



Government Gazette

of the State of

New South Wales

Number 93

Tuesday, 18 September 2018

The New South Wales Government Gazette is the permanent public record of official NSW Government notices. It also contains local council, private and other notices.

From 1 January 2018, each notice in the Government Gazette has a unique identifier that appears in square brackets at the end of the notice and that can be used as a reference for that notice (for example, [n2018-14]).

The Gazette is compiled by the Parliamentary Counsel's Office and published on the NSW legislation website (www.legislation.nsw.gov.au) under the authority of the NSW Government. The website contains a permanent archive of past Gazettes.

To submit a notice for gazettal – see Gazette Information.

COUNCIL NOTICES

COFFS HARBOUR CITY COUNCIL

Coastal Protection Act 1979, Section 55H

Gazettal and Commencement of a Coastal Zone Management Plan

COFFS HARBOUR CITY COUNCIL with the certification of the Minister for the Environment, have prepared and adopted the Willis Creek Estuary Coastal Zone Management Plan in accordance with Section 55 of the *Coastal Protection Act 1979*.

The Plan is a strategic and long term plan developed to provide guidance for achieving a sustainable estuary in the future, giving balanced consideration to environmental, social and economic demands on the estuarine system and its catchment area.

The Plan will remain in force until such time as it is amended or repealed by a coastal management program that replaces it.

The Plan may be viewed on Coffs Harbour City Council's website at www.coffsharbour.nsw.gov.au For more information, call 02 6648 4000.

Steve McGrath
General Manager
Coffs Harbour City Council
Locked Bag 155, Coffs Harbour NSW 2450

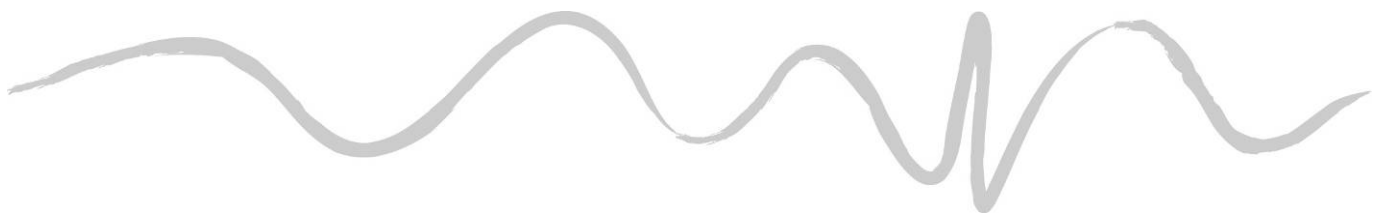


Willis Creek Estuary Coastal Zone Management Plan



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

Coastal Zone
Management Plan
Willis Creek Estuary



quality solutions sustainable future

Coastal Zone Management Plan Willis Creek Estuary

Prepared for: Coffs Harbour City Council and
Office of Environment and Heritage
© GeoLINK, 2013
Amended June 2018 for Certification



PO Box 119
Lennox Head NSW 2478
T 02 6687 7666

PO Box 1446
Coffs Harbour NSW 2450
T 02 6651 7666

info@geolink.net.au

<i>Version History</i>				
<i>UPR</i>	<i>Description</i>	<i>Date Issued</i>	<i>Issued By</i>	<i>Reviewed By</i>
1616693	Initial Draft	18/04/2012	TIM	Kim Casson
1616108	Final Draft	06/07/2012	Tim Ruge	Cate Walsh
1616613	Draft for Public Exhibition	15/08/2012	Tim Ruge	Cate Walsh
1616-1006	Final Report	31/01/2013	Tim Ruge	Kim Casson

Table of Contents

Background	xiii
Consultation	xv
Addressing Coastal Management Principles.....	xv
Key Values of Willis Creek Estuary	xvi
Key Management Issues.....	xvii
Key Management Strategies	xix
Coffs Harbour 2030 Plan.....	xix
Coffs Harbour Coastal Zone Management Plan.....	xxi
Public Land Ownership and Management Arrangements in the Coastal Zone	xxi
Crown Land Authorisations	xxii
Coffs Harbour Regional Park Management Plan	xxii
<i>Native Title Act 1993 (Commonwealth) and Aboriginal Land Rights Act 1983 (NSW) Considerations /</i> Obligations	xxii
1 Strategy 1 - Stormwater Management and Catchment Pollutants	1
1.1 Summary of Proposed Actions	2
1.1.1 Related Strategies.....	2
1.1.2 Objectives Addressed	2
1.2 Details of Proposed Actions	3
2 Strategy 2 – Water Quality	11
2.1 Summary of Proposed Actions	11
2.1.1 Related Strategies.....	11
2.1.2 Objectives Addressed	11
3 Strategy 3 - Riparian Vegetation	13
3.1 Summary of Proposed Actions	13
3.1.1 Related Strategies.....	13
3.1.2 Objectives Addressed	13
3.2 Details of Proposed Actions	14
4 Strategy 4 - Recreational Amenity and Cultural Heritage	19
4.1 Summary of Proposed Actions	19
4.1.1 Related Strategies.....	19
4.1.2 Objectives Addressed	19
4.2 Details of Proposed Actions	20
5 Strategy 5 - Climate Change Impacts on Water Quality	23

5.1	Summary of Proposed Actions	23
5.1.1	Related Strategies.....	23
5.1.2	Objectives Addressed	23
6	Strategy 6 - Fish Kills and Algal Blooms	25
6.1	Summary of Proposed Actions	25
6.1.1	Related Strategies.....	25
6.1.2	Objectives Addressed	25
7	Strategy 7 - Climate Change Impacts on Estuary Ecology	27
7.1	Summary of Proposed Actions	27
7.1.1	Related Strategies.....	27
7.1.2	Objectives Addressed	27
7.2	Details of Proposed Actions	28
8	Strategy 8 - Water Quality Monitoring	31
8.1	Summary of Proposed Actions	31
8.1.1	Related Strategies.....	31
8.1.2	Objectives Addressed	31
8.2	Details of Proposed Actions	32
9	Strategy 9 - Little Terns	33
9.1	Summary of Proposed Actions	33
9.1.1	Related Strategies.....	33
9.1.2	Objectives Addressed	33
10	Strategy 10 - Visual Amenity	35
10.1	Summary of Proposed Actions	35
10.1.1	Related Strategies.....	35
10.1.2	Objectives Addressed	35
10.2	Details of Proposed Actions	36
11	Strategy 11 – Entrance Management	39
11.1	Summary of Proposed Actions	39
11.1.1	Related Strategies.....	39
11.1.2	Objectives Addressed	39
11.2	Details of Proposed Actions	40

Illustrations

Illustration I.1	Illustration I.1 Geographical Extent of the Coastal Zone Management Plan.....xiv
Illustration 1.1	Modelled Nitrogen inputs from different landuses and areas of the Willis Creek catchment1
Illustration 1.2	Strategy 1 – Stormwater Management and Catchment Pollutants..... 10
Illustration 3.1	Strategy 3 – Riparian Vegetation 17
Illustration 4.1	Strategy 4 – Recreational Amenity 21
Illustration 7.1	Strategy 7 - Climate Change Impacts on Estuary Ecology..... 29
Illustration 10.1	Strategy 10 – Visual Amenity 37
Illustration 11.1	Strategy 11 – Entrance Management..... 44

Plates

Plate 1.1	Future Industrial and Residential Growth Areas..... 6
Plate 11.1	Beach Erosion and Shoreline Recession at Willis Creek Entrance..... 41

Appendices

A	Draft Entrance Management Policy Willis Creek Estuary
B	Funding Sources
C	Summary of Estuary Processes Study
D	Summary of Community Uses Assessment
E	Summary of Development of Management Objectives and Issues
F	Letters of Support from Agencies for Relevant Actions

This page has been left intentionally blank

Executive Summary

This Coastal Zone Management Plan (CZMP) describes proposed actions to be implemented by Coffs Harbour City Council, other public authorities and the private sector to address priority management issues for the Willis Creek estuary. The area addressed by this CZMP comprises the Willis Creek waterway and tributaries, foreshores and the catchment draining to the estuary up to the tidal limit of the creek and its tributaries. The CZMP also considers issues associated with the wider catchment upstream of the tidal limit.

Willis Creek is an Intermittently Closed and Open Lakes and Lagoon (ICOLL) meaning the entrance to naturally alternates between being open or closed to the ocean. The entrance is predominantly closed. The creek is part of the Solitary Islands Marine Park and is zoned as a Habitat Protection Zone up to the tidal limit.

There are no records of artificial opening of the entrance being used since the cessation of treated effluent release into the creek in 2005. Community consultation has not indicated any desire for artificial opening of the creek entrance and there is currently no significant need for artificial opening for the purpose of flood mitigation.

Sea level rise and increased storm events caused by climate change may result in higher flood inundation levels within the estuary in the future which may require mechanical intervention of the ICOLL opening regime. This CZMP incorporates an action to develop a formal entrance management strategy to deal with these potential future impacts.

The relatively dense vegetation and lack of public access to the Willis Creek estuary generates little recreational activity. However, the natural setting attracts people seeking quiet recreational opportunities such as bird watching and bushwalking. Willis Creek has a large area of swamp forest, wet heath and mangrove / saltmarsh complex which is largely contained in the Coffs Coast Regional Park. The Willis Creek / Hearnese Lake entrance area hosts a significant breeding site in NSW for the threatened species, Little Tern (South-eastern Australian population).

Banana plantations and blueberry farms cover the majority of the upper catchment of Willis Creek. Industrial and residential land comprises the majority of the mid-catchment on the eastern side of the Pacific Highway. The site of the Woolgoolga Water Reclamation Plant (WWRP) covers a significant proportion of the lower estuary catchment. The WWRP released treated effluent into Willis Creek from 1973 to 2005. The release ceased in 2005 with the plant upgrade and connection to the Coffs Harbour recycled water system.

Identification of key estuary management issues and development of management strategies has been undertaken based on technical studies and consultation with the community and key stakeholder organisations. Consultation has included community workshops in 2010 and 2011, a community survey in 2011.

Estuary Management Issues

The key management issues for the estuary relate to:

- management of sediment, nutrient and other pollutant inputs from the catchment;
- protecting the native riparian vegetation (which is generally in good condition) from environmental weeds which reduce the ecological value and potentially impact upon bank stability, recreational amenity and aesthetics;
- preserving the recreational and visual amenity which is predominantly an undisturbed natural environment with low key recreational activities; and
- climate change impacts (particularly sea level rise and consequent lake water level increases) on the estuarine ecology.

Estuary Management Strategies

A range of potential management strategies have been developed, prioritised and detailed to address the key issues. These strategies are summarised in the following Implementation Schedule. The key management strategies include:

- continue educational and incentive schemes that address the management of soil resources and pesticide / herbicide / fertiliser use in agricultural activities, encourage establishment of vegetated riparian zones on farm watercourses;
- auditing the existing drainage systems and industrial properties to identify any deficiencies in existing stormwater management systems;
- control significant land modification activities on rural lands by enforcing development consent where required under Council's Local Environmental Plan to enforce erosion and sediment controls for significant earthworks;
- a weed management strategy which targets priority environmental weeds in high value riparian areas;
- repairing the existing vehicular route to the carpark near the creek entrance to avoid / prevent vehicles creating additional 'bypass' tracks and maintaining the existing range and level of low impact recreation to preserve the dominant natural character and cultural heritage values of the estuary;
- implement development control provisions to facilitate upslope migration of mangroves and saltmarsh in response to sea level rise;
- include Willis Creek in the Ecohealth water quality monitoring program;
- a revegetation plan to enhance the existing natural character of the estuary to preserve and improve its high visual amenity; and
- implementing a formal Entrance Management Policy for Willis Creek with the aim to minimise interference with the natural opening and closing processes of the creek entrance whilst mitigating the impacts of extreme water quality issues and future sea level rise induced flooding of properties and infrastructure.

Review and Reporting

This document will be reviewed every 5-10 years to ensure its effectiveness and consistency with State Government policy. A comprehensive review will be required prior to 31 December 2021 to transition this CZMP into a Coastal Management Plan in order to retain its certification status under the Coastal Management Act 2016. Implementation of the strategies and the associated tasks will be coordinated by Council staff and monitored by the Coast and Estuary Management Advisory Committee (CEMAC) throughout the duration of the CZMP. During the revision phase of this document, any substantial changes to the Plan and strategies will be reported to Council, CEMAC, and State government and appropriate agencies to ensure that all relevant stakeholders are informed.

Throughout the revision process all relevant information will be made available to the community via the Council website and will be open for community feedback as a means of community reporting.

Implementation Schedule

The proposed management strategy actions are detailed in the following Implementation Schedule. Included in the schedule is:

- the lead agency responsible for executing the strategy action (other relevant support agencies are included in the strategy action details in the main body of the CZMP);
- the timeframe for implementing the strategy action. The year relates to the time following adoption of this CZMP eg. "Years 2 – 5" indicates the strategy action should be implemented within 2 to 5 years of adoption of the CZMP (refer to strategy action details in the main body of the CZMP with respect to monitoring of each action);
- The strategy actions are listed in general order of priority with a specific priority assigned to each strategy action in terms of "very high", "high", "medium" or "low" priority.

Prior to implementation of the Willis Creek estuary strategy actions Council will need to review to ensure consistency with the Coastal Zone Management Plan for the Coffs Harbour coastline and consistency with the Regional Park Management Plan.

Implementation Schedule

Strategy Action No.	Description	Lead Agency (refer to strategy details for related agencies)	Timeframe	Cost	Potential Funding Sources	Priority
Strategy 1 - Stormwater Management and Catchment Pollutants						
1.1	Educational strategies to address soil management and pesticide, herbicide and fertiliser use in agricultural activities	DPI – Agriculture NSW	Year 1	\$5,000 per workshop for preparation, materials and delivery	<ul style="list-style-type: none"> ▪ Caring for Our Country ▪ CHCC Environmental Levy ▪ North Coast LLS ▪ OEH - Environmental Education Grants 	High
1.2	Encourage horticultural landowners to uptake incentives program for Best Practice Management	North Coast LLS	Years 1 – 5	<ul style="list-style-type: none"> ▪ Staff budget time for coordinating uptake of the incentives program ▪ \$20,000 pa for incentives funding from CHCC Environmental Levy (Subject to funding and relevant processes) ▪ \$20,000 pa for incentives funding from North Coast LLS (Subject to approval and available funding) 	<ul style="list-style-type: none"> ▪ CHCC Environmental Levy ▪ North Coast LLS – Relevant Programs 	Very High
1.3	Audit stormwater management systems for existing urban development	CHCC	<ul style="list-style-type: none"> ▪ Initial audit: 1 – 5 years ▪ Retrofit works: long term 	<ul style="list-style-type: none"> ▪ Initial audit: CHCC staff time as part of asset management ▪ Retrofit works: dependant on proposed works 	NSW Government Coastal and Estuary Management Program	High - Medium
1.4	Stormwater management for new	CHCC	Review policy and	Part of Council's operational budget	n/a	Medium

Strategy Action No.	Description	Lead Agency (refer to strategy details for related agencies)	Timeframe	Cost	Potential Funding Sources	Priority
	urban development		guidelines every 5 years			
1.5	Encourage horticultural landowners to establish vegetated riparian zones on farm watercourses via the incentives program for Best Practice Management	North Coast LLS	Years 1 – 5	Part of cost listed in Strategy Action 1.2.	Same funding as listed in Strategy Action 1.2.	Very High
1.6	Control land modification activities on rural lands	CHCC	Year 1	Unknown additional staffing resources and additional costs to Council's operational budget	n/a	Very High
Strategy 2 - Water Quality - water quality issues are adequately addressed in the Strategy 1 actions of this CZMP. No further actions are proposed to address this issue						
Strategy 3 - Riparian Vegetation						
3.1	Develop a weed management strategy which prioritises areas of riparian foreshore to be treated and priority weeds to be targeted	CHCC	Years 1 - 2	Strategy development ~\$5,000 if done external to CHCC.	North Coast LLS through relevant programs.	Very High
3.2	Undertake primary weed control in priority areas using specialist bush regeneration contractors	CHCC	Years 2 – 5	Subject to Weeds Management Strategy under Strategy Action 3.1 If external contractors are to be used, funds required is subject to the Weed Management Strategy but initially estimated at 200 hours per year @ \$35/hr (\$7,000/yr) over 5 years.	<ul style="list-style-type: none"> ▪ North Coast LLS through relevant programs ▪ Environmental Trust Restoration and Rehabilitation grants. ▪ Grants through NSW Government for Public Reserves Management 	Very High

Strategy Action No.	Description	Lead Agency (refer to strategy details for related agencies)	Timeframe	Cost	Potential Funding Sources	Priority
3.3	Foster a local Landcare group to undertake the secondary control or follow-up maintenance of areas treated by the CHCC bush regeneration team or specialist contractors	CHCC	Long term commitment required to support community groups	Dependent on activities, but generally limited to provision of tools, consumables, and support.	<p>Fund for weed control works on Department of Industry – Lands & Water (Crown Lands).</p> <ul style="list-style-type: none"> ▪ CHCC Environmental Levy. <p>Support available through Coffs Landcare Network.</p> <p>Funding available through North Coast LLS relevant programs.</p>	Medium
Strategy 4 - Recreational Amenity and Cultural Heritage						
4.1	Protect recreation and cultural heritage values by repairing the existing vehicular route where required to avoid / prevent vehicles creating additional 'bypass' tracks	CHCC	Years 1 - 5	Repair the existing vehicular route and install discrete barriers: \$10,000	<ul style="list-style-type: none"> ▪ Caring for Our Country ▪ CHCC operating budget ▪ CHCC Environmental Levy 	Medium
Strategy 5 - Climate Change Impacts on Water Quality - addressing current water quality issues in accordance with Strategy 1 actions will be the best preparation for the impacts of climate change on water quality. No further actions are proposed to address this issue						
Strategy 6 - Fish Kills and Algal Blooms - Strategy 1 actions are considered adequate to address this issue. No further actions are proposed						
Strategy 7 - Climate Change Impacts on Estuary Ecology						

Strategy Action No.	Description	Lead Agency (refer to strategy details for related agencies)	Timeframe	Cost	Potential Funding Sources	Priority
7.1	Implement development control provisions to facilitate upslope migration of mangroves and saltmarsh in response to sea level rise	CHCC	Years 1 – 2	Staff time	CHCC operating budget	High
Strategy 8 - Water Quality Monitoring						
8.1	Include Willis Creek in the Ecohealth water quality monitoring program	CHCC	Years 1 – 2	\$5,000 for initial baseline report (or Council staff time) \$20,000 every 4 years for Ecohealth water quality monitoring program	<ul style="list-style-type: none"> ▪ CHCC operating budget. ▪ MPA - SIMP: in kind assistance 	Medium
Strategy 9 - Little Terns - current joint management undertaken by OEH - National Parks and Wildlife Service and Coffs Harbour City Council and the Shorebird Recovery Program for management of the Little Tern breeding site at the Hearn's Lake / Willis Creek entrance is consistent with the objectives of this CZMP. Therefore no specific CZMP actions are proposed in respect to the Little Tern breeding site at the Hearn's Lake / Willis Creek entrance						
Strategy 10 - Visual Amenity						
10.1	Prepare and implement a revegetation plan to enhance the existing natural character of the estuary to preserve and improve its high visual amenity	CHCC as Reserve Trust Manager	Years 1-10	Revegetation plan preparation and implementation: \$50,000	Caring for Our Country CHCC operating budget	Medium

Strategy Action No.	Description	Lead Agency (refer to strategy details for related agencies)	Timeframe	Cost	Potential Funding Sources	Priority
Strategy 11 – Entrance Management						
11.1	Prepare a Review of Environmental Factors for potential artificial opening of the entrance to Willis Creek estuary	CHCC	Years 1 – 5	Staff time	CHCC operating budget	Low
11.2	Refine, adopt and implement Willis Creek Entrance Management Policy	CHCC	Years 1 – 5	Staff time for adoption of policy.	CHCC operating budget	Low
11.3	Address flooding risks that have the potential to trigger artificial opening of the entrance in the future	CHCC	Years 5 - 10 for audit and assessment Years 10 – 25 for relocate, replace or modify essential services and assets	Audit and assessment: \$10,000 Augmentation works: dependant on proposed works	NSW Government Estuary Management Program	Low
11.4	Raise community awareness of the natural opening and closing regime of Willis Creek	CHCC	1-10 years	Incorporate into community awareness initiatives for Shorebird Recovery Program for Little Tern breeding site at the entrance	<ul style="list-style-type: none"> ▪ Caring for Our Country ▪ CHCC operating budget 	Low

Introduction

This document presents a Coastal Zone Management Plan (CZMP) for Willis Creek estuary. The primary purpose of this CZMP is to describe proposed actions to be implemented by Coffs Harbour City Council, other public authorities and the private sector to address priority management issues for the Willis Creek estuary. These management issues relate to:

- risks to public safety and built assets;
- pressures on estuary health; and
- community uses of the estuary.

The area addressed by this CZMP comprises the Willis Creek waterway and tributaries, foreshores and the catchment draining to the estuary up to the tidal limit of the creek. The CZMP also considers issues associated with the wider catchment upstream of the tidal limit. The Willis Creek estuary is shown below and the extents of this area are mapped overleaf in **Illustration I.1**.

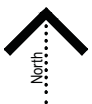


Source: Google Earth, 2011

Plate I.1 Aerial Image of Willis Creek Estuary

Background

In 2010, Coffs Harbour City Council (Council) and Office of Environment and Heritage (OEH) engaged GeoLINK in association with Aquatic Science and Management and GECO Environmental to develop a CZMP for Willis Creek estuary. Council's Coastal Estuary Management Advisory Committee's goal for the CZMP is to "to assist Council in achieving an integrated, balanced, responsible and ecologically sustainable use of the Willis Creek Estuary."



0 200



Geographical Extent of the Coastal Zone Management Plan

Coastal Zone Management Plan - Willis Creek Estuary
1616039

Illustration I.1

Development of this CZMP has included the following preliminary phases: literature and information review; technical study of the relationship between the estuary processes, external influences and issues of concern; community uses assessment and development of key management objectives and issues. These preliminary studies are reported in the following documents:

- *Data Compilation and Estuary Processes Study – Darkum Creek, Woolgoolga Lake and Willis Creek* (GeoLINK *et al.*, 2011a); and
- *Estuary Management Study – Willis Creek* (GeoLINK *et al.*, 2011b).

Summaries of these preliminary phases are contained in:

- **Appendix C** – summary of literature and information review and technical study of estuary processes;
- **Appendix D** – summary of community uses assessment; and
- **Appendix E** – summary of development of key management objectives and issues.

Consultation

Community and stakeholder consultation was undertaken to gain input to the development of management action for Willis estuary. Consultation has included community workshops in 2010 and 2011, a community survey in 2011 and liaison with relevant stakeholders.

Addressing Coastal Management Principles

The notes below describe how this CZMP has considered the relevant Coastal Management Principles as detailed in the *Guideline for Preparing Coastal Zone Management Plans* (DECCW, 2010).

Principle 1: The Plan will consider the objects of the Coastal Protection Act 1979 and the goals, objectives and principles of the NSW Coastal Policy 1997.

The NSW Coastal Policy deals with population and economic growth whilst protecting the natural, cultural, heritage and spiritual values of the coastal environment. The policy has a strong focus on the principles of Ecologically Sustainable Development. The NSW Coastal Protection Act 1979 aims to protect, enhance, maintain and restore the environment with concern for both the natural and built environments. These principles formed the basis of development and prioritisation of management strategies for Willis Creek estuary.

Principle 2: Optimise links between plans relating to the management of the coastal zone.

Development of this CZMP including the literature review component has considered Council's Coastal Processes and Hazard Definition Study and Coastal Zone Management Study for the coastline, Council's Climate Change Mitigation and Adaptation Action Plan and other studies and management plans related to Willis Creek estuary.

Principle 3: Involve the community in decision-making and make coastal information publicly available.

As indicated above, community consultation was undertaken to gain input to the development of management action for Willis Creek estuary including community workshops in 2010 and 2011, and a community survey in 2011 and liaison with relevant stakeholders.

Principle 4: Base decisions on the best available information and reasonable practice; acknowledge the interrelationship between catchment, estuarine and coastal processes; adopt a continuous improvement management approach.

The estuary processes study component of the CZMP considered the above issues. Development of management strategies has included a continuous improvement management approach such as the measures outlined in respect to climate change impacts on flooding to minimise the future need for artificial opening events.

Principle 5: *The priority for public expenditure is public benefit; public expenditure should cost effectively achieve the best practical long-term outcomes.*

Development of strategies and priorities has included consideration of public expenditure.

Principle 6: *Adopt a risk management approach to managing risks to public safety and assets; adopt a risk management hierarchy involving avoiding risks where feasible and mitigation where risks cannot be reasonably avoided; adopt interim actions to manage high risks while long-term options are implemented.*

This principle is not directly applicable to the issues for the Willis Creek estuary.

Principle 7: *Adopt an adaptive risk management approach if risks are expected to increase over time, or to accommodate uncertainty in risk predictions.*

This principle is not directly applicable to the issues for the Willis Creek estuary.

Principle 8: *Maintain the condition of high value coastal ecosystems; rehabilitate priority degraded coastal ecosystems.*

Development and prioritisation of strategies has considered the above approach such as management of environmental weeds which has been prioritised for riparian vegetation classified as either 'good' or 'very good' condition.

Principle 9: *Maintain and improve safe public access to beaches and headlands consistent with the goals of the NSW Coastal Policy.*

This principle is not directly applicable to the issues for Willis Creek estuary, however, actions under Strategy 4 address the provision of recreational infrastructure.

Principle 10: *Support recreational activities consistent with the goals of the NSW Coastal Policy.*

Strategy 4 in this CZMP directly addresses recreational activities related to Willis Creek estuary.

Key Values of Willis Creek Estuary

The natural settings of the estuaries and coast within the Mid North Coast area are a feature that attracts visitors and locals to the area. Willis Creek is in keeping with this natural setting, and forms part of the network of bushland settings along the coast and estuaries and is of local and broader significance. The creek is part of the Solitary Islands Marine Park and is zoned as a Habitat Protection Zone up to the tidal limit.

Key values of the estuary include its natural setting, Little Tern breeding site and quiet recreational opportunities including bird watching and bushwalking. Willis Creek is a relatively small and remote coastal estuary with dense vegetation and a lack of public access. However it offers the following recreational values:

- water-based activity including kayaking and canoeing in the creek; and
- the natural setting attracts people seeking quiet recreational opportunities such as bird watching and bushwalking.

Willis Creek offers a predominantly undisturbed natural environment that forms an integral and important component of the natural settings along the coastline. Willis Creek is a remote, densely vegetated estuary

and with limited access which combines to significantly restrict visual access into the area. It offers the following scenic values:

- limited, short distant views into the foreshore vegetation from the vehicle access track;
- highly scenic, panoramic views across upstream and downstream reaches of the creek from an elevated vantage point at the top of the dune near the carpark at the end of the track;
- the mouth of the creek to the south of the car park also offers an uninterrupted view of the downstream reach of the creek and its partial opening to the ocean; and
- much of the Willis Creek reserve has been retained in its natural state and the creek follows a narrow channel that meanders through dense, visually rich riparian vegetation which encloses and protects the creek to produce a highly tranquil and scenic environment.

Ecological values of Willis Creek include:

- a relatively large area of saltmarsh habitat. Saltmarsh contributes to the overall productivity of the estuary and provides habitat for fish and invertebrates. Saltmarsh is also protected as an endangered ecological community (EEC) under the *TSC Act*;
- an area close to the entrance to Willis Creek is used as a breeding site for a population of the endangered little tern (*Sterna albifrons*);
- the riparian vegetation of Willis Creek is mostly intact and in good (73%) to very good (9%) condition. Riparian vegetation filters overland flows, stabilises banks, provides structural habitat for fish and contributes to the overall productivity of the estuary;
- approximately 0.9 ha of mangrove habitat showing active recruitment. Mangroves are an important primary producer driving the overall productivity of the system, process pollutants in the water, provide structural habitat for fish and invertebrates and stabilise banks and sediment; and
- reeds and rushes are common along the margins of the central channel and upper creek, contributing to productivity, habitat value and bank stability.

The entrance to the Willis Creek estuary naturally alternates between being open or closed to the ocean. These types of estuaries are known as an ICOLL's - Intermittently Closed and Open Lakes and Lagoons.

Willis Creek Estuary and Catchment also has significance with regard to Aboriginal Cultural Heritage. The Woolgoolga area was (and continues to be) inhabited by the Gumbayngirr people prior to European Settlement. Records show that an artefact find is located within the study area, and two Aboriginal ceremonial and dreaming sites are located within close proximity of the Willis Creek catchment. The cultural values of these Aboriginal sites within the Willis Creek catchment area require sensitive consideration and preservation.

The Coffs Harbour Coastal Zone Management Plan includes an action (FS.11) with the purpose of developing a decision framework for managing indigenous and non-indigenous heritage items and places affected by coastal hazards. Once developed, Council will utilise this framework across the entire Coffs Harbour City Council Region, including Willis Creek. All Aboriginal places and Aboriginal objects are protected under the National Parks and Wildlife Act 1974 (NPW Act).

Key Management Issues

The key estuary management issues that have been identified relate to:

- sediment, nutrient and other pollutant inputs from the catchment;
- protecting the native riparian vegetation (which is generally in good condition) from environmental weeds which reduce the ecological value and potentially impact upon bank stability, recreational amenity and aesthetics;
- preserving the recreational and visual amenity which is predominantly an undisturbed natural environment with low key recreational activities; and
- climate change impacts (particularly sea level rise and consequent lake water level increases) on the estuarine ecology.

Key Management Strategies

Key management strategies for Willis Creek estuary include:

- continue educational and auditing strategies that address the management of soil resources and pesticide / herbicide / fertiliser use in agricultural activities in the upper catchment;
- auditing the existing drainage systems and industrial properties to identify any deficiencies in existing stormwater management systems;
- incorporating adequate riparian buffer widths into the planning framework for rural properties;
- a weed management strategy which targets priority environmental weeds in high value riparian areas;
- upgrading the existing vehicular route to the carpark near the creek entrance and maintaining the existing range and level of low impact recreation to preserve the dominant natural character and cultural heritage values of the estuary;
- upgrading the car park area near creek entrance to enhance the visitor experience and the appreciation of the estuary's natural values by improving site interpretation and opportunity to view Willis Creek;
- assessing available corridors for upslope migration of mangrove and saltmarsh communities in response to sea level rise and making appropriate changes to planning instruments in order to protect saltmarsh and mangroves from future impacts associated with sea level rise;
- a water quality monitoring program for Willis Creek;
- a revegetation plan to enhance the existing natural character of the estuary to preserve and improve its high visual amenity; and
- implementing a formal Entrance Management Policy for Willis Creek with the aim to minimise interference with the natural opening and closing processes of the creek entrance whilst mitigating the impacts of extreme water quality issues and future sea level rise induced flooding of properties and infrastructure.

The management strategies in this document are presented in general order of priority (Strategy 1 being the highest priority). Specific priorities have also been assigned to each strategy action in terms of "very high", "high", "medium" or "low" priority. The priorities and timeframes provided in this CZMP are indicative and are to be used to guide the order of implementation. Priorities were established in response to:

- the degree to which the management strategies will impact on estuary issues;
- timeframe over which the strategy impacts will extend (the longer the better);
- extent of the estuary addressed by each management strategy;
- community rating of issues addressed by each management strategy (based on a community survey); and
- likely cost of effective implementation of the management strategy.

Coffs Harbour 2030 Plan

The Coffs Harbour 2030 Plan (CHCC, 2009), a strategic plan for the Coffs Harbour community ('the 2030 Plan'), was adopted by Council in December 2009. The 2030 Plan is driven by the Community Vision 2030 and outlines the steps needed to create a sustainable future for Coffs Harbour LGA. It is the overarching plan that integrates planning and reporting frameworks, while mapping out the community's aspirations for the future of the Coffs Harbour LGA to 2030 and beyond.

This CZMP is consistent with the aspirations of the Coffs Harbour community as articulated in the 2030 Plan. The 2030 Plan covers five themes including *Moving Around* and *Looking after our Environment* which are more directly applicable to this CZMP. The 2030 Plan outlines outcomes, objectives and actions for each theme. The actions applicable to this CZMP are listed in **Table I.1** below. The final two columns of the table list the CZMP strategy actions that address the listed 2030 Plan strategies.

Table I.1 – Coffs Harbour 2030 Plan

<i>Coffs Harbour 2030 Plan</i>			<i>Related CZMP Strategy</i>	
<i>Outcome</i>	<i>Objective</i>	<i>Strategy</i>	<i>Strategy Action No.</i>	<i>Description</i>
MA2 Many of us walk and cycle from place to place	MA2.2 We have constructed an interconnected network of cycle ways, footpaths and walking tracks that connect our urban communities, hinterland and coastal villages.	MA 2.2.1 Work in partnership to provide cycle ways and footpaths.	-	Not considered an issue for Willis Creek estuary
LE1 We understand and value our unique natural environment and its cultural connections	LE1.3 We have many opportunities for nature experiences and learning through improved access to natural areas.	LE1.3.1 Promote connection to the environment through learning in the environment.	11.4	Raise community awareness of the natural opening and closing regime of Willis Creek via community awareness initiatives for <i>Shorebird Recovery Program</i> for Little Tern breeding site at the entrance
		LE1.3.2 Create and extend walking trails and other opportunities for environmental experiences.	4.1	Repair the existing vehicular route with the objective of preserving the recreational amenity of Willis Creek and the existing low level of activity
LE2 We protect and restore our environment to conserve its unique biodiversity for future generations	LE2.1 Our forests, beaches, headlands, ocean, rivers, forested mountain backdrop, plants and animals are conserved for future generations.	LE2.1.1 Ensure land use management policies and practices conserve the region's unique environmental and biodiversity values.	Strategy 1 actions	Best Practice Management for soil management and pesticide, herbicide and fertiliser use in agricultural activities Urban stormwater management
			Strategy 3 actions	Environmental weed strategy for riparian corridor
		LE2.1.2 Enhance protection of our marine areas and manage for change.	Strategy 1 actions	As above with respect to Strategy 1 actions
			8.1	Buffers to enable aquatic habitats to respond to sea level rise
	LE2.1.3 Maintain and conserve biodiversity through protected reserve systems and other land conservation mechanisms.	7.1	Buffers to enable aquatic habitats to respond to sea level rise	
	LE2.1.5 Implement climate change planning, adaptation and mitigation strategies.	7.1	Buffers to enable aquatic habitats to respond to sea level rise	
			Strategy 11 actions	Address increased flooding risks from sea level rise that will impact

<i>Coffs Harbour 2030 Plan</i>			<i>Related CZMP Strategy</i>	
<i>Outcome</i>	<i>Objective</i>	<i>Strategy</i>	<i>Strategy Action No.</i>	<i>Description</i>
				on artificial entrance openings
	LE2.2 We have active programs to restore and improve our environment.	LE2.2.2 Manage our catchments effectively and adaptably.	Strategy 1 actions	Best Practice Management for soil management and pesticide, herbicide and fertiliser use in agricultural activities Urban stormwater management
		LE2.2.3 Build ecosystem resilience through a system of local and regional habitat corridors.	Strategy 3 actions 7.1	Management of riparian vegetation Buffers to enable aquatic habitats to respond to sea level rise
LE3 We manage our resources and development sustainably.	LE3.1 We are responsible in the use and management of our natural resources and work to reduce our ecological footprint.	LE3.1.2 Use best practice to prevent pollution impacts on our environment.	Strategy 1 actions	Best Practice Management for soil management and pesticide, herbicide and fertiliser use in agricultural activities Urban stormwater management

Coffs Harbour Coastal Zone Management Plan

Council is preparing a separate Coastal Zone Management Plan that addresses coastal risks along the Coffs Harbour coastline. This coastline plan will define the level of risk from coastal hazards and provide a co-ordinated approach to management of coastal hazards.

Initial review of draft actions proposed in the coastline plan does not indicate any inconsistencies with the Willis Creek estuary strategy actions. However, prior to implementation of the Willis Creek estuary strategy actions Council will need to review to ensure consistency with the Coastal Zone Management Plan for the Coffs Harbour coastline.

Public Land Ownership and Management Arrangements in the Coastal Zone

There are many Crown Land Reserves that are either managed by Council, DoI – Crown Lands, or the various Reserve Trusts for some parcels of Crown Land (e.g. NSW Crown Holiday Parks Trust). Crown Land reserves are required to have a Plan of Management (POM) defining permissible uses of these lands in accordance with the *Crown Lands Act 1996* (or equivalent). When implementing actions in this CZMP for Crown Land Reserves, the applicable POM(s) should be consulted to ensure a consistent, integrated and 'whole of government' approach to coastal zone management.

Council is the manager of the Coffs Coast State Park, which extends from Sawtell to Park Beach, including Woolgoolga Lakeside and Woolgoolga Beach Reserve, and including Boambee Reserve except the section west of the railway bridge and south of the creek that is under a private lease through DoI – Crown Lands.

Council and NPWS jointly manage the Coffs Coast Regional Park (which extends from Diggers Beach to Woolgoolga Headland, and from north of Woolgoolga Lake to 450 m south of Corindi Beach Village) under

the *National Parks and Wildlife Act 1974*. The boundary of the park extends seaward to the mean high water mark (MHWM).

Private lands of the coastal zone mainly consist of residential, along with some commercial / business and industrial properties, and some rural lands.

Crown Land Authorisations

Where works or actions are proposed or to be implemented on Crown Land, not under Council Trust management, appropriate authorisations from DoI – Lands & Water (Crown Lands) are likely to be required prior to the works commencing. Authorisation may be provided by way of licence or potentially the appointment of Council as the reserve manager to streamline future management arrangements.

This issue has specific relevance to the actions in the CZMP regarding actions 4.1 and 10.1 but may also be relevant to action 3.1, 3.2, 3.3, 11.1 and 11.2 if the proposed works are to occur within Crown Lands.

Note 1 Adequate lead time (at least six months) is required for the Department to assess and issue authorisation (licence) works on Crown Land.

Note 2 The *Crown Land Management Act 2016* is expected to commence in early 2018. This may have implications that will need to be considered when the CZMP actions are implemented

Coffs Harbour Regional Park Management Plan

Council is also preparing a Regional Park Management Plan. Prior to implementation of the Willis Creek estuary strategy actions Council will need to review to ensure consistency with the Regional Park Management Plan.

Native Title Act 1993 (Commonwealth) and Aboriginal Land Rights Act 1983 (NSW) Considerations / Obligations

Where actions proposed on Crown Land consideration of Aboriginal Land Claims lodged under NSW *Aboriginal Land Rights Act 1983* will need to be undertaken. Any works will need to be compliant with the Commonwealth *Native Title Act 1993*.

Strategy 1 - Stormwater Management and Catchment Pollutants

Catchment inputs in the form of stormwater, diffuse runoff and point source inputs are typically the major sources of poor water quality in estuaries and other coastal water bodies. The effects of poor water quality inputs can be magnified in ICOLLs such as Willis Creek depending on the status of the entrance.

Modelling undertaken during the Willis Creek Estuary Processes Study (GeoLINK *et al.*, 2011a) suggests that the major sources of sediment and nitrogen are horticultural and residential land uses in the western part of the catchment. The same modelling indicated that phosphorus inputs were clearly dominated by horticultural land uses. Careful management of runoff from agricultural and residential areas within the catchment may lead to long term improvements in water quality.

Community consultation indicates concern that additional effects arising from catchment runoff may be related to pesticide and herbicide use in agricultural activities (mostly blueberry and banana farming). Guidelines for best practice management of soil and water resources on blueberry (NSW DPI 2008a) and banana farms (NSW DPI 2008b) are available and have been used in the past as a basis for workshops and training activities for farmers.

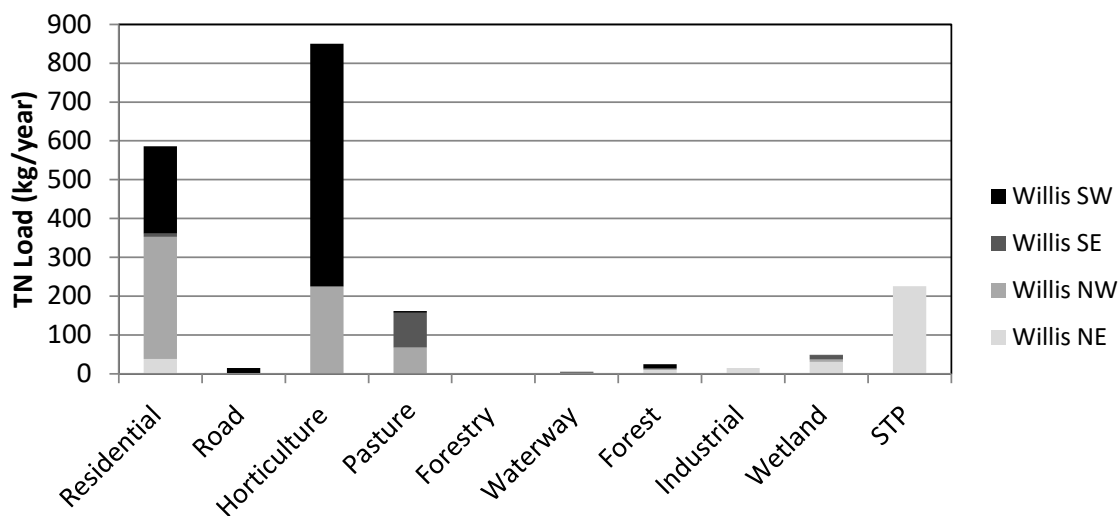


Illustration 1.1 Modelled Nitrogen inputs from different landuses and areas of the Willis Creek catchment

The site of the Woolgoolga Water Reclamation Plant occupies a significant proportion of the Willis Creek estuary. Effluent release from the plant into the creek ceased in 2005 with the upgrade of the plant and connection to the Coffs Harbour reclaimed water reticulation system. There are no releases of effluent into the creek with the exception of wet weather overflows approximately every 5 to 10 years. It is considered that current licence conditions and management of the plant adequately address potential issues associated with the plant.

1.1 Summary of Proposed Actions

- Educational strategies to address soil management and pesticide, herbicide and fertiliser use in agricultural activities.
- Encourage horticultural landowners to uptake incentives program for Best Practice Management.
- Audit stormwater management systems for existing urban development.
- Stormwater management for new urban development - ongoing updating of Council's Water Sensitive Urban Design (WSUD) Policy (2009) and associated guidelines.
- Encourage horticultural landowners to establish vegetated riparian zones on farm watercourses via the incentives program for Best Practice Management.
- Control land modification activities on rural lands to prevent soil erosion and other impacts associated with rural development such as the construction of building pads for greenhouse structures.

1.1.1 Related Strategies

- **Strategy 2** Water Quality.
- **Strategy 3** Riparian Vegetation.
- **Strategy 5** Water Quality Impacts Associated with Climate Change Impacts on Water Quality.
- **Strategy 6** Fish Kills and Algal Blooms.
- **Strategy 8** Water Quality Monitoring.

1.1.2 Objectives Addressed

- Restore Terrestrial Habitats of High Ecological or Conservation Value by Removing Threats and Through Targeted Rehabilitation.
- Improved Water Quality.

1.2 Details of Proposed Actions

Strategy Action 1.1

Educational strategies to address soil management and pesticide, herbicide and fertiliser use in agricultural activities.

Background:

Community consultation indicates concern that agricultural activities (mostly blueberry and banana farming) may be negatively impacting water quality in Willis Creek via inputs of sediment, nutrients and agricultural chemicals.

A campaign of awareness targeting rural landholders is considered an appropriate way of addressing these concerns, improving agricultural practices and having a positive effect on water quality in Willis Creek. Workshops run by Coffs Harbour Regional Landcare targeting fertiliser use on blueberry farms are an example of recent initiatives that could be expanded upon. Workshops could be based upon existing guidelines (NSW DPI 2008a & b) and utilise the expertise of NSW DPI (Agriculture) staff from the Coffs Harbour region.

Specific Tasks

Develop and deliver a series of workshops aimed at blueberry and banana farmers in the catchment that describe;

- strategies to reduce erosion, such as contour alignment of rows, installation of trafficable cross banks at regular intervals, establishment of groundcovers, adequate riparian buffer widths on rural properties and the use of subsurface drainage;
- strategies to maintain and monitor soil moisture such that irrigation is always used in the most efficient manner;
- strategies to maximise the efficiency of fertiliser, herbicide and pesticide use and application, such that the overall use is minimised and concentrations in runoff can be minimised; and
- strategies to minimise the risk of accidental spillage of fertiliser, herbicides and pesticides such as appropriate storage, transport and disposal;

<i>Responsible Agencies</i>	<i>Timeframe¹</i>	<i>Cost</i>	<i>Potential Funding Sources</i>	<i>Monitoring</i>
Lead Agency: <ul style="list-style-type: none"> ▪ DPI – Agriculture NSW Related Agencies: <ul style="list-style-type: none"> ▪ CHCC; ▪ North Coast LLS; Landcare.	Year 1	\$5,000 per workshop for preparation, materials and delivery	<ul style="list-style-type: none"> ▪ Caring for Our Country ▪ CHCC Environmental Levy ▪ North Coast LLS ▪ OEH - Environmental Education Grants 	Delivery of workshops is an appropriate benchmark.

Strategy Action 1.2

Encourage horticultural landowners to uptake incentives program for Best Practice Management

Background:

Community consultation indicates concern that agricultural activities (mostly blueberry and banana farming) may be negatively impacting water quality in Willis Creek via inputs of sediment, nutrients and agricultural chemicals.

The North Coast Local Land Services (North Coast LLS) provides support for landholders in specific horticultural industries to assist with the adoption of Best Management Practices for soil health in high priority landscapes including the Woolgoolga area. The targeted horticultural industries include blueberry, banana, macadamia, vegetable and coffee growers and growers of other perennial horticulture crops.

Eligible project activities include, but are not limited to improvements to soil condition / soil health through application of mulch, organic matter, compost, cover crops, minimum tillage, use of crop residues etc. or other biological farming techniques; soil conservation works such as runoff controls, diversion banks, waterways or other erosion control earthworks; and, establishment / improvement of ground cover to stabilise soil.

Successful applications use the Best Management Practice techniques outlined in the Horticulture BMP Guidelines (eg. Soil and Water Management Practices for Blueberry growers in Northern NSW, 2008) and have in-kind contributions from the landholder with an ongoing commitment to maintaining the project.

Specific Tasks

Council, North Coast LLS and Regional Landcare to promote and coordinate uptake of the incentives program amongst horticultural landowners.

<i>Responsible Agencies</i>	<i>Timeframe¹</i>	<i>Cost</i>	<i>Potential Funding Sources</i>	<i>Monitoring</i>
<p>Lead Agency:</p> <ul style="list-style-type: none"> ▪ North Coast LLS <p>Related Agencies:</p> <ul style="list-style-type: none"> ▪ CHCC ; ▪ Landcare; ▪ DPI - Agriculture 	Years 1 – 5	<ul style="list-style-type: none"> ▪ Staff budget time for coordinating uptake of the incentives program ▪ \$20,000 pa for incentives funding from CHCC Environmental Levy (Subject to funding and relevant processes) ▪ \$20,000 pa for incentives funding from North Coast LLS (Subject to approval and available funding). 	<ul style="list-style-type: none"> ▪ CHCC Environmental Levy ▪ North Coast LLS –Relevant Programs 	CHCC to report annually on uptake numbers and implemented measures

Strategy Action 1.3

Audit stormwater management systems for existing urban development

Background:

Residential and industrial land is the second largest contributor of sediment and nitrogen in the catchment. This indicates that investment into effective stormwater management could be an effective means of improving overall estuary health. Therefore, it is important that stormwater management improvements (treatment and detention) are pursued in existing residential and industrial areas where existing arrangements are deficient. This may include retrofitting of existing drainage systems to improve treatment and detention as opportunities arise in association with redevelopment.

Specific Tasks

- Audit key stormwater outlets and associated drainage catchment to identify sub-standard treatment or sub-standard detention of flows and opportunities for retrofitting of the existing system;
- Audit industrial premises to identify any key stormwater issues that can be readily addressed with on-site treatment and detention measures;
- Based on the above audits, retrofit high-priority stormwater drainage systems with treatment and/or detention systems and direct industrial premises to rectify on-site stormwater issues where necessary.

<i>Responsible Agencies</i>	<i>Timeframe¹</i>	<i>Cost</i>	<i>Potential Funding Sources</i>	<i>Monitoring</i>
CHCC	<ul style="list-style-type: none"> ▪ Initial audit: 1 – 5 years ▪ Retrofit works: long term 	<ul style="list-style-type: none"> ▪ Initial audit: CHCC staff time as part of asset management ▪ Retrofit works: dependant on proposed works 	NSW Government Coastal and Estuary Management Program	Implementation of this action is an appropriate benchmark

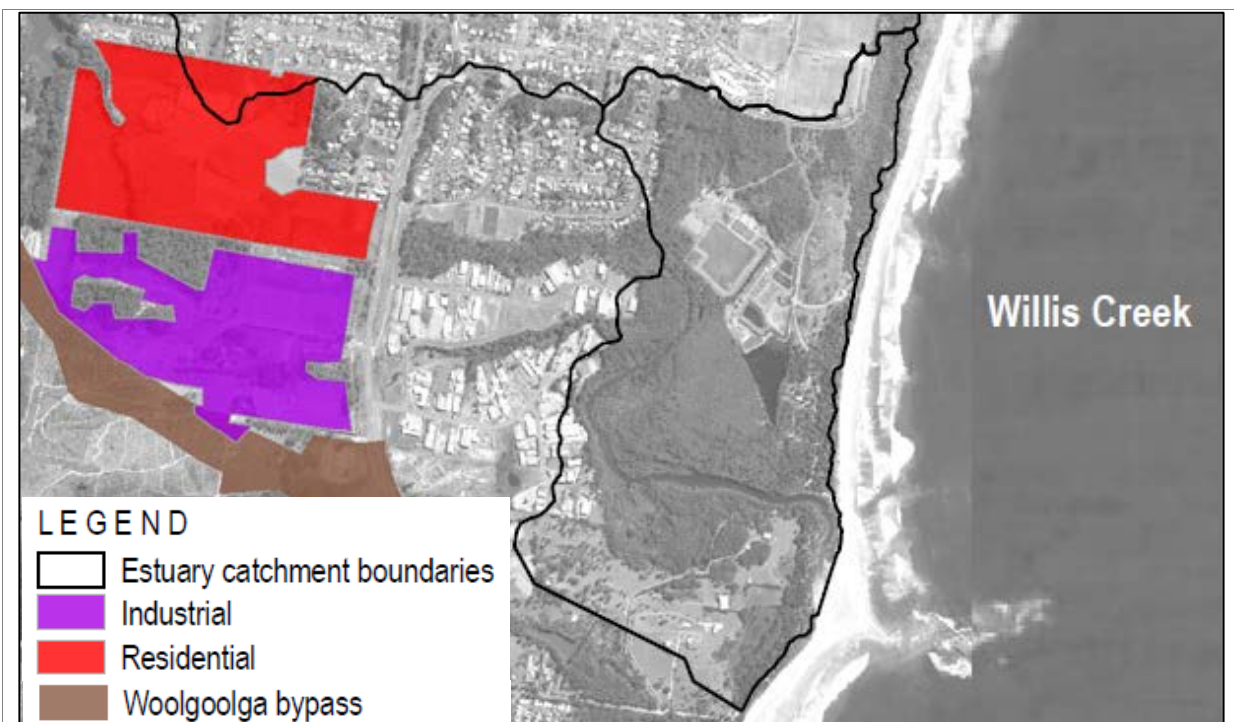
Strategy Action 1.4

Stormwater management for new urban development

Background:

Projected future growth in the upper catchment of Willis Creek includes a “Special Investigation” area for residential and potential industrial medium term growth (2011 - 2016) – refer to **Plate 1.1**. New development areas have the potential to reduce the quality of catchment runoff during and after the construction phase. It is important that controls placed on new developments are sufficient and enforced to ensure no negative net impact upon water quality.

A significant component (20%) of the estuary catchment is zoned “2E Residential Tourist” on the southern side of Willis Creek. This area currently has minimal development. The area is addressed under Council’s *Hearnes Lake / Sandy Beach Development Control Plan (DCP)* (2008) which promotes sustainable development of the area including: a proposed increase in environmental protection areas adjoining the southern side of the creek; masterplanning of low-density residential and ecotourism in existing cleared areas; and specific stormwater quality management guidelines. The Hearnes Lake / Sandy Beach DCP is considered to satisfactorily address any potential water quality issues associated with future development of this area, accordingly this is not considered a significant issue for the estuary provided the DCP measures are enforced.



Source: GeoLINK *et al.* (2011a)

Plate 1.1 Future Industrial and Residential Growth Areas

Council currently has a policy / guidelines addressing stormwater management for new development (Coffs Harbour City Council Water Sensitive Urban Design (WSUD) Policy, 2009a) and specific requirements for development of the “2E Residential Tourist” zone on the southern side of Willis Creek. These guidelines / development controls are consistent with current best-practice management measures in the industry. Therefore, this CZMP recommends continued implementation of Council’s policy and guidelines for stormwater management and ongoing updating of the policy and guidelines in line with developments in the stormwater management industry. No additional strategies are considered necessary in respect to controlling stormwater management for new development.

Specific Tasks

- Ongoing updating of Council’s Water Sensitive Urban Design (WSUD) Policy (2009) and associated guidelines in line with developments in the stormwater management industry.

<i>Responsible Agencies</i>	<i>Timeframe¹</i>	<i>Cost</i>	<i>Potential Funding Sources</i>	<i>Monitoring</i>
CHCC	Review policy and guidelines every 5 years	Part of Council’s operational budget	n/a	Review policy and guidelines every 5 years

Strategy Action 1.5

Encourage horticultural landowners to establish vegetated riparian zones on farm watercourses via the incentives program for Best Practice Management

Background:

When looked at over the whole state of NSW, water quality data shows that the condition of an ICOLL degrades significantly once natural vegetation is lost from more than half of the catchment (Haines 2008). Clearly increased urban and agricultural development can result in negative impacts on waterways within the catchment. However, making provisions for adequate riparian buffer widths throughout a catchment can result in a number of benefits to receiving waters, such as reduced sediment and nutrient loads. It can also serve greater environmental purposes such as provision of wildlife corridors between alternative habitats.

Generally, the urbanised tributaries of Woolgoolga Lake are provided with vegetated riparian buffers of a minimum of 10 to 20 m width. The Processes Study indicates that riparian vegetation in the study area is predominately in moderate to good condition (GeoLINK *et al.*, 2011a). However, some tributaries in the upper catchment in horticultural areas are lacking any vegetated riparian buffer as indicated in the following plate.

NSW DPI recommend a minimum buffer of 50 m between watercourses and greenhouse horticulture in its handbook for managing land use conflict issues on the NSW North Coast (Learmonth, *at. al.*, 2007). The handbook recommends minimum buffer distances between watercourses and grazing land or non-greenhouse horticulture to be based on 'best practice management'.



An indication of what may be considered 'best practice management' is provided in DPI Water recommendations for vegetated riparian zone widths – these widths should contain fully structured native vegetation (including groundcovers, shrubs and trees). These recommended widths are based on watercourse order as classified under the Strahler System of ordering watercourses and based on current 1:25 000 topographic maps (see table below). The width of the riparian zone should be measured from the top of the highest bank and on both sides of the watercourse. Based on the table below a minimum 10 metre wide vegetated riparian zone on either side of the watercourses is recommended in the upper tributaries.

Watercourse type	VRZ width (each side of watercourse)	Total RC width
1 st order	10 metres	20 m + channel width
2 nd order	20 metres	40 m + channel width
3 rd order	30 metres	60 m + channel width
4 th order and greater (includes estuaries, wetlands and any parts of rivers influenced by tidal waters)	40 metres	80 m + channel width

Source: NSW Office of Water, 2012

It is considered that the best approach to establishing a vegetated riparian zone in the upper tributaries on rural land is via the incentives program for Best Practice Management for horticultural landowners in **Strategy Action 1.2**. Therefore no additional actions or tasks are proposed.

<i>Responsible Agencies</i>	<i>Timeframe¹</i>	<i>Cost</i>	<i>Potential Funding Sources</i>	<i>Monitoring</i>
Lead Agency: <ul style="list-style-type: none"> ▪ North Coast LLS Related Agencies: <ul style="list-style-type: none"> ▪ CHCC; ▪ Landcare; ▪ DPI – Agriculture 	Years 1 – 5	Cost listed in Strategy Action 1.2 .	Same funding as listed in Strategy Action 1.2 .	Part of reporting as described for Strategy Action 1.2 .

Strategy Action 1.6

Control land modification activities on rural lands

Background:

Land disturbance associated with the construction, installation or maintenance of buildings, roads, or other infrastructure creates the potential for increased levels of soil erosion and consequent sediment pollution of waterways.

There has been significant development of the greenhouse horticulture industry in the rural area of Woolgoolga. Development of this industry can involve significant earthworks associated with the construction of building pads for greenhouse structures. These earthworks create the potential for significant sediment pollution of waterways without proper erosion and sediment control measures.

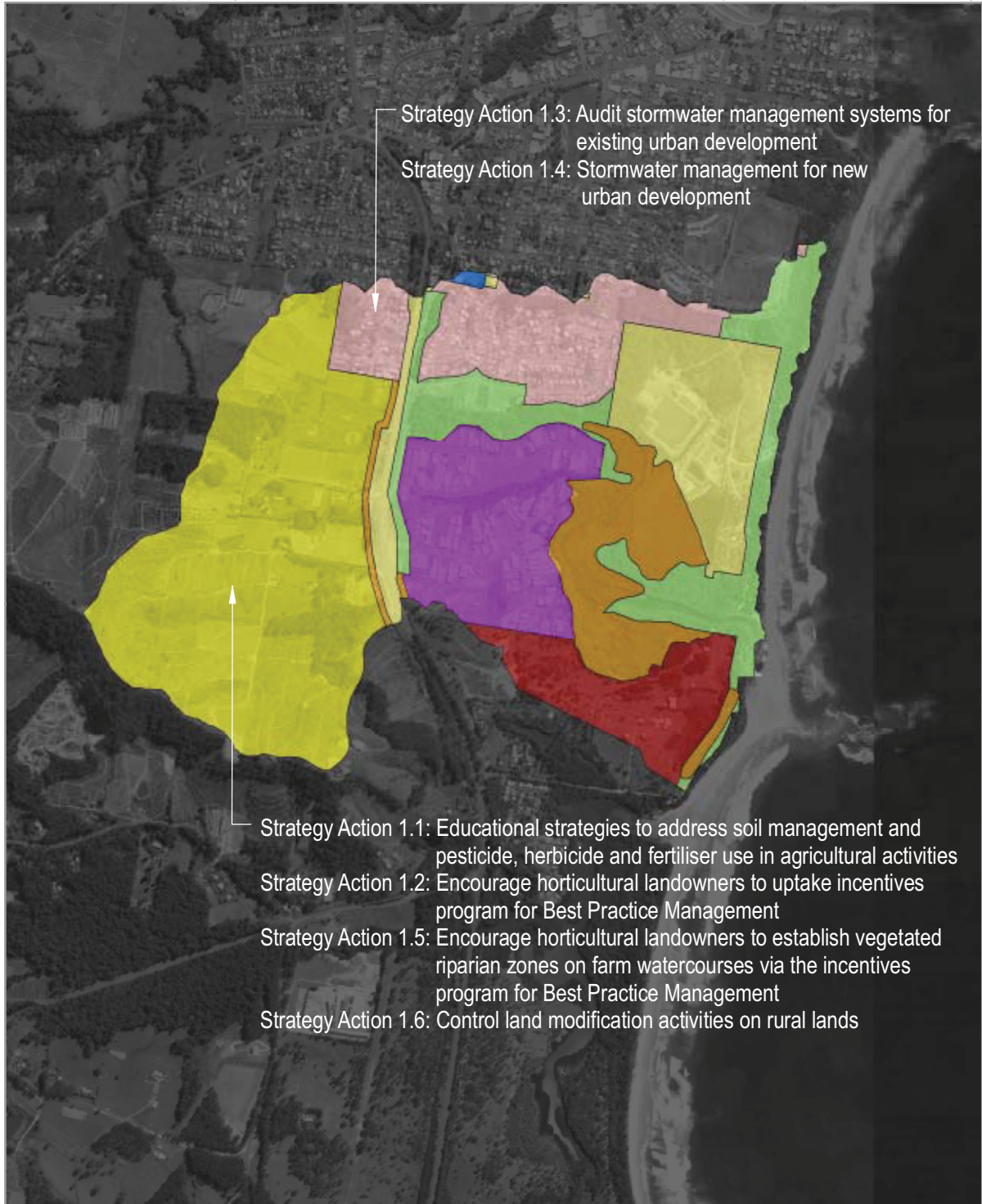
Past development of the greenhouse horticulture industry has generally proceeded without the requirement for development consent. There have been reported incidences where significant erosion and sediment control issues have occurred in association with construction of greenhouse structures. These incidences have been addressed under the Protection of the Environment Operations Act 1997. It is considered that a more proactive approach by Council to ensuring implementation of proper erosion and sediment control measures will provide a better outcome. This can be achieved through the development consent approach utilising relevant provisions from the proposed Standard Instrument Local Environment Plan (SiLEP) such as Clause 7.7 Earthworks of the draft SiLEP (2012).

Specific Tasks

- Educate rural land holders about the above provisions / requirement for development consent in timing with the adoption of the proposed SiLEP;
- With respect to enforcing the provisions of the proposed SiLEP relevant to the above issues, Council is to undertake the following tasks when issues are brought to Council's attention:
 - investigate the requirement for consent for development captured by the relevant SiLEP provisions;
 - investigate compliance with development conditions in regard to erosion and sediment control measures;
 - investigate compliance where development has occurred without consent (and not been exempt development under the SiLEP or SEPP (Exempt and Complying Development Codes) 2008; and
 - utilise the provisions of the Protection of the Environment Operations Act 1997 to enforce erosion and sedimentation control where poorly managed earthworks pose a risk to, or have impacted, the environment.

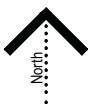
Responsible Agencies	Timeframe¹	Cost	Potential Funding Sources	Monitoring
CHCC	Year 1	Unknown additional staffing resources and additional costs to Council's operational budget	n/a	Review development application / consent numbers and comparison with hothouse development based on aerial imagery

Note: 1. Timeframe: the year relates to the time following adoption of this CZMP eg. "Years 2 – 5" indicates the strategy action should be implemented within 2 to 5 years of adoption of the CZMP



LEGEND

- Agriculture
- Urban
- Tourism
- Business
- Industrial
- Community purpose
- Open space and public recreation
- Environmental protection



0 400



Strategy 1 - Stormwater Management and Catchment Pollutants

Coastal Zone Management Plan - Willis Creek Estuary
1616040

Illustration 1.2

Strategy 2 – Water Quality

It is common practice to compare water quality measurements with guideline values in order to determine the status of water quality in an aquatic system. For the protection of aquatic ecosystems in coastal waterways such as Willis Creek the most commonly applied guideline values are described by ANZECC (2000) and for the assessment of estuary condition DECCW (now OEH) released a set of guideline values based upon the salinity range in the waterway.



Comparison of existing water quality against guideline values revealed that turbidity, total nitrogen, total phosphorus and chlorophyll-a measurements are all elevated in Willis Creek, based upon the available guidelines (GeoLINK *et al.*, 2011a). It should be noted that no recent data was available to assess Willis Creek and that the most recent data was from 2005, when treated effluent was still discharged into the waterway.

2.1 Summary of Proposed Actions

Elevated levels of turbidity, nitrogen, phosphorus and chlorophyll-a are most likely to be a result of inputs from urban and non-urban areas in the catchment. As there are no point source inputs of sediments and nutrients into Willis Creek the main strategy available to reduce these pollutants loads is reducing the concentrations of sediments and nutrients in diffuse runoff from rural areas and in stormwater from urban areas. This is adequately addressed in the **Strategy 1** actions of this CZMP. No further actions are proposed to address this issue.

2.1.1 Related Strategies

- **Strategy 1** Stormwater Management and Catchment Pollutants.
- **Strategy 5** Climate Change Impacts on Water Quality.
- **Strategy 6** Fish Kills and Algal Blooms.
- **Strategy 8** Water Quality Monitoring.

2.1.2 Objectives Addressed

- Improved Water Quality.

This page has been left intentionally blank

Strategy 3 - Riparian Vegetation

A variety of terrestrial habitats of high conservation value have been identified within the riparian zone of Willis Creek. However, riparian weed mapping in January 2011 identified the presence of five environmental weed species listed as priority weeds in the *Northern Rivers Invasive Plants Action Strategy 2009-2013 (NRIPAS)*: Oakwood, 2009). Environmental weeds degrade the native riparian vegetation, reducing its ecological value and in some cases potentially impacting upon bank stability and other estuary values including recreational amenity and aesthetics.

The restoration of riparian vegetation is listed among the goals of the NRCMA Catchment Action Plan. Additionally, the Coffs Harbour Settlement Strategy lists the enhancement of riparian corridors as a key strategy for the Woolgoolga area to provide ecological links between coast and hinterland (Coffs Harbour City Council, 2011b).

This strategy is aimed at the protection and rehabilitation of native riparian vegetation communities with high ecological or conservation value where degradation through weed infestation has occurred. The strategy focuses on weeds species identified in the NRIPAS as Priority C or above.

3.1 Summary of Proposed Actions

- Develop a weed management strategy which prioritises areas of riparian foreshore to be treated and priority weeds to be targeted.
- Undertake primary weed control in priority areas using specialist bush regeneration contractors.
- Foster a local *Bushcare* group to undertake the secondary control or follow-up maintenance of areas treated by contractors.

3.1.1 Related Strategies

- **Strategy 4** Recreational Amenity.
- **Strategy 10** Visual Amenity.

3.1.2 Objectives Addressed

- Restore terrestrial habitats of high ecological or conservation value by removing threats and through targeted rehabilitation (e.g. riparian vegetation, endangered ecological communities such as Coastal Saltmarsh, Freshwater Wetlands, etc).
- Maintain and preserve the existing natural characteristics of the area as the dominant visual feature.
- Remove weed infestation and rehabilitate natural areas disturbed by previous uses or uncontrolled vehicle access.

3.2 Details of Proposed Actions

Strategy Action 3.1

Develop a weed management strategy which prioritises areas of riparian foreshore to be treated and priority weeds to be targeted

Background

Weed mapping undertaken in January 2011 identified the presence of environmental weed species throughout Willis Creek (GeoLINK *et al.*, 2011a). The main species identified were groundsel bush, winter cassia, noogoora burr, and pink lantana in the mid to upper reaches, and bitou bush and coastal morning glory in the lower reaches.

According to the *Northern Rivers Invasive Plants Action Strategy 2009-2013 (NRIPAS)* (Oakwood, 2009), groundsel bush is the highest priority (Priority B) invasive weed species mapped during the field assessment. The Strategy also identifies winter cassia/senna and bitou bush (Priority C), and coastal morning glory (Priority D) as priority weeds in coastal landscapes, and lantana (Priority C) and coastal morning glory (Priority E) in riparian landscapes.

Weed control is a long-term and costly management action and so it is recommended that areas with important estuary values be targeted as a priority. **Illustration 3.1** identifies reaches where the riparian vegetation has been mapped as being in good to very good condition but where environmental weeds identified as either Priority B or C under the *NRIPAS* were also identified (ie. in this catchment: groundsel bush, senna/winter cassia, bitou bush, and lantana). These reaches are considered to be the highest priority for weed control for the next 5 years under this CZMP and should be the focus of the Weed Management strategy for Willis Creek.

Specific Tasks

It is recommended to develop a strategy based on existing mapping which;

- Sets clear objectives for weed management along the estuary over a 5 year timeline.
- Identifies priority areas for control efforts.
- Defines responsibilities for control works.
- Outlines appropriate methods for control works in estuarine environments.
- Estimates the number of hours required for primary control works and estimates hours required for maintenance over the 5 year time period.
- Outlines a strategy for raising community awareness of actions which can contribute to the spread of environmental weeds along the estuary.
- Identifies funding sources
- Sets monitoring and evaluation criteria

Note. Refer to the Crown Land Authorisations information in the Introduction section if proposed works are to occur within Crown Lands.

<i>Responsible Agencies</i>	<i>Timeframe¹</i>	<i>Cost</i>	<i>Potential Funding Sources</i>	<i>Monitoring</i>
Lead Agency: <ul style="list-style-type: none"> ▪ CHCC Related Agencies: <ul style="list-style-type: none"> ▪ North Coast LLS; ▪ Landcare. 	Years 1 - 2	Strategy development ~\$5,000 if done external to CHCC.	North Coast LLS	The benchmark for this Action is the development of a recognised NRM Plan for the Management of priority weed species in priority areas of Willis Creek.

Strategy Action 3.2

Undertake primary weed control in priority areas using specialist bush regeneration contractors

Background:

Estuarine and riparian areas are highly sensitive environments. As such, weed control work in these environments needs to be undertaken by specialist bush regenerators with skills in plant identification and knowledge of appropriate methods of control of weeds near waterways (especially where chemical control methods are to be used). In addition, such areas can be hazardous to workers, so it is essential that appropriate OHS strategies are implemented to ensure control works are undertaken in a safe manner.

Specific Tasks

- Priority areas for weed control, species to be targeted, appropriate methods to be used, total available contract hours, and monitoring and evaluation actions/maintenance are to be defined in the Weed Management Strategy developed in **Strategy Action 3.1** above.
- Priority works should where possible be scheduled into the operations/works plan of Council's Bush Regeneration team, alternatively specialist contractors could be engaged where funding is available

Note. Refer to the Crown Land Authorisations information in the Introduction section if proposed works are to occur within Crown Lands.

<i>Responsible Agencies</i>	<i>Timeframe¹</i>	<i>Cost</i>	<i>Potential Funding Sources</i>	<i>Monitoring</i>
<p>Lead Agency:</p> <ul style="list-style-type: none"> ▪ CHCC - Weeds Officer to provide oversight. <p>Related Agencies:</p> <ul style="list-style-type: none"> ▪ North Coast LLS; ▪ Landcare. 	Years 2 – 5	<p>Subject to development of the Weeds Management Strategy under Strategy Action 3.1 above.</p> <p>If external contractors are to be used, funds required is subject to the Weed Management Strategy but initially estimated at</p> <p>200 hours per year @ \$35/hr (\$7,000/yr) over 5 years.</p>	<ul style="list-style-type: none"> ▪ North Coast LLS ▪ Environmental Trust Restoration and Rehabilitation grants, ▪ Grants through the NSW Government's Public Reserves Management Fund for weed control works on Crown Lands. ¹ ▪ CHCC Environmental Levy. 	The benchmark for this Action is the engagement of specialist contractors to control priority weeds in areas identified in the Weed Management Strategy developed in Strategy Action 3.1

Note: 1. Potential funding through the Public Reserves Management Fund, is only available where the works are managed under the *Crown Lands Act 1989* (or equivalent), and subject to a competitive grant application process.

Strategy Action 3.3

Foster a local Landcare group to undertake the secondary control or follow-up maintenance of areas treated by the CHCC bush regeneration team or specialist contractors

Background:

The effective control of environmental weeds requires a long-term and consistent approach. To be successful, the initial control works undertaken by the CHCC team or specialist contractors needs to be followed by periodic maintenance to ensure areas cleared of weeds do not become re-infested by regrowth or new weed seedlings. A model that has worked in many parts of the North Coast region has been to support local care groups operating under the Landcare umbrella. Small scale funding and support in the form of insurance coverage and tools is often available through the Landcare network. Group activities are also often part funded via North Coast LLS small grants (where a recognised NRM Plan exists), via Council environmental levies, Environmental Trust grants, etc.

Specific Tasks

Liaise with Coffs Harbour Landcare to determine the appropriate actions for establishing a Willis Creek Care group.

Note. Refer to the Crown Land Authorisations information in the Introduction section if proposed works are to occur within Crown Lands.

<i>Responsible Agencies</i>	<i>Timeframe¹</i>	<i>Cost</i>	<i>Potential Funding Sources</i>	<i>Monitoring</i>
Lead Agency: <ul style="list-style-type: none"> ▪ CHCC. Related Agencies: <ul style="list-style-type: none"> ▪ North Coast LLS; ▪ Landcare. 	Long term commitment required to support community groups	Dependent on activities, but generally limited to provision of tools, consumables, and support.	Support available through Coffs Landcare Network. Potential funding available through North Coast LLS Any other grants available from time to time such as Environmental Trust Community Bush Regeneration and/or Restoration and Rehabilitation Grants.	The benchmark for this action is the successful formation of a Willis Creek Care group which includes as its activities the long term maintenance of high conservation value riparian vegetation communities.

Note: 1. Timeframe: the year relates to the time following adoption of this CZMP eg. "Years 2 – 5" indicates the strategy action should be implemented within 2 to 5 years of adoption of the CZMP

Strategy Action 3.1: Develop a weed management strategy which prioritises areas of riparian foreshore to be treated and priority weeds to be targeted

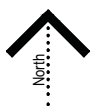
Strategy Action 3.2: Undertake primary weed control in priority areas using specialist bush regeneration contractors



Strategy Action 3.3: Foster a local Bushcare group to undertake the secondary control or follow-up maintenance of areas treated by contractors

LEGEND

- Coastal Saltmarsh plus riparian vegetation in good condition but with bitou bush present
- Coastal Saltmarsh plus riparian vegetation in very good condition but with bitou bush present
- Coastal Saltmarsh threatened by grousel, winter cassia, and lantana
- Coastal Saltmarsh threatened by lantana and grousel infestation
- Coastal Saltmarsh threatened by lantana infestation



0 250



This page has been left intentionally blank

Strategy 4 - Recreational Amenity and Cultural Heritage

Increased recreational activity and uncontrolled pedestrian access to riparian areas of Willis Creek has the potential to damage the natural environment. Additionally, increased recreational activity has the potential to impact on the existing 'low-key' recreational amenity, cultural heritage values and sense of solitude experienced by walkers.

Willis Creek offers a predominantly undisturbed natural environment that forms an integral and important component of the natural settings along the coastline. It is a remote, densely vegetated estuary with limited access which significantly restricts visual access into the area. The creek follows a narrow channel that meanders through dense, visually rich riparian vegetation which encloses and protects the creek to produce a highly tranquil and scenic environment.



The Willis Creek estuary is an important natural resource but is largely hidden from public view. This is largely due to the screening effect of the surrounding riparian vegetation, lack of bush track access and the low level elevation of the surrounding landscape to enable a clear view of the creek setting.

The area is generally accessed along a vehicular route from South Street (branching off High Street). The vehicular route comprises a bitumen sealed road from High Street to the Woolgoolga Water Reclamation Plant and an unsealed ('dirt') road from the plant to the car park area near the creek entrance. The unsealed road varies in condition with poor drainage / pooling of water in some sections which has resulted in the creation of additional 'bypass' tracks around the 'boggy' sections. This has consequently impacted on the adjoining vegetation.

This strategy aims to preserve the recreational amenity and cultural heritage values of Willis Creek and the existing level of activity.

4.1 Summary of Proposed Actions

- Repair the existing vehicular route where required to avoid / prevent vehicles creating additional 'bypass' tracks.

4.1.1 Related Strategies

- Strategy 3 Riparian Vegetation.
- Strategy 10 Visual Amenity.

4.1.2 Objectives Addressed

- Preserve the quiet, undeveloped natural setting.
- Prevent excessive disturbance or fragmentation of the existing natural and cultural values.
- Maintain and preserve the existing natural characteristics of the area as the dominant visual feature.

- Remove weed infestation and rehabilitate natural areas disturbed by previous uses or uncontrolled vehicle access.

4.2 Details of Proposed Actions


Strategy Action 4.1				
Repair the existing vehicular route where required to avoid / prevent vehicles creating additional 'bypass' tracks				
Background:				
<p>The southern half of the vehicular access route from High Street to the car park near the creek entrance is unsealed and includes sections with poor drainage / pooling of water which has led to the creation of additional 'bypass' tracks around the 'boggy' sections. This has consequently impacted on the adjoining vegetation.</p> <p>The objective of this strategy is to repair the vehicular access route where required to prevent the creation of additional 'bypass' tracks and thereby preventing impacts on the adjoining vegetation whilst maintaining the existing 'low-key' recreational amenity and cultural heritage values of the area.</p> <p>Works under this strategy may relate to Crown Reserve No. 752853 for Future Public Requirements – managed by NSW DoI – Crown Lands.</p> <p>Where actions are proposed on Crown Land, consideration of Aboriginal Land Claims lodged under the Aboriginal Land Rights Act 1983 (NSW) will need to be undertaken. Any works will need to be compliant with the Native Title Act 1993 (Cth).</p>				
Specific Tasks				
<ul style="list-style-type: none"> ▪ Seek relevant licences with respect to the following works on DoI – Crown Lands. ▪ Confirm the status of the existing route and address the legal status of the proposed road access corridor. ▪ Upgrade the existing vehicular route where required to prevent pooling of water on the roadway and to prevent disturbance of adjoining vegetation. This may include a combination of road configuration / drainage redesign and discrete barriers such as mounding, additional planting, or bollards to ensure vehicle access is maintained along the track. 				
<p>Note. Refer to the Crown Land Authorisations information in the Introduction section if proposed works are to occur within Crown Lands.</p>				
<i>Responsible Agencies</i>	<i>Timeframe¹</i>	<i>Cost</i>	<i>Potential Funding Sources</i>	<i>Monitoring</i>
CHCC	Years 1 - 5	Repair the existing vehicular route and install discrete barriers: \$10,000	<ul style="list-style-type: none"> ▪ Caring for Our Country ▪ CHCC operating budget ▪ CHCC Environmental Levy 	Annual assessment of condition of vehicular access route

Note: 1. Timeframe: the year relates to the time following adoption of this CZMP eg. "Years 2 – 5" indicates the strategy action should be implemented within 2 to 5 years of adoption of the CZMP



Strategy Action 4.1:
Repair the existing vehicular route where required to
avoid / prevent vehicles creating additional [bypass] tracks

LEGEND

 Crown land reserves



GeoLINK
environmental management and design

Coastal Zone Management Plan - Willis Creek Estuary
1616042

Strategy 4 - Recreational Amenity

Illustration 4.1

This page has been left intentionally blank

Strategy 5 - Climate Change Impacts on Water Quality

Forecast climate change and sea level rise scenarios are likely to result in a number of changes to water quality processes in ICOLLs such as Willis Creek. Some of the impacts will be direct, such as changes to average water temperature, whilst some will be indirect, following on from changes to physical process such as hydrodynamics (Haines 2006). Climate change scenarios may also result in an intensification of existing issues with water quality.

5.1 Summary of Proposed Actions

Addressing current issues in accordance with **Strategy 1** actions will be the best preparation for the impacts of climate change on water quality. No further actions are proposed to address this issue.

5.1.1 Related Strategies

- **Strategy 1** Stormwater Management and Catchment Pollutants.
- **Strategy 2** Water Quality.
- **Strategy 7** Fish Kills and Algal Blooms.
- **Strategy 8** Climate Change Impacts on Estuary Ecology.
- **Strategy 9** Water Quality Monitoring.

5.1.2 Objectives Addressed

- Improved Water Quality.

This page has been left intentionally blank

Strategy 6 - Fish Kills and Algal Blooms

The Woolgoolga Water Reclamation Plant previously released treated effluent into Willis Creek until 2005 when the plant was upgraded and connected to the Coffs Harbour reclaimed water reticulation system. There are no releases of effluent into the creek with the exception of wet weather overflows approximately every 5 to 10 years. These overflows from the wet weather balance pond occur in extreme rainfall events and the highly diluted sewage (approx. 90% stormwater / 10% sewage) (pers. comm. A. Wilson, CHCC, 10/10/2011). It is considered that current licence conditions and management of the plant adequately address potential issues associated with the plant operation.

Past releases of treated effluent into Willis Creek until 2005 has led to elevated nutrient concentrations that can lead to algal blooms and subsequent fish kills. Unfortunately there is little direct action that can be undertaken to rectify this problem. However, strategies aimed at reducing further input of nutrients and sediment from the catchment (see **Strategy 1** actions) will help to reduce new impacts and may increase the natural recovery of the system. No further actions are proposed to address this issue.

6.1 Summary of Proposed Actions

Strategy 1 actions are considered adequate to address this issue. No further actions are proposed.

6.1.1 Related Strategies

- **Strategy 1** Stormwater Management and Catchment Pollutants.
- **Strategy 2** Water Quality.
- **Strategy 3** Riparian Vegetation.
- **Strategy 6** Climate Change Impacts on Water Quality.
- **Strategy 9** Water Quality Monitoring.

6.1.2 Objectives Addressed

- Make Provisions for the Ecological Effects of Climate Change and Sea Level Rise.
- Improved Water Quality.

This page has been left intentionally blank

Strategy 7 - Climate Change Impacts on Estuary Ecology

Under current projections for climate change and associated sea level rise there are likely to be a number of impacts upon estuary ecology. These may include direct impacts upon mangroves and saltmarsh and direct impacts upon fish diversity and abundance.



It is expected that mangroves communities will typically migrate landward in response to higher lake water levels. The distribution and species of mangroves may change due to higher water temperatures (Walsh, 2004a cited in Haines, 2006). Saltmarsh communities are considered to be particularly vulnerable to increases in average lake water levels, as they occupy relatively flat ground near the waters edge. Small changes in sea level will therefore result in extensive inundation (Walsh, 2004a cited in Haines, 2006). Further, landward migration of saltmarsh, mangroves, and other wetland communities in response to rising lake water levels may be restricted by existing development or barriers (e.g. natural elevated banks adjoining the creek) resulting in a loss of habitat (Pittock, 2003; Walsh, 2004b, Gilman, 2004 cited in Haines, 2006).

There may be also be indirect impacts upon estuary ecology related to climate change impacts upon water quality. Strategies that will reduce the impacts of forecast climate change scenarios upon water quality are discussed under **Strategy 1**.

7.1 Summary of Proposed Actions

- Implement development control provisions to facilitate upslope migration of mangroves and saltmarsh in response to sea level rise.

7.1.1 Related Strategies

- **Strategy 1** Stormwater Management and Catchment Pollutants.
- **Strategy 2** Water Quality.
- **Strategy 3** Riparian Vegetation.
- **Strategy 5** Climate Change Impacts on Water Quality.

7.1.2 Objectives Addressed

- Protect Saltmarsh and Mangrove Habitats from Disturbance.
- Make Provisions for the Ecological Effects of Climate Change and Sea Level Rise.
- Preserve the Quiet, Undeveloped Natural Setting.

7.2 Details of Proposed Actions

Strategy Action 7.1

Implement development control provisions to facilitate upslope migration of mangroves and saltmarsh in response to sea level rise

Background:

Currently, mangroves and saltmarsh in Willis Creek are mostly located below the 1.5 mAHD contour line and all located below the 2 mAHD contour line. The response of mangroves and saltmarsh colonies to sea level rise forecasts is likely to be a mixture of sediment accretion (ie, no migration) and upslope migration. The exact balance will be dependent upon a variety of geomorphic, biogeographic and development factors that will vary significantly by location. However, it can be safely assumed that the future total vertical migration of mangroves and saltmarsh is likely to be closely aligned with future total sea level rise (i.e approx. 0.9m by 2100) as the distribution of saltmarsh and mangroves is strongly defined by tidal heights. In areas where upslope migration is made possible by low sloping land, low development pressure and compatible current landuse careful planning for the future may result in improved outcomes.

In addition to buffers allowing the upslope migration of mangroves and saltmarsh it is important to allow horizontal buffers for landward migration of riparian vegetation so that a suitable riparian strip is maintained under sea level rise scenarios. Current best practice suggests that a 40m riparian buffer is suitable for maintaining the environmental integrity of estuaries (see **Strategy Action 1.5**).

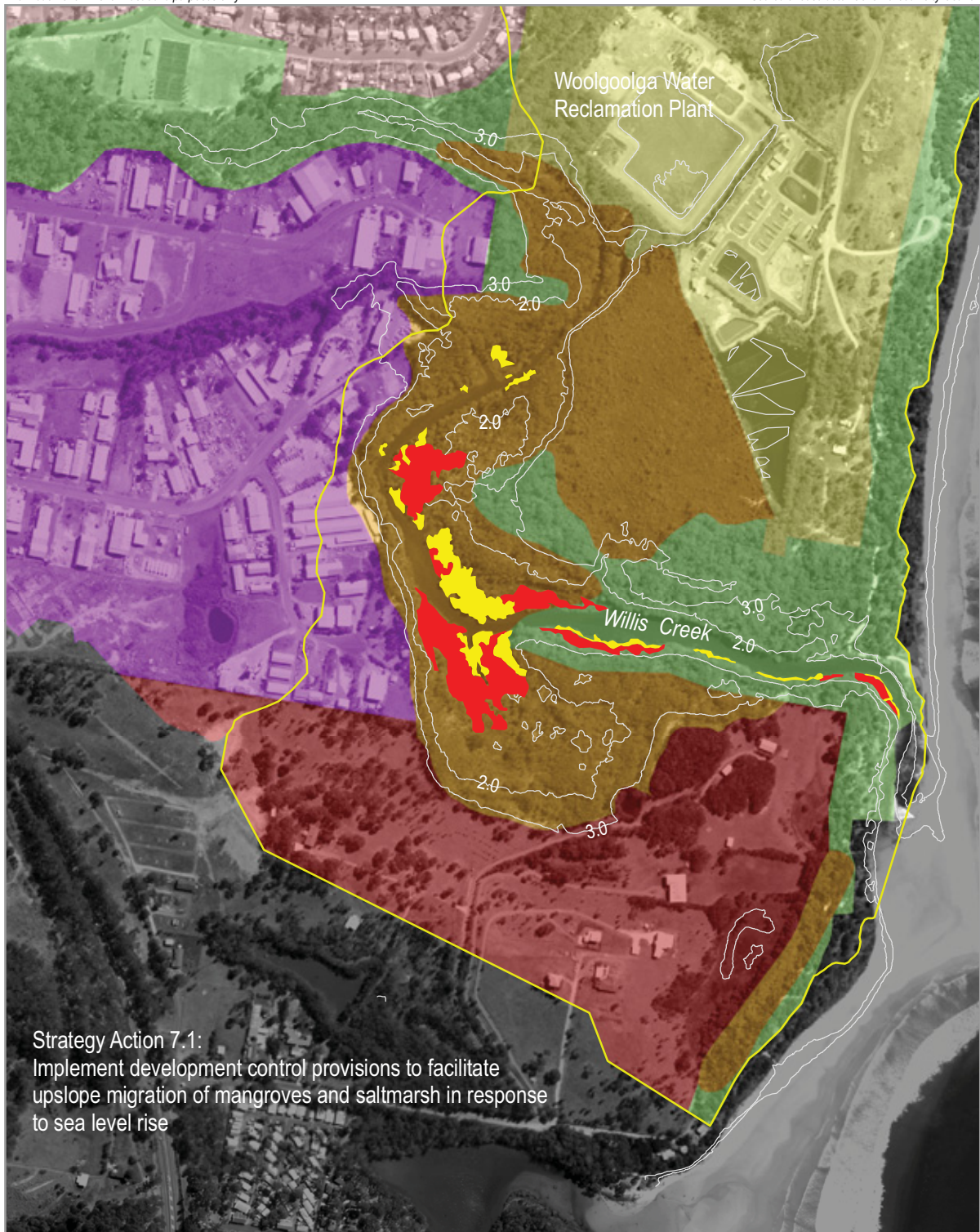
The majority of Willis Creek foreshore where retreat of mangroves and saltmarsh is likely to occur is largely zoned 7A – Environmental Protection Habitat and Catchment with other areas zoned 6A – Open Space and Public Recreation. This is considered an adequate zoning for the protection of vertical and horizontal buffers for the upslope migration of saltmarsh and mangroves resulting from sea level rise over the near future. However, in the case that changes to the current zoning of foreshore land around Willis Creek be proposed or the Coffs Harbour LEP is reviewed, appropriate horizontal and vertical buffers must be protected to ensure the future integrity of mangrove and saltmarsh habitat in addition to a riparian buffer zone. A vertical buffer incorporating the 3 mAHD contour line and a horizontal buffer of 40 m landward from the 3 mAHD contour line will be adequate to preserve the ecological integrity of the system.

Specific Tasks

- Map a buffer zone around Willis Creek incorporating all lands currently zoned 5A, 6A and 7A falling within 40 m landward of the 3 mAHD contour line.
- Develop Development Control Plan (DCP) provisions for the above buffer zone that controls or limits development within the buffer zone such that potential upslope migration of mangroves and saltmarsh is not impeded.

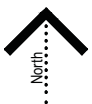
<i>Responsible Agencies</i>	<i>Timeframe¹</i>	<i>Cost</i>	<i>Potential Funding Sources</i>	<i>Monitoring</i>
CHCC	Years 1 – 2	Staff time	CHCC operating budget	Preparation of a report which describes priority potential areas for future colonisation

Note: 1. Timeframe: the year relates to the time following adoption of this CZMP eg. "Years 2 – 5" indicates the strategy action should be implemented within 2 to 5 years of adoption of the CZMP



LEGEND

- Saltmarsh (Aquatic Science and Management - 2009)
- Mangrove (Aquatic Science and Management - 2009)
- 2A Residential Low Density
- 2E Residential Tourist
- 4A Industrial
- 5A Sewage Treatment Plant
- 6A Open Space and Public Recreation
- 7A Environmental Protection Habitat and Catchment
- Contour at 2.0 and 3.0 m AHD



0 150



Coastal Zone Management Plan - Willis Creek Estuary
 1616043

Strategy 7 - Climate Change Impacts on Estuary Ecology

Illustration 7.1

This page has been left intentionally blank

Strategy 8 - Water Quality Monitoring

The collection of water quality data is an important aspect of overall estuary management. When collected in a suitable fashion, water quality data informs managers of:

- Natural and unnatural processes occurring in the waterway;
- Risks to public safety associated with recreational pursuits;
- Risks to public safety associated with the consumption of aquatic foods;
- Potential risks to aquatic ecosystems;
- Trends with respect to the 'health' of the aquatic system; and
- The effects of soil, water and other management strategies put in place throughout the catchment.

The long term dataset available for Willis Creek is not detailed or consistent enough to provide clear information about a number of the above listed items.

8.1 Summary of Proposed Actions

- Include Willis Creek in the Ecohealth water quality monitoring program.

8.1.1 Related Strategies

- **Strategy 1** Stormwater Management and Catchment Pollutants.
- **Strategy 2** Water Quality.
- **Strategy 5** Climate Change Impacts on Water Quality.
- **Strategy 6** Fish Kills and Algal Blooms.

8.1.2 Objectives Addressed

- Improved Water Quality.
- Improved Monitoring of Water Quality.

8.2 Details of Proposed Actions

Strategy Action 8.1

Include Willis Creek in the Ecohealth water quality monitoring program.

Background:

The combined water quality dataset for Willis Creek has been identified as lacking in continuity and detail and insufficient to assist with management decisions for the estuary. Since the cessation of effluent release into the creek in 2005, very little water quality information has been collected making it difficult to make an informed assessment of current water quality.

Council currently has a number of estuaries included in the Ecohealth program. However, Willis Creek is not currently included in the program. The Ecohealth program is a catchment-based aquatic health monitoring program (including water quality monitoring) in the North Coast region that aims to provide consistency in monitoring and reporting. The Ecohealth program integrates information from the NSW Monitoring, Evaluation and Reporting (MER) Program, NSW State of Environment (SoE) reports, and a range of other reporting programs.

It is recommended that Willis Creek is incorporated into the Ecohealth program for water quality monitoring.

Specific Tasks

- Prepare a baseline report that compiles all past water quality monitoring for Willis Creek (refer to GeoLINK *et al.* (2011a) with regard to previous water quality monitoring);
- Design an Ecohealth water quality monitoring program for Willis Creek that includes (but is not limited to):
 - a clear set of objectives;
 - appropriate temporal and spatial scales for sampling;
 - a comprehensive list of parameters that will add to the understanding of the health of Willis Creek;
 - the responsibilities for field operations and data storage;
 - reporting requirements of CHCC and the NSW State Government; and
 - a system of review;
- Implement the Ecohealth water quality monitoring program.

Responsible Agencies	Timeframe¹	Cost	Potential Funding Sources	Monitoring
Lead Agency: ▪ CHCC Related Agencies: ▪ North Coast LLS; ▪ OEH; ▪ MPA - SIMP	Years 1 – 2	\$5,000 for initial baseline report (or Council staff time) \$20,000 every 4 years for Ecohealth water quality monitoring program	▪ CHCC operating budget. ▪ MPA - SIMP: in kind assistance	Reporting every 4 years in line with SoE reporting

Note: 1. Timeframe: the year relates to the time following adoption of this CZMP eg. "Years 2 – 5" indicates the strategy action should be implemented within 2 to 5 years of adoption of the CZMP

Strategy 9 - Little Terns

The Little Tern (*Sterna albifrons*) is listed as an Endangered Species under the *Threatened Species Conservation Act 1995* (TSC Act) and a Migratory Species under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act).

In recent times the Willis Creek / Hearn's Lake entrance area has become a significant NSW breeding site for the Little Tern (South-eastern Australian population). The site is located on Crown Land and is currently being actively managed seasonally to protect the nesting colony in a joint project undertaken by OEH - Parks & Wildlife Group and Coffs Harbour City Council. The objective is to continue the current management program and avoid activities / development that may threaten the success of the program.



Source: Coffs Coast Advocate, 2010

A *Shorebird Recovery Program* has been devised to guide management of the Little Tern breeding site at the Hearn's Lake / Willis Creek entrance. Management actions include fencing off of the nesting site, community awareness initiatives, a fox abatement plan and monitoring. Continuance of this program is expected to reduce the impact of human activities on the Little Tern population.

The management works specifically undertaken for the Little Tern are considered to provide an umbrella effect for local biodiversity, including other locally breeding migratory and shorebirds species including the Red-capped Plover (*Charadrius ruficapillus*), Rainbow Bee-eater (*Merops ornatus*) and Striated Pardalote (*Pardalotus striatus*). It may also provide future benefits for other local threatened species such as the Sooty Oystercatcher (*Haematopus longirostris*) (Nigel Cotseil, CHCC Ecologist, *pers. comm.*).

9.1 Summary of Proposed Actions

It is considered the current joint management undertaken by OEH - National Parks and Wildlife Service and Coffs Harbour City Council is consistent with the objectives developed for the Willis Creek estuary. Therefore the CZMP supports the current joint management and *Shorebird Recovery Program* for management of the Little Tern breeding site at the Hearn's Lake / Willis Creek entrance. No specific CZMP actions are proposed in respect to the Little Tern breeding site at the Hearn's Lake / Willis Creek entrance.

9.1.1 Related Strategies

- Strategy 4 Recreational Amenity;
- Strategy 10 Entrance Management.

9.1.2 Objectives Addressed

- Protect Little Tern population from disturbance;
- Preserve the quiet, undeveloped natural setting;
- Prevent excessive disturbance or fragmentation of the existing natural values;
- Enhance public appreciation of the broader and site specific natural values of the creek environment; and
- Maintain and preserve the existing natural characteristics of the area as the dominant visual feature.

This page has been left intentionally blank

Strategy 10 - Visual Amenity

Willis Creek offers a predominantly undisturbed natural environment that forms an integral and important component of the regional coastal landscape. It is a remote, densely vegetated area with limited bush track access and few public vantage points. Nearby Woolgoolga Back Beach, on the other hand, is highly visible and is the predominant destination for people who access the area.



The estuary offers the following scenic values:

- limited, short distant views into the foreshore vegetation from the vehicle access track;
- scenic, panoramic views across upstream and downstream reaches of the creek from an elevated vantage point at the top of the dune near the carpark at the end of the track;
- attractive upstream views through the creek mouth from Woolgoolga Back Beach;
- quiet, tranquil settings along the creek corridor created by the narrow channel that meanders through dense, visually rich riparian vegetation which encloses and protects the creek; and
- dramatic, panoramic views along the coastline provided by several beach access tracks .

The only public access road into the reserve passes through an area of degraded, weed infested vegetation as a consequence of poor maintenance and past land use activities. While the area is relatively remote from Willis Creek, it is highly visible and reflects poorly on the overall visual image of the coastal landscape.

This strategy aims to preserve and optimise the scenic values of Willis Creek, to restore areas of degradation and to complement the amenity of the more popular nearby beach setting.

10.1 Summary of Proposed Actions

The following action is proposed:

- Prepare and implement a revegetation plan to enhance the existing natural character of the estuary to preserve and improve its high visual amenity

10.1.1 Related Strategies

- **Strategy 3** Riparian Vegetation
- **Strategy 4** Recreational Amenity

10.1.2 Objectives Addressed

- Preserve the quiet, undeveloped natural setting
- Prevent excessive disturbance or fragmentation of the existing natural values
- Enhance public appreciation of the broader and site specific natural values of the creek environment
- Maintain and preserve the existing natural characteristics of the area as the dominant visual feature
- Remove weed infestation and rehabilitate natural areas disturbed by previous uses or uncontrolled vehicle access.

10.2 Details of Proposed Actions

Strategy Action 10.1

Prepare and implement a revegetation plan to enhance the existing natural character of the estuary to preserve and improve its high visual amenity

Background:

The creek and its immediate environment generally exhibit a high degree of visual amenity due to the preservation of its natural values. Elsewhere within the reserve, however, previous land practices have caused considerable damage to the natural landforms and vegetation of the area which now appears degraded and neglected. Attention to these areas while preserving the existing natural vegetation will be paramount to the enhancement of the site's visual amenity.

A licence won't be required where Council is the Trust Manager. If works are to take place on Crown Land managed by the Crown i.e. 130/752853, 7055/1095146, then a licence would be required.

Where actions are proposed on Crown land, consideration of Aboriginal Land Claims lodged under the Aboriginal Land Rights Act 1983 (NSW) will need to be undertaken. Any works will need to be compliant with the Native Title Act 1993 (Cth).

Specific Tasks

- Seek relevant licences with respect to the following works on Crown Lands (not under Council Trust Management).
- Prepare a revegetation plan to restore previously disturbed areas adjoining access roads / paths particularly the northern reaches of the reserve adjacent to the access road. Actively implement the plan by expanding existing revegetation programs undertaken by local dune or land care groups;
- Continue to provide a minimal level of infrastructure to support the existing low level of passive recreation within the estuary area. Upgrade walking tracks if necessary eg. steps or retaining wall construction to ensure path routes cause minimal environmental and visual impact; and
- Monitor the area for environmental weed invasion and rubbish dumping and manage as necessary.
- Investigate the consolidation of suitable Crown Lands into the Coffs Coast Regional Park more integrated and effective Crown land management.

Note. Refer to the Crown Land Authorisations information in the Introduction section if proposed works are to occur within Crown Lands.

Responsible Agencies	Timeframe¹	Cost	Potential Funding Sources	Monitoring
CHCC as Reserve Trust Manager	Years 1-10	Revegetation plan preparation and implementation: \$50,000	Caring for Our Country CHCC operating budget	Monitor success of revegetation program and provide maintenance support as necessary until establishment.

Note: 1. Timeframe: the year relates to the time following adoption of this CZMP eg. "Years 2 – 5" indicates the strategy action should be implemented within 2 to 5 years of adoption of the CZMP


Information shown is for illustrative purposes only

Strategy Action 10.1:

- Prepare a revegetation plan to restore previously disturbed areas adjoining access roads / paths particularly the northern reaches of the reserve adjacent to the access road
- Continue to provide a minimal level of infrastructure to support the existing low level of passive recreation within the estuary area
- Monitor the area for environmental weed invasion and rubbish dumping and manage as necessary



LEGEND

 Crown land reserves

0 200



This page has been left intentionally blank

Strategy 11 – Entrance Management

The entrance to the Willis Creek estuary naturally alternates between being open or closed to the ocean. These types of estuaries are known as an ICOLL's - Intermittently Closed and Open Lakes and Lagoons. Willis Creek is an ICOLL system that is predominantly closed.

Council does not have any current opening protocol for Willis Creek entrance. However, it is noted that during the period of release of effluent into Willis Creek from the Woolgoolga Water Reclamation Plant (1973 to 2005), the plant operator checked the entrance on a daily basis to ensure that it did not fully close (Jelliffe, 1997a). There are no records of artificial opening of the entrance since the cessation of effluent release in 2005.



Community consultation has not indicated any desire for artificial opening of the creek entrance. Nor is there currently any significant need for artificial opening for the purpose of flood mitigation. Nevertheless, a formal entrance management policy is required in accordance with OEH *Guidelines for Preparing Coastal Zone Management Plans* (DECCW, 2010).

The objective of the entrance management policy will be to maintain a natural opening / closing regime for the creek entrance. Interference (artificial opening of the entrance) would only be employed for critical situations such as to mitigate and reduce the impacts of flooding on properties and infrastructure adjoining the creek or addressing extreme water quality issues.

A licence will be required under the *Crown Lands Act 1989 / Crown Land Management Act 2016*. Engaging with the department to consult on the REF will assist in streamlining the issuing of any Crown Lands licences.

11.1 Summary of Proposed Actions

- Prepare a Review of Environmental Factors for potential artificial opening of the entrance to Willis Creek estuary.
- Refine, adopt and implement the draft Willis Creek Entrance Management Policy detailed in **Appendix A** of this CZMP.
- Address flooding risks that have the potential to trigger artificial opening of the entrance in the future.
- Raise community awareness of the natural opening and closing regime of Willis Creek.

11.1.1 Related Strategies

- **Strategy 4** Recreational Amenity.

11.1.2 Objectives Addressed

- Promote natural entrance opening / closing processes.
- Avoid flooding of properties and infrastructure.
- Enhance public appreciation of the broader and site specific natural values of the creek environment.

11.2 Details of Proposed Actions

Strategy Action 11.1

Prepare a Review of Environmental Factors for potential artificial opening of the entrance to Willis Creek estuary

Background:

Willis Creek is an ICOLL system that is predominantly closed. The entrance opens and closes to the ocean naturally in a constant but irregular cycle depending on fluvial, tidal and wave processes. Artificial opening of ICOLL's can have significant negative impacts on water quality, fish and other ecological communities.

There are no records of artificial opening of the entrance being used in the past. Community consultation has not indicated any desire for artificial opening of the creek entrance. Nor is there currently any significant need for artificial opening for the purpose of flood mitigation. Nevertheless, a formal entrance management policy for Willis Creek is required in accordance with OEH *Guidelines for Preparing Coastal Zone Management Plans* (DECCW, 2010).

Works / activities for the purpose of flood mitigation or waterway / foreshore management (to address an extreme water quality issue) would be permitted without consent under Clause 50 of the State Environmental Planning Policy (Infrastructure), 2007. However the requirements of Part 5 of the EP&A Act 1979 must be fulfilled and Council is required to prepare a REF for proposed works / activities (e.g. artificial opening of the entrance to Willis Creek estuary). The REF needs to be consistent with the adopted CZMP and entrance management policy for Willis Creek estuary.

Specific Tasks

Prepare an REF for artificial opening of the entrance to Willis Creek estuary in consultation with relevant state government agencies. The REF will confirm the necessary approvals and licences required for artificial opening of the entrance.

A licence will be required under the *Crown Lands Act 1989 / Crown Land Management Act 2016*. Engaging with the department to consult on the REF will assist in streamlining the issuing of any Crown Lands licences.

Note. Refer to the Crown Land Authorisations information in the Introduction section if proposed works are to occur within Crown Lands.

Responsible Agencies	Timeframe¹	Cost	Potential Funding Sources	Monitoring
CHCC	Years 1 – 5	Staff time	CHCC operating budget	Implementation of this action is an appropriate benchmark.

Strategy Action 11.2

Refine, adopt and implement Willis Creek Entrance Management Policy

Background:

The development of an entrance management policy is a requirement for Coastal Zone Management Plans for ICOLL's under the OEH *Guidelines for Preparing Coastal Zone Management Plans* (DECCW, 2010). Therefore a policy has been drafted (included in **Appendix A** of this CZMP) with the aim to:

- minimise interference with the natural opening and closing regime for the estuary;
- address extreme water quality issues in the estuary;
- minimise flooding of properties and infrastructure from elevated water levels in the estuary.

Future updating of the policy is to consider adjustments in the location of the entrance in response to coastal processes and climate change impacts. The Coffs Harbour Coastal Processes and Hazards Definition Study (BMT WBM, 2011) indicates that shoreline recession of the beach may result in the creek entrance shifting north as indicated in **Plate 11.1**.



Source: BMT WBM, 2011.

- **Beach Erosion and Shoreline Recession at Willis Creek Entrance**

Specific Tasks

- Refine the draft Willis Creek Entrance Management Policy outlined in this CZMP (refer to **Appendix A**) based on the outcomes of the REF under **Strategy Action 11.1**.
- Adopt and implement the Willis Creek Entrance Management Policy.
- A licence will be required under the *Crown Lands Act 1989/ Crown Land Management Act 2016*. Engaging with the department to consult on the REF will assist in streamlining the issuing of any Crown Lands licences.

Note. Refer to the Crown Land Authorisations information in the Introduction section if proposed works are to occur within Crown Lands.

<i>Responsible Agencies</i>	<i>Timeframe¹</i>	<i>Cost</i>	<i>Potential Funding Sources</i>	<i>Monitoring</i>
CHCC	Years 1 – 5	Staff time for adoption of policy.	CHCC operating budget	Implementation of this action is an appropriate benchmark.

Strategy Action 11.3

Address flooding risks that have the potential to trigger artificial opening of the entrance in the future

Background:

Increased flood levels resulting from climate change impacts may present a risk of flooding in the future to some industrial properties at the end of Bosworth Road, sewer manholes to the north and south of the cul-de-sac of Hawke Drive, and potentially sewage pump station PS 5 located to the south of Nightingale Street – refer to **Illustration 11.1**.

The need for artificially opening the estuary entrance for future flood mitigation purposes can be avoided by implementing measures such as removing, relocating or otherwise managing items of low-lying infrastructure at risk of flooding which necessitates artificial openings. The intention of this objective is to minimise the need for future interference to the natural opening / closing regime of the creek entrance for the purpose of flood mitigation.

Specific Tasks

- undertake and audit of low-lying infrastructure and properties to identify key services and assets vulnerable to sea level rise impacts around Willis Creek which have the potential to necessitate artificial opening of the entrance (eg. industrial properties at the end of Bosworth Road, sewer manholes to the north and south of the cul-de-sac of Hawke Drive, and potentially sewage pump station PS 5 located to the south of Nightingale Street). Develop appropriate strategies where necessary for flood-proofing, relocation, replacement or modification of these services, assets and properties.
- Flood-proof, relocate, replace or modify essential services, assets and properties where appropriate to reduce potential for disruption and/or the need for artificial opening of the entrance.
- A licence will be required under the *Crown Lands Act 1989/ Crown Land Management Act 2016*. Engaging with the department to consult on the REF will assist in streamlining the issuing of any Crown Lands licences.

<i>Responsible Agencies</i>	<i>Timeframe¹</i>	<i>Cost</i>	<i>Potential Funding Sources</i>	<i>Monitoring</i>
CHCC	Years 5 - 10 for audit and assessment Years 10 – 25 for relocate, replace or modify essential services and assets	Audit and assessment: \$10,000 Augmentation works: dependant on proposed works	NSW Government Estuary Management Program	Implementation of this action is an appropriate benchmark

Strategy Action 11.4

Raise community awareness of the natural opening and closing regime of Willis Creek.

Specific Tasks

To assist with establishing broad based community understanding and support for the entrance management policy for Willis Creek it is recommended that development of interpretive signage under **Strategy Action 4.2** considers the inclusion of information on the natural opening and closing regime of Willis Creek.

<i>Responsible Agencies</i>	<i>Timeframe¹</i>	<i>Cost</i>	<i>Potential Funding Sources</i>	<i>Monitoring</i>
CHCC	1-10 years	Incorporate into community awareness initiatives under <i>Shorebird Recovery Program</i> for Little Tern breeding site at the entrance	<ul style="list-style-type: none">▪ Caring for Our Country▪ CHCC operating budget	Implementation of this action is an appropriate benchmark.

Note: 1. Timeframe: the year relates to the time following adoption of this CZMP eg. "Years 2 – 5" indicates the strategy action should be implemented within 2 to 5 years of adoption of the CZMP



0 100





Project Team

The Project Team members included:

GeoLINK

Ali McCallum
David Andrighetto
Garry Murray
Richard Elliot
Tim Ruge

Aquatic Science and Management

Matthew Birch

GECO Environmental

Damon Telfer

The following people and organisations have provided technical input to the preparation of this report:

Coffs Harbour City Council

Malcolm Robertson
Martin Rose

Office of Environment & Heritage, NSW Department of Premier and Cabinet

Mohammed Hanif
Rob Kasmarik

Coffs Harbour City Council Coastal Estuary Management Advisory Committee

Mr Peter Smith - Red Rock Preservation Association
Mr Robert Kasmarik - Office of Environment & Heritage
Mr Jim Green - NSW Maritime
Ms Anna Sedlak - NSW Maritime
Mr Glenn Storrie - National Parks & Wildlife Service
David Greenhalgh - Marine Park Authority
Craig Stehn - Coffs Harbour Regional Landcare Inc
Mr Simon Proust - Northern Rivers Catchment Management Authority
Mr Stephen Channells – Crown Lands
Dr Charles V Phipps
Ms Cherelle Brooke - CHCC - City Services Department
Clyde Treadwell - CHCC - Department of Land Use Health and Development
Mr Martin Rose - CHCC - Department of City Services
Mr Bob White - State Emergency Service
Jay Skinner - Northern Rivers Catchment Management Authority
Cr M Graham - CHCC
Cr J Arkan - CHCC
Cr P Templeton - CHCC

This page has been left intentionally blank

References

- ANZECC (2000). *Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Volume 1 The Guidelines*. Australian and New Zealand Environment and Conservation Council, Agriculture and Resource Management Council of Australia and New Zealand. October 2000.
- BMT WBM (2011). *Coffs Harbour Coastal Processes and Hazards Definition Study. Volume 1: Final Report*. Report prepared for Coffs Harbour City Council. Date of Issue 15/02/2011.
- BMT WBM (2010). *Climate Change Projections for the Coffs Harbour Local Government Area*. Draft Report, February 2010.
- BMT WBM *et al* (2010). *Coffs Harbour City Council Climate Change Mitigation and Adaptation Action Plan*. Report prepared for Coffs Harbour City Council in association with Eco Logical Australia and Coastal Zone Management.
- Coffs Harbour City Council (2011a). *Coffs Harbour Settlement Strategy* [Online]. Available: <http://www.coffsharbour.nsw.gov.au/www/html/2016-coffs-harbour-settlement-strategy.asp> Last Updated 14/01/2011 [Accessed 14/02/2011].
- Coffs Harbour City Council (2011b). *Settlement Strategy – Maps* [Online]. Available: <http://www.coffsharbour.nsw.gov.au/www/html/2027-settlement-strategy---maps.asp?intSiteID=1> Last Updated 14/01/2011 [Accessed 14/02/2011].
- Coffs Harbour City Council (2009). *Coffs Harbour 2030 Plan. A Strategic Plan for the Coffs Harbour Community*. December 2009 [Online]. Available: http://www.coffsharbour.nsw.gov.au/Coffs-And-Council/our-future/Pages/2030_documents.aspx [Accessed 14/02/2011].
- DECCW (2010). *Guidelines for Preparing Coastal Zone Management Plans*. Published by Department of environment, Climate Change and Water NSW. Report DECCW 2010/1019, December 2010.
- GeoLINK *et al.* (2011a). *Estuary Processes Study for Darkum Creek, Woolgoolga Lake and Willis Creek*. Report to Coffs Harbour City Council.
- GeoLINK *et al.* (2011b). *Estuary Management Study - Willis Creek*. Prepared for Coffs Harbour City Council and NSW Office of Environment and Heritage in association with Aquatic Science and Management and GECO Environmental, December 2011.
- A.1 Haines, P. E. (2006). *Physical and chemical behaviour and management of Intermittently Closed and Open lakes and Lagoons (ICOLLs) in NSW* [Online]. Griffith centre for Coastal Management, School of Environmental and Applied Sciences, Griffith University Available: <http://www4.gu.edu.au:8080/adt-root/public/adt-QGU20070221.132729/index.html> Australian Digital Theses Program [Accessed 15/12/2010].
- A.2 Haines, P. (2008) *ICOLL Management – Strategies for a Sustainable Future*. BMT WBM Pty Ltd, Broadmeadow NSW. [Online]. . BMT Group Ltd, Available:<http://www.bmtwbm.com.au/Documents%20&%20Resources/?/1906/3269/3269> [Accessed 28/02/2011].
- Jelliffe, PA (1997a). *Report on the Impact of the Disposal of Reclaimed Water into Willis Creek*
- Jelliffe P. (1997b) '*Willis Creek, Woolgoolga: Coastal Processes and Effluent Release Preliminary Investigation*.' Manly Hydraulics Laboratory, Coffs Harbour.
- Learmonth, R., Whitehead, R., Boyd, B. and Fletcher, S. (2007). *Living and Working in Rural Areas. A handbook for managing land use conflict issues on the NSW North Coast*. Centre for Coastal Agricultural Landscapes in partnership with Northern Rivers Catchment Management Authority. Published by NSW Department of Primary Industries.
- MHL (1997). *Willis Creek, Woolgoolga. Coastal Processes and Effluent Release. Preliminary Investigation* (Draft). Prepared by NSW Department of Public Works and Services, Manly Hydraulics Laboratory. Report No. MHL 854. Draft 18 March 1997.
- MHL (2004). *DIPNR Woolgoolga Lake and Darkum Creek, Tidal Data Collection February – May 2004*. Prepared by NSW Department of Commerce, Manly Hydraulics Laboratory. Report No.MHL1342.

NSW DPI (2008a) *Soil and Water Management Practices for Blueberry growers in Northern NSW*. December 2008

NSW DPI (2008b) *Soil and Water Best Management Practices for NSW Banana Growers*.

NSW Office of Water (2011). *Controlled activities: Guidelines for riparian corridors*. March 2011

Oakwood, M (2009) *Northern Rivers Invasive Plants Action Strategy 2009-2013*. North Coast Weeds Advisory Council.

Acronyms

AHD	Australian Height Datum
ANZECC	Australia and New Zealand Environment Conservation Council
APZ	Asset Protection Zone
ASS	Acid sulfate soils
CAP	Catchment Action Plan
CCA	Comprehensive Coastal Assessment
CEMAC	Coffs Harbour City Council Coastal Estuary Management Advisory Committee
CHCC	Coffs Harbour City Council
CMSS	Catchment Management Support System
DO	Dissolved Oxygen
DoI	NSW Department of Industries
DPI	NSW Department of Primary Industries
EMS	Estuary Management Study
ICOLL	Intermittently Closed and Open Lake and Lagoon
LGA	Local Government Area
MER	Monitoring Evaluating and Reporting
MHL	Manly Hydraulics Laboratory
MPA	Marine Parks Authority
NPWS	National Parks and Wildlife Service
LLS	(North Coast) Local Land Services
NRIPAS	Northern Rivers Invasive Plants Action Strategy 2009-2013
OEH	Office of Environment and Heritage, NSW Department of Premier & Cabinet
OEH – PWG	Office of Environment & Heritage – Parks & Wildlife Group
SIMP	Solitary Islands Marine Park
TN	Total Nitrogen
TP	Total Phosphorus
TSS	Total Suspended Solids
WSUD	Water Sensitive Urban Design

This page has been left intentionally blank



Appendix A

Draft Entrance Management Policy Willis Creek Estuary

This page has been left intentionally blank

Entrance Management Policy

Willis Creek Estuary

Prepared for: Coffs Harbour City Council and
Office of Environment and Heritage
© GeoLINK, 2013



PO Box 119
Lennox Head NSW 2478
T 02 6687 7666

PO Box 1446
Coffs Harbour NSW 2450
T 02 6651 7666

info@geolink.net.au

Version History				
UPR	Description	Date Issued	Issued By	Reviewed By
1616882	Initial Draft	18/04/2012	Tim Ruge	Cate Walsh
1616530	Final Draft	06/07/2012	Tim Ruge	Cate Walsh
1616-1003	Draft for Public Exhibition	15/08/2012	Tim Ruge	Cate Walsh
1616-1009	FINAL	31/01/2013	Tim Ruge	Kim Casson

Table of Contents

1	Introduction	1
1.1	Reason for this Policy.....	1
1.2	The Purpose of this Policy	1
1.3	Policy Statement.....	1
1.4	Area to Which this Policy Applies.....	1
1.5	Policy Context.....	1
2	Background	5
2.1	Entrance Management Issues.....	5
2.2	Entrance Behaviour.....	5
2.2.1	Entrance Location.....	5
2.2.2	Entrance Berm.....	6
2.3	Flood Mitigation	6
2.3.1	Mitigation for Major Flood Events	6
2.3.2	Mitigation for Minor Flood Events	8
2.4	Water Quality.....	8
3	Approvals	11
3.1	Statutory Provisions	11
3.1.1	Crown Lands Act 1989	12
3.1.2	Fisheries Management Act 1994	13
3.1.3	Marine Parks Act 1997	13
3.1.4	Water Management Act 2000	14
3.1.5	National Parks and Wildlife Act 1974	14
3.2	Summary of Potential Approvals	15
4	Artificial Opening Procedure	17
4.1	Decision Making Process.....	17
4.2	Responsibilities for Artificial Opening.....	17
4.3	Monitoring	17
5	Policy Updates	21
5.1	Review and Update of this Policy.....	21

Illustrations

Illustration 1.1	Area to Which this Policy Applies	3
Illustration 2.1	Contour Levels Indicative of Minor Flood Levels	7
Illustration 4.1	Artificial Opening Decision Making Flowchart.....	19

Tables

Table 2.1	Estimates of Flood, Ocean, and Berm Levels for Willis Creek Entrance	8
Table 3.1	Activities requiring concurrence under the Fisheries Management Act 1994	13

Introduction

1.1 Reason for this Policy

The entrance to the Willis Creek estuary naturally alternates between being open or closed to the ocean. These types of estuaries are known as an ICOLL's - Intermittently Closed and Open Lakes and Lagoons.

Many ICOLL's are manually or artificially opened to the ocean by authorities to 'drain' the estuary for a range of reasons, often to reduce the impacts of flooding around the estuary foreshores. However, artificially opening ICOLL's can impact on estuary health. Therefore a Policy is required to outline to Council if and when the entrance to Willis Creek estuary should be artificially opened.

1.2 The Purpose of this Policy

The purpose of this Policy is to provide Council with criteria for initiating an artificial opening event and a procedure for artificial opening of the entrance of Willis Creek estuary.

1.3 Policy Statement

The Willis Creek Entrance Management Policy aims to:

- minimise interference with the natural opening and closing regime for Willis Creek estuary;
- minimise flooding of properties and infrastructure from elevated water levels in the estuary; and
- provide a procedure to address extreme water quality issues in the estuary;
- detail procedures and responsibilities for artificial opening of the estuary entrance; and
- detail procedures for monitoring following an artificial opening event.

This Policy will be implemented by Coffs Harbour City Council in consultation with the appropriate NSW Government agencies.

1.4 Area to Which this Policy Applies

The area covered by this Policy is shown in **Illustration 1.1**. This Policy applies to the catchment of the estuary which comprises the waterway, foreshores and land adjacent to the estuary up to the tidal limit of the tributary creeks and the extent of the drainage catchment directly contributing to the estuary waterways.

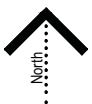
1.5 Policy Context

This Policy has been prepared as part of the Coastal Zone Management Plan (CZMP) for Willis Creek estuary. CZMP's for estuaries are prepared in accordance with Part 4A of the *Coastal Protection Act 1979* and the *Guidelines for Preparing Coastal Zone Management Plans* (DECCW, 2010). These guidelines require CZMP's for ICOLL's to include an entrance management Policy.

A range of NSW legislation and policies are relevant to estuary management and the establishment of any Entrance Management Policy and subsequent artificial opening procedures.

There may be a range of statutory approvals / licensing requirements that need to be sought in order to undertake entrance management activities, for example artificial opening. A range of approvals may be required due to potentially different land tenures, zonings and statutory provisions. These provisions may include Crown Lands licence under the NSW Crown Lands Act 1989, concurrence from NSW Fisheries for dredge and reclamation work on defined water land under the NSW Fisheries Management Act 1994, or other approvals and licences under the National Parks and Wildlife Act 1974 or the Marine Parks Act 1997.

In addition, the Environmental Planning and Assessment Act 1979 established the framework for development control and assessment in NSW. Certain activities may require approval under this Act and associated State Environmental Planning Policies (SEPP) (e.g. SEPP (Infrastructure) 2007). Certain works or activities may either require development consent or be exempt from requiring consent. In the case where works or activities may be exempt from requiring consent, a Review of Environmental Factors (along with all other relevant approvals / licences) would be required under Part 5 of the EP&A Act before works / activities can be carried out. This is addressed more fully in **Section 3** of this Policy.



0 200



Willis Creek Entrance Management Policy
1616047

Area to Which this Policy Applies

Illustration 1.1

This page has been left intentionally blank

Background

2.1 Entrance Management Issues

Willis Creek is an ICOLL system that naturally alternates between being open or closed to the ocean. There are no records of artificial opening of the entrance being used since the cessation of treated effluent release into the creek in 2005. Community consultation has not indicated any desire for artificial opening of the creek entrance. Nor is there currently any significant present need for artificial opening for the purpose of flood mitigation.

However, sea level rise caused by climate change will result in higher flood inundation levels within the estuary in the future. Current inundation levels are likely to increase by a similar amount as sea level rise increases. Adopted sea level rise estimates for NSW are a 0.4 m increase in sea level by 2050 (relative to 1990 levels) and a 0.9 m increase by 2100. Climate change also has the potential to result in an increased frequency of high rainfall events leading to more frequent flooding events.

This may present a risk of flooding to some industrial properties at the end of Bosworth Road and potentially sewage pump station PS 5 located to the south of Nightingale Street.

2.2 Entrance Behaviour

Theory suggests that the predominant hydrodynamic state of Willis Creek is a closed entrance. However, over the period of 1973 to 2005 when the creek received a continued release of treated effluent from the Woolgoolga Water Reclamation Plant the entrance was generally open, discharging low flows across the beach.

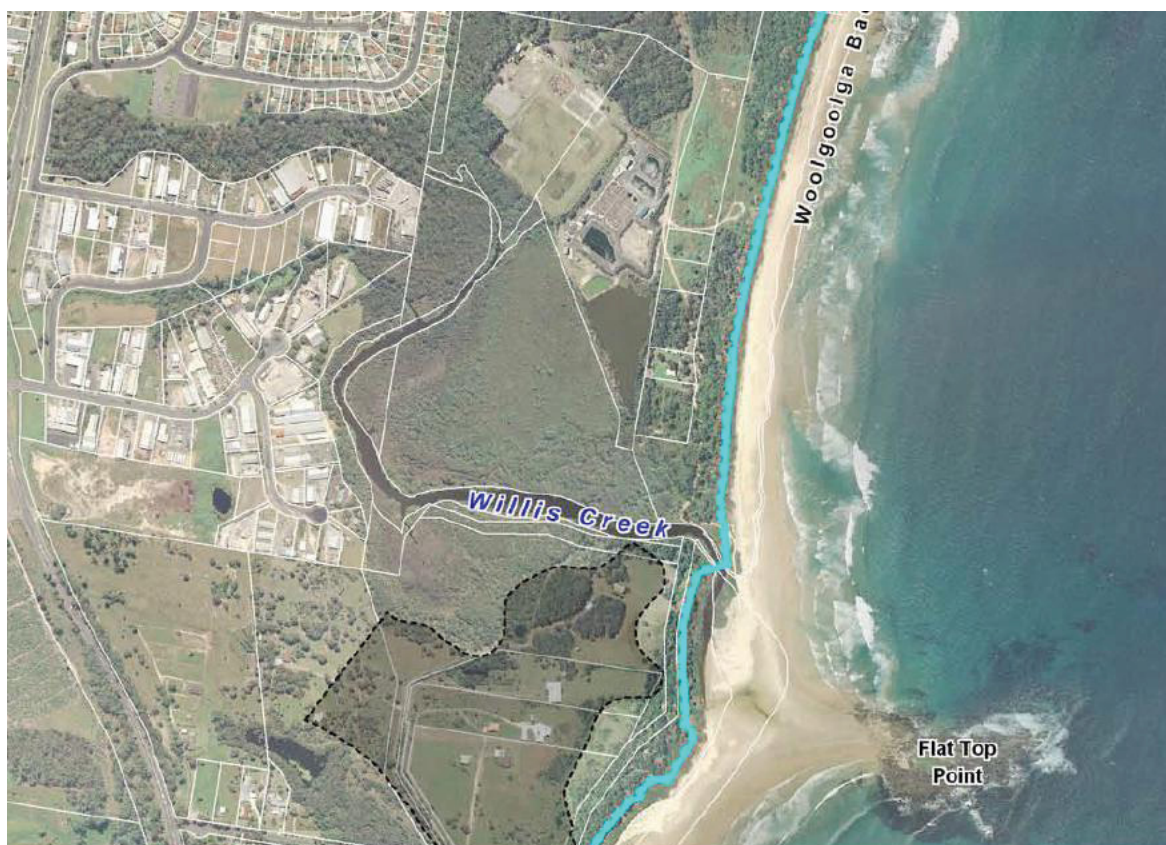
Aerial photography indicates the following in regard to entrance openings:

- 1940s and 1950s: the entrance channel was closed in the 1940s photography. In 1956 the entrance channel meandered to the south-east to discharge on the north side of the tombolo;
- 1960s and 1970s: six photos for the 1960s indicate the entrance channel was closed. Four photos for the 1970s indicate the entrance was open on three occasions and closed on the other;
- 1980s: the entrance channel was open on all photographs during the 1980s;
- 1990s: the entrance channel was open on all photographs (1994 and 1996); and
- 2000's: the entrance was closed in two photos (2000 and 2009) and open in three photographs (2001, 2006 and 2010).

2.2.1 Entrance Location

The entrance and dune along the back beach has revegetated such that the dune now has a low shrub/tree cover along its entire length. Where the creek channel used to discharge directly across the beach during high flows, it now runs to the south on the seaward face of this revegetated dune under all flow conditions. A low, hummocky sand spit has built up along the beach on the seaward side of the southerly trending channel. In the past 20 years this spit has become partly vegetated and is used for vehicular access to the beach. The creek flows across the sand tombolo (connecting to Flat Top Point) frequently discharging to the surf zone south of the tombolo and occasionally to the north (MHL, 1997).

The Coffs Harbour Coastal Processes and Hazards Definition Study (BMT WBM, 2011) indicates that shoreline recession of the beach may result in the creek entrance shifting north as indicated in **Plate 2.1**.



Source: BMT WBM, 2011.

Plate 2.1 Beach Erosion and Shoreline Recession at Willis Creek Entrance

2.2.2 Entrance Berm

The entrance berm level controlling flow into and out of the creek varied from 0.78 to 1.14 m AHD during the MHL study in 1997. The entrance berm level tends to increase during periods of higher tides and decrease during periods of lower tides (Jelliffe, 1997a).

The coastal processes assessment by BMT WBM (2011) did not assess entrance berm heights for Willis Creek. However, the nearby Hearn's Lake entrance berm reaches an estimated height of 2.0 m AHD on average, and a maximum of 2.6 m AHD (similar levels are expected at Willis Creek). The extreme scenario for entrance berm level adopted for all coastal lagoons is 3.5 m AHD, and relates to the potential height of incipient dunes should an entrance remain closed over a period of decades (BMT WBM, 2011).

2.3 Flood Mitigation

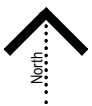
2.3.1 Mitigation for Major Flood Events

No flood study exists for Willis Creek however flood levels for 1 in 100 year event were estimated as part of the Estuary Processes Study (GeoLINK *et al.*, 2011a). The flood level estimates are shown below in **Table 2.1**. **Illustration 2.1** shows the 3.0 m AHD contour level to provide context for the estimated flood levels.



LEGEND

- 3.0 m AHD contour
- 2.0 m AHD contour
- Sewer network
- Sewage pump station 5



GeoLINK
environmental management and design

Willis Creek Entrance Management Policy
1616050

Contour Levels Indicative of Minor Flood Levels

Illustration 2.1

Table 2.1 Estimates of Flood, Ocean, and Berm Levels for Willis Creek Entrance

	Levels (m AHD)		
	Immediate	2050	2100
Flood - 1 in 100 year storm event	2.8	3.2 ¹	3.7 ²
Elevated Ocean Levels - 1 in 20 year event ³	2.5	2.9	3.5
Elevated Ocean Levels - 1 in 100 year event ³	2.7	3.1	3.7
Entrance Berm Height – Almost Certain ⁴	1.5	1.5	1.5
Entrance Berm Height – Unlikely ⁵	2.6	3.0	3.5

Notes: 1. Immediate flood level plus 0.4m sea level rise. Source: GeoLINK *et al.* (2011a);
 2. Immediate flood level plus 0.9m sea level rise. Source: GeoLINK *et al.* (2011a);
 3. Source: BMT WBM (2011);
 4. Estimated from comparison of MHL levels and BMT WBM levels – refer to **Section 2.2.2** above.
 5. Based on BMT WBM levels for Hearn's Lake in Table 3.8 in BMT WBM (2011).

It is important to note the flood levels for major events (shown above) are likely to be independent of any artificial entrance opening works. This is due to the effect of the elevated ocean water levels which would 'over-ride' any impact of an open entrance. This can be seen by comparing the elevated ocean levels in **Table 2.1** with the estimated berm heights at the entrance. The data in **Table 2.1** shows the entrance berm heights to be significantly less than the elevated ocean levels. Therefore, artificially opening the estuary entrance will not have any impact on major (1 in 100 year) flood levels.

Therefore, as flood levels for major events are independent of entrance conditions, there is no benefit to artificially opening the estuary entrance for flood mitigation purposes for major events.

2.3.2 Mitigation for Minor Flood Events

No flood study exists for Willis Creek however it is reasonable to assume that minor flood levels will be less than 2.5 m AHD for present conditions (this equates to a 1 in 20 year elevated ocean level). The extent of inundation at a flood level of 2.5 m AHD is indicated by the 2.0 and 3.0 m AHD contours in **Illustration 2.1**. It can be seen that this flood level does not impact significantly on properties or sewer pump stations. The only impact on sewer infrastructure at this flood level is potential inundation of sewer manholes to the north and south of the cul-de-sac of Hawke Drive. This latter issue could be rectified by sealing the manhole cover against floodwater inflow.

Therefore, there is no benefit to artificially opening the estuary entrance for flood mitigation purposes for present conditions to address minor flood events as there are no properties or infrastructure significantly at risk at present.

2.4 Water Quality

Artificially opening estuary entrances is often carried out as a 'quick fix' to redress water quality problems stemming from other causes such as inadequate stormwater treatment from urban areas or inadequate erosion control measures in the catchment. Best practice for estuary management is based on addressing the source of the water quality issues rather than treating the symptoms by artificially opening entrances to 'flush' an estuary. The CZMP for Willis Creek estuary includes strategies to address the source of current water quality issues.

No recorded physico-chemical water quality data has been found for Willis Creek for the period of 2005 to 2010 since cessation of effluent release in 2005.

Faecal indicator organism samples from the Estuary Processes Study for Willis Creek (GeoLINK *et al.*, 2011) indicate the waters of Willis Creek are generally safe for primary contact recreation. Chlorophyll-a concentrations indicate that Willis Creek was eutrophic during the period of effluent release. Nutrient and sediment modelling of the estuary catchment indicates horticulture and residential lands are the main

contributors of catchment derived sediments and nutrients for Willis Creek. Current assessments of general water quality in Willis Creek indicate there is no need for artificial opening of the entrance to improve water quality under 'normal' conditions.

Nevertheless, there may be instances where artificial opening is justified to address extreme water quality issues such as contaminant spills where it may be desirable to provide some 'draining' of the creek system. However, it is not considered practical to include triggers to address a broad range of potential water quality scenarios. A range of factors would need to be considered during a water quality crisis, such as:

- environmental and public health risks posed by the water quality issue;
- the extent to which artificial opening will mitigate the water quality issue; and
- consequent environmental and public health risks along the adjoining coastline following artificial opening of the creek.

This Policy does not include triggers for water quality issues due to the broad range of potential water quality scenarios and the associated uncertainties. It is recommended that any water quality crisis is assessed on an individual basis.

This page has been left intentionally blank

Approvals

3.1 Statutory Provisions

The area of Willis Creek and any proposed entrance management works would be located within the Coffs Harbour LGA. The actual water body of Willis Creek is not zoned, but identified as "Creeks" under the Coffs Harbour Local Environmental Plan (CHLEP) 2000. Land immediately adjacent to and surrounding the defined water body of Willis Creek is zoned as 6A Open Space and Public Recreation (6A zoning affects land adjoin the entrance) and 7A Environmental Protection Habitat and Catchment under the CHLEP 2000.

Specifically, for the purpose of flooding mitigation works, Clause 50 of the State Environmental Planning Policy (Infrastructure), 2007 (ISEPP) applies, allowing such works to be carried out by or on behalf of a public authority on any land and precludes them from requiring development consent. Clause 50 of ISEPP 2007 states the following:

Development permitted without consent

- (1) *Development for the purpose of flood mitigation work may be carried out by or on behalf of a public authority without consent on any land.*
- (2) *A reference in this clause to development for the purpose of flood mitigation work includes a reference to development for any of the following purposes if the development is in connection with flood mitigation work:*
 - (a) *construction works,*
 - (b) *routine maintenance works,*
 - (c) *environmental management works.*

Specifically, for the purpose of waterway or foreshore management activities, Clause 129 of the State Environmental Planning Policy (Infrastructure), 2007 (ISEPP) applies, allowing such works to be carried out by or on behalf of a public authority on any land and precludes them from requiring development consent.

Waterway or foreshore management activities means:

- (a) *riparian corridor and bank management, including erosion control, bank stabilisation, re-snagging, weed management, revegetation and the creation of foreshore access ways, and*
- (b) *instream management or dredging to rehabilitate aquatic habitat or to maintain or restore environmental flows or tidal flows for ecological purposes, and*
- (c) *coastal management and beach nourishment, including erosion control, dune or foreshore stabilisation works, headland management, weed management, revegetation activities and foreshore access ways, and*
- (d) *coastal protection works, and*
- (e) *salt interception schemes to improve water quality in surface freshwater systems, and*
- (f) *installation or upgrade of waterway gauging stations for water accounting purposes*

Clause 129 of ISEPP 2007 states the following:

Development permitted without consent

- (1) *Despite clause 129A, development for the purpose of waterway or foreshore management activities may be carried out by or on behalf of a public authority without consent on any land.*
- (1a) *To avoid doubt, subclause (1) does not permit the subdivision of any land.*

- (2) *In this clause, a reference to development for the purpose of waterway or foreshore management activities includes a reference to development for any of the following purposes if the development is in connection with waterway or foreshore management activities:*
- (a) *construction works,*
 - (b) *routine maintenance works,*
 - (c) *emergency works, including works required as a result of flooding, storms or coastal erosion,*
Note. Emergency coastal protection works within the meaning of the Coastal Protection Act 1979 are excluded from the operation of the EP&A Act and therefore are not development to which this clause applies.
 - (d) *environmental management works.*
- (2a) *The following provisions apply in relation to the carrying out of new coastal protection works by or on behalf of a public authority on the open coast or entrance to a coastal lake:*
- (a) *if a coastal zone management plan is in force in relation to the land on which the development is to be carried out—the public authority (or person carrying out the works on behalf of the public authority) must consider the provisions of that plan before carrying out the development,*
 - (b) *if a coastal zone management plan is not in force in relation to the land on which the development is to be carried out—the public authority (or person carrying out the works on behalf of the public authority) must:*
 - i. *notify the Coastal Panel before carrying out the development, and*
 - ii. *take into consideration any response received from the Coastal Panel within 21 days of the notification.*
- (2b) *For the purposes of subclause (2a):*
New coastal protection works means coastal protection works other than:
- (a) *the placement of sand (including for beach nourishment) or sandbags, or*
 - (b) *the replacement, repair or maintenance of any such works.*

Although flood mitigation works and waterway and foreshore management activities would be permitted without consent on any land, the requirements of Part 5 of the EP&A Act 1979 must be fulfilled and Council would be required to prepare a REF for any proposed relevant works or activities, e.g. artificial opening of Willis Creek. The REF would outline the nature and extent of the proposal, what would be the trigger and determining factors for proceeding with relevant works / activities such as artificial opening and identify and address any potential environmental effects which may result from such works. Hence the REF would also include mitigation measures and safeguards for the protection of the environment during relevant works / activities. The REF would need to be consistent with the adopted CZMP and entrance management Policy for Willis Creek.

In conjunction with preparation of the REF, Council would be required to consult with and seek any relevant licences and or concurrence from other state government agencies. These would include:

- Crown Lands under the Crown Lands Act 1989;
- Department of Primary Industries - Fisheries under the Fisheries Management Act 1994;
- Marine Parks Authority under the Marine Parks Act 1997;
- NSW Office of Water under the Water Management Act 2000;
- Office of Environment and Heritage (National Parks and Wildlife) under the National Parks and Wildlife Act 1974.

3.1.1 Crown Lands Act 1989

Due to the artificial opening works affecting the waterway of Willis Creek and the coastline, it is likely that such works would affect Crown Land. Artificial opening of the entrance will require authority by way of licences from the Crown under Part 4, Division 1 of the Crown Lands Act 1989.

3.1.2 Fisheries Management Act 1994

The objectives of the Fisheries Management Act 1994 are to conserve, develop and share the fishery resources of the State for the benefit of present and future generations. The provisions of Division 3, Part 7 of the Act are likely to be relevant to any works associated with the artificial opening of Willis Creek. The provisions relate to the protection of aquatic habitat. Although flood mitigation works and waterway or foreshore management activities would be precluded from requiring consent under ISEPP, the provisions of the Fisheries Management Act 1994 are still applicable and as part of the REF process concurrence from the Department of Primary Industries (Fisheries) would be required for certain activities. **Table 3.1** outlines the relevant provisions of the Act that would apply to the artificial opening of Willis Creek.

Table 3.1 Activities requiring concurrence under the Fisheries Management Act 1994

Fisheries Management Act 1994	Sections 198-202	Concurrence is required from the Minister, Department of Primary Industries (Fisheries) for dredge and reclamation works on defined water land. The nature of artificial opening would constitute dredge works and also potentially reclamation works in watered land. Hence a permit and concurrence from s required prior to commencement of any works.
	Sections 219-220	Concurrence is required when barriers to the movement of fish including water course crossings are to be constructed or modified. Any proposed artificial opening is unlikely to create a barrier to the movement of fish. However such specifics would need to be confirmed within the REF.
	Sections 204-205	Any artificial opening works would likely be restricted to the sand berm. Any works must not affect mangroves or other protected marine vegetation. If marine vegetation would be harmed by relevant works / activities, a permit must be sought from the Minister before works commence. Clause 205 (2) states that <i>A person must not harm any such marine vegetation in a protected area, except under the authority of a permit issued by the Minister under this Part.</i> The REF would need to determine if artificial opening works are likely to affect mangroves or other protected marine vegetation.
	Schedules 4, 4A, 5 and 6	The REF prepared for works associated with artificial opening would need to consider any presence of local threatened aquatic habitat for flora or fauna. Thus Key Threatening Processes (KTPs) would need to be considered in preparation of the REF. The following KTPs may be relevant and required consideration: <ul style="list-style-type: none"> ▪ <i>Degradation of native riparian vegetation along NSW water courses.</i> ▪ <i>Installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams.</i>

3.1.3 Marine Parks Act 1997

As Willis Creek forms park of the Solitary Islands Marine Park, Council would be required to obtain a permit / concurrence from the Marine Park Authority / the Minister under the Marine Parks Act 1997 in order to undertake any works on land affected by the Marine Park and any associated zoning. Preparation of the REF would need to consider these factors and seek the relevant concurrence / permit.

3.1.4 Water Management Act 2000

A controlled activity approval under the Water Management Act 2000 (WM Act) is required for certain types of developments and activities that are carried out in or near a river, lake or estuary (water land). Under the WM Act, a controlled activity means:

- the erection of a building or the carrying out of a work (within the meaning of the Environmental Planning and Assessment Act 1979), or
- the removal of material (whether or not extractive material) or vegetation from land, whether by way of excavation or otherwise, or
- the deposition of material (whether or not extractive material) on land, whether by way of landfill operations or otherwise, or
- the carrying out of any other activity that affects the quantity or flow of water in a water source.

Artificial opening of Willis Creek would constitute a controlled activity under the WM Act. However under the Water Management (General) Regulation 2011, Clause 38 Controlled activities—public authorities, states: *A public authority is exempt from section 91E (1) of the Act in relation to all controlled activities that it carries out in, on or under waterfront land.*

Although Coffs Harbour City Council would be exempt from requiring a Controlled Activity Approval, Clause 37, *Condition applying to all exemptions under this Subdivision*, of the Regulations states: *An exemption conferred under this Subdivision is subject to the condition that the person by whom the relevant controlled activity is carried out must comply with applicable requirements (if any) of the Minister that are published in the Gazette, or notified in writing to the person, for the purposes of this clause and that are for the protection of:*

- (a) *the waterfront land on which the activity is carried out, or*
- (b) *any river, lake or estuary to which that land has frontage.*

3.1.5 National Parks and Wildlife Act 1974

The Willis Creek system falls within the Coffs Coast Regional Park. The park was created through a partnership of Council and the National Parks and Wildlife Service (now within OEH). The National Parks and Wildlife Act 1974 applies if the park is a reserve made under the Act. The Park's management is guided by a Trust Board. Preparation of an REF for artificial opening works would need to determine whether or not the park is a reserve under the Act and hence consultation / concurrence are required with OEH / National Parks and Wildlife Service. Consultation with the Trust Board would be required whether or not the park is affected by the Act. The REF would also need to consider any management plan that has been prepared for the park.

3.2 Summary of Potential Approvals

Works / activities for the purpose of flood mitigation or waterway / foreshore management (to address an extreme water quality issue) would be permitted without consent under Clause 50 of the State Environmental Planning Policy (Infrastructure), 2007. However the requirements of Part 5 of the EP&A Act 1979 must be fulfilled and Council is required to prepare a REF for proposed works / activities (e.g. artificial opening of the entrance to Willis Creek estuary). The REF needs to be consistent with the adopted CZMP and Entrance Management Policy for Willis Creek estuary.

Preparation of the REF will involve consultation with relevant state government agencies. This will confirm the necessary approvals and licences required for artificial opening of the entrance. Preliminary assessment indicates the following approvals and licences may be necessary:

- a license from the Department of Crown Lands under the Crown Lands Act 1989;
- a permit and concurrence from the Minister, Department of Primary Industries (Fisheries) under the Fisheries Management Act 1994 pursuant to Sections 198-202 for dredge and reclamation works on defined water land (the nature of artificial opening would constitute dredge works and also potentially reclamation works); and
- a permit / concurrence from the Marine Park Authority / the Minister under the Marine Parks Act 1997 as Willis Creek forms park of the Solitary Islands Marine Park.

The Willis Creek system falls within the Coffs Coast Regional Park, which was created through a partnership of Council and the National Parks and Wildlife Service. Consultation with the National Parks and Wildlife Service and Trust Board is required to determine if any approvals are required under the National Parks and Wildlife Act 1974.

It is noted that a Controlled Activity Approval under the Water Management Act 2000 is not required due to the Water Management (General) Regulation 2011, Clause 38 Controlled activities - public authorities, which states: *A public authority is exempt from section 91E (1) of the Act in relation to all controlled activities that it carries out in, on or under waterfront land.* However, Council is still required to follow any applicable guidelines of NSW Office of Water under the Water Management Act 2000.

This page has been left intentionally blank

Artificial Opening Procedure

4.1 Decision Making Process

This Policy presently only recommends artificial opening of the Willis Creek estuary entrance in the event of extreme water quality issues such as contaminant spills where it may be desirable to provide some 'draining' of the creek system. However, the decision to initiate an artificial opening event will be based on assessment of each individual circumstance of an extreme water quality issue with consideration of:

- environmental and public health risks posed by the water quality issue;
- the extent to which artificial opening will mitigate the water quality issue; and
- consequent environmental and public health risks along the adjoining coastline following artificial opening of the creek.

As noted in **Section 2.3**, this Policy does not include triggers for water quality issues due to the broad range of potential water quality scenarios and the associated uncertainties. Determining what constitutes an extreme water quality issue would include reference to water quality monitoring results for Willis Creek to determine if the issue is 'outside' normal water quality variations for the creek system.

The general decision making process / procedure for determining if artificial opening is to be employed to address an extreme water quality issue is shown in the flow chart in **Illustration 4.1** and involves:

- following warning of potential extreme water quality issues Council's designated officer will alert relevant state government agencies of the issues and potential for an artificial opening event;
- Council's designated officer will then conduct a site assessment and/or review of water quality monitoring data to determine in consultation with relevant state government agencies if artificial opening is an appropriate response;
- if artificial opening is considered an appropriate response Council's designated officer will initiate deployment of Council's personnel and machinery to the entrance and direct when and where artificial opening is to be initiated. Ideally, the artificial opening should be initiated during a falling tide and shortly after the tide turns from high to low (if possible around a spring tide when tidal fluctuations are larger).

4.2 Responsibilities for Artificial Opening

Coffs Harbour City Council is responsible for artificial opening of the entrance.

4.3 Monitoring

When artificial openings have been carried out, monitoring of the entrance should be undertaken to determine the efficiency of the opening. For each artificial opening event, the following data will be tested / recorded:

- prior to opening:
 - testing of water quality parameters relevant to the specific water quality issue;
 - survey water level of creek prior to opening;
- date and time of opening;
- survey water levels of creek over 24 hours following opening;

- testing of water quality parameters relevant to the specific water quality issue over 24 hours and at appropriate intervals following 24 hours after the opening;
- location and length of excavation;
- approximate width and depth of initial channel;
- ocean swell conditions (wave height and direction);
- preceding rainfall;
- date of closure; and
- digital photographs.

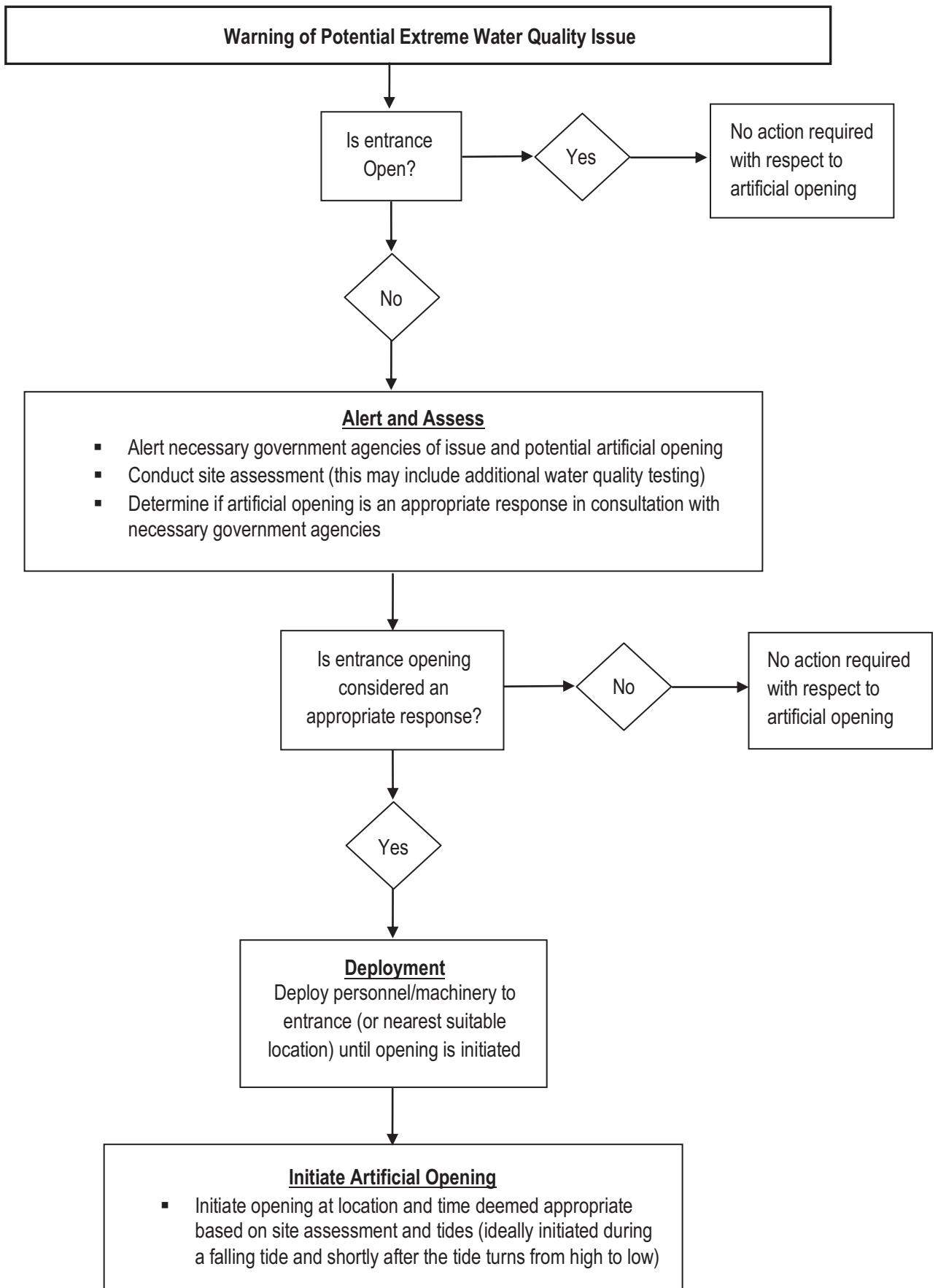


Illustration 4.1 Artificial Opening Decision Making Flowchart

This page has been left intentionally blank

Policy Updates

5.1 Review and Update of this Policy

This Policy and the associated REF should be reviewed every five years or in response to:

- legislation changes; and
- any other significant factors relevant to artificial opening of the entrance of Willis Creek estuary.

Review of the Policy will include analysis of all monitoring data collected over that period to assess if the assumptions and procedures outlined in the current Policy and REF are correct or appropriate. This will include a review of changes to climate change and sea level rise predictions and consequent impacts to this Policy.

This page has been left intentionally blank



Project Team

The Project Team members included:

GeoLINK

Jacob Sickinger
Richard Elliot
Tim Ruge

Aquatic Science and Management

Matthew Birch

GECO Environmental

Damon Telfer

The following people and organisations have provided technical input to the preparation of this report:

Coffs Harbour City Council

Malcolm Robertson
Martin Rose

Office of Environment & Heritage, NSW Department of Premier and Cabinet

Mohammed Hanif
Rob Kasmarik

Coffs Harbour City Council Coastal Estuary Management Advisory Committee

This page has been left intentionally blank

References

BMT WBM (2011). *Coffs Harbour Coastal Processes and hazards definition Study. Volume 1: Final Report*. Prepared for Coffs harbour City Council. Date of Issue 15/02/11.

BMT WBM (2010). *Climate Change Projections for the Coffs Harbour Local Government Area*. Draft Report, February 2010.

BMT WBM *et al* (2010). *Coffs Harbour City Council Climate Change Mitigation and Adaptation Action Plan*. Report prepared for Coffs Harbour City Council in association with Eco Logical Australia and Coastal Zone Management.

Department of Primary Industries (n.d.), *Management of Coastal Lakes and Lagoons in NSW* [online], NSW Government, available: <http://www.dpi.nsw.gov.au/fisheries/habitat/aquatic-habitats/wetland/coastal-wetlands/management-of-coastal-lakes-and-lagoons-in-nsw#Who-is-responsible-for-managing-ICOLL-entrances-and-artificially-opening-them>

GeoLINK *et al.* (2011a). *Data Compilation and Estuary Processes Study - Darkum Creek, Woolgoolga Lake and Willis Creek*. Prepared for Coffs Harbour City Council and NSW Office of Environment and Heritage in association with **Aquatic Science and Management** and **GECO Environmental**, July 2011.

GeoLINK *et al.* (2011b). *Estuary Management Study - Willis Creek*. Prepared for Coffs Harbour City Council and NSW Office of Environment and Heritage in association with **Aquatic Science and Management** and **GECO Environmental**.

GeoLINK *et al.* (2012). *Draft Coastal Zone Management Plan - Willis Creek Estuary*. Prepared for Coffs Harbour City Council and NSW Office of Environment and Heritage in association with **Aquatic Science and Management** and **GECO Environmental**.

Haines, P. E. (2006). *Physical and chemical behaviour and management of Intermittently Closed and Open lakes and Lagoons (ICOLLS) in NSW* [Online]. Griffith centre for Coastal Management, School of Environmental and Applied Sciences, Griffith University Available: <http://www4.gu.edu.au:8080/adt-root/public/adt-QGU20070221.132729/index.html> Australian Digital Theses Program [Accessed 15/12/2010].

Haines, P. (2008) *ICOLL Management – Strategies for a Sustainable Future*. BMT WBM Pty Ltd, Broadmeadow NSW. [Online]. . BMT Group Ltd, Available:<http://www.bmtwbm.com.au/Documents%20&%20Resources/?/1906/3269/3269> [Accessed 28/02/2011].

Jelliffe, PA (1997a). *Report on the Impact of the Disposal of Reclaimed Water into Willis Creek*

Jelliffe P. (1997b) '*Willis Creek, Woolgoolga: Coastal Processes and Effluent Release Preliminary Investigation*.' Manly Hydraulics Laboratory, Coffs Harbour.

MHL (1997). *Willis Creek, Woolgoolga. Coastal Processes and Effluent Release. Preliminary Investigation (Draft)*. Prepared by NSW Department of Public Works and Services, Manly Hydraulics Laboratory. Report No. MHL 854. Draft 18 March 1997.

MHL (2004). *DIPNR Woolgoolga Lake and Darkum Creek, Tidal Data Collection February – May 2004*. Prepared by NSW Department of Commerce, Manly Hydraulics Laboratory. Report No.MHL1342.

This page has been left intentionally blank

Acronyms

AHD	Australian Height Datum
CEMAC	Coffs Harbour City Council Coastal Estuary Management Advisory Committee
CHCC	Coffs Harbour City Council
CHLEP	Coffs Harbour Local Environmental Plan
CZMP	Coastal Zone Management Plan
ICOLL	Intermittently Closed and Open Lake and Lagoon
ISEPP	State Environmental Planning Policy (Infrastructure), 2007
LGA	Local Government Area
MHL	Manly Hydraulics Laboratory
PS	Pump Station
REF	Review of Environmental Factors
SEPP	State Environmental Planning Policy

This page has been left intentionally blank



Appendix B

Funding Sources

This page has been left intentionally blank

Fund Name	Funding Body(ies)	Objectives and Priorities	Web Address
<p>Various – jointly administered by North Coast Local Land Services (LLS)</p>	<ul style="list-style-type: none"> ▪ Various – jointly administered by North Coast LLS 	<ul style="list-style-type: none"> ▪ Community capacity targets. These include targets with respect to the awareness, knowledge and skills of the community in relation to Natural Resource Management, and the levels of engagement of the community. These are specifically: <ul style="list-style-type: none"> ▪ CCB1, Awareness knowledge and skills; ▪ CCB2, Community engagement; and ▪ CCB3, Community support. ▪ Land use planning targets. The relevant land use planning targets relate to aboriginal cultural integration in the planning process, environmental assets and significant farmland protection, landuse conflict within and adjacent to Key environmental and farming assets and the integration of natural resource assets into planning. They are specifically: <ul style="list-style-type: none"> ▪ LUP1, Aboriginal cultural integration; ▪ LUP2, Environmental assets/rural production areas; ▪ LUP3, Land use conflict and key natural resources; and ▪ LUP4, Natural resource integration. ▪ Biodiversity targets. These targets relate to the area of land under secure conservation management, habitat connectivity, the mitigation of threats to biodiversity, threatened species management, sustainable management of terrestrial and aquatic ecosystems and habitat rehabilitation and revegetation. The targets are: <ul style="list-style-type: none"> ▪ B1, Secure conservation management; ▪ B2, Habitat connectivity; ▪ B3, Biodiversity threat mitigation; ▪ B4, Threatened species; ▪ B5, Biodiversity management and enhancement; and ▪ B6, Habitat rehabilitation and revegetation. 	<p>Funding (General): http://www.northern.cm.a.nsw.gov.au/get-involved/funding</p> <p>Current Funding Opportunities: http://www.northern.cm.a.nsw.gov.au/get-involved/funding</p>

Fund Name	Funding Body(ies)	Objectives and Priorities	Web Address
		<ul style="list-style-type: none"> ▪ Water targets. These targets relate to the integrated management of urban water cycles and community education about and monitoring of water resources. The targets are; <ul style="list-style-type: none"> ▪ W1, River structure riparian vegetation and fish passage; ▪ W2, Urban water cycle management; ▪ W3, Water information and education; and ▪ W4, Aquifer health and river flow. ▪ Coastal targets. The relevant coastal targets relate to the management and assessment of coastal lakes and estuaries. The targets are; <ul style="list-style-type: none"> ▪ C1, Coastline; and ▪ C2, Estuaries and coastal lakes. ▪ Marine targets. The relevant marine targets relate to management practices that reduce threats to and impacts on the marine environment. The targets are; <ul style="list-style-type: none"> ▪ M1, Marine research and planning; ▪ M2, Best practice; ▪ M3, Marine protected areas; and ▪ M4, Improved marine environment management practices. ▪ Soil and land resource targets. The most relevant of the soil and land targets relates to the area of high risk acid sulfate soils under active management. The complete list of targets is; <ul style="list-style-type: none"> ▪ L1, Soil health; ▪ L2, Acid sulphate soils; and ▪ L3, Soil conservation/remediation. 	

Fund Name	Funding Body(ies)	Objectives and Priorities	Web Address
Caring for Our Country	<p>Jointly administered by the Australian Government:</p> <ul style="list-style-type: none"> ▪ Department of Agriculture, Fisheries and Forestry; and ▪ Department of Sustainability, Environment, Water, Population and Communities 	<p>Objectives:</p> <ul style="list-style-type: none"> ▪ to achieve an environment that is healthy, better protected, well-managed, resilient and provides essential ecosystem services in a changing climate. <p>Priorities:</p> <ul style="list-style-type: none"> ▪ the National Reserve System; ▪ biodiversity and natural icons; ▪ coastal environments and critical aquatic habitats; ▪ sustainable farm practices; ▪ natural resource management in northern and remote Australia; and ▪ community skills, knowledge and engagement. 	<p>http://www.nrm.gov.au/index.html</p>
Estuary Management Program	NSW Office of Environment and Heritage	<p>Objectives:</p> <ul style="list-style-type: none"> ▪ to provide support to councils to improve the health of NSW estuaries; and ▪ understand the potential risks from climate change. <p>Support provided to councils under these programs includes financial assistance to:</p> <ul style="list-style-type: none"> ▪ prepare estuary management plans and supporting studies; ▪ carry out projects to improve estuary health. <p>Priorities:</p> <ul style="list-style-type: none"> ▪ updating estuary plans to consider climate change impacts, including sea level rise ▪ estuary health monitoring and improvement ▪ focusing on high-hazard coastal areas and stressed estuaries. <p>Grant offers are subject to availability of funds for each financial year and State-wide priorities. Funding of up to 50% of a project's costs will normally be offered for successful grant applications.</p>	<p>http://www.environment.nsw.gov.au/coasts/InfoCoastEstFloodGrants.htm</p>

Fund Name	Funding Body(ies)	Objectives and Priorities	Web Address
Coastal Management Program	NSW Office of Environment and Heritage	<p>Objectives:</p> <ul style="list-style-type: none"> ▪ to provide support to local councils to manage the risks from coastal hazards such as coastal erosion, ▪ and to restore degraded coastal habitats. <p>Support provided to councils under these programs includes financial assistance to:</p> <ul style="list-style-type: none"> ▪ prepare coastline, and coastal zone management plans and supporting studies ▪ carry out projects to reduce risks associated with coastal hazards and improve coastal environments. ▪ updating coastal hazard studies to incorporate sea-level rise benchmarks ▪ focusing on high-hazard coastal areas and stressed estuaries. <p>Grant offers are subject to availability of funds for each financial year and State-wide priorities. Funding of up to 50% of a project's costs will normally be offered for successful grant applications.</p>	http://www.environment.nsw.gov.au/coasts/InfoCoastEstFloodGrants.htm
Floodplain Management Program	NSW Office of Environment and Heritage	<p>Objectives:</p> <ul style="list-style-type: none"> ▪ to reduce the impacts of flooding and flood liability on communities; and ▪ to reduce private and public losses resulting from floods, utilising ecologically positive methods wherever possible. <p>Priorities:</p> <p>Provides financial support to councils and eligible public land managers to:</p> <ul style="list-style-type: none"> ▪ make informed decisions on managing flood risk by preparing floodplain risk management plans (and associated background studies) under the floodplain risk management process; ▪ implement floodplain risk management plans to reduce flood risk to both existing and future development, and reduce losses through a range of property, flood and response modification measures as outlined in the manual; and ▪ provide essential information to the State Emergency Service to enable the effective preparation and implementation of local flood plans to deal with flood emergency response. <p>Assistance normally State Government providing \$2 for every \$1 provided by the council.</p>	http://www.environment.nsw.gov.au/coasts/InfoCoastEstFloodGrants.htm

Fund Name	Funding Body(ies)	Objectives and Priorities	Web Address
Environmental Trust Grants	NSW Office of Environment and Heritage	<p>to encourage and support restoration and rehabilitation projects;</p> <ul style="list-style-type: none"> ▪ to promote research into environmental problems of any kind; ▪ to promote environmental education in both the public and private sectors; ▪ to fund the acquisition of land for the national parks estate; ▪ to fund the declaration of areas for marine parks and for related purposes; ▪ to promote waste avoidance, resource recovery and waste management (including funding enforcement and regulation and local government programs); ▪ to fund environmental community groups; and ▪ to fund the purchase of water entitlements for the purpose of increasing environmental flows for the State's rivers and restoring or rehabilitating major wetlands. <p>Relevant Programs:</p> <ul style="list-style-type: none"> ▪ the urban sustainability program funds projects carried out by local councils in partnership with the community that protect and restore the urban environment; ▪ the lead environmental community groups program provides administrative funds for environmental organisations that work with their communities to conserve the environment; ▪ the environmental restoration and rehabilitation program funds projects that restore or rehabilitate degraded areas, or protect important ecosystems and habitats, prevent or minimise future environmental damage and enhance the quality of specific environmental resources; ▪ the environmental education program supports projects that increase commitment to protecting the environment and promoting sustainable behaviour; ▪ the environmental research program funds projects managed by educational institutions and government agencies that research local solutions to environmental problems and ways of operating that are less harmful to the environment; ▪ the eco schools program funds schools so they can involve their students and the community in developing and implementing environmental management projects; ▪ the protecting our places program supports projects that restore or rehabilitate Aboriginal land or land that is culturally significant to Aboriginal people, or that educate Aboriginal and other communities about the environment. 	http://www.environment.nsw.gov.au/grants/envtrust.htm

Fund Name	Funding Body(ies)	Objectives and Priorities	Web Address
Grants to Voluntary Environment Heritage Organisations (GVEHO)	Australian Government: Department of Sustainability, Environment, Water, Population and Communities	<p>Objectives:</p> <ul style="list-style-type: none"> ▪ help eligible community based environment and heritage organisations to value, conserve and protect Australia's natural environment and historic heritage by assisting with their administrative funding. <p>Priorities:</p> <ul style="list-style-type: none"> ▪ funds provided may be used to assist with salaries and salary on-costs for executive and administrative staff; office accommodation rental; electricity, gas, phone and other similar charges; essential office supplies and equipment; staff and volunteer training; photocopying and printing costs; and travel costs incurred on behalf of the organisation. 	http://www.environment.gov.au/about/programs/gveho/index.html
NSW Recreational Fishing Trusts	NSW Department of Primary Industries	<p>Objectives:</p> <ul style="list-style-type: none"> ▪ projects that improve recreational fishing in NSW; ▪ anyone can apply for funding from the Recreational Fishing Trusts, including fishing clubs and organisations, universities, councils, community groups, individuals and so on. Joint applications are also encouraged. ▪ funding applications must relate to the improvement of recreational fishing. <p>Priorities:</p> <ul style="list-style-type: none"> ▪ recreational fisheries enhancement; ▪ angler education and information; ▪ research on recreational fishing; ▪ recreational fisheries access and facilities; and ▪ recreational fisheries sustainability 	http://www.dpi.nsw.gov.au/fisheries/recreational/licence-fee/apply-for-funds
NSW Maritime Infrastructure Program: Better Boating Program Regional Infrastructure	Roads and Maritime Services	<p>Objectives:</p> <ul style="list-style-type: none"> ▪ the Better Boating Program provides waterways infrastructure for the benefit of the boating community and the marine sector on New South Wales waterways; ▪ the BBP provides individual grant contributions to proponents such as Local Government, State agencies, boating organisations and community groups for the development of public boating infrastructure. 	http://www.maritime.nsw.gov.au/mpd/infra_program.html

Fund Name	Funding Body(ies)	Objectives and Priorities	Web Address
Grants		<p>Priorities:</p> <p>Consideration for BBP funding will only be given to those projects that are:</p> <ul style="list-style-type: none"> ▪ principally infrastructure works of a lasting nature; ▪ intended to greatly improve current amenities (or address the lack thereof); ▪ located in a readily accessible public area with unrestricted public access; ▪ for use of or available to, a broad cross-section of the public boating community; ▪ situated either on public land or land owned by the Local Council, the Crown or NSW Maritime; ▪ able to be commenced within 6 months of the approval of the grant and be completed within 18 months from this approval date. It should be noted that any funding grants not utilised within that period may be withdrawn; ▪ supported in writing by key stakeholders, including the Local Council; ▪ able to meet the Program's criteria for assessment and are submitted by the nominated closing date. 	
Raising National Water Standards Program	Australian Government: National Water Commission	<p>Objectives:</p> <ul style="list-style-type: none"> ▪ support for projects that are improving Australia's national capacity to measure, monitor and manage our water resources. <p>Priorities:</p> <ul style="list-style-type: none"> ▪ funds are directed at activities across three strategic investment areas: <ul style="list-style-type: none"> - advancing the implementation of the National Water Initiative - improving integrated water management across Australia - improving knowledge and understanding of our water resources. ▪ more than 175 Raising National Water Standards projects have been funded under the following themes: <ul style="list-style-type: none"> - water accounting - emerging water markets - water planning and management - knowledge and capacity building - irrigation and other rural water 	http://www.nwc.gov.au/www/html/347-introduction-to-rnws.asp

Fund Name	Funding Body(ies)	Objectives and Priorities	Web Address
Country Towns Water Supply and Sewage Program	NSW Department of Primary Industries Office of Water	<ul style="list-style-type: none"> - water-dependent ecosystems - integrated urban water management - groundwater - northern rivers - national assessment of water resources - Northern Australia water futures assessment <p>Objectives:</p> <ul style="list-style-type: none"> ▪ a major government reform program that provides management, technical and financial support to local water utilities (LWUs) in the provision of water supply and sewerage services to country towns in NSW. <p>Priorities:</p> <ul style="list-style-type: none"> ▪ management assistance through the Best-Practice Management of Water Supply and Sewerage Guidelines. ▪ technical assistance through: <ul style="list-style-type: none"> - regular inspections and advice on water and sewage treatment works operational problems - conducting water supply and sewerage operator training seminars/ courses - pre commissioning inspections of Fluoridation Plants and technical assistance to NSW Health to enable councils to comply with requirements under the Fluoridation of Public Water Supplies Act 1957 and in certification of fluoridation officers. - ongoing LWUs dam safety inspections and mentoring/ training of operators - ongoing LWUs liquid trade waste discharge approvals - conducting regional trade waste regulation courses - providing help desk services. ▪ financial assistance through grants to local water utilities towards the capital cost of works to address the backlog in water supply and sewerage infrastructure. 	http://www.water.nsw.gov.au/Urban-water/Country-town-water/default.aspx
Job Services Australia – New	Australian Government: Department of Education,	<p>Objectives:</p> <ul style="list-style-type: none"> ▪ to give young people, aged 17 to 20 years, quality training and experience through 	http://www.deewr.gov.au/Employment/SA/Em

Fund Name	Funding Body(ies)	Objectives and Priorities	Web Address
Enterprise Incentive Scheme (NEIS)	Employment and Workplace Relations	<p>structured and supervised projects that focus on areas where natural environmental conservation work and cultural heritage restoration is required</p> <ul style="list-style-type: none"> ▪ to contribute to high priority conservation projects, to promote environmental, conservation and natural heritage outcomes and through this benefit the community and the environment and ▪ to contribute to NEIS participants: <ul style="list-style-type: none"> - personal development, including teamwork and leadership skills - skill development and training through activities that are structured and sequential in their learning outcomes - strengthened connections with the community through relationships, participation and contribution to the community; and - improved career and employment prospects through accredited training and on-the-project training. <p>Priorities:</p> <ul style="list-style-type: none"> ▪ DEEWR provides funding for NEIS teams to work on projects which focus on areas where environmental and heritage restoration and conservation are needed ▪ participants in the NEIS programme work in teams from a central or regional location and may undertake projects in remote locations ▪ each project has a community focus and is developed in consultation with community representatives and ▪ participants undertake accredited training which enable them to complete project tasks, and increases their capacity to move into employment or further training at the end of their placement. 	http://www.industry.nsw.gov.au/business-and-industry-in-nsw/news/news/201819-public-reserves-management-funds-program-open
Public Reserve Management Funds Program (PRMP)	NSW Government DoI – Crown Lands	<p>Objective:</p> <ul style="list-style-type: none"> ▪ to maintain, protect and improve Crown Reserves for the entire community <p>Priorities:</p> <ul style="list-style-type: none"> ▪ to support a range of activities, including repairs and maintenance, pest and weed control, new recreational infrastructure and environmental initiatives. 	https://www.industry.nsw.gov.au/business-and-industry-in-nsw/news/news/201819-public-reserves-management-funds-program-open

This page has been left intentionally blank



Appendix C

Summary of Estuary Processes Study

This page has been left intentionally blank

Willis Creek is an Intermittently Closed and Open Lakes and Lagoon (ICOLL). The density of vegetation and lack of public access to the Willis Creek estuary generates little recreational activity. However, the natural setting attracts people seeking quiet recreational opportunities such as bird watching and bushwalking. The Willis Creek / Hearnese Lake entrance area hosts a significant breeding site in NSW for the threatened species, Little Tern (South-eastern Australian population).

The total catchment area of Willis Creek is approximately 2.6 km². Banana plantations and blueberry farms cover the majority of the upper catchment. Industrial and residential land comprises the majority of the mid-catchment on the eastern side of the Pacific Highway. The catchment area downstream of the tidal limit includes the Woolgoolga Water Reclamation Plant (sewage treatment plant) and a large area of swamp forest, wet heath and mangrove / saltmarsh complex which is largely contained in the Coffs Coast Regional Park.

The tidal limit of Willis Creek is located near the eastern edge of the residential and industrial estates in the mid-catchment. The creek is part of the Solitary Islands Marine Park and is zoned as a Habitat Protection Zone up to the tidal limit.

The Woolgoolga Water Reclamation Plant released secondary treated effluent into Willis Creek from 1973 to 2005. The release ceased in 2005 with the upgrade of the plant and connection to the Coffs Harbour reclaimed water reticulation system.

The key findings and recommendations of the *Data Compilation and Estuary Processes Study – Darkum Creek, Woolgoolga Lake and Willis Creek* (GeoLINK *et al.*, 2011) is summarised below for Willis Creek.

C.1 Hydrodynamics

C.1.1 Hydrodynamic States and Entrance Behaviour

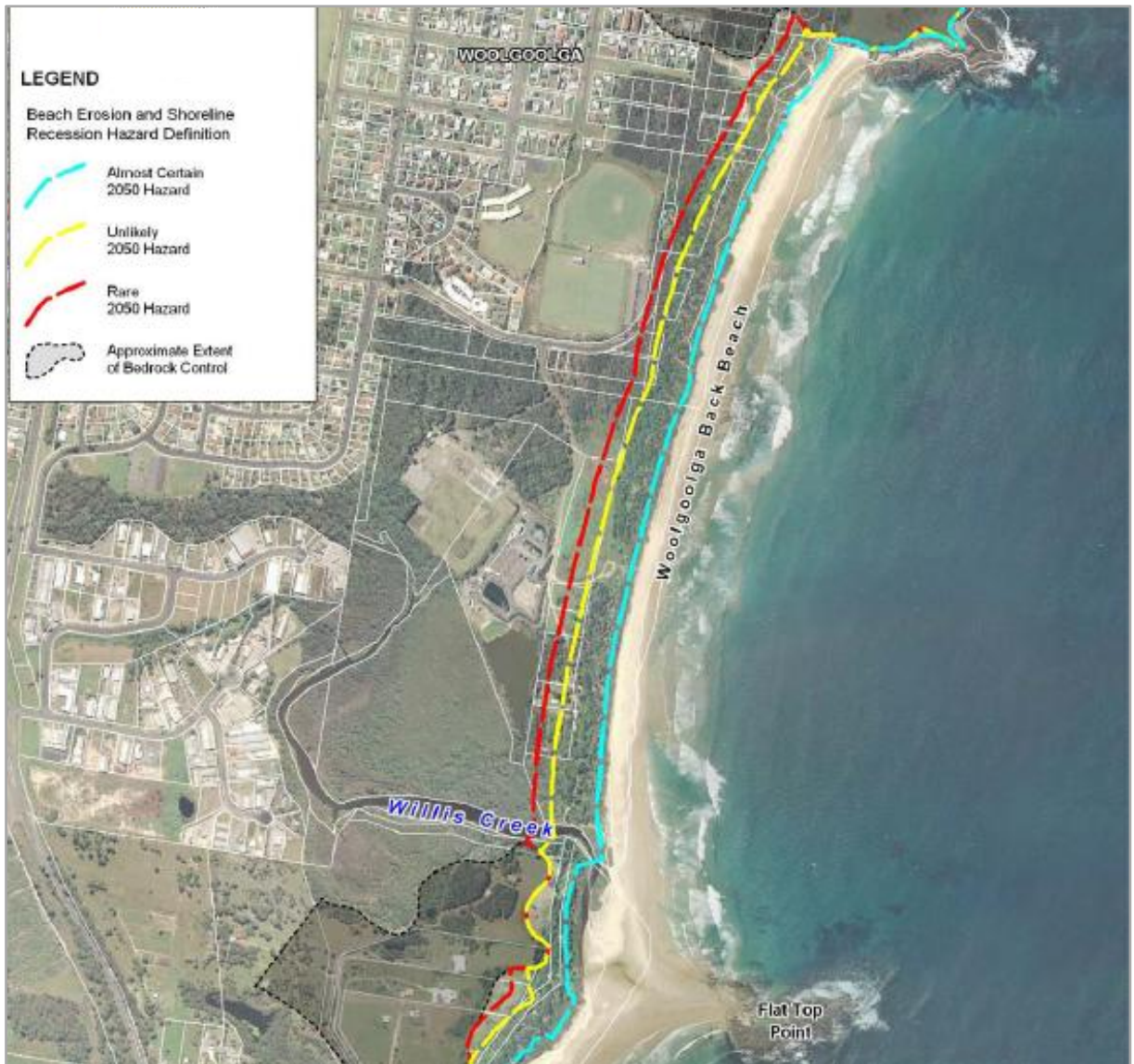
Theory suggests that the predominant hydrodynamic state of Willis Creek is a closed entrance. However, over the period of 1973 to 2005 when the creek received a continued release of treated effluent from the Woolgoolga Water Reclamation Plant the entrance was generally open, discharging low flows across the beach.

Aerial photography indicates the following in regard to entrance openings:

- 1940s and 1950s: the entrance channel was closed in the 1940s photography. In 1956 the entrance channel meandered to the south-east to discharge on the north side of the tombolo;
- 1960s and 1970s: six photos for the 1960s indicate the entrance channel was closed. Four photos for the 1970s indicate the entrance was open on three occasions and closed on the other;
- 1980s: the entrance channel was open on all photographs during the 1980s;
- 1990s: the entrance channel was open on all photographs (1994 and 1996); and
- 2000's: the entrance was closed in two photos (2000 and 2009) and open in three photographs (2001, 2006 and 2010).

C.1.2 Coastal Processes and Inundation

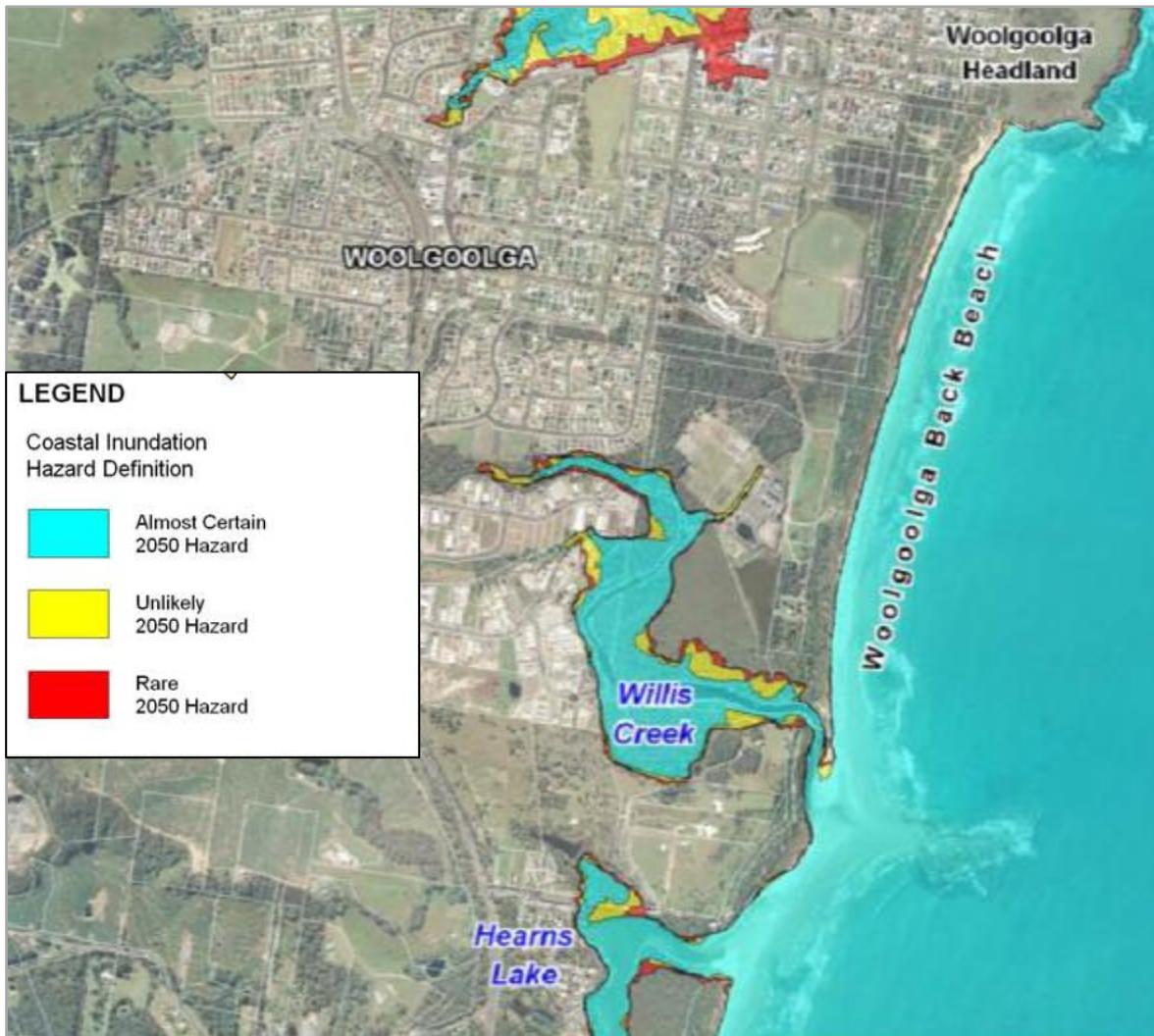
Coastal processes influence estuary hydrodynamics, sedimentation processes and entrance behaviour. Water levels in Willis Creek are relatively constant. Conductivity levels indicate the estuary is subject to regular seawater ingress through overtopping of the entrance berm during higher stages of the tide. The likely extent of beach erosion for the immediate timeframe is an 'almost certain' probability of 15 m, 'unlikely' probability of 50 m and 'rare' probability of 85 m landward movement of the beach position (BMT WBM, 2010b). For the 2050 and 2100 timeframes, the 'almost certain', 'unlikely' and 'rare' erosion extents are added to the long term shoreline recession values described above.



Source: BMT WBM (2010b)

Plate C.1 Beach Erosion and Shoreline Recession Mapping for the Year 2050

In the immediate timeframe, there is potential inundation of back beach areas at Willis Creek, with the 'almost certain' to 'rare' probability water levels covering a similar extent, generally over the footprint of Willis Creek. By 2100 with sea level rise, the 'unlikely' and 'rare' inundation extents expand in area around the creek footprint, but do not appear to threaten development (BMT WBM, 2010b:141) - refer to **Plate C.2**.



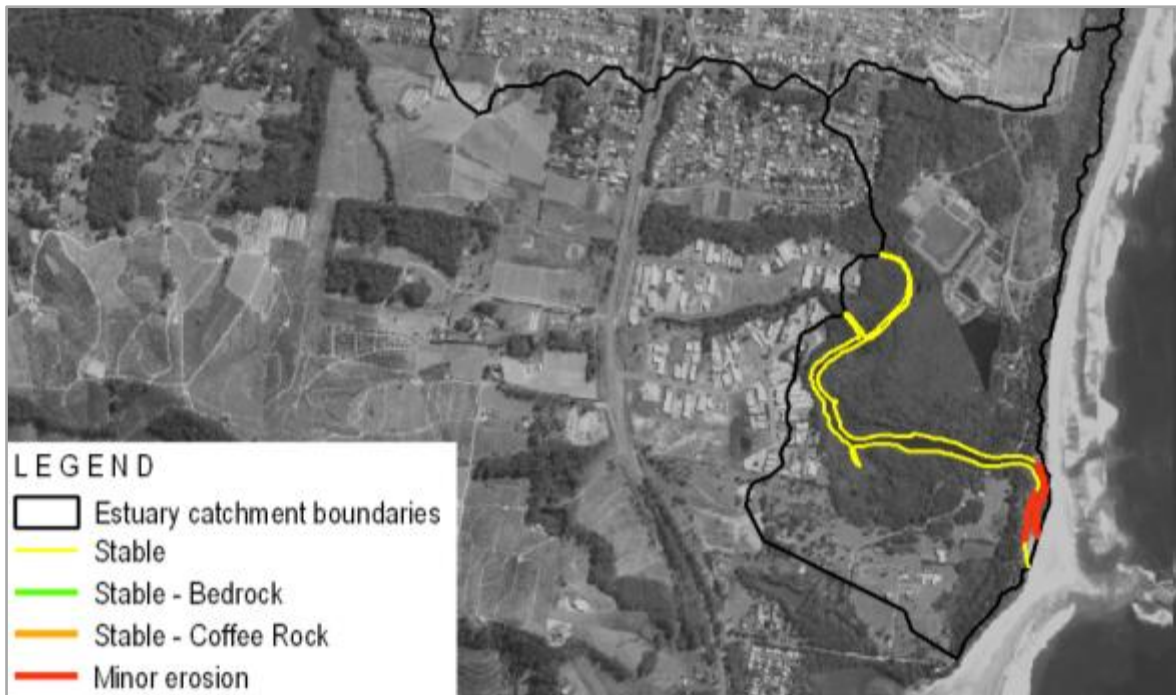
Source: BMT WBM (2010b)

Plate C.2 Coastal Inundation Mapping for the Year 2050

C.2 Geomorphology and Sediment Dynamics

C.2.1 Bank Erosion

Bank erosion is not a significant issue in the Willis Creek estuary with only 11% of estuary banks subject to minor erosion and no moderate or severe erosion reaches identified – refer to **Plate C.3**. The stable banks were naturally stable without the use of erosion protection works or bedrock outcropping.



Source: GeoLINK *et al.* (2011)

Plate C.3 Bank Erosion Severity (mapped January 2011)

C.3 Water Quality Processes

No recorded physico-chemical water quality data has been found for the period of 2005 to 2010 since cessation of effluent release in 2005.

Faecal indicator organism samples indicate the waters of Willis Creek (for the period sampled) are generally safe for primary contact recreation. Chlorophyll-a concentrations indicate that Willis Creek was eutrophic during the period of effluent discharge. Nutrient and sediment modelling of the estuary catchment indicates horticulture and residential land are the main contributors of catchment derived sediments and nutrients for Willis Creek.

C.4 Ecological Processes

C.4.1 Estuarine Habitat

Benthic habitat was a mixture of sand, mud and gravel bars in the estuary.

The extent of mangroves has increased in the estuary. In the opinion of the author/s this is probably a result of a reduction in freshwater inflow since the cessation of effluent discharge. Using the difference between the volume of effluent received at the plant and the volume of effluent recycled the average discharge over the years between 2002/03 and 2004/05 was in the order of 449 ML per annum (S Thorn 2011 pers comm). The removal of this freshwater influence is thought to have improved the conditions for grey mangrove recruitment through changes to the salinity regime.

Willis Creek has a large area of saltmarsh habitat – refer to **Plate C.4**. The area of saltmarsh recently mapped (2010) appeared almost four times less than shown by previous mapping (2004), however there are clear differences in the methods used between the two studies leading to an inconclusive trend.



Source: GeoLINK *et al.* (2011)

Plate C.4 Riparian Vegetation Condition (mapped January 2011)

C.4.2 Aquatic Fauna

Macroinvertebrate fauna were sampled and analysed: the results indicate that the central regions of the waterway contain the most diverse and abundant benthic macroinvertebrate fauna. A survey of fish species was undertaken with relatively few animals from a small number of taxa collected.

No threatened aquatic species have been reported for Willis Creek.

C.4.3 Little Terns

A significant NSW breeding site for the Little Tern is located at the Willis Creek / Hearn's Lake entrance area. A *Shorebird Recovery Program* has been devised to guide management of the site including fencing off of the nesting site, community awareness initiatives, a fox abatement plan and monitoring. The management works will provide an umbrella effect for local biodiversity, including other locally breeding migratory and shorebirds species.

C.4.4 Riparian Vegetation

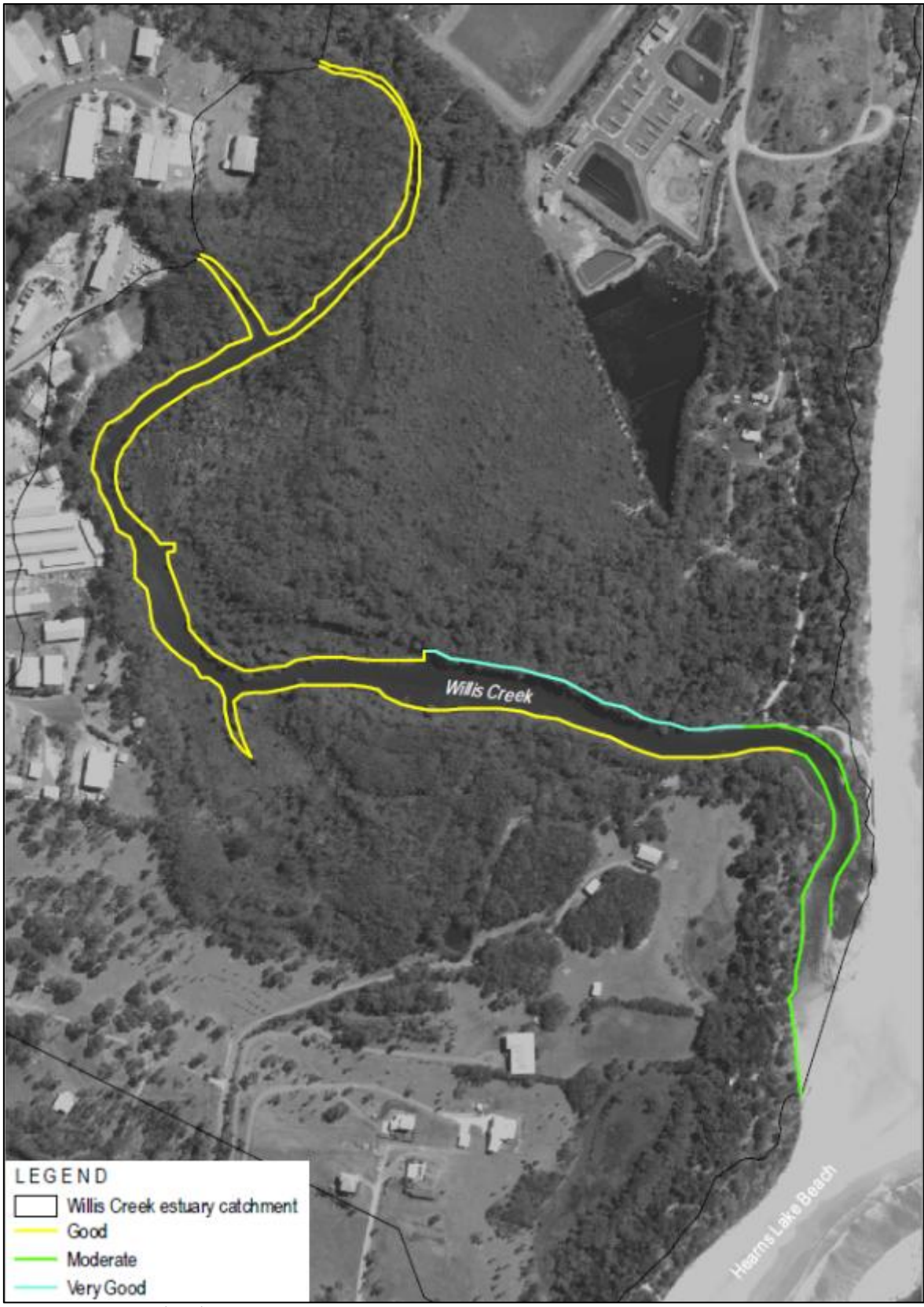
Riparian vegetation in the study area is predominately in moderate to very good condition (refer to **Plate C.5**). 17% of banks had riparian vegetation in moderate condition and these reaches were confined to the banks nearest to the entrance.

The distributions of major weeds along the estuary have been mapped (refer to **Plate C.6**). Four of the mapped invasive weed species are listed as Priority B or C in coastal or riparian landscapes under the Northern Rivers Invasive Weed Strategy 2009-2013.

C.4.5 Estuary Health

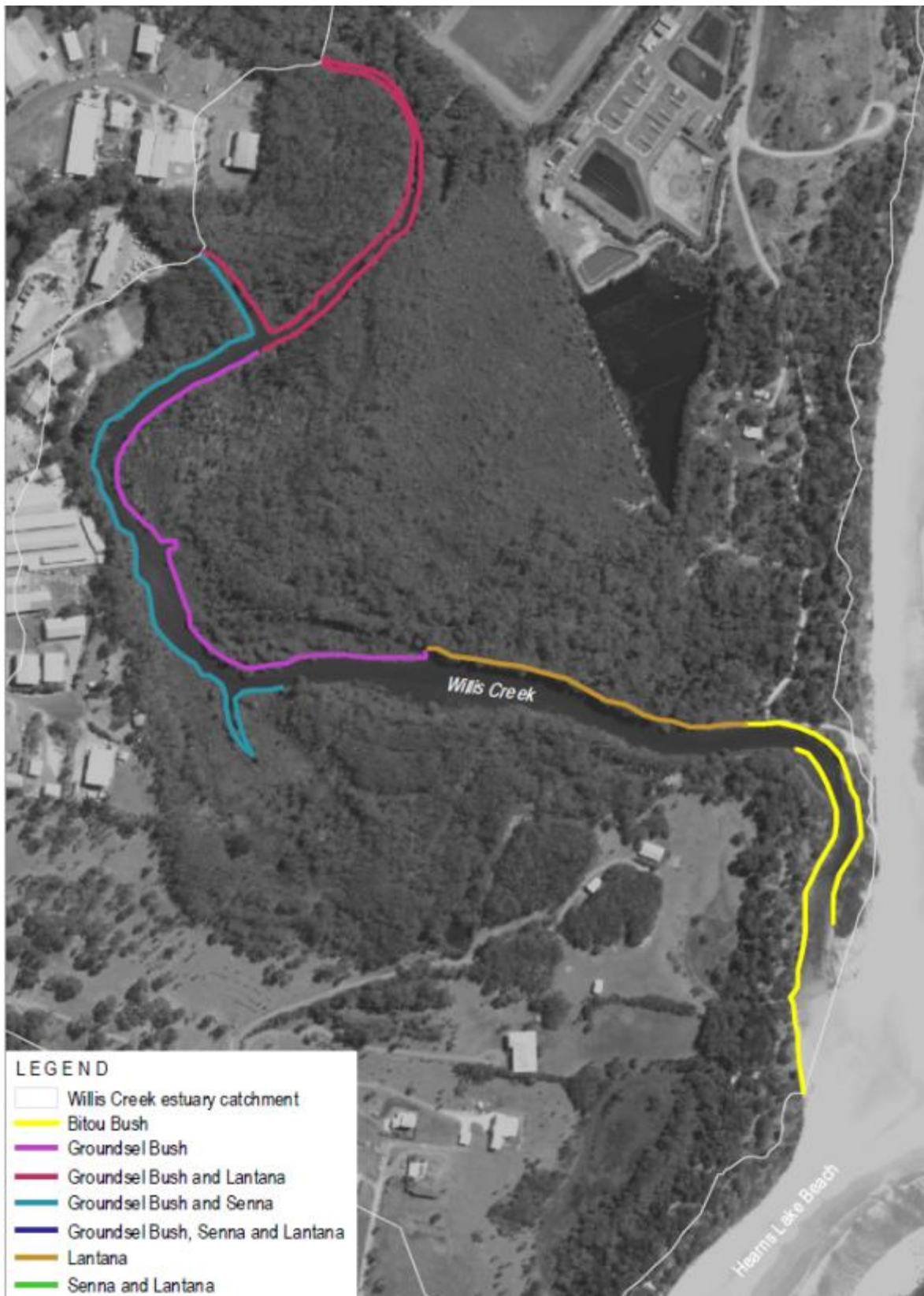
There is too little information to make an informed assessment of the health of Willis Creek:

- there is a lack of recent water quality data. Sediment quality data would also be useful as excess nutrients are likely to have been stored in the benthic sediment. Previous water quality data indicated that Willis Creek suffered from excessively high nutrient concentrations;
- saltmarsh and mangrove habitats are in relatively good condition. The riparian corridor is negatively impacted by weeds but well protected against erosion and well vegetated;
- fish and macroinvertebrate populations are scarce and lack diversity, though macroinvertebrate diversity appears to be improving; and
- blue green algae occurs in frequent small patches. There are no reported fish kills.



Source: GeoLINK *et al.* (2011)

Plate C.5 Riparian Vegetation Condition (mapped January 2011)



Source: GeoLINK *et al.* (2011)

Plate C.6 Distribution of Priority B and Priority C Invasive Weed Species (mapped January 2011)

C.5 Climate Change and Sea Level Rise

Climate change is projected to include an increased frequency of hot days, increased intensity and frequency of extreme daily rainfall events and droughts, changes to sea levels and changes in the occurrence of intense storm events. Climate change projections at the local scale for the Coffs Harbour area are described in a report by BMT WBM (2010a). The climate change projections for the Coffs Harbour area (relative to the 1977 to 2007 period) include the following:

- evaporation: decreases in summer and spring and increases in autumn and winter;
- temperature: decreases in average temperatures for summer, autumn and spring and increases in winter;
- Extreme Hot Days: significant increases in the annual number of extreme hot days;
- Average Rainfall: increases in annual totals and seasonal totals except for decreases in autumn totals for the Coffs Harbour area;
- High Rainfall Events: increases in frequency of high rainfall events in summer and autumn;
- Sea Level Rise: 0.4 m increase in mean sea level by 2050 and 0.9 m increase by 2100 (relative to 1990 mean sea levels); and
- Wave Climate: future wave climate will be similar to the present or within the variability of the existing wave climate. However, the Coffs Harbour Coastal Processes and Hazards Definition Study (BMT WBM, 2010b) investigated the possibility of a permanent shift from the existing south easterly wave climate to a more easterly wave climate with average wave height remaining the same.

C.5.1 Climate Change and Sea Level Rise Impacts on Estuary Processes

General estuary processes that will be impacted by climate change include (after Haines, 2006 and 2008; Mackenzie *et al.*, 2009):

- coastal processes and interactions with estuary entrances: e.g. a landward and upward shift in entrance channels in response to sea level rise;
- hydrodynamics: changes in water level and altered tidal prisms due to changes to entrance conditions; impacts of altered rainfall and evaporation patterns. Predicted sea level rise may result in higher water levels within the estuary and potentially an increase in typical water depths;
- sediment dynamics: changes to ingress of marine sediment due to changes to entrance conditions and changes to sediment derived from catchment runoff in response to an increase in high rainfall events;
- water quality: changes to water temperature and sediment dynamics and subsequent changes to chemical and physical processes in the estuary; and
- ecology: the impacts of increased water levels and altered hydrodynamics, sediment dynamics and water quality on ecological processes.

This page has been left intentionally blank



Appendix D

Summary of Community Uses Assessment

This page has been left intentionally blank

Community consultation aims to discover community aspirations and gain stakeholder input to the Project to ensure that the Estuary Management Plan is accepted by the community as a coherent, practical and achievable plan.

D.1 Initial Community Workshop

A Community Workshop was held at Woolgoolga Community Centre on 14 September 2010. The purpose of the initial Community Workshop was to gain input on Community values, issues and objectives for the three estuaries. Approximately 30 people attended the workshop.

Council and the consultant team (GeoLINK / GECO Environmental / Aquatic Science and Management) provided an introduction on the Estuary Management Plan process. The attendees then formed five groups to discuss and compile a list of key issues and goals for the estuaries. Following the group work a representative from each group summarised their key issues and goals. A final question time was undertaken before the workshop concluded.

The key focus of the attendees was generally Woolgoolga Lake and no specific comments were provided in regard to Willis Creek. However, some of the general comments applicable to the three estuaries are provided below in regard to goals and issues developed during group work.

Goals:

- improved water quality;
- foreshore management;
- water quality monitoring; and
- improved fish breeding.

Issues:

- Address water quality issues associated with runoff from rural lands and urban areas (nutrients, herbicides, pesticides, sediment and organic matter).

D.2 Community Survey

A Community survey was undertaken over a two month period from April to May 2011, encompassing a school holiday period to provide opportunity to capture input from the widest possible catchment of users. The surveys were located at Council offices, local outlets in the estuary catchments such caravan parks, newsagents and post offices. In addition, a web survey was made available through the website.

The survey data is summarised below. The total number of completed surveys received was 50. Note that Questions 6 and 8 apply to the Woolgoolga Lake Estuary and have therefore not been included.

1. Where are respondents from?

Sixty percent of respondents were from the Woolgoolga area, 22 % from Safety Beach and 16 % from elsewhere in the Coffs Harbour Council area. One respondent was from outside the Coffs Harbour Council area at the time of completing the survey.

2. How often do you visit or use Willis Creek?

Eighty-four percent of respondents indicated they visit Willis Creek. 44% rarely or never visit, and 26% visit Willis Creek a few times a year. 4% of total respondents visit Willis Creek daily.

3. Indicate how you use the estuary:

Survey results indicate the main use of the Willis Creek estuary is walking, with 36% of total respondents identifying this use. Bird-watching and dog walking were the next most significant uses, identified by 14 and 10% of respondents respectively. Swimming and boating were not identified by any respondents as uses of

the Willis Creek estuary. Other uses of Willis Creek identified by respondents included volunteering for the Little Tern Colony, and bait collecting.

4. Indicate your level of concern for the following estuary-related issues:

The estuary issues of most concern that apply to Willis Creek estuary, identified by 66% of respondents was water quality issues associated with runoff from agricultural lands and urban areas. The estuary issues of least concern that apply to Willis Creek, identified by 38% of respondents was insufficient walking tracks around Willis Creek.

5. Indicate the importance you place on the following estuary related goals:

The estuary goals of most importance, identified by 76-82% of respondents were:

- improved water quality;
- improved aquatic habitat within the lake and creeks to support fish stocks, crustaceans, etc; and
- improved runoff control in urban areas of the catchment.

The estuary goals of least importance that apply to Willis Creek, identified by 22% of respondents was improved walking tracks around Willis Creek estuary.

7. Use of motor boats in the estuary:

Seventy-six percent of respondents indicated they do not support the use of motor boats, and 22% of respondents indicated they do support the use of motor boats in the Darkum Creek, Woolgoolga Lake and Willis Creek estuaries.

D.3 Stakeholder Consultation

The organisations listed below were consulted to obtain initial input to the study:

- NSW Department of Environment, Climate Change and Water (Now NSW Office of Environment and Heritage)
- NSW Department of Environment, Climate Change and Water – Environmental Protection Authority (Now NSW Environmental Protection Authority)
- NSW Department of Environment, Climate Change and Water – Parks and Wildlife Group (Now NSW Office of Environment and Heritage – National Parks and Wildlife Service)
- Solitary Islands Marine Park Authority
- NSW Department of Primary Industries (Fisheries) – Industry and Investment NSW
- Northern Rivers Catchment Management Authority - Coffs Harbour (Now North Coast Local Land Services)
- NSW Department of Planning - Grafton
- NSW Department of Water
- Land and Property Management Authority
- NSW Maritime (Now NSW Roads and Maritime Services)
- Roads and Traffic Authority (Now NSW Roads and Maritime Services)
- Coffs Coast Tourism Association
- Local Aboriginal Land Council – Coffs Harbour
- Gumbular-Julipi Elders Council, c/o Coffs Harbour Local Aboriginal Land Council
- Woolgoolga Surf Life Saving Club
- Coffs Harbour Historical Society and Museum Inc.
- Landcare
- Woolgoolga Chamber of Commerce Industry & Tourism Inc
- Let's Save Woolgoolga Lake
- Coffs Harbour City Council

- Garby Elders
- Jim Stevens
- Woolgoolga Returned Services Golf Club

Input received from various organisations has been incorporated into the assessment of the relevant issues in the EMS. The issues are summarised below.

Table D.1 Consultation Correspondence

<i>Stakeholder</i>
Department of Planning (DoP)
The DoP refers to the following documents for consideration in preparing the CZMP: <ul style="list-style-type: none"> ▪ Mid North Coast Regional Strategy; and ▪ SEPP 71 – Coastal Protection.
The DoP raises the issue of future sea level changes and its consideration in planning for coastal areas. The DoP refers to the following documents and guidelines for consideration in preparing the CZMP: <ul style="list-style-type: none"> ▪ NSW Coastal Planning Guideline: Adapting to Sea Level Rise; ▪ Coastal Risk Management; and ▪ Flood Risk Management.

D.4 Final Community Workshop – Development of Strategies

A community workshop was held at Woolgoolga Community Centre on 13 October 2011 for the three estuaries (Darkum Creek, Woolgoolga Lake, and Willis Creek). The purpose of the workshop was to gain community input into the development of management strategies to ensure appropriate strategies have been developed, and to assist with identifying priorities. Approximately 30 people attended the workshop.

Council and the consultant team (GeoLINK / GECO Environmental / Aquatic Science and Management) provided an introduction on the key issues for the estuaries. The attendees then formed six groups to develop a list of key management strategies targeting the key issues for the estuaries. The output of the six groups are summarised in the following table. Following the group work a representative from each group summarised their strategies and reasoning. A final question time was undertaken before the workshop concluded.

The key focus of the attendees was generally Woolgoolga Lake, however some strategies such as catchment pollutant strategies related to all three estuaries. The main strategies generally aligned and supported the strategies that were being developed by the consultant team. The main strategies developed by the six groups are included:

- catchment pollutant strategies particularly with respect to rural runoff;
- management of environmental weeds and protection of riparian areas;
- urban stormwater management;
- sewerage overflows;
- dredging of the entrance;
- maintaining and enhancing existing walking trails; and
- prevent new development in areas affected by increased water / flood levels from sea level rise.

Table D.2 Management Strategies Developed in Community Workshop on 13 October 2011

ISSUES	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Stormwater and Catchment Inputs	<ul style="list-style-type: none"> ▪ Education and address policing / fining ▪ Erosion due to building and bad farming practices (eg. Blueberry / bananas) ▪ Sewerage inspections ▪ Dog excrement: place "poo bags" at head of walking tracks and police this / fines ▪ Council and NPWS to enforce "Animals Act". 	<ul style="list-style-type: none"> ▪ Eliminate or reduce top soil erosion / runoff from entering Poundyard Creek from construction and rural activities eg. blueberries 	<ul style="list-style-type: none"> ▪ Ongoing monitoring of water quality from all waterways and action taken to correct any silt or chemical imbalances ▪ In rural areas ensure a minimum buffer zone of 22 m along all waterways to trap sediment runoff 	<ul style="list-style-type: none"> ▪ Address the issue of erosion from orchards ▪ Campaign awareness for residents in the catchment (rural and urban) 	<ul style="list-style-type: none"> ▪ Buffer zones to 30 m along waterways ▪ Construct nitrogen traps / filter zones ▪ Address litter from children ▪ Inspection of sewerage especially Poundyard Ck 	<ul style="list-style-type: none"> ▪ Stormwater treatment devices implemented on all outlets and regularly serviced ▪ Water quality monitoring ▪ Audit agricultural practices ▪ Fish sampling for water quality monitoring
Impacts to foreshores	<ul style="list-style-type: none"> ▪ Seek funding for protection of riparian areas ▪ Support for volunteer groups for removal of rubbish and regeneration activities ▪ Council implement / supplies facilities (eg. common green skip bins) for landowners / caravan parks to remove green waste to prevent illegal dumping ▪ Wooden barriers / bollards and planting to define boundary to prevent mowing encroachment to native bushland 	<ul style="list-style-type: none"> ▪ Removal of noxious weeds eg. mile-a-minute and morning glory 	<ul style="list-style-type: none"> ▪ Educate residents and council workers on detrimental effects of mowing and other foreshore gardening activities on native riparian vegetation ▪ Develop and implement a management plan to keep lantana and other environmental weeds out of the foreshore areas ▪ Develop and implement an erosion management strategy 	<ul style="list-style-type: none"> ▪ Bollard the western end of the Woolgoolga Lake picnic area to eliminate vehicle access and a sign erected to prohibit cars, bikes onto the lake foreshores ▪ Campaign to control noxious weeds on the edges of Woolgoolga Lake ▪ A campaign to eliminate the camphor laurel problem that is developing along these creeks in the upper reaches 	<ul style="list-style-type: none"> ▪ Address illegal mowing, tree removal, and use of fertilisers ▪ Requires more landcare, neighbourhood and weed management groups ▪ Bush regeneration at TAFE ▪ Re-establish buffer zones ▪ Council get rid of green bins and place mulch around trees ▪ Promote / educate community regarding composting / worm 	<ul style="list-style-type: none"> ▪ Address weeds – lantana, asparagus fern (CMA, School, Community) – continue spraying; ▪ Mangroves – implement colonisation study (CMA, schools).

ISSUES	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
<p>Flooding</p> <ul style="list-style-type: none"> ▪ Council to revise: <ul style="list-style-type: none"> ▪ stormwater planning level of outlets for sewerage or relocating outlets ▪ relocation of housing at risk from flooding 	<ul style="list-style-type: none"> ▪ Address sewerage pumping stations overflow in heavy rains ▪ Keep stormwater drains cleared 	<ul style="list-style-type: none"> ▪ Rebuild and vegetate southern dune peninsula (near Caravan Park) by pumping sand from sedimentation area. This should improve any flooding problems in Woolgoolga Lake 	<ul style="list-style-type: none"> ▪ Keep natural, no rock walls, no retaining walls, no sandbags ▪ Have to maintain vegetation corridors within the catchment to slow run-off and reduce intensity of flooding, particularly when setting up new developments ▪ To alleviate the flooding of foreshore, removing the silt from the estuary mouth (dredging and sand pumping) Council should setup regular maintenance of clearing sand build-up by way of earth moving equipment after dune erosion. Push the sand back onto the southern dune entrance and beachfront ▪ Stop removing branches and tree trunks from waterways 	<p>farms</p> <ul style="list-style-type: none"> ▪ Odour issues from pump station at end of Young Street ▪ Convert kerb and guttering to dish drains and local grasses and plants ▪ Install retention basin and sedimentation traps ▪ Promote stormwater infiltration devices on properties 	<ul style="list-style-type: none"> ▪ Manually open Woolgoolga Lake mouth in storm events ▪ Public notification (paper) of water quality following flood events. 	

ISSUES	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Sedimentation	<ul style="list-style-type: none"> ▪ Holding ponds higher up the catchment ▪ Do not remove or install large logs (natural damming) to slow water flow, catch sediment and provide fish / aquatic habitat. 	<ul style="list-style-type: none"> ▪ Dredging to remove sediment from bottom of lake 	Refer to Flooding comments.	<ul style="list-style-type: none"> ▪ Reinstatement the natural northern lake entrance by removing the retaining wall ▪ Bulldoze the sand; Dredge the entrance to remove sand ▪ Return to contour planting in agriculture on the catchment hills (eg. blueberry farms) 	<ul style="list-style-type: none"> ▪ Re-establish riparian vegetation using neighbourhood group eg Sunset Lakes ▪ Utilise sediment traps and biological solutions to address sediment runoff ▪ Increase riparian buffer near sports oval by reclaiming 10 – 20 m on east of oval ▪ Increase riparian buffer along Darkum Creek within Golf Course 	<ul style="list-style-type: none"> ▪ Runoff and marine silts are considered the issue ▪ Water depth varies depending on mouth status ▪ Dredging is considered to be temporary relief (optic cable maybe impacted by dredging)
Recreation	<ul style="list-style-type: none"> ▪ Prevent 4WD entry / damage to environment ▪ No new walking tracks to be put in ▪ Maintain and enhance existing walking tracks so that public stay on tracks ▪ NPWS to prevent and police / fine 4WD's on beach 	<ul style="list-style-type: none"> ▪ No further trail networks are needed ▪ Bank erosion at the picnic area of the lake needs to be addressed 	<ul style="list-style-type: none"> ▪ Existing trail networks which are retained should be converted to boardwalks to prevent erosion ▪ Where trail (where boardwalks) are set back from waterways, then the land between can be developed as a catchment / erosion control zone for runoffs to ease siltation and erosion 	<ul style="list-style-type: none"> ▪ Walking trails on the cemetery side of the lake need fixing as it is washed out and dangerous ▪ Very important to keep and expand the walking trails so residents and visitors can enjoy the waterways 	<ul style="list-style-type: none"> ▪ Close off unnecessary trails ▪ Make clear signage – interpretation ▪ Retain only necessary well-walked trails ▪ Stop 4WDs / motorbikes on trails 	<ul style="list-style-type: none"> ▪ Pathways – adequate quantity but quality poor (fix steps / drainage – north shore, Safety Beach) ▪ Upgrade to “in-ground”, permanent well-constructed eg Port Macquarie Headland Walk.

ISSUES	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Climate Change and sea level rise	<ul style="list-style-type: none"> No new developments in flood prone areas as designated by Coffs Coastal Zone Management Plan Protection (by zoning) of existing native riparian habitat 	<ul style="list-style-type: none"> No comment 	<ul style="list-style-type: none"> Educational signage at key points of each waterway on the importance of these as a natural environment. Council to identify and publicise those properties which will be affected by climate change and flooding events and develop and implement property prevention measures 	<ul style="list-style-type: none"> No comment 	<ul style="list-style-type: none"> Make retreat areas for animals and plants Households to use water retention strategies No new development in river /lake / sea level rise areas. 	<ul style="list-style-type: none"> No comment
Other	<ul style="list-style-type: none"> More active policing / fining of regulations by NPWS and Council Use signs and education avenues eg. in schools, social media, tv and papers Container legislation – 10c for return of bottles and cans to prevent litter 	<ul style="list-style-type: none"> The poor condition of Woolgoolga Lake Bridge is considered an eyesore 	<ul style="list-style-type: none"> No comment 	<ul style="list-style-type: none"> Community Dune Care Groups should have to seek approval from Council and community before performing strategies and so-called improvements to the lake and foreshores, in particular pruning has been done which leaves a lot to be desired Ugly shade-cloth fences on beach front etc unnecessary and for long periods. 	<ul style="list-style-type: none"> Teach people to look at rivers for health, deterioration and regeneration, street education All new development to be required to be 40% under indigenous vegetation 	<ul style="list-style-type: none"> No superfluous signage – if a must, eco-friendly and reduce (maintain) education signs to a minimum

This page has been left intentionally blank



Appendix E

Summary of Development of Management Objectives and Issues

This page has been left intentionally blank

E.1 Values

E.1.1 Local and Regional

The natural settings of the estuaries and coast within the Mid North Coast area are a feature that attracts visitors and locals to the area. Willis Creek is in keeping with this natural setting, and forms part of the network of bushland settings along the coast and estuaries and is of local and broader significance.

Key values of the estuary include its natural setting, Little Tern breeding site and quiet recreational opportunities including bird watching and bushwalking.

E.1.2 Cultural Heritage

Aboriginal, European and Sikh cultural heritage values are significant for the Woolgoolga area.

The Woolgoolga area was (and continues to be) inhabited by the Gumbayngirr people prior to European Settlement. Records show that an artefact find is located within the study area, and two Aboriginal ceremonial and dreaming sites are located within close proximity of the Willis Creek catchment. The cultural values of these Aboriginal sites within the Willis Creek catchment area require sensitive consideration and preservation.

Europeans moved into the Woolgoolga area from the 1870s. Records indicate that there are no listed European cultural items of significance within the study area. Land use within the Willis Creek estuary catchment changed from predominantly native vegetation in 1943, to clearing of land on the southern and western side of the creek between 1964 and 1974, and the significant growth of residential and industrial development (including the STP site) between 1974 and 1994 between the creek and the existing Pacific Highway.

The *Coffs Harbour Coastal Processes and Hazards Definition Study Draft Report*, prepared by WBM, indicates that sand mining leases existed and sand mining may have occurred at Woolgoolga Back Beach and Hearn's Lake Beach (Willis Creek estuary catchment area).

E.1.3 Recreational Values

Willis Creek is a relatively small and remote coastal estuary with dense vegetation and a lack of public access. However it offers the following recreational values:

- water-based activity including kayaking and canoeing in the creek; and
- the natural setting attracts people seeking quiet recreational opportunities such as bird watching and bushwalking.

Odours from the STP site may deter visitors at certain times such as early mornings when odours are relatively strong around the STP site.

E.1.4 Scenic Values

Willis Creek offers a predominantly undisturbed natural environment that forms an integral and important component of the natural settings along the coastline. Willis Creek is a remote, densely vegetated estuary and with limited access which combine to significantly restrict visual access into the area. It offers the following scenic values:

- limited, short distant views into the foreshore vegetation from the vehicle access track;
- highly scenic, panoramic views across upstream and downstream reaches of the creek from an elevated vantage point at the top of the dune near the carpark at the end of the track;
- the mouth of the creek to the south of the car park also offers an uninterrupted view of the downstream reach of the creek and its partial opening to the ocean; and
- much of the Willis Creek reserve has been retained in its natural state and the creek follows a narrow channel that meanders through dense, visually rich riparian vegetation which encloses and protects the creek to produce a highly tranquil and scenic environment.

E.1.5 Water Quality Values

It is difficult to describe the current water quality values of Willis Creek as very little water quality data has been collected since 2005. When water quality data were last collected the creek received treated effluent from the Woolgoolga Wastewater Treatment Plant (WWTP). In 2005 CHCC upgraded the WWTP and diverted treated effluent elsewhere. It is likely that the intervening years have resulted in an improvement in water quality. By most measures available, the water quality of Willis Creek was poor during the effluent release period. However, surprisingly, the water quality data during this period indicates that according to the old ANZECC (2000) guidelines for recreational use, Willis Creek would have been suitable for primary contact recreation.

Physico-chemical water quality information (salinity, pH, dissolved oxygen (DO), turbidity and temperature) was collected on 8 February 2011 as part of this study from three sites in Willis Creek to assess long channel and vertical variation in water quality. The creek was open to the ocean at the time of sampling, though it did not appear to be receiving tidal water, only draining to the ocean. Willis Creek was sampled at the beginning of the incoming tide. The results indicated the creek is well mixed for most of the estuary length, with a gentle reduction in salinity moving upstream, accompanied by a fall in pH and DO. The water quality of Willis Creek was a relatively even mixture of seawater and freshwater.

E.1.6 Ecological Values

Ecological characteristics of Willis Creek that can be considered values include:

- a relatively large area of saltmarsh habitat. Saltmarsh contributes to the overall productivity of the estuary and provides habitat for fish and invertebrates. Saltmarsh is also protected as an endangered ecological community (EEC) under the *TSC Act*;
- an area close to the entrance to Willis Creek is used as a breeding site for a population of the endangered little tern (*Sterna albifrons*);
- the riparian vegetation of Willis Creek is mostly intact and in good (73%) to very good (9%) condition. Riparian vegetation filters overland flows, stabilises banks, provides structural habitat for fish and contributes to the overall productivity of the estuary;
- approximately 0.9 ha of mangrove habitat showing active recruitment. Mangroves are an important primary producer driving the overall productivity of the system, process pollutants in the water, provide structural habitat for fish and invertebrates and stabilise banks and sediment;
- reeds and rushes are common along the margins of the central channel and upper creek, contributing to productivity, habitat value and bank stability; and
- a quiet, natural environment where low impact activities, such as bird watching and walking, can be appreciated.

E.2 Management Objectives

E.2.1 Entrance Conditions and Hydrodynamics Objectives

E.2.1.1 *Promote Natural Entrance Opening / Closing Processes*

Willis Creek is an ICOLL system that is predominantly closed. The entrance opens and closes to the ocean naturally in a constant but irregular cycle depending on fluvial, tidal and wave processes. Artificial opening of ICOLL's can have significant negative impacts on water quality, fish and other ecological communities.

Council does not have any current opening protocol for Willis Creek entrance. However, it is noted that during the period of release of effluent into Willis Creek from the Woolgoolga Water Reclamation Plant (1973 to 2005), the plant operator checked the entrance on a daily basis to ensure that it did not fully close (Jelliffe, 1997a). There are no records of artificial opening of the entrance since the cessation of effluent release in 2005.

Community consultation has not indicated any desire for artificial opening of the creek entrance. Nor is there currently any significant need for artificial opening for the purpose of flood mitigation. Nevertheless, a formal entrance management policy will be developed for Willis Creek in accordance with OEH *Guidelines for Preparing Coastal Zone Management Plans* (DECCW, 2010) which requires EMPs for ICOLLS to include such a policy.

The objective of the entrance management policy will be to maintain a natural opening / closing regime for the creek entrance. Interference (artificial opening of the entrance) would only be employed for critical situations such as to mitigate and reduce the impacts of flooding on properties and infrastructure adjoining the creek.

E.2.1.2 *Minimise Flooding of Properties and Infrastructure*

Flood level estimates for Willis Creek and inundation mapping associated with elevated ocean levels indicates there are no properties or infrastructure currently at risk of significant flooding. However sea level rise will result in higher inundation levels within the creek system in the future. Therefore the objective is to minimise or avoid future flooding of properties and infrastructure around the creek by appropriate means such as development controls for future development in flood prone areas; artificial opening of the creek entrance where appropriate; flood-proofing infrastructure; etc.

E.2.2 Bank Stability and Sedimentation Objectives

Bank erosion and estuary sedimentation are not significant issues in the Willis Creek estuary (Geolink et al., 2011), although 11% of banks surveyed were recorded with minor erosion, all such banks occurred in the lower reaches of the estuary where the channel runs between the beach dunes and the back barrier dune. As the banks are essentially composed of sands with little cohesion they are highly susceptible to wash and, when the entrance is open, tidal flow. Intervention in this setting is not required and consequently there are no recommended objectives for addressing bank stability or sedimentation in the Willis Creek estuary.

E.2.3 Ecological, Habitat and Biodiversity Objectives

E.2.3.1 *Protect and Enhance Aquatic Habitats*

The NRCMA CAP lists rehabilitation of aquatic habitats among its goals. Willis Creek has abundant mangrove habitat and a locally significant area of saltmarsh habitat.

Mangrove and saltmarsh habitats in Willis Creek are mostly in good condition. An objective of the Willis Creek Estuary Management Plan is to protect these communities from disturbance;

E.2.3.2 *Restore terrestrial habitats of high ecological or conservation value by removing threats and through targeted rehabilitation (e.g. riparian vegetation, endangered ecological communities such as Coastal Saltmarsh, Freshwater Wetlands, etc)*

A variety of terrestrial habitats of high conservation value have been identified within Willis Creek estuary. The main threat to the integrity and viability of some of these habitats in the Willis Creek estuary is weed invasion.

This management objective is aimed at the rehabilitation of sites with high ecological or conservation value where degradation (such as weed infestation) has occurred.

E.2.3.3 Make Provisions for the Ecological Effects of Climate Change and Sea Level Rise

Some negative ecological impacts are likely to result under current climate change and sea level rise scenarios. These may include changes in the distribution and extent of mangrove and saltmarsh colonies and reductions in the overall productivity of the estuary. Effective planning for future changes will help to mitigate negative impacts.

E.2.3.4 Protect Little Tern Population from Disturbance

A significant breeding site for the Little Tern (South-eastern Australian population) in NSW in recent times is located at the Willis Creek / Hearn's Lake entrance area. The site is located on Crown Land and is being actively managed seasonally to protect the nesting colony in a joint project undertaken by OEH - National Parks and Wildlife Service and Coffs Harbour City Council. The objective is to continue the current management program and avoid activities / development that may threaten the success of the program.

E.2.4 Water Quality Objectives

E.2.4.1 Improve Water Quality

There are a number of areas in which the water quality of Willis Creek can be improved. Unfortunately, nutrient enrichment after years of effluent discharge will only be mitigated as part of a natural recovery process. However, the process of natural recovery will be maximised if the current and future impacts of runoff from the catchment are minimised.

The NRCMA CAP lists an improvement in the condition of coastal zone natural resources as one of its targets. The assembled water quality information indicates that a reduction in the export of nutrients and sediment from the catchment through land and stormwater management would be the most efficient way to improve water quality in Willis Creek.

E.2.4.2 Improved Monitoring of Water Quality

A key objective for the management of Willis Creek is to improve the understanding of the current status of water quality in Willis Creek. A suggested water quality monitoring program that meets NSW government reporting obligations will be delivered as part of the Estuary Management Plan.

E.2.5 Recreational Use and Access Objectives

E.2.5.1 Preserve the quiet, undeveloped natural setting

Given the density of vegetation and lack of public access, the Willis Creek reserve generates little recreational activity. However the natural setting attracts people seeking quiet recreational opportunities such as bird watching, bushwalking and non-motorised water-craft.

This objective is accordingly to preserve the quiet undeveloped natural setting of the Willis Creek foreshores.

E.2.5.2 Prevent excessive disturbance or fragmentation of the existing natural values

An unformed access road connects the southern edge of Woolgoolga settlement with Woolgoolga Back Beach where it terminates as a small car park and turning area close to the mouth of the creek. A timber slatted walkway provides pedestrian access to the beach and there are no known walking tracks within the reserve.

This objective is to prevent excessive disturbance or fragmentation of the existing natural values by minimising the provision of additional recreational infrastructure and formal access routes.

E.2.5.3 Enhance public appreciation of the broader and site specific natural values of the creek environment.

Much of the Willis Creek reserve has been retained in its natural state and is protected as part of the Coffs Coast Regional Park. Identification, regulatory and interpretive signs provide limited information at the start of the beach access track. The purpose of this objective is partly to develop a sense of custodianship for the area to assist with preserving the existing natural characteristics.

E.2.6 Views and Visual Character

E.2.6.1 Maintain and preserve the existing natural characteristics of the area as the dominant visual feature

E.2.6.1 Remove weed infestation and rehabilitate natural areas disturbed by previous uses or uncontrolled vehicle access.

E.3 Management Issues

E.3.1 Entrance Conditions and Hydrodynamics Issues

E.3.1.1 Impacts of Climate Change on Flooding

Sea level rise caused by climate change will result in higher flood inundation levels within the Willis Creek system in the future. Current inundation levels are likely to increase by a similar amount as sea level rise increases. Adopted sea level rise estimates for NSW are a 0.4m increase in sea level (relative to 1990 levels) by 2050 and a 0.9m increase by 2100. Climate change also has the potential to result in an increased frequency of high rainfall events leading to more frequent flooding events.

Infrastructure that may be impacted by future coastal inundation include sewage pump station no. 5, located to the south of residential properties in Nightingale Street. The elevation within this area is approximately 4 to 5 m Australian Height Datum (AHD). Higher future flood levels may also present a risk of backyard flooding to some properties residential properties in Nightingale Street adjoining the creek system and industrial properties in Hawke Drive, Bosworth Road and Willis Road adjoining the creek system.

E.3.1.2 Shift in Entrance Location as a Result of Coastal Processes

The Willis Creek entrance may move to the north as a result of coastal processes responding to sea level rise and other climate change impacts. This may impact on the existing car park, 4WD access to the beach and associated infrastructure.

E.3.2 Bank Stability and Sedimentation Issues

At the date of development of this Estuary Management Study, there were no bank erosion issues requiring active management within the Willis Creek estuary.

E.3.3 Ecological, Habitat and Biodiversity Issues

E.3.3.1 Effects of Human Activities on the Little Tern Population

A *Shorebird Recovery Program* has been devised to guide management of the Little Tern breeding site at the Hearnese Lake / Willis Creek entrance. Management actions include fencing off of the nesting site, community awareness initiatives, a fox abatement plan and monitoring. Continuance of this program is expected to reduce the impact of human activities on the Little Tern population.

E.3.3.2 Impacts of Climate Change on Estuary Ecology

Some negative ecological impacts are likely to result under current climate change and sea level rise scenarios. These may include changes in the distribution and extent of mangrove and saltmarsh colonies, reductions in the overall productivity of the estuary and a reduction in feeding and nesting areas for wading birds.

E.3.3.3 Environmental weeds degrading native riparian vegetation communities along the estuary banks.

Weed mapping undertaken in January 2011 identified the presence of environmental weed species throughout Willis Creek (GeoLINK *et al.*, 2011). The main species identified were groundsel bush, senna, noogoora burr, and pink lantana in the mid to upper reaches, and bitou bush and coastal morning glory in the lower reaches. Environmental weeds degrade the native riparian vegetation, reducing its ecological value and in some cases potentially impacting upon bank stability and other estuary values including recreational amenity and aesthetics. Reaches of high priority for weed control will be determined as part of the Estuary Management Plan.

E.3.4 Water Quality Issues

E.3.4.1 Elevated Turbidity, Total Nitrogen and Chlorophyll-a Values

The assembled water quality data for Willis Creek triggers ANZECC (2000) interim guidelines for the protection of aquatic ecosystems for total phosphorus, total nitrogen and chlorophyll-a. The limited dataset collected during the DECCW MER monitoring project indicates that turbidity is also above guideline levels.

The specific cause of elevated turbidity levels in Willis Creek is most likely to be associated with high levels of micro-algal growth in the water column. The following factors may also be contributing:

- re-suspension of fine sediments on the bottom due to tidal flow or during entrance breakout events;
- elevated suspended sediment loads in catchment runoff.

Phosphorus and nitrogen enrichment in Willis Creek are a result of many years of effluent discharge. It is uncertain how the cessation of effluent discharge has affected nutrient concentrations but they are still likely to be contributing to high levels of micro-algal growth in the water column (indicated by high chlorophyll-a concentrations) and the risk of algal blooms and associated fish kills is probably still high.

E.3.4.2 Stormwater Management and Pollutant Inputs from the Catchment

During community consultation water quality issues associated with runoff from rural and urban lands were raised as a perceived issue. Nutrients, sediments, pesticides and herbicides, and organic matter were all seen as potential contaminants in runoff. A basic modeling exercise was undertaken as part of the Estuary Processes Study (GeoLINK *et al.*, 2011) using the Catchment Management Support System (CMSS). The CMSS is a method of calculating nutrient and sediment budgets based upon landuse types and their distribution within a catchment.

- **Rural Landuse:**

CMSS results indicate horticultural landuses, which account for approximately 25% of the Willis Creek catchment, dominate the supply of sediment and nutrients to the creek (particularly phosphorus). This highlights the importance of erosion and sediment controls for the main agricultural practices in the catchment (eg. banana and blueberry cultivation) and wastewater controls for intensive horticultural practices such as excess fertigation from greenhouse cucumber production.

- **Urban Development:**

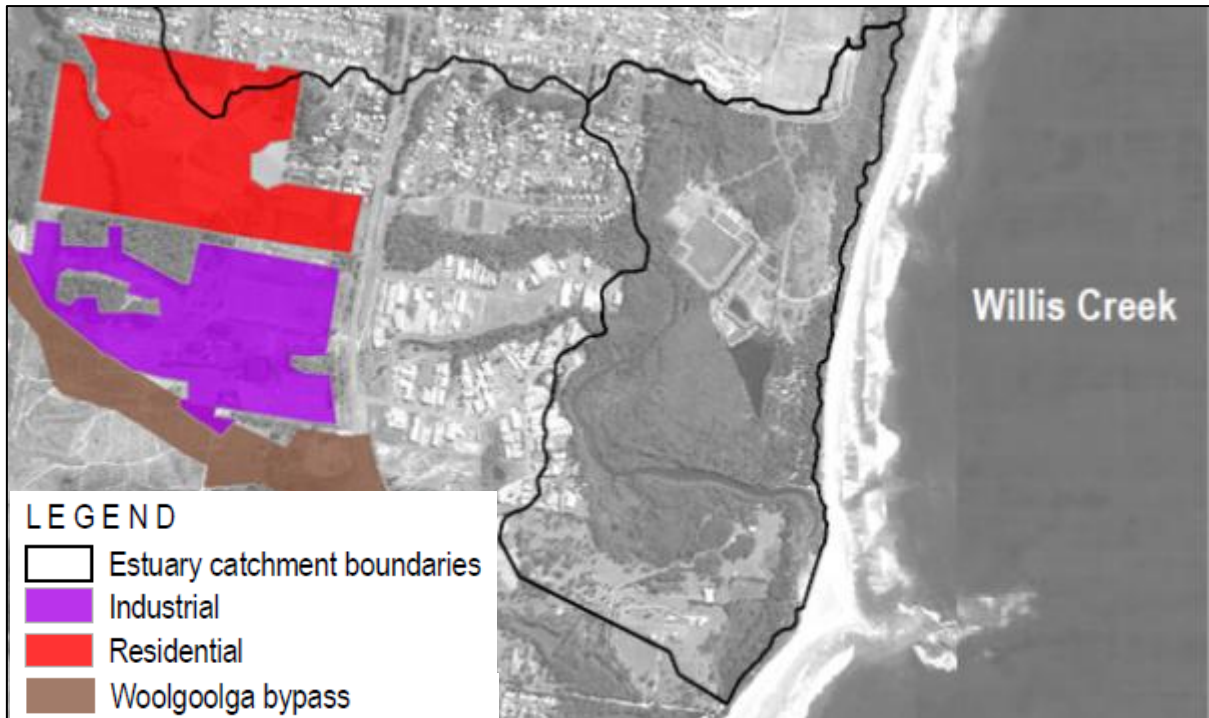
Residential and industrial land is the second largest contributor of sediment and nitrogen in the catchment. This indicates that investment into effective stormwater management could be an effective means of improving overall estuary health.

Projected future growth in the upper catchment of Willis Creek includes a "Special Investigation" area for residential and potential industrial medium term growth (2011 - 2016) – refer to **Plate E.1**. New development areas have the potential to reduce the quality of catchment runoff during and after the construction phase. It is important that controls placed on new developments are sufficient and enforced to ensure no negative net impact upon water quality.

A significant component (20%) of the estuary catchment is zoned "2E Residential Tourist" on the southern side of Willis Creek. This area currently has minimal development. The area is addressed under Council's *Hearnes Lake / Sandy Beach Development Control Plan (DCP)* (2008) which promotes sustainable development of the area including: a proposed increase in environmental protection areas

adjoining the southern side of the creek; masterplanning of low-density residential and ecotourism in existing cleared areas; and specific stormwater quality management guidelines. The Hearnes Lake / Sandy Beach DCP is considered to satisfactorily address any potential water quality issues associated with future development of this area, accordingly this is not considered a significant issue for the estuary provided the DCP measures are enforced.

Old on-site sewage management systems (septic systems) on rural and rural-residential properties also have potential to deliver excess nutrients and pathogens to the estuary system.



Source: GeoLINK *et al.* (2011)

Plate E.1 Future Industrial and Residential Growth Areas

- **Woolgoolga Water Reclamation Plant**

The site of the Woolgoolga Water Reclamation Plant occupies a significant proportion of the Willis Creek estuary. Effluent release from the plant into the creek ceased in 2005 with the upgrade of the plant and connection to the Coffs Harbour reclaimed water reticulation system.

There is an overflow from the wet weather balance pond which overflows into Willis Creek in extreme rainfall events approximately every 5 to 10 years. The overflow is a highly diluted sewage (approx. 90% stormwater / 10% sewage) (pers. comm. A. Wilson, CHCC, 10/10/2011).

- **Decommissioned Landfill Site**

A decommissioned landfill site is located to the east of the Woolgoolga Water Reclamation Plant. However, there are no records of this site contaminating Willis Creek.

- **Pacific Highway Upgrade**

An additional and immediate development within the greater catchment area is the construction of the Woolgoolga bypass. It is important that water quality runoff from the construction of this major development is subject to strict controls and does not result in adverse impacts to water quality.

E.3.4.3 Water Quality Impacts Associated with Climate Change and Sea Level Rise

It is difficult to predict precisely how forecast climate change and sea level rise may impact upon water quality in Willis Creek. It is likely, however, that some existing issues might become more pronounced under climate change and sea level rise scenarios, particularly issues relating to catchment inputs.

E.3.4.4 Poor Water Quality Leading to Fish Kills and Algal Blooms

Jelliffe (1997) reported that both fish kills and algal blooms had resulted from poor water quality in Willis Creek. Nutrient enrichment as a result of many years of effluent discharge is the root cause of these issues. Refer to the previous discussion of the Woolgoolga Water Reclamation Plant in **Section E.3.4.2**.

E.3.4.4 General Lack of Water Quality Data

Water quality information was collected on a weekly basis during the period that treated effluent was released into Willis Creek. However, since the cessation of this activity in 2005, very little information has been collected making it difficult to make an informed assessment of current water quality. It is also uncertain what effect, if any, runoff from the Bosworth Road Industrial Estate has upon water quality.

E.3.5 Recreational Use and Access Issues

E.3.5.1 Damage and loss of amenity from increased use

Increased recreational activity and uncontrolled pedestrian access to riparian areas of Willis Creek has the potential to damage the natural environment. Additionally, increased recreational activity has the potential to cause a loss of existing recreational amenity and sense of solitude experienced by walkers.

E.3.5.2 Lack of Appreciation of the Values of Willis Creek

Given the density of vegetation and lack of public access, the Willis Creek reserve generates little recreational activity. The natural setting attracts people seeking quiet recreational opportunities such as bird watching and bushwalking, and the creek would also be attractive to non-motorised water craft users although there are no boat launching sites near the access road. Swimming in the creek is prohibited. An issue for this estuary is therefore a lack of appreciation of the values of Willis Creek.

E.3.6 Views and Visual Character Issues

E.3.6.1 Loss of Visual Amenity

Weed infestation and fragmentation of the natural environment by uncontrolled vehicle and pedestrian movement may result in loss of visual amenity.

E.4 Ranked List of Issues

Table E.1 shows the ranked management issues in terms of their priority for management over the next five years. Five years is the expected planning timeframe for the Coastal Zone Management Plan before it undergoes review and adjustment. The ranking has been based on the scoring system below. The scoring attributed to each management option is shown in **Table E.1**.

Priorities have been allocated to management objectives based on a matrix assessment that considers:

- the degree to which the management objectives will impact on estuary issues:
(scoring: low = 1, moderate = 3, high = 5);
- timeframe over which the impacts are likely to occur:
(scoring: short (< 3 years) = 1, medium (5-8 years) = 3, long (>10 years) = 5);
- extent of the estuary addressed by the management objective:
(scoring: lower estuary = 1, middle estuary = 1, upper estuary = 1, whole estuary = 3); and
- community rating of the issues addressed by the management objectives based finding from the community survey): (scoring: not important = 0, important = 3, very important = 5).

Table E.1: Ranked List of Key Estuary Management Issues

Priority	Key Estuary Management Issue	Report Reference	Potential for Impact on Estuary Objectives	Timeframe over which Impacts Occur	Extent of Estuary Addressed	Community Rating	Priority Score
1	Stormwater Management and Pollutant Inputs from the Catchment	E.2.4.2	4	5	3	5	17
2	Elevated Turbidity, Total Nitrogen, Total Phosphorus and Chlorophyll-a Values	E.2.4.1	4	5	3	5	17
3	Environmental weeds degrading native riparian vegetation communities along the estuary banks.	E.2.3.3	3	5	3	4	15
4	Damage and Loss of Amenity from Increased Use	E.2.5.1	4	5	3	3	15
5	Lack of Appreciation of the Values of Willis Creek	E.2.5.2	4	5	3	3	15
6	Water Quality Impacts Associated with Climate Change and Sea Level Rise	E.2.4.3	3	5	3	3	14
7	Poor Water Quality Leading to Fish Kills and Algal Blooms	E.2.4.4	3	5	3	3	14
8	Impacts of Climate Change on Estuary Ecology	E.2.3.2	3	5	3	2	13
9	General Lack of Water Quality Data	E.2.4.5	2	5	3	3	13
10	Effects of Human Activities on the Little Tern Population	E.2.3.1	3	5	1	3	12
11	Loss of Visual Amenity	E.2.6.1	3	3	3	2	11
12	Impacts of Climate Change on Flooding	E.2.1.1	1	5	2	1	9
13	Shift in Entrance Location as a Result of Coastal Processes	E.2.1.2	1	5	1	1	8

This page has been left intentionally blank



Appendix F

Letters of Support from Agencies for Relevant Actions

DOC18/127263

Steve McGrath
General Manager
Coffs Harbour City Council
Locked Bag 155
Coffs Harbour NSW 2450

Attn: Sally Whitelaw

By email: sally.whitelaw@chcc.nsw.gov.au
cc: marc.daley@environment.nsw.gov.au

Dear Mr McGrath

Darkum Creek Estuary and Willis Creek Estuary Coastal Zone Management Plans (CZMPs)

The Department of Industry – Lands & Water (Dol Crown Lands) has reviewed the Darkum Creek Estuary and Willis Creek Estuary Coastal Zone Management Plans, as amended for certification June 2018, where relevant to the NSW *Crown Lands Act 1989*.

The review has considered technical, planning and financial aspects of the CZMP as relevant to Crown land management. The review has not considered the adequacy of the CZMP in relation to other legislation or the 'Guidelines for Preparing a Coastal Zone Management Plans', published by the NSW Office of Environment & Heritage (2013).

Dol Crown Lands agrees 'in principle' to the amended CZMPs under section 15(4)(b) of the *Coastal Management Act 2016* (formerly section 55C(2)(b) of the *Coastal Protection Act 1979* - now repealed). This agreement does not exclude or replace the need for authorities to undertake the various planning, regulatory and approval processes that may be required as per the *Crown Lands Act 1989* and as part of implementing the CZMPs.

Should you wish to discuss this matter further, please do not hesitate to contact Ms Catherine Knight, Coastal Management Specialist, on (02) 6620 5511 or by email at catherine.knight@crowmland.nsw.gov.au.

Yours sincerely



Glenn Bunny
Director Infrastructure and Land Management
28 June 2018

From: Tony Broderick
To: [Sally Whitelaw](#); [Jackson Pfister](#)
Subject: Fwd: Agency support for actions under Estuary Coastal Zone Management Plans
Date: Monday, 4 December 2017 9:50:13 AM
Attachments: [image001.jpg](#)
[image001.jpg](#)
[Attachment 1 - BoambeeNewports CZMP LLS Relevant Strategy Updates.docx](#)
[Attachment 2 - Darkum Willis Woolgoolga CZMP LLS Relevant Strategy Updates.docx](#)
[LLS Letter Agency Support for Actions. Follow-up- Local Land Services.pdf](#)

Hi Sally and Jackson,

Thankyou for the opportunity to comment on the revised strategy and actions outlined in the CZMP's for Darkum, Willis and Woolgoolga creeks.

North Coast LLS supports the listed Strategy actions 1.2 and 1.5 for Darkum and Willis Creek CZMP's and the responsibilities attributed to NCLLS as outlined in the attached. Please note that in 171/8 NCLLS will update the "Soil and Water Management Practices for Blueberry growers in Northern NSW, 2008" as part of its current Ecological Sustainable Development: blueberry engagement project.

North Coast LLS also supports Strategy actions 2.2 and 2.6 fo5r Woolgoolga Creek CZMP's and the responsibilities attributed to NCLLS as outlined in the attached.

kind regards
Tony Broderick

Tony Broderick | Team Leader Land Services
North Coast Local Land Services
24-26 Mulgi Drive, South Grafton NSW 2460.
t: 02 6604 1114 | m: 0409 225 798
w: www.lls.nsw.gov.au/northcoast

----- Forwarded message -----

From: **Sally Whitelaw** <sally.whitelaw@chcc.nsw.gov.au>
Date: 30 November 2017 at 12:08
Subject: Agency support for actions under Estuary Coastal Zone Management Plans
To: "tony.broderick@lls.nsw.gov.au" <tony.broderick@lls.nsw.gov.au>
Cc: Jackson Pfister <jackson.pfister@chcc.nsw.gov.au>

Hi Tony,

As discussed the other day we are seeking comments from LLS in regards to a number of CZMPs so that we can get them certified and available for grant funds.

A letter is attached explaining this further.

Please give me a call if you have any questions. It would be great to get this sorted before xmas if possible. If not I am on leave for most of January however Jackson is available in

January if you have any questions. He can be reached on 6648 4462.

Regards,

Sally Whitelaw

Senior Biodiversity Officer| Coffs Harbour City Council

P: | 02 6648 4673

E: sally.whitelaw@chcc.nsw.gov.au | W: www.coffsharbour.nsw.gov.au |



This email (including any attachments) is intended only for the use of the individual or entity named above and may contain information that is confidential, proprietary or privileged. If you are not the intended recipient, please notify Council immediately by return email and then delete the email, destroy any printed copy and do not disclose or use the information in it.

Coffs Harbour City Council advises that this email and any attached files should be scanned to detect viruses and accepts no liability for loss or damage (whether caused by negligence or not) resulting from the use of any attached files.

Scanned by **MailMarshal** - Marshal8e6's comprehensive email content security solution. Download a free evaluation of MailMarshal at www.marshall.com

This email (including any attachments) is intended only for the use of the individual or entity named above and may contain information that is confidential, proprietary or privileged. If you are not the intended recipient, please notify Council immediately by return email and then delete the email, destroy any printed copy and do not disclose or use the information in it.

Coffs Harbour City Council advises that this email and any attached files should be scanned to detect viruses and accepts no liability for loss or damage (whether caused by negligence or not) resulting from the use of any attached files.



OUT17/16446

27 April 2107

Coffs Harbour City Council
Locked Bag 155
COFFS HARBOUR, NSW 2450

Attn: Marten Bouma
Email address marten.bouma@chcc.nsw.gov.au

Dear Mr Bouma

Support for actions required to be undertaken by DPI Agriculture under Council's adopted Estuary Coastal Zone Management Plans (EMPs)

Thank you for the opportunity to provide comment for the above proposal as per your correspondence dated 23 March 2017.

DPI Agriculture has reviewed the commitments included in the EMPs and agrees to undertake the actions outlined. To assist Council to plan to undertake these actions DPI Agriculture encourages Council in the first instance to contact Mr Mark Hickey Leader Northern Horticulture, Primary Industries Horticulture on telephone (02 6626 1277) or email mark.hickey@dpi.nsw.gov.au to ensure that the relevant industry development officers will be available.

Yours sincerely

A handwritten signature in blue ink that reads 'Liz Rogers'.

Liz Rogers
Manager
Agriculture Landuse Planning