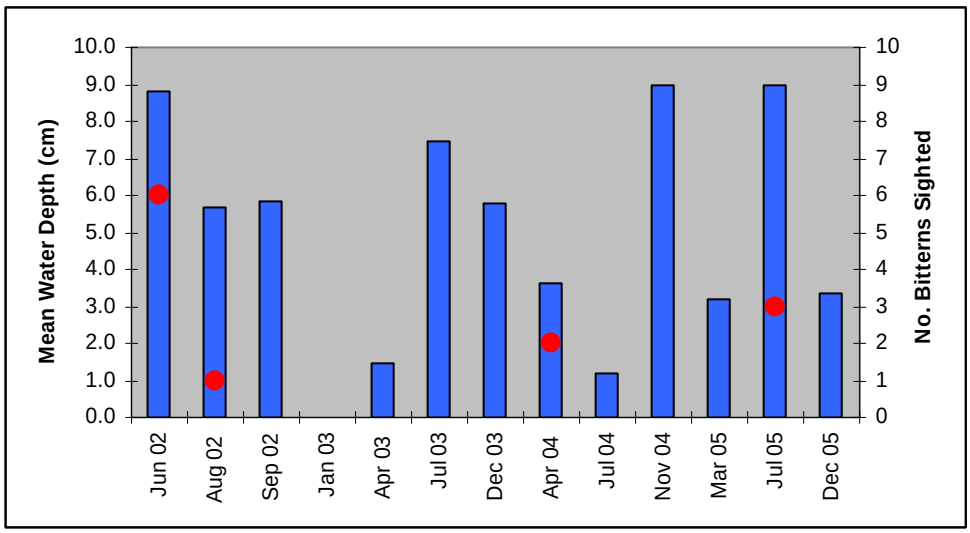

Figure 5-2 Comparison of sightings of Australian Bittern (dots) with mean water depth (average across all sample sites) (columns)

5.1.5 Green & Golden Bell Frog

The endangered Green & Golden Bell Frog (Schedule 1 of the *Threatened Species Conservation Act 1995*), was noted in the EIS as previously occurring in parts of Hexham Swamp (in 1984) but has not been recorded since. The species has been recorded, however, within the nearby '2HD swamp', which was noted in the EIS to support a population of Green & Golden Bell Frog.

The baseline ecological survey includes opportunistic records of frogs in Hexham Swamp as well as targeted searches for Green & Golden Bell Frog. The targeted searches have focussed on the '2HD swamp' and immediate environs. No Green & Golden Bell Frog have been heard or observed during the baseline survey searches since the 2002/3 season. Although Green & Golden Bell Frog were recorded by others during the 2003/4 season, there have evidently been no records in the '2HD swamp' by any researchers since that season (*pers comm*.., Michael Mahony, University of Newcastle, 2006). The reasons for the evident decline in the Green & Golden Bell Frog population are not clear, but it is likely that prevailing dry conditions in each of the past three summers is a contributing factor.

Under the provisions of the Environmental Protection and Biodiversity Conservation Act 1999, the Commonwealth Department of Environment and Heritage (DEH) has stated that monitoring of water levels, salinity and frog population is to occur within the 2HD ponds during the staged opening of the gates (refer ***Appendix B: Volume 2*** of the EIS). DEH further state that if modelling suggests a credible risk of inundation of the 2HD ponds by saline water (under king tide conditions or similar), then floodgates are to be installed downstream of the ponds to limit the tidal inundation extents.

Given the uncalibrated nature of predictive tidal modelling of Hexham Swamp, a precautionary, adaptive management approach will be adopted with respect to construction of the floodgates downstream of the 2HD ponds. Past monitoring indicates that salinity within the pond is typically about 1 ppt (*pers comm*.., G. Winning, HWR Ecological, 2006). Christy & Dickman (2002) have shown that tadpoles of the Green and Golden Bell Frog are detrimentally affected by salinity concentrations in excess of 1.87ppt (compared to no impact on tadpoles for concentrations of 1.58ppt).

It is proposed to monitor salinity within the 2HD ponds at 3 monthly intervals, covering at least four (4) sampling points within the ponds. If the monitoring results exceed a designated salinity threshold, then the floodgate structure will be constructed in the channel downstream of the ponds. The salinity threshold within the 2HD ponds to be adopted for this Project is:

- Salinity (averaged over a minimum of four points within the ponds) exceeding a level of 2 ppt for two (2) consecutive sampling rounds; or
- Salinity (averaged over a minimum of four points within the ponds) exceeding a level of 1.5 ppt for four (4) consecutive sampling rounds.

5.1.6 Legislative Updates

None of the new species, population or ecological communities listed on the *Threatened Species Conservation Act 1995* (NSW) and *Environmental Protection & Biodiversity Conservation Act 1999* (Comm.) since the EIS was prepared occur with Hexham Swamp nor are likely to be affected by the proposal.

5.1.7 Modified Timing of Proposed Floodgate Opening

There are some ecological considerations that influence the timing of the staged opening of the floodgates. The EIS proposed the initial opening of the first floodgates for late spring or early summer, in part to provide for dispersal of *Zannichellia palustris* seeds into upper reaches of Ironbark Creek and its tributaries. However, the recommendation on which this proposal was based, was itself based on the then limited understanding that *Zannichellia palustris* is largely restricted to in-channel habitats. The baseline ecological survey (as described above in Section 5.1.3) has shown that *Zannichellia palustris* occurs throughout Hexham Swamp in shallow, brackish ponds, at least one of which is well removed from the tidal system along the edge of the disused Richmond Vale railway. The proposed gradual re-introduction of tidal water into Hexham Swamp is therefore unlikely to substantially affect the dispersal of *Zannichellia palustris* seeds, and as such, the timing of the initial gate opening does not therefore need to coincide with production of Zannichellia seeds (*pers comm*.., G. Winning, HWR Ecological, 2006).

The preferred ecological outcome is for the establishment of extensive areas of saltmarsh within a rehabilitated Hexham Swamp. The establishment of saltmarsh would be a gradual process, and would require the dieback of existing vegetation, especially Phragmites reedswamp, to provide a substrate for the germination of seeds of saltmarsh plants. This die-back is likely to take some months. In the mean time, it is important that areas where existing vegetation is dying are not colonised by Grey Mangrove (*Avicennia marina*), which establish from floating propagules. The main fruiting season for Grey Mangrove is approximately October, and there is often a secondary fruiting season in autumn. Thus, it is desirable that floodgate openings not coincide with availability of floating propagules and, for this reason, it is recommended that openings in winter would probably be most effective.

As discussed in Section 4.1.2.3 of the EIS, the initial opening of one floodgate is not likely to result in substantial overbank inundation, instead being mostly confined to the existing waterways except in the vicinity of the Marsden Street bund (refer Figure 4.6 of the EIS). The risk of significant mangrove colonisation resulting from opening one gate would be relatively minor. Subsequent stages of floodgate opening (ie, 2 gates open; 4 gates open; 8 gates open) would result in more significant areas of overbank inundation, and should be timed to minimise potential for dispersal of mangrove propagules (ie during winter).

As stated previously in Chapter 4 of this EA supplement and Section 2.4 of the EIS, subsequent staged floodgate openings will occur in winter, immediately preceding the solstice, to maximise the immediate inundation by king tides. Opening of the floodgates in winter also has advantages with respect to the density of Phragmites and for mosquito management (refer Section 2.4 of the EIS).

5.2 Biodiversity Offsets

The Department of Planning has also requested consideration of biod0verisyt offset strategies as potential mitigation measures where impacts on threatened species or endangered ecological communities have been predicted.

The NSW Government is proposing a ‘biobanking’ scheme to minimise the loss of biodiversity through management of development. The biobanking working paper (DEC 2005) proposes a

combination of biodiversity offsets and biobanking credits, although the latter component of the scheme is yet to be established. Nevertheless, the Department of Environment & Conservation (DEC) promotes the application of biodiversity offsets to development proposals, and presents, on its internet site (http://www.environment.nsw.gov.au/threatspec/biobankscheme.htm), a number of case studies to demonstrate its application.

Although the DEC is yet to develop its rule-based biodiversity assessment tool, it will be based on:

- the amount and significance of biodiversity loss that a development will cause; and
- the improvement in biodiversity value provided by conservation management actions on the offset site(s) (DEC 2005, p.10).

"The loss in biodiversity from the development would be scored exactly the same as the gain in biodiversity from offsets in all cases. In all instances the loss in biodiversity would be the loss in vegetation condition, loss in connectivity, loss in biodiversity in relation to the conservation significance of the vegetation type, and loss in threatened species habitat from the development. In all instances, the gain would be the gain in vegetation condition, connectivity and threatened species with management actions, and the increase in biodiversity in relation to conservation significance of the vegetation type and the management actions" (DEC 2005, p.10).

In the case of the Hexham Swamp Rehabilitation Project, a substantial (but unquantified) area of brackish and freshwater wetlands would be replaced by the same area of estuarine wetlands. The existing brackish and freshwater wetlands constitute two endangered ecological communities: Swamp Oak Floodplain Forest and Coastal Floodplain Wetlands. They also provide habitat for the threatened species *Zannichellia palustris* and Australasian Bittern, in particular. Although the abundance and distribution of these species is likely to be affected by the Project, it is difficult to predict to what extent this would occur. However, it is evident from observations made during the baseline ecological survey that remaining habitat for *Zannichellia palustris* and Australasian Bittern would eventually be lost due to expansion of Phragmites reedswamp.

As stated in the EIS, it is not possible to accurately model the likely distribution of ecological communities after the floodgates are opened, however, the objectives of the Project mean that the establishment of the endangered ecological community Coastal Saltmarsh would be favoured. Some habitat for *Zannichellia palustris* and Australasian Bittern would remain, and it is even likely that additional habitat would be created as the Phragmites reedswamp died-off (again, the actual distribution of vegetation communities is impossible to accurately predict). Also, as stated in the EIS, the rehabilitated Hexham Swamp environment would have important benefits for other species, particularly fish, marine invertebrates (e.g. crustaceans), and migratory waders.

Unfortunately, the nature of the Project makes it difficult to quantify vegetation and habitat changes but, unlike a residential development for example, the Hexham Swamp Rehabilitation Project involves the replacement of one vegetation and habitat complex with another. The available information indicates that the existing vegetation and habitats have a low biodiversity (i.e. due to the dominance of the monospecific community Phragmites reedswamp). Although the actual vegetation distribution subsequent to the rehabilitation in uncertain, assuming that it would approximate the pre-floodgate vegetation, it will have a greater biodiversity than the existing vegetation (see Figures 3.15 and 3.18 in the EIS).

In summary, while it is difficult to quantify biodiversity changes likely to result from the Hexham Swamp Rehabilitation Project, it is evident that there would be an increase in biodiversity as a result of the project, making it unnecessary to offset biodiversity losses.

5.3 Acid Sulfate Soils

As discussed in Section 3.5 of the EIS, the presence of Acid Sulfate Soils (ASS) is somewhat sporadic around Hexham Swamp. Only one of nine samples tested positive for ASS for investigations carried out specifically for this Project, whereas 59 of the 73 samples collected as part of the Tarro to Shortland Pipeline Replacement EIS (Robert Carr and Associates, 1999) tested positive for ASS. It must therefore be assumed that ASS are located within Hexham Swamp at relatively shallow depth.

Water quality results from Hexham Swamp suggest some acidic runoff from existing exposed ASS, most notably in brackish sections of Fishery Creek (with recorded pH levels of 4.59, 5.75, 6.06 and 6.36). These low pH levels appear to be relatively localised with limited impact on the wider swamp environment, as corresponding pH levels within other sections of the swamp, including the main waterways of Ironbark Creek, were within a normal range. pH levels upstream of the floodgates were within the range of 7.82 to 8.46, suggesting no acidity is discharged into the Hunter estuary. It is considered that the main waterway channels, with salinity levels typically > 20ppt have sufficient buffering capacity to neutralise any acid leached from the swamp.

As discussed in Section 4.3.1 of the EIS, re-inundation of Hexham Swamp will result in a net increase of groundwater levels within the swamp. This may re-inundate currently exposed ASS, particularly in the immediate vicinity of Ironbark Creek and its tributaries. It is noted that the one site that recorded high acidity by RCA (1998) was located immediately adjacent to Ironbark Creek, just upstream of Morris Jetty. Maximum increases in groundwater level would occur at such locations adjacent to the waterway, where the mean tidal water level is predicted to increase from approximately -0.2m AHD to approximately +0.1m AHD, an increase of 0.3 metres. The increase in groundwater levels would diminish with distance away from the major waterways. Re-inundation of existing ASS would reduce the potential for acid to be generated from the soil.

Furthermore, increased tidal flushing within the swamp will increase the potential for neutralisation of acidic runoff from the swamp, as the estuarine waters of the Hunter River are naturally alkaline due to carbon dioxide and bicarbonate ions within the water. Estuarine waters are predicted to inundate vast areas of existing swampland, including the area around Fishery Creek, where low pH levels have been recorded in the past. It is considered that the proposed ingress and inundation of saline water would be an effective management strategy for neutralising existing ASS in Hexham Swamp.

Most recognised strategies for managing in-situ ASS relate to the control of groundwater levels and the re-inundation of former swamplands. It is considered that the increase in groundwater levels in Hexham Swamp, as anticipated in response to the proposed works, would accord to standard ASS management practice. Re-introduction of tidal waters into drains and former creeks behind uni-directional floodgates has been carried out at numerous locations along the NSW coast, including the Clarence River, in an effort to rehabilitate ASS lands.

Further discussion regarding the predicted impacts of the Project on ASS is provided in Section 4.3.1 of the EIS.

Whilst acidic runoff is not anticipated, extensive water quality monitoring will still be undertaken throughout the different stages of floodgate opening at Hexham Swamp. Details of the proposed water quality monitoring program are provided in Section 6.2.3 of the EIS, which includes a continuous water quality probe in Fishery Creek, where low pH levels have been recorded in the past (thus indicating the presence of ASS nearby).

5.4 Bund Construction and Materials Sources

Two low level bunds are to be constructed to exclude the tidal inundation of private lands, thus maintaining existing function of such lands. In addition, some low-lying sections of other private lands are to be raised in order to prevent tidal inundation or groundwater impacts associated with the Project.

All filling works to be carried out as part of the Project are to use clean sandy-clay fill (or similar). The material is to have an 'inert' classification in accordance with the guidelines for liquid and non-liquid waste EPA (1999), and is not to contain actual or potential Acid Sulfate Soil, as defined by ASSMAC (1998) guidelines "Acid Sulfate Soil Manual".

Approximate quantities of clean fill required for construction of the bunds and for localised filling of private lands include:

- 3,500m^3 for construction of Marsden Street bund
- 1,100m^3 for construction of BAL bund
- 3,150m^3 for raising of Wallsair airstrip
- 1,000m^3 for filling of properties at end of Marsden Street
- 450m^3 for filling on Watts property
- 400m^3 for construction of floodgate structure downstream of 2HD pond

A total of approximately 9,600m^3 of clean fill is required to carry out the Project. A number of potential sources of clean fill have been identified for utilisation by the Project. First, material can be supplied from Stockrington Quarry, near Minmi. The quarry material is a sandy-clay, excavated (ripped) from the base of the quarry. A geotechnical assessment of the material has confirmed that the material can be regarded as Virgin Excavated Natural Material, and is free of industrial or agricultural contaminants. As such, the material receives a default inert classification in accordance with EPA (1999) guidelines.

Second, clean fill can be sourced progressively from Newcastle City Council Works Division. The material would generally be generated during construction works, such as roadworks (typically excavated road base material or similar). Building and demolition waste also receives a default inert classification, providing that it is not mixed with any other waste or contains asbestos material (EPA, 1999).

Material from these sources are unlikely to contain actual or potential acid sulphate soil, but would be tested in accordance with ASSMAC (1998) to confirm the status prior to use.

Material will not be sourced from excavation within Hexham Swamp.

5.5 Drainage and Flooding

The potential impacts of the Project on flooding within Hexham Swamp was assessed and reported within Section 4.1.2.4 of the EIS. For floods generated by runoff from the local catchment, impacts would be limited to less than 50mm. Maximum flood impacts occur immediately upstream of the floodgates during small flood events (1 in 1 yr, say) that carry a relatively small runoff volume. For larger flood events (1 in 20 yr or 1 in 100 yr, say), the runoff volume is large compared to the volume of tidal water held in the swamp prior to the flood event, thus the impacts of the tidal volume is small to negligible.

Areas affected by the minor increase in flood levels for small catchment floods are located fully within the Project Area, with all lands either owned by the CMA, or the CMA has an agreement (easement) for inundation of the land (or under negotiation).

For flooding from the Hunter River, the swamp will act the same as under existing conditions. When a flood warning is issued for the Hunter River, DNR will close the floodgates in accordance with their Flood Procedures Manual, to prevent backwater inundation of the swamp. When floods in the Hunter River exceed a level of approximately RL 1.8m AHD (equivalent to about a 1 in 10 yr flood level), the Pacific Highway levee becomes overtopped, and floodwaters enter Hexham Swamp. As under existing conditions, the volume of flood waters held in Hexham Swamp are retained within the swamp until flood levels in the Hunter River subside to below the swamp flood level.

The main exceptions to the above flood behaviour description are areas situated behind the proposed bunds. Two tide-exclusion bunds are proposed to prevent the inundation of saline water onto private properties. The crests of the bunds are high enough to prevent overtopping by tidal waters, but low enough not to significantly modify flood behaviour behind the bunds (i.e., would be overtopped by the 1 in 1 yr flood event). Nonetheless, following overtopping of the bunds by flood waters (either from catchment flooding or by Hunter River flooding), drainage of the land will be impaired slightly by the presence of the bunds, as waters will be directed through culverts under the bund rather than free-flow across the ground surface (refer Section 4.15.2.1 of the EIS). For lands behind the bunds that are lower than the crest level of the bund, drainage times are predicted to increase. For the 1 in 1 yr flood event, the duration of flood inundation is predicted to increase from 15 days to 19 days. This change is unlikely to modify long-term groundwater conditions or vegetation communities in the affected area.

With respect to local drainage within the swamp, it is considered that the lack of tidal flows within creeks and drainage lines over the past 30 years has resulted in sedimentation of key drainage paths, which has been further exacerbated by establishment of vegetation with the drainage paths (typically by Phragmites). An example of this is Muckeye Creek, where creek depths have reduced significantly since installation of the floodgates. The density of tall vegetation (mostly Phragmites and typha) throughout the swamp would typically inhibit the effective drainage of water from the swamp following rainfall and flood conditions.

The Project is predicted to improve local drainage within the swamp in two ways. First, the re-introduction of saline waters to the swamp will reduce the density of reeds (Phragmites), thus allowing improved conveyance of water across the ground surface of the swamp. Second, increased

tidal flows in the creeks and drainage lines are likely to mobilise and remove some of the material that has previously been deposited in these drainage paths, which will further increase the potential for tidal flows and drainage along these paths.

Given the tolerance of mature Phragmites plants to saline water (refer Section $.4.2 of the EIS), the transition in vegetation from freshwater-dominated to saltwater-dominated species is likely to occur over an extended period of time. Thus changes to drainage of the swamp as a result of the Project are likely to be gradual, possibly spanning a period of 10 years, depending on the timing of the proposed staged opening of the gates.

6 CONSISTENCY WITH SPECIFIED PLANS AND POLICIES

6.1 SEPP-14

Mapping of SEPP-14 wetlands at Hexham Swamp was carried out in the mid 1980s, based on broad vegetation categorisation, interpreted from aerial photography. As discussed in Section 3.7.3.1 of the EIS, the vegetation patterns of Hexham Swamp have changed significantly, even since the original mapping of SEPP-14 boundaries. Nonetheless, the provisions of SEPP-14 apply to all lands within the gazetted boundaries, as shown in Figure 2.20 of the EIS. In accordance with Clause 4(2) of SEPP-14, the policy does not apply to the Hexham Swamp Nature Reserve, which is shown as 8(a) zoned land in Figure 2.21 of the EIS, and also in Figure 6-1, below.

The aim of SEPP-14 is "to ensure that the coastal wetlands are preserved and protected in the environmental and economic interests of the State". To meet this aim, Clause 7(1) of SEPP-14 states that "a person shall not:

a) clear that land,

b) construct a levee on that land,

c) drain that land, or

d) fill that land,

except with the consent of the council and the concurrence of the Director". Furthermore, in accordance with Clause 7(2), in considering whether to grant concurrence under subclause (1), the consent authority shall take into consideration:

(a) the environmental effects of the proposed development, including the effect of the proposed development on:

(i) the growth of native plant communities,

(ii) the survival of native wildlife populations,

(iii) the provision and quality of habitats for both indigenous and migratory species,

(iv) the surface and groundwater characteristics of the site on which the development is proposed to be carried out and of the surrounding area, including salinity and water quality,

(b) whether adequate safeguards and rehabilitation measures have been, or will be, made to protect the environment,

(c) whether carrying out the development would be consistent with the aim of this policy,

(d) the objectives and major goals of the "National Conservation Strategy for Australia" (as set forth in the second edition of a paper prepared by the Commonwealth Department of Home Affairs and Environment for comment at the National Conference on Conservation held in June, 1983, and published in 1984 by the Australian Government Publishing Service) in so far as they relate to

wetlands and the conservation of "living resources" generally, copies of which are deposited in the office of the Department,

(e) whether consideration has been given to establish whether any feasible alternatives exist to the carrying out of the proposed development (either on other land or by other methods) and if so, the reasons given for choosing the proposed development,

(f) any representations made by the Director of National Parks and Wildlife in relation to the development application, and

(g) any wetlands surrounding the land to which the development application relates and appropriateness of imposing conditions requiring the carrying out of works to preserve or enhance the value of those surrounding wetlands.

SEPP-14 wetland no. 840, which occupies most of Hexham Swamp, has experienced significant vegetation change since the construction of the floodgates. In general, the swamp has evolved into a more freshwater-dominated wetland, with significant stands of *Phragmites australis* and typha. It is considered that this change has diminished the value of the SEPP-14 wetland, as it was originally mapped to accord more with estuarine vegetation, including saltmarshes and mangrove extents (as seen by a correlation between estuarine vegetation mapping of 1976 and 1986, and the gazetted SEPP-14 boundaries).

The Project aims to restore former estuarine vegetation communities within much of the downstream sections of Hexham Swamp, replacing the existing *Phragmites australis* stands with saltmarshes. Limitations on the extent of tidal inundation will ensure freshwater wetland habitats within the upper reaches of the swamp are retained following opening of the floodgates, thus increasing habitat diversity. The Project therefore is expected to largely re-establish the original SEPP-14 values of Hexham Swamp, when the wetland was initially gazetted. Consequently, it is regarded that the project is consistent with the aims and objectives of SEPP-14, given that the Project endeavours to restore estuarine vegetation within Hexham Swamp.

6.2 Hexham Swamp Nature Reserve Plan of Management

The Hexham Swamp Nature Reserve is shown in Figure 6-1. SEPP-14 provisions do not apply to Nature Reserves. Rather, as specified in Section 72 of the NPW Act 1974, management of Nature Reserves is to be guided by the development of a formal Plan of Management for the Reserve.

As outlined in Section 2.7.5.3 of the EIS, the Kooragang Nature Reserve and Hexham Swamp Nature Reserve Plan of Management (PoM) was completed and formally adopted in 1998. Section 4.1.5 of the PoM details objectives and strategies for wetland rehabilitation. Wetland rehabilitation is seen as a requirement for the Nature Reserves under international treaty obligations (including JAMBA, CAMBA and Ramsar). With respect to Hexham Swamp, two wetland rehabilitation programs are proposed:

- The enhancement of the Ironbark Creek and Hexham Swamp catchment by re-establishment of saltwater wetlands in lower Ironbark Creek and freshwater wetlands upstream; and
- Control of the common reed in Hexham Swamp.

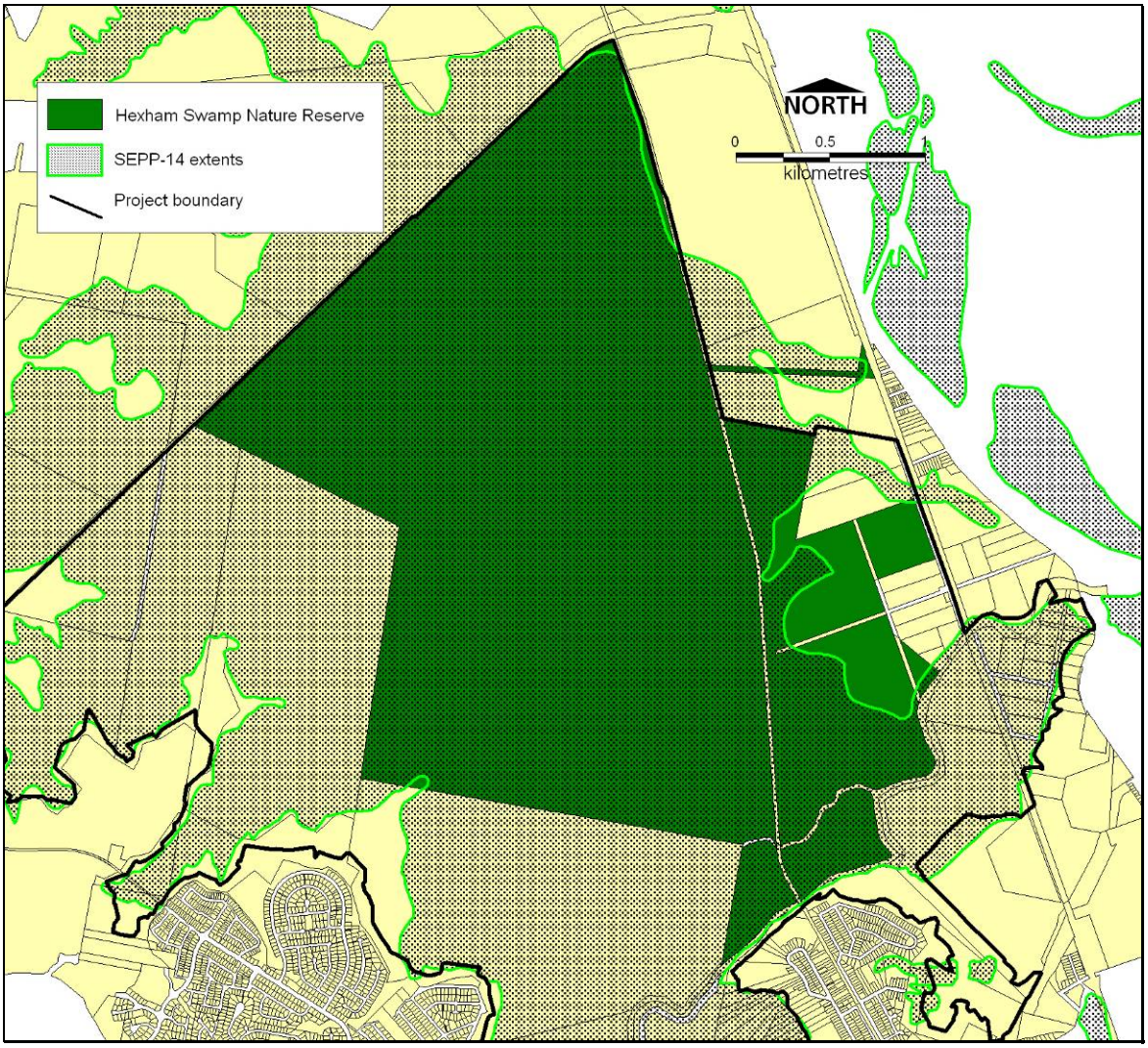

Figure 6-1 Hexham Swamp Nature Reserve and SEPP-14

The primary action to address these programs, as specified in the PoM, is the alteration of the tidal regime at the lower end of Hexham Swamp, and by constructing / relocating floodgates, levee banks and drainage paths to regulate the flow and level of freshwater in the more upstream sections of the Reserve.

It is considered that this Project fulfils the primary PoM action outlined above, by introducing controlled tidal waters back into the lower reaches of Hexham Swamp. Whilst bunds proposed for the Project do not affect the Nature Reserve directly, they will still meet the objectives of the PoM by limiting the extents of tidal inundation and preserving areas of freshwater habitat upstream. It is considered that additional bunding within the Nature Reserve is not required to limit the extent of tidal inundation, as model predictions suggest that not all of the Nature Reserve would be inundated during king tide conditions.

The Project is therefore consistent with the Hexham Swamp PoM. Further details regarding the PoM are provided in Section 2.7.5.3 of the EIS.

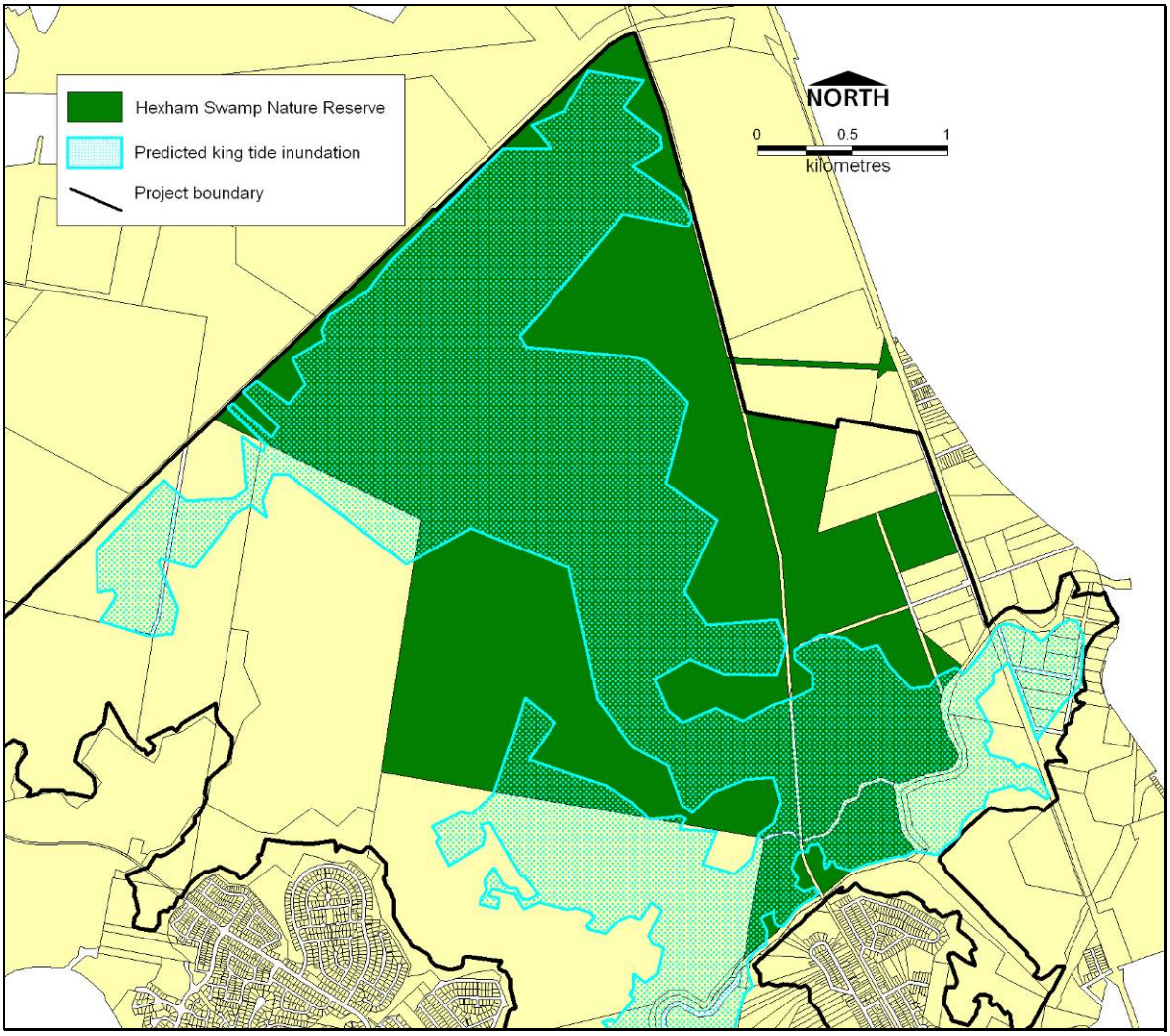

Figure 6-2 Predicted King Tide Inundation within the Nature Reserve

7 INSTITUTIONAL ARRANGEMENTS FOR PROJECT MANAGEMENT

The construction and operational works associated with implementing the Hexham Swamp Rehabilitation Project will be managed by the Hunter-Central Rivers Catchment Management Authority (HCRCMA), with guidance from the Hexham Swamp Project Committee. The Committee will meet on a periodic basis, as required, to discuss and confer on issues associated with implementation of the Project (through construction and long-term operation).

Lands acquired by the HCRCMA as part of the Project will be managed by the HCRCMA, including pest and weed control, and bushfire risk abatement. A Management Plan for Hexham Swamp has been prepared by the CMA, and outlines proposed management actions and strategies to be followed before, during and after opening of the floodgates (refer ***Appendix L: Volume 2*** of the EIS).

Furthermore, a formal Environmental Management System (conforming to ISO 14001 and subject to annual audits), is currently being prepared by the HCRCMA, and will be implemented prior to opening of the floodgates. The Environmental Management System (EMS) will be designed to incorporate environmental considerations into day-to-day operations and management of Hexham Swamp. The EMS will provide a structured framework for the Project, specifically, to achieve continual environmental improvement. Ultimately both environmental concerns and economic imperatives will be addressed by creating a system of processes and procedures that bring focus to important environmental goals, as highlighted in the Hexham Swamp Management Plan (refer ***Appendix L: Volume 2*** of the EIS).

The Statement of Commitments, presented in Section 3 of this Environmental Assessment supplement, testifies the arrangements and goals for future management of the Project Area, and mitigation of the predicted consequences of proposed works and actions.

8 STAKEHOLDER CONSULTATION

The Hexham Swamp Rehabilitation Project has been driven by the Hexham Swamp Project Committee, which contains representations from the community, as well as a number of federal, state and local government agencies, including DEC, DPI, DNR, HCRCMA, Hunter Water Corporation, DEH (Cth), Newcastle City Council, and State Parliamentary Members for Port Stephens and Wallsend.

In addition to membership on the Project Committee, broad consultation has been carried out with all relevant stakeholder groups and government agencies (refer Section 2.8 of the EIS). Specific details of consultation with agencies identified in the revised Director General Requirements, are provided below.

8.1 Department of Environment and Conservation

Consultation with the former NSW Environment Protection Authority and National Parks and Wildlife Service (now combined to form the Department of Environment and Conservation) was originally initiated during the inception stages of the Project, at which time these authorities provided written comments on the proposal and the requirements for environmental assessment. Correspondence from these agencies is provided in ***Appendix B: Volume 2*** of the EIS.

8.2 Department of Primary Industries

The Fisheries section of the Department of Primary Industries has also been involved with the Project since its inception. Correspondence from the then NSW Fisheries is included in ***Appendix B: Volume 2*** of the EIS.

DPI – Fisheries reviewed the contents of the EIS during preparation to ensure that it covered all concerns and considerations of the Department.

8.3 Newcastle City Council

Newcastle City Council has been aware of the Project for many years. Consultation with the Council was extensive leading up to and immediately following previous submission of a Development Application to Council for the Project (which was subsequently withdrawn and resubmitted to the Minister for Planning under Part 3A of the EP&A Act 1979 – refer Section 2).

Formal correspondence from Newcastle City Council dating back to Project inception (in 1998) is provided in ***Appendix B: Volume 2*** of the EIS.

8.4 Commonwealth Department of Environment and Heritage

Referral to the Commonwealth Department of Environment and Heritage (DEH) regarding the Project was made in October 2003 in respect to the requirements of the Commonwealth Environmental Protection and Biodiversity Conservation (EPBC) Act 1999. DEH announced that

the Project was not a controlled action and thus did not require approval under Chapter 4 of the EPBC Act in November 2003. Copies of correspondence from DEH are provided in ***Appendix B: Volume 2*** of the EIS.

DEH was further consulted in March 2005 to ensure that minor changes to the Project boundary, and the inclusion of Hexham Swamp on the Register of the National Estate (maintained under the EPBC Act) did not alter the previous decision by DEH. Correspondence from DEH in this regard is also provided in ***Appendix B: Volume 2*** of the EIS.

8.5 Local Aboriginal community

Awabakal Local Aboriginal Lands Council has been consulted with respect to this project. The results of this consultation are documented in ***Appendix G: Volume 2*** of the EIS, and have been factored into the Project. A copy of a letter to the Hunter Catchment Management Authority (now the Hunter Central Rivers CMA) is provided at the rear of ***Appendix G: Volume 2*** of the EIS.

8.6 Shortland Wetlands Centre

Discussions have been held with Shortland Wetlands Centre (now called The Wetlands Centre) regarding the Project, including the purchase of an easement of parts of their land, for some time. Copies of correspondence from The Wetlands Centre to the Hunter Catchment Management Trust (now Hunter-Central Rivers CMA) are provided in Appendix B of this EA supplement in this regard.

9 REFERENCES

ASSMAC (1998) **Acid Sulfate Soil Manual**. Prepared by the NSW Acid Sulfate Soil Management Advisory Committee, Wollongbar

Christy, MT & Dickman, CR (2002), **Effects of salinity on tadpoles of the green and golden bell frog (*Litoria aurea*)**, *Amphibia-Reptilia*, vol. 23, pp. 1-11

Department of Environment & Conservation (2005) **BioBanking – a biodiversity offsets and banking scheme: conserving and restoring biodiversity in NSW, working paper**, NSW Department of Environment & Conservation, Sydney.

EPA (1999) **Environmental guidelines: Assessment, classification and management of liquid and non-liquid waste**. Department of Environment and Conservation, Sydney

WBM (2005) **Hexham Swamp Rehabilitation Project Environmental Impact Statement** Prepared for the Hunter Central Rivers Catchment Management Authority, WBM Oceanics Australia, Broadmeadow, August 2005 (Volumes 1 and 2)

Winning, G (2006) **Vegetation changes in a large estuarine wetland subsequent to construction of floodgates: Hexham Swamp in the lower Hunter Valley, New South Wales**, MPhil thesis, Australian Catholic University, submitted.

APPENDIX A: MODIFICATIONS TO DIRECTOR GENERAL REQUIREMENTS

Project	A project to rehabilitate the Hexham Swamp by: • opening the existing floodgates located at the mouth of Ironbark Creek in stages so as to restore tidal flows to the wetland; and • carrying out certain works, including filling and the construction of bunds, to minimise the impact of the increased tidal flows on private property owners.
Site	The Project Area includes all of the Hexham Swamp to the south-east of the Richmond-Pelaw railway embankment, covering an area of approximately 1 946 hectares. A list of properties located within the Project Area is provided in Attachment 1 (*refer Appendix J of the EIS (WBM, 2005)*).
Proponent	Minister for Natural Resources
Date of Expiration	These modified Environmental Assessment Requirements expire two years from the date of issue.
General Requirements	The Environmental Assessment must include: • an Executive Summary; • a description of the current statutory processes that apply to this project; • a description of the proposal, including construction, operation, and any staging; • details of the location of the project and environmental planning provisions applicable to the site and the project; • consideration of alternatives to the project; • an assessment of the environmental impacts of the project, with particular focus on the key assessment requirements specified below; • proposed mitigation/ management measures of residual environmental impacts; • justification for undertaking the project with consideration of the benefits/ impacts of the proposal, and proposed management/ mitigation/ monitoring; • a draft Statement of Commitments for environmental mitigation, management and monitoring for the project; and • certification by the author of the Environmental Assessment that the information contained in the Assessment is neither false nor misleading.
Key Assessment Requirements	The Environmental Assessment must address the following key issues: • The issues specified in the Director-General's requirements previously issued to you on 27 July 2004. • Impacts on wetland flora and fauna as a result of the change to Hexham Swamp from a freshwater wetland to an estuarine wetland incorporating information from: (c) recent specific surveys (eg. latest results from baseline monitoring data) and databases such as the Atlas of NSW Wildlife, Australian Museum, Royal Botanic Gardens, and Hunter Bird Observers Club records; (d) revised impact assessment and mitigation measures that may be suggested by any additional records/information obtained in (a) above; • Investigate biodiversity offset strategies as potential mitigation measures where impacts on threatened species or endangered ecological communities have been predicted. (Principles for biodiversity offsets and banking schemes are currently under development by the Department of Environment and Conservation, and can be found at http://www.environment.nsw.gov.au/threatspec/biobankscheme.htm) • The management of actual and potential occurrence of Acid Sulfate Soils with particular regard to discharges of acidified waters to adjacent waterways; • The source(s) of all bund materials, method(s) for transporting bund material to bund sites, and methods for constructing bunds;

	• Changes to the local drainage and the potential to affect flooding behaviour; • Consistency with the Hexham Swamp Nature Reserve Plan of Management 1998 prepared by the National Parks and Wildlife Service (now part of the Department of Environment and Conservation); • Consistency with the aims and objectives of State Environmental Planning Policy No. 14 – Coastal Wetlands; and • The institutional arrangements for managing the construction and operation of the project.
Relevant Guidelines	• Australian and New Zealand Environment and Conservation Council - National Water Quality Management Strategy: Australian Water Quality Guidelines for Fresh and Marine Waters; and Guidelines for Groundwater Protection in Australia. • Acid Sulphate Soil Manual (ASSMAC) • draft *Guidelines for Threatened Species Assessment* (July, 2005), prepared by the Department of Environment and Conservation and the Department of Primary Industries • draft *Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (July, 2005), prepared by the Department of Environment and Conservation
Consultation Requirements	You must consult with the following parties during the preparation of the Environmental Assessment: • Department of Environment and Conservation; • Department of Primary Industries; • Newcastle City Council; • Commonwealth Department of Environment and Heritage regarding the application of the *Environment Protection and Biodiversity Conservation Act;* • Local Aboriginal community; and • Shortland Wetlands Centre.
Exhibition of EA and notification requirements	Pursuant to Section 75H(3) of the EP&A Act, the EA must be exhibited for a minimum of 30 days.
Deemed refusal period	Not applicable. However, consistent with clause 8E(2) of the EP&A Regulations, the Department's indicative assessment period will be 120 days.

APPENDIX B: CORRESPONDENCE FROM THE WETLANDS CENTRE

16- 3-06;17:37 ;HUNTER CENTRAL RIVERS CMA WBM Broadmeadow ;61249301013 # 3/ 3

FCWL030

The Wetlands Centre Australia

Naturally

PO Box 292 Wallsend NSW 2287 • Ph: 02 4951 6466 • Fax: 02 4950 1875 • twc@wetlands.org.au
www.wetlands.org.au • Location: off the roundabout, Sandgate Road Shortland, Newcastle

Sharon Vernon
Hunter Catchment Management Trust
Private Bag 2010
PATERSON NSW 2421

RECEIVED
16 MAY 2002
H.C.M.T.

14 May 2002

Dear Sharon

Re: Easement through The Wetlands Centre's Land below the 1.5 m contour

As discussed, I would appreciate it if you could proceed with arranging an easement through the Wetlands Centre as part of your Hexham Project compensation scheme.

Our conveyance solicitor is :

Judith Olsen
Boyd Wooi Olsen
4h Floor AMP Building,
57 Hunter Street
NEWCASTLE NSW 2300

Phone 49295655

Perhaps you could fax me a copy of the valuation of this easement at your earliest convenience.

Regards

Louise Duff
CEO

Sponsored by **Supported by**

Hunter Water

HUNTER CATCHMENT MANAGEMENT TRUST
Care for the land

A haven for wildlife and people.

WBM OCEANICS AUSTRALIA

16- 3-06;17:37 ;HUNTER CENTRAL RIVERS CMA WBM Broadmeadow ;61249301013 # 2/ 3

The Wetlands Centre Australia

Naturally

RECEIVED
18 JUN 2002
H.C.M.T.

PO Box 292 Wallsend NSW 2287 • Ph: 02 4951 6466 • Fax: 02 4950 1875 • twc@wetlands.org.au
www.wetlands.org.au • Location: off the roundabout, Sandgate Road Shortland, Newcastle

Sharon Vernon
Hunter Catchment Management Trust
Private Bag 2010
PATERSON NSW 2421

13 June 2002

Dear Sharon

Re: Easement to inundate.

Sponsor

Hunter Water

Supporters

HUNTER CATCHMENT MANAGEMENT TRUST

HVPH

Thank you for your letter of June 6. The Wetlands Centre accepts your offer to purchase an easement below the 3.5 m contour line for the value of [redacted]

Please progress this matter at your earliest convenience.

Regards

Louise Duff
Chief Executive Officer

A haven for wildlife and people.

WBM OCEANICS AUSTRALIA