Macleay River Estuary CMP Stage 1 Scoping Study

February 2020

KEMPSEY Shire Council

Document Control Sheet

BMT Commercial Australia Pty Ltd
126 Belford Street
Broadmeadow NSW 2292
Australia
PO Box 266
Broadmeadow NSW 2292

Tel: +61 2 4940 8882
Fax: +61 2 4940 8887

ABN 54 010 830 421

www.bmt.org

Document:	R.N20956.001.02.CMPS1_SS_Macleay.docx
Title:	Macleay River Estuary CMP Stage 1 Scoping Study
Project Manager:	Verity Rollason
Author:	Verity Rollason
Client:	Kempsey Shire Council
Client Contact:	Ron Kemsley
Client Reference:	

Synopsis: This Scoping Study fulfils Stage 1 of the New South Wales Government process for developing a Coastal Management Program. The report reviews existing information and data, establishes the strategic context for coastal management, outlines key management issues, reviews current management arrangements, identifies knowledge gaps and develops a forward plan for CMP Stages 2 to 5.

REVISION/CHECKING HISTORY

Revision Number	Date	Checked by		Issued by	
0	October 2018	DR & GW		VPR	
1	6 February 2019	VPR		VPR	
2	26 February 2020	VPR	V.Rollason.	VPR	V.Rollason.

DISTRIBUTION

Destination	Revision										
	0	1	2	3	4	5	6	7	8	9	10
KSC	PDF	PDF	PDF								
BMT File	PDF	PDF	PDF								
BMT Library		PDF	PDF								

Executive Summary

A CMP for the Macleay, Killick and Korogoro Estuaries

Kempsey Shire Council (Council) has resolved to prepare Coastal Management Program(s) (CMP) for the Macleay River, Killick Creek and Korogoro Creek Estuaries. A CMP aims to provide a long term, coordinated strategy for managing the coastal zone in accordance with the *Coastal Management Act 2016* and local objectives. The CMP(s) shall be implemented through a coordinated approach that brings Council, Department of Planning, Industry and Environment (DPIE): Environment, Energy and Science – Coasts and Estuaries (DPIE – Coasts and Estuaries), other state agencies, public authorities, stakeholders and local communities together to achieve the strategy, and management objectives.

It is recommended that Council and DPIE – Coasts and Estuaries pursue a single CMP that covers the Macleay River, Killick Creek and Korogoro Creek systems, rather than 3 separate CMPs. A single CMP offers the greatest management benefit to all the estuaries and financial and resource efficiencies for Council. Given the financial and resource limitations faced by Council, these efficiencies are pivotal to the successful funding of a CMP.

Killick and Korogoro Creeks are hydraulically connected to the Macleay through the Macleay Flood Mitigation Scheme, and so, some of the key environmental issues in Killick and Korogoro are dependent on the condition and operation of the Macleay system. In turn, management actions in the Macleay should consider impacts to Killick and Korogoro. The hydraulic connection of the systems also offers significant financial efficiencies where studies (e.g. tidal inundation modelling) may be conducted for the three systems at once. To ensure the local pressures for Killick and Korogoro Creeks are not eclipsed by the larger scale issues in the Macleay, some of the preparation of the CMP should be done in a manner that identifies and manages risks specifically for each estuary.

Why is a new CMP required?

A new NSW Coastal Management Framework was finalised in April 2018, which included replacing the former Act with the *Coastal Management Act 2016*, a new *State Environmental Planning Policy (Coastal Management) 2018* that replaced a range of former coastal SEPPs and legislation, and a new NSW Coastal Management Manual (OEH, 2018) to replace the former guidelines.

The new NSW Coastal Management Framework prescribes a 5-stage process for preparing a CMP. This report fulfils Stage 1 of preparing a CMP, which is to undertake a Scoping Study. The purpose of this Korogoro Creek CMP Stage 1 Scoping Study is to identify the scope of the CMP and detail the forward works program and costs to complete the CMP from Stage 2 to Stage 4 (noting Stage 5 is for the implementation of the CMP).

All the estuaries have CZMPs or equivalent (ie, EMPs are effectively CZMPs), namely Killick Creek Estuary Management Study and Plan was completed in 2006, Korogoro Creek Estuary Management Plan was prepared in 2009 and the Macleay River Estuary Coastal Zone Management Plan (CZMP) was prepared in 2012. All of these plans were completed in accordance with the former NSW Coastal Management Framework and were adopted by Council, but were not certified.

The CZMPs were supported by a wealth of technical studies, describing many aspects of the estuary environments. While these CZMPs are no longer suitable under the new NSW Coastal Management Framework, many of the existing studies and actions from the CZMPs remain suitable and relevant to managing the estuaries. As is supported by the new CMP process, the existing information and relevant management actions have been recommended to be transferred into the new CMP format.

Executive Summary

Overarching Strategy for Coastal Management in the Kempsey Shire

For the purpose of adequately encompassing and addressing coastal management issues for the Kempsey Shire, the following format for CMP coverage is proposed, as developed in consultation with Council and DPIE – Coasts and Estuaries (see also figure below).

- **Prepare a single CMP encompassing the Macleay River, Killick Creek and Korogoro Creek**, as explained above and in detail in the report.
- **Continue to manage the open coastline of the Kempsey LGA using the certified Kempsey Coastal Zone Management Plan.** Prepare a separate Kempsey Open Coastline CMP prior to December 2021 (in accordance with the CM Act). Coastal inundation relating to coastal storms and elevated ocean levels, and erosion and recession of all creek entrances (and artificial flood cuts) connecting with beach dunes will continue to be managed via the Kempsey CZMP. Entrance management issues relating to opening of the entrance of Killick Creek, and dredging and boating use of Back Creek shall be captured by the Macleay, Killick and Korogoro CMP.
- **Continue to manage Saltwater Creek using the existing Saltwater Creek Coastal Zone Management Plan.** Commence preparation of a Saltwater Creek CMP prior to December 2021 (in accordance with the CM Act).Saltwater Creek is hydraulically separate from the Macleay River estuary and catchment, so there are no significant cost efficiencies gained by running studies concurrently. Issues in Saltwater Creek and its catchment will continue to be better served through a separate CMP.

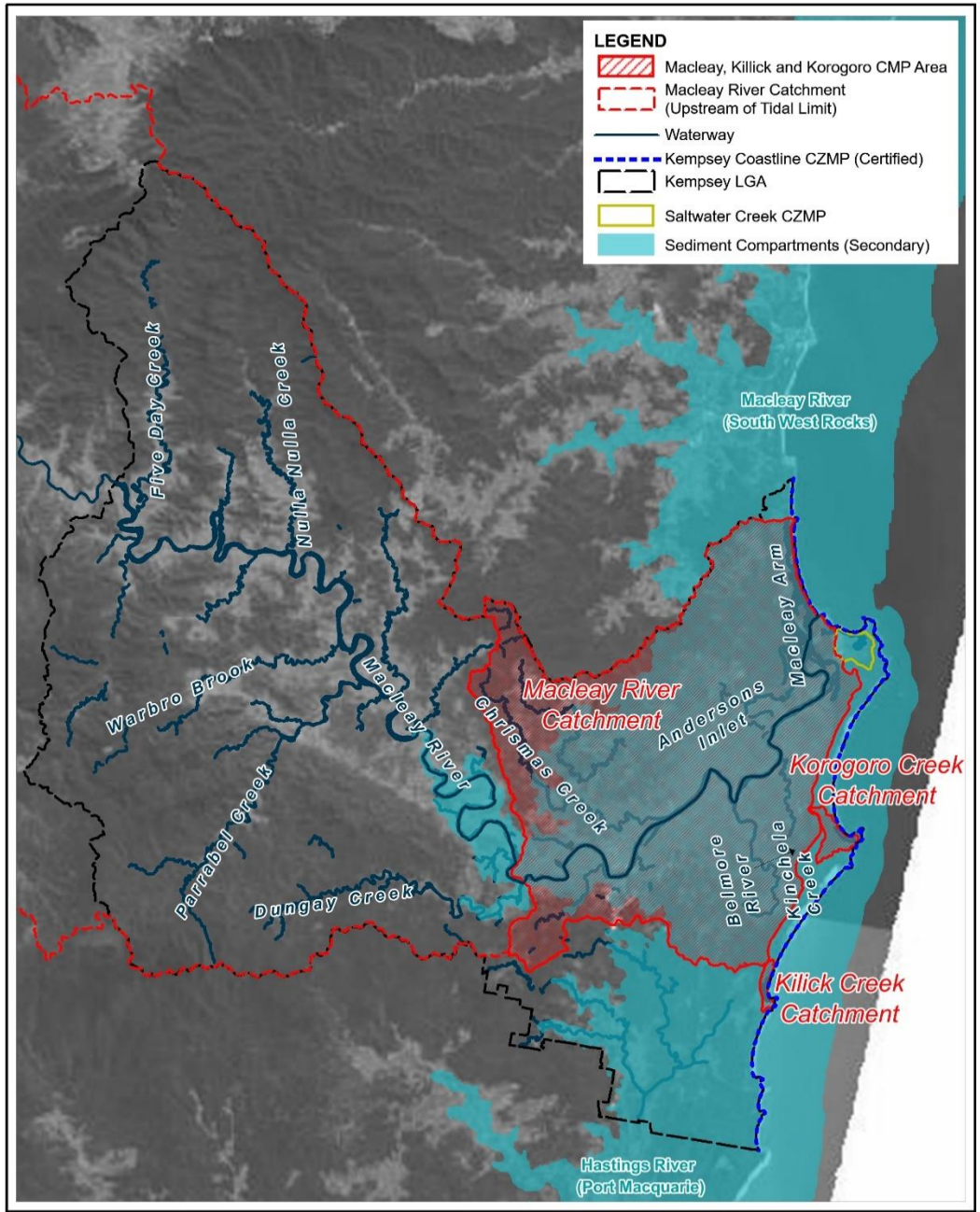
Study Area

The study area for the CMP technically covers the river and creek waterbodies, and their tributaries, floodplain wetlands and catchment from their entrances to the tidal limit, see Figure 1 below.

For the Macleay, the study area covers the river and catchment from its mouth at South West Rocks to the tidal limit of the river at Belgrave Falls The health of the Macleay River Estuary is influenced by the entire catchment, which extends well beyond the tidal limit to the tablelands of Armidale, covering a total area of 11,435 km^2.

Killick Creek extends from its entrance at the southern end of Killick Beach to the to the tidal limit at the floodgates to Belmore Swamp. The creek connects to the Macleay system via Scotts and Killick drains in the upper Belmore and the Upper Maria River via Connection Creek. During significant rainfall events water is discharged through the Killick Creek Floodgates via Killick Creek to the ocean.

Korogoro Creek stretches 5.4 km from its entrance along Hat Head to the tidal limit at the floodgates on Hat Head Road. The Korogoro Creek catchment covers approximately 18 km^2 the majority of which undeveloped. Korogoro Creek is also used to drain the Macleay Floodplain, with the floodgates allowing drainage of the Swan Pool. In order to protect Hat Head village during extreme floods, outflow is diverted from Korogoro Creek via a control structure known as “the Choke” to Rowe’s Cut (an artificial ocean outlet), several levees also exist along the length of the Creek.



Vision and Objectives for the CMP

The vision statement below was developed based upon the vision given in the CM Act plus feedback from Council, DPIE – Coasts and Estuaries and other stakeholders. Macleay River, Killick Creek and Korogoro Creek Estuaries CMP shall reflect those of the CM Act.

Vision for the CMP

Sustainably manage the health of the Macleay River, Killick Creek and Korogoro Creek Estuaries for the well-being of the environment and the social, cultural and economic well-being of the people, and build the resilience of the estuary to current and future pressures.

Business Case

Estuaries in the Kempsey Region are an important environmental, cultural, social and economic resource, forming the basis of the local rural and coastal economy. The area provides significant local, state, national and even international benefits through its ecological significance. Pursuing actions to maintain or improve estuary health are viewed by managers of the estuaries and the local community to be of high importance in their own right, with the economic and social benefit derived from this seen as an added benefit.

The Macleay River floodplain supports a range of agricultural industries, including dairy farming. The River waterway directly supports a commercial fishery and oyster aquaculture industry. The opportunities for boating, and shore- and boat-based fishing in the various waterways of the Macleay also

help to support the local tourism economy, as well as the economy generated by local residents undertaking these recreational industries.

Killick Creek forms one of the major attractions of Crescent Head providing a safe swimming haven for visiting families. The estuary also supports important coastal wetland habitat, and associated wildlife.

Korogoro Creek is an important drawcard for tourists and local residents of Hat Head. Its permanently open entrance provides safe(r) entry and exit to and from the ocean for fishing and boating. The creek itself is popular for fishing, swimming and snorkelling. Korogoro Creek hosts a rich variety of habitats including riparian woodlands and heaths, wetlands, mangroves, seagrass, saltmarsh, intertidal sands and mudflats (GECO Environmental, 2009).

Both Killick and Korogoro Creeks support local agricultural producers by providing drainage of Belmore Swamp, Swan Pool and Kinchella Swamp, as part of the Macleay Floodplain Mitigation Scheme. And both creeks have important coastal wetland and habitat values.

Clean waters, a natural and diverse aquatic and riparian habitat, and its associated wildlife provide for the health of the estuary fishery, oyster farms, agricultural productivity, the local tourism and leisure industry, and the direct and indirect wellbeing of the community throughout the Kempsey Region. A CMP is an integrated, long term approach to managing and enhancing these natural resources of the estuaries, which in turn supports the local community and economy. Other advantages of the CMP process are as follows.

- The CMP will build on past studies and plans for the estuaries and coast.
- The CMP will support an integrated and stakeholder driven approach.
- The CMP provides a process for investigating risks from a range of pressures including urban growth and climate change, for example, identifying coastal hazard risks such as tidal inundation over time, and / or identifying areas suited to future development.
- The CMP provides a process for developing actions to manage and adapt to identified risks, for example, preparing adaptation actions for already developed areas for climate change and to improve environmental outcomes, or identifying opportunities in the region for adaptation to support a sustainable and resilient economy into the future.

Estimated Costs and Forward Program

A clear, achievable and fit for purpose pathway to prepare a CMP within the financial and resource limitations of Council has been recommended. Those studies that are essential (mandatory) to enable preparation of the CMP across Stages 2 to 4 of the CMP are listed and costed in Table 6-1 (reproduced below). As shown in the table, there are direct cost savings of $125,000 for conducting the CMP simultaneously across all three estuaries. The table also provides a timeline for completion of the studies, with a view to completing the CMP by December 2021 in accordance with the CM Act.

Kempsey Shire is an area with abundant natural resources, however, this also means a lower population contributing to Council's budget for managing such resources. Therefore, even though the NSW Coastal Program is very well financed, Council remains stretched to provide the 50:50 financial input and staff time required to access this and other funding programs.

The forward program recommended here focuses on building upon the information and management experience from the existing CZMPs and preparing the CMP upfront (i.e. without a substantial burden of additional prerequisite studies), in straightforward compliance with the CM Act and Manual. The forward program also illustrates the cost efficiencies that can be gained by pursuing a single CMP, and thereby completing the studies for all three estuaries simultaneously.

Other additional studies were identified and prioritised through the course of the scoping studies. This list is an excellent starting point for actions to be assessed in Stage 3 and 4 of the CMP. Through the CMP process, these additional studies will be rigorously assessed, designed, costed, and evaluated, and the benefits of these studies weighed against other potential actions to manage high priority risks and improve outcomes for the estuaries, prior to investment by Council and its funding partners.

Funding the CMP

Council will be eligible to apply for 'dollar for dollar' (50:50) funding to prepare CMP(s) for the Kempsey estuaries under the NSW Coastal Management Program competitive grant program. Assuming this as a minimum input to CMP preparation, an example cost -sharing breakdown over a 3 year period is provided below, to assist Council with forward estimates for their operational plan and delivery program. Responsibilities, collaboration and cost sharing arrangements will need to be confirmed with all project partners, in order to commence Stages 2 to 4 of the CMP.

Example cost sharing arrangements

Project Partner	CMP Approach	Contribution (~ 3 years)	Annual Contribution	Total cost %
Council	**$360,000**: (Single CMP for all estuaries)	$180,000	$60,000	50%
NSW CM Program		$180,000	$60,000	50%
Council	**$485,000**: (individual estuary CMPs)	$242,500	$80,833.33	50%
NSW CM Program		$242,500	$80,833.33	50%

Supporting in-kind, or funding for the CMP may also be available via community participation, input from other interests particularly research institutions, and partnerships with private enterprises who obtain a direct financial benefit from the sustainable management of the estuaries.

Once the CMP is completed, the NSW Coastal Management Program and a range of other grant programs are available to fund actions specified in a CMP, e.g. the Environmental Trust, the NSW MEMA Strategy and so on. The eventual CMP will outline funding opportunities in detail.

Table 1 Forward Program and Estimated Costs for Completion of a CMP(s) for Macleay, Killick and Korogoro Estuaries

CMP Stage	Item #	Details / Comments (refer also Section 4.5)	Macleay	Killick	Korogoro	Estuaries Combined	Time-frame	IP&R Link
All Stages **Community and Stakeholder Engagement**	1	• Implement community and stakeholder engagement strategy with ongoing internal and external engagement activities including surveys, fact sheets, information sessions, workshops, presentations, meetings etc (see Appendix A for the full CMP Engagement Strategy). • Periodically review, refine and update the strategy as the CMP progresses. • Establish a Coastal Estuary Management Committee.	$30,000	$15,000	$15,000	$50,000	Year 1 to 3, & ongoing	Resourcing Strategy, Operational Plan (2019-2020 onwards), and Delivery Program 2017-2021 (onwards)
Stage 2 **Determine risks, vulnerabilities and opp's**	2.1	Tidal inundation study (to specifically model and map the permanent tidal water level in the estuary with sea level rise)	$50,000	$25,000	$25,000	$75,000	Year 1 (start)	Operational Plan 2019-2020
	2.2	Prepare mapping of the Coastal Vulnerability Area (desktop study using existing available information)	$10,000	$5,000	$5,000	$15,000	Year 1 (end)	Operational Plan 2020-2021
Stage 3 **Identify and evaluate options**	3.1	Full Scale Risk Assessment, including: • Specialist input from ecologists, water quality scientists, and contamination academics; • Use of Stage 2 study outcomes, e.g. tidal inundation. • Inclusion of existing management arrangements, and actions from previous CZMPs (as recommended in this SS), to evaluate the level of risk; • Workshops and input from all key stakeholders involved in estuary management i.e. Council staff across various departments, state agencies, industry representatives etc.	$40,000	$25,000	$25,000	$60,000	Year 2 (start)	Delivery Program 2017-2021, Operational Plan 2020-2021
	3.2	Options Development and Assessment, including: • Use of risk assessment outcomes to guide priorities; • Consideration of actions from previous CZMPs (as recommended in this SS); • Standard approaches for developing options; and • Standard / fit for purpose cost benefit / multi criteria analysis to select CMP actions.	$50,000	$25,000	$25,000	$80,000	Year 2 (end)	Delivery Program 2021-2025, Operational Plan 2021-2022

CMP Stage	Item #	Details / Comments (refer also Section 4.5)	Macleay	Killick	Korogoro	Estuaries Combined	Time-frame	IP&R Link
Stage 4 **Prepare, exhibit, finalise, certify and adopt CMP**	4.1	Prepare CMP in line with Stages 1 to 3 and in consultation with stakeholders and community partners. Exhibit draft, review, finalise and certify CMP.	$40,000	$20,000	$20,000	$60,000	Year 3	Delivery Program 2021-2025, Operational Plan 2021-2022
	4.2	Undertake a Planning Proposal to adopt the CVA mapping under the CM SEPP (cost is for external consultancy to assist Council).	$15,000	$10,000	$10,000	$20,000	Year 3	Delivery Program 2021-2025, Operational Plan 2022-2023
TOTAL FEE			**$235,000**	**$125,000**	**$125,000**	**$360,000**	3 years	

Contents

List of Figures

List of Tables

1 Introduction

1.1 Chapter Overview

This chapter provides an introduction as to why a Coastal Management Program (CMP) is being prepared for the Macleay River Estuary. It explains the new NSW Coastal Framework including how this Scoping Study fits into the new 5 stage process for preparing Coastal Management Programs (CMPs). An introduction to the Macleay River Estuary and the vision and objectives for the Macleay's CMP are also given.

1.2 Introduction to the Project

Kempsey Shire Council (Council) has resolved to prepare a Coastal Management Program (CMP) for the Macleay River Estuary. A CMP aims to provide a long term, coordinated strategy for managing the coastal zone in accordance with the *Coastal Management Act 2016* (CM Act) and local objectives. It shall be implemented through coordination between Council(s), state agencies and other key stakeholders.

The Macleay River Estuary has an existing Coastal Zone Management Plan (CZMP), prepared in 2012 in accordance with the former NSW Coastal Management Framework. The CZMP was supported by a wealth of technical studies, describing many aspects of the Macleay River Estuary environment. While the NSW Coastal Management Framework has changed, it is a tenet of the new process that existing studies and plans that provide suitable management of the coastal zone should be transferred into the new CMP format.

In accordance with the NSW Coastal Management Framework, Stage 1 of preparing a CMP is to undertake a Scoping Study. The aims of a Scoping Study for an area of interest are to:

- review management arrangements and supporting technical information to determine elements that should be retained in the CMP;
- develop a shared understanding of the strategic context of the CMP, identifying priorities;
- establish the focus (purpose, vision, objectives and scope) of the CMP; and
- Provide a forward plan for undertaking subsequent stages (Stages 2 to 5) of the CMP.

This Macleay River Coastal Management Program Stage 1 Scoping Study documents the above elements. It has been prepared by BMT for Council and DPIE – Coasts and Estuaries in consultation with relevant state and local stakeholders and in accordance with the NSW Coastal Management Framework.

1.3 Introduction to the Study Area

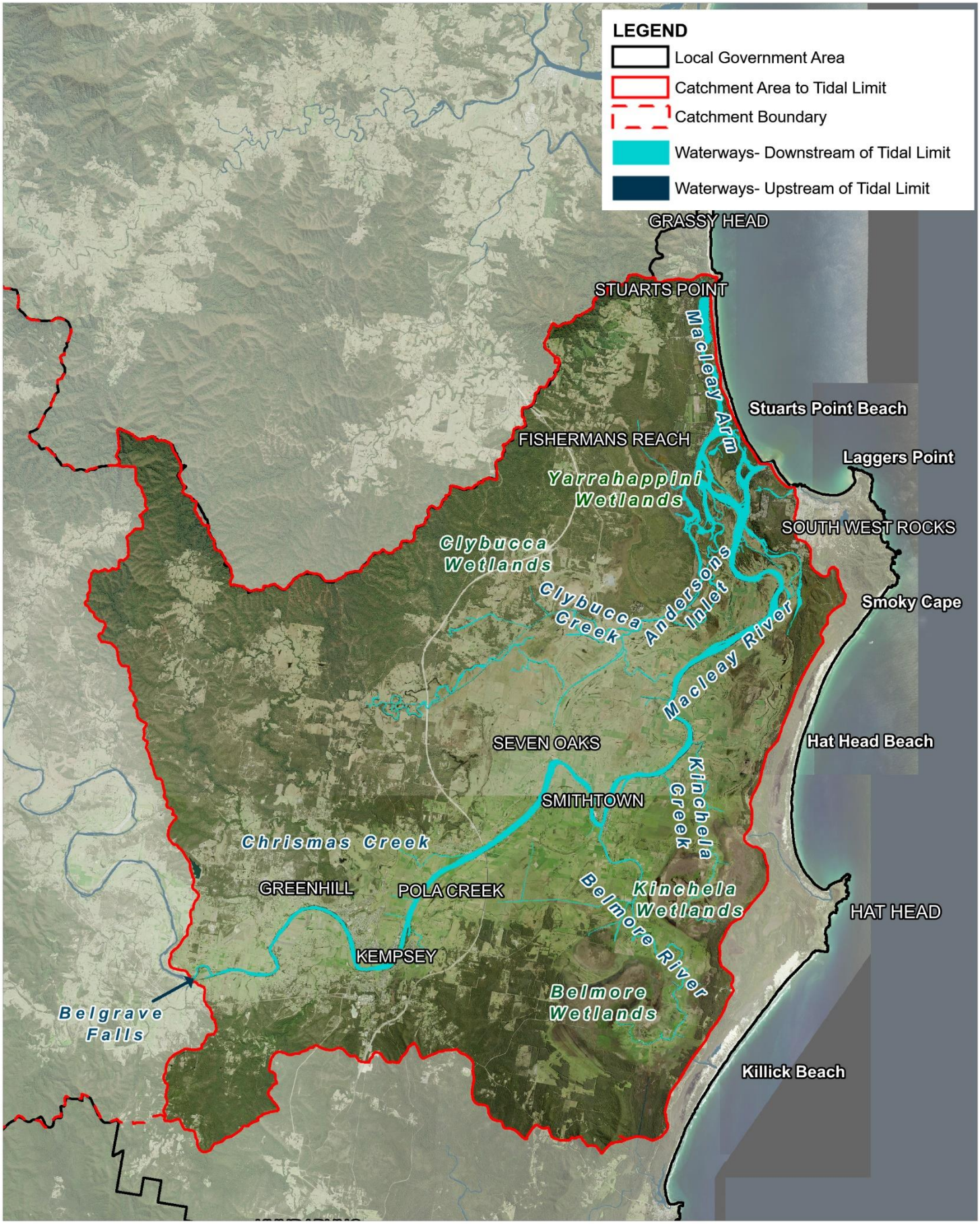
The study area for the Macleay River Estuary CMP technically covers the river, its tributaries, floodplain wetlands and catchment from the mouth of the River at South West Rocks to the tidal limit of the river at Belgrave Falls, as shown in Figure 1-1. The health of the Macleay River Estuary is influenced by the entire catchment, which extends well beyond the tidal limit to the tablelands of Armidale, covering a total area of 11,435 km^2, see Figure 1-2.

Though it is the dominant watercourse on the floodplain there are several significant tributaries including: the Apsley, Chandler, Styx, Gara, and Dyke Rivers in the upper catchment, and the Belmore River, Clybucca Creek and Kinchela Creek in the estuarine catchment. The Macleay River has an extensive flood mitigation scheme that includes the use of Killick and Korogoro coastal creeks as ocean outlets for flood waters.

The Macleay River Estuary has an expansive coastal floodplain wetland system. These floodplain wetlands or backswamps cover 60% of the Macleay's 400 km^2 floodplain, and are responsible in large part for the ongoing health of the estuary (GeoLINK, 2012). The environmental significance of the estuary is evident in the fact that it supports some 1.1 km^2 of seagrass, most of which is within the Macleay Arm, 3.7 km^2 of saltmarsh, most of which occurs as fields of marine rush and salt couch in Clybucca Creek-Andersons Inlet; and some 5% of the state's mangroves (5km^2) (GeoLINK, 2012).

With its diversity of waterways, the Macleay offers significant recreational boating opportunities. Recreational boating is enjoyed by a large proportion of the local community, as well as contributing to the region's tourism industry through holiday visitors and commercial charters (fishing and diving) (GeoLINK, 2012). Passive recreation along the river foreshore is beginning to flourish, as the local and visiting population turns back towards the Macleay River. Historically, the Macleay River was spurned for the significant flood risk it poses, but this viewpoint is shifting.

The estuary also supports a range of industries including commercial fishing, oyster aquaculture, agriculture, and tourism.



Title:

Coastal Management Program Study Area
Macleay River

Figure: 1-1

Rev: A

N

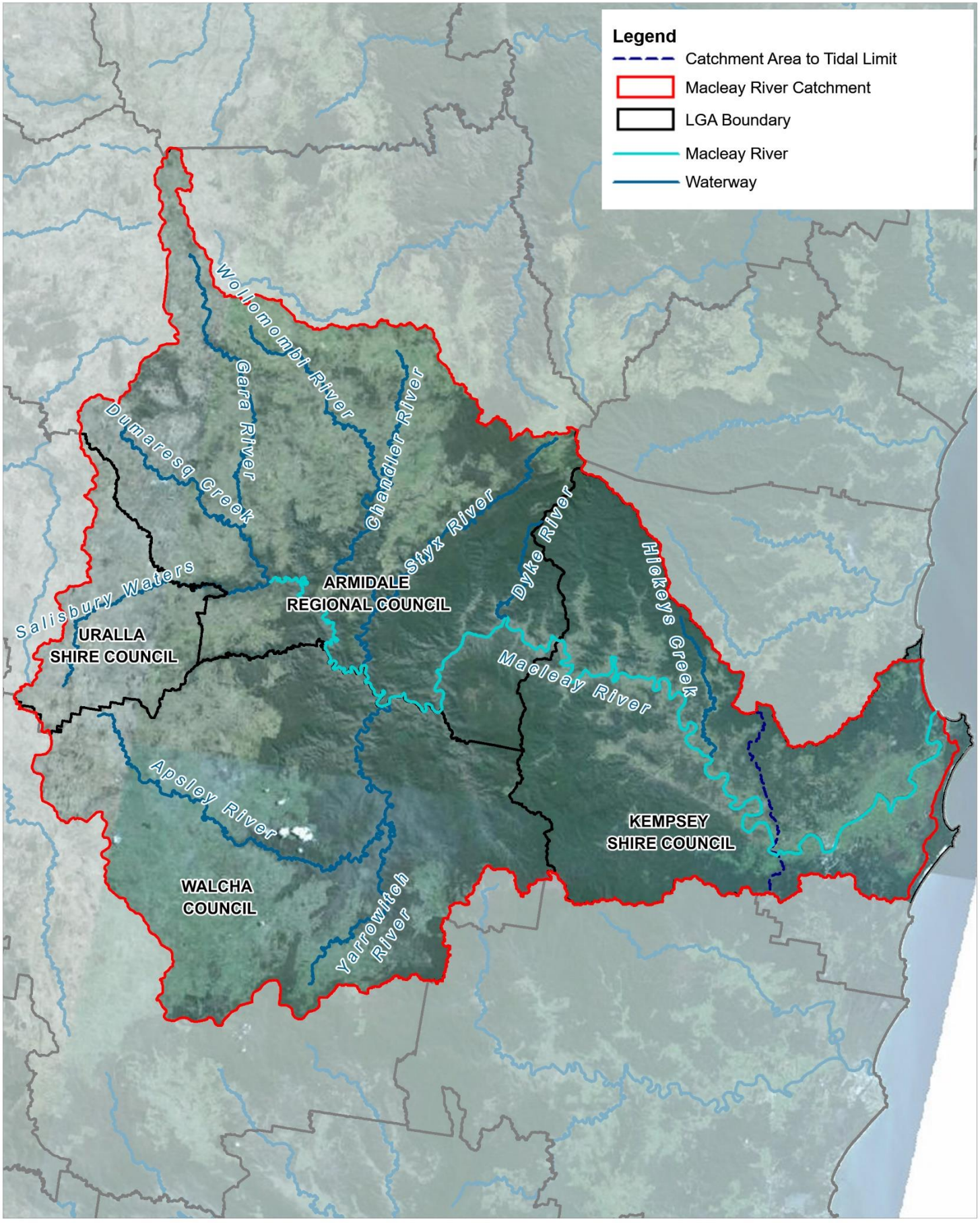
0 5 10km

Approx. Scale

BMT

www.bmt.org

Filepath: S:\WATER\PROJECTS\N20956_Scoping_Study_Kempsey_Estuary_CMP\GIS\MI\workspaces



Title:
Macleay River Catchment

Figure: **1-2**

Rev: **A**

BMT endeavours to ensure that the information provided in this map is correct at the time of publication. BMT does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

N

0 20 40km

Approx. Scale

BMT
www.bmt.org

Filepath: S:\WATER\PROJECTS\N20956_Scoping_Study_Kempsey_Estuary_CMP\GIS\MI\workspaces

1.4 NSW Coastal Management Framework

The NSW Government recently completed a re-invigoration of the NSW Coastal Management Framework for managing the open coast, estuaries, and the marine estate. The new framework came into force in April 2018 and now comprises the elements outlined in Figure 1-3. Detailed review of the legislation is provided in Appendix D. In relation to the preparation of CMPs, the framework includes the following elements that came into force in April 2018:

- the *Coastal Management Act 2016* (the CM Act) which replaced the *Coastal Protection Act 1979*, and provides minimum requirements for preparing CMPs (which replace CZMPs previously made under the *Coastal Protection Act 1979*) and a revised definition of the coastal zone as comprising four coastal management areas;
- the *State Environmental Planning Policy (Coastal Management) 2018* (CM SEPP) which amalgamated and replaced SEPP No. 71 Coastal Protection, SEPP No. 14 Coastal Wetlands, and SEPP 26 Littoral Rainforest, and provides development controls for each of the four coastal management areas with supporting mapping for these areas; and
- the NSW Coastal Management Manual (OEH, 2018), (the Manual) which outlines the mandatory requirements for preparing CMPs in Part B, and guidelines for the five stages of CMP preparation in Part B (noting Part B is not mandatory). The Manual is the certified guideline document that, when followed, provides exemptions for liability for Council under Section 733 of *the Local Government Act 1993*.

1.4.1 What is a Coastal Management Program?

As stated in the CM Act (s12): "*The purpose of a coastal management program is to set the long-term strategy for the co-ordinated management of land within the coastal zone with a focus on achieving the objects of this Act*". That is, a CMP aims to provide a long-term, coordinated strategy for managing the coastal zone, considering the local context, priorities and objectives as well as the state objectives in accordance with the CM Act.

The mandatory requirements for preparing a CMP are set out in section 13 to 18 of the CM Act, and Part A of the Manual. Part B of the Manual provides guidance for how to prepare a CMP.

The Manual outlines five stages of delivering a CMP, as illustrated in Figure 1-4. It is a mandatory requirement to "identify the scope of the CMP" (p21, Part A, the Manual, 2018). This Scoping Study fulfils this mandatory requirement, as Stage 1 of preparing a CMP. Councils need to conduct a Stage 1 Scoping Study regardless of the existence of any preceding CMP, Coastal Zone Management Plan (CZMP) or other management plans, policies and practices. However, if the existing CMP and supporting reports meets the requirements set by the CM Act and Manual, preparation of the CMP may be fast tracked from Stage 1 to Stage 4 or 5 (certification and implementation of the CMP).

A CMP shall be implemented through coordination between local government, state agencies and other key stakeholders. Councils are responsible for ensuring that their CMP(s) are reviewed at least once every 10 years. Nevertheless, any CMP may be amended (in whole or in part) or replaced by another CMP at any time.

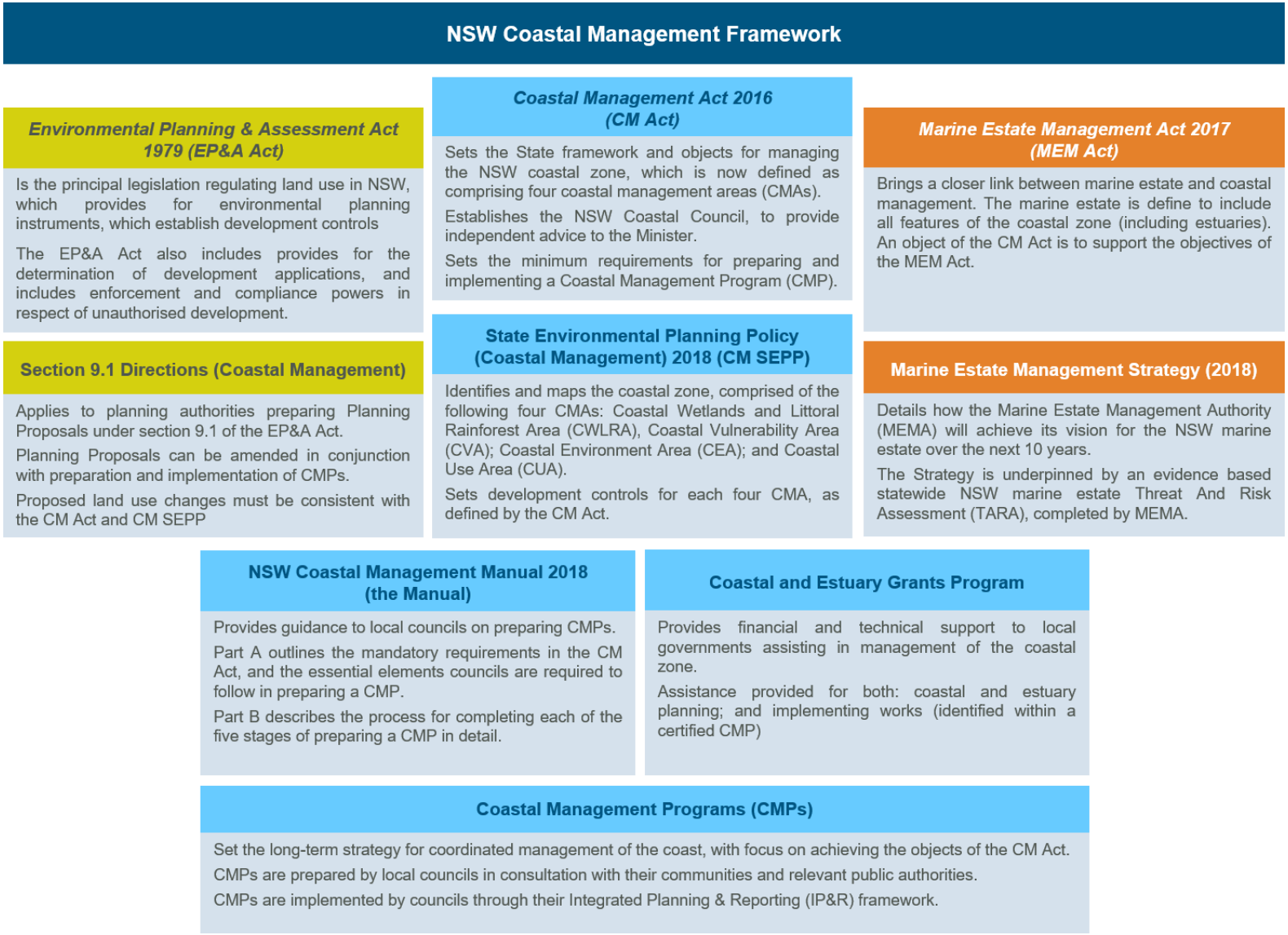


Figure 1-3 NSW Coastal Management Framework

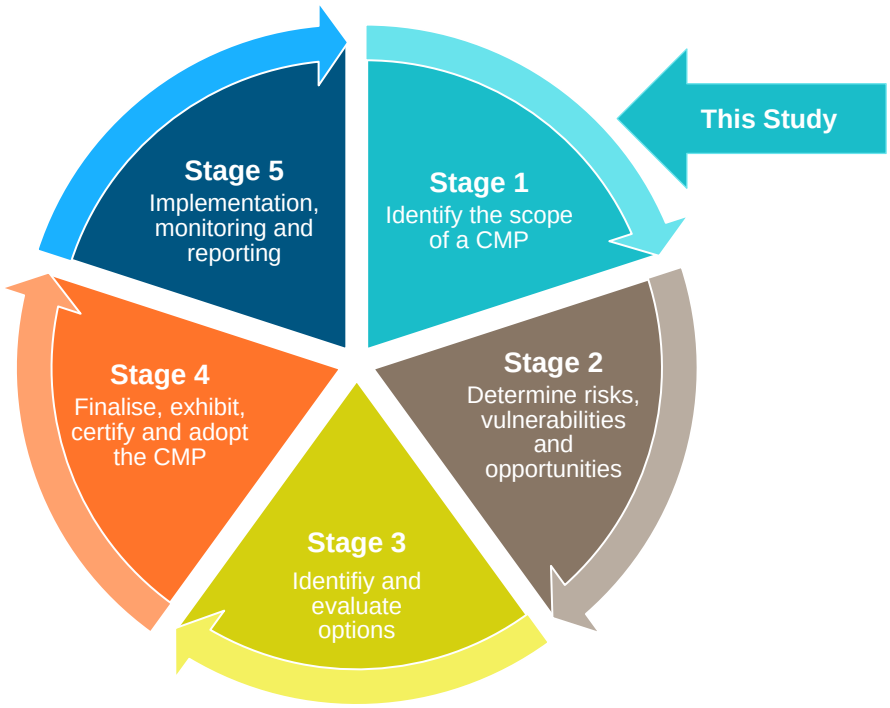


Figure 1-4 Five Stage Process for Preparing a Coastal Management Program (adapted from the Coastal Management Manual; OEH, 2018)

1.4.2 What is the Purpose of the CMP Stage 1 Scoping Study?

A Scoping Study (Stage 1) is instrumental in helping Councils to "get ready" and understand where their organisations are now, where they need to be, and how to make informed and confident decisions during development and implementation of the CMP. It is therefore about establishing a forward plan to complete the rest of the CMP stages (Stages 2 to 5).

The primary purposes of Stage 1 of a CMP are to determine the scope of the CMP and define a path for progressing further stages of the CMP. In this regard, the scope comprises: the strategic context for coastal management; the vision and objectives of the CMP; the areas to be covered (geographic extent and coastal management areas); the priority issues to be addressed, as well as knowledge and information gaps requiring attention; the communities and stakeholders to be involved; the governance, roles and responsibilities of stakeholders on the CMP; and a forward plan to complete the CMP, including the possibility of fast-tracking.

In cases where a Council has been implementing a CMP or CZMP, the Scoping Study should provide continuity to the planning cycle by evaluating and building on previous plans or programs (Figure 1-4). In cases where no previous coastal management plans are in place, the Scoping Study should provide a platform for development of a CMP, in accordance with the CM Act.

1.5 Structure of this Report

The required components of a Scoping Study as specified in the Manual, and their location in this report are outlined in Figure 1-5 below.

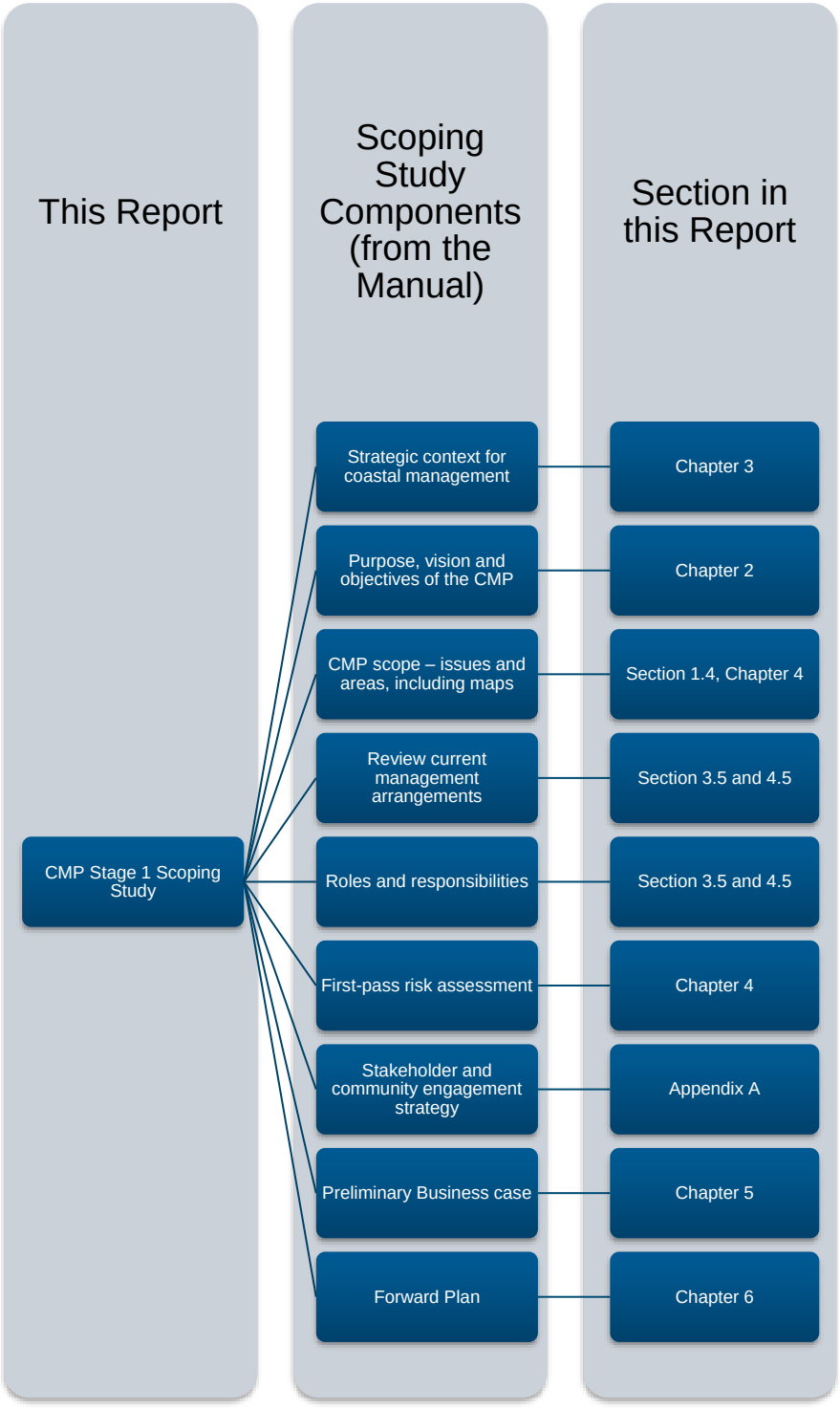


Figure 1-5 Components of CMP Scoping Study and Structure of this Report

1.6 Community and Stakeholder Consultation for this Study

Through the course of preparing this CMP Stage 1 Scoping study, a variety of engagement and other activities were conducted to involve both the local community and broader stakeholders in the development of this Scoping Study, as the first stage of preparing a CMP.

These activities had the additional advantage of establishing the community consultation process that will be carried through the entire CMP preparation and implementation.

An online survey was made available to the entire community through Councils' Online Engagement Portal (Your say Macleay), and a number of responses were received. The survey sought input from residents and visitors about how they use and enjoy the Macleay River. Survey responses also contributed directly to understanding the values, threats and management focus areas for this CMP, as described in Sections 4.3 and 4.2. A copy of the online survey and results are included in Appendix E.

Stakeholders for this project include the various departments of Council, as well as the many state agencies involved in the management of the estuary and its catchment. Various stakeholder consultation activities were undertaken to capture information and guide development of the forward program for the CMP. Activities included:

- regular contact with key representatives from Council and DPIE – Coasts and Estuaries to ensure a flow of information relevant to the CMP, as these organisations form the key project team delivering the CMP;
- The First Pass Risk Assessment Workshop where activities were conducted to gather feedback from various council departments, the state agencies and other stakeholders who are involved in estuary management, including representatives from known active local community groups. Invitees and attendees are listed in Table 1-1, with further details and results of the first pass risk assessment provided in Section 4.5.

Review and feedback on the Scoping Study was sought from all relevant state agencies and stakeholders, and has been incorporated into this document where relevant. Support from the state agencies for the proposed forward program was also gathered through this review process. Review requests and responses are listed in Table 1-2.

The knowledge, information and input provided by stakeholders and the community into this Scoping Study has helped shape the forward program for the CMP in the near future. Remaining sections of this report highlight where appropriate where input has been included.

Table 1-1 Invitees and Attendees at the First Pass Risk Assessment Workshop

Attended Workshop	Invited but unable to attend
• Council – various Departments • Department of Planning, Industry and Environment (DPIE) – Environment, Energy and Science – Coast and Estuaries (DPIE – Coasts and Estuaries) • DPIE – National Parks and Wildlife Service (NPWS) • DPIE – Crown Lands • Transport for NSW – (TfNSW) • DPIE Regions, Industry, Agriculture and Resources – North Coast Local Land Services (LLS) • DPIE Regions, Industry, Agriculture and Resources – Fisheries (DPI Fisheries) • Oyster Growers Association • Save Our Macleay River (community group) • North Coast Environmental Council (community group)	• DPIE - Planning and Assessment (DPIE - PA) • Kempsey Local Aboriginal Land Council (KLALC) • NSW Farmers • Kempsey Dairy Industry Group • Macleay Landcare Network

Table 1-2 Agencies that Commented on the Draft Scoping Study

Agency	Indication of support for CMP Scoping Study
Council	Various, and incorporated into this existing report
DPIE – Coasts and Estuaries	Support for this document is provided, having addressed the detailed comments provided on the report in May 2019.
NPWS	NPWS supports the preparation of a single CMP for Macleay, Killick and Korogoro estuaries that includes the four Coastal Management Areas as set out in the Coastal Management SEPP 2018 and the Coastal Management Act 2016. NPWS support the inclusion of NPWS reserves in the scope of the proposed Macleay, Killick and Korogoro Estuaries CMP. Inclusion of reserves acknowledges NPWS as both a landholder and stakeholder with significant landscape and ecological assets to manage that are integral elements of the Macleay floodplain and estuary. Consideration of reserve assets and issues with those occurring in the broader floodplain and estuary will allow for a more complete and considered CMP. NPWS may also be able to assist with: • Information on specific natural values and threats for the Lower Macleay. • Specific advice on matters such as the management of species and ecological communities.
TfNSW	TfNSW welcomes the opportunity to work closely with Council in the development of the CMP, as they are a key agency with statutory and policy responsibilities related to the safety and accessibility of New South Wales waterways for recreational and commercial vessels. As part of the NSW Maritime Infrastructure Plan (December 2018), the NSW Government will continue to provide support to Councils for upgrading and renewing maritime infrastructure and highlights that CMPs will be an important consideration in prioritising investment under future funding programs for maritime infrastructure. TfNSW expects that the CMP will consider the full range of issues relevant to facilitating safe navigation, including ensuring that there is sufficient and well maintained maritime infrastructure and related facilities to meet demand into the future, for both local and visiting vessels.

Agency	Indication of support for CMP Scoping Study
DPI Fisheries	DPI Fisheries supports the recommended development of a single CMP covering the Macleay River, Korogoro Creek and Killick Creek as the estuaries are hydraulically connected and this approach would offer the best holistic management approach and provide significant resource and cost efficiencies. DPI Fisheries also applauds Council's initiative for developing a CMP. DPI Fisheries identified the following direct links between the MEM Strategy and recommended further studies for the CMP. In recognising the links between the CMP and the MEM Strategy projects outlined below, DPIE – Coasts and Estuaries recommends that the preparation of next stages of the CMP leverage off the key findings of these projects and adopt key recommendations where relevant. • DPI Fisheries support identification of a range of actions to improve floodplain management. The Macleay floodplain is one of eight large coastal floodplains where, as part of a MEM Strategy Action, data will be collated to inform the development of strategic, evidence-based drainage management plans. The drainage management plans shall streamline and better integrate the existing regulatory complexity, consider cumulative impacts; and prioritise actions, investment planning and support decision making. The • Actions to manage migration of wetlands due to sea level rise aligns with a MEM Strategy action to develop two marine vegetation strategies to direct decision making toward maximising resilience, accommodating sea level rise, addressing key threats, facilitating rehabilitation opportunities, and reducing "red tape" for low impact works. Effective implementation of the marine vegetation strategies will rely on CMPs specifically referring to such strategies as an evidence-based estuary-wide document that informs decision making about intertidal marine vegetation. • Bank management, including management of private foreshore structures, is recognised in the MEM Strategy with two management actions that will see DPI Fisheries coordinate preparation of foreshore structure strategies for eight estuaries including the Macleay River, and bank management strategies for three estuaries. The intention of these strategies is to streamline and simplify assessment of private structures spanning the intertidal foreshore particularly where proponents adopt the recommended bank treatment for that estuary. DPI Fisheries highlights the significant opportunity for efficiencies, consistency and transparency for foreshore development proposals where such strategies can be incorporated into Council's planning assessment process and are identified as actions within the CMP.
DPIE – Planning and Assessment (PA)	PA required only minor changes to the Scoping Study report, including a changes to the suggested timing for submission of a planning proposal to amend the coastal vulnerability area maps in the CM SEPP, which needs to occur after the CMP is certified (see Section 6.5 for changes). PA also recommended that in developing the CMP, it needs to consider and identify strategies to appropriately manage existing and proposed land uses within all areas of the coastal zone.
Invited to respond but did not reply	
• DPIE - Crown Land • LLS • Macleay Landcare Network • Kempsey LALC	

1.6.1 Ongoing Consultation through the CMP Engagement Strategy

A CMP Engagement Strategy outlining the approach to engaging the community and stakeholders for the remainder of CMP preparation and implementation is provided in Appendix A. The Engagement Strategy involves ongoing internal and external engagement activities including surveys, fact sheets, information sessions, workshops, presentations, meetings etc. A Coastal Estuary Management Committee shall also be established as part of the strategy.

The current strategy has been reviewed by Council's Communications Department and follows agreed Council processes, and by agencies through their review of this scoping study. This includes consultation with the local Aboriginal community and representatives on how they seek to be engaged in this CMP.

While the list of stakeholders consulted to date as part of preparing the Scoping Study is considered comprehensive, since this study was prepared new potential avenues of engagement have been convened that can be accessed for later stages of the CMP. These include the Clybucca Creek Custodian Group that has representatives from the Kempsey LALC as well as relevant local Aboriginal groups; and Council's Natural Resource Group that includes representatives from three local Aboriginal Groups also.

The Engagement Strategy is a live evolving document that will continue to be reviewed, refined and updated as the CMP progresses.

2 Overarching Strategy for Kempsey's Coastal Management

2.1 Chapter Overview

This chapter details the overarching strategy for coastal management throughout the Kempsey Shire, and how the proposed Macleay, Korogoro and Killick Estuaries CMP format fits within this strategy. The purpose, vision and objectives for coastal management of the Macleay River are then outlined.

2.2 Coastal Management in the Kempsey Shire

The coastal zone of Kempsey Shire comprises the open coastline extending from Barries Beach (just north of Point Plomer) to Middle Head; the estuaries of the Macleay River (including Back Creek), Saltwater Creek, Korogoro Creek, and Killick Creek. It is worth noting there is a very small creek on Middle Head Beach; and flood mitigation structures connecting to the ocean, namely Rowes Cut (on Hat Head Beach), Ryans Cut (on Killick Beach) and Big Hill Cut (on Delicate Nobby Beach).

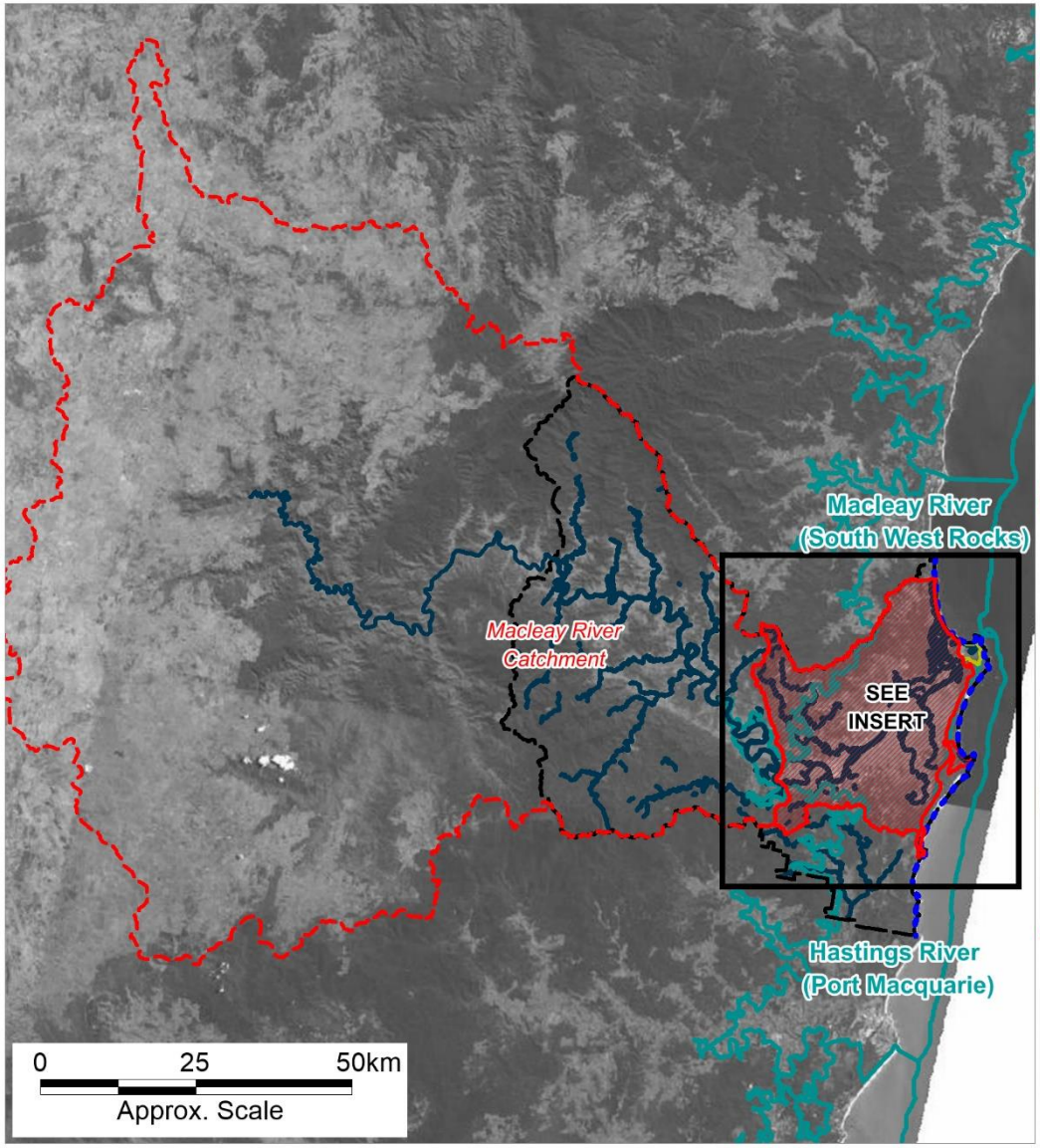
For the purpose of adequately encompassing and addressing coastal management issues for the Kempsey Shire, the following format for CMP coverage is proposed (as developed in consultation with Council and DPIE – Coasts and Estuaries) and illustrated in Figure 2-1.

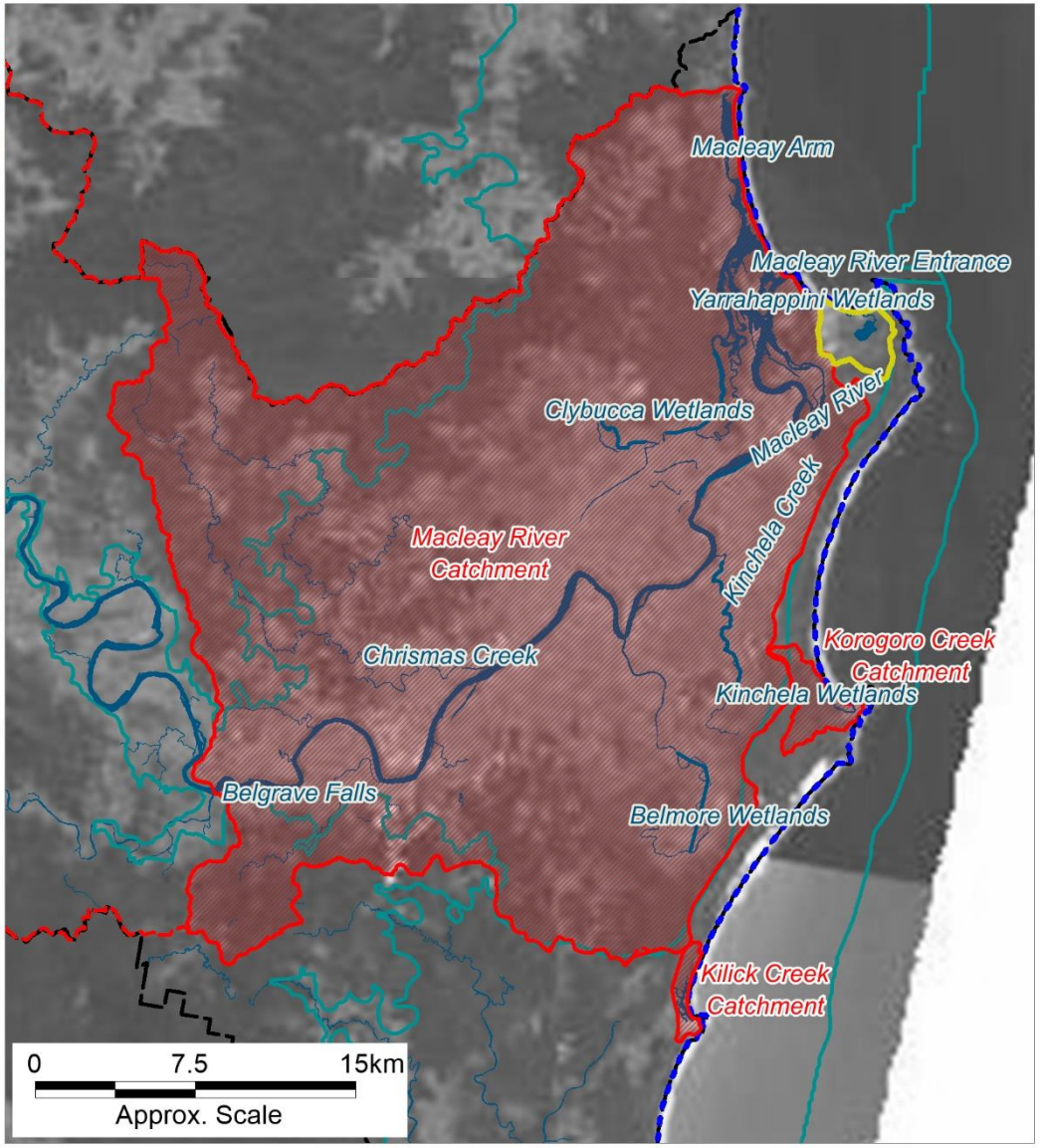
- **Prepare a single CMP encompassing the Macleay River, Killick Creek and Korogoro Creek.**

  Because Killick and Korogoro Creeks form part of the Macleay River flood mitigation scheme, their environmental conditions are intrinsically linked with the operation of the flood gates connecting them with the Macleay. Due to this hydrologic connection, some of the main the environmental issues experienced in Killick and Korogoro Creeks are related to the Macleay Estuary and floodplain. Furthermore, key technical and management studies also more cost effectively done concurrently across the three estuaries, as they are hydraulically linked (e.g. a tidal inundation study where the set up and calibration of a model is a major part of the cost).

  To ensure the local pressures for Killick and Korogoro Creeks are not eclipsed by the larger scale issues in the Macleay, it will be important that some of the preparation of the CMP is done in a manner that identifies and manages risks specifically for each estuary. The cost, timing and resource advantages of this approach are outlined in detail in Section 5.3.

  The preparation of this CMP takes a catchment management based approach, focussing initially on the tidal reaches of the catchment and expanding to the upper catchment as necessary to address key threats to the estuaries. It is recognised clearly in this scoping study and will flow through remaining stages of preparing the CMP that many of the water quality and issues in the estuaries relate to activities on land in the catchment.





LEGEND

- Macleay, Killick and Korogoro CMP Area
- Macleay River Catchment (Upstream of Tidal Limit)
- Waterway
- Kempsey Coastline CZMP (Certified)
- Kempsey LGA
- Saltwater Creek CZMP
- Sediment Compartments (Secondary)

Title:

Kempsey Shire's Strategy for Coastal Management

Figure: **2-1**

Rev: **B**

N

BMT
www.bmt.org

Filepath: S:\\PROJECTS\N20956_Scoping_Study_Kempsey_Estuary_CMP\GIS\MI\workspaces\20190116_Locality_Figures

- **Continue to manage the open coastline of the Kempsey LGA using the certified Kempsey Coastal Zone Management Plan.**

  Prepare a separate Kempsey Open Coastline CMP prior to December 2021 (in accordance with the CM Act).

  Coastal inundation relating to coastal storms and elevated ocean levels, and erosion and recession of all creek entrances (and artificial flood cuts) connecting with beach dunes will continue to be managed via the Kempsey CZMP.

  Notwithstanding the above, entrance management issues relating to opening of the entrance of Killick Creek, and dredging and boating use of Back Creek shall be captured by the Macleay, Killick and Korogoro CMP outlined above.

- **Continue to manage Saltwater Creek using the existing Saltwater Creek Coastal Zone Management Plan.**

  Commence preparation of a separate Satlwater Creek CMP prior to December 2021 (in accordance with the CM Act).

  Saltwater Creek, while a small catchment and in spite of its close proximity, is hydraulically separate from the Macleay River estuary and catchment. There are no significant cost efficiencies to be attained by running modelling and similar studies concurrently with the Macleay. As such, issues that are specific and individual to Saltwater Creek and its catchment will be better served through a separate CMP, as is presently the case.

2.3 Limitations on Coastal Management in the Kempsey Shire

Given the expansive nature of Kempsey Shire's coastal assets in the form of beaches, dunes, headlands, rock platforms and cliffs, and estuaries and wetlands, it is important to also recognise the resource and financial limitations of this rural coastal council. Kempsey Shire's population, and therefore its rate payer base to fund management of all its environmental assets including the coast, is restricted. While the lower population has helped to preserve the natural beauty and environmental richness of this region, the funding for coastal management must be weighed against the many other competing demands on Council as a service provider to its community. Similarly, staffing and technical resources to administer and facilitate implementation of the Coastal Management Program are also stretched.

The forward program, priorities for Stages 2 to 4, and funding and financing have been designed with these financial and resource limitations in mind. Only those studies seen as mandatory in Stage 2 have been recommended and Stages 3 and 4 are recommended to utilise existing information. The further studies devised during this Scoping Study are recommended for further investigation as potential actions that may be implemented through the CMP's program of works. The business case and forward program for preparation of the CMP are detailed in the final chapters of this report.

2.4 CMP Purpose, Vision and Objectives

2.4.1 Purpose

The purpose of preparing this CMP is to provide the long term coordinated strategy for managing the coastal zone of the Macleay River Estuary. A coordinated approach is needed, to bring Council, DPIE – Coasts and Estuaries, other state agencies, public authorities, stakeholders and local communities together to achieve the strategy, and management objectives.

The purpose of this Macleay River CMP Stage 1 Scoping Study is to identify the scope of the CMP and detail the forward works program and costs to complete the CMP from Stage 2 to Stage 5.

This report has been prepared on behalf of Council and DPIE – Coasts and Estuaries, and has been prepared in accordance with the CM Act, the Coastal Management Manual (the Manual) (OEH, 2018), consistent with the NSW Coastal Management Framework.

2.4.2 Vision Statement

As stated in the Manual, *"A local vision statement that is consistent with the state's vision while reflecting the local context, will help communities to identify with the future of their coast, encourage a sense of community ownership of the actions in the CMP and foster commitment to its preparation and implementation"* (p7, the Manual Part B: Stage 1, OEH, 2018).

The following vision statement was developed based upon the vision given in the CM Act plus feedback from Council, DPIE – Coasts and Estuaries and other attendees at the First Pass Risk Assessment Workshop (see Section 4.5.1).

Vision for the CMP

Sustainably manage the health of the Macleay River estuary for the well-being of the environment and the social, cultural and economic well-being of the people, and build the resilience of the estuary to current and future pressures.

2.4.3 CMP Objectives

Council, DPIE – Coasts and Estuaries and other attendees at the First Pass Risk Assessment Workshop agreed that for this Scoping Study Stage 1 of CMP development, the objectives for the Macleay River CMP shall reflect those of the CM Act, being:

- (a) to protect and enhance natural coastal processes and coastal environmental values including natural character, scenic value, biological diversity and ecosystem integrity and resilience, and
- (b) to support the social and cultural values of the coastal zone and maintain public access, amenity, use and safety, and
- (c) to acknowledge Aboriginal peoples' spiritual, social, customary and economic use of the coastal zone, and

- (d) to recognise the coastal zone as a vital economic zone and to support sustainable coastal economies, and
- (e) to facilitate ecologically sustainable development in the coastal zone and promote sustainable land use planning decision-making, and
- (f) to mitigate current and future risks from coastal hazards, taking into account the effects of climate change, and
- (g) to recognise that the local and regional scale effects of coastal processes, and the inherently ambulatory and dynamic nature of the shoreline, may result in the loss of coastal land to the sea (including estuaries and other arms of the sea), and to manage coastal use and development accordingly, and
- (h) to promote integrated and co-ordinated coastal planning, management and reporting, and
- (i) to encourage and promote plans and strategies to improve the resilience of coastal assets to the impacts of an uncertain climate future including impacts of extreme storm events, and
- (j) to ensure co-ordination of the policies and activities of government and public authorities relating to the coastal zone and to facilitate the proper integration of their management activities, and
- (k) to support public participation in coastal management and planning and greater public awareness, education and understanding of coastal processes and management actions, and
- (l) to facilitate the identification of land in the coastal zone for acquisition by public or local authorities in order to promote the protection, enhancement, maintenance and restoration of the environment of the coastal zone, and
- (m) to support the objects of the *Marine Estate Management Act 2014*.

In addition, the Macleay River CMP shall give effect to the management objectives provided in the CM Act for the following four coastal management areas that comprise the NSW coastal zone, i.e.:

- Coastal Wetland and Littoral Rainforest Area (CWLRA);
- Coastal Vulnerability Area (CVA);
- Coastal Environment Area (CEA); and
- Coastal Use Area (CUA).

It should be recognised that the above objectives will likely undergo refinement during Stage 2 in consultation with stakeholders and the community so that they are consistent state wide reflecting local issues and conditions.

3 Strategic Context for the CMP

3.1 Chapter Overview

This chapter sets the context for coastal management in Macleay River Estuary location. It provides an overview of:

- the strategic direction
- the legislative, policy and strategic context for coastal management;
- the environmental setting of the location;
- key governing bodies and their responsibilities in the coastal zone
- the community and recreational amenity, including cultural significance;
- the industries supporting and supported by the coastal zone that in turn support the local economy; and
- future pressures affecting the coastal zone, most notably climate change and population growth

Understanding the context of the coast provides the backbone to the objectives, vision and need for developing a CMP. The information summarised below was largely derived from the data and information review that was conducted as a key part of preparing this Scoping Study. The data review process and outcomes are described in Section 4.2.1, with a summary of key documents and information sources provided in Appendix B.

3.2 Strategic Direction for the Coast

The strategic direction outlined in Section 2 for the Macleay River Estuary coastal zone is formulated acknowledging existing visions, strategies and directions developed for existing state, regional and local strategic planning documents namely:

Coastal Management framework 2018 (OEH) - "*aims to have thriving and resilient coastal communities living and working on a healthy coast, now and into the future*"

Coastal Management Act 2016 - "*manage the coastal environment of New South Wales in a manner consistent with the principles of ecologically sustainable development for the social, cultural and economic well-being of the people of the State*"

Marine Estate Management Act 2014 - "*provide for the management of the marine estate of New South Wales consistent with the principles of ecologically sustainable development, to promote the co-ordination of the exercise, by public authorities, of functions in relation to the marine estate and to provide for the declaration and management of a comprehensive system of marine parks and aquatic reserves*"

North Coast Regional Plan - "*supporting local and creative industries, agriculture and tourism, reinforcing local character and providing greater housing choice, the network of centres has enlivened their communities and enhanced the region's charm and community wellbeing*"

Kempsey Community Strategic Plan - "*We live in a community that provides opportunity to all, to prosper in an environment that supports well-being, connectedness and access to resources the community wants and needs*."

Kempsey Coastal Zone Management Plan (CZMP) - "*The overarching aim for the CZMP is to provide practical and affordable actions to improve community use and facilities of the coastal zone, and to plan and initiate actions that protect values and build resilience to existing and future coastal hazards. While it is expected that the CZMP will be reviewed and updated periodically (every 5-10 years), the longer-term directions established by the current coastal zone management process will be maintained and supported in the future*."

3.3 Macleay Coastal Zone Context

The study area for this Macleay River Estuary CMP includes all four management areas that make up the coastal zone as defined by the CM Act and mapped under the CM SEPP, including:

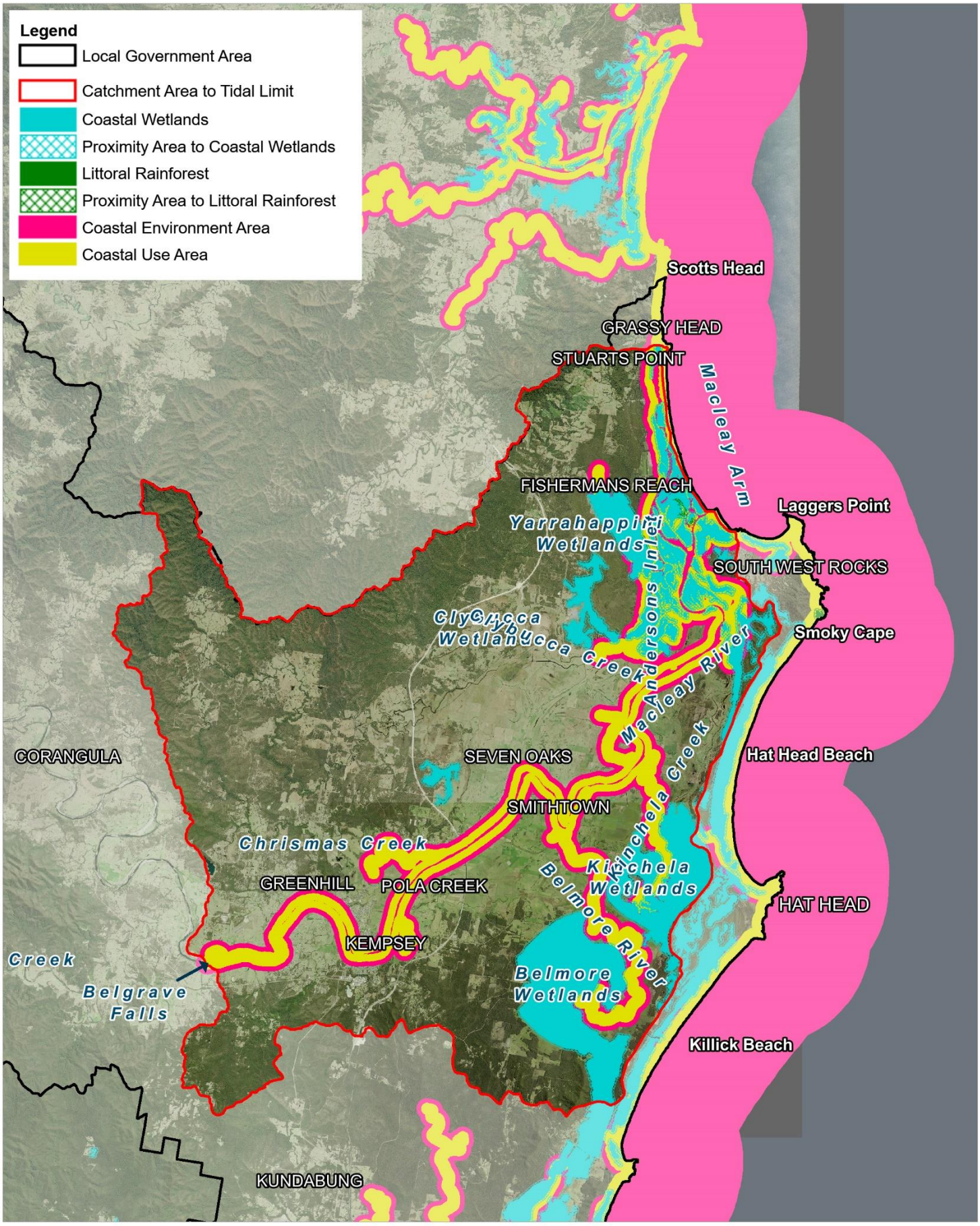
- Coastal Wetland and Littoral Rainforest Area (CWLRA);
- Coastal Vulnerability Area (CVA);
- Coastal Environment Area (CEA); and
- Coastal Use Area (CUA).

All of the above coastal management areas are shown in Figure 3-1except for the **Coastal Vulnerability Area** for which there is currently no gazetted maps under the CM SEPP. The suitability of existing information to develop a Coastal Vulnerability Area for the study area is investigated in this report. Full definitions for each of the coastal management areas is provided in Appendix D. Examples of the different coastal management areas are shown in Figure 3-2.

The Macleay River Estuary has an expansive coastal floodplain wetland system, a large portion of which is now mapped as **Coastal Wetland and Littoral Rainforest Area** under the CM SEPP. These floodplain wetlands or backswamps cover 60% of the Macleay's 400 km^2 floodplain, and are responsible in large part for the ongoing health of the estuary (GeoLINK, 2012).

The **Coastal Environment Area** within the Macleay is absolutely of environmental significance. For example, the Macleay estuary supports 1.1 km^2 of seagrass, most of which is within the Macleay Arm, 3.7 km^2 of saltmarsh, most of which occurs as fields of marine rush and salt couch in Clybucca Creek – Andersons Inlet; and some 5% of the state's mangroves (5km^2) (GeoLINK, 2012).

In terms of the **Coastal Use Area**, the Macleay, with its diversity of waterways, offers significant recreational boating opportunities. Recreational boating is enjoyed by a large proportion of the local community, as well as contributing to the region's tourism industry through holiday visitors and commercial charters (fishing and diving) (GeoLINK, 2012). Passive recreation along the river foreshore is beginning to flourish, as the local and visiting population turns back towards the Macleay River as a source of solace and leisure. Historically, the Macleay River was spurned for the significant flood risk it poses to the local population and to the agricultural industry, but this viewpoint is shifting.



Title:

Coastal Management Areas
Macleay River

Figure: 3-1

Rev: A

BMT endeavours to ensure that the information provided in this map is correct at the time of publication. BMT does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

N

0 5 10km

Approx. Scale

BMT
www.bmt.org

Filepath: S:\WATER\PROJECTS\N20956_Scoping_Study_Kempsey_Estuary_CMP\GIS\MI\workspaces

Figure 3-2 Macleay River's Coastal Zone

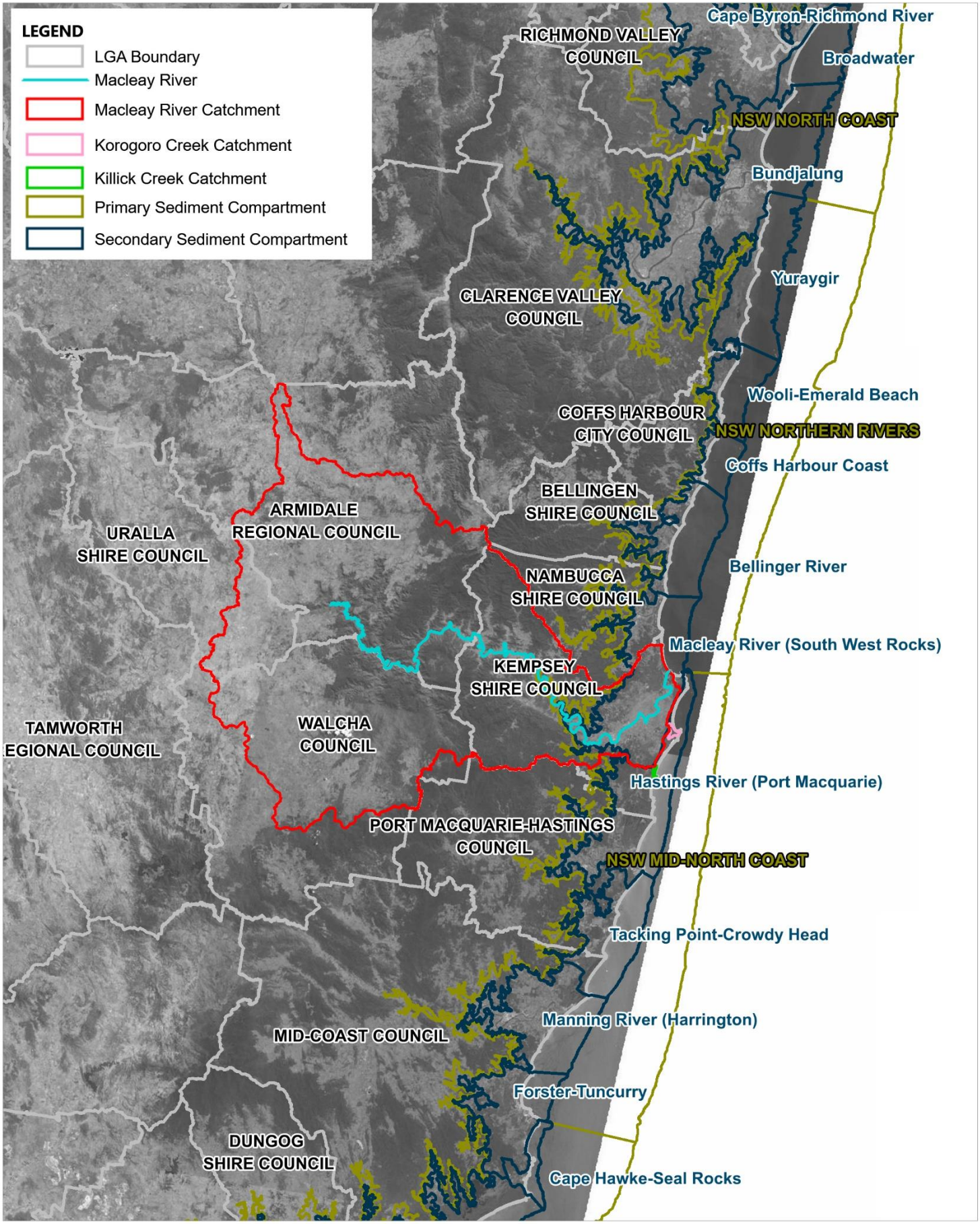
A) Shark Island Littoral Rainforest (Source: GECO Environmental, 2005); B) Bank Erosion / Instability in Macleay Arm Area (Source: Cohen, 2005); C) Macleay River Tidal Limit Environment (Source: Ryder et. al., 2016); and D) Community Recreational Use of the Macleay River (Source: GeoLink, 2012)

3.3.1 Coastal Sediment Compartments

The CM Act requires councils and public authorities to consider the study area for a CMP in the context of the broader regional coastal processes, which occur (at the very least) within the primary sediment compartment within which the section of coast or estuary is located. The Macleay River Estuary study area is part of the Macleay secondary sediment compartment that extends from Nambucca's north head to Laggers Point (Shoreline Explorer on Coast Adapt, 2017), see Figure 3-3. The Macleay River lies within the primary sediment compartment extending from Laggers Point northwards to Yamba Point (NSW02). Through the use of both Korogoro Creek and Killick Creek as flood outlets as part of the Macleay River flood mitigation scheme, the Macleay River Estuary also influences the Crescent Head sediment compartment that extends from Laggers Point southwards to Tacking Point in Port Macquarie LGA, and includes both Killick and Korogoro Creek catchments.

For the Macleay, this means that management of the estuary and its catchment should consider:

- the impact of water quality and sediment quality and quantity from and into the Macleay River via the open entrance at South West Rocks; with tides tending to flush the lower estuary on a regular basis, fluvial flows from rainfall delivering freshwater to the lower estuary, and outflows dominated by floodwaters on rare occasions, delivering flood water and eroded river sediments of varying quality to the open coast; and
- the impact of management of sediment within the entrance (e.g. dredging), because sediment transport into and out of the entrance is part of the regional coastal sediment system. Natural sediment transport processes under the action of tides and waves will tend to transport marine sands into the entrance to form the flood tide delta, entrance bar and other shoals; while floodwaters exiting Macleay River during floods may erode marine sands back out to the open coast and deliver finer sediments and contaminants (such as Arsenic and Antimony) from the catchment (with muds and silts being dispersed to the outer continental shelf as the sediments are too fine to be retained within the surf-zone).



Title:
Sediment Compartments

Figure: **3-3**

Rev: **A**

BMT endeavours to ensure that the information provided in this map is correct at the time of publication. BMT does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

N

0 37.5 75km

Approx. Scale

BMT
www.bmt.org

Filepath: S:\WATER\PROJECTS\N20956_Scoping_Study_Kempsey_Estuary_CMP\GIS\MI\workspaces

3.4 Legislative and Policy Context

The legislation and policy governing the management of Macleay River Estuary and its catchment is complex and includes:

- 1 Commonwealth Act, and 3 agreements,
- 11 State Government Acts,
- 1 Regional Plan,
- 1 Local Environment Plan,
- 2 State Environmental Planning Policies.

As outlined previously, the CM Act establishes the framework and overarching objectives for coastal management in NSW which focus on strategic, integrated and ecologically sustainable management of the NSW's coastal zone.

Table 3-1 provides a snap shot of the legislation and policy that have a major influence in the management of the Kempsey coastal zone, which is further expanded in Appendix D.

Table 3-1 Key Legislation Governing the Macleay River Estuary

NSW Coastal Zone Legislation and Policy	Additional Key Legislation Supporting Coastal Management
Coastal Management Act 2016 Coastal Management SEPP 2018 Marine Estate Management Act 2014	**Commonwealth** Environment Protection and Biodiversity Conservation Act 1999 Japan-Australia Migratory Bird Agreement China-Australia Migratory Bird Agreement Republic of Korea-Australia Migratory Bird Agreement Native Title Act 1993 **NSW** National Parks and Wildlife Act 1974 Environmental Planning & Assessment Act 1979 Marine Safety Act 1998 Mining Act 1992 No 29 Local Government Act 1993 Fisheries Management Act 1994 Protection of the Environment Operations Act 1997 Water Management Act 2000 Local Land Services Act 2013 Crown Land Management Act 2016 Biodiversity Conservation Act 2016 Draft Environment SEPP Aboriginal Land Rights Act 1983

State Level Plans

The key State level plan for the Macleay River Estuary is the new coastal management framework, as explained in Section 1.3. Additional key legislation that covers the Macleay River Estuary and supports management of its coastal environment is listed in Table 3-1, and detailed in Appendix D.

Regional Level Plans

The North Coast Regional Plan 2036 ('the Regional Plan') sets an overarching vision and strategy for the Northern NSW coast. The plan sets out four regionally specific goals focusing on the environment, economy, community and lifestyle. The priorities identified in the Regional Plan' for the North Coast are economic and jobs growth, greater housing choice to meet demand, delivering infrastructure to support growth and communities and protecting natural areas. Actions to support these outcomes represent the immediate areas of focus. An Implementation Plan for 2017-2019 for the Regional Plan' for implementing priority actions would be expected to be nearing completion, with a new implementation plan for the subsequent two years likely to commence in 2020. A more detailed review of the Regional Plan as it relates to this CMP is provided in Section 3.4.1.

The North Coast Local Strategic Plan 2016 – 2021 was devised by the North Coast Local Land Services (North Coast LLS) to deliver the State Strategic Plan in the North Coast Region. The strategic approach focuses on community engagement, setting and delivering local priorities and how the North Coast LLS priorities are best achieved at a local level. Goal 3 of the plan outlines regional and area specific priorities and details a range of expected outcomes with a focus on healthy, diverse and connected natural environments.

Local Level Plans

The Kempsey Local Environmental Plan 2013 (KLEP) details aims for the use and development of land within the Kempsey Local Government Area (LGA). The KLEP was prepared in accordance with the Standard Instrument (Local Environmental Plans) Order 2006 and Standard Instrument – Principal Local Environmental Plan in accordance with Section 3.20 of the *Environmental Planning and Assessment Act 1979.* The Kempsey Development Control Plan 2013 (KDCP) provides detailed planning and design guidelines to support the planning controls in the KLEP.

Under the CM Act, councils are required to establish links and alignment between management strategies in their CMPs and objectives and strategies in their Community Strategic Plan – with the aim to mainstream coastal management into councils' overall service delivery and asset management responsibilities, i.e. their Integrated Planning and Reporting (IPR) Frameworks.

The State Government's IPR Framework is set out in the *Local Government Act 1993*. Note Council has always integrated their estuary and coastal plans into the IPR Framework, including the preparation of this CMP. The cornerstone of the IPR Framework is the Community Strategic Plan (CSP), which for the Kempsey region is the *Macleay Valley 2036 Community Strategic Plan*. The CSP identifies the community's main priorities and aspirations for the future, and is supported by:

- Delivery Programs (4 yearly) which outlines to the community how council intends to achieve the community priorities and goals and the
- Operational Plan (annual), which outlines the details of the Delivery Program on an annual basis.

In addition to the above, the Kempsey Coastal Zone Management Plan (CZMP) was developed under the former State Government coastal management framework and was certified and gazetted.

3.4.1 Relationship of North Coast Regional Plan 2036 with the CMP

The North Coast Regional Plan provides an indication of the likely future population growth pressures on Kempsey, and how these are expected to be managed. This may assist in developing actions for the Macleay, Korogoro and Killick Estuaries CMP at later stages. Key Directions and Actions in the Regional Plan that are likely to align with the preparation and implementation of the CMP are detailed in Table 3-2, noting there may be other links between the remaining directions and the CMP process.

Table 3-2 Linkages between the CMP and the North Coast Regional Plan 2036

North Coast Regional Plan 2036		
Directions	**Actions**	**Link to CMP**
Direction 1: Deliver environmentally sustainable growth	• 1.1 Focus future urban development to mapped urban growth areas. • 1.2 Review areas identified as 'under investigation' within urban growth areas to identify and map sites of potentially high environmental value. • 1.3 Identify residential, commercial or industrial uses in urban growth areas by developing local growth management strategies endorsed by the Department of Planning and Environment. • 1.4 Prepare land release criteria to assess appropriate locations for future residential, commercial and industrial uses.	Coastal management area mapping and CMP actions should provide input to these actions, particularly identifying environmentally sensitive areas and excluding these from development (within local growth management strategies and land release criteria). The Regional Plan identified the following Urban Growth Areas within the catchment of the Macleay River, and connected Killick and Korogoro Creeks.(refer also Figure 3 16), with a focus on delivering housing in these areas: Kempsey, Crescent Head, Hat Head, and South West Rocks.
Direction 2: Enhance biodiversity coastal and aquatic habitats and water catchments	• 2.1 Focus development to areas of least biodiversity sensitivity in the region and implement the 'avoid, minimise, offset' hierarchy to biodiversity, including areas of high environmental value. • 2.2 Ensure local plans manage marine environments, water catchment areas and groundwater sources to avoid potential development impacts.	Coastal management area mapping and CMP actions should provide input to these actions, particularly identifying areas of high environmental value, and sensitive marine environments, water catchment areas and groundwater sources, to avoid development impacts.
Direction 3: Manage natural hazards and climate change	• 3.1 Reduce the risk from natural hazards, including the projected effects of climate change, by identifying, avoiding and managing vulnerable areas and hazards. • 3.2 Review and update floodplain risk, bushfire and coastal management mapping to manage risk, particularly where urban growth is being investigated. • 3.3 Incorporate new knowledge on regional climate projections and related cumulative impacts in local plans for new urban development.	As part of the CMP, completion of coastal vulnerability area mapping and updates to hazard mapping over time should be used as input to these actions, particularly avoiding development in areas vulnerable to natural hazards.

North Coast Regional Plan 2036		
Direction 8: Promote the growth of tourism	• 8.2 Facilitate tourism and visitor accommodation and supporting land uses in coastal and rural hinterland locations through local growth management strategies and local environmental plans. • 8.3 Prepare destination management plans or other tourism focused strategies that: – identify culturally appropriate Aboriginal tourism opportunities; – encourage tourism development in natural areas that support conservation outcomes; – strategically plan for a growing international tourism market. • 8.4 Promote opportunities to expand visitation to regionally significant nature-based tourism places, such as Ellenborough Falls, Dorrigo National Park, Wollumbin–Mount Warning National Park, Iluka Nature Reserve and Yuraygir Coastal Walk. • 8.5 Preserve the region's existing tourist and visitor accommodation by directing permanent residential accommodation away from tourism developments, except where it is ancillary to existing tourism developments or part of an area identified for urban expansion in an endorsed local growth management strategy.	The Urban Growth Areas for the Macleay, Killick and Korogoro catchments are identified as areas to deliver housing, but these areas are also already key coastal locations for tourism and visitor accommodation. Local growth management strategies and local environmental plans are expected to manage the delivery of these housing and tourism directions and actions. It is vital that the CMP actions and outcomes are considered in developing these local growth management strategies and local environmental plans that will set the direction of housing and tourism in the estuary catchments. Section 3.7.3 describes potential impacts from tourism on these coastal villages, if not properly managed.
Direction 15: Develop healthy safe socially engaged and well-connected communities	• 15.3 Implement actions and invest in boating infrastructure priorities identified in regional boating plans to improve boating safety, boat storage and waterway access.	Input to locations, scale etc for boating infrastructure should be undertaken through the CMP.
Direction 21: Coordinate local infrastructure delivery	• 21.2 Maximise the cost-effective and efficient use of infrastructure by directing development towards existing infrastructure or promoting the co-location of new infrastructure.	CMP needs to provide guidance on this action with regards to demands on infrastructure during peak holiday seasons that differs markedly from outside of holiday times.
Direction 22: Deliver greater housing supply	• 22.1 Deliver an appropriate supply of residential land within local growth management strategies and local plans to meet the region's projected housing needs.	Refer to notes for Directions 1 and 2 above, noting the CMP can guide the appropriate strategic planning for land use within the estuary catchment.
Direction 23: Increase housing diversity and choice	• 23.1 Encourage housing diversity by delivering 40 per cent of new housing in the form of dual occupancies, apartments, townhouses, villas or dwellings on lots less than 400 square metres, by 2036.	Increased density of housing delivery can reduce the overall footprint of development, provided that infrastructure can cope with the increased population. The CMP process can be used to guide strategic land use planning in this regard, as per notes on Direction 1, 2 and 8.

North Coast Regional Plan 2036		
Direction 25: Deliver more opportunities for affordable housing	• 25.1 Deliver more opportunities for affordable housing by incorporating policies and tools into local growth management strategies and local planning controls that will enable a greater variety of housing types and incentivise private investment in affordable housing.	CMP actions in this regard should link potential impacts of tourism in relation to holiday accommodation with this action.

3.4.2 Native Title Claims in the Study Area

There is currently one native title claim (NCD1997/001) across the study region (Macleay, Killick and Korogoro Creeks and tidal catchments). The successful claim, made by the Dunghutti People, covers land in Cresent Head and came into effect in April 1997. Native title clams are made under the Commonwealth's *Native Title Act 1993* (NTA), and are frequently made for Crown Lands. The aim of the NTA is to address past injustice by providing a process to recognise and protect native title in addition to providing processes to reach agreements or provide compensation. The number of native title claims is expected to change in the future, as existing claims are determined, and new claims are made.

Under Section 8.6 of the Crown Land Management Act 2016 (CLM Act) Councils are required to employ or engage a native title manager to ensure their (i.e. Council as the land manager of some crown lands) dealings with the land comply with any applicable provisions of native title legislation. Section 8.7 of the CLM Act sets out when written advice of a native title manager is needed for certain activities on the land they manage.

3.4.3 Land Rights Claims (NSW) in the Study Area

The *Aboriginal Land Rights Act 1983* (NSW) (ALRA) was principally established to return land in NSW to Aboriginal peoples through a process of lodging claims for certain Crown lands. Aboriginal Land Councils constituted under the ALRA can make claims. There are 120 Local Aboriginal Land Councils (LALCs) in NSW, the study area is covered by the Kempsey LALC.

3.5 Environmental Context

Kempsey's relatively untouched coastline has intrinsic environmental, social and economic value, for residents and visitors. (BMT WBM, 2015). The Macleay River Estuary contains significant environmental attributes.

Values

From an environmental perspective, values for residents relating to the Macleay River include water quality, riverbank protection, riparian vegetation and the floodplain wetlands (GeoLINK, 2012). The Macleay River Estuary also hosts a strong commercial fishing industry as well as oyster farms which rely on a healthy functioning estuary.

Pressures

For the Macleay River Estuary, environmental pressures on its coastal floodplain and foreshores come as a result of past flood mitigation works combined with the increases in population, tourism,

commercial and recreational activities as well as climate change and sea level rise (GeoLINK, 2012). Agriculture / aquaculture productivity and estuarine habitats are often threatened by water quality deterioration as a result of acid sulphate soils, arsenic and antimony contamination and blackwater discharges. A degraded riparian corridor and bank stability are put under strain by grazing, past clearing and infestation of exotic highly invasive vine weeds along the river banks.

3.5.1 Physical Features and Processes

The Macleay River covers an area of approximately 32 km^2 and is formed 25 km upstream of the tidal limit at Belgrave Falls. Throughout the 1800's the Macleay River Estuary entered the Pacific Ocean at Grassy Head however following major flooding in 1883 the sand barrier was breached north of South West Rocks. Following extensive works to stabilise the entrance in the late 1800's the Macleay River is now classified wave dominated barrier estuary with an open, trained entrance. (Dela-Cruz et al., 2017).

Along with entrance breaching and localised bank movements, extensive channelisation and flood mitigation works (following large flood events of 1949 and 1955) have heavily modified the hydrology and relationship of the floodplain wetland areas to the estuary. The works involved the construction of levees, barrages, drains, floodgates, floodways, training walls, ocean cuts and river bank stabilisation works (KSC, 2019).

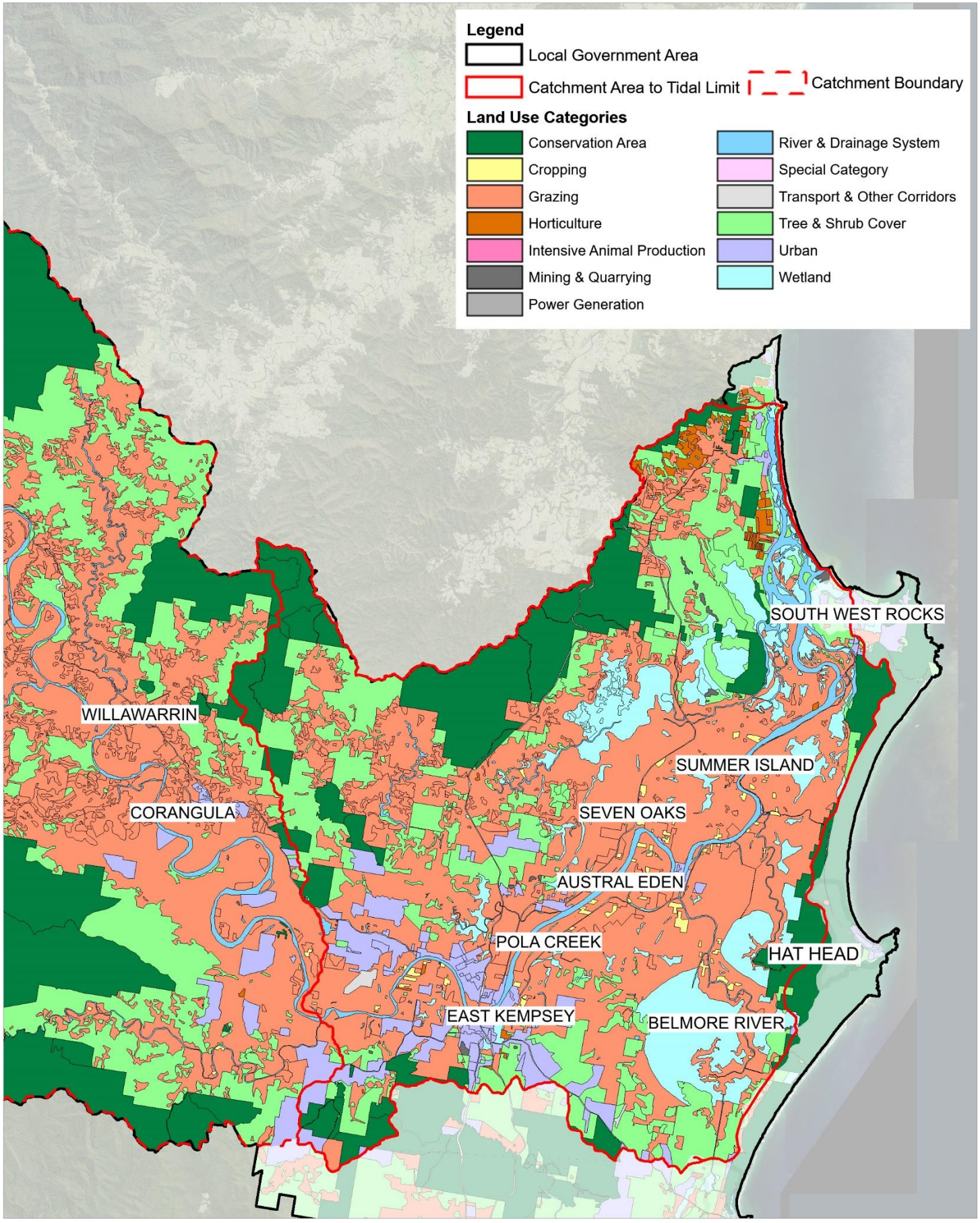
Hydrodynamics within the Macleay are driven by both fluvial inflows and ocean tides with wind driven currents and waves having localised impacts. Comparison of fluvial and tidal flows undertaken in the Macleay River Processes Study (WMAWater, 2009) indicated tidal flows dominated the entrance and Macleay Arm with floods also playing an important role, particularly in the upper estuarine reaches.

In the upstream reaches bank erosion was often driven by these fluvial processes as well as vegetation clearing and grazing with isolated areas of scour with wind and boat waves the main causes in the marine tidal zone. The Macleay River Estuary is dominated by fluvial sediments with a short-mixed zone before transitioning to coastal and marine sands where the Macleay River meets the Macleay Arm and Clybucca Creek. Entrance dredging, and natural deepening of the lower river channel coupled with breakout and then permanent opening of the entrance some 10 km upstream of the prior entrance at Grassy Head enabled the movement of fluvial sediments closer to the entrance when compared to similar riverine systems (WMAWater, 2009).

The total catchment area covers 11,435 km^2 (see Figure 1-2) with 740 km^2 contributing directly into the estuary, of which the floodplain covers approximately 54%. Large backswamps cover 60% of the floodplain and are linked to the estuary via a series of floodgates, drains and levees. The management of which has historically has impacted on floodplain wetlands, acid sulfate soil management and estuarine water quality.

Tenure

Within the KSC LGA, which occupies 25% of the Macleay catchment, urban land uses (residential, commercial and industrial) occupy less than 1%. Nearly 90% of the catchment is classified as rural, with the remaining classified as National Parks, Reserves and protection, refer Figure 3-4.



Title:

Land Use Categories
Macleay River

Figure: **3-4**

Rev: **A**

N

0 0.5 1km

Approx. Scale

BMT
www.bmt.org

Filepath: S:\WATER\PROJECTS\N20956_Scoping_Study_Kempsey_Estuary_CMP\GIS\MI\workspaces

3.5.1.1 Inundation

Flooding has long been a hazard in the Macleay catchment. Council has recently commissioned a Lower Macleay Flood Study (Jacobs, in prep) that captures the Macleay and associated Killick and Korogoro Creek catchments. This study provides a very detailed assessment of flood inundation and associated risks across the Lower Macleay for all three catchments (i.e. Macleay, Killick and Korogoro). In accordance with NSW Government's Floodplain Risk Management Framework, Lower Macleay Flood Study will have assessed a range of sea level rise scenarios and a range of entrance conditions and ocean water levels over appropriate planning timeframes using a dedicated hydraulic model. The Lower Macleay Flood Study also provides additional information on entrance scour processes in Killick and Korogoro creeks. The CMP will adopt the findings of this latest flood study as appropriate to coastal management.

With respect to the current and future hazards of coastal inundation and tidal inundation in the Lower Macleay (including Killick and Korogoro), previous 'bath tub' style mapping has been completed, as detailed below. This scoping study will recommend that both coastal inundation and tidal inundation be assessed using the existing flood model developed for the Lower Macleay Flood Study, as this model will account for the shape and hydrodynamics of the estuaries and provide the best information regarding potential inundation extents from oceanic influences including future sea level rise, with and without rainfall.

As part of the Kempsey Coastal Processes and Hazards Definition Study (BMT WBM, 2013) a range of coastal erosion and inundation scenarios were investigated for immediate, 2050 and 2100 timeframes that variously included the previously prescribed SLR projections from 2009, plus an arbitrary 0.5 m higher SLR by 2100. Of relevance to the estuary, the sea level rise and coastal inundation scenarios investigated through the BMT WBM (2013) study are reproduced in Table 3-3 and Table 3-4. The coastal inundation analysis undertaken by BMT WBM (2013) assumed that all components of the elevated water level (storm surge, SLR, tide, wave set up) occur simultaneously. The coastal inundation extents resulting from the various likelihood scenarios were mapped for the open coast and estuaries using a 'bath-tub' approach. It is important to note that a 'bath tub' approach does not account for hydraulic controls on water level from the ocean entrance to upper reaches of an estuary that may either attenuate or amplify the resultant water level upstream from the inundation event. Mapping of the coastal inundation hazard in BMT WBM (2013) covers some 24 maps and therefore has not been reproduced here, but can be referenced from the original report.

Tidal inundation (i.e., the likely increase in water levels on a daily basis from tides with SLR) was not investigated through the BMT WBM (2013) study, as this was not a requirement of open coastline hazards assessments at the time. Coastal Risk Australia provides mapping of the Australian coastline for a range of future 2100 SLR scenarios again taking a 'bath-tub' approach. Future potential water levels with SLR are discussed further in Section 3.10.1.1.

Table 3-3 Coastal Inundation Scenarios Assessed by BMT WBM (2013)

Probability	Immediate	2050	2100
Almost Certain	1 in 20 yr storm surge and wave set up	As per immediate	As per immediate
Likely	NM[1]	NM	NM
Possible	NM	NM	NM
Best Estimate (Unlikely)	1 in 100 yr storm surge and wave set up	1 in 100 yr storm surge and wave set up + 0.4 m SLR and climate change impacts	1 in 100 yr storm surge and wave set up + 0.9 m SLR and climate change impacts
Worst Case (Rare)	1 in 100 yr storm surge and wave set up + extreme climatic conditions (e.g. tropical cyclone, 1 in 1000 year east coast low)	**Worst Case of either:** 1 in 100 yr storm surge and wave set up + extreme climatic conditions + 0.4 m SLR and climate change impacts **OR** 1 in 100 yr storm surge and wave set up + 0.7 m SLR and climate change impacts	**Worst Case of either:** 1 in 100 yr storm surge and wave set up + extreme climatic conditions + 0.9 m SLR and climate change impacts **OR** 1 in 100 yr storm surge and wave set up + 1.4 m SLR and climate change impacts

[1] *NM = Not Mapped*

Table 3-4 Coastal Inundation Levels Adopted for Scenarios in BMT WBM (2013)

Adopted Inundation Levels	Immediate (m AHD)	2050 (m AHD)	2100 (m AHD)
Almost Certain	2.5	2.5	2.5
Best Estimate (Unlikely)	2.7	3.2	3.8
Worst Case (Rare)	2.9	3.5	4.3

3.5.1.2 Significant Storms in Recent Memory

There have been no major flood or storm events in the Kempsey region since the CZMP was developed. Indeed, the catchment and estuary are experiencing a drought, with very much below average conditions over the last 3 years, refer Figure 3-5. Extended dry conditions may drive other physical, chemical and ecological issues, such as the occurrence of fish kills when the first rainfall event after an extended dry washes out agricultural and other drains that may contain acid sulphate soils and/or decomposed materials into the waterway.

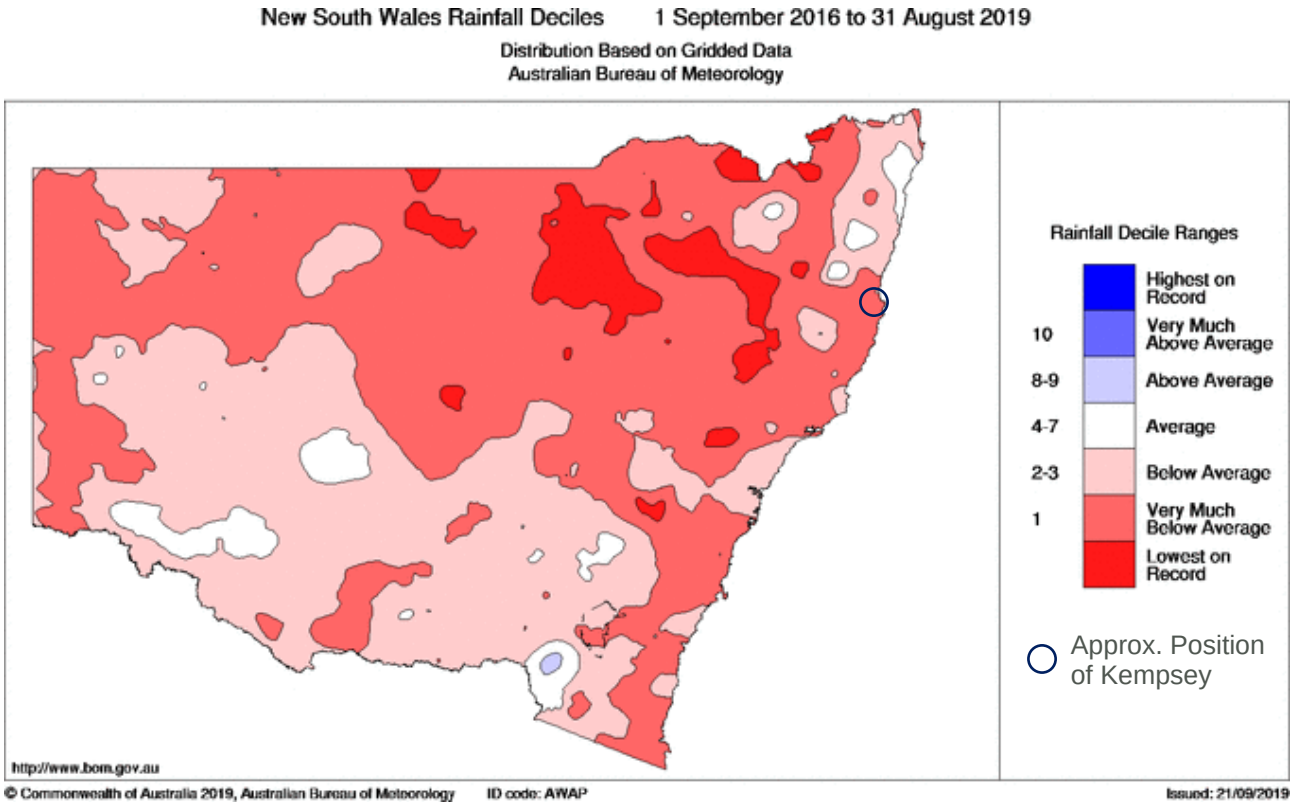


Figure 3-5 Rainfall Deciles Across NSW over past 36 months

3.5.2 Ecological Processes

Ecological health in the Macleay River Estuary is influenced by the system's hydrodynamics, saline/freshwater interaction, water quality, sediment dynamics and quality, and human usage (WMA Water, 2009).

The Macleay River and its surrounds hosts a range of habitats including mangroves, seagrasses and saltmarsh which are responsible for a significant proportion of the total primary production of the estuary (GeoLINK, 2010). Mangrove mapping in 1956 and 1981 indicated large losses from 830ha to 530ha. The most recent Macleay Ecohealth Report (UNE et al., 2016) compared 2011 mapping by the NSW Department of Industry and Investment (DI&I) – Primary Industries and Energy, and found that the total estuarine macrophyte cover (i.e. grouped - mangroves, saltmarsh and seagrass) increased between 1980 and 2011 in both the Macleay River (8%) and Back Creek (55%) estuaries, due to an increase in mangrove and saltmarsh cover in both estuaries. In contrast, seagrass cover declined between 1980 and 2011 in both the Macleay River (20%) and South West Rocks Creek (96%), with the largest reductions occurring in the Pelican Island estuary (-88%) and Clybucca Creek (-59%). Only one estuary zone, Stuarts Point, recorded a proportional increase in seagrass cover (3%). Current mapping of estuarine macrophytes is provided in Figure 3-6. It is noted that mapping from 1980 was not available for reproduction (and comparison) in this report. The habitat mapping has now been digitised.

A range of potentially endangered ecological communities exist in the Macleay River catchment, as illustrated in Figure 3-6. A total of 46 threatened fauna have been found within the Macleay estuary, 7 of which are endangered and 39 are considered vulnerable under the NSW Threatened Species

Conservation Act 1999. Of these 6 are also listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Under the EPBC Act, 82 migratory species have been recorded or potentially occur in the study area. The majority of these are bird and mammal taxa with bird species more likely to be dependent on the estuarine and floodplain wetlands (WMA Water, 2009).

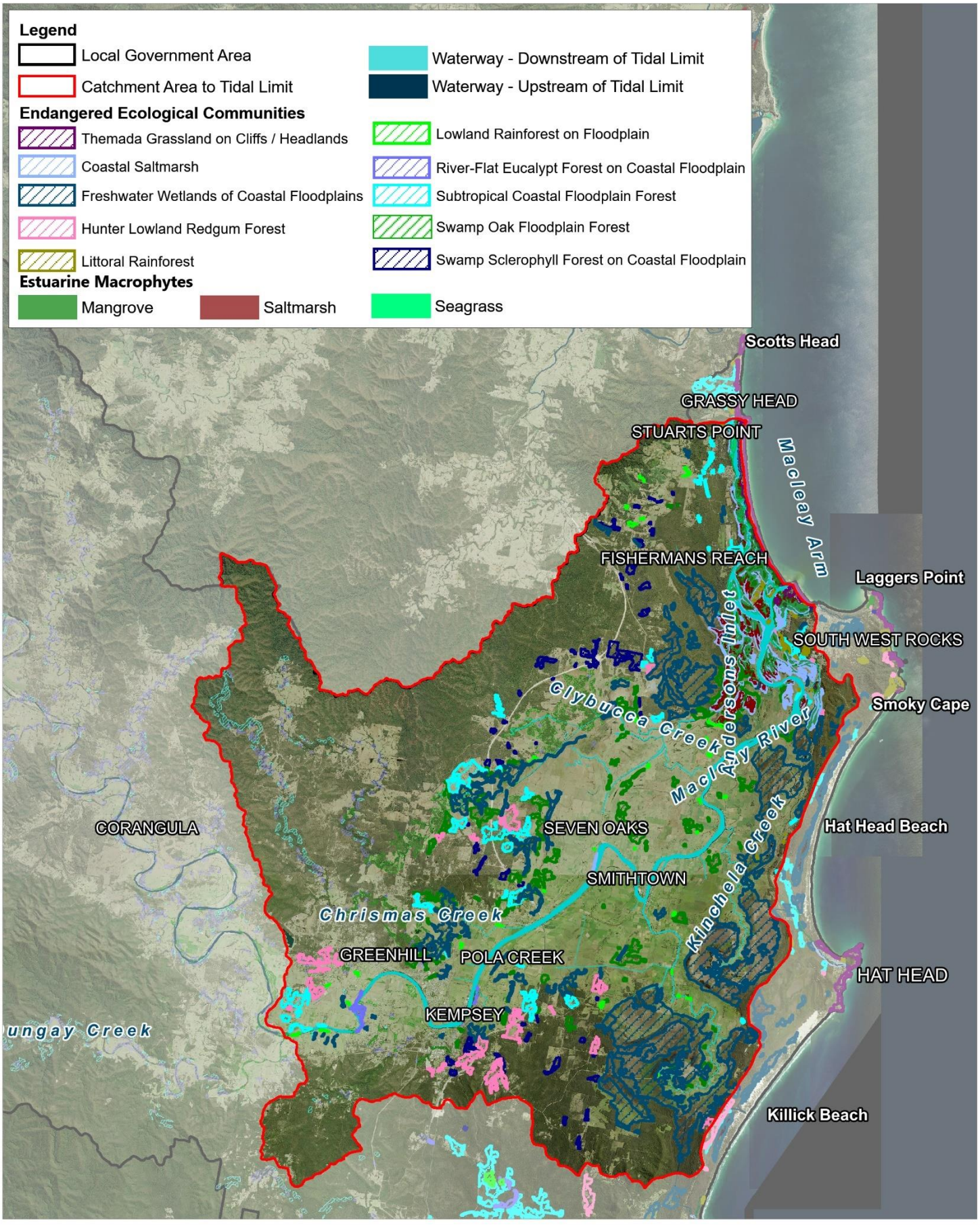
3.5.3 Water Quality

The Macleay River Estuary Processes Study (WMAwater, 2009) suggested flood events have the greatest influence on water quality in the estuary. Floodwaters from the surrounding floodplains are released to the estuary, delivering substantial amounts of sediments (including antimony and arsenic rich sediments), nutrients, sulphides and other pollutants. The release of these flood waters can result in poor water quality, and 'black water' events that result in fish kills. High nutrient levels in the floodwaters can cause algal blooms, which as the algae decomposes, results in low dissolved oxygen that subsequently causes fish kills.

Standing water after rainfall, particularly within the existing flood drainage network or cut-off wetlands, leads to the submersion, die off and then rotting of existing vegetation, which in turn results in the depletion of oxygen in the water column as bacteria consume the rotting vegetation. The acidity of the water is also changed, and can dissolve heavy metals, further reducing the quality of these waters. Fish kill events may occur in the drains themselves due to hypoxia, and can also occur when the deoxygenated waters are flushed into the estuary after further rainfall. Such dissolved oxygen or 'black water' events occur fairly frequently in the Macleay.

The Macleay River Estuary Processes Study also indicated the annual (2006 to 2007) physical inputs of nitrogen and phosphorus to the Macleay River Estuary were dominated by diffuse runoff (i.e. runoff of water across the land surface, rather than point sources such as stormwater drains or specific outlets such as effluent outlets from wastewater treatment plants, onsite sewage plants, or industrial sites etc). During the dryer months nitrogen loads from point sources were found to equal to the diffuse loads. It was concluded that during the dry season nutrient levels are generally lower in the upper estuary due to the uptake by macrophyte beds, and the lower levels of runoff that reduce the delivery of nutrients. Primary production by macrophyte beds were found to be the largest sources of carbon. It is likely that these macrophyte beds limit excess nutrients in the water column and without their presence there would be a likely increase in the frequency, duration and magnitude of algal blooms.

Trace metals enter the system from a range of sources including natural erosion, mining activities, urban and industrial effluent and land use activities that enhance erosion. Elevated concentrations of both arsenic (As) and antimony (Ab) have been found within the Macleay estuary as a result of historic mining practices in the upper Macleay catchment (noting that these metals are found in higher concentrations in the natural sediments also). These are widely spread across the floodplain and estuary. These trace metals do not degrade in the natural environment and are in some cases toxic to both plants and animals. Recent sampling indicated elevated concentrations in both the sediments and water column particularly in the tableland reaches. Sediment samples from Kinchela and Jerseyville also exceeded the national sediment low guideline value for As and Ab.



Title:

Ecological Mapping
Macleay River

Figure: **3-6**

Rev: **A**

N

0 5 10km

Approx. Scale

BMT

www.bmt.org

Filepath: S:\WATER\PROJECTS\N20956_Scoping_Study_Kempsey_Estuary_CMP\GIS\MI\workspaces

The Macleay River Estuary floodplain contains areas at high risk of Potential Acid Sulphate Soils (PASS). When ASS soils become oxidised, such as due to draining the land or lowering the water table (such as from groundwater extraction), acid leachate is formed. The acid leachate from ASS can then be washed to the estuary after rainfall where it is harmful to aquatic habitats. Throughout the Lower Macleay Estuary there are multiple drainage schemes and flood mitigation structures which are associated with the lowering of the water table and drainage of land. The presence of stunted vegetation, yellow jarosite deposits, red or brown coloured water and corrosion of concrete and steel structures throughout the Lower Macleay indicates the presence of ASS, and formation of acid leachate from these soils.

3.5.3.1 Ecohealth Reporting

The most recent Macleay Ecohealth Report (UNE et.al, 2016), which uses a series of standardised water chemistry indicators for reporting the health of coastal catchments indicated poor water quality with the Macleay Estuary catchment tributaries and main stem receiving a grade of D- and broader Macleay River catchment receiving an overall grade of D+ (Figure 3-7). UNE et.al (2016) indicated concentrations in both total and dissolved nutrients often exceeded trigger values whilst pH, DO, Chl-*a* and turbidity had fewer exceedances of thresholds.

3.5.3.2 Waterway Health Risk Mapping

DPIE (formerly OEH) and the EPA have developed a *Risk-based Framework for Considering Waterway Health Outcomes in Strategic Land-use Planning Decisions* (2017) (the Risk-based Framework), that sets out a 5-step process for assessing waterway health and determining management priorities and actions to achieve waterway health objectives. To support the effects-based assessment (Step 2) of the Risk-based Framework, DPIE's Science Division has produced the 'Estuary Sub-catchment Health Risk' dataset for all estuaries along the NSW coast. The dataset provides model outputs and then an assessment of the relative risk to waterway health from each sub-catchment. The modelling comprises a coupled series of catchment runoff, hydraulic or hydrodynamic, and ecological response models for each estuary. DPIE has advised that the models are intended to "*predict i) the quantity and quality of runoff from the catchment, ii) transport of runoff and pollutants in the estuary and iii) subsequent ecological response in terms of changes to algal biomass, changes to water clarity and seagrass cover in the estuary"* (pers. comm., Jocelyn Dela-Cruz, 2018, December).

DPIE determined a relative risk ranking for the sub-catchments in each estuary as follows.

- Likelihood was determined based upon the modelled quantity of pollutants as a percentage of the total modelled quantity (i.e. sub-catchment SF, TN, TP and TSS total loads or loads per hectare as a percentage of the entire catchment total loads or loads per hectare). A likelihood score of 1 (very low), 2 (low), 3 (moderate) or 4 (high) was assigned as explained in Table 3-5.
- Consequence was determined based upon the modelled value for water quality indicators as a percentage total value for the waterway (i.e. sub-catchment secchi depth (water clarity), Chl *a*, TN concentrations (for 1D-Box Models), or base exceedance and/or extent of potential impact (for 1D-Branched Model), as a percentage of total values for the entire waterway). A consequence score of 1 (very low), 2 (low), 3 (moderate) or 4 (high) was assigned as explained in Table 3-5.

- The risk rating / score = likelihood x consequence. The risk scores describe the relative risk from a sub-catchment, because the likelihood, consequence and therefore overall risk score is based on the contribution from a sub-catchment to the entire catchment of that waterway (i.e. a high risk sub-catchment in Killick Creek does not necessarily deliver the same pollutant loads or loads per hectare as from a high risk sub-catchment in the Macleay River).
- DPIE – Coasts and Estuaries has not defined or dictated how the risk scores should be used to determine management priorities. The aim here is to allow users the flexibility to define their own groupings based on their own tolerance for risk, other catchment priorities, and with or without combining these risk scores with other indicators of waterway health (i.e. catchment land managers can determine what risk scores equates to a low risk that should be accepted, a moderate risk that can be tolerated and treated in future, or a high risk requiring treatment as a priority).

The estuary sub-catchment risk ratings provided by DPIE – Coasts and Estuaries for the Macleay River Estuary are mapped in Figure 3-8, and for the entire Macleay River in Figure 3-9.

The dataset is provided by DPIE – Coasts and Estuaries to serve as a 'first-pass' assessment, to represent spatial trends and identify relative priorities for management. DPIE – Coasts and Estuaries clearly state that the model outputs "*do not provide absolute values to allow decisions on the amount of nutrients or sediments that need to be mitigated, or provide predictions on the absolute amount of algal biomass within the estuary.*" (pers. comm., Jocelyn Dela-Cruz, December 2018)

Table 3-5 Likelihood, consequence and risk scores to rank sub-catchments according to their risk of impact on waterway health (adapted from pers. comm. Jocelyn Dela-Cruz, 2018)

	Likeli-hood	**Very Low** Quantity[1] ≤ 25th percentile of dataset	**Low** 25th < Quantity[1] ≤ 50th percentile of dataset	**Moderate** 50th < Quantity[1] ≤ 75th percentile of dataset	**High** Quantity[1] > 75th percentile of dataset
Consequence	**Score**	**1**	**2**	**3**	**4**
Very Low Quantity[2] ≤ 25th percentile of dataset	**1**	**1**	**2**	**3**	**4**
Low 25th < Quantity[2] ≤ 50th percentile of dataset	**2**	**2**	**4**	**6**	**8**
Moderate 50th < Quantity[2] ≤ 75th percentile of dataset	**3**	**3**	**6**	**9**	**12**
High Quantity[2] > 75th percentile of dataset	**4**	**4**	**8**	**12**	**16**

1 Likelihood of impact based on model output quantities of SF, TN, TP and TSS loads from the subcatchment or loads per hectare
2 Consequence of impact based on model output quantities of secchi depth (water clarity), Chl a, TN concentrations (for 1D-Box Models), or base exceedance and/or extent of potential impact (for 1D-Branched Model)

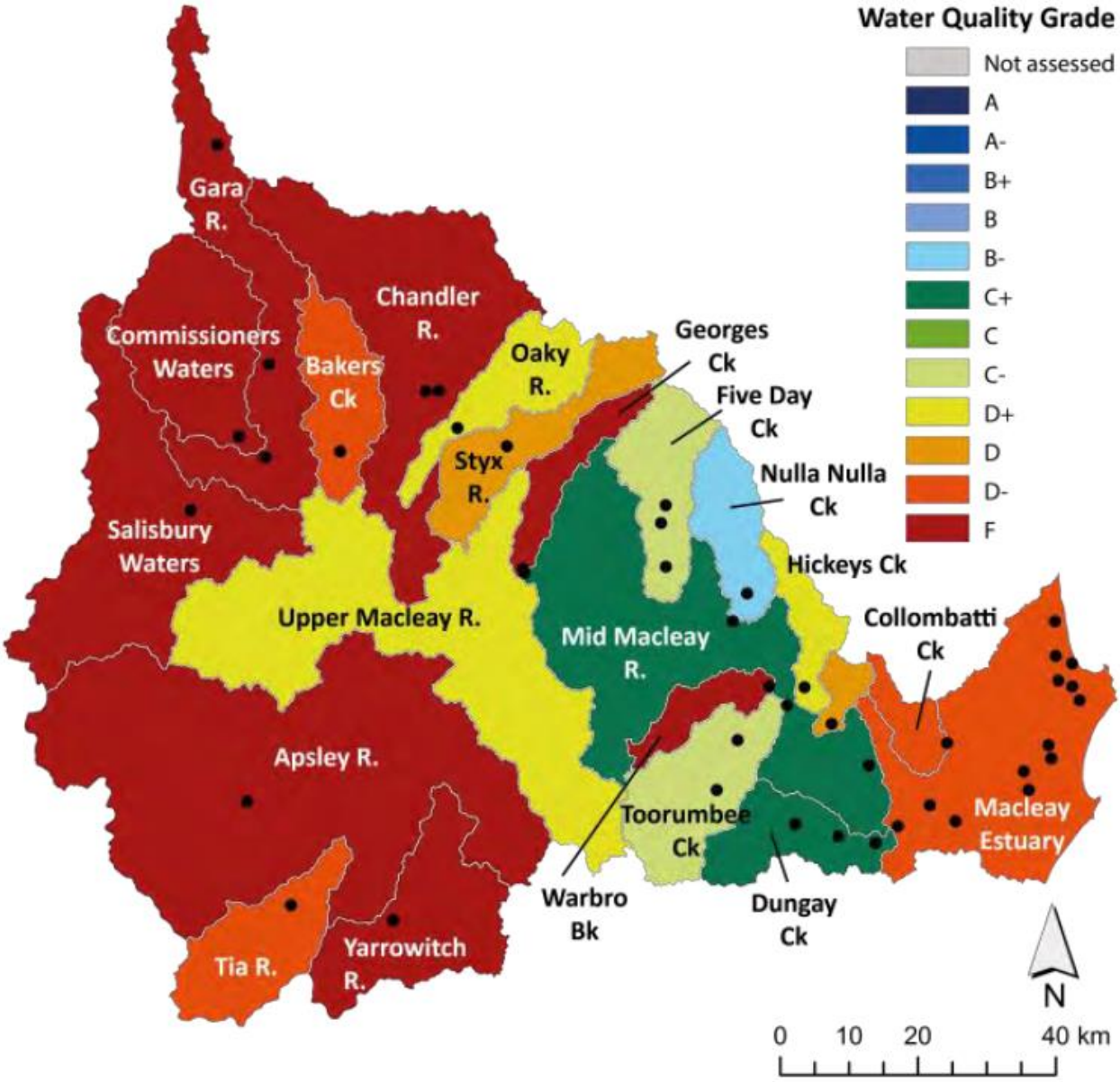
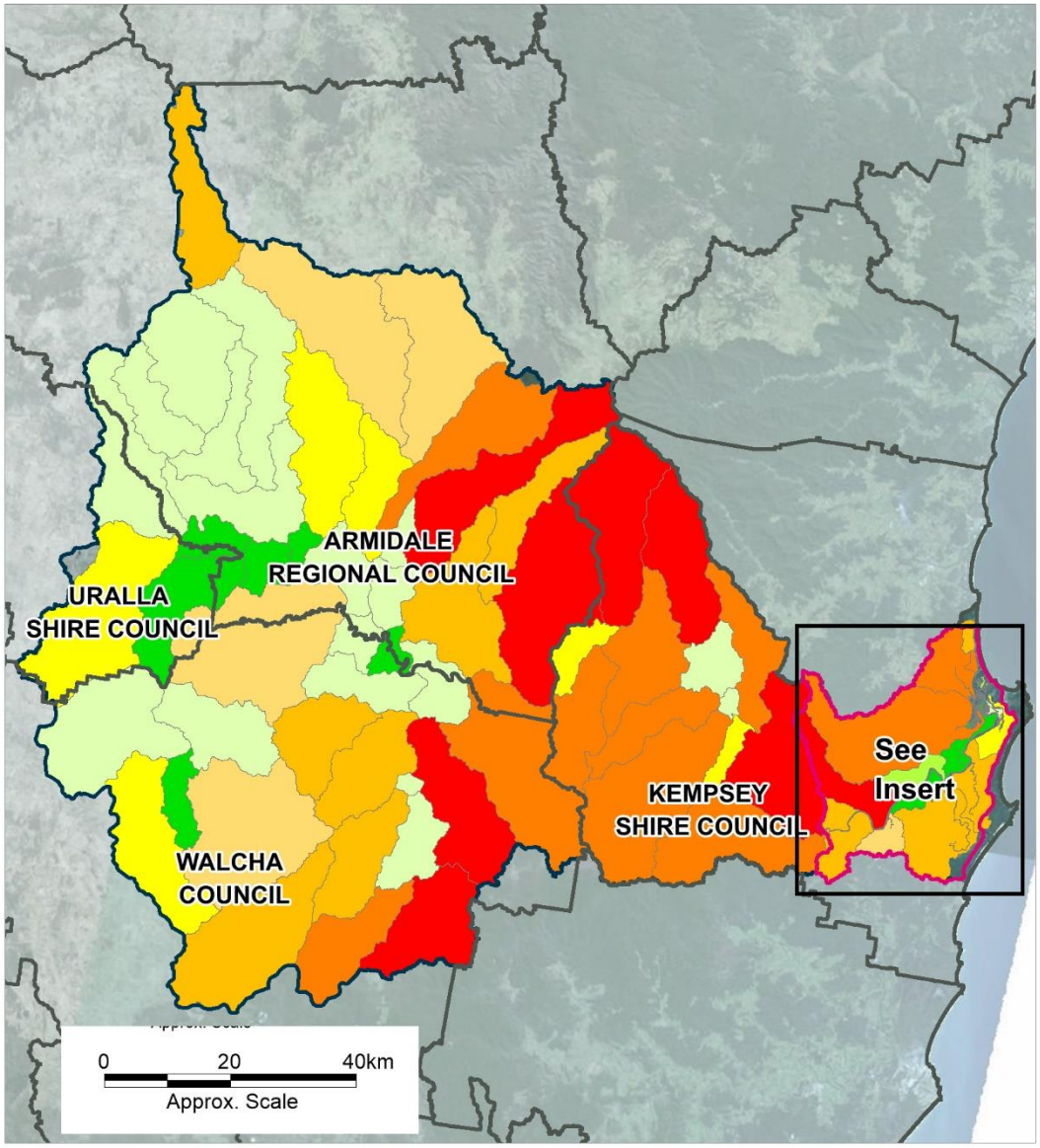
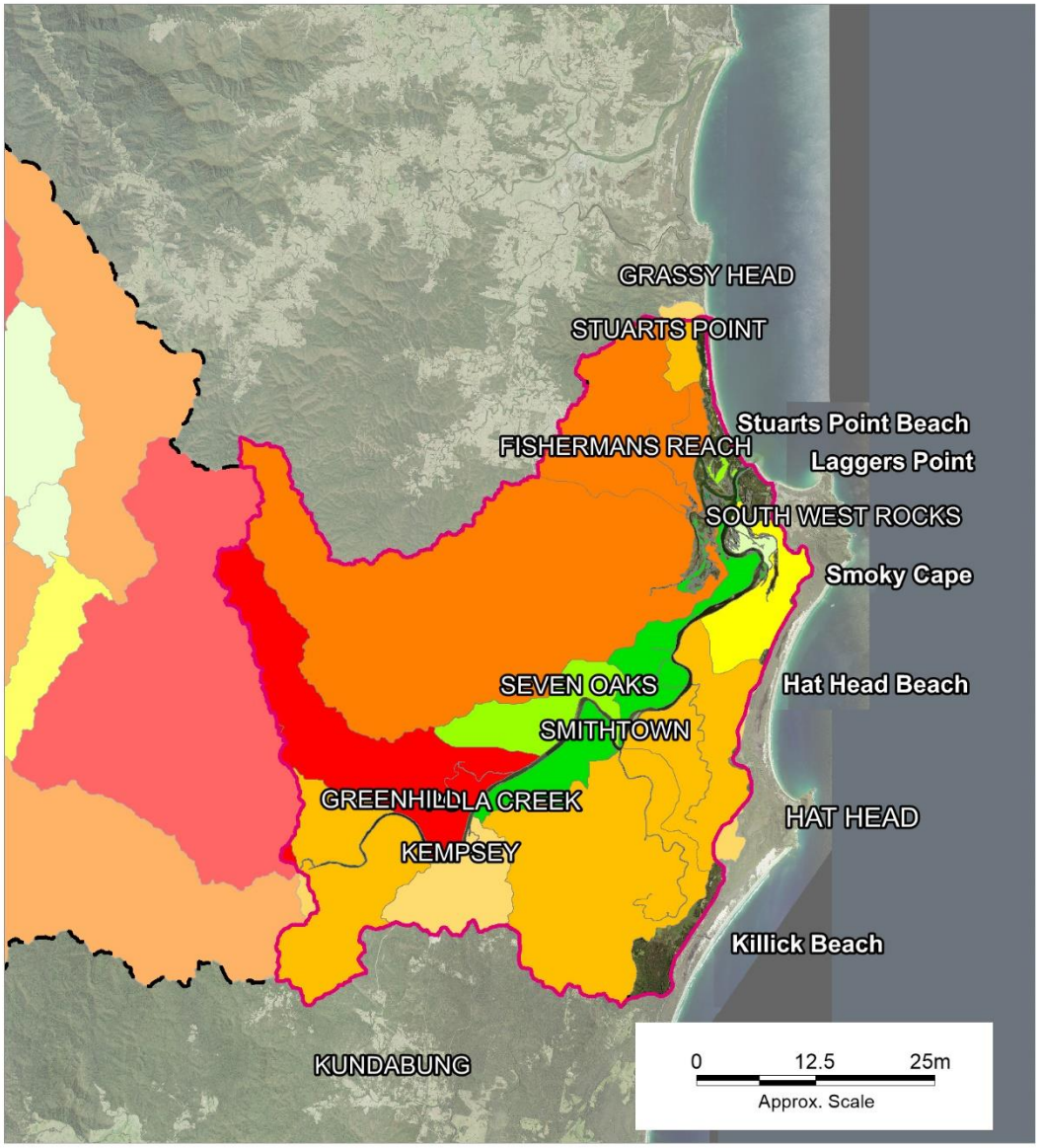


Figure 3-7 Sub-catchment Ecohealth grades for Water Quality (Macleay Ecohealth Report, UNE et.al, 2016)





LEGEND

Macleay River Catchment

LGA Boundary

Catchment Area to Tidal Limit

Risk Rating

1 - Lowest
2
3
4
6
8
9
12
16 - Greatest

Title:

Waterway Health Risk Mapping for Sub catchments of Macleay River

Figure: 3-8

Rev: A

N

BMT
www.bmt.org

Filepath: "K:\N20956_Scoping_Study_Kempsey_Estuary_CMP\MapInfo\package_WS\Macleay_River_Risk_Rating.wor"

3.5.3.3 Comparison of Ecohealth Monitoring with Waterway Health Risk Map

While the estuary sub-catchment risk ratings provided by DPIE for the Macleay River Estuary are only relative to each other, there is still much to be gleaned from the comparison of the Macleay sub-catchment risk ratings (in Figure 3-8) and the Sub-catchment Ecohealth grades for Water Quality (in Figure 3-7). Waterways in the tidal reaches of the Macleay River catchment have poor water quality, with a rating of D- (refer Figure 3-7). However, in terms of pollutant loads and loads per hectare of nutrients in runoff from the sub-catchments, the relative risk mapping in Figure 3-8 illustrates that most of the sub-catchments contributing the greatest total loads and loads per hectare of pollutants lie upstream of the Macleay's tidal limit. Certainly a couple of the sub-catchments within the tidal reaches of the estuary also have high risk ratings, but the mapping suggests a fair proportion of the poor water quality experienced in the lower Macleay River may be due to inputs from sub-catchments in the upper reaches of the estuary, above the tidal limit.

The comparison of the Ecohealth monitoring (Figure 3-7) and waterway health relative risk mapping (Figure 3-8) clearly demonstrates that waterway health in the estuary is affected by activities and catchment runoff upstream of the tidal limit of the Macleay River. Management of water quality and waterway health in the estuary will also require actions within the upper sub-catchments and therefore adjacent council local government areas (LGAs), namely. Armidale, Walcha and Uralla.

3.6 Governance Context

The Commonwealth Government's *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) protects nationally significant threatened species and communities within the Macleay region (e.g. *Maundia triglochinoides*).

State and local governments share strategic and statutory planning responsibilities for land in the Macleay River foreshore and catchment. Both DPIE and Council administer the *Environmental Planning and Assessment Act 1979*, which is the key legislation for land use planning and development assessment in NSW. The bed of the waterway, and many tracts of land along the foreshore and catchment are publicly owned Crown Land, which are administered by the DPIE – Crown Lands under the *Crown Land Management Act 2016*. Similarly, NPWS manages six reserves in the Lower Macleay Area: Yarrahapinni Wetlands National Park, Fishermans Bend Nature Reserve, Clybucca Aboriginal Area, Clybucca Historic Site, Hat Head National Park and Arakoon National Park.

The North Coast Regional Plan 2036 prepared by the then DPE (now DPIE – PA) aims to guide land use planning decisions for the Northern NSW Coastal regions including Kempsey Shire. A description of the key directions and actions of the Regional Plan in relation to this CMP is provided in Section 3.4.1.The Kempsey Local Environmental Plan (LEP) 2012 is prepared in accordance with the *Environmental Planning and Assessment Act 1979* and details the land zoning and permissible development in the LGA, which includes the Macleay catchment.

The CM Act provides the legislative framework for managing the coastal zone in a strategic and coordinated manner, including Macleay River Estuary. The CM Act is administered by DPIE – Coasts and Estuaries, and the Macleay CMP when completed will be administered by Council, which is currently the case for the existing CZMP. Acknowledging actions developed and certified in CMPs

are implemented by local councils (through their Integrated Planning and Reporting Frameworks), state agencies (through written agreement) and other stakeholders as required.

Other state agencies and departments that are involved in the governance of the Macleay estuary are listed in B.2.

3.7 Social Context

3.7.1 Population and demographics

As of 2016, Kempsey Shire Council was home to 28,885 residents, living in 13,547 dwellings with an average household size of 2.4 (idcommunity, 2016). The population is made up of roughly 20.9% residents under the age of 18 and 32.1% of residents aged 60+. Kempsey has a larger portion of post retirement residents when compared to the regional NSW average of 27.2%.

Roughly 7% of residents were born overseas with 3% having non-English speaking backgrounds. The 2016 Australia Census data showed the Aboriginal or Torres Strait Islander population accounts for 11.6% of the total population of Kempsey, compared to 3.4% in NSW.

3.7.2 Community values and issues

The key values and issues associated with the Macleay River Estuary were identified in the Macleay River Estuary CZMP (GeoLink, 2012) following extensive stakeholder engagement and community consultation. Results from the community consultation are presented in Figure 3-9 with the social values identified during this process being boating, recreational fishing, passive recreation (picnicking/walking) and swimming.

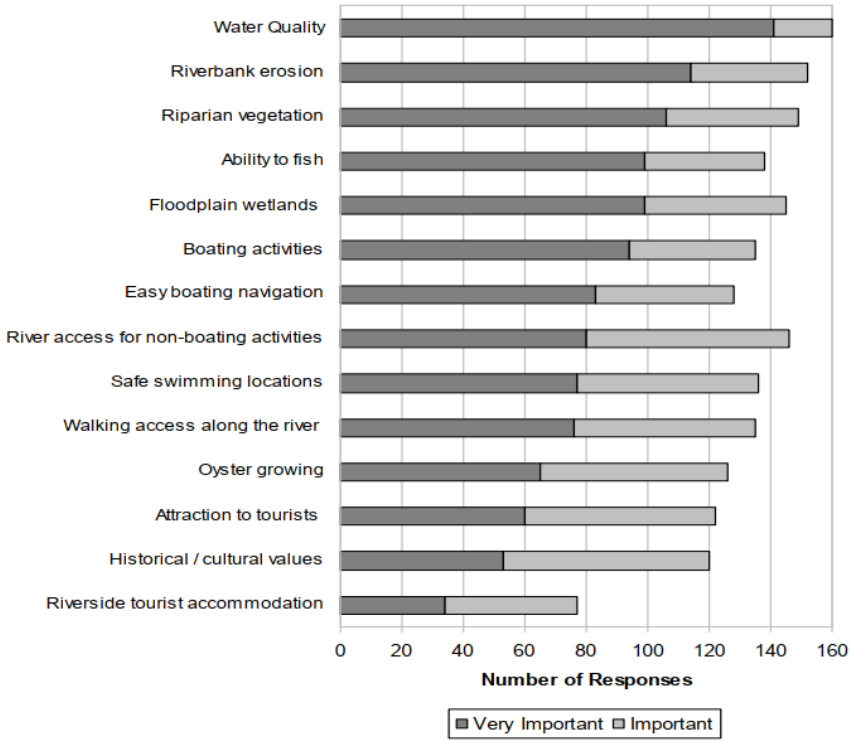


Figure 3-9 Ranking of Values from Community Survey (GeoLink, 2012)

3.7.3 Seasonal Population Influxes

Tourism is a major industry in the region, and results in a swelling of particularly the small coastal communities within the Macleay catchment particularly South West Rocks, Stuarts Point and Grassy Head. Tourism can result in a quadrupling of the local population during peak holiday periods, and this in turn places pressure on the existing infrastructure and facilities of these coastal villages that were not designed to cater for such population numbers. Impacts may include:

- increased demand and usage of recreational facilities and amenities, particularly in river foreshore reserves and in the coastal towns and villages, and can in turn result in damage to the facilities and / or conflicts between users;
- increased pressure on the water supply, wastewater and waste management systems that may result in failure of such systems and overflows to the estuary, but because these pressures only occur on a seasonal basis, it makes larger, more appropriately sized systems prohibitively expensive for the local population to support;
- increased demand for holiday accommodation, which can place housing pressures within the local villages, and change the structure of community and ownership in these villages.

Most of the coastal communities that support tourism are also earmarked as Urban Growth Areas in the Regional Plan (refer Section 3.10.2), and this may further exacerbate the pressures and risk of failure of the systems and infrastructure in these coastal villages, if not properly planned and funded.

3.8 Cultural Context

The Macleay River Estuary study area is a sharing place for the Thunghutti (or Dhunghutti, or Dunghutti) tribe with elders from the tribe along with the Kempsey Local Aboriginal Land Council representing the area. The territory of the Thunghutti people extended from Point Plommer on the coast to near Macksville to the north and inland to Kemps Pinnacle. The north east coast of NSW and the narrow adjoining coastal plain, such as occurs in the Macleay Region, featured some of the most productive and hospitable regions in Australia for Aboriginal life. The sea, tidal estuaries, rivers, creeks and adjacent wetlands provided a rich source of fish, shell-fish and crustacea. Before European occupation of the Macleay Region the river plains and coastal headlands were open grasslands maintained by fire and grazed by large numbers of macropods and smaller marsupials. With these rich resources and favourable climate, the coast and adjacent river valleys supported a high and densely concentrated Aboriginal population. (NSW NPWS, 1998).

The study area contains many sites of Aboriginal significance, many of which are protected within the National Parks, State Recreation Areas and Nature Reserves of the region.

The Clybucca-Stuarts Point midden complex is the largest of its type (estuarine midden) in temperate Australia (Hughes & Sullivan, 2002). It is almost continuous for a distance of 14km and is unique in that it contains a rich and variable assemblage of well preserved shell and bone remains, with remains dating back from around 2,500 to 6,000 years ago (NSW NPWS, 2007).

Mount Yarrahapinni (a registered Aboriginal site), Scotts Mountain and Middle Head have long been recognised as areas of traditional and contemporary significance to local Aboriginal peoples. Mount

Yarrahapinni and Middle Head feature in the Dreamtime stories of both the Gumbaynggirr and Dhunghutti peoples (NSW NPWS, 2015).

European settlement in the region dates to 1827 with the establishment of a group tasked to cut Australian Red Cedar. This was closely followed by other early industry such as grazing and maize farming. There are several heritage listed sites within the Kempsey LGA with 25 of these located on or adjacent to the Macleay River as detailed in the Draft Kempsey Shire Community based Heritage Study.

3.9 Economic Context

Kempsey Shire is strategically positioned as a half way point on the Sydney to Brisbane Corridor. The local economy is underpinned by a strong agricultural sector and supports a range of manufacturers including Nestle and Akubra Hats, see Figure 3-10. KSCs gross regional product (GRP) of $1.08 billion (NIEIR, 2017) accounts for 0.2% of NSW gross state product (GSP).

Key employment sectors in Kempsey Shire include health care and social assistance, retail trade, education and training, and accommodation and food services. Over the past few years KSC has seen a reduction in the unemployment rate from 10% in 2015 to 6.4% as of March 2018. The median household income of $894 per week (ABS, 2016).

Tourism is a growing industry in the region. Particularly the coastal villages within the Kempsey region are reliant on tourism to drive their local economies (GeoLINK, 2012).

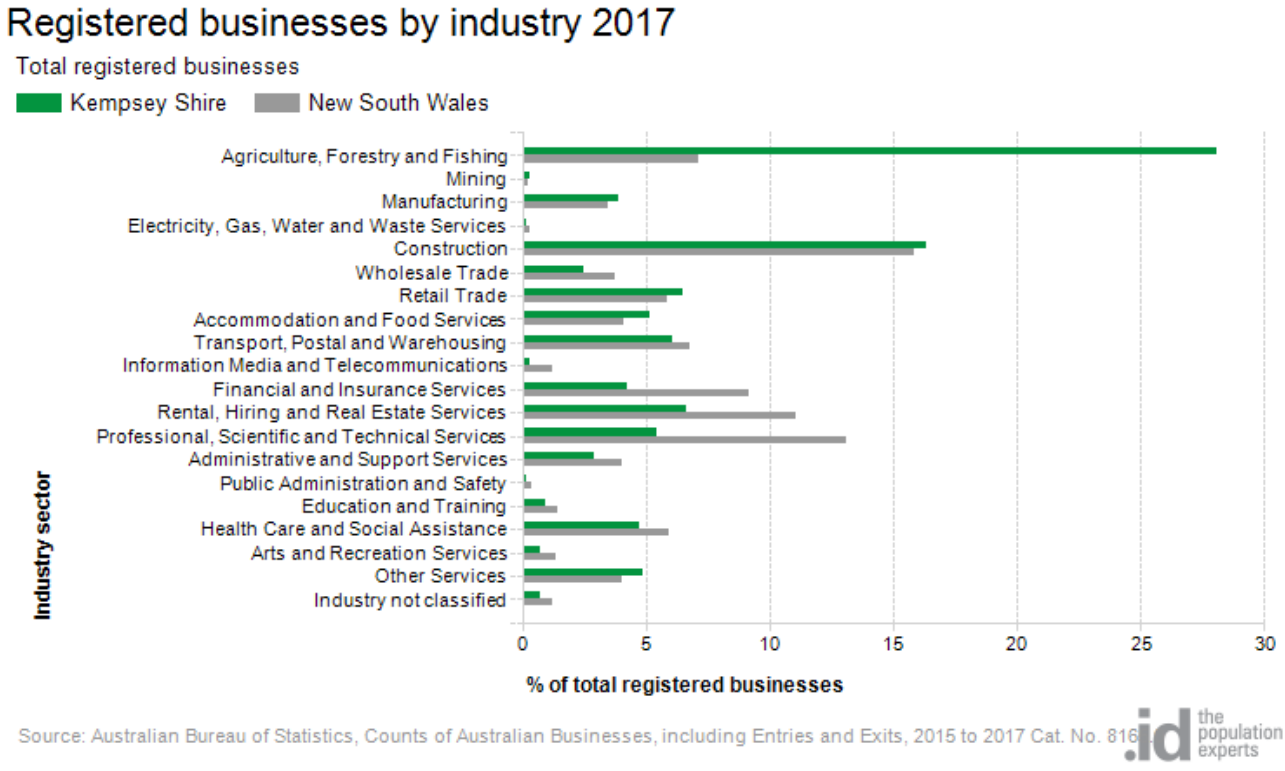


Figure 3-10 Contribution of Industry Sectors in Kempsey compared to NSW

The Regional Plan identifies economic and jobs growth as one of the priorities for the North Coast. The Regional Plan identifies a number of Directions and actions that aim to support this economic and jobs growth, which includes the following specific directions (and associated actions):

- Direction 6: Develop successful centres of employment, with a further seven actions relating to economic growth, including in industry anchors and sectors such as health, education, airports, knowledge industries and business parks, housing, tourism, social activity, regional services, and retail and commercial activities.
- Direction 5: Strengthen communities of interest and cross-regional relationships, with a further four actions to enhance collaboration and remove barriers to regional and intra-regional housing, employment and industry land and development, and jobs growth; and identifying key enabling infrastructure and other interventions / supports to unlock economic growth.

Other less direct actions that will support economic growth include the following:

- Direction 7: Coordinate the growth of regional cities;
- Direction 8: Promote the growth of tourism;
- Direction 8: Promote the growth of tourism;
- Direction 9: Strengthen regionally significant transport corridors;
- Direction 10: Facilitate air, rail and public transport infrastructure;
- Direction 11: Protect and enhance productive agricultural lands;
- Direction 12: Grow agribusiness across the region;
- Direction 13: Sustainably manage natural resources;
- Direction 14: Provide great places to live and work.

3.10 Future Context

3.10.1 Climate Change

The threat of sea level rise, increasing temperatures and changes to rainfall will place unprecedented stress on species, ecosystems and human settlements and industries. Consideration is needed as to how species, ecosystems and human communities can adapt to these anticipated stressors (NCCARF, 2012).

The CSIRO and IPCC regularly update the projections for key climate change parameters such as sea level rise and temperature. The latest projections relevant to the Kempsey region are available on the CoastAdapt website, and have been summarised in the following sections.

Existing adaptation actions for Kempsey Shire from relevant documents has also been reviewed and summarised in Section 3.10.1.5.

3.10.1.1 Sea Level Rise

Sea level variation, atmospheric, hydrologic and hydrodynamic processes are all predicted to shift under climate change, all of which influence coastal landforms and ecosystems (Roy et al., 2001).

Climate models are used to develop multiple projections of the Earth's future climate. Drivers of these projections are social, economic and technical which will impact the future release of greenhouse gas emissions into the atmosphere. The most recent Intergovernmental Panel on Climate Change (IPCC) emissions scenarios used are described as Representative Concentration Pathways (RCPs) and range from very low emission scenarios (RCP2.6) to very high (RCP8.5) emission scenarios.

Sea level rise (SLR) future climate information based on these RCP scenarios have been produced for Australian coastal councils (coastadapt.com.au). Projections for Kempsey indicate an increase of between 0.38m and 0.66m (RCP2.6 and RCP8.5) by 2090 (CSIRO, 2016). The median sea level rise projections for these scenarios are presented in Figure 3-11.

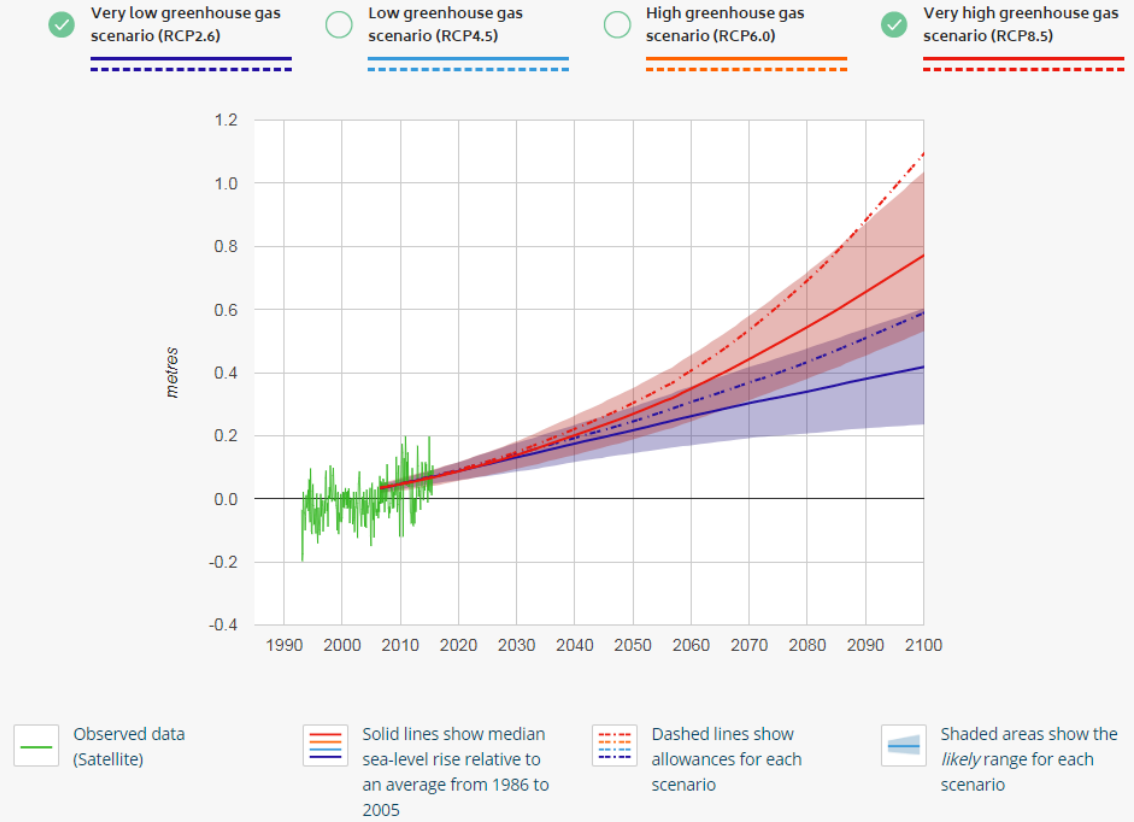


Figure 3-11 Predicted SLR for Kempsey (source: coastadapt.com.au, accessed 2018)

As outlined in Section 3.5.1.1, the Kempsey Coastal Processes and Hazards Definition Study (BMT WBM, 2013) investigated a range of coastal inundation scenarios including a range of SLR projections for the immediate, 2050 and 2100 timeframes. The coastal inundation extents resulting from the various likelihood scenarios were mapped for the open coast and estuaries using a 'bath-tub' approach (refer to BMT WBM, 2013 for mapping, as the map set is extensive).

Coastal Risk Australia provides mapping of the Australian coastline for a range of future 2100 SLR scenarios again taking a simple 'bath-tub' approach using high resolution LiDAR data. This is currently the best available mapping of tidal inundation for the Macleay, Killick and Korogoro estuaries. Scenarios include a 'low' scenario, termed RCP 2.6 has a median SLR of 0.44m, a 'medium' scenario aligning approximately with RCP 4.5 and RCP 6.0 and a median SLR of 0.54m

and a 'high' scenario aligning to RCP 8.5 and a median SLR of 0.74m. A snapshot of the 'high' scenario for the Macleay River is presented in Figure 3-12.

As also noted in Section 3.5.1.1, mapping using a 'bath tub' approach does not account for hydraulic controls on water level from the ocean entrance to upper reaches of an estuary that may either attenuate or amplify the resultant water level upstream from the inundation event. It has therefore been recommended in this Scoping Study (Section 6.5) that coastal inundation and tidal inundation extents be modelled using the existing Lower Macleay flood model (Jacobs, in prep), as this will provide the best available information and far improved mapping compared with the existing coastal inundation mapping from BMT WBM (2013) and sea level rise mapping from Coastal Risk Australia.

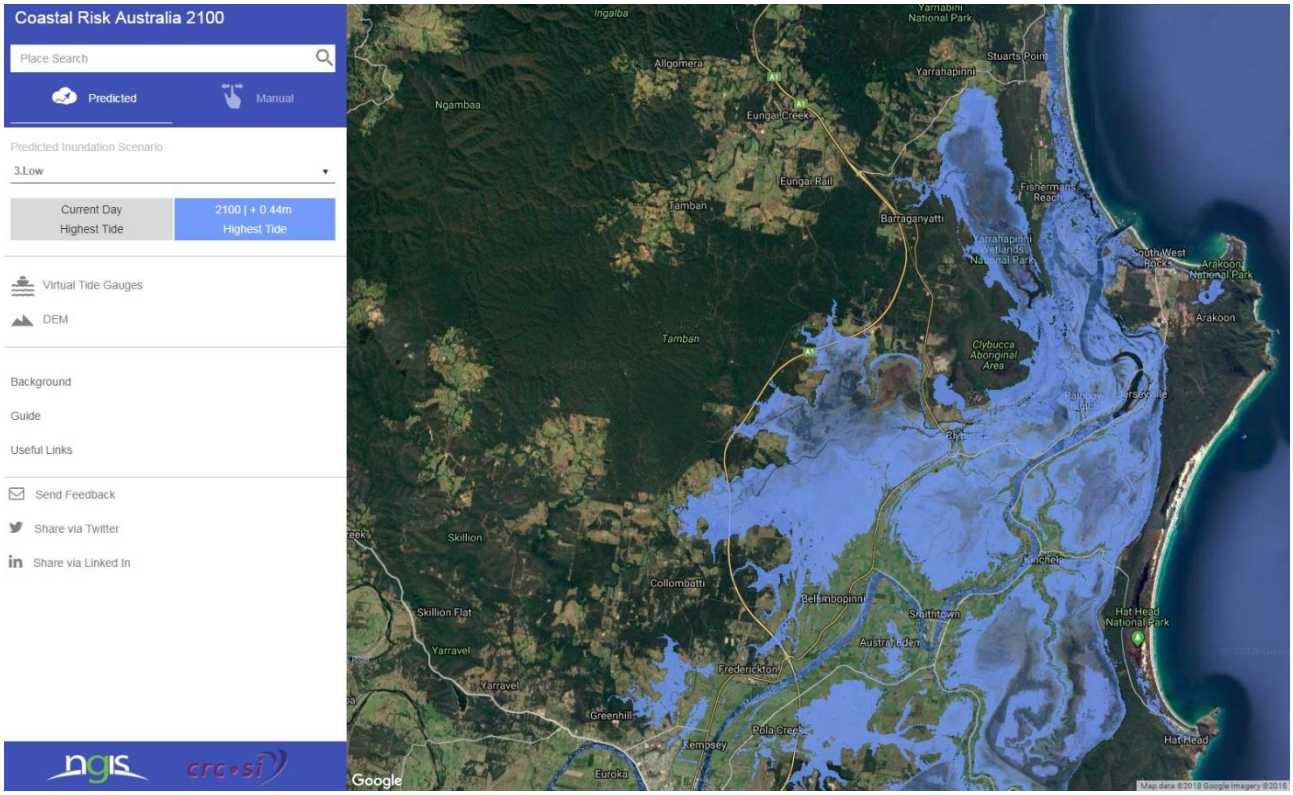


Figure 3-12 2100 Sea Level Rise Inundation Mapping (Coastal Risk Australia)

3.10.1.2 Temperature

CSIRO investigated a range of future potential temperature extremes based on the same RCP scenarios and determined increases for:

- **Hot days -** Mean annual number of days with a maximum temperature greater than 30˚;
- **Warm nights -** Mean annual number of nights with a minimum temperature greater than 25˚; and
- **Heatwaves -** Average of longest run of days in each year with maximum temperature greater than 30˚.

These are presented in Figure 3-13 and indicate the number of hot days is expected to increase to between 75 and 128 days (RCP4.6and RCP8.5) for Kempsey by 2090 compared to the historic average of 28 days. The number of warm nights is expected in increase to between 0.5 and 6.6 days (RCP4.6 and RCP8.5) by 2090 compared to the historic average of 0. The length of heatwaves is expected in increase to between 12 and 21 days (RCP4.6 and RCP8.5) by 2090 compared to the historic average of 5 days.

Sea surface temperatures around Australia are expected to rise by around 0.4-1.0˚C by 2030 and around 2-4˚C by 2030 under RCP 8.5 (CCIA, 2016).

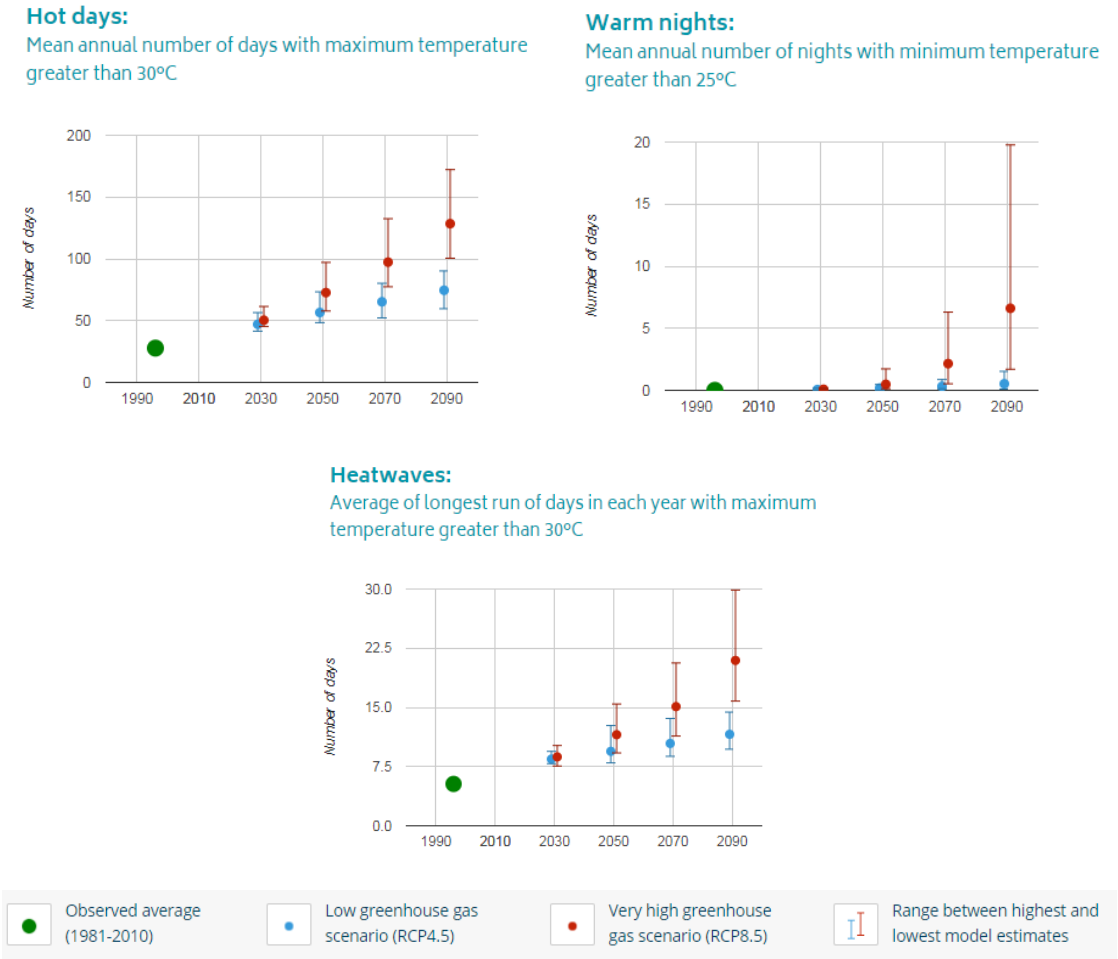


Figure 3-13 Future Temperature Information (CoastAdapt, 2017)

3.10.1.3 Rainfall

Climate change is expected to change average conditions by extending the extremes. That is, the intensity of extreme rainfall events (as represented by the number of wet days) may be increased, and the intervening periods of dry weather (as represented by the number of dry months) may be extended. Such shifts in these extremes will certainly challenge management of both floods and droughts, which are already incredibly damaging to the environment, society (particularly in areas that are dependent on agriculture and other rural activities) and the economy (via the cost of damages and reduced productivity).

Future rainfall projections have been determined based on the RCP scenarios including:

- **Very wet days –** mean annual number of days where rainfall exceeds the observed 99.9th percentile; and
- **Dry conditions –** mean annual (May to Apr) number of months when the total rainfall is less than the historic 10th percentile.

For Kempsey, these results are presented in Figure 3-14 and indicate that the number of very wet days is expected to increase to between 0.3 and 0.4 days (RCP 4.6 and RCP8.5) by 2090 compared to the current 0.3 days.

Such changes to wet days and dry weather over the coming future may be expected to enhance the level of expectation for flood relief via the existing flood mitigation scheme, while during intervening dry periods, access to water resources will be under increasing pressure.

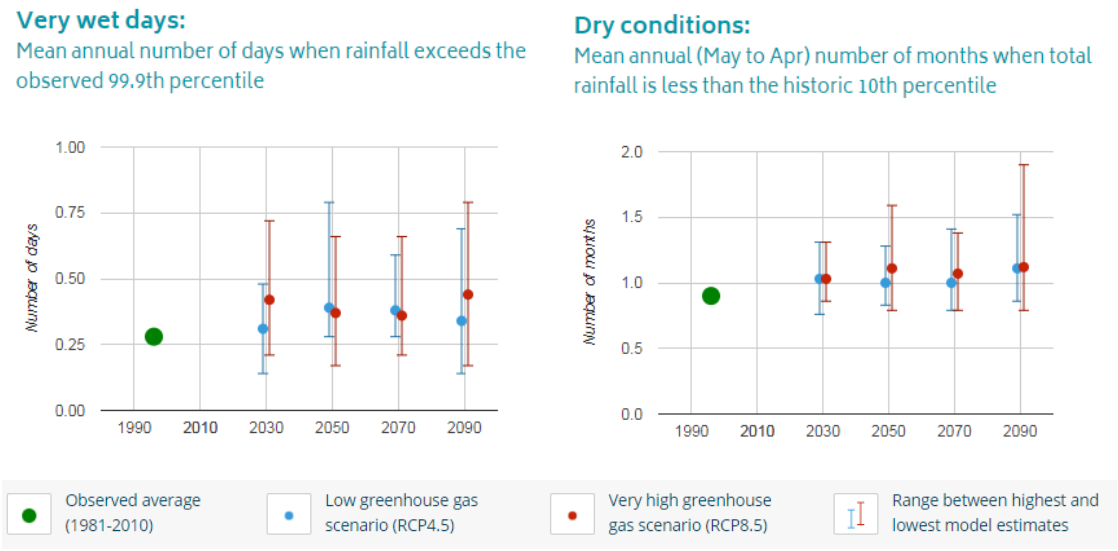


Figure 3-14 Future Rainfall Information (CoastAdapt, 2017)

3.10.1.4 Water Quality

Higher water temperatures and increases in extreme hydrological events, including floods and droughts, are projected to affect water quality and exacerbate many forms of water pollution – from sediments, nutrients, dissolved organic carbon, pathogens, pesticides and salt, as well as thermal pollution with possible negative impacts on ecosystems, human health, and water system reliability and operating costs (Climate Risk, 2010). Increasing atmospheric carbon dioxide concentrations are causing a global decline in oceanic pH leading to ocean acidity. Again, having a potentially negative impact on coastal ecosystems, for example a reduction in calcium carbonate availability for the protective shells of some species.

3.10.1.5 Climate Change Adaptation Actions

In 2007, Kempsey Shire Council became a signatory on the local Government Climate Mitigation and Adaptation Program. In 2010 Kempsey Shire Council partnered with Nambucca and Bellingen Shire Councils and were approved for funding under the Local Adaptation Pathways Program (LAPP)

to undertake risk assessments and develop an Adaptation Action Plan for the Region. The project was motivated by the recognised potential impacts of a changing climate upon the region's economy, community and environment. The project resulted in two documents:

- *Climate Change Risk Assessment: Kempsey Shire Council* (Climate Risk, 2010a); and
- *A Climate Change Adaption Strategy for Nambucca, Bellingen and Kempsey* (Climate Risk, 2010b).

While the adaptation actions in the above strategy are likely to remain relevant, it is important to adopt the latest climate change projections released by CSIRO and IPCC, as reproduced from the Coast Adapt website in Section 3.10.1, when undertaking studies and developing management actions for this CMP.

The *Climate Change Risk Assessment: Kempsey Shire Council* (Climate Risk, 2010a) determined the following higher level climate change related risks for the Kempsey Shire:

1. Impact on assets from extreme temperatures
2. Change in agricultural viability due to increase in extreme temperatures
3. Increased water consumption during extreme temperature events
4. Increased risk of bushfire (increased season and intensity)
5. Aged population - effect on health in extreme temperature events
6. Blackouts, brownouts in extreme Temperatures
7. Rainfall change, Increased vegetation growth (esp weeds)
8. Increasing impacts placed on biodiversity due to rising temperatures and changes to precipitation
9. Impact on rural production due to drought
10. Impact on industries, businesses and tourism due to flooding
11. Loss of food security during extreme weather events
12. Increased incidence of flooding affecting rural lands
13. Loss of rural lands as a rates source for Council due to sea level rise
14. Increased incidence of wetting/drying of soil horizons, affecting soils
15. Dislocation of community - flooding isolating workers/school students
16. Waterborne disease incidence risk increased eg Ross River virus due to a rise in average temperatures
17. National impact as highway/transport corridors cut due to flooding eg heavy transport/milk etc.
18. Sea level rise: Confluence of sea level rise and sea surge/storm event – with low lying coastal villages
19. Increased (high) cost to public infrastructure – due to sea surge/ storm event and sea level rise
20. Impact on service provision - local govt eg garbage
21. Increase price of petrol - need for increased public transport network

The above list of higher level risks is reflected through this scoping study in terms of the first pass risk assessment whereby the existing issues and risks are considered in terms of the potential future level of risk due to climate change, population growth and its related issues, refer Section 4.5.

The *A Climate Change Adaption Strategy for Nambucca, Bellingen and Kempsey* (Climate Risk, 2010b) outlines an adaptation strategy to address the higher level risks for Kempsey. Many of the actions are consistent with actions that should be undertaken as part of a CMP or floodplain risk management plan. The adaptation actions variously covered:

- Planning controls for developments in at risk lands (i.e. at risk of coastal / flood / bushfire hazards);

- Planning and other measures to reduce water usage, electricity consumption, fuel usage and so on, and to enhance community walkability, public transport usage, electric vehicle uptake, telecommuting and so on, to reduce Kempsey's contribution to climate-related hazards;
- Planning controls on the siting and placement of infrastructure, to reduce climate related risks;
- Buffers, corridors, constraints mapping, migration pathways, pest and weed control, land re-zoning and so on for natural environments (on private and public lands) and high value agricultural lands, to improve their resilience;
- Exploring options with the tourism industry, agricultural industry and other local economies to partner in climate actions that will assist to maintain the area as a high value tourism destination, high value agricultural industry (e.g. transitioning crops, stock) and local economy;
- Exploring actions to prepare Council's Water Supply System for seasonal changes in water availability (i.e. reduced mean monthly winter rainfall), including sources from harvesting, recycling, grey water use etc;
- Exploring actions to moderate the extraction of water by license holders, e.g. such as in periods of low versus high rainfall;
- Identifying and classifying climate risks to all assets (stormwater, wastewater, water supply, roads, bridges, waterway facilities such as boat ramps etc, recreational assets etc), and identifying preferred action to manage the risk and timing to implement (e.g. when replaced);
- Updating / preparing emergency response plans for climate related risks (flood, drought, coastal, bushfire etc) and the coincidence of such risks, to improve preparedness for risk impacts (e.g. power outages, isolation by flooding, food security, demands on and access to emergency services, adequacy of communication to locals and visitors etc);
- Investigating security of service provision (power and water supply) and determine management approaches for more frequent disruptions and prolonged outages of such services (continuity management plans, preparing at risk sections of community / locations, etc);
- Consulting and collaborating with neighbouring Councils, state agencies and infrastructure suppliers to jointly "climate proof" the region, such as through developing and implementing climate change mitigation and adaptation action plans;
- Educating and engaging the community regarding climate related risks and potential impacts, and the adaptation and mitigation actions to address the risks; and
- Investigating funding mechanisms to manage climate related risks.

3.10.2 Population Growth

The NSW Department of Planning and Environment suggests Kempsey Shire Council is likely to experience a 3% increase in population from 29,800 residents in 2016 to 30,700 residents in 2026. Scenario forecasting indicates this increase could range from 1% to 5% based on a range of possible population futures.

The Kempsey Local Growth Management Strategy (KLGMS) provides a framework for the integration of residential, rural residential, business and industrial growth strategies for the Kempsey Shire (KSC, 2010). It is anticipated that Kempsey will cater for approximately 12% of the total new dwellings in the shire required by 2031.

The North Coast Regional Plan 2036 sets an overarching vision and strategy for the Northern NSW coast. It has identified many Urban Growth Areas within the Kempsey LGA (Figure 3-15) including Kempsey, Crescent Head, Hat Head, and South West Rocks with a focus to deliver housing in Kempsey, Crescent Head and South West Rocks.

These urban growth areas lie within the catchment of the Macleay River, and connected Killick and Korogoro Creek estuaries. Urban growth places a range of pressures upon these estuaries, depending upon how the growth is planned and implemented. In the past, urban growth and development has placed pressures on the estuaries including:

- poor quality water from stormwater (urban) runoff,
- an increase in the quantity of runoff where pervious (vegetated areas) are replaced by impervious surfaces such as concrete and house roofs,
- increased recreational usage of the nearby waterways for boating, swimming, and fishing, which in turn may damage and reduce the extent and condition of aquatic, estuarine and riparian habitat (flora and fauna), and will increase the demands upon recreational facilities in the urban growth and nearby areas.

3.10.2.1 Influences of Population Growth on Visiting Population Pressures

In addition to the impacts of population growth within the Kempsey Shire, there will also be an increase in visiting populations from other areas of the state and country as these populations grow over time. The increase in tourism visitation add to the existing pressures from tourism upon the estuary as noted in Section 3.7.3, such as:

- increased demand and usage of recreational facilities and amenities, particularly in river foreshore reserves and in the coastal towns and villages that are already under high demand from tourism and are also earmarked for urban growth,
- increased pressure on the water supply, wastewater and waste management systems from the visiting population on a seasonal basis.
- Increased demand for holiday accommodation, which can place housing pressures within the local villages, and change the structure of community and ownership in these villages.

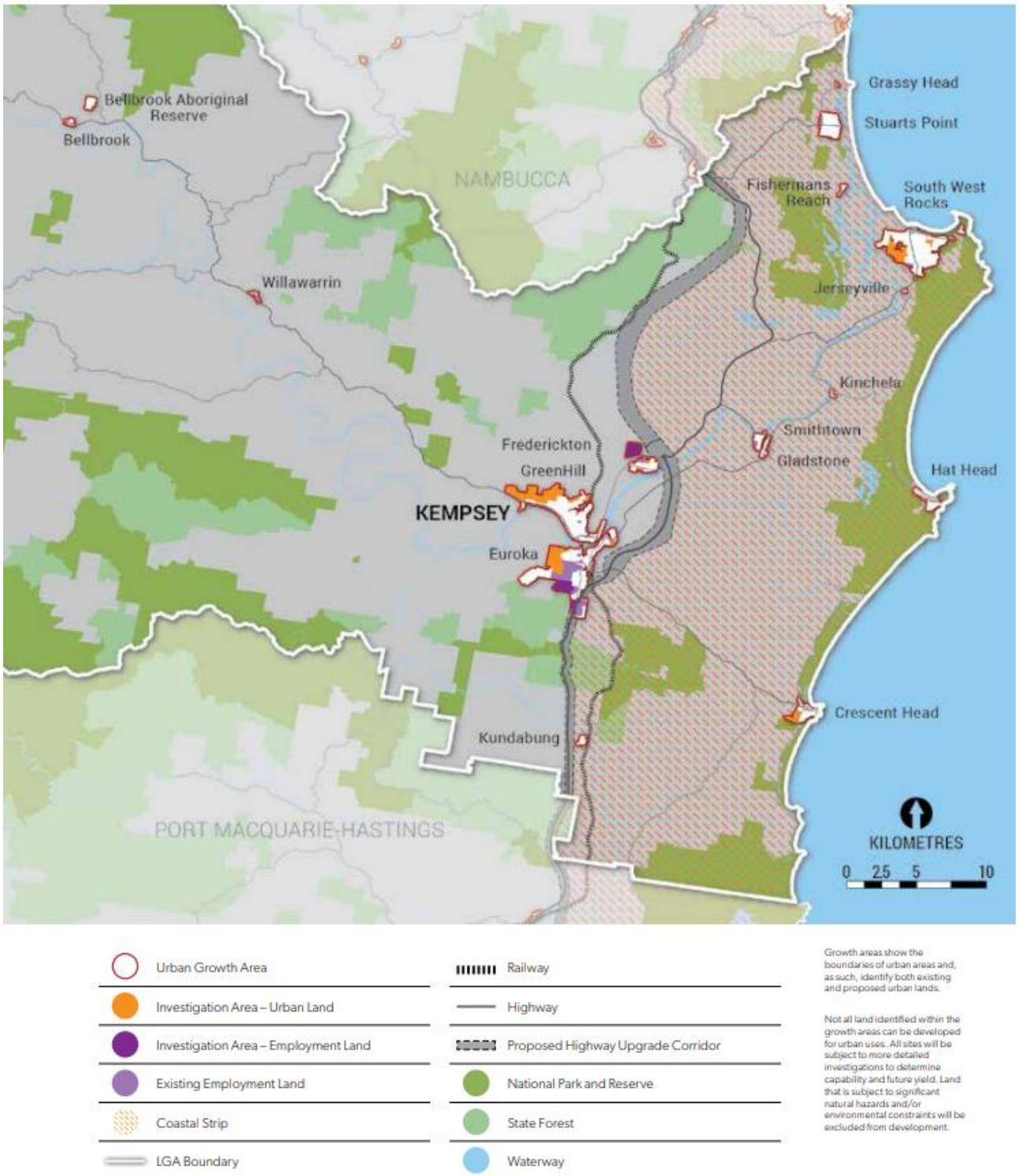


Figure 3-15 Urban Growth Areas identified in the Kempsey LGA

3.10.3 Rare and Potentially Catastrophic Events

Assessment of risks associated with natural hazards such as coastal and flood related hazards is guided by manuals and technical guidelines of the NSW Government. The manuals stipulate consideration of 1% AEP events (or equivalent) and worst case scenarios (such as the Probable Maximum Flood) when determining the likelihood of risk from coastal or flood processes. The NSW Government guidelines also encourage consideration of the coincidence of coastal and flood storm events, which have a very low probability but are potentially catastrophic. Climate change may potentially increase the probability of the coincidence of extreme storm events. Any future hazard assessments recommended by this Scoping Study would be expected to follow the latest technical guidelines, and consider rare and potentially catastrophic events.

4 Setting the Scope of the CMP

4.1 Chapter Overview

The scope for the CMP encompasses the geographic scope, the management areas to be covered, and the priority threats to the estuary that will need to be investigated further and managed through the course of the CMP. This chapter provides the results of the data information review, stakeholder consultation and first pass risk assessment, and the data analysis, to define the scope for the next stages of the Macleay River CMP.

4.2 Inputs to the Scope

The data information review, first pass risk assessment and stakeholder consultation were the key tools used to assess and determine the existing level of information about the Macleay River Estuary, including its values, issues and how these are being managed at present. Based upon the outcomes of these assessments, a gap analysis was conducted documenting: the performance of current management arrangements and governance structures, and the quality of existing technical information and baseline data. From this, the future studies that will set the scope of the CMP at its next stages were determined.

4.2.1 Data and Information Review

There is a great deal of information from a wide range of sources relating to the processes and management of Kempsey's coastal zone including the Macleay River Estuary. A critical review of this information was conducted to determine content of the reports / data that is directly or indirectly relevant to:

- understanding the environmental processes occurring within the estuary;
- identifying key values (or benefits) of each estuary, and known issues or threatening processes that may be reducing or undermining these values or benefits; and
- determining existing management actions or strategies for managing the threats, and if possible, the scale and effectiveness of these actions.

The data review focusses on environmental process information, threats and benefits, and existing management, as it is the quality of information available to define and assess these factors that determine what (if any) additional studies are required to prepare and effective CMP.

The data and information reviewed included:

- technical studies and academic literature;
- planning documents (e.g. strategic, operational and natural resource/coastal zone management plans); and
- spatial mapping and data.

A full list of documents and review of their adequacy or relevance to preparing the CMP is provided in Appendix B. Remaining sections of this chapter have utilised the outcomes of the data and information review to formulate the scope of the CMP.

4.2.2 Stakeholder Consultation

Various stakeholder consultation activities were undertaken to capture information for use in this Scoping Study. These activities have the additional advantage of establishing the community consultation process that will be carried through the entire CMP preparation and implementation. Activities included:

- Input from residents about how they used and enjoyed the Macleay River was gathered through an online survey, which was made available to the entire community through Councils' Online Engagement Portal (Your say Macleay).
- The First Pass Risk Assessment Workshop where activities were conducted to gather feedback from the state agencies and other stakeholders who are involved in estuary management.

Outcomes from this survey and other stakeholder activities were used to prioritise the relevant values/benefits and threats/risks and are described in Sections 4.3 and 4.4. A copy of the online survey and results are included in Appendix E.

4.2.3 First Pass Risk Assessment

The first pass risk assessment enabled consideration of the severity of known threats in the estuary, and the effectiveness of existing management actions – including from the existing CZMP – to manage the threats. Further description of the first pass risk assessment and outcomes are detailed in the final sections of this chapter.

4.3 Values and Benefits

Values and benefits of Macleay River relate to those physical assets (natural or built), resources, activities or general associations that are highly prized by the community (residents and visitors) and stakeholders, and are listed in prioritised order in Table 4-1. The occurrence of each value or benefit within each of the Coastal Management Areas is also indicated in Table 4-1.

The list of benefits was derived based upon the data and information review, particularly the previous CZMP, the information provided by attendees during the first pass risk assessment workshop, responses to the online survey, and from a comparison with the list of benefits developed for the NSW Marine Estate Statewide Threat and Risk Assessment (TARA) (BMT WBM, 2017).

Table 4-1 Values and Benefits in Prioritised Order

Value / Benefit (in order of priority[1])	Details	CW LR	CV	CE	CU
Accessible waterways and foreshores	e.g. boat ramps, jetties, wharfs, walkways & paths, picnic grounds, play and other equipment, reserves, safe swimming. Access and facilities supports recreation, participation, safety, health, wellbeing, relaxation and sense of community.				✓
Clean waters	e.g. for oyster growing, swimming, and estuary health.	✓	✓	✓	✓
Healthy estuarine habitats (which supports abundant fish, birds and other wildlife in and around the river)	This includes: saltmarsh, mangroves, seagrass, beach and mudflats, shallow soft sediments, rocky shores, subtidal reefs, planktonic assemblages, fish assemblages and other fauna assemblages. Healthy habitats provide for endangered ecological communities (EECs) and threatened and protected species (FM Act, BSC Act, EPBC Act).	✓		✓	
Enjoying the biodiversity, beauty, naturalness and scenery of the Estuary	e.g. Land and water-based.	✓		✓	✓
Floodplain wetlands	Belmore Swamp, Clybucca Wetlands, Yarrahappini Wetlands, Kinchela Swamp, Swan Pool, and others. Floodplain backswamps cover 60% of the Macleay's 400 km^2 floodplain, and are responsible in large part for the ongoing health of the estuary.	✓	✓	✓	✓
Abundance of recreational opportunities in the water and on the foreshore	There are very high rates of community participation in fishing and boating, as well as opportunities for swimming, kayaking, walking, bush walking, birdwatching, picnicking and so on. This directly supports health and wellbeing and sense of community.				✓
Accessible, productive farmland	Provides direct economic value, and indirectly provides social wellbeing and sense of community.				✓
Flood mitigation	To improve the safety and wellbeing of the people during floods, and to support accessible, productive farmland.		✓		✓
Healthy riparian and terrestrial habitats	This supports estuary water quality and habitat health, and provides for EECs and threatened and protected species (FM Act, BSC Act, EPBC Act).	✓		✓	✓
Economic value from tourism and recreation	Direct tourism economic values and indirect recreation economic values arise from fishing, boating, tours, holiday letting and other recreational activities by locals and visitors to the Estuary. These economic values are enhanced by the biodiversity, beauty, naturalness and scenery of the Estuary.				✓
Cultural heritage and use	Includes tangible and intangible Aboriginal cultural heritage (traditions, spiritual values, knowledge, places, items, and source of food).			✓	✓
Oyster aquaculture	Providing direct economic value.				✓

[1] *Values have been ranked based upon feedback from attendees to the workshop and responses to the online community survey*
[2] *CWLR – Coastal Wetlands and Littoral Rainforest, CV – Coastal Vulnerability, CE – Coastal Environment, CU – Coastal Use.*

4.4 Threats

The threats relate to activities that directly or indirectly impact upon the values and benefits associated with Macleay River. Risk is often characterised by a reference to potential events and consequences, or a combination of these (ISO 31000:2009). In the context of this study, a threat may include a driver (issue, activity or process) that results in a detrimental impact(s) or consequence(s) to the values or benefits of the study area. For example, a sewer overflow (driver) may result in a detrimental impact to clean waters (value).

As part of the first-pass risk assessment process, an initial list of threats was derived using the list of threats from the MEMA TARA (BMT WBM, 2017). The list was then refined and ranked for the Macleay River based upon the data and information review, particularly the previous CZMP, the information provided by attendees during the first pass risk assessment workshop and responses to the online survey. As the initial list of threats was extensive, the threats were grouped into themes that are based firstly upon the 8 high priorities identified in the CZMP (GeoLINK, 2012), then other lower priorities from that document. The themes and associated threats are listed in order of priority as per the CZMP in Table 4-2 below.

The occurrence of each issue within each of the Coastal Management Areas is indicated in Table 4-2. Themes with direct and indirect influence on a coastal management area are differentiated by colouring of checkmarks in dark blue or light blue, respectively.

Table 4-2 Priorities and Threats

Theme	Threats	CW LR	CV	CE	CU
Impacts of Floodplain Management	Floodplain drainage, flood gates, other mitigation structures, and drain management has resulted in: • acid sulphate soils exposure, causing: – poor quality water being exported from the floodplain to the river; – "Black water" events and fish kills after rainfall; – Reduction in agricultural productivity • Loss of estuarine habitat, including floodplain wetlands • Reduced fish passage	✓	✓	✓	✓
Wetlands and Other Habitats	• Clearing of wetland habitats and other habitats • Excessive groundwater extraction. • Insufficient protections for EECs and other key habitats (e.g. coastal wetlands outside of the CW LR area), particularly from clearing on private property. • Insufficient protection for migratory shorebirds and other important wildlife • Impacts from invasive species (pests, weeds and diseases) • *Note: floodplain management impacts on wetlands and other habitats is captured in above threat*	✓		✓	✓
Sedimentation	• Sedimentation of estuary watercourses, reducing navigation for boats				✓

Theme	Threats	CW LR	CV	CE	CU
Community Connection to the River	• Lack of sufficient and appropriate waterway access points and facilities (boat ramps, jetties, sewage disposal facilities, fish cleaning etc) • Lack or loss of public foreshore access and facilities (e.g. reserves, paths, picnic tables, etc) • Loss of tourism opportunities where foreshore and waterway access facilities are lacking • Insufficient or inconsistent protections for Aboriginal and European cultural heritage	✓		✓	✓
Antimony, Arsenic and other Contamination	• Disturbance of contaminated sediments • Ongoing contaminated discharges from Legacy mines • Pollutants in discharges from present mining and other extractive industries • Bioaccumulation in the food chain	✓		✓	✓
Sea Level Rise Inundation	• Permanent increase in estuary water level with sea level rise • Increase in inundation (flood levels) during catchment rainfall and ocean storm events due to sea level rise • Traditional agricultural landuse within the floodplain wetland areas will lose productivity • Diminished effectiveness of drainage function of flood mitigation structures across the floodplain	✓	✓	✓	✓
Riparian and Foreshore Condition	• Clearing, fragmentation and degradation of riparian habitats • Foreshore and bank erosion, including degraded / failing bank protection structures • Degradation caused from stock grazing of creek banks, and riparian and aquatic vegetation, including wetlands	✓	✓	✓	✓
Fishery Productivity	• Poor water quality affecting Oyster Aquaculture • Reduction in abundance of species and trophic levels • Excessive or illegal extraction (i.e. fishing) • Insufficient protections / habitats for endangered Black Cod and other native fish species • Ocean temperature shift resulting in fish species moving south	✓		✓	✓
Catchment Influences on Water Quality	• Agricultural diffuse source runoff • Stormwater discharge and runoff (resulting in litter, plastics, etc and / or erosion) from urban development • Septic runoff, sewage overflows and sewerage outlets • Clearing, fragmentation and degradation of terrestrial habitats • Occasional algal blooms, which potentially cause low dissolved oxygen, and may affect fauna and human health and safety	✓	✓	✓	✓
Governance	• Lack of community/stakeholder engagement • Inadequate, inefficient, over or under regulation • Over regulation resulting in restoration activities not supported by the permitting process	✓	✓	✓	✓

4.5 First Pass Risk Assessment

4.5.1 Process

A first pass risk assessment is different to the full-scale detailed risk assessment that will be conducted in Stage 3 of the CMP preparation process. In a full-scale risk assessment, we specifically investigate the likelihood and consequence of individual hazards/pressure and combine these to derive the level of risk. The first pass risk assessment is a preliminary assessment that considers consequence and likelihood in combination and at high level, to determine risk as high, medium or low, see Figure 4-1. That is, likelihood and consequence are considered during the first pass risk assessment, in an inherent manner in determining the risk as either high, medium or low. The approach used here to assess likelihood and consequence inherently in determining risk at the first pass level is a valid and acceptable approach in accordance with the ISO 31000:2009 Risk Management Principles and Guidelines.

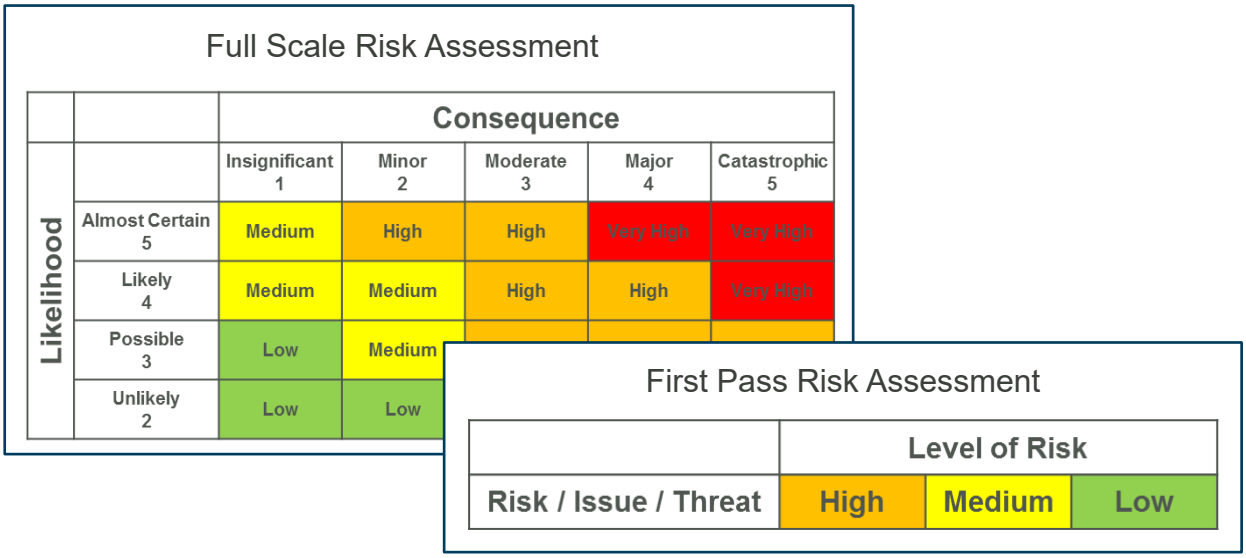


Figure 4-1 First Pass Risk Assessment vs Full Scale Risk Assessment

Given that the core aim of the CMP Scoping Study is to set the forward program for completing the remainder of the CMP (i.e. Stages 2 to 4), the first pass risk assessment approach was also designed to encompass the effectiveness of management of each threat, and the quality of available information to prepare actions to manage the threat.

With regards to the environmental, social and economic criteria for assessing each threat and determining a forward program of works for the CMP, the first pass risk assessment also considered the future level of risk in relation to the core changes that will affect the environment, society and economy, being climate change, and population growth (and associated development increase considering the core changes that will affect the environmental, social and economic

Therefore, first pass risk assessment approach used herein was to:

- broadly prioritise the known threats / risks / issues;

- assess the effectiveness of existing management actions and governance arrangements for these threats by considering the level of risk remaining after a management action is accounted for (also known as the 'residual risk'),
- investigate why a management action is effective or ineffective;
- consider the future trajectory of the risk taking into account future pressures such as population growth and climate change;
- determine knowledge gaps and other barriers to management.

In assessing the above, the scales listed in Table 4-3 were applied.

A First Pass Risk Assessment Workshop was conducted with attendees from Council, state agencies, local community groups, industry representatives and other stakeholders involved in the management of the Macleay River. Following the workshop, the assessment results were expanded upon using the information gathered from the data and information review. The results of the first pass risk assessment are used in the remaining sections of this chapter to define the scope of the CMP and forward works program. First pass risk assessment worksheets with outcomes are provided in Appendix F.

Table 4-3 Scales used in the First Pass Risk Assessment

Assessment	Scale		
Overall Level of Risk (accounting for existing management arrangements and data)	**High**	**Medium**	**Low**
Current Threat	**High**	**Medium**	**Low**
Future Threat	**High**	**Medium**	**Low**
Adequacy of Existing Management Arrangements	**Inadequate**	**Moderate**	**Adequate**
Adequacy of Existing Data to support management through the CMP	**Inadequate**	**Moderate**	**Adequate**
Recommended Studies	High Priority (in Stage 2)	**Medium Priority**	**Low Priority**
	High Priority (investigate through CMP)		

4.5.1.1 Uncertainty

Uncertainty is inherent in any risk assessment, and particularly so a first pass risk assessment. At the scoping study stage of the CMP process, not all information is, or should be expected to be, available to assess the threats and determine management actions for the estuary, and this is indeed the reason that a scoping study is conducted.

It is important to recognise that the first pass risk assessment is just that – a first pass assessment to assist with prioritising future studies to be completed for preparation of the CMP, and not the final

outcome or solution of the CMP itself. Nor will this process be the only assessment of potential threats and consequences in the estuary, with a detailed risk assessment required at Stage 2 – 3 of the CMP process, and feeding into the preparation of actions for implementation in the CMP.

4.5.2 Results

In the following pages, for each threat theme a description of the overall threat level, the current threat and future threat levels, the adequacy of existing management arrangements, the suitability of existing data, and then recommended studies for the following stages of the CMP has been provided. The threat categories are presented in order from highest to lowest overall threat.

The first pass risk assessment process was used to determine the adequacy of existing management actions and arrangements, and then broadly determine the likely level of risk (or 'residual risk') from the threats. When combined with an understanding of the available data and information, studies and assessments at the next stages of CMP preparation were developed. That is, this report section provides a description of the current management arrangements, governance, and suitability of existing information, to inform subsequent stages of CMP preparation.

The first pass risk assessment provided a process for investigating the existing information about each threat, and the current and future threat level, and therefore design the next stages of the CMP. That is, for some themes, further studies are required in Stage 2 to provide for targeted development of management actions. For other themes, the existing information is very good, but management approaches require updating. And for yet other themes, both the existing information and current management actions remain suitable to manage the threat, and are recommended to be directly transcribed into the CMP at Stage 4.

The first pass risk assessment process was run concurrently for the Macleay, Killick and Korogoro estuaries and, although the process was focused on the specific issues to each estuary, it became apparent that some issues were consistent across all the three systems. Furthermore, the three systems are also linked through the Macleay flood mitigation scheme. In this case, consideration and recommendations have also been made regarding efficiencies and economies of scale that may be achieved where some issues and further studies can be run concurrently for all three systems.

A summary table of the threats assessed and their current, future and overall risk rating (accounting for existing management effectiveness and the availability of data also) is provided in Table 4-4.

Table 4-4 Summary of Level of Risk from Threats Determined through First Pass Risk Assessment

Theme	Threats	Current Risk	Future Risk	OVERALL Risk
Impacts of Floodplain Management	Floodplain drainage, flood gates, other mitigation structures, and drain management has resulted in: • acid sulphate soils exposure, causing: – poor quality water being exported from the floodplain to the river; – "Black water" events and fish kills after rainfall; – Reduction in agricultural productivity • Loss of estuarine habitat, including floodplain wetlands • Reduced fish passage	High	High	High
Wetlands and Other Habitats	• Clearing of wetland habitats and other habitats • Excessive groundwater extraction. • Insufficient protections for EECs and other key habitats (e.g. coastal wetlands outside of the CW LR area), particularly from clearing on private property. • Insufficient protection for migratory shorebirds and other important wildlife • Impacts from invasive species (pests, weeds and diseases) • *Note: floodplain management impacts on wetlands and other habitats is captured in above threat*	High	High	High
Antimony, Arsenic and other Contamination	• Disturbance of contaminated sediments • Ongoing contaminated discharges from Legacy mines • Pollutants in discharges from present mining and other extractive industries • Bioaccumulation in the food chain	High	High	High
Catchment Influences on Water Quality *(excluding floodplain influence which is covered in first theme)*	• Agricultural diffuse source runoff • Stormwater discharge and runoff (resulting in litter, plastics, etc and / or erosion) from urban development • Septic runoff, sewage overflows and sewerage outlets • Clearing, fragmentation and degradation of terrestrial habitats • Occasional algal blooms, which potentially cause low dissolved oxygen, and may affect fauna and human health and safety	High	High	High

Theme	Threats	Current Risk	Future Risk	OVERALL Risk
Foreshore and Riparian Condition	• Clearing, fragmentation and degradation of riparian habitats • Foreshore and bank erosion, including degraded / failing bank protection structures • Degradation caused from stock grazing of creek banks, and riparian and aquatic vegetation, including wetlands	Medium	High	High
Sea Level Rise Inundation	• Permanent increase in estuary water level with sea level rise • Increase in inundation (flood levels) during catchment rainfall and ocean storm events due to sea level rise • Traditional agricultural landuse within the floodplain wetland areas will lose productivity • Diminished effectiveness of drainage function of flood mitigation structures across the floodplain	Medium	High	Medium
Community Connection to the River	• Lack of sufficient and appropriate waterway access points and facilities (boat ramps, jetties, sewage disposal facilities, fish cleaning etc) • Lack or loss of public foreshore access and facilities (e.g. reserves, paths, picnic tables, etc) • Loss of tourism opportunities where foreshore and waterway access facilities are lacking • Insufficient or inconsistent protections for Aboriginal and European cultural heritage	Medium	High	Medium
Sedimentation	• Sedimentation of estuary watercourses, reducing navigation for boats	Medium	High	Medium
Fishery Productivity	• Poor water quality affecting Oyster Aquaculture • Reduction in abundance of species and trophic levels • Excessive or illegal extraction (i.e. fishing) • Insufficient protections / habitats for endangered Black Cod and other native fish species • Ocean temperature shift resulting in fish species moving south	Low	Low	Low
Governance and Engagement	• Lack of community/stakeholder engagement • Inadequate, inefficient, over or under regulation • Over regulation resulting in restoration activities not supported by the permitting process	Low	Low	Low

Impacts of Floodplain Management		
Overall Level of Risk *(accounting for existing management arrangements and data)*		**HIGH**
Current Threat	Floodplain management is known to have a substantial impact upon the health of floodplain wetlands and exposure of acid sulphate soils and in turn, black water and fish kill events, water quality, estuarine habitats, fish passage and fishery productivity.	**High**
Future Threat	Sea level rise is very likely to make many of the floodgates, ocean outlets and floodplain drainage unviable for flood protection and mitigation, as the water gradient from land to sea is reduced (or at times reversed). The changes in floodplain management required due to sea level rise could benefit the wetlands, provided this process is well managed. Regional population growth will also increase recreational users in the estuary. This may benefit the wetlands where the economic benefits from recreation and tourism and the demand for clean water and good habitat to support this in turn adds pressure to change floodplain management in favour of wetlands.	**High**
Adequacy of Management Arrange-ments	No management actions were recommended for fast tracking to the CMP. The CZMP showed sound intent towards improving floodplain management for wetland outcomes, and this intent should be retained. However, implementation was hampered by the substantial overlap, questions over responsibility, lack of clarity about expected benefits (which is needed for bringing local landholders onboard) and separation of actions for discrete areas. Some management actions have been implemented, or are underway. Those that weren't are generally not considered workable or suitable to be carried forward to the new CMP. As noted in Section 3.5.1.2, there have been no significant storm events over the implementation phase of the CZMP, therefore the adequacy of emergency responses has not been tested.	**Inadequate**
Adequacy of Existing Data	There is a wealth of excellent ecological information about the Macleay, e.g. extensive vegetation mapping, potential EEC mapping, and estuarine macrophyte mapping, to guide the location and environmental value of floodplain wetlands. There is presently no model / analysis of the relationship between wetland hydrology and flood mitigation structure management, or wetland economic value. Much of the baseline data for modelling is present (e.g. LiDAR, aerial photography, river bathymetry, tides, hydrology, flood mitigation structures and management regimes etc). The flood model established for the Lower Macleay Flood Study may provide a suitable base model for further studies.	**Moderate**
Recommended CMP Initiative	**Establish a coastal and estuary management committee**, see Governance. North Coast LLS, DPI Agriculture, and DPI Fisheries are vital partners for investigating and initiating any actions in the floodplain. A strong working partnership could be coordinated through the committee. Engagement with local landholders will also be vital to the successful implementation of actions to improve floodplain management. Their involvement should therefore commence in tandem with preparation of the CMP.	**High Priority**

Impacts of Floodplain Management		
Recommended Studies	**Stage 2: Tidal Inundation Study**, to support understanding of changes to floodplain management and wetland hydrology. See Sea Level Rise Inundation for further details.	**High Priority (in Stage 2)**
	Assessment (e.g. modelling) for whole floodplain system to clarify how management of drains and flood gates could be changed to improve wetland hydrology (e.g. which gates/drains may have greatest benefit to which wetlands etc). • The assessment must be linked with. the updated Lower Macleay Floodplain Risk Management Plan (expected to follow the Lower Macleay Flood Study). That is, wetland management will need to be viewed in the context of risk to life and risk to property from floods. Conversely, flood risk management for property should consider the economic value of the wetlands. • Some wetlands already have projects in progress (e.g. Collombatti-Clybucca, see Action 7.2 and 7.3; Yarrahappini, see Action 10.1). These wetlands are still needed in the model to provide a whole-of-system overview, although further management action may not. • Because Belmore Swamp, Kinchela Swamp and Swan Pool are part of the Macleay floodplain, Killick and Korogoro Creeks should also be included in the assessment. • When designing the scope of works, consider including groundwater flow and groundwater extraction in the model.	**High Priority (investigate through CMP)**
	Economic cost benefit analysis of changes to wetland hydrology through floodplain mitigation structure management, wetland migration / inundation management. • The study should include determining the economic value of floodplain wetlands to local economy e.g. through provision of clean water, reduced exposure of acid sulphate soils (black water events and fish kills) and fish habitat, which in turn supports recreation, tourism and industry (oyster aquaculture, commercial fishing) • GeoLINK (2010) identified that floodplain wetland systems (particularly lagoonal wetland systems) such as those found in the Macleay floodplain are 'one to three orders of magnitude more productive than their downstream systems'. Information regarding the productivity of wetland systems should be included in the economic assessment • Consider linking economic and hydrology models, to demonstrate what floodplain management or land management to allow SLR inundation actions may have greatest economic benefit. • Economic modelling should aim to provide clear justification for investment, to support grant applications for implementation. • Consider ecology input to provide guidance on economic valuations of wetland benefit. Assessment must also consider impact of loss of agricultural productivity on local economy. • Because Belmore Swamp, Kinchela Swamp and Swan Pool are part of the Macleay floodplain, Killick and Korogoro Creeks should also be included in the assessment.	**High Priority (investigate through CMP)**

Wetlands and Other Habitats		
Overall Level of Risk *(accounting for existing management arrangements and data)*		**HIGH**
Current Threat	A range of threats contribute to the degradation of habitats, including clearing (particularly on private land), invasive species (weeds, e.g. *Salvinia molesta*, pests and marine diseases), over-extraction of groundwater that reduces wetland water tables further, and trampling by recreational users. This is in addition to the impacts of flood mitigation structures (see prior section). Without proper protections for EECs and other key habitats, (e.g. wetland areas outside of the CWLRA, National Park zone etc), the impacts of these pressures are heightened. Poor condition of adjacent riparian and terrestrial habitats can also reduce estuarine habitat health.	**High**
Future Threat	Increased land and water temperatures with climate change will exacerbate the threat from land clearing, excess groundwater extraction and invasive species. Inundation with sea level rise will place pressure on wetland habitats to migrate, particularly for species at the edge of the tidal limit. Conversely, where adequate planning for migration is implemented, using both tidal inundation mapping projections and landholder relationships, sea level rise may offer an opportunity to reclaim or revert unsuitable farmland to wetland and riparian habitats. Planned regional population growth (e.g. urban release areas) and the increase in visitation to the Macleay region may place additional pressures for clearing for development (urban, infrastructure) and increased recreational usage, which may increase trampling of habitats where access is not adequate or controlled.	**High**
Adequacy of Management Arrangements	Actions 11.3, 11.6 and 11.7 should be retained, combined, and reworded, e.g. “Investigate opportunities to implement further mangrove & saltmarsh habitat protection projects”, with action to make note that: projects are to use best practise approach(es) to stock exclusion and rehabilitation; and a campaign is required to enlist private landholders to undertake rehabilitation and protection of habitats on private lands. While LEP zoning and CWLRA mapping has increased the area of wetland habitat protected, there remain areas outside the protection of CWLRA, LEP or NP zoning. Some actions relate to National Parks wetland areas (e.g. Yarrahapinni, East Kinchela), which are already subject to POMs. There remains a role for Council to provide consistent management approaches where Council wetlands are adjoining NPWS wetlands. The CZMP includes a number of suitable actions for monitoring and managing shorebirds and their habitats sites (see Strategy 21). All of the actions are ongoing and found to be effective, so are recommended for fast tracking to Stage 4 of the CMP.	**Moderate**
Adequacy of Existing Data	There is a wealth of excellent information to determine the extents of coastal wetlands in the study area, e.g. extensive vegetation mapping, potential EEC mapping, and estuarine macrophyte mapping)	**Adequate**

Wetlands and Other Habitats		
Recommended Studies	**Stage 2: Tidal Inundation Study**, to support understanding of changes to floodplain management and wetland hydrology. See Sea Level Rise Inundation for further details.	**High Priority (in Stage 2)**
	Investigate migration pathways, barriers and resilience to sea level rise for fringing habitats The study should build upon the tidal inundation study (see Sea Level Rise Inundation). Wetlands, estuarine vegetation, riparian zones and other such estuarine habitats are to be included in the study.	**High Priority (investigate through CMP)**
	Economic cost benefit analysis of changes to wetland hydrology through floodplain mitigation structure management, wetland migration / inundation management (refer to Impacts of Floodplain Management). Study to be conducted for Macleay, Killick and Korogoro combined.	**High Priority (investigate through CMP)**
	Update the coastal wetlands and littoral rainforest area (CWLRA) mapping using existing information and ground-truthing, then pursue a planning proposal to include new or amend the existing CWLRA map in the CM SEPP. The CWLRA mapping shall be checked and updated to include all relevant areas of coastal wetlands and littoral rainforests in the catchment, as the CM SEPP provides additional legislative protection. Previous Council submissions to DPIE – PA on the CWLRA may provide a suitable starting point. Ground truthing of the potential EEC mapping and other existing habitat mapping sources would then be worthwhile to support updates and changes to the boundary of the CWLRA. Careful consideration of landholder and community objectives will be needed to support adding or removing CWLRAs.	**Medium Priority**

Antimony, Arsenic and Other Contaminants		
Overall Level of Risk *(accounting for existing management arrangements and data)*		**HIGH**
Current Threat	Ongoing discharges of antimony and arsenic from legacy mines is a known issue, as is remobilisation of contaminants throughout the river system particularly during floods when the As and Sb contamination leaching from the upper catchment is variously reworked into the estuary (tidal) reaches, the intertidal zone, and out to sea. The risk from of these contaminants on ecological health (ecotoxicity) is currently being researched. The risk to human health, through the food web, is also being researched, but is in its infancy. There are other current mines in the catchment. The re-invigoration of former mine deposits also remains a possibility. The mining industry is far more heavily regulated than in the past, reducing the likelihood of increased pollution discharges from current or new mines.	**High**
Future Threat	Until an appropriate method to rehabilitate or at the least reduce ongoing discharge of contaminants from the known Legacy (Derelict) mines is implemented, contaminants will continue to enter the estuary. Contaminants that have previously entered the system can also be expected to continue to be reworked and remobilised into the future. . Although research is ongoing, high level of risk also remains while there is incomplete information regarding the impacts of As and Sb.	**High**
Adequacy of Management Arrangements	Current management arrangements should be revisited and updated to reflect the ongoing and improved research occurring through the universities, and to reflect realistic priorities for inclusion in a CMP.	**Inadequate**
Adequacy of Existing Data	There is currently excellent information regarding the source(s) of contamination, how they may be mobilised throughout the estuary and research regarding ecotoxicity of the contaminants. More research is needed to better understand the risks from this contamination, and in the context of the CMP, what actions can and should be supported.	**Moderate**
Recommended Studies	Progress with Stage 3-4 as per CMP Manual, including Antimony and Arsenic Contamination as a potential risk, considering the below. **Stage 3:** Input to the risk assessment from academics currently researching mobilisation and ecotoxicity of As and Sb (i.e. UNE and SCU) is strongly recommended. The risk assessment should target the main knowledge gaps that are driving the high levels of risk, such as risk to human health from contact with contaminated soils and from ingestion through the food web (e.g. fish, agricultural products farmed on contaminated soils). **Options development should reconsider actions to manage contamination issues that are appropriate to the context of a CMP.** Contaminants are sourced from the upper catchment, but are found throughout the estuary. Known management knowledge gaps include a lack of environmental guidelines, and a lack of land use planning controls. The degree to which these knowledge gaps are a CMP issue needs to be determined. CMP actions may be best targeted towards providing support for ongoing research, in return for influencing research projects towards filling the main knowledge gaps.	*Minimum Requirement*

Catchment Influences on Water Quality		
Overall Level of Risk *(accounting for existing management arrangements and data)*		**HIGH**
Current Threat	Several threats pose a risk to water quality at present including: • Agricultural diffuse source runoff, particularly contributing increased nutrient loads and pesticides / herbicides. Nutrients increase the risk of algal blooms, which deplete oxygen levels during die-offs, in turn affecting fauna, and human health and safety • Stormwater discharge and runoff resulting in litter, plastics, etc and / or erosion, from development in Urban Growth Areas including Kempsey, Crescent Head, Hat Head, and South West Rocks. • Septic runoff, sewage overflows and sewerage outlets. • Clearing, fragmentation and degradation of terrestrial habitats. *Note: water quality impacts from Impacts of Floodplain Management and Antimony, Arsenic and Other Contaminants are dealt with in those themes.*	**High** ***(excluding floodplain influence)***
Future Threat	Planned regional population growth (e.g. urban release areas) and the increase in visitation to the Macleay region has the potential to increase catchment pollution, stormwater runoff and sewage overflows if these issues are not adequately managed.	**High**
Adequacy of Manage-ment Arrange-ments	A number of important water quality initiatives have or are being implemented such as upgrades to various STPs (West Kempsey, Frederickton, Gladstone). Stuarts Point village is also planned for sewer connection, although the pipeline pathway may interfere with an important Aboriginal midden site. There are no specific actions recommended for fast tracking to Stage 4 of the CMP. Council undertakes regular water quality monitoring, as part of the Eco Health monitoring program, and this should be continued as monitoring for the CMP. The comparison of the EcoHealth monitoring and waterway health relative risk mapping (Section 3.5.3.3) clearly demonstrates that waterway health in the estuary is affected by activities and catchment runoff upstream of the tidal limit of the Macleay River. Management of water quality and waterway health in the estuary will also require actions within the upper sub-catchments and therefore adjacent council local government areas (LGAs), namely. Armidale, Walcha and Uralla. The MEM Strategy is well resourced, and provides an opportunity for support from the existing state agencies involved in delivering the MEM priority water quality strategy (e.g. LLS, DPI Agriculture, DPI Fisheries) and to engage with the upstream councils including Armidale / Dumaresq and Walcha to implement actions to reduce diffuse source runoff from rural lands.	**Moderate**
Adequacy of Existing Data	The existing baseline water quality data and ongoing monitoring of water quality (through the Eco Health program, Mika et al UNE) and the existing risk based assessment of contributions from land use in the sub-catchments is adequate to identify those catchments that contribute to and / or experience poor water quality and guide management efforts towards these priority catchments. The existing data is detailed in Section 3.5.3. Poor water quality associated with flood mitigation structures is addressed in the Impacts of Floodplain Management theme. E.g. WMAWater (2009) determined the main cause of poor water quality to be floodwaters released after flood events. Flood structure management between rainfall events also reduces water quality. The CMP is an avenue to manage diffuse and point sources of water pollution.	**Adequate**

Recommended Studies	Progress with Stage 3-4 as per CMP Manual, including Catchment Influences on Water Quality as a potential risk.	*Minimum Requirement*
	Water quality benchmarking and review monitoring data, objectives and program. This would support CZMP Action 24.1 (recommended to be retained as "support a Regional Ecohealth-style Program that monitors catchment to sea providing health assessment and identifies where strategic action is required to improve health").	**Medium Priority**
	Develop an integrated catchment and receiving water quality model, to investigate the influence of management options on improving water quality.	**Medium Priority**

Foreshore and Riparian Condition		
Overall Level of Risk *(accounting for existing management arrangements and data)*		**HIGH**
Current Threat	Riparian degradation is primarily due to stock grazing and weed infestation, particularly Cats Claw Creeper (*Dolichandra unguis*-cati) and Madeira Vine (*Anredera cordifolia*). The Action Plan for the Management of Vine Weeds in the Greater Macleay Catchment, 2018 was developed to guide future work and investment in addressing vine weeds in the greater Macleay Catchment. There are areas of riverbank erosion, as well as failing bank protection structures that are known to exist, with some actions underway.	**Medium**
Future Threat	While landholder behaviours can be shaped over time, sea level rise will exacerbate pressures on riparian habitats in locations where they cannot migrate in response to inundation, and this may result in a loss of habitat over time. For example, where riparian habitat directly abuts tilled farmland or urban development, the ability to migrate is restricted. Conversely, where adequate planning for migration is implemented, using both tidal inundation mapping projections and landholder relationships, sea level rise may offer an opportunity to reclaim or revert unsuitable farmland to wetland and riparian habitats. Increased land and water temperatures with climate change will exacerbate the threat from stock grazing and weed infestation. Planned regional population growth (e.g. urban release areas) and the increase in visitation to the Macleay region may increase the pressure for clearing for development (urban, infrastructure) and increase recreational usage, which may increase trampling of habitats and bank / foreshore erosion where access is not adequate or controlled.	**High**
Adequacy of Management Arrangements	Current management actions remain largely relevant, with some combining and rationalising required. New actions should also be investigated through the CMP preparation. The effects of sea level rise should also be accounted for when planning rehabilitation efforts.	**Moderate**
Adequacy of Existing Data	Areas of degraded riparian habitat, bank erosion, river styles, ecohealth, riparian condition, vine weeds, macrophytes and areas of high conservation value should be (re) mapped or ground-truthed.	**Moderate**
Recommended Studies	**Stage 2: Tidal Inundation Study**, to support understanding of changes to foreshore and riparian extent and condition. See Sea Level Rise Inundation for further details.	**High Priority (in Stage 2)**
	Mapping and ground truthing of areas of bank erosion and riparian degradation, to bring existing information up-to-date.	**High Priority (investigate through CMP)**
	Investigate migration pathways, barriers and resilience to sea level rise for fringing habitats, see Wetlands and Other Habitats for further details.	**High Priority (investigate through CMP)**

Sea Level Rise Inundation		
Overall Level of Risk *(accounting for existing management arrangements and data)*		**Medium**
Current Threat	At present, the influences of sea level rise upon estuary water levels are not yet tangible	**Medium**
Future Threat	Sea level rise poses a very high future risk in terms of inundation through the permanent increase in water level across the estuary floodplain. Much of the floodplain is very low lying, at or around 1 m AHD. These low lying lands will become permanently wet by the end of the century based upon current sea level rise projections and tracking of measurements. Such permanent changes in estuary water levels will certainly impact upon the viability of certain land for agriculture, urban development and infrastructure, and in turn the local economy. Estuarine vegetation and ecological habitats at the intertidal fringes will also be substantially affected (as discussed further in the Wetlands and Other Habitats, and Foreshore and Riparian Condition). Sea level rise will also influence inundation during flood events (from rainfall and /or ocean storm events). Not only may flood levels be increased with sea level rise, the time taken to drain floodwaters will also be significantly increased. The increased flood risk will affect land uses, agricultural productivity, flood damages and the local economy.	**High**
Adequacy of Management Arrangements	Management actions in the CZMP are largely completed, providing an excellent base level of information (Adequacy of Existing Data, as below). There is a lack of information (mapping) of the permanent influence of sea level rise (i.e. the change in water level that will occur on a daily basis, not just during storms). Actions to plan for and manage sea level rise inundation are also required (to allow migration of habitats, changing of land uses etc). The Floodplain Risk Management Plan for the Lower Macleay should also be updated, once the Lower Macleay Flood Study is completed, to determine appropriate floodplain risk management options for flood risk that are cognisant of permanent inundation and habitat migration responses. As noted in Section 3.5.1.2, there have been no significant storm events over the implementation phase of the CZMP, therefore the adequacy of emergency responses has not been tested.	**Inadequate**
Adequacy of Existing Data	Suitable baseline data exists for any new or updated modelling required, e.g. lidar / topography, aerial photography, bathymetry, data on flood mitigation structures (e.g. flood gates), sea level rise projections, and tidal time series. Coastal inundation levels were provided in the Kempsey Hazard Definition Study for the open coast Kempsey CZMP. However, only a simplistic 'bath tub' approach was applied. Sea level rise projections are regularly updated by CSIRO and IPCC, for use in sea level rise impact investigations. Sea level rise inundation mapped by CoastAdapt also only use a bathtub approach. The Lower Macleay Flood Study (in prep.) uses a hydrodynamic (flood) model to investigate inundation levels during coincident catchment rainfall and oceanic storm events, and therefore will provide superior analysis of coastal inundation during storms, compared with the "bathtub" mapping, as above. The Lower Macleay Flood model is also likely to be suitable for modelling tidal (permanent) inundation due to sea level rise, to provide an improved assessment compared with online sea level rise maps.	**Adequate**

Sea Level Rise Inundation		
Recommended Studies	**Stage 2: Tidal inundation study** to specifically model and map the permanent tidal water level in the estuary with sea level rise. A model approach is recommended, to improve projections compared with "bath tub" style sea level rise maps (available online) Modelling is expected to be straight forward, as there is already a hydrodynamic flood model established for the Lower Macleay. The modelling will be most cost effective to Council (and other partners) if combined with Killick and Korogoro Creek estuaries.	**High Priority (in Stage 2)**
	Stage 2: Prepare mapping of the Coastal Vulnerability Area. The CM Act provides clear definition of seven coastal hazards to be assessed through the preparation of CMPs. Of these, coastal inundation, tidal inundation and foreshore (bank) erosion are applicable in the estuary. Based upon the definition and / or mapping of these hazards, a CVA Map should be developed. Existing information is available (coastal inundation from the Kempsey Hazard Definition Study and the Lower Macleay Flood Study) or would be forthcoming (tidal inundation study noted above) to develop a CVA. Existing information on foreshore erosion areas may be used to develop the CVA, although re-mapping and ground-truthing is recommended in future (see Foreshore and Riparian Condition). Care will be required when mapping areas subject to inundation to avoid an unworkable overlap between the flood planning maps / levels, and the CVA maps. Consultation between DPIE – Coasts and Estuaries, DPIE – PA and Council may be required to resolve potential conflicts.	**High Priority (in Stage 2)**
	Stage 4: Undertake a Planning Proposal to adopt the CVA under the CM SEPP using outcomes of the Stage 2 mapping exercise. This will occur in parallel to CMP drafting.	**High Priority (in Stage 4)**

Community Connection to the River		
Overall Level of Risk *(accounting for existing management arrangements and data)*		**Medium**
Current Threat	Considerable work has been and is ongoing to improve the community's connection to the river, through improved provision and design of foreshore access and amenity, and improved boating access arrangements. Cultural and heritage values are typically protected in existing national park reserves (e.g. Clybucca Historic (Midden) Site, Yarrahapinni Wetlands NP). However, there remains more work that could be done.	**Medium**
Future Threat	Planned regional population growth (e.g. urban release areas) and the increase in visitation to the Macleay region will continue to increase the demands on the existing facilities; and then the potential for congestion, overuse and informal substitutes for facilities and access. For this reason, many existing management actions should be continued in the CMP.	**High**
Adequacy of Management Arrangements	Substantial work has been done to date to improve boating facilities. Much work is ongoing, and upgrades for some specific sites are imminent. These management actions should be fast tracked for inclusion in the CMP (Stage 4), see Appendix B.2, in particular: • Mattys Flat - Action 14.16 boat ramp upgrades are in progress, however requirement for a sewer pump out, expanded parking to support high usage and charter operators is to be fast tracked to CMP. This can be incorporated into Action 6.6. • Back Creek – Action 14.17 to be retained as ramp upgrade is pending. Action to be reworded to note need for toilet facilities. There remains high demand for boating facilities and upgrades, therefore an action to review of boating infrastructure demand, access and amenity at existing and new facilities, presumably in collaboration with TfNSW (e.g. updating the Macleay Region Boating Strategy) across the Macleay region should be investigated when preparing the CMP.	**Adequate**
Adequacy of Existing Data	There is already suitable information regarding community values and demand points for boating and foreshore access and facilities.	**Adequate**
Recommended Studies	Progress with Stage 3-4 as per CMP Manual, including Community Connection as a potential risk.	*Minimum Requirement*

Sedimentation		
Overall Level of Risk *(accounting for existing management arrangements and data)*		**MEDIUM**
Current Threat	Sedimentation of estuary watercourses reduces accessibility for boats. Sedimentation is a largely natural process. Given the high usage of the Macleay for boating, safety issues arise in relation to poor navigation from sedimentation. A key area of interest is Back Creek, which is used by boaters in some conditions to access the open ocean (as an alternative to the difficult bar crossing in the main Macleay entrance). DPIE – Crown Lands currently issues a dredging licence to a private contractor, however the dredging activity is not currently managed to improve navigability outcomes. It is noted that this issue relates to the settling of sediments, not turbidity and other water quality and ecological issues relating to sediments in run off, which is covered under the Catchment Influences on Water Quality threat.	**Medium**
Future Threat	Sea level rise is expected to influence entrance dynamics and conditions through beach recession and tidal inundation. This is likely to be accompanied by landward and upward translation of the entrance shoals. The extent to which this poses a threat to navigation is not known.	**High**
Adequacy of Management Arrangements	Actions to map and manage navigability of the Macleay, particularly through the entrance, are the responsibility of TfNSW, and is currently well managed. Back Creek remains an issue, with the need for a review of the dredging licence to achieve better outcomes for the community recognised in the open coast CZMP as well as the Macleay CZMP.	**Moderate**
Adequacy of Existing Data	Bathymetric surveys are conducted from time to time, with TfNSW maintaining a more current record of navigation issues, for use in their role to maintain waterway safety.	**Moderate**
Recommended Studies	Progress with Stage 3-4 as per CMP Manual, including Sedimentation as a potential risk.	*Minimum Requirement*

Fishery Productivity		
Overall Level of Risk *(accounting for existing management arrangements and data)*		**LOW**
Current Threat	Threats to productivity of the estuary fishery include: • Poor water quality affecting Oyster Aquaculture; • Reduction in abundance of species and trophic levels; • Excessive or illegal extraction (i.e. fishing); and • Insufficient protections / habitats for endangered Black Cod and other native fish species As there is already sufficient management initiatives, the risks to the productivity of the fishery are considered low.	**Low**
Future Threat	Regional population growth and the increase in visitation to the Macleay region will continue to increase the demands on the fishery, although there are suitable management actions in place to maintain suitable productivity.	**Low**
Adequacy of Management Arrangements	Issues such as oyster leases, the endangered black cod, monitoring fish stocks and checking recreational fish catch are the responsibility of DPI Fisheries, and are already well managed. No further investigations or actions through the CMP process are considered necessary.	**Excellent**
Suitability of Existing Data	DPI Fisheries maintains suitable up to date information to maintain its role in managing the productivity of the fishery	**Excellent**
Recommended Studies	No further analysis or options assessment of this risk is recommended in the CMP. The level of risk is low, and adequately managed.	*n/a*

Governance and Engagement		
Overall Level of Risk *(accounting for existing management arrangements and data)*		**LOW**
Current Threat	Main threats in relation to poor governance and management are: • Inadequate, inefficient, over or under regulation • Lack of community/stakeholder engagement	**Low**
Future Threat	Population growth may result in additional visitation and pressures on the estuary, which may result in increased conflict of use. A CMP is an important tool for providing integrated management of the coastal zone in line with current and future community values and needs.	**Low**
Adequacy of Management Arrangements	Stakeholder and community engagement is carried out regularly as part of large projects occurring in the Kempsey region or as part of studies that are setting the future direction for the area or community. The Macleay CZMP did not specifically set governance or policy actions. Many State Agencies play a role in the management of the NSW coastal zone and marine estate. Recent legislative changes have consolidated and streamlined the regulatory framework providing clarity around coastal management. While an estuary management committee was established in the past, there is currently no formal or informal arrangement that brings all land and waterway managers together.	**Moderate**
Suitability of Existing Data	Council has conducted extensive community consultation in the past in preparing the Macleay CZMP, as well as regular consultation for the Community Strategic Plan and community strategies.	**Excellent**
Recommended CMP Initiative	**Establish a coastal and estuary management committee**, to continue building relationships between various levels of government and help streamline CMP consultation requirements. It will be important to have Council, DPIE – Coasts and Estuaries, DPIE – Crown Lands , LLS, DPI, NPWS, TfNSW and others working together to ensure this CMP maximises the opportunities arising out of the recent coastal and marine estate reforms.	**High Priority**
Recommended Studies	Progress with Stage 3-4 as per CMP Manual, including Governance as a potential risk.	*Minimum Requirement*

5 Preliminary Business Case

5.1 Chapter Overview

This document outlines the preliminary business case for developing a CMP for the Macleay River, Killick Creek and Korogoro Creek Estuaries. The business case identifies the advantages of preparing a CMP for the three estuaries in tandem, to assist Council (and others) to seek and secure funding to develop the CMP. This business case demonstrates the benefit of preparing a CMP to the economic, social and ecological values of the Kempsey region. It clearly shows the need to take a long-term, risk based approach to coastal management, which can be facilitated through preparation of a CMP. The wealth of existing information and suitable management actions is demonstrated, and the CMP is illustrated as an opportunity to build on these past studies and planning. Initial cost estimates for each remaining stage of CMP preparation are provided. This business case also presents the case for conducting some or all of the subsequent stages of CMP preparation simultaneously, to reduce costs and increase resource efficiencies.

5.2 Why Prepare a CMP?

5.2.1 Economic, Ecosystem and Social Basis

A CMP aims to provide for the coordinated and strategic management of the coastal zone, in this case the Macleay, Killick and Korogoro estuaries and catchment. By providing a consolidated and coordinated management strategy, a CMP provides the action plan for maintaining and improving estuary health, and the social and economic values underpinned by this.

A catchment-wide approach is recommended (i.e. to consider issues beyond the mapped “coastal zone”), as catchment influences are key to the water quality and ecological health of the system, which in turn supports the social and economic values associated with the estuaries. As demonstrated through the risk assessment outcomes (Section 3.5), many of the highest threats to the estuary arise from management issues within the catchment, e.g. flood mitigations structures, historical contamination, catchment land use, habitat degradation, and so on.

Estuaries in the Kempsey Region are an important environmental, cultural, social and economic resource, forming the basis of the local rural and coastal economy. The area provides significant local, state, national and even international benefits through its ecological significance. As such these important resources must be managed effectively to ensure they remain sustainable and resilient into the future. A CMP will build on past studies and plans for the estuaries and coast and support an integrated and stakeholder driven approach for understanding risks from a range of pressures including urban growth and climate change, and develop a pathway forward for achieving the desired outcomes of stakeholders.

The Macleay River floodplain supports a range of agricultural industries, including dairy farming. The River waterway directly supports a commercial fishery and oyster aquaculture industry. The opportunities for boating, and shore- and boat-based fishing in the various waterways of the Macleay also help to support the local tourism economy, as well as the economy generated by local residents undertaking these recreational industries. For example, boat ramps at Back Creek and Mattys Flat are extremely popular with visitors and local charter services. In turn, clean waters, a natural and

diverse aquatic and riparian habitat, and its wildlife provide for the health of the local tourism and leisure industry, and associated social wellbeing. For example, wetlands of the Macleay Floodplain such as Clybucca Wetlands, Yarrahapinni Wetlands, Belmore Swamp and Kinchella Swamp, provide good water quality, aquatic and wetland habitat and fishery productivity in the Macleay River.

Killick Creek forms one of the major attractions of Crescent Head as a highly popular tourist destination on the NSW coast. It provides a safe swimming haven for families flocking to the adjacent Caravan Park and nearby township during holiday periods. The regional economy of Kempsey is also supported by Killick Creek as an element of the Macleay Flood Mitigation Scheme, which allows for faster drainage of the Belmore Swamp area via Killick Drain (and floodgate) as required. Aside from its value as a source of economic and social benefit, the estuary also supports important coastal wetland habitat, and associated wildlife.

Korogoro Creek is an important drawcard for tourists and local resident to the township of Hat Head, as its permanently open entrance provides a relatively safe entry and exit point to the open ocean for fishing and boating. Local fishermen also take advantage of the creek itself for shore and boat-based recreational fishing. The creek also offers a safe swimming haven. The area around the Creek is popular for 4WDing. Korogoro, like Killick Creek, supports nearby agricultural productivity in the Macleay catchment, as a drainage point during large floods for Kinchella Swamp and Swan Pool via floodgates into Korogoro Creek. Aside from the local village, much of the remainder of the catchment is protected within Hat Head National Park. Korogoro Creek hosts a rich variety of habitats including riparian woodlands and heaths, wetlands, mangroves, seagrass, saltmarsh, intertidal sands and mudflats (GECO Environmental, 2009).

As expressed in the vision statement for the estuaries, estuary health is highly beneficial in its own right. Pursuing actions to maintain or improve estuary health are viewed by managers of the estuaries and the local community to be of high importance, regardless of the economic and social benefit derived from this. The Macleay floodplain including Killick and Korogoro Creeks support 6 species listed on the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), 46 species listed on the *Threatened Species Conservation Act 1999*. At least 82 migratory bird species listed on the EPBC Act have been recorded in the study region. Migratory birds are internationally significant, and protected through international agreements.

5.2.2 Scientific Understanding to Support Coastal Management

The preparation of a CMP provides an excellent mechanism for filling data gaps that may currently impede effective management. A CMP also requires a detailed risk assessment and cost benefit analysis be undertaken to guide the selection of management options. Thus, the CMP process also provides a mechanism for developing actions for adapting to coastal hazard risks such as tidal inundation over time. Importantly, the CMP process supports identification of areas suited to future development and can help to identify opportunities in the region for adaptation to support a sustainable and resilient economy into the future.

There have been a number of studies conducted in the estuaries and coast in the study area, such as the estuary processes studies for the Macleay, Killick and Korogoro estuaries, regional habitat mapping, and the Kempsey open coast coastal hazards definition study. These provide a sound evidence base to underpin management plans. There is a need however to continue to augment the

existing data and reports and fill any gaps or information needs that have become apparent. And the additional studies recommended also aim to support investment in management actions.

For all of the estuaries, a significant data gap is detailed mapping of the inundation associated with sea level rise at various time intervals into the future. While it is noted that very good studies are available and are ongoing that map storm based inundation risks with and without sea level rise (i.e. from catchment rainfall and elevated ocean levels), specific information regarding risks from sea level rise that may occur on a daily to yearly basis regardless of storms is not currently available. This information is particularly pertinent in Kempsey because so much of the estuary catchments are low lying (<1-2 m AHD). A permanent increase in the tidal water level is likely to substantially impact upon estuarine dynamics, chemistry (e.g. acid sulphate soils) and surrounding land availability for agriculture, particularly where agricultural lands compete with riparian and aquatic habitats for land.

5.2.3 Existing Management Arrangements

The estuaries have been the subject of previous management investigations and each has an existing CZMP or EMP prepared under the former NSW Coastal Management Framework and *Coastal Protection Act 1979*. The plans vary in age and in the extent to which actions have been implemented, with the Killick Creek EMP prepared in 2006, Korogoro Creek EMP in 2009 and Macleay River CZMP in 2012. CZMPs were intended to be implemented over a 5-10-year timeframe, therefore the existing EMPs and CZMP are past or very near to the end of their design life. Detailed review of the CZMPs for the Scoping Study has identified that all three plans should be updated to account for new knowledge, new or continually increasing threats, and for lessons learned from actions that have been implemented to date. Implementation of actions from the existing Macleay CZMP is reviewed in detail in Section B.2, Appendix B. Additionally, the new NSW Coastal Management Framework and *Coastal Management Act 2016* require all existing certified CZMPs to be updated by 2021.

It is important to recognise that developing a CMP does not mean starting from scratch. As outlined in detail in the Scoping Study reports, the CMP process inherently requires review of all previous actions to test their effectiveness for treating known risks, and retaining existing suitable actions by “fast-tracking” into the CMP at Stage 4. For known risks where the existing CZMP actions are no longer suitable (e.g. because they have been implemented, are no longer practical, were found to be ineffective, and so on), the CMP process provides for new actions to be formulated. It also enables actions to be identified for new risks and risks that may become apparent in the future, for example as a result of climate change, population grown and shifts in demographics.

The three Kempsey estuaries have a significant advantage in the governance context, in that they all lie within one local government area. This streamlines decision making and implementation in partnership with relevant public authorities and stakeholders who share management responsibilities for these systems. However, it can also challenge financial and other resource availability with the burden of estuary management falling to a single council. It also challenges the prioritisation that is required in allocating funding to actions in the three systems (regardless of whether the estuaries are covered under a single or separate CMPs). The significant funding boost to both coastal management and marine estate management given by the NSW Government (and the supporting state agencies who administer these programs) is expected to ease this financial and resource

burden. Section 23 of the CM Act states “Other public authorities to have regard to coastal management program and coastal management manual”. This also serves to improve collaboration between and ownership by local and state agencies for coastal management.

5.2.4 Risk Management Supported Through CMP Preparation

The CMP process provides a mechanism for identifying and treating risks associated with coastal hazards in the estuaries, for example, coastal inundation during storms and permanent inundation with sea level rise. NSW legislation promotes risk mitigation, with S733 of the *Local Government Act 1993* providing an exemption from liability for Councils provided they follow the specified guidelines, namely the CMM, when investigating and managing coastal risks.

Given that risks from permanent inundation with sea level rise are likely to be high in the Macleay region, the costs of “doing nothing” may be significant. The process of preparing the CMP, including tidal inundation studies in Stage 2, detailed risk assessment and cost benefit analysis for options in Stage 3, and preparing the CMP action plan in Stage 4, will provide information about the severity of risks and a long-term plan for mitigating and managing such risks.

5.3 Costs and Funding Options for CMP Preparation

5.3.1 Estimated Cost of Preparing the CMP(s)

The total cost of preparing the CMPs is estimated at:

- $360,000 for all 3 estuaries simultaneously; or
- $235,000 for the Macleay River;
- $125,000 for Killick Creek; and
- $125,000 for Korogoro Creek.

The cost advantages of conducting the CMP simultaneously across all three estuaries is clearly evident, as discussed further below.

Funding opportunities, responsibilities and cost sharing arrangements are also detailed below.

5.3.2 Cost and Other Savings Associated with Separate Versus Combined Studies

Given that many of the recommended studies are required for all three estuaries, and the estuaries are linked through the Macleay Floodplain, there are economies of scale from conducting relevant studies simultaneously in each estuary which can enable cost savings for Council and its State Government funding partners (particularly DPIE – Coasts and Estuaries). For example, the cost savings for conducting tidal inundation modelling for all three locations at once are significant (Table 6-1).

There are also likely to be efficiencies and cost savings from combining some of the recommended modelling studies into a single project, particularly as the main element of cost is in model set up, with the model then being suitable to investigate a range of questions or actions, with minor modifications or add-ons. The potential cost savings from this approach have not been documented,

as this would need to be explored further by Council when reviewing the recommendations of this Scoping Study to progress to the next stages.

Council (and DPIE – Coasts and Estuaries) may also consider how the CMPs for the three estuaries will be prepared, as there may be cost savings and other efficiencies to be gained by preparing the CMPs, or stages of the CMPs, simultaneously. For example, certain CMP actions may be relevant across all three estuaries, and so there may be resourcing efficiencies at all stages of options development (i.e. Stage 3), CMP preparation (i.e. Stage 4) and CMP implementation (i.e. Stage 5).

One disadvantage of this approach may be that the local particulars of Killick and Korogoro may be lost if combined with the Macleay. However, this risk could be mitigated by having separate risk assessments, CMP sub-plans or separate Action Plans, and so on to ensure that the smaller estuaries are sufficiently targeted in the CMP.

5.3.3 Funding Opportunities

The NSW government is committed to managing the coastal environment and marine estate of NSW. Major reforms have recently taken place and associated government funding has been allocated for coastal management ($87M package) and managing the marine estate (an initial $46M package). These funding packages are available to support preparation of CMPs, and further studies that support the CMP and management of the marine estate. The funding to prepare the CMP is expected to come from the NSW Coastal Management Program.

Once the CMP is completed, the NSW Coastal Management Program and a range of other grant programs are available to fund actions specified in a CMP. This includes the Environmental Trust, and. Much of the MEMA funding is expected to flow to North Coast LLS and DPI Fisheries to implement actions from the NSW MEM Strategy relevant to the North Coast region. As such, support for the CMP may be either in-kind support from these agencies to implement an action, or financial support to undertake actions the CMP where they align with or support an action or objective of the NSW MEM Strategy.

Supporting in-kind resources to prepare and implement the CMP may also be available via community participation and input from other interests particularly research institutions. Funding contributions may also be available through partnerships with private enterprises who obtain a direct financial benefit from the sustainable management of the estuaries.

5.3.4 Cost Sharing Arrangements

Responsibilities, collaboration and cost sharing arrangements will need to be discussed with all project partners, in order to commence Stages 2 to 4 of the CMP. Table 5-1 provides an example cost -sharing breakdown for the expected project partners to prepare a single CMP for the 3 estuaries combined for a $360,000 budget, or separate CMPs for each estuary for a total budget of $485,000, over a 3 year period (in order to meet the December 2021 deadline for CMPs in accordance with the CM Act). The values provided in the table provide Council with an indication of forward estimates to include in their operational plan and delivery program over the next 1 to 3 years.

Council will be eligible to apply for 'dollar for dollar' funding to prepare CMPs for the Kempsey estuaries under the NSW Coastal Management Program competitive grant program, and should budget for this accordingly.

Table 5-1 Example cost sharing arrangements for CMP preparation

Project Partner	CMP Approach	Individual Contribution (~ 3 years)	Annual Contribution	Total cost %
Council	**$360,000**: One CMP covering all estuaries	$180,000	$60,000	50%
Coastal Management Program (administered by DPIE – Coasts and Estuaries)		$180,000	$60,000	50%
Council	**$485,000**: individual CMPs for each estuary	$242,500	$80,833.33	50%
Coastal Management Program (administered by DPIE – Coasts and Estuaries)		$242,500	$80,833.33	50%

6 Forward Program

6.1 Chapter Overview

As stated in the Manual and as outlined in Section 1.3, preparation of the CMP is to be completed following a staged process (illustrated in Figure 1-4). The subsequent stages in this process after this Stage 1 Scoping Study are:

- *Stage 2 – Determine risks, vulnerabilities and opportunities* (through further detailed studies);
- *Stage 3 – Identify and evaluate options* (through risk assessment and cost, benefit analysis);
- *Stage 4 – Prepare, exhibit, finalise, certify and adopt a CMP* (leading to implementation); and
- *Stage 5 – Implement, monitor, evaluate and report* (to feedback to the cycle)

This chapter provides:

- A summary of the requirements, process and expected outcomes for Stages 2 to 4 outlined from the Manual (Part B);
- A summary of the recommended studies, investigations and assessments proposed forming the forward program, as an outcome of this Stage 1 Scoping Study; and
- A summary of CMP project governance recommendations for the Kempsey estuaries.

6.2 CMP Stages 2 to 4 Key Requirements – from the Manual

6.2.1 Stage 2 – Determine risks, vulnerabilities and opportunities *(through further detailed studies)*

Stage 2 of the CMP process involves undertaking detailed studies that will assist Council in identifying, analysing and evaluating risks, vulnerabilities and opportunities in the study area. The studies conducted during Stage 2 are to provide information to support decision-making in the subsequent stages of the CMP planning process.

In summary, the Coastal Management Manual identifies Stage 2 as including the following:

- engaging with the community and stakeholders
- refining understanding of key management issues
- identifying areas exposed to coastal hazards and threats to coastal values
- analysing and evaluating current and future risks (detailed risk assessment)
- identifying scenarios for social and economic change and related opportunities for coastal communities
- preparing a planning proposal to amend maps of coastal management areas, to commence the Gateway process
- identifying timing and priorities for responses, thresholds and lead times.

6.2.2 Stage 3 – Identify and evaluate options *(through risk assessment and cost, benefit analysis)*

Stage 3 of the CMP process requires Council to identify and evaluate possible management options in order to select preferred coastal management actions to address the issues identified as affecting the CMP study area. The aim of Stage 3 is to develop strategies and actions that reduce exposure to coastal hazards, address coastal management issues and take advantage of opportunities.

In summary, the Coastal Management Manual identifies Stage 3 as including the following:

- identifying and collating information on management options
- evaluating management actions, considering:
  - feasibility (is it an effective and sustainable way to treat the risks?)
  - viability (economic assessment)
  - acceptability to stakeholders
- engaging public authorities about implications for their assets and responsibilities
- evaluating mapping options and implications if a planning proposal is being prepared
- identifying pathways and timing of actions
- preparing a business plan for implementation

6.2.3 Stage 4 – Prepare, exhibit, finalise, certify and adopt a CMP *(leading to implementation)*

Stage 4 of the CMP process involves a draft coastal management program being prepared, exhibited and then submitted to the Minister for certification. It is a mandatory requirement of the Coastal Management Manual that a draft CMP be exhibited for a period of at least 28 calendar days. It is also a requirement under Section 16 of the CM Act that consultation is carried out during the preparation of the draft CMP. Once the CMP is certified by the Minister, Council must publish it in the Gazette. The CMP takes effect on the date on which it is published in the Gazette (or on a later date if specified in the CMP).

6.3 CMP Project Governance Recommendations

With respect to governance arrangements for the Macleay River, Killick Creek and Korogoro Creek CMPs, the following recommendations are made.

- As the Macleay, Killick and Korogoro catchments to the tidal limit lie wholly within the Kempsey LGA (and within a single sediment compartment), Council is best placed to lead preparation of the CMP, with financial and technical support from DPIE – Coasts and Estuaries .
- It is recommended that a Committee or Working Group be convened by Council to assist in preparing and implementing the CMP from here onwards. The Committee should include key Council staff, representative Councillors, and the stage agencies (DPIE – Coasts and Estuaries , DPIE – Crown Lands, DPI, NPWS etc) who oversee, fund or are otherwise involved in coastal management, particularly for the Macleay, Killick and Korogoro estuaries.

- To take advantage of cost, time and resource efficiencies, it is recommended that a CMP(s) for the Macleay River, Killick Creek and Korogoro Creek be conducted in tandem. The most effective format would be a single CMP document that covers threats common to all estuaries (e.g. sea level rise inundation, coastal vulnerability, management of floodplain mitigation structures), with subsections as required to manage estuary specific threats (such as antimony and arsenic contamination from the upper Macleay catchment; or entrance management at Killick Creek). Killick and Korogoro Creeks are part of the broader Macleay Floodplain, and so the systems are connected.
- Cost, time and resource efficiencies are achieved at many levels, such as the Stage 2 investigations that cover all estuaries; the Stage 3 and risk assessment and options studies to manage common threats; and even at the Stage 5 implementation where consistent actions can be rolled out across the connected catchments, or at an LGA scale.
- Further cost savings could be achieved where recommended modelling is combined into a single modelling project (e.g. tidal inundation, wetland hydrology, floodplain mitigation, water quality etc that may use the same underlying model framework).
- In investigating (Stage 2) and managing (Stage 3 to 5) threats, it is recommended that opportunities to link resourcing with or seek funding through the MEMA strategy should be sought.

6.4 CMP Scope Recommendations

The following recommendations are made as to the geographical and management area scope for the Macleay River, Killick Creek and Korogoro Creek CMP(s).

- It is recommended that a combined CMP for the three estuaries be undertaken. Further evidence of the governance and project efficiencies gained from this approach are given in Section 6.3.
- The estuary waterbodies and catchments as illustrated in Figure 2-1 for each estuary are recommended to be adopted as the geographical extent for the CMP.
- All coastal management areas as illustrated in Figure 3-1 for each estuary are to be included in the CMP scope.
- The study area for the combined CMP for the three estuaries should encompass the estuary catchments to the tidal limit, and consider issues in the waterway and catchment beyond the tidal limit where it is evident that such issues pose a significant risk to the estuaries.
- A catchment-wide approach has been adopted to allow issues beyond the mapped “coastal zone” to be addressed by the CMP. Catchment influences are key to the water quality and ecological health of the system, which in turn supports the social and economic values associated with the estuaries. As demonstrated through the risk assessment outcomes (Section 3.5), many of the highest threats to the estuary arise from issues in the catchment, e.g. flood mitigations structures, historical contamination, catchment land use, habitat degradation, and so on.
- It is recommended that a Planning Proposal be undertaken under the CM SEPP to adopt a coastal vulnerability area map (to be developed through a recommended Stage 2 study), see Table 6-1.

6.5 The Way Forward: CMP Stages 2 to 4 Recommended Studies, Investigations and Assessments

A clear, achievable and fit for purpose pathway to prepare a CMP within the financial and resource limitations of Council has been recommended. Those studies that are essential (mandatory) to enable preparation of the CMP across Stages 2 to 4 of the CMP are listed in Table 6-1. Table 6-1 provides indicative costs for the studies in each stage, and a combined cost for undertaking the CMP stages for all estuaries simultaneously. The table also provides a timeline for completion of the studies, with a view to completing the CMP by December 2021 in accordance with the CM Act.

Kempsey Shire is an area with abundant natural resources, however, this also means a lower population contributing to Council's budget for managing such resources. Therefore, even though the NSW Coastal Program is very well financed, Council remains stretched to provide the 50:50 financial input and staff time required to access this and other funding programs.

The forward program recommended here focuses on building upon the information and management experience from the existing CZMPs and preparing the CMP upfront (i.e. without a substantial burden of additional prerequisite studies), in straightforward compliance with the CM Act and Manual. The forward program also illustrates the cost efficiencies that can be gained by compiling the CMPs for all three estuaries combined.

Council has demonstrated its commitment to coastal management by including "continued preparation of CMPs" into its IPR Framework to date, including the long term Resourcing Strategy, Operating Plan and associated Delivery Program. Council is expected to continue this commitment through its IPR Framework. The forward program shown in Table 6-1 indicates the relevant IPR Framework documents (Operating Plan, Delivery Program and Resourcing Strategy) that the items in subsequent stages of CMP preparation will need to be incorporated into.

The additional studies identified and prioritised through the course of this scoping study (refer Section 4.5) are listed with costings in Table 6-2. This list is an excellent starting point for actions to be assessed in Stage 3 and 4 of preparation of the CMP. The important advantage of this approach for Council is that the CMP preparation process itself becomes the method to rigorously assess, design, cost, and evaluate the additional recommended studies listed in Table 6-2, and to weigh the benefits of these studies against other potential actions to manage high priority risks and improve outcomes for the estuaries. The CMP will in future provide the conduit to access further funding to implement such studies, in addition to the other actions that will be identified through the course of CMP preparation.

Table 6-1 Forward Program and Estimated Costs for Completion of a CMP(s) for Macleay, Killick and Korogoro Estuaries

CMP Stage	Item #	Details / Comments (refer also Section 4.5)	Macleay	Killick	Korogoro	Estuaries Combined	Time-frame	IP&R Link
All Stages **Community and Stakeholder Engagement**	1	• Implement community and stakeholder engagement strategy with ongoing internal and external engagement activities including surveys, fact sheets, information sessions, workshops, presentations, meetings etc (see Appendix A for the full CMP Engagement Strategy). • Periodically review, refine and update the strategy as the CMP progresses. • Establish a Coastal Estuary Management Committee	$30,000	$15,000	$15,000	$50,000	Year 1 to 3, & ongoing	Resourcing Strategy, Operational Plan (2019-2020 onwards), and Delivery Program 2017-2021 (onwards)
Stage 2 **Determine risks, vulnerabilities and opp's**	2.1	Tidal inundation study (to specifically model and map the permanent tidal water level in the estuary with sea level rise)	$50,000	$25,000	$25,000	$75,000	Year 1 (start)	Operational Plan 2019-2020
	2.2	Prepare mapping of the Coastal Vulnerability Area (desktop study using existing available information)	$10,000	$5,000	$5,000	$15,000	Year 1 (end)	Operational Plan 2020-2021
Stage 3 **Identify and evaluate options**	3.1	Full Scale Risk Assessment, including: • Specialist input from ecologists, water quality scientists, and contamination academics; • Use of Stage 2 study outcomes, e.g. tidal inundation. • Inclusion of existing management arrangements, and actions from previous CZMPs (as recommended in this SS), to evaluate the level of risk; • Workshops and input from all key stakeholders involved in estuary management i.e. Council staff across various departments, state agencies, industry representatives etc.	$40,000	$25,000	$25,000	$60,000	Year 2 (start)	Delivery Program 2017-2021, Operational Plan 2020-2021
	3.2	Options Development and Assessment, including: • Use of risk assessment outcomes to guide priorities; • Consideration of actions from previous CZMPs (as recommended in this SS); • Standard approaches for developing options; and • Standard / fit for purpose cost benefit / multi criteria analysis to select CMP actions.	$50,000	$25,000	$25,000	$80,000	Year 2 (end)	Delivery Program 2021-2025, Operational Plan 2021-2022

CMP Stage	Item #	Details / Comments (refer also Section 4.5)	Macleay	Killick	Korogoro	Estuaries Combined	Time-frame	IP&R Link
Stage 4 **Prepare, exhibit, finalise, certify and adopt CMP**	4.1	Prepare CMP in line with Stages 1 to 3 and in consultation with stakeholders and community partners. Exhibit draft, review, finalise and certify CMP.	$40,000	$20,000	$20,000	$60,000	Year 3	Delivery Program 2021-2025, Operational Plan 2021-2022
	4.2	Undertake a Planning Proposal to adopt the CVA mapping under the CM SEPP (cost is for external consultancy to assist Council).	$15,000	$10,000	$10,000	$20,000	Year 3	Delivery Program 2021-2025, Operational Plan 2022-2023
TOTAL FEE			**$235,000**	**$125,000**	**$125,000**	**$360,000**	3 years	

Table 6-2 Additional Recommended Studies for Consideration in the CMP(s) for Macleay, Killick and Korogoro Estuaries

CMP Stage	Priority	Details / Comments (refer also Section 4.5)	Macleay	Killick	Korogoro	Estuaries Combined
Stage 2 Determine risks, vulnerabilities and opportunities	High	Investigate migration pathways, barriers and resilience to sea level rise for fringing habitats	$30,000	$10,000	$10,000	$40,000
	High	Assessment (e.g. modelling) for whole floodplain system to clarify how management of drains and flood gates could be changed to improve wetland hydrology	$100,000	(inc w/ Macleay)	(inc w/ Macleay)	$100,000
	Medium	Mapping and ground truthing of areas of bank erosion and riparian degradation, to bring existing information up to date	$40,000	$10,000	$10,000	$50,000
	Medium	Water quality benchmarking and review of monitoring data, objectives and program	$30,000	$10,000	$10,000	$40,000
	Medium	Integrated catchment and receiving water quality model, to investigate management options. (this may be allocated to North Coast LLS / DPI Fisheries, through MEMA strategy 1 WQ)	$150,000	(inc w/ Macleay)	(inc w/ Macleay)	$150,000
	Medium	Review Entrance Opening Policy, considering climate change	n/a	$15,000	n/a	$15,000
	Low	Rock Revetment Condition Assessment	n/a	$15,000	n/a	$15,000
	Medium	Update the coastal wetlands and littoral rainforest area (CWLRA) mapping using existing information and ground-truthing; pursue a planning proposal to include new or amend the existing CWLRA map in the CM SEPP	$20,000	(inc w/ Macleay)	(inc w/ Macleay)	$20,000
Stage 3 Identify and evaluate options	High	Economic cost benefit analysis of changes to wetland hydrology to test options for floodplain structure management, and wetland migration.	$45,000	(inc w/ Macleay)	(inc w/ Macleay)	$45,000
Stage 4 Prepare, exhibit, finalise, certify and adopt the CMP	Medium	Additional consultation to develop Business Plan	$5,000	n/a	n/a	$5,000

7 References

ANU iCLAM (2007) **Back Creek South West Rocks Sustainability Assessment Report**

Australian Bureau of Statistics (2016). **2016 Census Quick Stats**, accessed 27 July 2018, < http://quickstats.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat>

BMT WBM (2006) **Killick Creek Estuary Management Study and Plan.**

BMT WBM (2013), **Kempsey Coastal Processes and Hazards Definition Study**, Prepared for Kempsey Shire Council

BMT WBM (2015), **Kempsey Coastal Zone Management Study**, Prepared for Kempsey Shire Council.

BMT WBM (2016), **Kempsey Coastal Zone Management Plan**, Prepared for Kempsey Shire Council.

BMT WBM (2017) NSW Marine Estate State wide Threat and Risk Assessment (TARA)

CoastaAdapt (2018). **CoastAdapt datasets**, accessed 27 July 2018, <https://coastadapt.com.au/tools/coastadapt-datasets#present-day>

Climate Change in Australia (2018). **Coastal and marine projections**, accessed 14 August 2018, < https://www.climatechangeinaustralia.gov.au/en/climate-projections/coastal-marine/coastal-marine-projections/>

Climate Risk. (2010a). **Climate Change Risk Assessment: Kempsey Shire Council**.

Climate Risk. (2010b). **Climate Change Adaption Strategy**.

Church et al. (2016): **Sea-Level Rise and Allowances for Coastal Councils around Australia** – Guidance Material. CSIRO Report

Dela-Cruz et al. (2017), **Risk-based framework for considering waterway health outcomes in strategic land-use planning decisions**, Office of Environment and Heritage and Environment Protection Authority, Sydney.

Department of Public Works and Services (1999). **Had Head Sewerage Scheme**

Dillion, M., McNellie, M. & Oliver, I (2010) Assessing the extent and condition of native vegetation in NSW, Prepared for Officer of Environment and Heritage.

EcoLogical (2008) **Environmental Investigation and Assessment of Strategy H of the Killick Creek Estuary Management Plan**

GECO Environmental (2005). **Macleay River Estuary Data Compilation Study**

GECO Environmental (2006). **Native Vegetation and Candidate Endangered Ecological Community Mapping Report**

GECO Environmental (2007). **Korogoro Creek Estuary Data Compilation and Processes Study Report**

GeoLINK (2009). **Macleay River Estuary Management Study and Plan** (Ecology Literature Review and Information Gaps)

GeoLINK (2009). **Macleay River Estuary Management Study and Plan**

GeoLINK (2010). **Macleay River Estuary and Floodplain Ecology Study**

GeoLINK (2012). **Macleay River Estuary Management Study**

GeoLINK (2012). **Macleay River Estuary Coastal Zone Management Plan**

GHD (2003). **Stormwater Management Plan – Crescent Head**

GHD (2007). **Report for Vegetation Mapping for Western Portion Kempsey LGA**

Hughes, P., & Sullivan, M. (2002). **Clybucca Historic Site. Informtaion for a Statement of Scientific / Archaeological Significance.** A report to the NSW National Parks and Wildlife Service, Conservation Programs and Planning Division by Huonbrook Environment and Heritage Pty Ltd, Canberra.

ID Landscape management (2005). **Macleay Estuary Data Compilation Study** (Flora and Fauna Habitat Study)

Id Community (2016). **Community Population Profiles**, accessed 20 July 2018, <http://content.id.com.au/community-profiles-australia >

Industry and Investment (2018). **Fish Kill Notification and Investigation Report**

KSC (2010). **Korogoro Creek South Bank Project – Stage**

KSC (2012). **Implementation of Strategy '18' Macleay River Estuary CZMP**

KSC (2012). **Korogoro Creek South Bank Foreshore Rehabilitation Project Overview**

KSC (2014). **Hat Head Flood Levee Audit Report**

KSC (2014). **Review of Environmental Factors for Korogoro Creek North Bank Foreshore Erosion Abatement Works**

KSC (2015). **Flood Levee Audit Reports**

KSC. (2019, November). **Background of Macleay River floodplain risk management**. Retrieved from Kemspey Shire Council: https://www.kempsey.nsw.gov.au/environment/floodplain/background-lower-macleay-flood-risk-management.html

MHL (2002). **Killick Creek Estuary Processes Study**

MHL (2003). **DIPNR Macleay River Estuary Tidal Data Collection**

MHL (2005). **DIPNR Korogoro Creek Tidal Data Collection**

MHL (2016). **Tidal data compilation study**

North Coast Local Land Services (2015), Fish kill highlights the need for Collombatti-Clybucca Floodplain Restoration, media release.

NSW NPWS. (1998). **Hat Head National Park Plan of Management.**

NSW NPWS. (2007). **Clybucca Historic Site Plan of Management.**

NSW NPWS. (2015). **Yarriabini National Park Draft Plan of Management.**

OEH (2018). **NSW Coastal Management Manual Part A**

OEH (2018). **NSW Coastal Management Manual Part B: Stage 1**

OEH, DPI, Southern Rivers CMA (2010). **Assessing the condition of estuaries and coastal lake ecosystems in NSW**

OEH, DPI, Southern Rivers CMA (2010). **State of the catchment reports (Northern Rivers region)**

Patterson Britton and Partners (2006) **Mattys Flat and New Entrance**

Roy, P. S., Williams, R. J., Jones, A. R., Yassini, R., Gibbs, P. J., Coates, B., West, R. J., Scanes, P. R., Hudson, J. P., and Nichol, S., (2001). **Structure and function of southeast Australian estuaries. Estuarine, Coastal and Shelf Science**. 53:351-384.

Royal Haskoning DHV (2017), **Mid-North Coast Boating Investigations Package: Back Creek Boating Access Improvements Investigation**, Prepared for NSW Roads & Maritime Services.

UNE Aquatic Ecology and Restoration Research Group (2007). **Antimony and arsenic dispersion in the Macleay River catchment**

UNE Aquatic Ecology and Restoration Research Group (2016). **Macleay Ecohealth Project 2015-2016**

UNE Aquatic Ecology and Restoration Research Group (2007). **Freshwater Macrophyte Communities of the Macleay River**

Webb, McKeown and Associates (2004). **Lower Macleay Floodplain Management Plan**

West G., (2018) Redefining the past – **The impact of digitising historic data on our understanding habitat change over time**, NSW Coastal Conference 2018.

Wetland Care Australia (2002). **Swan Pool Drainage Management Project**

WRL (2004). **Hat Head Dune Effluent Disposal Site Post Commissioning Groundwater Monitoring**

WRL (2011). **Rehabilitation of Yarrahapinni Wetlands National Park: Hydrodynamic Modelling of Tidal Inundation**

WMA Water (2009). **Macleay River Estuary Processes Study**

Appendix A CMP Engagement Strategy

Provided by Kempsey Shire Council

MACLEAY RIVER ESTUARY, KILLICK CREEK ESTUARY & KOROGORO CREEK ESTUARY COASTAL MANAGEMENT PROGRAM

Stakeholder Engagement Strategy

A document to guide the stakeholder engagement process for the preparation of the Macleay River Estuary, Killick Creek Estuary & Korogoro Creek Estuary Coastal Management Programs

Kempsey Shire Council

Contents

Macleay River Estuary, Killick Creek Estuary & Korogoro Creek Estuary Coastal Management Program Stakeholder Engagement Strategy

1 Introduction

The Macleay River, Killick Creek and Korogoro Creek Estuaries Coastal Management Program "Stakeholder Engagement Strategy" has been prepared compliant to and consistent with the core principles of the Kempsey Shire Council Community Engagement Strategy – Procedure 2.3.1 (2011), Part 3 of the *Coastal Management Act2016* and the NSW Coastal Management Manual (OEH, 2018).

This Stakeholder Engagement Strategy has been developed to formulate a strategic approach for the purpose of community and coastal management stakeholder engagement (inform & consult) to;

1) assist Council in the preparation of the Coastal Management Programs, in accordance with the *Coastal Management Act2016* and the NSW Coastal Management Manual (2018), and
2) raise awareness of coastal management reforms and legislative requirements.

Note: It is proposed that this Stakeholder Strategy be reviewed following the completion of the Stage 1: Scoping Study

1.1 Deliverables

Coastal Management Program:

Coastal Management Program sets out the long-term strategy for the coordinated management of the Macleay River, Killick Creek & Korogoro Creek estuaries coastal zones with a focus of fulfilling the objectives of the *Coastal Management Act 2016*. The CMP's will aid Kempsey Shire Council to identify, understand, prepare for and respond to the uncertainties of a changing coastal estuarine environment.

Key Project Milestones (dates to be confirmed following engagement of Consultant)

Date Month/Year	Activity (Refer Section 5.2 for further details)
April 2018	General Media Release No1 – Commencement of Stage 1 (Scoping Study)
October 2018	Completion of the Context & Scoping Study Report
	General Media Release No2 – Commencement of subsequent Stage (TBD)
	Facilitation of Community Workshop
	Draft Macleay River Estuary Coastal Management Program prepared
	Public Exhibition of Draft Macleay River Estuary Coastal Management Program
	Draft Macleay River Estuary Coastal Management Program forwarded for Certification
	Macleay River Estuary Coastal Management Program adopted by Council
	General Media Release No3

1.2 Statutory framework

The development of the Coastal Management Program follows statutory obligations and regulations set out in the *Coastal Management Act2016*, *State Environmental Planning Policy (Coastal*

Management) 2018, the *Environmental Protection & Assessment Act 1979* and the *Local Government Act 1993.*

2 Background

Macleay River Estuary
In 2012 Kempsey Shire Council with financial and technical support from the OE&H (Estuary Program) prepared the Macleay River Estuary Coastal Zone Management Plan (2012), in accordance with the NSW Estuary Management Manual (1992) and the NSW Guidelines for Preparing Coastal Management Plans (2010).

In accordance with Section 55G (4) of the *Coastal Protection Act 1979* (now repealed) Council submitted the Macleay River Estuary CZMP to the Minister for the Environment for consideration of the CZMP to be certified. Council was advised by the Minister that as a result of amendments to Coastal Management legislation, the Macleay River Estuary CZMP in its current form did not meet the requirements of the Act and as such could not be certified.

Killick Creek Estuary
In 2006 Kempsey Shire Council with financial and technical support from the DNR (Estuary Program) prepared the Killick Creek Estuary Management Plan (2006), in accordance with the NSW Estuary Management Manual (1992) and the NSW Guidelines for Preparing Coastal Management Plans (2010).

Council has been advised by the Minister that as a result of amendments to Coastal Management legislation, the Killick Creek EMP in its current form will not meet the requirements of the Act and as such would not be certified.

Korogoro Creek Estuary
In 2009 Kempsey Shire Council with financial and technical support from the DECC (Estuary Program) prepared the Korogoro Creek Estuary Management Plan (2009), in accordance with the NSW Estuary Management Manual (1992) and the NSW Guidelines for Preparing Coastal Management Plans (2010).

Council has been advised by the Minister that as a result of amendments to Coastal Management legislation, the Korogoro Creek EMP in its current form will not meet the requirements of the Act and as such would not be certified.

Council's Commitment
Acknowledging that the preparation, certification and implementation of the Coastal Management Programs is an important component of long-term sustainable use of the estuaries, Council is committed to upgrading the existing Plans to a CM Program format that complies with all current coastal legislation obligations.

2.1 Goals of Stakeholder Engagement Strategy:

1. To provide the community and coastal management stakeholders with appropriate levels of information on the preparation and development of the Coastal Management Programs.
2. To engage the community and coastal management stakeholders to seek their involvement, collaboration and input into the preparation and development of the Coastal Management Programs.

2.2 Aims of the Macleay River, Killick Creek & Korogoro Creek Estuaries Coastal Management Program:

1. Sustainably manage the health of the Macleay River Killick Creek, and Korogoro Creek Estuaries for the well-being of the environment and the social, cultural and economic well-being of the people, and build the resilience of the estuary to current and future pressures.
2. The objectives for the Macleay River CMP reflect those of the CM Act.
3. The CMP shall provide the long term coordinated strategy for managing the coastal zone of the Macleay River Estuary.

2.3 Key Engagement Strategy Messages:

- What is the rationale behind Council preparing a Coastal Management Program?
- What are the legislative changes to coastal management and what processes are driving coastal management reforms?
- What changes to the existing Plans will be required to comply with current coastal management legislation?
- What coastal management areas will the Coastal Management Programs cover?
- Are the management strategies within the existing Plans still relevant?
- Are there any "new or other" priority management objectives?
- What are the key issues and challenges to be included within the proposed CM Program?
- How will the CM Program function?
- How will the management recommendation in the CM Programs fit into Council's planning and integrated planning and reporting framework?
- How will the information on the preparation and development of the CMP be disseminated?

3 Communication Objectives

The following objectives have been formulated to be specific, measurable, achievable, realistic and time-focused.

3.1 Stakeholder engagement strategy objectives:

1. To identify key stakeholders and community sector groups and individuals
2. To establish and effective communication mechanism to ensure all stakeholders are informed, consulted and engaged
3. To inform the community about coastal management reforms and program process
4. To provide an opportunity for community and stakeholders to provide input
5. To ensure Council and the community has a sound appreciation of the intent and objectives of the Coastal Management Program process
6. To ensure Council and stakeholders are fully informed of the outcomes of the Coastal Management Program
7. To seek community and stakeholder views on what actions Council will undertake in relation to identified coastal risks and when proposed actions scheduling
8. Review and assess the effectiveness of the engagement strategy at Key program milestone and/or completion of required stages

4 Stakeholders

For the purpose of the strategy, stakeholder are people, groups or organisations that have an interest in the coastal management.

4.1 Stakeholders relevant to the Macleay River, Killick Creek & Korogoro Creek Estuaries Coastal Management Program:

- General Community & community groups
- Kempsey Shire Council (Councillors & staff)
- Relevant state agencies (DPIE (EES, Coasts & Estuaries, Crown Lands, NPWS, EPA, PA), DPI (Fisheries, Agriculture), TfNSW, LLS etc)
- Specific interest groups (Fishing Clubs, Surf Life Saving Clubs, etc)
- Volunteer conservation groups (Macleay Landcare, Dune Care Groups, Rotary & Lions Clubs, Friends of the Macleay, etc).
- Local Aboriginal Land Councils
- Industry Sectors (Oyster Growers, Professional Fishers, Tourism etc).
- Academic Institutions
- Independent Consultants

5 Communication approach

The following section outlines the proposed communication and engagement approach during the preparation and development of the Macleay River Estuary Coastal Management Program.

5.1 Roles and Responsibilities

Primary Council Officers;

1) Council's Senior Natural Resources Officer
2) Council's Coordinator of Strategic Planning and Natural Resources
3) Council's Community Engagement Officer

Primary OE&H Officers

1) Coast & Estuary Officer

Consultants

Stage 1 – BMT Pty Ltd

5.2 Staged Communication & Engagement Methods

A range of ***staged*** communication and engagement methods will be used to reach identified stakeholders and promote the preparation of the Coastal Management Programs for the three estuarine systems. Intended methods include, posting project information and response software on Councils website and social media sites, distribution of project Milestone media releases, Council notices in local paper and Mayoral column, Council reports, community workshops and stakeholder meetings and providing and maintaining a primary project contact point within Council (Section 7).

5.3 Internal council communications

Department	Staff	Communications Task	Timeframe/due	Responsibility Name
Customer Service	Customer Service Officers	Provide background information Advise on existing information database Provide relevant contact information	April 2018	SNRO
Communications	Web Administer Communications Manager	Provide background information Advise on existing information database Provide relevant contact information Arrange Web page production	April 2018	SNRO
Councillors	All	Report to Council	At completion of Stage1 Subsequent Key Milestone / stage Report	SNRO
Leadership Executive Team (LET)	General Manager & Directors	Presentation & notices	At completion of Stage1 Subsequent Key Milestone / stage Report	SNRO
All	All	Advise & Provide background information Seek department input	At commencement of Program and throughout the preparation phases	SNRO

* SNRO (Kempsey Shire Council's Senior Natural Resources Officer)

The following Table identifies other councils and state agencies that are required to be consulted in accordance with Part 3 16 1(b) and Schedule 1 of the *Coastal Management Act 2016.*

5.4 Adjoining Council & Public Authorities communications

Name	Communication Methods	Timeframe	Responsibility
Nambucca Shire Council	Direct phone & email contact Project updates prepared for MIDROC meetings Technical Group meeting notes	As required	SNRO
Port Macquarie Hasting Council	Direct phone & email contact Project updates prepared for MIDROC meetings Technical Group meeting notes	As required	SNRO
Armidale Regional Council	Direct phone & email contact Project updates prepared for MIDROC meetings Technical Group meeting notes / representatives	As required	SNRO
Walcha Council	Direct phone & email contact Project updates prepared for MIDROC meetings	As required	SNRO

	Technical Group meeting notes / representatives		
Uralla Shire Council	Direct phone & email contact Project updates prepared for MIDROC meetings Technical Group meeting notes	As required	SNRO
Public Authorities & Agencies	Technical Group Representatives	Technical group meetings and As required	SNRO

5.5 External communications

Project Milestone	Proposed communication tool	Audience group	Purpose of communication	Whose Responsibility	When
Stage 1:	Scoping Study				
Submission of Grant application	NRG or Technical Group Meetings	Technical Group (see Section 5.5)	To advise that applications have been submitted	KSC	NRG & Tech. Group Meeting
Confirmation of Grant funding	Meeting	KSC Natural Resources Group (see Section 5.6)	To advise on outcome of Grant application submission	KSC	Following notification from Funding Program
Preparation of Consultancy Brief (Stage 1 – Scoping Study)	Phone & email	Submission Review Team	To seek agency input and finalise Consultancy Brief	KSC & OE&H	Nov 2017
Consultant Engagement	Media Release E Tender	Qualified Consultancy Organisations	To seek Consultant submission	Submission Review Team	Feb 2018
General Media Release No1	Local Print & Radio media releases Community notice boards Councils Have Your Say Web page & social media interfaces	General community & Interested stakeholder groups	To advise : 1) that a Consultant has been engaged to prepare Stage 1 – Scoping Study and that the Coastal Management Programs 2) that community input can be provided through the Have Your say website	KSC Technical Group	April 2018
Risk Assessment	Workshop	Key Stakeholders & Agencies	To elicit key knowledge. Conduct risk assessments	Consultants KSC	May 2018
Context & Scoping Study Report completed	Council's Web page & social media interfaces	General community	For general information	KSC	Following endorsement by OE&H
Scoping Study finalised	Council Report NRG & Tech. Group meeting	Council, NRG & Tech. Group & general community	To advise that the Scoping Study has been completed and endorsed by DPIE	KSC	Following endorsement by OE&H

Project Milestone	Proposed communication tool	Audience group	Purpose of communication	Whose Responsibility	When
General Media Release No2	Local Print media Radio & television Community notice boards	General community & Interested stakeholder groups	To inform of the outcomes of the Scoping Studies and pathway forward.	KSC	When OE&H advises
Ensuing Stages	To be determined				
Submission of required Stage Grant Application	NRG or Technical Group Meeting	NRG & Technical Group	To advise on the progress forward.	KSC	Submission of Grant Application
Report to Council	Council Meeting	Councillors	To advise Council that Grant funding will be provided.	KSC	Following confirmation of successful Grant funding
Preparation of Consultancy Brief (Stages x) and select Consultants	Phone & email	Technical Group & Submission Review Team	To seek input and finalise Consultancy Brief	KSC & OE&H	Following confirmation of successful Grant funding
Consultant Engagement	Media Release E Tender	Qualified Consultancy Organisations	To seek Consultant submission	Submission Review Team	
Review Stakeholder Engagement Strategy	Meeting	NRG, Technical Group & Consultants	To evaluate effectiveness and adjust if required	Technical Group Consultants	
General Media Release No3	Local Print media Radio & television Community notice boards	General community & Interested stakeholder groups	To inform of the pathway forward. To advise of proposed Community Workshop	KSC	When OE&H advises
Community Workshop	Workshop	General community & Interested stakeholder groups	To inform of the process, finding & outcome to-date. To seek community input into DRAFT CM Programs	KSC – Technical Group - Consultants	Following 3rd media release
Review of initial DRAFT CM Program by Technical & NR Group	Meeting / presentation	Technical Group NRG Consultant	To review initial DRAFT CM Programs and ensure suitability	NRG – Tech. Group - Consultant	When initial DRAFT Coastal Management Programs has been prepared
Report to Council	Council Meeting	Councillors	Seek approval to put Draft CM Program on Public Exhibition	KSC	Following preparation of Draft CMP
Public Exhibition of DRAFT CM Program		General community & Interested stakeholder groups	To inform of the process, finding & outcome to-date. To seek community input into DRAFT CM Program	KSC	To be determined

Project Milestone	Proposed communication tool	Audience group	Purpose of communication	Whose Responsibility	When
Certification of DRAFT CM Program	Submission to Minister administering the Coastal Management Act	Minister administering the Coastal Management Act	A requirement under Part 3 (17) of the Coastal Management Bill 2016	KSC	Following completion of public exhibition period and completion of required or recommended modifications
Report to Council	Council Report	Councillors & general community	To inform that the CM Program has been Certified by the Minister and seek Council adoption of CM Program		Following receipt of Certification by the Minister
Gazettal Notice					Following adoption by Council
General Media Release No3	Local Print media Radio & television	General community & Interested stakeholder groups	To advise that the Macleay River Estuary Coastal Management Program has been prepared, Certified and adopted by Council	KSC	Following confirmation of Certification and inclusion in Government Gazette

6 Project Management

The following section outlines project management responsibilities and identifies stakeholder forum groups.

6.1 Kempsey Shire Council

Kempsey Shire Council is responsible for management and preparation of the Macleay River Estuary, Killick Creek & Korogoro Creek Coastal Management Programs. Council will oversee all aspects and stages of the project and provide resources to facilitate intended communication and engagement strategies, keep project records, administer funding agreements and prepare required reporting obligations. To assist Council two (2) primary Groups have been established to provide logistical and technical support.

6.2 Coastal Management Program Technical Group

A Technical Group of practitioners in the field of natural resource management will be formed and meetings held with the Technical Group to discuss the Coastal Management Programs.

The initial meeting will be held prior to the submission of Grant Application to the NSW Estuary Management Program. Additional meetings along with phone and email interaction will continue throughout the preparation of the CM Program.

The expert panel will be used to gain feedback and advice during the development of the Macleay River Estuary Coastal Management Program. The Technical panel will consist of representatives from the following organisations (if possible):

- Department of Planning, Industry and Environment (DPIE) – Environment, Energy and Science – Coast and Estuaries (DPIE – Coast and Estuaries)
- DPIE – National Parks and Wildlife Service (NPWS)
- DPIE - Planning and Assessment (DPIE - PA)
- DPIE – Crown Lands
- DPIE Regions, Industry, Agriculture and Resources – Fisheries (DPI Fisheries)
- DPIE Regions, Industry, Agriculture and Resources – North Coast Local Land Services (LLS)
- Transport for NSW – (TfNSW)
- Kempsey Shire Council (KSC)
- University of New England (UNE)
- Kempsey Local Aboriginal Land Council (KLALC)

6.3 Kempsey Shire Council's Natural Resources Group

In July 2012 Council formed a Natural Resources Group. The purpose of the NRG is to assist Council in the development and review of natural resource management policies and plans within the Kempsey Shire Council LGA.

7 Primary Communication Contact

Mr Ron Kemsley

Senior Natural Resources Officer – Kempsey Shire Council

Email: ron.kemsley@kempsey.nsw.gov.au

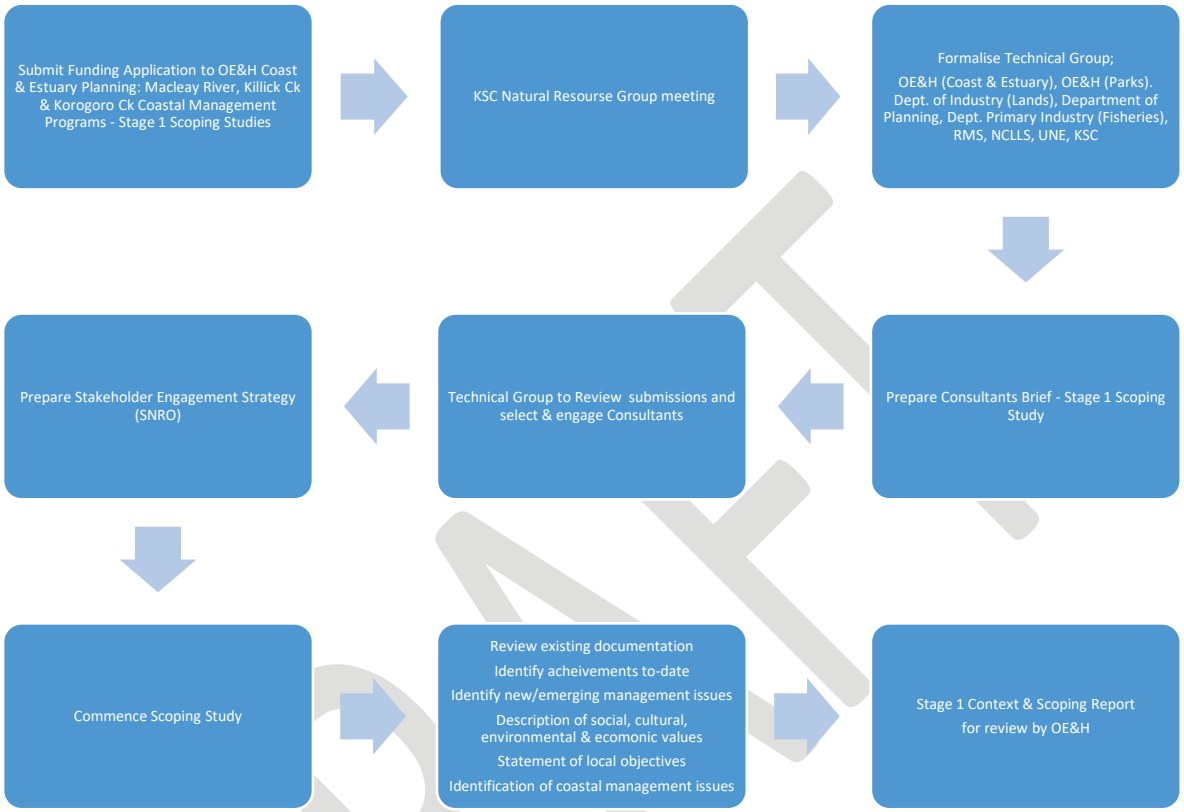
Office: (02) 6566 3248

Mobile: 0429392782

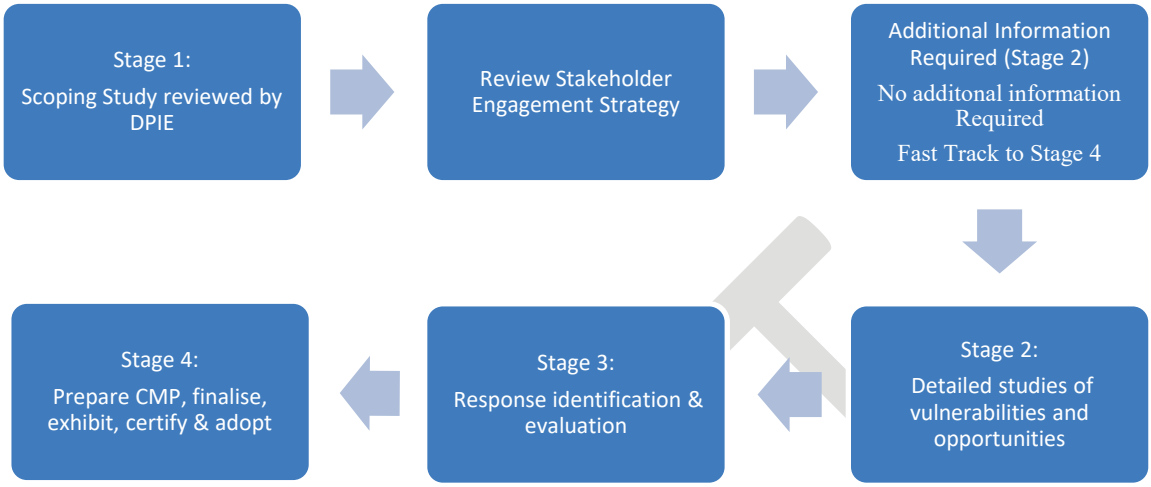
8 Engagement Strategy Evaluation & Review

Periodic evaluation by the Technical Group of the effectiveness of the engagement strategy is proposed following completion of specific project Milestones. The evaluation will assess what has been undertaken successfully and what (if anything) could be improved to fulfil the objectives of the engagement strategy.

9 Stage 1: Scoping Study Process



10 Coastal Management Program Process (post Stage1)



11 Approval of this plan

This communication plan has been reviewed and endorsed by:

Council name and contact…….

Date ……

Director of Sustainable Environment……

Date ……

Appendix B Data and Information Review

B.1 Listing of Documents and Relevance

To provide a quick reference within the review tables, the following colour-coded assessment of the data and reports was applied:

	Priority Data or Report: contains information/data directly relevant to developing the CMP.
	Secondary Data or Report: contains information/data indirectly relevant to developing the CMP, such as data useful for comparison with results, a CMP for adjacent area etc.
	Data or Report not relevant: contains little or no information/data relevant to preparing the CMP, the report need not be reviewed at later stages of the CMP's preparation.
	Data gap: data or report is not currently known to exist.

Table B-1 Spatial and Technical Data Review and Availability

Title/Folder	Published Year	Format	Author / Agency	Description	Data/GIS outcomes	Relevance to the prep'n of the CMP
Imagery		GIS Rasters		Aerial Imagery	.ewc files containing high resolution aerial imagery ranging from 10cm to 50cm grids.	Required base data for all mapping
LiDAR		GIS Layers		LiDAR data	1m, 5m, 10m LiDAR data	Required base data for inundation modelling and mapping
Macleay River Bathymetric Survey	2005	Drawings	DIPNR	Series of Hydrographic Surveys of the Macleay River	Detailed mapping of the Macleay River bathymetry	Required base data for inundation modelling
OEH tidal data compilation	2016	Report	MHL	Report presenting data collected by MHL in NSW estuaries between 1988 and 2015 as part of the NSW OEH Estuary Management Program.	Summarises data available for Macleay River (water level and water quality data)	Data required for tidal inundation modelling. Note, data is for Macleay. There are no tidal gauges in Killick or Kororgoro Creeks.
Local Environment Plans	2018	GIS Layer		Kempsey Local Environment Plans as at 13 March 2018	.tab files for LEP including	Required base data
Cadastre and Ownership Data		GIS Layers		Crown Land, LPI Lots and Operational Community Land layers	.tab files containing lot details for Crown Land, LPI Lots and Operational Community Land	Required base data
Vegetation Mapping		GIS Layers		Various vegetation maps	Potential endangered ecological communities, High Environmental Value sites, key fish habitats, Koala habitat mapping, detailed vegetation mapping. Split into east and west of the motorway.	Required output data for preparing actions, as describes environmental assets of the estuary
Quaternary Geology	2004	GIS Layers	NSW GS	Mapping of Quaternary geology of the NSW coast	.shp files containing surface, near surface and subsurface geology	Very useful base data when available
Soils		GIS Layers		Soil mapping for Kempsey estuarine catchment zone	Soil mapping as well as acid sulphate soil and acid soil risk mapping.	Very useful base data when available
Assessing the condition of estuaries and coastal lake ecosystems in NSW	2010	Report	OEH, DPI, Southern Rivers CMA	Provides a broad baseline to capture the condition of estuaries within NSW as at January 2009. Includes the methods for collecting, analysing and interpreting the data used to derive the condition.	Provides estuary definition data, contextual data (including morphometry, catchment areas, hydrology and hydrodynamics), estuary classifications as well as condition data which includes chlorophyll-*a*, turbidity, macrophytes and fish. The document contains a range of pressure data that was used to inform baseline condition.	Very useful base data when available

Title/Folder	Published Year	Format	Author / Agency	Description	Data/GIS outcomes	Relevance to the prep'n of the CMP
State of the catchment reports (Northern Rivers region)	2010	Report(s)	OEH, DPI, Southern Rivers CMA	A collection of 13 reports relating to biodiversity, water, land and community for the Northern Rivers Region. The reports assess the state of natural resources in the region.	Reports provide regional scale information on native vegetation, fauna, threatened species, invasive species, riverine ecosystems, groundwater ,marine waters and ecosystems, wetlands, estuaries and coastal lakes, soil condition, land management within capability, economic sustainability and social well-being and capacity to manage natural resources.	
Rehabilitation of Yarrahapinni Wetlands National Park: Hydrodynamic Modelling of Tidal Inundation	2011	Report	WRL	Technical report that details the hydrodynamic model developed, calibrated and applied to the Yarrahapinni Wetland National Park.	Results from 5 scenarios – simulation of existing conditions, simulation of initial restoration, fully restored system and fully restored system with SLR. Aerial imagery, DEM, TUFLOW model results including flood levels and velocities.	Report provides tidal inundation levels for one area of the estuary under specific condition. Levels will be very useful for comparison with future tidal inundation modelling
Flood & Mitigation		GIS Layers		Flood mitigation assets	.tab files containing location and details for flood level velocities, flood planning levels, flood bank rock protection, council drains, earth levees, flood gates, joint owned drains, bridges, floor and house levels.	Data will be useful for conducting tidal inundation modelling. Note, flood planning levels and velocities are expected to be superseded by Lower Macleay River Flood Study (Jacobs, in prep), which includes Killick and Korogoro Creeks.
Land Use Mapping		GIS Layer		NSW Land Use Mapping	A dataset of land use between June 2000 and June 2007 for NSW. Classified under NSW Land Use Mapping Program (LUMPA), NSW SCALD (Standard Classification of attributes of Land), ALUM (Australian Land Use) and Management).	Assists with understanding current threats and management options
Seven Oaks Drainage Union Map	1999	Mapping	DLWC	North Coast Region Seven Oaks Drainage Union	Outlines the drainage union boundary, union drains, drainage lines.	May be useful for understanding the extent of the river/estuary waterbody, if needed.
DIPNR Macleay River Estuary Tidal Data Collection	2003	Report	MHL	Report presenting data collected in the Macleay River between 14 April and 23 May 2003 as a part of the DIPNR EMP.	Daily flow in the Macleay River at Turners Flat, Meteorological data (wind speed and direction, solar irradiance, air temperature, relative humidity, atmospheric pressure, hourly rainfall, water level data from 35 sites, discharge data from 7 sites, water quality data from 59 sites. Includes ADCP data, met data and seabird data	May be useful if more recent tidal gauging and water level data is not available. Weather etc data may be useful for context.

Title/Folder	Published Year	Format	Author / Agency	Description	Data/GIS outcomes	Relevance to the prep'n of the CMP
Flood Levee Audit Reports	2015	Report	KSC	Compilation of known reports and information available and comparison of the levee designs crest levels, existing crest levels and flood levels.	Photographs, design plans, survey plans, defect inspection reports.	Levels may be useful for tidal inundation modelling
Flood Mitigation Assets	Ongoing	Spreadsheet	KSC	Details for all flood mitigation assets within KSC	Data for flood structures, bridges, levees and council drains. Details include an asset number, name, map reference, location, length, size, comments, costs and replacement costs in some instances.	Asset data that will be useful for detailed risk assessment at later stage of the CMP
Coastal Hazard Assessment		GIS Layers		Erosion and inundation hazard mapping	.tab files containing erosion hazard mapping for 2010, 2050 and 2100 scaled at almost certain, rare, unlikely. Inundation hazard mapping for 2010, 2050 and 2100.	Useful for understanding climate change risks to Macleay entrance
Lower Macleay Floodplain Management Plan	2004	GIS Layer	Webb, McKeown and Associates	Flood levels and velocities from associated report	RUBICON hydraulic model outputs for flood levels and velocities between Kempsey and Frederickton.	Expected to be superseded by Lower Macleay River Flood Study (Jacobs, in prep), which includes Killick and Korogoro Creeks.
Macleay River Flood Mitigation Bench Marks and Levels	1961	Drawings	Dept. of Public Works	Detailed drawings of bench marks and flood levels	Series of drawn maps detailing flood mitigation bench mark schedule and levels	Data superseded by later reports
Flood mitigation	Various (historical)	Reports	Macleay River County Council	A series of historical documents associated with flood mitigation detailing various stage hydrographs, flood profiles, proposed works, drain locality plans, cross sections and arrangements, floodway contours, earthworks, bridge arrangements etc.	Detailed surveys and drawings as appropriate.	Data superseded by later reports
Macleay River Cross sections		Drawings		Hand drawn cross sections of the Macleay River	7 detailed cross sections of the Macleay river with a focus on the 18-20-mile upstream section.	Data superseded by later reports
Stream Order		GIS Layer		Stream ordering	Strahler Stream Ordering	Unlikely to be relevant
Modelling / Mapping of tidal inundation with sea level rise						Data gap: no known suitable outputs

Table B-2 Macleay River Estuary Documentation Review

Title/Folder	Published Year	Format	Author / Agency	Description	Outcomes	Relevance to the prep'n of the CMP
Macleay River Estuary Data Compilation Study	2005	Report	GECO Environmental	Collation and review of existing data sources relevant to the management of the Macleay River. Determines gaps in data and information available which could potentially limit the development of the EMP and makes recommendations accordingly.	Suggests gaps to be addressed in processes study: Riparian Land Management, Bank erosion and sedimentation issues: Collation of planform changes, collation of historical hydrographic surveys, examination of changes to bank fill cross-sectional capacity, collation of nature and timing of tidal dredging. F&F: definitive mapping for vegetation listed as endangered ecological communities, long term plan to guide riparian, coastal and rainforest regen/restoration, impact assessments of weed species, documentation on habitat corridors, control program for Juncus Acutus, data on invasive saltmarsh communities. WQ: Research into arsenic and antimony in the Macleay floodplain, studies into growth of aquatic weeds in the vicinity of Kempsey and Frederickton, Tidal flushing times throughout the estuary. Climate Change: issues and potential strategies. Other: Aboriginal Heritage Issues, attitudes and perceptions of residents and visitors to the Macleay, tourism statistics and trends. Contains an extensive information and data register.	Required base data, analysis and information
Macleay River Estuary Processes Study	2009	Report	WMA water	Defines the baseline conditions and identifies key issues for various estuarine processes and examines the interactions between these processes and human use of the estuary. Enables development of management strategies in the next stage of the EMP.	Report details catchment characteristics, hydrodynamics, sediment dynamics, water and sediment quality, ecological characteristics and waterway usage. Macleay ecology has been altered substantially because of land clearing, development, floodplain mitigation structures and drainage systems however still relatively stable, water quality is adequate. Threatened terrestrial species are birds and mammals with birds relying mostly upon estuarine habitat. Estuary supports a number of commercially and recreationally significant aquatic species. Detailed waterway usage and available facilities. Soil landscapes, meteorological data, land use mapping, estuary access, tidal flows and current conditions, water balance, projected SLR levels and resulting tidal prisms, sediment sampling and distribution, historical planforms and beachfront/coastline, water and sediment quality sampling results, benthic habitat mapping, acid sulphate soil risk mapping, threatened species, fish species, seasonal summary of life cycles of threated and migratory wetland fauna, commercial fish catch numbers, oyster production,	Required base data, analysis and information
Macleay River Estuary Management Study and Plan (Ecology Literature Review and Information Gaps)	2009	Report	GeoLINK	Reviews state of information available with respect to ecology of the Macleay estuary and its floodplain,	Updates existing compilation of data by GECO (2005), identifies gaps in collated information which create obstacles to effective estuary management, comments on feasible approaches to the collection of new ecological information. Identifies a series of information gaps relating to aquatic habitat extent and distribution, fisheries resources, wetland ecology, floodplain management and ecology, floodgate and drain management, productivity, riparian habitat, high conservation value flora, fauna and ecological communities, habitat corridors, threatening processes, factors controlling ecological processes, rehabilitation efforts and GIS layers. Also identifies ways in which these gaps can be filled.	Required base data, analysis and information

Title/Folder	Published Year	Format	Author / Agency	Description	Outcomes	Relevance to the prep'n of the CMP
Macleay River Estuary Management Study and Plan	2009	Report	GeoLINK	Data gap analysis relating to ecological processes of the Macleay River.	Includes a review of the information available, update to existing data compilation, identification of gaps, commentary on feasible approaches to the collection of new information. Several identified information gaps, solutions of how these gaps can be filled, associated field components and consultation components for Aquatic Habitat Extent and Distribution, Fisheries Resources, Wetland Ecology, Floodplain Management and Ecology, Floodgate and Drain Management, Productivity, Riparian Habitat, High conservation value flora, fauna and ecological communities, Habitat Corridors, Threatening Processes, Factors controlling ecological processes, Rehabilitation efforts and GIS layers.	Required base data, analysis and information
Macleay River Estuary Management Study	2012	Report	GeoLINK	Identifies estuary values, uses, issues, management objectives and an initial set of management strategies aiming to improve the health of the Macleay River and accommodating various uses.	Study identifies the main issues and focus areas as well as 44 management objectives. Summary of outcomes from community consultation process, overview of estuary values, uses and issues derived from consultation and literature review. Each Issue has associated management issues, objectives and proposed management strategies. Identifies critical processes and threats, identifies and describes management issues and develops a prioritised list of the management issues. Includes a detailed marine infrastructure report.	Useful data, details and analysis to inform future stages and management strategies
Macleay River Estuary Coastal Zone Management Plan	2012	Report	GeoLINK	Details priority strategies and actions to address environmental and community issues associated with the health and management of the Macleay River Estuary.	The document details 30 strategies over the life of the plan and identified 8 high priority actions. Key priorities identified as improving management of the floodgates and drains, improvement to floodplain wetlands, improvements to fishery productivity in the estuary, improved boating facilities, strategies to reconnect riverside townships with the Macleay River, address antimony and arsenic contamination within the estuary and floodplain, planning for SLR, implementing bank erosion works and improving the condition of the riparian corridor. For each strategy specific actions and tasks are detailed as well as responsibilities, timeframes costs, potential funding sources and monitoring programs and performance indicators. Eight priority strategies include, planning for SLR and climate change, improving WQ from floodplain wetlands, coordinate and prioritise drainage projects, active water management of floodgates, conservation of floodplain wetlands, connecting the community with the Macleay River, water management improvements in the Collombatti Clybucca drainage scheme, antimony and arsenic contamination in the Macleay River Estuary.	Useful data, details and analysis to inform future stages and management strategies
Macleay Ecohealth Project 2015-2016	2016	Report	UNE Aquatic Ecology and Restoration Research Group	Assessment of Ecohealth condition through 32 freshwater and 12 estuarine sites.	Overall Grade for the Macleay was a C-. Tia River received an F and the Styx River received a B-. Contains GIS layers for geomorphic condition, riparian condition, water quality and aquatic macroinvertebrates, stream condition. Study aimed to assess health of coastal catchments using standardised indicators and contribute scientific information to feed into the report card system. Report included details outlining the study area, design and sites as well as the sampling methods and indicators. Each sampled six times from April 2015 to February 2016.	Provides detailed summary and data of estuary's condition

Title/Folder	Published Year	Format	Author / Agency	Description	Outcomes	Relevance to the prep'n of the CMP
Native Vegetation and Candidate Endangered Ecological Community Mapping Report	2006	Report	GECO Environmental	Vegetation distribution map and supporting reporting for the eastern portion of the Shire.	Compiles and analyses existing mapping to determine data gaps and areas requiring updating, compiled single GIS dataset for the study area deriving Candidate EECs, soil landscape mapping, indicates likelihood of occurrence of EECs	Report supports GIS vegetation mapping layers. May also be useful for later stages e.g. risk assessment
Report for Vegetation Mapping for Western Portion Kempsey LGA	2007	Report	GHD	Vegetation distribution map and supporting reporting for the western side of the Shire.	Vegetation mapping, EEC Description summaries, Forest Ecosystems and Keith Classification, threatened species lists for Kempsey Shire. Describes the distribution of native vegetation across the western portion of the shire, illustrates the spatial distribution of vegetation communities, highlights the potential presences of EECs highlights potential habitat corridors, provides suitable data sets to inform future decision-making processes.	Report supports GIS vegetation mapping layers. May also be useful for later stages e.g. risk assessment
Macleay River Estuary and Floodplain Ecology Study	2010	Report	GeoLINK	Ecological study undertaken to support the preparation of the Macleay CZMS	Report detailing the productivity of the estuary with emphasis on the floodplain wetlands and riparian zone, fisheries resources including analysis of general fisher, oyster aquaculture and recreational fisheries, estuarine habitats analysis of temporal and spatial dynamics, key threatening processes as an assessment of their impact upon estuarine ecology and assessment of key threatening processes, high conservation value flora and fauna communities as a review and update of existing information, habitat corridors identified on the floodplain, sea level rise change and climate change and their potential effects, rehabilitation and monitoring efforts to provide an update of programs that have taken place since the previous review, and GIS resources. The study also presents a series of management options and the management implications of information collected	Report describes estuary ecology and will be useful for later stages e.g. economic analysis of the floodplain wetlands, risk assessment and management options
Antimony and arsenic dispersion in the Macleay River catchment	2007	Publication	University of New England	Investigation into antimony and arsenic contamination in Macleay River and Bakers Creek Sub catchment.	Antimony and arsenic in stream sediments presented as long section data for the Macleay River and Bakers Creek Sub catchment. Composition of stream sediments, water, dried alga and ashed riparian vegetation from Bakers Creek sites. Study found that though much of the catchment is little affected from inputs of heavy metals and metalloids however the Bakers Creek catchment was found to be heavily contaminated by Sb and As. Should further information be sought, Council's website also has copies of investigation reports by GHD, see: http://www.kempsey.nsw.gov.au/environment/river-management/derelict-mines-macleay-catchment.html	Assists with later stages, noting that main areas of contamination are beyond the tidal limit. UNE and SCU are continuing research and publications for this.
Macleay Estuary Data Compilation Study (Flora and Fauna Habitat Study)	2005	Report	ID Landscape Management Pty Ltd	Categorises vegetation communities and areas of the riparian zone. Investigates threats and habitat vulnerability. Identifies a range of gaps and recommendations.	Categorises 16 vegetation communities and identifies 150 different vegetation areas over the 347km of riparian zone investigated. Identifies 3 weed species, 8 endangered ecological communities, 4 endangered and 5 vulnerable flora species, seven endangered and 39 vulnerable fauna species. Study indicated almost 60% of the riparian vegetation is 'improved pasture and cropland' with 66.9% of riparian vegetation being documented as high degree of disturbance occurrence. Weed species categorised into 3 groups dependent on their invasiveness, capacity to dominate natural vegetation communities and degree of difficulty to control.	Report may be useful for detailed risk assessment at later stage of the CMP

Title/Folder	Published Year	Format	Author / Agency	Description	Outcomes	Relevance to the prep'n of the CMP
Fish Kill Notification and Investigation Report	2018	Fish Kill Report	Industry & Investment	Report outlining the effects and causes of the fish kill incident.	Approximate fish kill numbers (hundreds), extents and species affected. Details the water bodies within the Macleay in which the fish kill occurred. Determined it to be a 'blackwater' event where poor quality, oxygen deficient water moves into the estuarine reaches of the Macleay.	Supports understanding threats and management options
Fish kill highlights the need for Collombatti-Clybucca Floodplain Restoration	2015	Media Release	North Coast Local Land Services	Department-issued media release about fish kill event.	Technical background into the fish kill which occurred on and around Australia Day in 2015. Heavy rainfall prior to the 26th pushed deoxygenated flood waters from the back swamps and drains into the estuary resulting in kills for various aquatic organisms.	To be read in combination with above report.
Freshwater Macrophyte Communities of the Macleay River	2016	Report	UNE Aquatic Ecology and Restoration Research Group	Literature review on Egeria densa focusing on its dispersal, invasiveness, ecological and economic impacts on freshwater ecosystems and management techniques.	Summarises existing information on the extent of Egeria densa in the Macleay River. Includes details on previous studies within the region. Study includes results from sampling of macrophytes, in particular, egeria densa. Schematic diagram of macrophyte species distribution, comparison of exotic and native macrophytes, mean relative cover of all species, distribution and total cover, example GIS layers and some site visit photos. Recommendations for management include - giving consideration to controlling further distribution, follow up surveys following floods, repeat surveys next flowering season. suggest further research with specific areas of focus.	Data and details that will be useful detailed risk assessment at later stage of the CMP
Implementation of Strategy '18' Macleay River Estuary CZMP	2012	Report	KSC	Report detailing the erosion control and foreshore improvement works at Rotary Park Jerseyville as per the Macleay River Estuary CZMP (2012).	3000 native endemic low-land rainforest trees and shrubs were planted along with environmental awareness interpretive signs elected along the pedestrian walkway. Fishing steps and rock armouring works were undertaken also.	Data and details that will be useful for detailed risk assessment at later stage of the CMP
Mattys Flat and New Entrance	2006	Report	Patterson Britton and Partners Pty Ltd	Report detailing the decision-making framework for managing Mattys Flat and New Entrance.	The plan assesses the physical characteristics, importance and issues affecting the study area. Report includes an action plan presenting a strategy that outlines the details relating to ongoing management of the area. Arrived at several proposed management options including; additional parking, upgrade of existing boating facilities, facilitate development of new boating facilities, improve public access, improve visor facilities, undertake environmental enhancement and protection, categorises Council-controlled areas. Action plan that details, estimated costs, timeframes for actions and responsibilities for each strategy.	Report may assist with understanding management options
Lower Macleay Floodplain Management Plan	2004	Report	Webb, McKeown and Associates	Supplementary report covering the floodplain between Kempsey and Frederickton which was not covered in the Lower Macleay Floodplain Management Study or Plan.	Details a list of floodplain management issues including, siltation and dredging, stock mounds, equity of protection, operation of Belmore and Kinchela Floodway's, flood velocities and debris, Kempsey Stormwater Runoff. Plans are detailed to combat each issue with associated priorities. Report contains design flood profiles for 1%, 2%, 5% and 10% AEP and their flood levels and velocities.	Assists with understanding current threats and management options, noting that Lower Macleay Flood Study is currently being revised.

Title/Folder	Published Year	Format	Author / Agency	Description	Outcomes	Relevance to the prep'n of the CMP
Redefining the past – The impact of digitising historic data on our understanding habitat change over time	2018	Conference Paper	Greg West NSW DPI, Taylors Beach	Presents estuarine macrophyte area estimates derived from digitally-corrected version (DCV) maps of West et al. 1985.	Describes the consequences for interpretations of temporal trends in these habitats by focussing on the estuaries showing the greatest changes in trends. The study showed that, for most NSW estuaries, the original Dot Grid (DG) method underestimated the actual mapped areas for seagrass, mangrove and saltmash habitats.	Conference Paper may assist with understanding trends of seagrass, mangrove and saltmash habitats.
Back Creek South West Rocks Sustainability Assessment Report	2007	Report	iCLAM (ANU)	Sustainability Assessment report based on the results from the Coastal Lake Assessment and Management (CLAM) tool for Back Creek.	Analyses three scenario groups: entrance/channel management, upgrade maintenance road with entrance and channel management, and, combinations of estuary management, channel management and road upgrade with development, foreshore management, stormwater management and sewerage management. Key data gaps identified are stormwater nutrient, pathogen and sediment inputs, nutrients and sediments. Results showed complexity in interactions and provided no conclusive best way forward from the options available,	May provide some more specific information about Back Creek, but management scenarios will have been superseded by other reports.
Mid-North Coast Boating Investigations Package: Back Creek Boating Access Improvements Investigation	2017	Report	Royal Haskoning DHV	Investigated recreational boating needs at Back Creek, South West Rocks. T	The investigation has been proposed to address several issues at Back Creek including: • entrance and channel navigability; • manoeuvrability of applicable vessels; • the standard of boat launching facilities upstream of Humpty Back Bridge; • balancing the needs of passive recreation users and motorised watercraft; • ease of foreshore access; and, • car parking and amenities	Provides specific information about Back Creek that may assist in developing appropriate actions for these issues in the CMP

Table B-3 Review of reports generic to all Kempsey estuaries

Title	Published Year	Format	Author / Agency	Description	Findings/Outcomes	Relevance to CMP
Kempsey Coastal Processes and Hazards Definition Study		Report	BMT WBM	Comprehensive review of coastal processes and associated hazards affecting the Kempsey Shire coastline. Provides analysis of current and future hazards to the open coast (beach erosion, shoreline recession) and estuaries (coastal inundation).	Of relevance to the estuaries is the coastal inundation assessment and mapping, although caution should be applied in using the coastal inundation maps as these are based on a simplistic "bath tub" approach. The report also contains useful information regarding the estuary entrances. The report does not contain mapping of tidal inundation, as this was not a requirement for estuaries at the time it was produced.	May be relevant to the assessment of estuary-based coastal hazards (entrance instability, coastal inundation).
Kempsey CZMS	2015	Report	BMT WBM	Outlines and prioritises the risk to natural and built assets along the Kempsey Coastline from coastal hazards for an immediate, 2050 and 2100 timeframe. Erosion and recession, and coastal inundation are considered.	Detailed review of Coastal Processes and Hazard definition studies, community and stakeholder consultation process, land uses and community amenity, description of Coastal Hazard Risks and management options. Includes Erosion and Recession risk, coastal inundation risks, existing controls, risk rankings and frequency scales. Mapping for the open coast areas includes: Land Use Zoning Maps, Erosion and Recession Risk Maps and registers, Coastal inundation Risk Maps and registers, Inundation likelihoods, adopted inundation levels, consequence, risk assessments	May be relevant to developing actions in the CMPs
Kempsey Coastal Erosion Emergency Action Plan	2015	Appendix	BMT WBM	Outlines Emergency Responses for given circumstances and the roles and responsibilities of relevant agencies.	An appendix to the Kempsey CZMP that outlines actions to be performed before, during and after an erosion emergency event and the roles and responsibilities for coastal emergencies.	May be relevant to developing emergency actions in the CMPs
Kempsey CZMP	2016	Report	BMT WBM	Kempsey Coastal Zone Management Plan includes 19 actions with descriptions, responsibilities, resources timeframes and monitoring and performance indicators for each.	designed to be succinct and practical to enable implementation of the recommended management actions. Summarises the works undertaken to date, legislative requirements, objectives, integration with Councils Operating Plan and Government Agencies as well as an Emergency Action Plan.	Actions in the new CMPs will need to be consistent with this CZMP
Assessing the condition of estuaries and coastal lake ecosystems in NSW	2010	Report	OEH, DPI, Southern Rivers CMA	Provides a broad baseline to capture the condition of estuaries within NSW as at January 2009. Includes the methods for collecting, analysing and interpreting the data used to derive the condition.	Provides estuary definition data, contextual data (including morphometry, catchment areas, hydrology and hydrodynamics), estuary classifications as well as condition data which includes chlorophyll-*a*, turbidity, macrophytes and fish. The document contains a range of pressure data that was used to inform baseline condition.	Very useful base data when available
SOC Report – Estuaries and coastal lakes	2010	Report(s)	OEH, DPI, Southern Rivers CMA	Presents the current condition of estuaries and coastal lakes in the northern Rivers Region	Presents current conditions and pressures as indicator scores and details state and local level management activities.	Contains condition and pressure scores for the KSC region.
State of the catchment reports (Northern Rivers region)	2010	Report(s)	OEH, DPI, Southern Rivers CMA	A collection of 13 reports relating to biodiversity, water, land and community for the Northern Rivers Region. The reports assess the state of natural resources in the region. These reports set state level targets for management.	Reports provide regional scale information on native vegetation, fauna, threatened species, invasive species, riverine ecosystems, groundwater, marine waters and ecosystems, wetlands, estuaries and coastal lakes, soil condition, land management within capability, economic sustainability and social well-being and capacity to manage natural resources.	Useful for understanding regional scale issues though more KSC specific information available
SOC Report – Native Vegetation	2010	Report(s)	OEH, DPI, Southern Rivers CMA	Report detailing the overall status of vegetation within the Northern Rivers regional catchment and combines	Vegetation extent state mapping including (native – intact, native – derived, native/non-native mosaic and non-native) Vegetation condition states mapped as residual, modified, transformed, transformed/replaced-adventive mosaic, replaced-managed and removed)	Useful for understanding regional scale issues though

Title	Published Year	Format	Author / Agency	Description	Findings/Outcomes	Relevance to CMP
				assessments of vegetation extents and vegetation condition.	Vegetation pressure mapping classed as conservation and natural environments, relatively natural environments, dryland agriculture and plantations, irrigated agriculture and plantations and intensive uses. Details existing management activities at state, regional and local levels.	more KSC specific information available
Risk-based Framework for Considering Waterway Health Outcomes in Strategic Land-use Planning Decisions (Risk-based Framework)	2017	Report	OEH & EPA	The Risk-based Framework provides information to assist Council to consider the potential impacts on coastal waterways as a result of potential land-use change, evaluate the associated risks and identify appropriate management actions. The purpose of the Framework is to: • ensure the community's environmental values and uses for waterways are integrated into strategic land-use planning decisions; • identify relevant objectives for waterways that support the community's environmental values and uses, and can be used to set benchmarks for design and best practice; • identify areas or zones in waterways that require protection identify areas in the catchment where management responses cost-effectively reduce the impacts of land-use activities on waterways, and; • support management of land-use developments to achieve reasonable environmental performance levels that are sustainable, practical, and socially and economically viable.	There are 5 steps associated with the Framework which are consistent with those activities required for the preparation of a CMP and align with the key initiatives of the MEMA. They include: • **Step 1 – Establish Context**: Involves identifying the existing land-use activities, waterway type and its response to previous land-use activities as well as the likely trajectory of the waterway in response to future land-use changes. The waterway objectives (which consists of community environmental values and uses of the waterway and indicators with corresponding numerical assessment criteria) are also identified in this step as well as potential types of impact on the waterway objectives as a result of land-use activities • **Step 2 – Effects-based assessment: I**s used to quantify how a land-use activity will change the health of the waterway determined using the indicators and corresponding numerical criteria outlined in step 1. Effects-based assessments are increasingly implemented through the use of numerical models though can also be implemented via desktop assessments. • **Step 3 – Compare against waterway objectives:** Involves comparing the indicators against the numerical criterion to assess if they are within a desirable range as determined by community's environmental values and uses. An acceptable level of change is determined based on the extend and frequency of exceedance. • **Step 4 – Strategic impact assessment:** Involves evaluating the risks resulting from land-use activities on the waterway based on the feasibility of achieving the intended outcomes for a given management response. It ensures management responses are reasonable, practical and cost-effective. • **Step 5 – Design and implementation:** Involves detailed planning of specific controls or treatment measures to achieve the intended outcomes for a given management response. This step should involve a monitoring and review process to ensure intended outcomes from the Framework are implemented and achieved and remain relevant. Steps 2 to 4 allow for several management responses to be considered with communication and consultation an integral part which involve providing information on any trade-offs that may be required to meet waterway objectives. OEH (now DPIE – Coasts and Estuaries) has conducted nutrient load modelling for the Macleay, Killick and Korogoro Creeks. The outcomes of this modelling have been used to develop maps that outline the priority	

Title	Published Year	Format	Author / Agency	Description	Findings/Outcomes	Relevance to CMP
					catchments for further management action and attention. The maps and outcomes are discussed in the main body of this Scoping Study.	

B.2 Detailed Review of Management Actions in the Macleay CZMP

Quick reference guide to colour coding of the review table

At the action level:

	Action is recommended for fast-tracking to Stage 4 of the CMP. Notes also provided regarding any wording changes or amalgamation requirements
	Action has been completed
	Action is not recommended for fast-tracking to Stage 4 of the CMP. Explanation has been provided.

At the strategy level:

	Strategy is relevant / adequate Many actions are recommended for fast tracking
	Strategy is largely relevant Some actions should be fast tracked.
	Strategy is no longer relevant / is inadequate Explanation has been provided.
	Strategy has been completed / mostly completed

Table B-4 Review of Actions in the Macleay CZMP

	Existing Management Actions	Adequacy / Comment
CZMP	**Strategy 1 – Planning for Sea Level Rise and Climate Change**	***Largely completed***
1.1	*Incorporate development controls for Climate Change into Local Environmental Planning Framework*	*Largely completed*
1.2	Utilise LiDAR information and sea level rise projections to refine areas at risk from flooding	In progress. Flooding is currently being investigated through a revised Lower Macleay Flood Study.
CZMP	**Strategy 2 Improve Water Quality from Floodplain Wetlands**	**Inadequate** Actions generally have not been implemented, or are no longer considered likely to be effective or workable.
2.1	Continue to encourage the uptake of wetter pasture management in the Belmore and West Kinchela Swamps.	These actions need to be revised with respect to the following issues: • Lack of landholder support for changes to drain and wetland management. There remains tension between agricultural productivity and ecological health and water quality outcomes. • Clarity over the jurisdiction of the CMP. Most of the Macleay floodplain sits outside of any mapped "coastal management area". But, floodplain management contributes directly to estuary water quality and health. • Individual backswamps have their own character and structure. However, a whole of system approach is needed first, before breaking down to individual swamp actions. In fact, need to know where to target investment for maximum benefit.
2.2	Continue to encourage the uptake of wetter pasture management in the Clybucca/Collombatti swamps.	
2.3	Investigate further changes to the drainage infrastructure in the Belmore and Kinchela Swamps that could increase water retention and reduce groundwater drawdown.	
2.4	Strategies to reduce the formation of MBOs in drains.	
2.5	Reinitiate plans for improved management of the Gladstone Union Drain.	
2.6	Investigate changes to the drainage infrastructure in the Clybucca/Collombatti area with the aim of improved export water quality.	
2.7	Investigate the effects of changes to drainage infrastructure in Rafferty's Swamp.	
2.8	Create a Project Officer position within NRCMA or KSC to manage high priority actions associated with EMP Strategies 2, 3, 4, 5, 9 and 10 (based on a similar structure to the Clarence Floodplain Project)	Numerous Environmental Trust fund applications were unsuccessful. May relate to floodplain management being viewed as an LLS versus a CM issue.
CZMP	**Strategy 3 – Coordinate and Prioritise Drainage Projects**	**Completed (where possible).**
3.1	*Adopt prioritised drainage catchments*	*Completed where possible, other areas lack landholder support for action (including resentment to previous projects)*
3.2	*Prioritise unmanaged major floodgates for active water management*	*Completed where possible*

	Existing Management Actions	Adequacy / Comment
CZMP	*Strategy 4 – Active Water Management of Floodgates*	*Completed, or no longer required as likely completed through Strategy 2 actions*
4.1	Assess Effectiveness of Drainage Works-to-Date	Would be completed through new floodplain projects
4.2	*Develop and implement management plans for the unmanaged major floodgates identified and prioritised in Strategy 3*	*Completed* *Killick, Belmore, Kinchela, Riley's and Worthing's floodgates now have Management Plans*
4.3	Continue to encourage wet pasture management in the drainage catchments	Same as Actions 2.1, 2.2
CZMP	**Strategy 5 – Conservation of Floodplain Wetlands**	**No longer relevant** Area now managed by NPWS through site specific POM. NPWS notes that such actions have been implemented on NPWS land. Focus for CMP should be on management of wetland areas abutting the NP zones, to ensure consistent management
5.1	Encourage the uptake of private conservation measures on floodplain wetlands	Repetition / overlap with Action 2.1
5.2	Continue to improve the management of East Kinchela wetland for ecological values.	No longer relevant to CMP as area now managed by NPWS through site specific POM. Focus should be on management efforts for area of wetland outside of NP zoning
5.3	Continue to control *Salvinia molesta* in East Kinchela Wetland and apply successful techniques to other wetlands and drains.	No longer relevant to CMP as area now managed by NPWS through site specific POM. Focus should be on management efforts for area of wetland outside of NP zoning
5.4	Update Wetland Care Australia floodplain wetland maps to include the Rafferty's and Frogmore swamps.	Superseded by CWLRA mapping. Accuracy of this mapping to capture all relevant coastal wetlands should be investigated.
CZMP	**Strategy 6 – Connecting the Community with the Macleay River**	**Relevant** Many actions should be retained in CMP, as they are ongoing and considered effective
6.1	Promote the identity of the Macleay River as a unique, high quality tourism destination for boating and water-based recreation	Ongoing Action to be continued in CMP
6.2	Improve and expand the use of public river access points and their attributes for the benefit of visitors and the local community	Ongoing Action to be continued in CMP

	Existing Management Actions	Adequacy / Comment
6.3	Explore educational opportunities in association with boating upgrades to enhance the values of the river for greater community awareness and visitor interest	Ongoing Action to be retained and reworded to incorporate 6.8 and 26.1/26.2, e.g. "Explore opportunities to incorporate environmental and historical values and objectives (site specific or general) to enhance community connection and visitor interest, as part of boating and foreshore facility upgrades (including cycleways, shared paths)"
6.4	Enhance the visual image and identity of public boating and recreation sites along the entire Lower Macleay estuary	Ongoing Action to be continued in CMP
6.5	Investigate appropriate strategies to reconnect riverside townships with the Macleay River	Ongoing Action to be continued in CMP
6.6	Upgrade existing boating facilities at riverside townships to promote boating access to townships	Action to be continued in CMP. Recommend rewording to "Review TfNSW boating strategy for the Macleay, and work with TfNSW to continue to provide upgrades and additional facilities, for example at: • Greenhill Boat ramp (see Action 14.2) • Greenhill quarry site (see Action 14.3) • Railway bridge boat ramp site (for canoe / passive watercraft access, Action 14.4) • platform and setting of Wharf Reserve, Gladstone (see Action 14.10) • Smithtown boat ramp (see Action 14.11) • Mattys Flat: additional facilities such as Sewer Pump out, expanded parking to support high usage, charter operators) (Action 14.6) • Back Creek entrance: toilet facilities required (Action 14.7)
6.7	*Incorporate heritage strategies into any redevelopment works of the Riverside Park boat ramp facilities at Kempsey*	*Completed.*
6.8	Incorporate heritage strategies into any redevelopment works of historical boating infrastructure	Action to be incorporated into Action 6.3, see above.

	Existing Management Actions	Adequacy / Comment
CZMP	**Strategy 7 – Water Management Improvements in the Collombatti-Clybucca Drainage Scheme**	**No longer relevant, or in progress** Roles and Responsibilities Unclear Collombatti-Clybucca is an important wetland restoration project, however governance and responsibilities for the project are unclear. Needs to have the involvement of Council and state agencies, however the lead agency needs to be determined. For example, if NCLLS is best placed to manage this project, then CMP should indicate support and require written agreement from NCLLS for this responsibility. There is also a risk of having too many "working groups" for the Macleay (there are already two).
7.1	Create a Project Officer position within NRCMA or KSC to facilitate and manage implementation of the following actions	No longer relevant given NCLLS has already progressed the project, as below.
7.2	Scoping study of potential floodgate and drain modification works in the Collombatti-Clybucca Drainage Scheme	In progress, undertaken by NCLLS
7.3	Options study for floodgate and drain modification works in the Collombatti-Clybucca Drainage Scheme	In progress
7.4	Implement floodgate and drainage modification works in the Collombatti-Clybucca Drainage Scheme	Will presumably follow on from 7.2 and 7.3
CZMP	**Strategy 8 – Utilise best practice erosion control and riparian management techniques (Medium)**	**Relevant** Most actions should be retained in CMP.
8.1	Produce guideline "Macleay River Estuary Riverbank Restoration Guide"	Action to be progressed to CMP, noting that DPIE – Coasts and Estuaries have seen the value of such a guideline in other estuary systems. It should also be noted that appropriate information for such a brochure / webpage is already available from the Data Compilation Study.
8.2	Incorporate BPM into conditions where development approval is required for works.	No longer relevant
8.3	Refine and implement erosion management concept designs for high priority sites	Action retained and reworded, e.g. "Implement erosion control/abatement management projects where appropriate" Locations need to be identified.
CZMP	**Strategy 9 – Develop a Floodgate Management Regime for Flood and Non-Flood Events**	**No longer relevant** Overlaps with Actions 4.2 and 2.1

	Existing Management Actions	Adequacy / Comment
9.1	Future floodgate management plans to include Flood, Post-Flood; and Non-Flood operating regimes	Repetition with Action 4.2 and Action 2.1
9.2	Amend existing floodgate management plans for major Floodgates to include Flood, Post-Flood; and Non-Flood operating regimes	Repetition with Action 4.2 and Action 2.1
CZMP	**Strategy 10 – Management of Yarrahapinni Wetlands National Park**	**No longer relevant** Area managed by NPWS through site specific POM, actions not relevant to CMP
10.1	Floodgate Management for Yarrahapinni floodgates	As above.
10.2	Undertake Restoration Plan for Yarrahapinni Wetlands NP	As above
10.3	Undertake the appropriate planning and environmental assessment to facilitate the wetland restoration	As above
10.4	Further Investigate the Possibility of Establishing an Aquatic Reserve in Yarrahapinni Wetlands NP	Not relevant, is a MEMA consideration.
10.5	Long term ecological monitoring	As above
CZMP	**Strategy 11 – Protect and Manage Important Habitat Areas**	**Actions (largely) relevant** With recommendations for consolidating
11.1	*Amend Council LEP Land Zoning to Protect Important Habitat.*	*Completed.*
11.2	Encourage Incentive Property Vegetation Plans or BioBanking for Important Habitat Areas	Action no longer considered a priority. It should remain a potential option for priority areas if this arises through existing State government offset / biobanking programs.
11.3	Encourage Landholder Management of Important Habitat Areas	Action to be continued, combined with 11.6 and 11.7 (see below)
11.4	Further Investigate the Possibility of Establishing an Aquatic Reserve in Yarrahapinni Wetlands National Park	Not relevant, is a MEMA consideration.
11.5	Undertake a control program for *Juncus acutus* on the Lower Macleay Floodplain.	Action to be continued in CMP, with rewording to “Continue a control program…”

	Existing Management Actions	Adequacy / Comment
11.6	Protect mangroves and saltmarsh from grazing stock by encouraging the use of fencing around these habitats.	Action to be continued, combine with Actions 11.3 and 11.7. Recommend rewording to "Investigate opportunities to implement further mangrove & saltmarsh habitat protection projects", with action to: make note of projects using best practise approaches to stock exclusion (e.g. type of fencing etc) and rehabilitation; and include a campaign to enlist private landholders to undertake rehabilitation and protection of habitats on private lands.
11.7	Encourage the rehabilitation of mangrove and saltmarsh habitats on private lands.	As above
11.8	Protect seagrass habitat from further decline.	Action not workable in current form. Roles and responsibilities unclear, particularly in relation to DPI Fisheries responsibility and Council responsibilities through the CMP process.
CZMP	**Strategy 12 – Protect Important Riparian Conservation Values Under Threat (Medium)**	**Relevant** Most actions to be retained and combined with Strategy 8
12.1	Identify sites with important riparian conservation values	Action to be retained and combined with Strategy 8 (i.e. identify sites for erosion control as well as conservation)
12.2	Undertake site assessments to identify the most appropriate protection/remediation techniques.	No longer relevant
12.3	Seek funding and landholder agreement for rehabilitation works	Ongoing. Action to be continued in CMP, and reworded e.g. "Investigate opportunities…"
12.4	Implement works according to best-practice guidelines.	No longer relevant
12.5	Monitor condition and review threats to identified high conservation value riparian vegetation communities	Ongoing Action to be continued in CMP, combined with Strategy 8
CZMP	**Strategy 13 – Manage Recreational Boat Use in Areas of Vulnerable to Wave Wash Erosion**	**No longer relevant** Actions are mostly standard TfNSW responsibilities.
13.1	Develop a 'River Friendly Boating' Code of Practice in association with local recreational boat users to limit the potential for damage to susceptible river banks and riparian vegetation communities.	Retain intent to combine with Action 6.3.

	Existing Management Actions	Adequacy / Comment
13.2	Develop an education and awareness program to encourage local and visiting boat users to observe existing controls on boat speed and no wave wash zones.	Action not relevant to CMP, remains an TfNSW responsibility and is ongoing.
13.3	Continue the enforcement of speed and 'no wash' regulations.	Action not relevant: this is an TfNSW responsibility, and is being enforced.
CZMP	**Strategy 14 – Improved Boating Access and Infrastructure**	**Partly relevant** Some actions to be incorporated into Action 6.6; others to be retained as is.
14.1	*Seek to ensure the construction of a replacement boat ramp at Frederickton as part of the Pacific Highway bypass proposals*	*Completed*
14.2	Undertake minor upgrade work to improve capacity of Greenhill Boat ramp	Incorporate into Action 6.6
14.3	Investigate provision of a new boat ramp facility at the Greenhill quarry site	Incorporate into Action 6.6
14.4	Undertake minor upgrade work to the Railway bridge boat ramp site	Incorporate into Action 6.6
14.5	*Undertake upgrade work to Riverside Park Kempsey to enhance river access and the recreational and social values for overall community benefit (refer to Appendix A for concept design of possible site improvements)*	*Completed*
14.6	Investigate opportunity for an additional public boat ramp facility at Forth Street, Kempsey	No longer supported
14.7	Consider upgrading Frederickton North boat ramp site	No longer supported
14.8	Investigate opportunity to expand Frederickton South boat ramp site into adjoining TfNSW - Maritime Services land and upgrade the whole site.	No longer needed
14.9	Create a new boat ramp facility within an existing park on the southern edge of the Smithtown (refer to Appendix A for concept design of new facility)	Option recently investigated by Council, not supported.
14.10	Undertake minor upgrade work to the platform and setting of Wharf Reserve, Gladstone	Incorporate into Action 6.6
14.11	Undertake minor upgrade work to the existing Smithtown boat ramp	Incorporate into Action 6.6
14.12	Consider decommissioning the existing Summer Island boat ramp	No longer supported
14.13	Continue to undertake improvements to the Kinchela boat ramp	No longer supported

	Existing Management Actions	Adequacy / Comment
14.14	*Upgrade the existing facilities at the Jerseyville boat ramp (refer to Appendix A for concept design of possible site improvements)*	*Completed*
14.15	Undertake minor upgrade work to the Oyster barn boat ramp	No longer supported
14.16	Undertake upgrade to Mattys Flat boat ramp	Boat ramp upgrades in progress. However, further facilities may be needed (Sewer Pump out, expanded parking to support high usage and charter operators). This can be incorporated into Action 6.6
14.17	Provide / upgrade boat ramp and associated facilities near Back Creek entrance.	Action to be continued in CMP as ramp upgrade is pending. Action to be reworded to note need for toilet facilities.
14.18	Undertake upgrade work to Fishermans Reach boat ramp (refer to Appendix A for concept design of possible site improvements)	Ongoing Action to be continued in CMP
14.19	Undertake upgrade work to the Stuarts Point boat ramp	Ongoing Action to be continued in CMP
14.20	Develop a Vessel Mooring Management Plan	TfNSW responsibility through existing charter
CZMP	**Strategy 15 – Improve the Riparian Corridor to Address Bank Erosion**	**Largely Relevant** Combine with Strategy 8 and retain identified actions in the CMP.
15.1	Continue NRCMA incentive funding program to facilitate broad-scale riparian improvement works in the estuary.	Ongoing Action to be continued in CMP, reworded to be incorporated into Strategy 8.
15.2	Develop conditions for leasehold/licence to use land along the estuary foreshore that encourage best-practice riparian management including managed stock access, weed control, and native vegetation retention.	Action not sensible for implementation. Remove.
15.3	Implement planning controls that encourage the retention and/or improvement of riparian vegetation along the estuary.	Action to be retained in CMP. Has proven to be successful elsewhere.
CZMP	**Strategy 16 – Clarify the Protocol for Responding to Oyster Mortality Events on the Macleay River**	**Not relevant to the CMP** Actions are DPI Fisheries responsibilities.
16.1	Define clear protocols for the reporting of oyster mortality events by oyster growers.	Not relevant, is a DPI Fisheries responsibility
16.2	Define clear protocols for the state agency response to oyster mortality events.	Not relevant, is a DPI Fisheries responsibility
CZMP	**Strategy 17 – Improve Water Quality for Ecosystem Health, Oyster Aquaculture and Recreation**	**Largely completed or no longer relevant** No actions are recommended for CMP

	Existing Management Actions	Adequacy / Comment
17.1	*Reduce the nutrient content of effluent discharged into the Macleay estuary from the West Kempsey STP.*	*Action completed - Upgrade works are underway, no further discharges area occurring.*
17.2	Reduce the nutrient content of effluent discharged into the Macleay estuary from the Frederickton and Gladstone STPs.	Action in progress, and not required to be retained in new CMP. Upgrades are being investigated.
17.3	Investigate the impacts of nutrient and bacteriological pollution on the Macleay Arm	Action in progress, and not required to be retained in new CMP. Stuarts Point is planned for sewer connection. Monitoring of nutrients is being undertaken by Council.
17.4	Develop and undertake a water quality public education program.	Action is ongoing.
17.5	Reduce the diffuse sediment load in runoff from throughout the greater Macleay River catchment	Monitoring program is in place. Action no longer relevant in current form.
CZMP	**Strategy 18 – Protect Public Infrastructure Vulnerable to Bank Erosion**	**Not relevant to the CMP**
18.1	Continue to monitor reaches of estuary where public infrastructure is sited to ensure erosion processes do not threaten community assets such as public bridges, wharves, jetties, boat ramps	Action no longer relevant. Is a routine operational activity.
CZMP	**Strategy 19 – Protect Existing Bank and Riparian Management Works**	**Not relevant to the CMP**
19.1	Identify existing bank or riparian works sites that require further protection or maintenance.	Action no longer relevant. Is a routine operational activity.
19.2	Undertake site assessments to identify the most appropriate protection/remediation techniques.	Action no longer relevant. Is a routine operational activity.
19.3	Seek funding for maintenance works as required.	Action no longer relevant. Is a routine operational activity.
19.4	Implement works according to best-practice guidelines.	Action no longer relevant. Is a routine operational activity.
CZMP	**Strategy 20 – Consider Commercial Fishing Requirements in the Planning Process for Wharves, Jetties and Pontoons**	**Not relevant to the CMP** Actions are DPI Fisheries responsibilities.
20.1	Incorporate commercial fishing requirements into the planning approvals process for wharves, jetties and pontoons.	Not relevant, is a DPI Fisheries responsibility
CZMP	**Strategy 21 – Protection and Management of Migratory and Threatened Birds**	**Relevant** Actions to be retained in CMP.

	Existing Management Actions	Adequacy / Comment
21.1	Undertake shorebird surveys in the Macleay Estuary to gather up-to-date information on population size, species richness and the distribution of roost and foraging areas	Action is completed and ongoing. Reword as "Conduct follow up monitoring…"
21.2	Identify high conservation value habitat sites for shorebirds and prioritise for management	Action is completed and ongoing. Reword as "Continue to…"
21.3	Identify and prioritise threats at high priority sites and devise appropriate management actions and plan	Action is completed and ongoing. Reword as "Continue to…"
21.4	Include shorebird habitat mapping, site prioritisation data and information on threats in EMP updates	Action is completed and ongoing. Reword as "Continue to…"
21.5	Implement management plans at high priority sites	Action is completed and ongoing. Reword as "Continue to…"
CZMP	**Strategy 22 – Improve Community Understanding of Safety Issues of Crossing Entrance Bars**	**Not relevant to the CMP** Actions are standard TfNSW responsibilities
22.1	Conduct audit of existing bar crossing signage	As above
22.2	Provide additional bar crossing signage at certain locations as boating facilities are upgraded	As above
22.3	Maintain "bar cam" and community education of safety issues	As above
CZMP	**Strategy 23 – Protect and Enhance the Local Population of Black Cod**	**Not relevant to the CMP** Actions are DPI Fisheries responsibilities.
23.1	Encourage the participation of local diving groups in the collection of information about the local black cod population	As above
23.2	Educate local recreational and professional fishers in identifying black cod, best practice release methods and gear types to reduce impacts on accidentally caught black cod	As above
CZMP	**Strategy 24 – Ecological Health Monitoring and Reporting Program**	**Relevant** Action is ongoing and should be continued.
24.1	Design and implement a monitoring program that will provide essential information regarding the health of the Macleay River Estuary	Action is ongoing, suggest rewording to "Support a Regional Ecohealth style Program that monitors catchment to sea providing health assessment and identifies where strategic action is required to improve health"
CZMP	**Strategy 25 – Clean-up Derelict Oyster Leases**	**Not relevant to the CMP** Actions are DPI Fisheries responsibilities.
25.1	Clean up derelict oyster leases	As above

	Existing Management Actions	Adequacy / Comment
CZMP	**Strategy 26 – Macleay River Estuary Foreshore Pedestrian / Cycle Paths**	**No longer relevant or to be incorporated**
26.1	Explore opportunities to improve pedestrian and cycle linkages between riverside towns and the Macleay River Estuary	No longer relevant to CMP. Currently being considered as part of Council's Pedestrian Access Plan
26.2	Ensure future recreation pedestrian / cycle paths in the Macleay Arm area complement the objectives of the Clybucca Historic Site and Yarrahapinni Wetlands National Park	Incorporate into Action 6.3
CZMP	**Strategy 27 – Protocol for Boating Navigation Concerns associated with Sedimentation in the Macleay River**	**Not relevant to the CMP** Actions are standard TfNSW responsibilities
27.1	Monitor river morphology changes to assist in determining sedimentation and shoaling patterns	As above
27.2	Prepare a Maintenance Dredging Protocol	As above
27.3	Seek Approval for Maintenance Dredging	As above
CZMP	**Strategy 28 – Protocol for Boating Navigation Concerns associated with Sedimentation in Back Creek**	Actions no longer relevant However risk remains in relation to the dredging of Back Creek and ongoing navigation issues, and should be investigated through the CMP
28.1	Prepare an Entrance Management Protocol	No longer relevant
28.2	Seek Approval for Maintenance Dredging	No longer relevant
CZMP	**Strategy 29 – Continue to Monitor the Spread of Egeria**	***Action completed***
29.1	Monitor the spread of Egeria at regular intervals.	Initial and follow up monitoring has been completed
29.2	If necessary develop and implement a control program.	Action not necessary
CZMP	**Strategy 30 – Antimony and Arsenic Contamination within the Macleay River Estuary and its Floodplain**	**Actions require update**

	Existing Management Actions	Adequacy / Comment
30.1	Develop a coordinated strategy to address arsenic and antimony contamination within the estuary and its floodplain	How this may be implemented is unclear. There is an existing Macleay River Working Group (MRWG) (convened by Premier and Cabinet in 2011, and meets as needed as convened by DPIE – Coasts and Estuaries). The MRWG includes academics from UNE and SCU, who are continuing to research Antimony and Arsenic contamination in the Macleay. It also includes DPIE Legacy Mines, who continue to report on attempts to remediate the sites (which are highly inaccessible). The MRWG is currently largely a platform for information sharing, particularly from academics who inform of the latest research outcomes. The MRWG also includes other state agencies, Council and key community groups.
30.2	Improve our understanding of the biologic uptake of arsenic and antimony and their transmission through river food webs	Ongoing in collaboration with universities. Research priorities should be reconsidered through CMP, or otherwise, CMP to confirm support for research.
30.3	Improve our understanding of soil concentrations in backswamps and how floodplain management relates to arsenic and antimony distribution and toxicity	As above.
30.4	Research to examine the ecotoxicity of both Arsenic and Antimony in the Australian estuarine environment	As above.
30.5	Ecohealth Monitoring program for Macleay River Catchment to assess level and trends of arsenic and antimony contamination	Action already in progress through alternative mechanism.
30.6	Environmental Quality Guidelines for Antimony	Not relevant to the CMP, as this action is the responsibility of the National Health and Medical Research Council (NHMRC) who maintain the ANZECC guidelines. The current academic research contributes to this. The Macleay is one of the few research sites globally for ecotoxicity of Antimony, for which there are essentially no guidelines worldwide.
30.7	Ensure existing landuse planning and development controls give consideration to potential for elevated arsenic and antimony contamination	Difficult to implement without clear guidance from ANZECC.
30.8	Prepare a comprehensive Communication Strategy	No longer relevant. The communication function is facilitated through peak community groups inclusion in the MRWG.

Appendix C Governance Table

Table C-1 Governance Table: Organisations and Responsibilities Relevant to the Coastal Environment

Govt Level	Agency / Organisation	Responsibility: Agency / Organisation
Federal	Department of the Environment and Energy	• Designs and implements Australian Government policy and programs to protect and conserve the environment, water and heritage, promote climate action, and provide adequate, reliable and affordable energy. • Administers the *Environmental Protection and Biodiversity Conservation Act 1999.* • Heritage items of national environmental significance in and around the Macleay River Estuary are protected under the EPBC Act • Threatened species occurring in and around the Macleay River Estuary are protected under the EPBC Act
Federal	National Health and Medical Research Council	• Australian government body expert body promoting the development and maintenance of public and individual health standards. • Oversees the ongoing development of the National Water Quality Management Strategy, that consists of policy, process and guidelines (including the 'ANZECC guidelines')
State	Department of Planning, Industry and Environment (DPIE)	• The department is a combination of a variety former departments/offices, including the Department of Planning and Environment, Department of Industry (DOI), Office of Local Government, Office of Environment and Heritage, Environment Protection Authority, National Parks and Wildlife Service, Marine Infrastructure Delivery Office (MIDO) and DOI Lands and Water. Relevant sections of this department are explained below.
	DPIE – Coasts and Estuaries	• Agency within the DPIE portfolio. Formerly known as the Office of Environment and Heritage (OEH) • Cares for and protects NSW's environment and heritage (natural, cultural and built), and supports the community, business and government in protecting, strengthening and making the most of a healthy environment and economy in NSW. • Administers the *Coastal Management Act 2016*, which provides framework for strategic management of the NSW coastal zone now and into the future. • Provides technical advice and financial assistance to Councils with preparing and implementing Coastal Management Programs, in line with the Coastal Management Manual and CM Act. • Administers the *Biodiversity Conservation Act 2016,* which establishes a balanced approach to land management and biodiversity conservation in NSW.

Governance Table

Govt Level	Agency / Organisation	Responsibility: Agency / Organisation
State	DPIE – Crown Lands	• Agency within DPIE. Formerly known as Department of Industry – Lands and Water. • Develops strategy, programs and policy for the management of the Crown land estate and Water, with key business areas aiming to deliver social and economic outcomes for the state. • Administers the *Crown Land Management Act 2016*, which provides for ownership and management of NSW Crown land. • Many Crown reserves are managed by Local Government either through appointment as trust managers or by devolvement under the *Local Government Act 1993*. • Approves jetties and other domestic waterfront structures on estuaries not covered by TfNSW. • Investigates and assesses Aboriginal land claims across the state under the *NSW Aboriginal Land Rights Act 1983*. The Crown estate is managed in accordance with Commonwealth Native Title legislation. • Manage NSW water resources, both groundwater and surface waters, through planning, policy and regulation including implementing the *Water Management Act, 2000*.
State	DPIE – Planning and Assessment (PA)	• Administers the Environmental Planning and Assessment Act, including the review and making of LEPs and other gateway determinations, and providing regional to state scale strategic planning, such as documented in the relevant regional plans.
State	DPIE - Office of Local Government	• Agency within the Department of Planning and Environment portfolio. Formerly known as the Office of Local Government. • Is responsible for local government across NSW and is an advisor to the NSW Government on Local Government matters. • Has a policy, legislative, investigative and program focus in matters ranging from Local Government finance, infrastructure, governance, performance, collaboration and community engagement. • Administers the *Local Government Act 1993*, which provides the legal framework for the system of local government for New South Wales.
State	DPIE - National Parks and Wildlife Service (NPWS)	• NPWS manages more than 870 protected areas in NSW including national parks, nature reserves, flora reserves, World Heritage areas, beaches etc. This includes the management on numerous sites within the Kempsey Shire Council LGA including Hat Head National Park, Arakoon National Park, Maria National Park, Yarrahapinni Wetlands National Park and Fishermans Bend National Park.

Governance Table

Govt Level	Agency / Organisation	Responsibility: Agency / Organisation
State	DPIE Environment Protection Authority (EPA)	• The EPA is the primary environmental regulator for NSW and aims to reduce pollution and waste, protect human health and prevent degradation of the environment. • The NSW EPA is an independent statutory authority that sits in the Environment Portfolio under the Minister for the Environment as part of the Planning and Environment Cluster. • Responsible for administering the *Protection of the Environment Operations Act 1997*.
State	DPIE Regions, Industry, Agriculture and Resources – Fisheries	• Agency within the Department of Primary Industries. • Administers the *Fisheries Management Act 1994*, which provides the legislative framework for conserving, developing and sharing the fishery resources of NSW for present and future generations. • Supports economic growth and sustainable access to aquatic resources through commercial and recreational fisheries management, research, aquaculture development, marine protected areas management, habitat protection and rehabilitation, regulation and compliance. Also mitigates and manages risks from use of land and water. • Responsible for ensuring that fish stocks are conserved and key fish habitat is protected. • Responsible for ensuring the sustainable management of commercial, recreational and Aboriginal cultural fishing, aquaculture, aquatic habitat and biodiversity, and marine protected areas within NSW. • Involved in the delivery of the MEM Strategy particularly in regional areas (funding gone directly to Fisheries).
State	Local Land Services	• LLS are a regionally based NSW Government agency that delivers quality services to farmers, landholders and the community. LLS have 11 regions, one of which is North Coast (that covers the Kempsey Shire Council LGA). • The *Local Land Service Act 2013* requires the development of regional strategies to set the vision, priorities and strategy for the delivery of LLS in each region. North Coast Local Land Services consulted with landholders, customers and the community to develop their local strategic plan. The plan was adopted in the first half of 2016 for the period from 2016 to 2021. • Each LLS region is governed by a board of local community representatives. The statewide LLS Board is responsible for safeguarding the delivery of state-wide priorities under the direction of the Minister for Primary Industries. • Involved in the delivery of the MEM Strategy particularly in regional areas (funding gone directly to LLS regions).

Governance Table

Govt Level	Agency / Organisation	Responsibility: Agency / Organisation
State	Marine Estate Management Authority	• The NSW Government Marine Estate Management Authority assists in implementing the Marine Estate Management Strategy to ensure that policies and programs address priority issues, are efficient and evidence based and result in positive outcomes. Their vision is to have a healthy coast and sea managed for the greatest wellbeing of the community now and in the future. • The *Marine Estate Management Act 2014* and *Marine Estate Management Regulation 2017* provides for the strategic and integrated management of the whole marine estate.
State	NSW Coastal Council	• The NSW Coastal Council provides independent expert advice to the Minister administering the *Coastal Management Act 2016* on coastal planning and management issues. • The NSW Coastal Council was appointed under the *Coastal Management Act 2016 and* replaced the NSW Coastal Panel and the Coastal Expert Panel. • The Minister can request the NSW Coastal Council to audit a local council's implementation of its coastal management program to determined if they are being effectively implemented.
State	Transport for NSW (TfNSW)	• Transport for NSW is the lead agency of the NSW Transport cluster. • Tasked with leading the development of a safe, efficient, integrated transport system that connects communities and regions. • Responsible for strategy, planning, policy, regulation, funding allocation and other non-service delivery functions for all modes of transport in NSW (including ferry, cycling and walking)

Governance Table

Govt Level	Agency / Organisation	Responsibility: Agency / Organisation
State	Transport for NSW	• TfNSW is an agency responsible for delivering safe and efficient journeys throughout NSW and managing the operations and programs of waterways (and roads). • TfNSW is responsible for administering the following Acts: - *City of Sydney Act 1988*, Part 4A and Schedule 2, jointly with the Minister for Transport (remainder, the Minister for Local Government) - *Driving Instructors Act 1992* - *Heavy Vehicle (Adoption of National Law) Act 2013* and the *Heavy Vehicle National Law (NSW)* - *Marine Pollution Act 2012* - *Marine Safety Act 1998* - *Marine Safety Legislation (Lakes Hume and Mulwala) Act 2001* - *Motor Vehicles Taxation Act 1988* - *Photo Card Act 2005* - *Ports and Maritime Administration Act 1995* - *Recreation Vehicles Act 1983*, Parts 4 and 6 (remainder, the Minister for the Environment) - *Road Transport Act 2013* - *Roads Act 1993* (except parts, jointly the Minister for Primary Industries and other Ministers, parts, the Minister for the Environment, and parts, the Minister for Local Government) - *Sydney Harbour Tunnel (Private Joint Venture) Act 1987* - *Transport Administration Act 1988*, Part 4A, Divisions 1 to 3, so far as it relates TfNSW, Part 6, and so much of the Act as relates to TfNSW (remainder, the Minister for Transport
State	NSW Land Registry Services (LRS)	• The NSW LRS maintains a secure, efficient and guaranteed system of land ownership for NSW, defines the legal ownership and boundaries of land parcels throughout the State, both private and public, and records changes as they occur. • NSW LRS collects, collates and integrates property information in NSW and makes it readily available. • The community, business and government rely on this information for a variety of purposes including land management, conveyancing, property development, investment, local planning, state economic and social development and historical research.

Governance Table

Govt Level	Agency / Organisation	Responsibility: Agency / Organisation
State	Treasury	• NSW Treasury manage the State's finances and assets, monitor the performance of its commercial agencies and develop its financial and industrial relations policies. • They assist the NSW government in establishing, implementing and delivering the State Budget and provide funding to government agencies and programs.
State	Department of Infrastructure, Regional Development and Cities, Regional Development Australia – Mid North Coast	• Regional Development Australia (RDA) is a joint partnership between the Australian, State, Territory and Local Government to support growth and development of Australia Region; RDA Mid North Coast is one of 14 committees in NSW and covers the local government areas of Coffs Harbour, Bellingen, Nambucca, Kempsey, Port-Hastings and the community of Taree. • RDA Mid North Coast's current priorities include attracting investment to the region, creating opportunities in employment for young people and stimulating innovation across the region.
State	Destination NSW	• Destination NSW is the lead government agency responsible for the major events and tourism sectors. • Their role is to devise and implement strategies to grow the State's visitor economy.
State	Independent Pricing and Regulatory Tribunal	• IPART provides advice and independent regulatory decisions to protect and promote the interests of taxpayers, citizens and consumers of NSW. They are the independent pricing regulator for water, public transport and local government as well as the licence administrator of water, gas and electricity. • IPART is responsible for reviewing Kempsey Shire Councils special rate variation requests etc.
State	Infrastructure NSW	• Infrastructure NSW is an independent statutory agency tasked with identifying and prioritising the delivery of critical public infrastructure for NSW.
State	Local Government NSW	• Local Government NSW is the industry association that represents the interests of NSW general and special purpose councils.
Local	Kempsey Local Aboriginal Land Council	• LALCs are established following the *Aboriginal Land Rights Act 1983 (ALRA)* and are bound by key legislative requirements in the amended ALRA. • The objects of each LALC are to " improve, protect and foster the best interests of all Aboriginal persons within the Council's area and other persons who are members of the Council". • Functions include acquiring and managing land, and promoting/protecting culture and heritage, facilitating business enterprise, provide community benefits

Governance Table

Govt Level	Agency / Organisation	Responsibility: Agency / Organisation
Local	Kempsey Shire Council	• Each local council is an independent entity responsible for administering the local government area over which it has jurisdiction as per the *Local Government Act 1993.* • Council is responsible for administering various legislation and developing their own plans and policies for their LGA (i.e. LEPs, CMPs etc). • Council has key responsibilities in relation to Coastal Zone Management in the LGA including: coastal management works, land use planning, development approval, water quality and pollution regulation, open space and stormwater management etc. • Councils service provision is undertaken through its Integrated Planning and Reporting (IPR) Framework, which consists of a Community Strategic Plan, 4 year Delivery Program, 1 year Operational Plan and various 10 year financial plans for assets, staff resources etc. Actions of the CMP that are councils responsibility are expected to be implemented via the CMP.
Local	Mid North Coast Regional Organisation of Councils (MIDROC)	• MIDROC is a voluntary organisation comprised of seven councils who represent over 300,000 residents. • MIDROC work together to address regional issues, work co-operatively for the benefit of the region and advocate on agreed regional positions and priorities. They aim to improve the wellbeing of our communities on the Mid North Coast, through working with state and federal governments to bring services and funds into the region.
Local	North Coast Environment Council Inc	• The North Coast Environment Council (NCEC) is the peak regional conservation organisation for northern NSW. • Formed in 1976, the NCEC membership consists of more than 30 groups and individuals based in the area from the Hunter to the Tweed and west to the New England Tablelands. • NCEC educate, lobby, campaign and advocate for the environment of the north coast region and the communities which depend on it.
Local	Oyster Farmers	• Oyster farms exist on the Macleay River

Appendix D Legislation Summary

D.1 NSW Coastal Zone Legislation and Policy

D.1.1 Coastal Management Act 2016

The *Coastal Management Act 2016* was passed in the NSW Parliament in April 2016, and came into force in April 2018 once the CM SEPP was passed. The CM Act replaced the *Coastal Protection Act, 1979*. Under the CM Act, the coastal zone is now defined as comprising four coastal management areas, each with its own objectives under the Act:

- Coastal wetlands and littoral rainforests area;
- Coastal vulnerability area;
- Coastal environment area; and
- Coastal use area.

Mapping of all coastal management areas is gazetted under the CM SEPP, although no maps are currently available for the *coastal vulnerability area*. The SEPP mapping can be updated or in the case of the CVA, included via a Planning Proposal under the EPA Act. Further definition of the coastal management areas is provided below.

Under the CM Act, a coastal zone management plan will now take the form of a Coastal Management Program (CMP). The CM Act sets the minimum requirements for preparing and certifying CMPs.

D.1.1.1 Coastal Wetlands and Littoral Rainforest Area

Coastal wetlands and littoral rainforest support high value biodiversity that are particularly sensitive to development. This management area is defined in the CM Act as land which displays 'the hydrological and floristic characteristics of coastal wetlands or littoral rainforests and land adjoining those features' (DPE, 2016). This area focusses on protecting well established and more extensive vegetation communities (as opposed to single trees or isolated stands). The maps include a 100-metre proximity area, applying to all land use zones, around coastal wetlands and littoral rainforests.

The objectives of the coastal wetland and littoral rainforest management area within the CM Act are to:

- protect coastal wetlands and littoral rainforests in their natural state, including their biological diversity and ecosystem integrity,
- promote the rehabilitation and restoration of degraded coastal wetlands and littoral rainforests,
- improve the resilience of coastal wetlands and littoral rainforests to the impacts of climate change, including opportunities for migration,
- support the social and cultural values of coastal wetland and littoral rainforest communities,
- promote the objectives of State policies and programs for wetlands or littoral rainforest management.

D.1.1.2 Coastal Vulnerability Area

The CM Act recognises seven coastal hazards within the NSW coastal zone. The coastal vulnerability area focusses on identifying land subject to current and future coastal hazards, and ensure land use management undertaken in these areas recognise coastal risk.

The summarised objectives of the coastal vulnerability management area within the CM Act are to:

- ensure public safety and prevent risks to human life;
- mitigate current and future coastal hazards;
- maintain the presence of beaches, dunes and other natural features;
- maintain public access, amenity and use of the coast;
- encourage land use that reduces exposure to hazards, including through siting, design, construction and operational decisions;
- adopt coastal management strategies that reduce exposure to hazards, in the first instance by restoring or enhancing natural defences such as dunes, and thereafter by taking other action and
- if taking other action, to
  - avoid significant degradation or disruption of biological diversity, ecosystem integrity, coastal processes (ecological, biophysical, geological, geomorphological), beach and foreshore amenity, and social and cultural values,
  - avoid adverse offsite impacts, or otherwise restore the land if any impacts are caused by the action to reduce exposure to hazards,
- maintain essential infrastructure; and
- improve community resilience and reduce reliance on emergency responses.

D.1.1.3 Coastal Environment Area

The NSW coastal environment is diverse and encompasses a range of different landforms, processes and environments. The coastal environment management area is land containing features such as the coastal waters of the State, estuaries, coastal lakes and lagoons, and land adjoining those features such as headlands and rock platforms.

The objectives of the coastal environment areas within the CM Act are to:

- protect and enhance coastal environmental values and natural processes of coastal waters, estuaries, coastal lakes, coastal lagoons, and enhance natural character, scenic value, biological diversity and ecosystem integrity;
- reduce threats to and improve resilience of these coastal environments, including in response to climate change;
- maintain and improve water quality and estuary health;
- support social and cultural values of the coastal environments;
- maintain the presence of beaches, dunes and natural features of the foreshore; and
- maintain and improve public access, amenity and use of the coast.

D.1.1.4 Coastal Use Area

The coastal zone comprises land that is extremely valuable to the economy and society. Indeed, the coast supports a range of human uses and development types that enable the wider coastal community to live, work and play on the coast. The coastal use management area encompasses land adjacent to coastal waterways (ocean, estuaries, lakes etc.) where impacts of development on the use and enjoyment of the beaches, dunes, estuaries and lakes need to be considered.

The objectives of the coastal use area within the CM Act are to:

- protect and enhance the scenic, social and cultural values of the coast by ensuring that:
  - the type, bulk, scale and size of development is appropriate for the location and natural scenic quality of the coast,
  - adverse impacts of development on cultural and built environmental heritage are avoided or mitigated,
  - urban design, including water sensitive urban design, is supported and incorporated into development activities,
  - adequate public open space is provided, including for recreational activities and associated infrastructure, and
  - the use of the surf zone is considered;
- accommodate both urbanised and natural stretches of coastline.

D.1.2 SEPP (Coastal Management) 2018

The *State Environmental Planning Policy (Coastal Management) 2018* (the 'CM SEPP') passed in Parliament in April 2018, which brought the CM Act into force. The CM SEPP amalgamated and repealed SEPP No. 71 – Coastal Protection, SEPP No. 14 – Coastal Wetlands and SEPP No. 26 – Littoral Rainforest. The CM SEPP also allowed for the repeal of compulsory LEP Clause 5.5 Development in the Coastal Zone.

The CM SEPP defines the strategic planning objectives and development controls applicable to the four coastal management areas comprising the coastal zone as defined in the CM Act (i.e. coastal wetlands and littoral rainforests area, coastal vulnerability area, coastal environment area, and coastal use area).

The CM SEPP is supported by maps of the coastal management areas, except the coastal vulnerability area. Under the new process for the preparation of CMPs, Council may submit a Planning Proposal (in accordance with the EPA Act) to update any of the coastal management area maps. It is anticipated that Councils will submit planning proposals to have existing or new coastal hazard mapping adopted as the coastal vulnerability area. Updating the coastal wetland and littoral rainforest management area maps is also likely to be common.

D.1.3 Marine Estate Management Act 2014

The *Marine Estate Management Act 2014* replaced the *Marine Parks Act 1997*. Under the *Marine Estate Management Act 2014* marine parks are now declared and managed by the NSW Department

of Primary Industries (DPI). The NSW Marine Estate Management Authority (MEMA) was established by the NSW Government in 2013 to advise on policies, priorities and directions for the NSW marine estate.

The marine estate is defined in the *Marine Estate Management Act 2014* (s6), as:

"(a) the coastal waters of the State within the meaning of Part 10 of the Interpretation Act 1987,

(b) estuaries (being any part of a river whose level is periodically or intermittently affected by coastal tides) up to the highest astronomical tide,

(c) lakes, lagoons and other partially enclosed bodies of water that are permanently, periodically or intermittently open to the sea,

(d) coastal wetlands (including saltmarsh, mangroves and seagrass),

(e) lands immediately adjacent to, or in the immediate proximity of, the coastal waters of the State that are subject to oceanic processes (including beaches, dunes, headlands and rock platforms),

(f) any other place or thing declared by the regulations to be the marine estate,

but does not include any place or thing declared by the regulations not to be the marine estate".

In this case, and as reciprocated in the *Coastal Management Act 2016*, CMPs need to align with the *Marine Estate Management Act 2014*.

Marine protected areas are part of the NSW marine estate managed to conserve marine biodiversity and support marine science, recreation and education. The NSW marine protected area system includes: six marine parks; 12 aquatic reserves; and marine and estuarine habitats within national parks and nature reserves.

D.1.4 Coastal Management Manual

The NSW Coastal Management Manual ('the Manual') was released by the [former] NSW Office of Environment and Heritage (OEH) in 2018 to guide the preparation of Coastal Management Programs (CMPs) in accordance with the CM Act. A CMP sets out the long-term strategy for co-ordinated management of land within the coastal zone, that addresses local circumstances while also meeting the state objectives. The Manual comprises three parts:

- Part A: outlines the mandatory requirements in the CM Act, and the essential elements councils are required to follow in preparing a CMP.
- Part B: describes in detail the process for preparing a CMP.
- Part C: provides a technical toolkit with advice on a range of topics.

D.2 Key Commonwealth Legislation Supporting Coastal Management

D.2.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act) is Australia's key piece of environmental legislation focusing on the protection of matters of national environmental

significance (MNES). It provides the legal framework for the protection and management of nationally and internationally important flora, fauna, ecological communities and heritage places.

The nine MNES to which the EPBC Act applies are:

- world heritage properties
- national heritage places
- wetlands of international importance (often called 'Ramsar' wetlands)
- nationally threatened species and ecological communities
- migratory species
- Commonwealth marine areas
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mining)
- a water resource, in relation to coal seam gas development and large coal mining development

Additionally, the EPBC Act confers jurisdiction over actions that have a significant environmental impact where the actions affect or are taken on Commonwealth land or are carried out by a Commonwealth agency (even if the significant impact is not on a MNES).

The EPBC Act is administered by the Australian Government Department of the Environment and Energy.

D.3 Key NSW Legislation Supporting Coastal Management

D.3.1 Environmental Planning & Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EPA Act) is the key NSW legislation for planning and land use. The Act provides a system of environmental planning and assessment for NSW, and involves developing plans to regulate competing land uses, through 'environmental planning instruments'. The EPA Act establishes three types of environment planning instruments (EPI):

- Local Environmental Plans;
- Regional Environmental Plans; and
- State Environmental Planning Policies.

The objectives of the EPA Act are to encourage:

- proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment;
- promotion and co-ordination of the orderly and economic use and development of land;
- protection, provision and co-ordination of communication and utility services;

- provision of land for public purposes;
- provision and co-ordination of community services and facilities;
- protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats;
- ecologically sustainable development;
- the provision and maintenance of affordable housing;
- promotion of the sharing of the responsibility for environmental planning between the different levels of government in the State; and
- provision of increased opportunity for public involvement and participation in environmental planning and assessment.

Approval processes for “development” and “works” in NSW are provided for in Part 3A, Part 4, Part 5 and Part 5A of the EPA Act. Key provisions are outlined briefly below.

Part 3A – Major Infrastructure and Other Projects

Part 3A came into operation in August 2005 and applies to development that is declared to be a project to which the part applies. A project can be declared by:

- A State Environmental Planning Policy (SEPP), with SEPP No. 71 – Coastal Protection of relevance to the coastal zone, or
- By order of the Minister for Planning published in the Government Gazette.

There are two types of development that may be declared for Part 3A approval (i.e. in addition to those directed to the Minister via a SEPP):

- Major infrastructure or other development that in the opinion of the Minister is of state or regional environmental significance, or
- Old Part 5 activity approvals where the proponent is the determining authority and an EIS would have been required.

Guidelines regarding Part 3A projects have been provided by DPIE. Part 3A of the EPA Act has now been repealed, with the provisions largely incorporated into other planning instruments, such as *SEPP Infrastructure*.

Part 4 – Development Assessment

Part 4 of the EPA Act lays out the legislative regime for the standard process for lodgement and consideration of development applications. Part 4 processes essentially apply where the local authority (Council) is the consent authority.

The controls and permissibility for development of particular sites and / or uses are found in the Local Environment Plan (LEP) and Development Control Plan (DCP) (see following sections).

Part 5 – Environmental Assessment

Part 5 outlines the requirements for determining authorities to consider the environmental impact of activities, through an environmental assessment for the proposed activity. The environmental assessment shall outline the effect of the activity on critical habitat, endangered fauna, vulnerable species, conservation agreements (under the *National Parks and Wildlife Act 1974*), plans of management, wilderness areas (under the *Wilderness Act 1987*) and joint management agreements and bio-banking agreements under the *Threatened Species Act, 1995*, and any other legislation pertaining to the proposed activity.

Part 5 of the Act applies to proposed activities that are permissible without development consent under Part 4 of the EPA Act but require approval from a Minister or Public Authority, or is proposed to be carried out by a Minister or Public Authority (and Council is classified as a Public Authority).

Part 5 obliges the "determining authority" for the proposal to consider the environmental impact of any activity. A determining authority is the public authority which is required to approve an activity, and can also be the public authority proposing to carry out the activity. For example, Council is permitted to undertake certain environmental management activities under SEPP (Infrastructure) 2007 without development consent, however may need to complete and environmental assessment under Part 5 of the EPA Act.

Part 5A (Development by the Crown) essentially provides a legislative regime for consideration of Development Applications made by, or for and on behalf of, the Crown.

The remaining parts of the EPA Act relate to: Part 6 – Implementation and Enforcement; Part 7 – Finance and Part 8 – Miscellaneous.

D.3.2 Draft Environment SEPP

The NSW Government is in the process of developing a new SEPP which will ensure the protection and management of the natural environment. The new Environment SEPP combine, repeal and replace the following:

- State Environmental Planning Policy No. 19—Bushland in Urban Areas
- State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011
- State Environmental Planning Policy No. 50—Canal Estate Development
- Greater Metropolitan Regional Environmental Plan No. 2—Georges River Catchment
- Sydney Regional Environmental Plan No. 20—Hawkesbury-Nepean River (No.2-1997)
- Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005
- Willandra Lakes Regional Environmental Plan No. 1—World Heritage Property.

The purpose of the proposed SEPP Environment is to promote the protection and improvement of key environmental assets for their intrinsic value and the social and economic benefits they provide.

The SEPP (Environment) will have provisions set out under four parts, being:

(1) Catchments

(2) Waterways

(3) Bushland

(4) Protected Areas

It will incorporate revisions to current SEPPs to remove unnecessary or outdated policy, address emerging issues and locate provisions in the most appropriate level of the planning system. The proposed Environment SEPP will provide a consistent level of environmental protection to that which is currently delivered under the existing SEPPs.

D.3.3 Local Government Act 1993

The *Local Government Act 1993* (the LG Act) creates local governments and grants them the power to perform their functions, which involve management, development, protection, restoration, enhancement and conservation of the environment for the local government area. The functions of the local government are to be performed in a manner that are consistent with and promote the principles of ecologically sustainable development.

The service functions of local councils (defined in Chapter 6 of the LG Act) includes the classification, use and management of public land, including the objectives for management of the Community Land owned by Council (i.e. that is not Crown Land).

Plans of Management for Community Land need also to be prepared under Section 35 of the Act. Section 35 of the act provides that community land only be used in accordance with the plan of management applying to the parcel of community land; any law permitting the use of the land for a specified purpose or otherwise regulating the use of the land; and the provisions of Division 2 Chapter 6 of the Act.

Community land can be categorised into a range of categories under Section 36 of the Act, and each of these categories have their own core objectives specified under the Act. The categorisation of community lands is important as the Act requires Council to only grant a lease, licence or another estate (other than in respect of public utilities) for a purpose consistent with the core objectives of the category of that community land.

D.3.4 Crown Land Management Act 2016

The *Crown Land Management Act 2016* (the CLM Act) which commenced on 1 July 2018 implements reforms identified through a comprehensive review of Crown land management and follows almost six years of community engagement.

The objects of the CLM Act are to:

- *"provide for the ownership, use and management of the Crown land of New South Wales,*
- *provide clarity concerning the law applicable to Crown land,*
- *require environmental, social, cultural heritage and economic considerations to be taken into account in decision-making about Crown land,*
- *provide for the consistent, efficient, fair and transparent management of Crown land for the benefit of the people of New South Wales,*

- *facilitate the use of Crown land by the Aboriginal people of New South Wales because of the spiritual, social, cultural and economic importance of land to Aboriginal people and, where appropriate, to enable the co-management of dedicated or reserved Crown land,*
- *provide for the management of Crown land having regard to the principles of Crown land management".*

A key feature of the new CLM Act is the appointment of a Crown Land Commissioner with broad advisory and inquiry functions who will play a key role in maintaining transparency regarding Crown land management.

D.3.5 Fisheries Management Act 1994

The *Fisheries Management Act 1994* outlines legislation relating to the management of fishery resources in NSW. The aim of the *Fisheries Management Act 1994* is to conserve, develop and share the fishery resources of the State for the benefit of present and future generations.

The Act is divided into 10 parts and covers: fishery management strategies, general fisheries management, commercial share management fisheries, licensing and other commercial fisheries management, charter fishing management, co-operation with Commonwealth and other States in fisheries management, aquaculture management, protection of aquatic habitats, threatened species conservation, administration and enforcement.

The *Fisheries Management Act 1994* is administered by the Minister for Primary Industries.

D.3.6 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (the BC Act) commenced on 25 August 2017 with the intent to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development.

The BC Act established a modern and integrated legislative framework for biodiversity conservation and repealed the previous *Threatened Species Conservation Act 1995*, the *Nature Conservation Trust Act 2001*, and the animal and plant provisions of the *National Parks and Wildlife Act 1974*. It is comprised of 14 parts including:

- Part 1: Preliminary
- Part 2: Protection of animals and plants
- Part 3: Areas of outstanding biodiversity value
- Part 4: Threatened species and threatened ecological communities
- Part 5: Investment Strategy and private land conservation agreements
- Part 6: Biodiversity offsets scheme
- Part 7: Biodiversity assessment and approvals under Planning Act
- Part 8: Biodiversity certification of land

- Part 9: Public consultation and public registers
- Part 10: Biodiversity Conservation Trust
- Part 11: Regulatory compliance mechanisms
- Part 12: Investigation powers
- Part 13: Criminal and civil proceedings
- Part 14: Miscellaneous

D.3.7 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act) is the NSW legislation in place to conserve the State's natural and cultural heritage, foster public appreciation, understanding and enjoyment of NSW's natural and cultural heritage and manage any lands reserved for those purposes.

The NPW Act is the main piece of legislation for managing and protecting Aboriginal cultural heritage with Part 6 of the Act providing protection for Aboriginal objects and places. All Aboriginal sites in NSW are protected under the NPW and it is an offence to damage or destroy them (this includes collecting artefacts) without prior permission of the Director-General of DPIE – Coasts and Estuaries.

D.3.8 Water Management Act 2000

The *Water Management Act 2000* (WM Act) establishes the principles and legislative framework governing water management in NSW. The WM Act aims to provide for the sustainable and integrated management of NSW water sources for the benefit of both present and future generations.

It includes requirements on water management planning, sharing, allocation and the use and the granting of access licences. The WM Act also defines what constitutes an offence. Examples of offences include taking water without an access licence, taking water for which there is no water allocation or contravening the terms and conditions of an access licence.

D.3.9 Local Land Services Act 2013

The *Local Land Services Act* (LLS Act) commenced on 1 January 2014, establishing Local Land Services and paving the way for the 11 regional Local Land Services organisations to begin operating. The LLS Act repealed the *Rural Lands Protection Act 1998*, the *Rural Lands Protection Amendment Act 2008* and the *Catchment Management Authorities Act 2003*.

The LLS Act identifies Local Land Services *"programs and advisory services associated with agricultural production, biosecurity, natural resource management and emergency management, including programs and advisory services associated with the following:*

(a) agricultural production,

(b) biosecurity, including animal pest and disease and plant pest and disease prevention, management, control and eradication,

(c) preparedness, response and recovery for animal pest and disease and plant pest and disease emergencies and other emergencies impacting on primary production or animal health and safety,

(d) animal welfare,

(e) chemical residue prevention, management and control,

(f) natural resource management and planning,

(g) travelling stock reserves and stock watering places,

(h) control and movement of stock,

(i) related services and programs".

The LLS Act designates local decision making and priority setting to Local Land Services.

D.3.10 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) is the primary piece of legislation concerned with environmental protection in NSW and is administered by the NSW Environment Protection Authority (EPA). The POEO Act deals with the regulation and licensing of certain activities, issuing of environmental protection notices and conducting environmental audits and investigations.

Councils have the power under the act to regulate non-scheduled activities through notices and enforcement. Specifically, the Council can issue a clean-up notice if a pollution incident has occurred. This can include water pollution, littering and dumping of waste.

D.3.11 Mining Act 1992

The *Mining Act 1992* makes provisions with respect to prospecting for and mining minerals. The objects of the Mining Act 1992 are to *"encourage and facilitate the discovery and development of mineral resources in New South Wales, having regard to the need to encourage ecologically sustainable development, and in particular*:

- *to recognise and foster the significant social and economic benefits to New South Wales that result from the efficient development of mineral resources, and*
- *to provide an integrated framework for the effective regulation of authorisations for prospecting and mining operations, and*
- *to provide a framework for compensation to landholders for loss or damage resulting from such operations, and*
- *to ensure an appropriate return to the State from mineral resources, and*
- *to require the payment of security to provide for the rehabilitation of mine sites, and*
- *to ensure effective rehabilitation of disturbed land and water, and*
- *to ensure mineral resources are identified and developed in ways that minimise impacts on the environment."*

Appendix E Consultation Activities

E.1 Online Community Survey

E.1.1 Online Community Survey from Councils Website

Figure E-1 KSC Online Engagement Portal

E.1.2 Results obtained from Council's Website

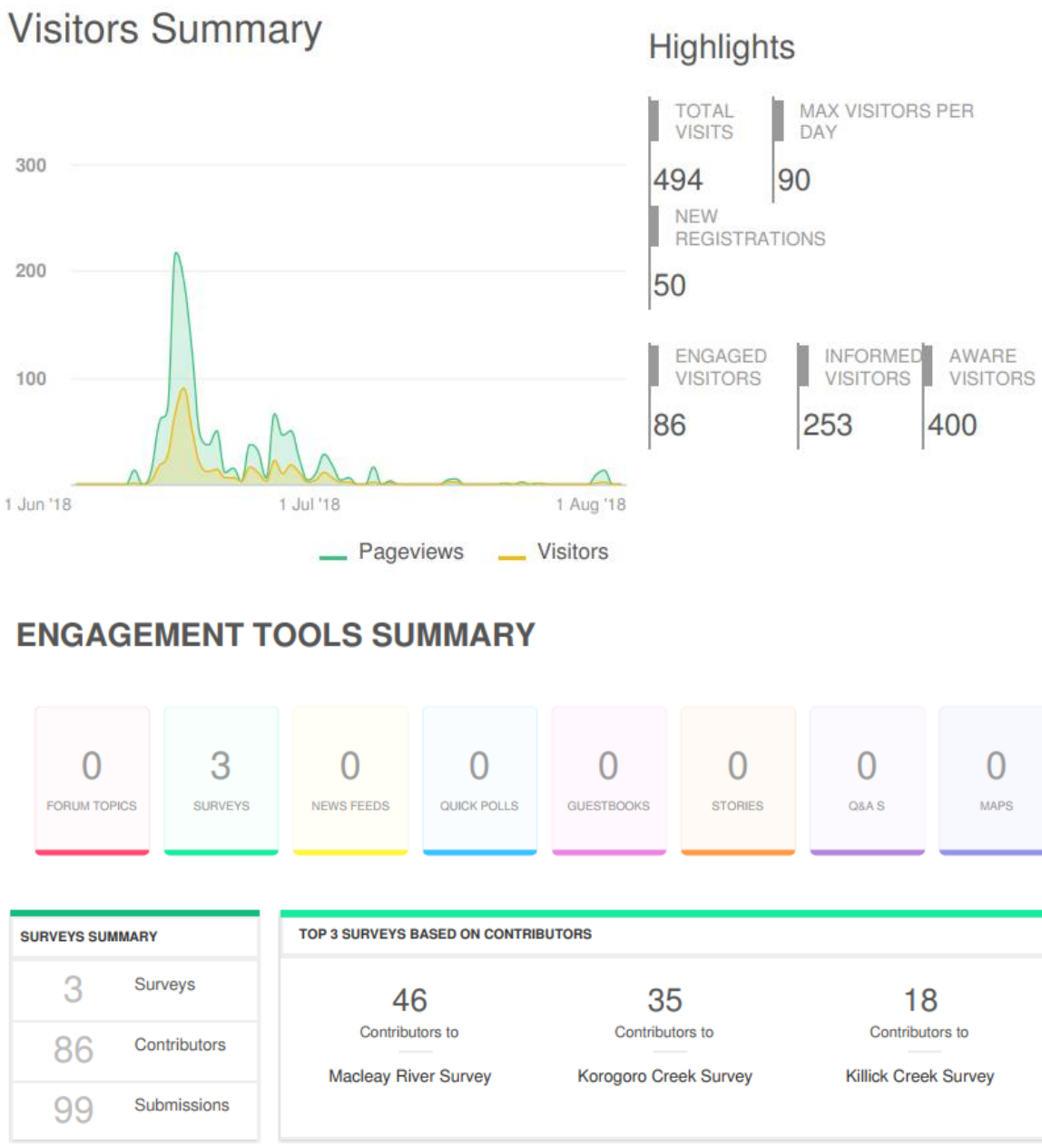


Figure E-2 KSC Survey Responses Summary

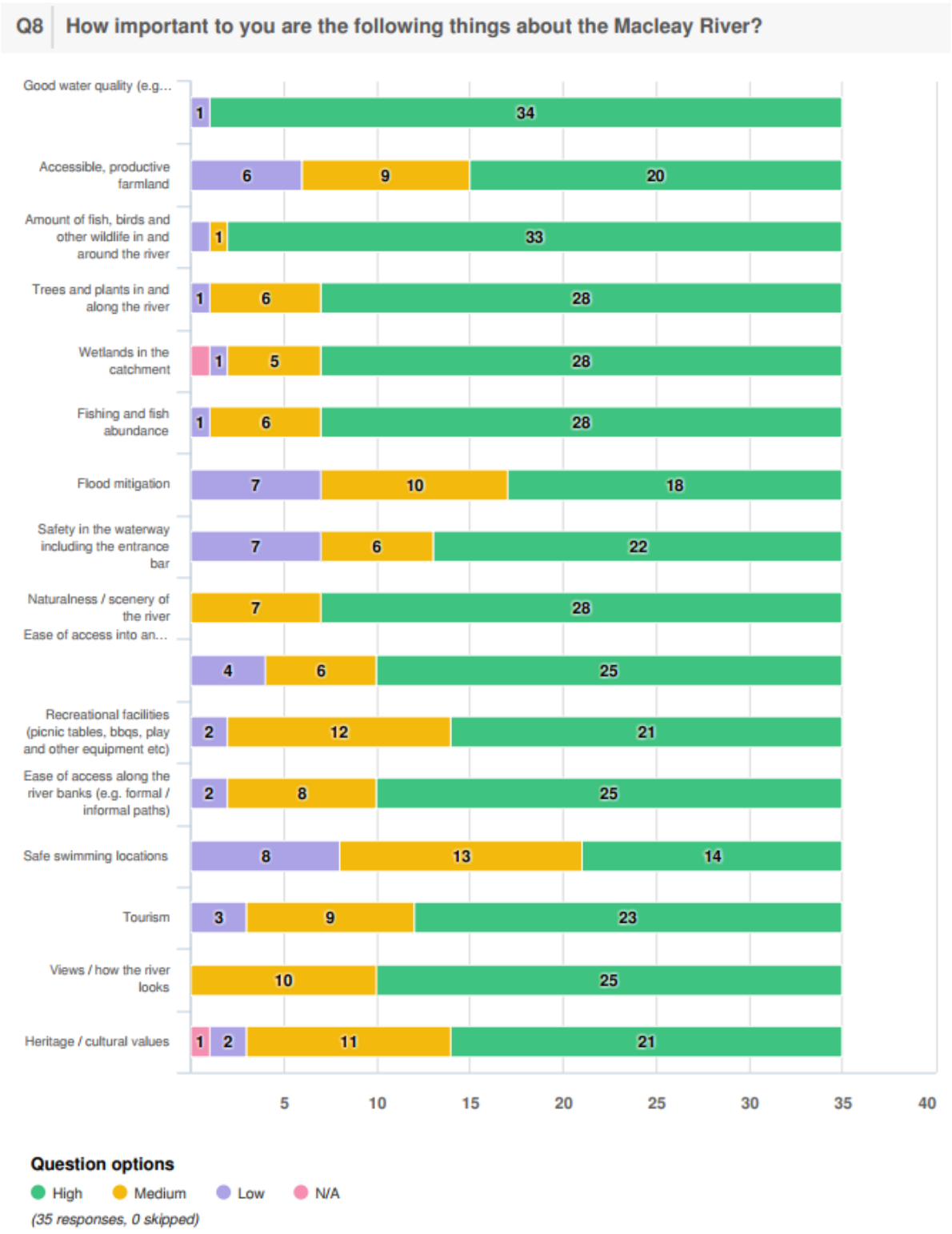


Figure E-3 Macleay Survey Responses (Values)

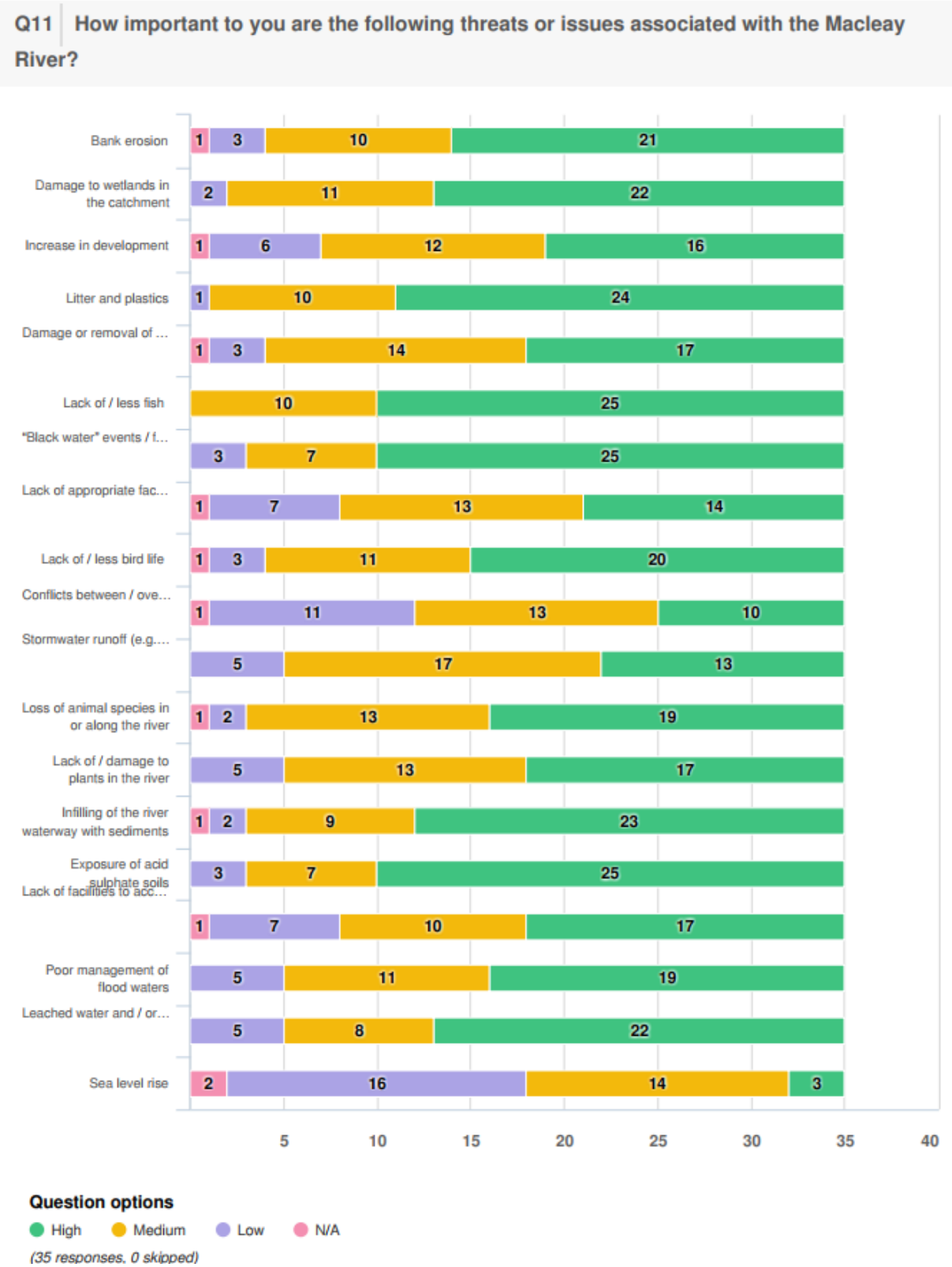


Figure E-4 Macleay Survey Responses (Threats and Issues)

Appendix F First Pass Risk Assessment

F.1 First Pass Risk Assessment Workshops: Worksheets

Threat	Broad Risk Level	Current Management Action / Arrangements	Risk Level after Management action	Future trajectory of risk1 (including existing management action)	Assessment of Management Adequacy
Clearing of riparian, terrestrial and wetland habitats, including wetland drainage	High	Priority sites identified in CZMP in lower Macleay, range of management actions suggested in CZMP	High	High	Inadequate due to existing policy
Foreshore and bank erosion, including degraded / failing riverbank protection structures	High	Management action recommending monitoring of public foreshore infrastructure in erosion prone areas	High	High	Inadequate due to lack of existing policy
Stock grazing of riparian and aquatic vegetation, including wetlands	High	Ecohealthy and risk assessment undertaken by DPIE – Coasts and Estuaries. Best practice conditions are within licences..	High	High	Inadequate as actions only exist in the estuarine areas under the CZMP but not in areas of greatest impact (upper catchment). These areas are however outside of the Kempsey LGA. Current licencing conditions also inadequate.
Agricultural diffuse source runoff	High	Ecohealthy and risk assessment undertaken by DPIE – Coasts and Estuaries.	High	High	Inadequate as actions only exist in the estuarine areas under the CZMP but not in

Threat	Broad Risk Level	Current Management Action / Arrangements	Risk Level after Management action	Future trajectory of risk1 (including existing management action)	Assessment of Management Adequacy
					areas of greatest impact (upper catchment). These areas are however outside of the Kempsey LGA
Urban development: catchment and foreshore	Low	DCPs and LEPs have extensive groundwater aquifer studies which drove the strategy for existing and future water supply. CZMP contains a range of development planning control actions.	Low	Med	Inadequate due to existing policy
Introduction of invasive species (pests, weeds and marine diseases)	Med	N/A - State wide programs in place for some specific weeds. NPWS has eradication plans.	Med	High	Inadequate as no programs or management actions exist specifically for the Macleay.
Oyster Aquaculture	Med	N/A	Low	Med	N/A
Occurrence of algal blooms toxic to fish and human health	Med	N/A	Med	Med	N/A
Clearing of estuarine habitats (mangroves etc); EECs on private property	High	Priority sites identified in CZMP in lower Macleay. Legislation in place to mitigate risk and protect EECs. A range of management	High	High	Inadequate do to existing governance arrangements

Threat	Broad Risk Level	Current Management Action / Arrangements	Risk Level after Management action	Future trajectory of risk1 (including existing management action)	Assessment of Management Adequacy
		actions suggested in CZMP.			
Boating activities (recreational, commercial tourism / fishing charters; passive and motorised)	High	N/A - management action suggested in CZMP for education programs	Med	High	N/A
Recreational fishing (shore-based, boat-based)	Med	N/A - management action suggested in CZMP for education programs	Med	Med	N/A
Lack of sufficient or appropriate waterway access facilities (boat ramps, jetties, sewage disposal facilities, fish cleaning etc)	Med	Management action relating to the provision of formalised access within CZMP.	Low	Med	Adequate. Recommended action be carried forward to CMP Stage 4 following updates incorporating existing works
Lack or loss of public foreshore access and facilities (e.g. reserves, paths, picnic tables, etc)	Low		Low	Low	N/A
Sedimentation of estuary watercourses	High	Range of man agent actions in CZMP to reduce sediment load	High	High	Inadequate do to existing governance arrangements
Entrance modifications (breakwaters, training walls) and navigation maintenance dredging	Low	Monitoring and management actions detailed under CZMP	Low	Low	Inadequate

Threat	Broad Risk Level	Current Management Action / Arrangements	Risk Level after Management action	Future trajectory of risk1 (including existing management action)	Assessment of Management Adequacy
Flood mitigation, flood gates, other artificial barriers to flow (e.g. dams, weirs, waterway crossings), and water extraction.	High	Management actions and plans now in place for Killick, Belmore, Kinchela, Riley's and Worthings floodgates.	High	Med	Adequate. Recommended action be carried forward to CMP Stage 4 incorporating updated management plans.
Overland flooding	Low	N/A	Low	Med	N/A - Flood model under development which will help inform future management actions
Stormwater discharge and runoff (resulting in litter, plastics, etc)	Low	Stormwater management plan	Low	Low	N/A
Acid Sulphate soils exposure	High		High	High	N/A
Derelict mine discharges: sediments and water	High	N/A	High	High	N/A
Disturbance of contaminated sediments	High	Management actions in CZMP to reduce sediment load	High	High	Inadequate as actions do not specifically target contaminated sediment
Mining and other extractive industries	High	N/A	High	High	N/A
Permanent tidal Inundation due to sea level rise	Low	CZMP includes SLR mapping of open coast	Low	High	Mapping does not cover estuarine reaches of the Macleay River

Threat	Broad Risk Level	Current Management Action / Arrangements	Risk Level after Management action	Future trajectory of risk1 (including existing management action)	Assessment of Management Adequacy
Drought	Low	N/A	Low	Med	
Bushfire	Low	N/A	Low	Med	
Septic runoff and sewage overflows	Low	Operator has organisational plans and septic monitoring has been undertaken.	Low	Low	No plans to mitigate future risks though worsening.
Loss of social connection	Low	N/A -Actions detailed in CZMP	Low	Low	N/A

BMT has a proven record in addressing today's engineering and environmental issues.

Our dedication to developing innovative approaches and solutions enhances our ability to meet our client's most challenging needs.

BMT in Environment Other BMT offices

Brisbane
Level 8, 200 Creek Street
Brisbane Queensland 4000
PO Box 203 Spring Hill Queensland 4004
Australia
Tel +61 7 3831 6744
Fax +61 7 3832 3627
Email brisbane@bmtglobal.com

Melbourne
Level 5, 99 King Street
Melbourne Victoria 3000
Australia
Tel +61 3 8620 6100
Fax +61 3 8620 6105
Email melbourne@bmtglobal.com

Newcastle
126 Belford Street
Broadmeadow New South Wales 2292
PO Box 266 Broadmeadow
New South Wales 2292
Australia
Tel +61 2 4940 8882
Fax +61 2 4940 8887
Email newcastle@bmtglobal.com

Adelaide
5 Hackney Road
Hackney Adelaide South Australia 5069
Australia
Tel +61 8 8614 3400
Email info@bmtdt.com.au

Northern Rivers
Suite 5
20 Byron Street
Bangalow New South Wales 2479
Australia
Tel +61 2 6687 0466
Fax +61 2 6687 0422
Email northernrivers@bmtglobal.com

Sydney
Suite G2, 13-15 Smail Street
Ultimo Sydney New South Wales 2007
Australia
Tel +61 2 8960 7755
Fax +61 2 8960 7745
Email sydney@bmtglobal.com

Perth
Level 4
20 Parkland Road
Osborne Park Western Australia 6017
PO Box 2305 Churchlands Western Australia 6018
Australia
Tel +61 8 6163 4900
Email wa@bmtglobal.com

London
Zig Zag Building, 70 Victoria Street
Westminster
London, SW1E 6SQ
UK
Tel +44 (0) 20 8090 1566
Email london@bmtglobal.com

Leeds
Platform
New Station Street
Leeds, LS1 4JB
UK
Tel: +44 (0) 113 328 2366
Email environment.env@bmtglobal.com

Aberdeen
11 Bon Accord Crescent
Aberdeen, AB11 6DE
UK
Tel: +44 (0) 1224 414 200
Email aberdeen@bmtglobal.com

Asia Pacific
Indonesia Office
Perkantoran Hijau Arkadia
Tower C, P Floor
Jl: T.B. Simatupang Kav.88
Jakarta, 12520
Indonesia
Tel: +62 21 782 7639
Email asiapacific@bmtglobal.com

Alexandria
4401 Ford Avenue, Suite 1000
Alexandria, VA 22302
USA
Tel: +1 703 920 7070
Email inquiries@dandp.com