APPENDIX A SCOPING STUDY FOR MORUYA RIVER, MUMMUGA LAKE AND WAGONGA INLET

Moruya River, Mummuga Lake and Wagonga Inlet

Scoping Study

for

Estuarine Coastal Management Program

Final

Prepared by Salients, Coastal Environment and the University of Newcastle for Eurobodalla Shire Council

4th December 2020

MORUYA RIVER, MUMMUGA LAKE AND WAGONGA INLET
SCOPING STUDY FOR ESTUARINE MANAGEMENT PROGRAM

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Executive Summary

E.1 Introduction

Salients, in consultation with Coastal Environment and the University of Newcastle, has been engaged by Eurobodalla Shire Council (Council) to prepare a Coastal Management Program (CMP) for the Moruya River, Mummuga Lake and Wagonga Inlet estuaries. The CMP is to be prepared under the governing framework for coastal management in NSW, which commenced in April 2018. That framework defines four coastal management areas: the coastal wetland (and littoral rainforest); coastal vulnerability; coastal environment and coastal use management areas. These areas are mapped under *State Environmental Planning Policy (Coastal Management) 2018*. There are no identified littoral rainforest areas within the coastal zone surrounding the three subject estuaries and the coastal vulnerability area has not yet been mapped around the estuaries. The *Coastal Management Manual* details a process for developing a CMP. This *Scoping Study* fulfils the first stage of that process for the three estuaries.

Preparation of the Scoping Study commenced prior to final adoption of the current governing framework for coastal management in NSW. The project (including finalisation of this Scoping Study and development of the CMP) has experienced delays due to:

- Uncertainties associated with the new framework and its implementation.
- A severe bushfire emergency on the South Coast of NSW over the Summer of 2019/2020, which stretched Council's resources and meant that expenditure on some of the studies initially recommended by the draft Scoping Study could not be funded.
- The global COVID-19 pandemic which presented complications in progressing with consultation tasks to support stages 2 and 3 of the framework.

Ultimately, Council and DPE provided comments on the draft Scoping Study around mid-2019 but delays of around one year meant that the remainder of the process was not picked up until around mid-2020. The Scoping Study has evolved to better reflect the contents and approach of the CMP to which it is now appended. Where relevant, changes made in the final Scoping Study are highlighted alongside a description of the reasons for those changes.

E.2 Location

The Eurobodalla LGA is some 220km south of Sydney on the NSW coast. The location of the three estuaries, inside the Eurobodalla Local Government Area (LGA), is shown in Figure E.1. The Moruya River, Mummuga Lake and Wagonga Inlet estuaries are important features of the Moruya, Dalmeny, and Narooma communities, respectively. A closer look at the coastal management areas associated with the three estuaries is provided in the following sections. As the coastal management program process is followed, proposals to modify the maps in the Coastal Management SEPP may arise, but no modifications to the maps are proposed at this stage.

E.3 Moruya River

The extent of the coastal zone surrounding the Moruya River Estuary is mostly defined by the coastal environment area, which has been mapped as an all-inclusive buffer of some 600m from the estuarine waterway foreshores. In contrast, the coastal use area, which is almost entirely contained within the

coastal environment area, comprises a fringing buffer of some 300m around the foreshores of the estuarine waterway. The Moruya Estuary also contains several mapped coastal wetlands.

E.3 Mummuga Lake

Similarly, the coastal zone surrounding Mummuga Lake is mostly defined by the coastal environment area, an all-inclusive buffer of some 600m from the estuarine waterway. The coastal use area, which is almost entirely contained within the coastal environment area, comprises a fringing buffer of some 300m around the foreshores of the estuarine waterway. The Mummuga Estuary contains mapped coastal wetlands associated with the entrance (flood tide) delta and the Lawlers Creek alluvial delta.

E.4 Wagonga Inlet

The extent of the coastal zone surrounding the Wagonga Inlet is again mostly defined by the 600m buffer coastal environment area containing the coastal use area comprising a fringing buffer of some 300m. The Wagonga Estuary contains mapped coastal wetlands within the flood tide delta, upstream of the Princes Highway Bridge, and within alluvial deltas associated with Brices Bay and Punkally Creek.

E.5 Effectiveness of Current Management Practices

Both Wagonga Inlet and Moruya River have existing but outdated management plans. Audits of the implementation of these plans were prepared by Council and these are appended to the Scoping Study. The management of Mummuga Lake has not yet been informed by such a plan.

The audits were reviewed by the study team and two broad observations are made:

- Council has internally reviewed implementation of the plans and updated them as necessary, however, as has been common in NSW, this has occurred at long intervals (5 years or greater). This makes it difficult to ascertain how and when actions are being completed with reference to execution of the plan in question. In some instances, clear reference back to the existing plan appears to be missing. An example of this is bank stabilisation works along the Moruya River, which have been extensive, but largely carried out in an opportunistic manner by Local Land Services (and its predecessor organisations) with no clear records kept.

- It was common for existing plans to contain actions that organisations external to Council were best placed to complete, through either legislative, jurisdictional, or funding mechanisms. It has been difficult for Council to drive action on these items. There are two key reasons for this: (i) there has been previously no mechanism for completion of actions to be enforced; (ii) the legislative, jurisdictional or funding environment changes continuously within state government and responsibilities that are not clearly laid out tend to be forgotten or disregarded as this occurs.

The new framework for coastal management in NSW contains features which should assist in addressing these problems.

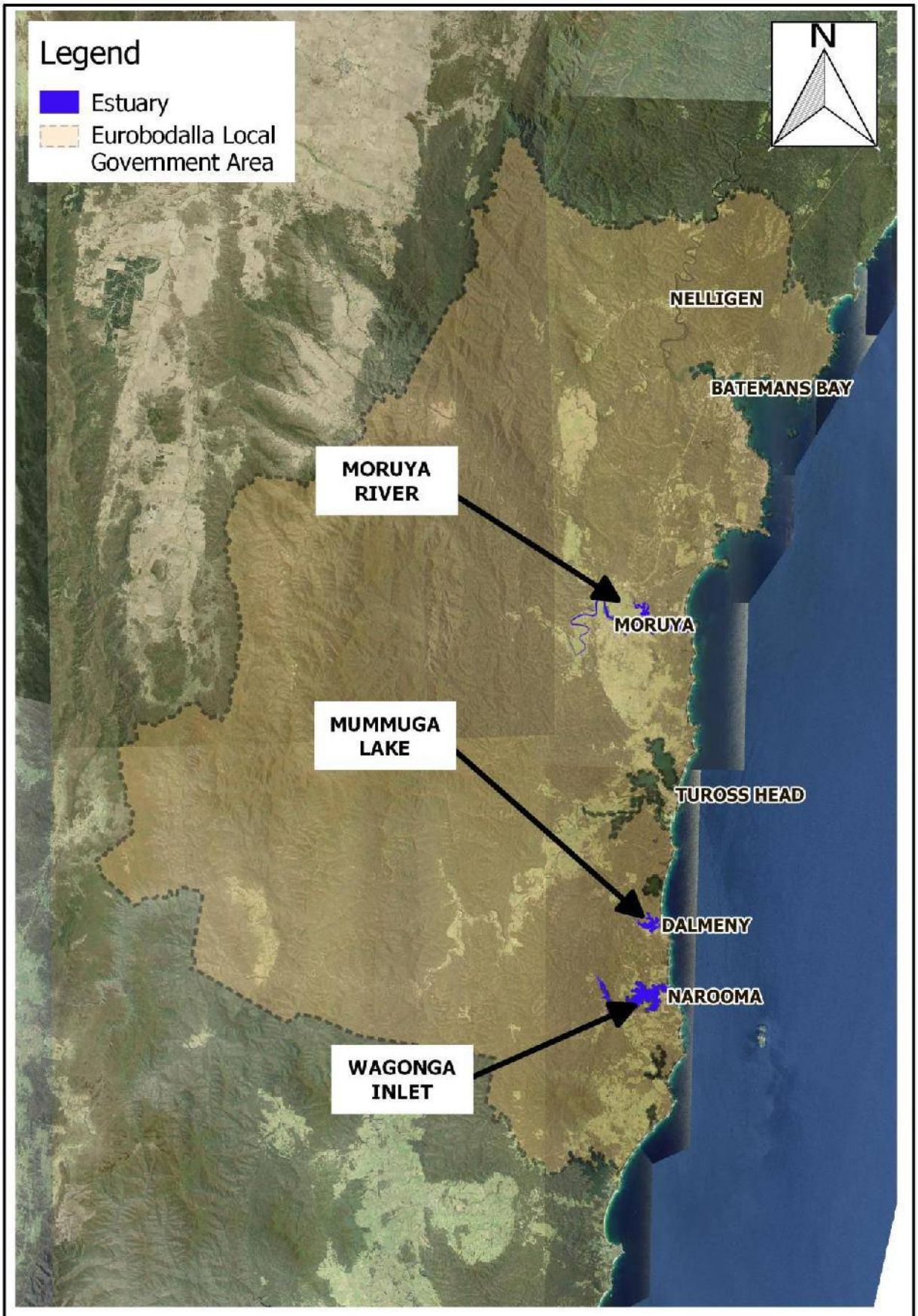

Figure E1: Estuary Locations within the Eurobodalla LGA

0 5 10 15 20 km
APPROX SCALE

COASTAL MANAGEMENT PROGRAM FOR MORUYA RIVER, MUMMUGA LAKE AND WAGONGA INLET

REV	DRAWN	CHECK
A	DJW	DJW

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E.6 Outcomes from First Pass Risk Assessment

Risks were identified through a combined review of background information, site inspection and community workshop/drop-in sessions held during preparation of this Scoping Study. Our risk assessment was based on the objectives outlined in the Coastal Management Act and the identified risks were assessed qualitatively.

The complete preliminary risk assessment tables for all three estuaries are appended to the Scoping Study. The estuaries had similar distributions of high and extreme risks (Table E.1). A relatively larger number of moderate and low risks were identified for Moruya River, apparently resulting from attendance at the Moruya drop-in session of enthusiastic individuals who discussed multiple potential concerns.

Table E.1 Tabulation of Identified Risks

Estuary	Risk Ranking				
	Extreme	High	Moderate	Low	Total
Moruya River	2	6	12	4	24
Mummuga Lake	1	6	6	1	14
Wagonga Inlet	3	5	5	1	14

E.7 Strategic Context and Purpose for CMP

Detailed studies were initially identified for all three estuaries and it was not recommended that CMP preparation be fast-tracked by skipping stages 2 and 3 of the process outlined in the Coastal Management Manual.

It was also not possible to clearly define the overarching “purpose” and “vision”, nor dominant “objectives” for the CMP. Additional community consultation was subsequently completed to help clarify CMP “purpose”, “vision” and “objectives”. The outcomes of that consultation will be appended to the CMP.

Considering the distribution of the “high” and “extreme” risks across the different coastal management areas, the expected degree of focus is outlined in Table E.2. The coastal vulnerability area has been excluded from Table E.2, as the absence of present mapping for this area makes it difficult to incorporate at the present time. Council is intending to develop tidal inundation mapping under the Floodplain Risk Management process. The results of this will be used, as relevant, to inform other actions associated with, for example, coastal wetland and coastal environment areas. Coastal vulnerability will not be a key focus for the proposed CMP but may be incorporated in a more rigorous manner at a later stage.

Table E.2 Expected Focus of Coastal Management Program

ESTUARY	COASTAL MANAGEMENT AREA		
	Wetlands	Environment	Use
Moruya River	Strong	Moderate	Minor
Mummuga Lake	Minor	Moderate	Moderate
Wagonga Inlet	Very Strong	Strong	Moderate

E.8 Additional Studies and CMP Preparation

A preliminary list of studies to fill knowledge gaps associated with the "extreme" and "high" ranked risks was provided to representatives of Council and OEH, for consideration and discussion during preparation of the Scoping Study. At final draft stage of this Scoping Study, five (5) detailed studies were recommended as listed in Table E.3. However, it was not possible for Council to commit to the completion of all studies due to funding limitations. The fees required for all studies could not be justified by Council for the reasons outlined above. Following consultation with Council and DPE, alternative approaches for these studies were settled upon. Some of these studies have been completed (at least partially), some have been informed further by other means in preparation of the CMP, and some postponed as actions for the CMP.

Table E.3 Preliminary List of Additional Studies Required for CMP Preparation and Subsequent Actions Taken

Recommended Study	Agreed Action[2]
Derive Interim Tidal Inundation Mapping for Moruya River	This task was to be superseded by mapping outputs to be provided by DPE science unit.
Update CM SEPP (Wetlands) Mapping (Including Field Work for Mummuga Lake)	To be included as an action in the CMP.
Mummuga Entrance Foreshore Management Assessment and Strategy	Feasibility of including this action under Council's responsibilities either through general operations or Plan of Management for the Crown Reserve. To be assessed as part of Stage 3.[3]
Water Quality Risk Assessment Analysis (Mummuga Lake and Wagonga Inlet)	To be completed as per original proposal.
Wagonga Inlet Preliminary Morphodynamic Assessment	Council to request installation of second water level recorder at Barlows Bay, Wagonga Inlet plus a Bathymetric Survey. Detailed assessment of entrance wall impacts potential to be deferred, potentially funded under Marine Infrastructure Delivery Office.

[2] As per email correspondence between Cameron Whiting (ESC), Andrew Williams (DPE) and David Wainwright (Salients) 26 March 2020 through 1 April 2020.

[3] As per emailed document "*SS review to DW*" sent from Norm Lenehan (ESC) to Andrew Williams (DPE) and David Wainwright (Salients), 1 July 2019.

E.9 Purpose, Vision and Objectives for Estuarine Coastal Management Program

Additional consultation, completed following Council's review of the Scoping Study Report, has included an online survey for community members and additional face to face interviews with key stakeholder representatives to help establish priorities and responsibilities for actions in the CMP.

Through this process, the following overriding vision and purpose statement was derived:

Council and the local community aim to protect and sustainably manage the estuaries of the Eurobodalla Shire in a responsible manner for both current and future generations. While doing so, we will promote activities that help local communities to thrive socially, culturally, and economically.

Eurobodalla residents have an innate connection to the water. Consultation has identified that good water quality, access for recreation and sporting activities, and maintenance of natural beauty are important to the local community. This Estuarine Coastal Management Program (ECMP) incorporates input from the community and various government stakeholders responsible for estuary management in the Eurobodalla Shire.

Consistent with the requirements of the Coastal Management Act, the overriding purpose of Council's Estuarine Coastal Management Program (ECMP) is to set the long-term strategy for co-ordinated land management within the coastal zone surrounding the Estuaries of the Eurobodalla Shire.

Considering its key focus on estuary management the ECMP concentrates on achieving the following objects of the CM Act:

- **To protect and enhance natural coastal processes and coastal environmental values including natural character, scenic value, biological diversity and ecosystem integrity and resilience.**
- **To support the social and cultural values of the coastal zone and maintain public access, amenity, use and safety.**
- **To acknowledge Aboriginal peoples' spiritual, social, customary, and economic use of the coastal zone.**
- **To recognise the coastal zone as a vital economic zone and to supports sustainable coastal economies.**
- **To facilitate ecologically sustainable development in the coastal zone and promote sustainable land use planning decision-making.**
- **To promote integrated and co-ordinated coastal planning, management, and reporting.**
- **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.**
- **To support public participation in coastal management and planning and greater public awareness, education and understanding of coastal processes and management actions.**
- **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.**

Furthermore, consistent with the Marine Estate Management Act the following purposes are also supported:

- **To promote the co-ordination of the exercise, by public authorities, of functions in relation to the marine estate.**

- **To provide for the management of the marine estate of New South Wales in a manner that:**

(i) Promotes a biologically diverse, healthy, and productive marine estate.

(ii) Facilitates:

-economic opportunities for the people of New South Wales, including opportunities for regional communities, and. the cultural, social, and recreational use of the marine estate, and

-the maintenance of ecosystem integrity, and

-the use of the marine estate for scientific research and education.

The State Environmental Planning Policy (Coastal Management), which defines the Coastal Zone in NSW, incorporates four Coastal Management Areas. Based on the key risks identified during its preparation, the key management areas for the ECMP are the "*Coastal Wetlands Area*" and the *"Coastal Environment Area"*. A secondary focus is the "*Coastal Use Area*".

There are no mapped littoral rainforests around the estuaries subject to this ECMP, therefore the *"Littoral Rainforest Area"* is not presently relevant. Should littoral rainforests be identified within the LGA, this management area may become relevant in time and incorporated during review of the Program.

This ECMP does not address the *"Coastal Vulnerability Area"*, which exists to facilitate the management of coastal hazards, for the following reasons:

- **Council intends to address coastal hazards associated with the open coast and entrance processes are to be addressed by an Open Coast CMP covering the entire coastline of the Eurobodalla LGA.**

- **Council intends to address coastal hazards associated with inundation inside estuaries from the combined effects of coastal and catchment processes as part of flood studies completed under the NSW Flood Risk Management Process.**

While not a focus, Coastal Vulnerability cannot be completely ignored. The ECMP has been prepared to be consistent with Council's management of coastal vulnerability through those other processes.

Specific goals or 'objectives' were set for each particular estuary considering the focus indicated in Table E.2, and the corresponding objectives set in Part 2 of the Coastal Management Act. These were determined as part of the management options study and were subsequently carried forward as the focus of actions in the Coastal Management Program.

Contents

Figures

Tables

1 Introduction

1.1 Coastal Management In NSW

The framework for Coastal Management in NSW changed with commencement of the *State Environmental Planning Policy (Coastal Management) 2018* and associated maps on April 3, 2018. The associated maps[4] inform application of the *Coastal Management Act 2016.*

The *Coastal Management Manual* (CMM) was released alongside the Coastal Management SEPP to guide local councils in the preparation of Coastal Management Programs. The Coastal Management Program (CMP) for Moruya River, Mummuga Lake and Wagonga Inlet is to be prepared using the CMM as a guide. Eurobodalla Shire Council (Council) has engaged Salients, in conjunction with the University of Newcastle and Coastal Environment, to prepare the CMP.

Stage 1 of the process outlined in the Manual involves identifying the required scope of a CMP. The present document contains the *Scoping Study* which will inform development of an estuarine CMP for Moruya River, Mummuga Lake and Wagonga Inlet.

The coastal management framework requires local councils to consider management of four different "Coastal Management Areas" (CMAs):

1. **Coastal wetlands and littoral rainforest areas,** which display the characteristics of coastal wetlands or littoral rainforests, as previously protected by SEPP-14 and SEPP-26 respectively (both now repealed). Mapped coastal wetlands and littoral rainforests have associated proximity areas which also require consideration.
2. **Coastal vulnerability areas,** including areas subject to coastal hazards such as coastal erosion, coastal entrance instability and tidal inundation.
3. **Coastal environment areas,** broadly covering natural features such as beaches, rock platforms, marine and estuarine waterways (including coastal lakes or lagoons), undeveloped headlands and buffers around those features.
4. **Coastal use areas,** broadly comprising land adjacent to the coast and estuarine waterways.

A CMP is required to address management of either all, or a subset of these CMAs. One objective of the scoping study is to assess which of those CMAs need to be considered. The combined coverage of these four areas define the *Coastal Zone* and are listed above in order of importance; for example, where mapping for coastal wetlands

[4] http://webmap.environment.nsw.gov.au/PlanningHtml5Viewer/?viewer=SEPP_CoastalManagement, accessed 17/10/2018

and littoral rainforests overlies the mapped coastal environment area, relevant wetland and rainforest provisions of the CM SEPP and the *Coastal Management Act 2016* will take precedence over those relating to the coastal environment area.

There are no mapped littoral rainforest areas associated with any of the subject estuaries. Similarly, we note that, at the time of writing, the Department of Planning has not provided mapping for the coastal vulnerability area. The scoping study and CMP process can result in mapping of additional coastal management areas, or proposals to modify mapping of existing areas if required and/or otherwise desired.

1.2 Location

The Eurobodalla Local Government Area (LGA) is located some 220km south of Sydney on the NSW coast. The location of the three estuaries subject to the CMP, with reference to the LGA boundary, are shown in Figure 1. The Moruya River, Mummuga Lake and Wagonga Inlet estuaries are important features of the Moruya, Dalmeny, and Narooma communities, respectively. A closer look at the coastal management areas associated with the three estuaries is provided in the following sections.

1.3 Moruya River

The Moruya River Estuary and its associated CMAs, noting that these may be changed as part of a CMP, are shown in Figure 2. Overall, the extent of the coastal zone surrounding the estuary is mostly defined by the coastal environment area, which has been mapped as an all-inclusive buffer of some 600m from the estuarine waterway. In contrast, the coastal use area, which is almost entirely contained within the coastal environment area, comprises a fringing buffer of some 300m around the foreshores of the estuarine waterway.

The Moruya Estuary has several mapped coastal wetlands, described in order from downstream to upstream as follows:

1. A complex of interconnected wetlands near Moruya Heads, south of the estuary and including areas fringing South Head Road and Quandolo Island. The hydrology of this wetland is significantly controlled by the size and location of gaps through the internal training wall of the Moruya River.
2. A lake contained largely within the bounds of 480 North Head Drive Moruya, north of the downstream reaches of the river. The lake is hydraulically isolated from the river and perched.
3. A moderately sized (~60ha) area contained largely between South Head Road and the river, draining through a small side tributary known as "The Anchorage" around midway between Moruya Heads and Moruya.

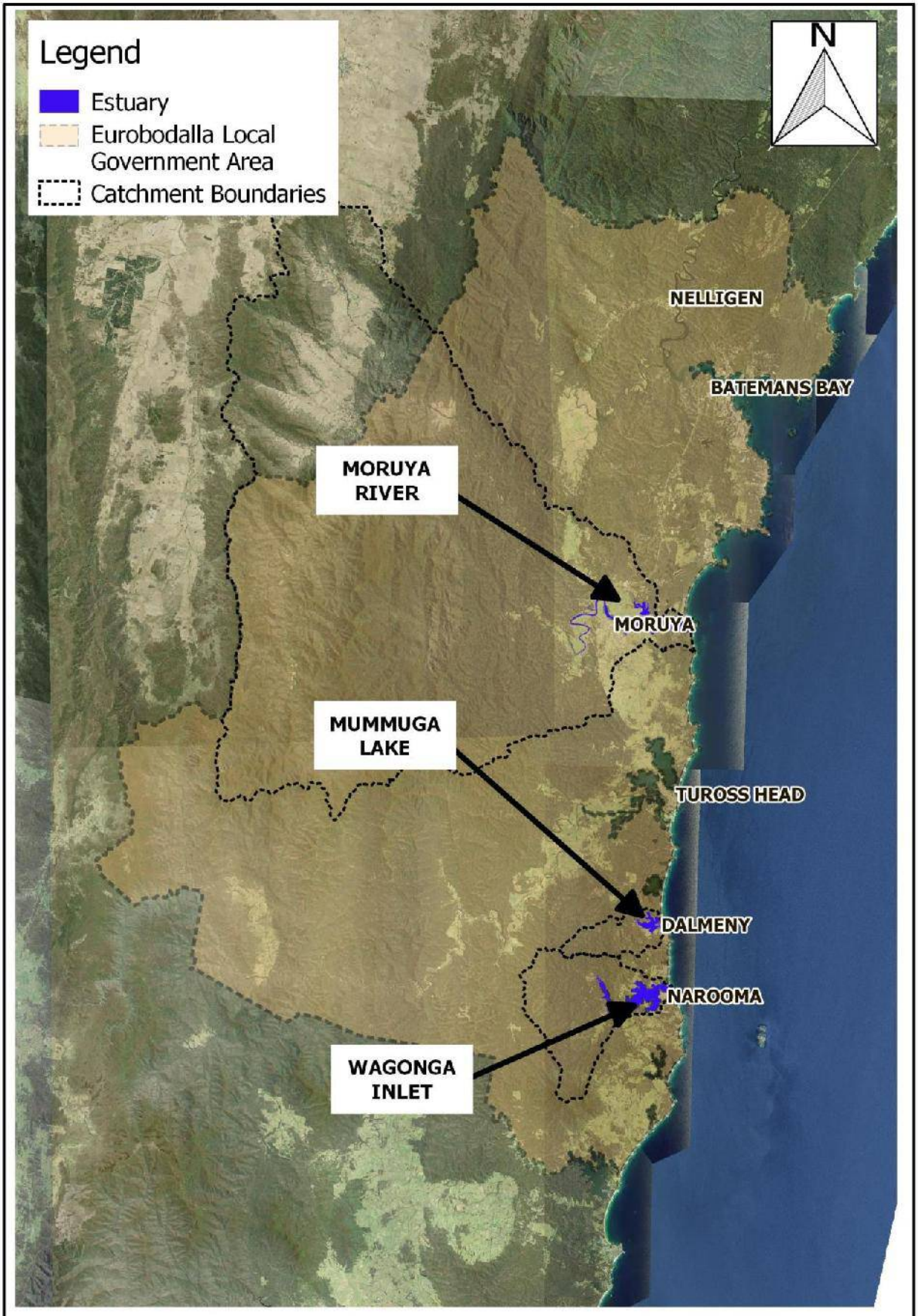

Figure 1: Locality Plan

0 5 10 15 20 km

APPROX SCALE

COASTAL MANAGEMENT PROGRAM FOR MORUYA RIVER, MUMMUGA LAKE AND WAGONGA INLET

REV	DRAWN	CHECK
A	DJW	DJW

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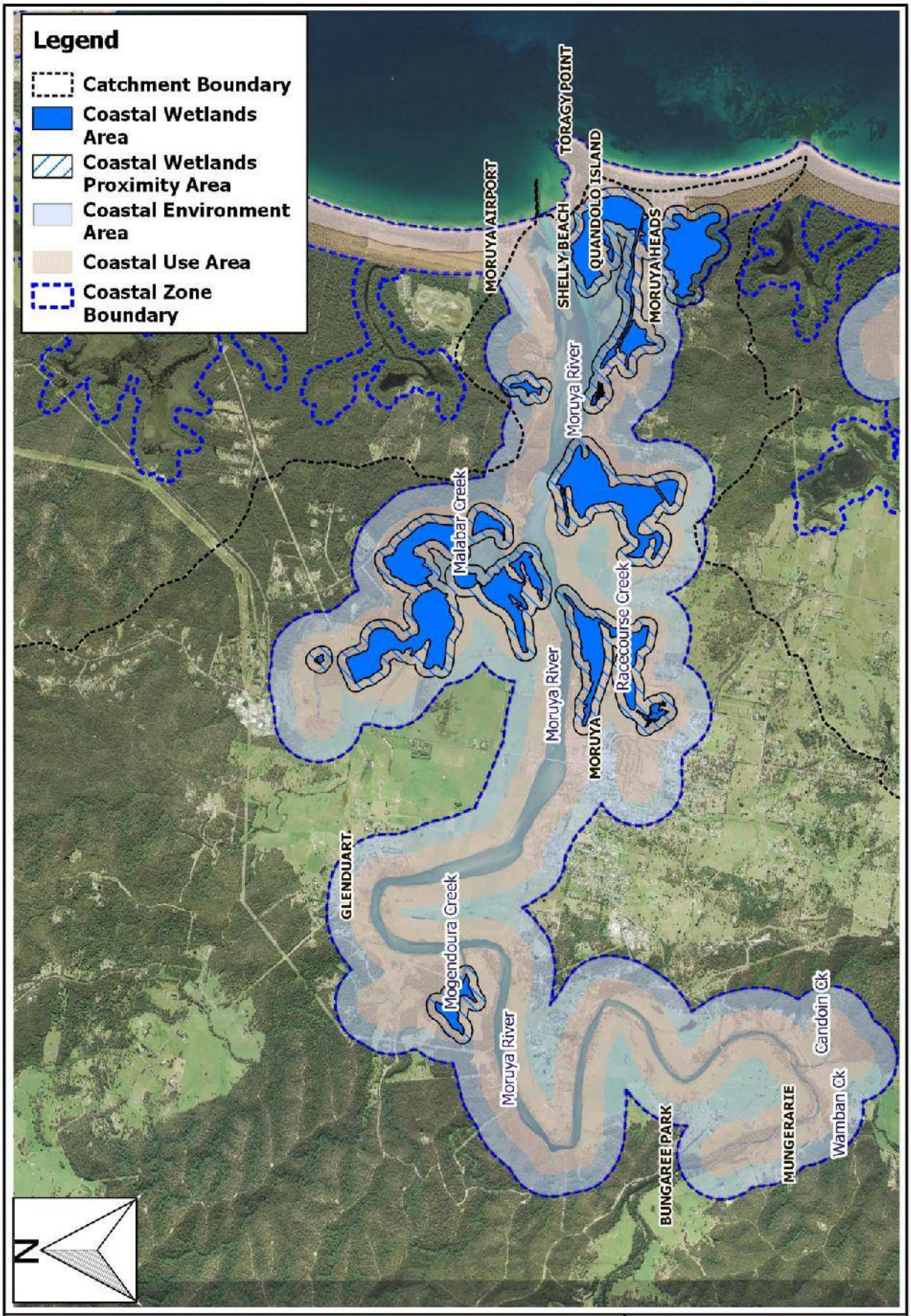

Figure 2: Coastal Management Area Mapping for the Moruya River Estuary

0 0.5 1 1.5 2 2.5 km

APPROX SCALE

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REV	DRAWN	CHECK
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4. A locally significant complex of wetlands surrounding Malabar Creek and Lagoon, totalling some 120ha. While a small part of the wetland is downstream of North Head Road, the hydrology is largely controlled by a weir within the culvert which connects Malabar Lagoon to the Moruya Estuary.

5. A complex of wetlands (~45ha) immediately to the east of the Moruya township and south of the Moruya River, which drains through Ryans and Racecourse Creeks into the downstream reaches of the Moruya River. The Moruya Sewage Treatment Plant is located largely within the proximity area surrounding this wetland complex, from which some effluent discharges to Ryans Creek.

6. A small (~9ha), wetland fringing, low-lying area adjacent to Mogendoura Creek, which is a minor tributary flowing into the upper reaches of the Moruya Estuary. The wetlands are contained within private properties located between Hawdon Road, Mogendoura and the river.

1.4 Mummuga Lake

The Mummuga Lake Estuary and its associated CMAs, noting that these may be changed as part of the CMP, are shown in Figure 3. The extent of the coastal zone surrounding the estuary is mostly defined by the coastal environment area, which has been mapped as an all-inclusive buffer of some 600m from the estuarine waterway. In contrast, the coastal use area, which is almost entirely contained within the coastal environment area, comprises a fringing buffer of some 300m around the foreshores of the estuarine waterway.

The Mummuga Estuary contains mapped coastal wetlands as follows:

1. A 7ha wetland associated with Amherst Island and the upstream end of the flood tide delta of the lake's ocean entrance channel (also known as Lawlers Creek). This wetland, and its associated proximity area are completely contained within the Eurobodalla National Park.

2. A 16ha wetland associated with an alluvial delta located where Lawlers Creek discharges into the western end of the lake. This wetland, and its associated proximity area, are largely contained within the Bodalla State Forest. The most downstream reaches are primarily contained within the Eurobodalla National Park, which also contains the open waterway of Mummuga Lake and areas further north along the coast.

1.5 Wagonga Inlet

The Wagonga Inlet Estuary and its associated CMAs, noting that these may be changed as part of the CMP, are shown in Figure 4.

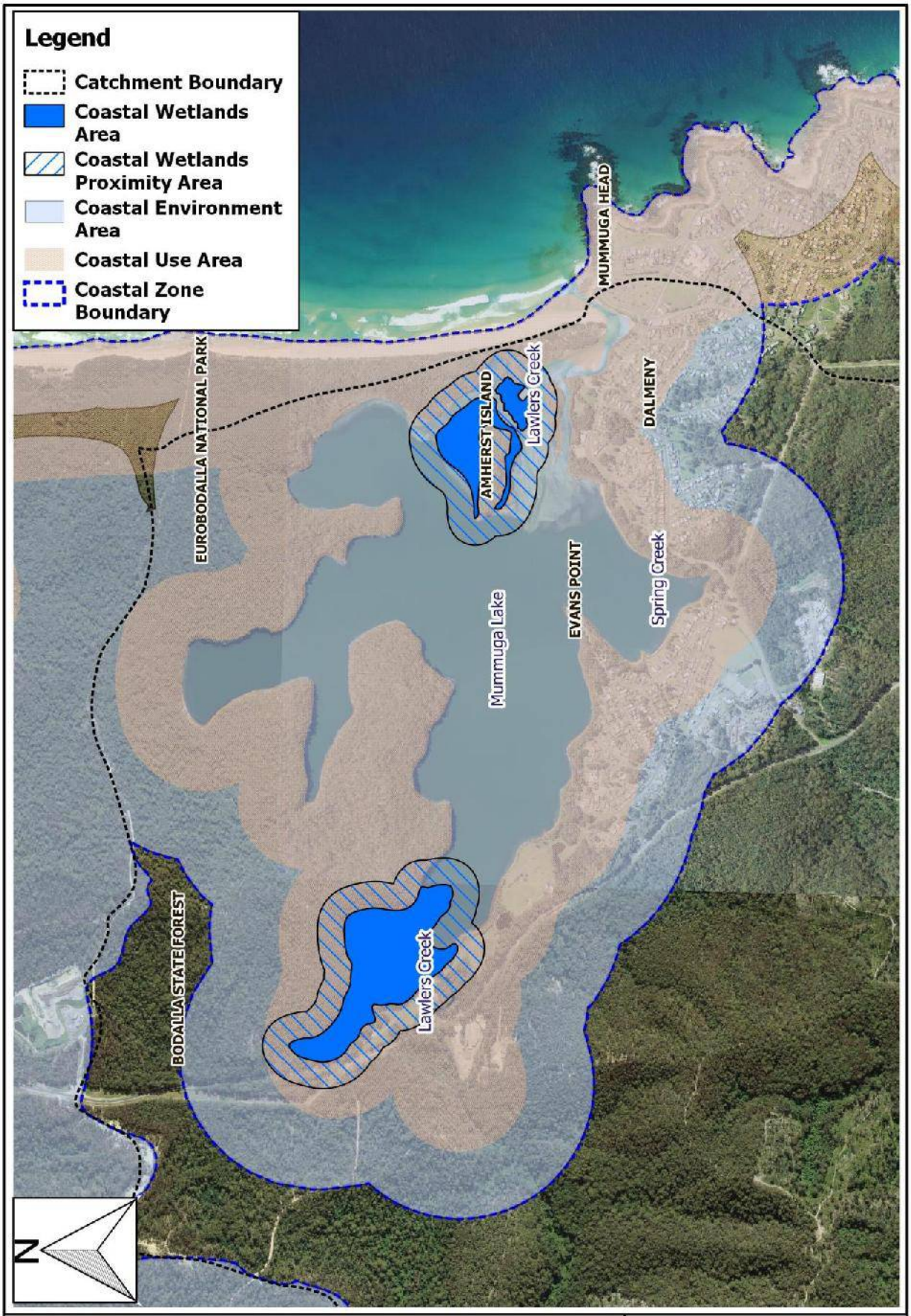

Figure 3: Coastal Management Area Mapping for the Mummuga Lake Estuary

0 200 400 600 800 m

APPROX SCALE

COASTAL MANAGEMENT PROGRAM FOR MORUYA RIVER, MUMMUGA LAKE AND WAGONGA INLET

REV	DRAWN	CHECK
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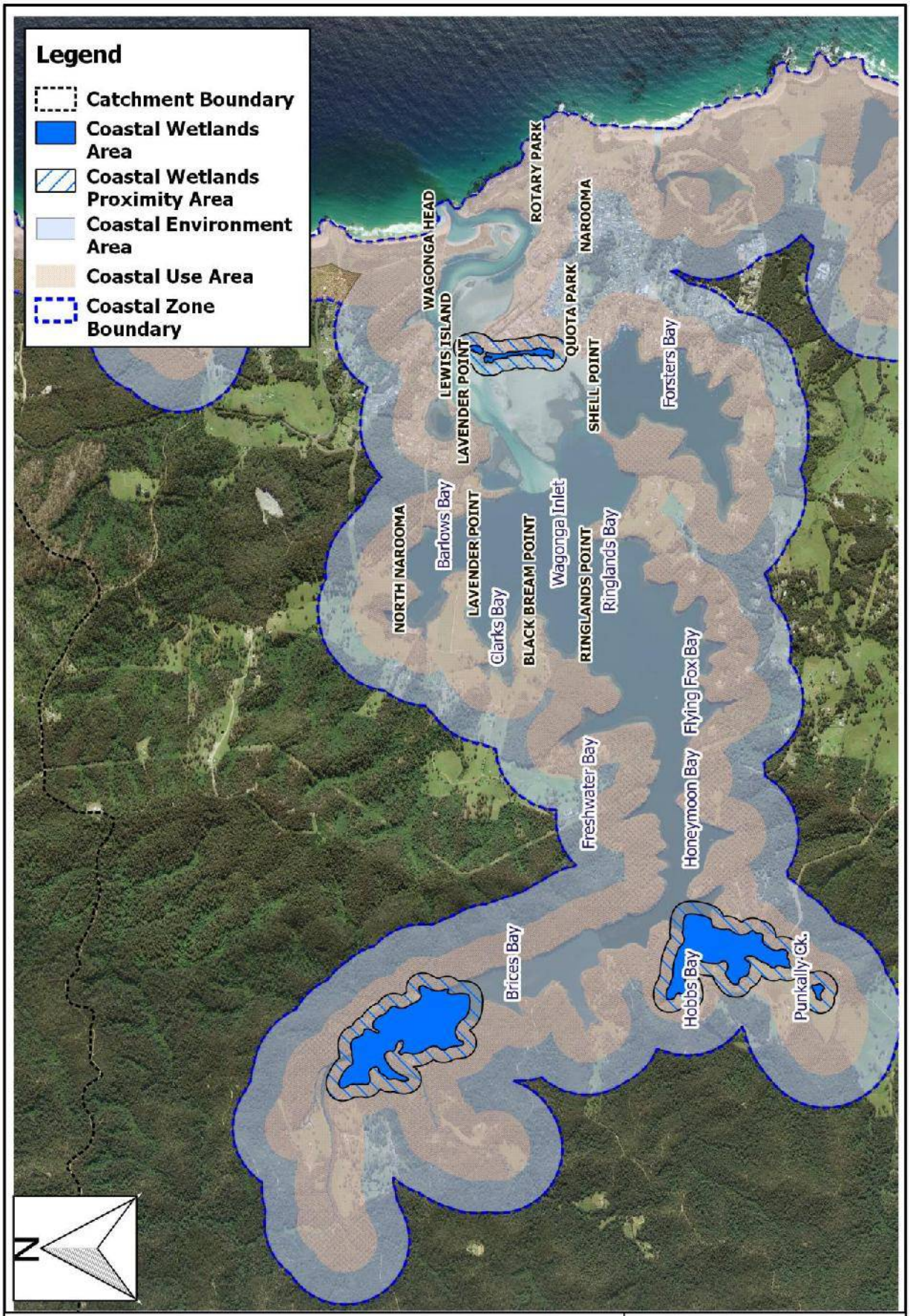

Figure 4: Coastal Management Area Mapping for the Wagonga Inlet Estuary

0 0.4 0.8 1.2 1.6 km

APPROX SCALE

COASTAL MANAGEMENT PROGRAM FOR MORUYA RIVER, MUMMUGA LAKE AND WAGONGA INLET

REV	DRAWN	CHECK
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Salients

Overall, the extent of the coastal zone surrounding the estuary is mostly defined by the coastal environment area, which has been mapped as an all-inclusive buffer of some 600m from the estuarine waterway. In contrast, the coastal use area, which is almost entirely contained within the coastal environment area, comprises a fringing buffer of some 300m around the foreshores of the estuarine waterway.

The Wagonga Estuary contains mapped coastal wetlands as follows:

1. A stand of mangroves, saltmarsh and tidal flats (~3ha), which extend for some 900m southwards from the Princes Highway Bridge towards Quota Park, along the foreshore to the west of Narooma adjacent to a low-lying area known as the Narooma Flats. The area is fronted by the extensive flood tide delta of the estuary entrance. The extent of mangroves on recent aerial photography is clearly larger than that presently mapped, indicating that the mangrove stand is expanding. This may be partly related to an increasing tidal range following training of the entrance in the late 1970s.
2. A wetland area (~27ha) associated with the alluvial delta within the downstream reaches of Punkally Creek and Hobbs Bay. Hobbs Bay and the mouth of Punkally Creek contain oyster leases.
1. A wetland area (~37ha) associated with the alluvial delta within the upper reaches of Brices Bay. This area is used extensively by oyster leases. There is evidence of oyster farming activity within the boundaries of this wetland.

1.6 Population and Demographics

Together, the three main settlements associated with the three estuaries comprise around a quarter of the Eurobodalla LGA permanent population, estimated as 39,369 (2020) and projected to grow by over 15% to 45,515 in 2036. However, due to the presence of visitors, the number of people present overnight during winder, based on 2016 census data was around 50,000. In comparison, during the summer tourism peak up to 120,000 individuals may be present. Around 15,000 residents are actively employed, with the largest industry being health care and social assistance. The breakdown of population for the main settlements is shown in Table 1.

While Narooma and Moruya are the second and third largest centres in the Eurobodalla LGA, Narooma is more of a destination for retirees and tourists, whereas Moruya provides a function as a rural service town. Moruya Heads is a coastal residential area associated with Moruya that attracts families who work in Moruya.

Table 1 Demographics and Change

Locality	Population 2020 (via Forecast)	Population 2036 (forecast)	Change in Population	Median Age 2016	Median Age 2011
Urban Moruya / Moruya Heads	3687	4732	+28.32%	51	46
Dalmeny	2027	2197	+8.38%	59	53
Narooma/North Narooma	3586	4029	+12.33%	59	53

Around 40% of property owners are not resident in the Eurobodalla LGA, and around 30% of dwellings are not permanently occupied. 5.1% of the local population identifies as being Aboriginal, consistent with regional areas in NSW, and 80% of the population was born in Australia.

The median age in Eurobodalla is 50, which is high for both the local region and NSW. More than a quarter of residents are over 65 years in age and this proportion is expected to grow by around 34% by 2036. In other words, this age cohort is expected to grow at around twice the rate of the general population over the next 20 years.

Unsurprisingly, the population is highly seasonal which introduces substantial challenges. For example, facilities need to be constructed to handle summer peak seasonal loads and capacities. Around 1.2 million individuals visit the area annually, and 96% of nights booked in accommodation are for people from Australia, which is relatively high both regionally and for NSW. Visitors are commonly from Canberra and the ACT, who treat the region as a main holiday destination, and from Sydney, who are generally touring regionally.

1.7 Pre-existing Information

1.7.1 General Background

Reports and guidelines, covering management of the coast in New South Wales generally, have underpinned this Scoping Study. The Coastal Management Manual (NSW Government, 2018a) provides guidance on all stages of preparing a coastal management program. The Marine Estate Management Strategy (MEMS, in draft at the time of review) and underpinning documents have been considered insofar as the MEM process will interact with coastal management (BMT WBM, 2017; Craik et al., 2017; Marine Estate Management Authority, 2017). There are significant links between the objectives of the *Coastal Management Act 2018* and the *Marine Estate Management Act 2014*, and this is discussed further in Chapter 2 and Appendix F of this report. The background environmental information used to support development of the Marine Estate Management Strategy (MEMA, 2017) is of interest, in that it provides a recent summary of background information relating to individual estuaries. Similarly, the

assessment report of Roper et al. (2011) contains useful site specific information. In comparison, the Threat and Risk Assessment (BMT WBM, 2017) and MEMS (Marine Estate Management Authority, 2017) are high level documents that provide limited information on local scale recommendations and implementation strategies.

There is an existing Plan of Management for Eurobodalla National Park (NSW National Parks and Wildlife Service, 2000). The Park covers the bed of Mummuga Lake and areas to the south of the entrance to Moruya River, at Moruya Heads. The Local Strategic Plan for South East Local Land Services (2016) provides some context for the work undertaken by Local Land Services (LLS) in the Region. LLS are active in riverbank and habitat restoration works within the Moruya River and Wagonga Inlet estuaries, and the non-estuarine reaches of associated tributaries.

Several recent studies provide further information about the subject estuaries in the Eurobodalla LGA. Dale Donaldson (2006) contains a compilation of stories from First Nations People relating to different localities within the Eurobodalla LGA. Voyer's (2014) thesis provides information on the community's response to the Batemans Marine Park, which covers all three estuaries. The thesis includes a comparative assessment of community response to the Port Stephens Marine Park. Finally, Rogers and Woodroffe (2016) provided an assessment of the biophysical vulnerability of south coast estuaries to sea level rise, using broad scale assessments of estuarine geomorphic characteristics.

The coordination of the Coastal Management Program with Council's integrated planning and reporting obligations is an important consideration. In that regard, the contents of Council's existing Community Strategic Plan, Delivery Program and Operational Plan (Eurobodalla Shire Council, 2017a, 2017b, 2017c) have been referenced where relevant.

1.7.2 Spatial Data Sets

Many GIS data sets were provided by Council for use in mapping and assessment tasks. Vector data sets (shapefiles) included:

- Boundaries for the Coastal SEPP mapping, including the littoral rainforest, coastal wetlands, coastal environment, and coastal use management area boundaries, plus the coastal zone, comprising the envelope of all four management areas.
- Boundaries of National Parks, State Forests, Crown Land parcels (including areas of Crown Waterway) and zone boundaries within the Batemans Marine Park, which cover the waterways of all three estuaries subject to this study.
- A full set of Land and Property Information parcels, as managed by NSW Land Registry Services.

- Data sets developed by Eurobodalla Shire Council, including the LEP zones surrounding the estuaries, reserves including their conservation status[5], plus subdivision of those open areas into operational and community land. In addition, data sets showing those crown reserves under control of Council and those not under Council's control were also provided.

- Environmental datasets including: (i) polygons delineating areas of high environmental value vegetation from 2015; (ii) two datasets of estuarine macrophyte mapping across all three estuaries (dated 2006 and 2012, but based on aerial photographs and ground truthing from between 1998 and 2005) which appeared to be identical within the bounds of the coverage provided; and (iii) updated estuarine macrophyte mapping from 2017 (based on aerial photographs from 2014 and field mapping in 2017) for both Wagonga Inlet and Moruya River. These datasets are described in more detail in Elgin Associates (2018). In addition, a bank condition survey, recorded as geographical points with comments and some linked photos, was provided for both the Moruya River and Wagonga Inlet. The survey was completed by Council and OEH staff in early 2018.

- Datasets containing the locations of stormwater infrastructure including pipes, nodes (pits and junctions) and Gross Pollutant Traps (GPTs).

Additionally, a range of topographic and bathymetric data are available, covering the land surrounding the estuaries and their catchments from the ELVIS database maintained by Geosciences Australia[6].

Aerial Photographs have been provided by both Council and OEH (South Coast Region and Conservation Programs Branch). These are summarised in Table 2.

1.7.3 Moruya River

Reports of specific interest to the Moruya River Estuary were reviewed to facilitate assessment of any data gaps. As there is an existing coastal zone management plan (CZMP) for the Moruya / Deua River Estuary (Worley Parsons, 2009a), review has focussed on the reports which contributed to the development of that plan (AMOG Consulting, 2003; Crowley, 2005; Donaldson, 2006; Worley Parsons, 2009b). An audit of the implementation of the existing CZMP was undertaken by Eurobodalla Shire Council in 2018 and is provided as Appendix C and discussed, where relevant, throughout this document.

[5] More information can be found in Council's Recreation and Open Space Strategy (Ross Planning, 2018)
[6] http://elevation.fsdf.org.au/

Table 2 Summary of Available Aerial Photographs

Estuary	Years of Rectified Images	Years of Unrectified Images
Moruya River	2014	1969, 1975
Mummuga Lake[1]	2014	1957[1], 1967, 1971, 1972, 1975, 1977,1979, 1981, 1986[1], 1989, 1994[1], 1998, 1999, 2001, 2005, 2007, 2011
Wagonga Inlet	2014	1957, 1967, 1979, 1985, 1986, 1989 (Incomplete Coverage), 1994, 1998, 1999, 2002, 2006

[1]Some Aerial photographs that cover Wagonga Inlet also cover Mummuga Lake

The floodplain management process in NSW has relevance to the definition of the inundation hazard which could assist in defining the coastal vulnerability area. For the Moruya River, an existing floodplain management plan (Patterson Britton and Partners, 2004) was updated to incorporate the effects of climate change in 2010 (Worley Parsons, 2010). Subsequently, a code has been developed to inform the community about requirements when developing potentially flood affected lands. (Eurobodalla Shire Council, 2012).

A search was also undertaken to identify any research that had occurred more recently and therefore unlikely to have been captured by the previous CZMP development process. Additional, site specific information seems quite limited.

The results from catchment scale modelling of erosion from unsealed roads in the Moruya River catchment are presented in Fu et al. (2007). Subsequently, Newham et al. (2008) described progress on the development of a catchment scale water quality model, including sediment and nutrients, although the published conference paper contains limited detail. Post et al. (2012) contains some estimates of projected changes to rainfall in the Moruya River catchment due to climate change which may be of some interest.

In addition to the above reports, water quality data (pH, DO, salinity, temperature, total dissolved solids, turbidity, enterococci, and chlorophyll-a) were provided for five sites in the Moruya Estuary, covering dates between 2010 and 2014.

1.7.4 Mummuga Lake

Mummuga Lake has received relatively limited attention when compared to the other two estuaries. The only systematic treatment of estuarine issues appears to have been in the Review of Environmental Factors document prepared for the artificial opening of coastal entrances within the Eurobodalla National Park (Department of Environment and Conservation, 2007).

The floodplain management process in NSW has relevance to the definition of the inundation hazard which could be used to define the coastal area. For Mummuga, a recent flood study has been completed (WMA Water, 2016) and a floodplain management study is presently being prepared.

The lake does not have an existing CZMP (or estuary management plan). Accordingly, an unconstrained search for existing literature was undertaken. Very little information was uncovered. The only relevant information relates to the use of First Nations Peoples, which continues to the present day, and the overall importance of the area, also known as "Brou". Much available information stems from the work of Dale Donaldson (2006).

1.7.5 Wagonga Inlet

Reports of specific interest to Wagonga Inlet were reviewed to facilitate assessment of any data gaps. There is an existing Estuary Management Plan for Wagonga Inlet (Nelson Consulting, 2001), and that Plan was reviewed and upgraded more recently (Eurobodalla Shire Council, 2010). From the mid-1990s through to the mid-2000s there is evidence of some interest in dredging the navigation channel of Wagonga Inlet upstream of the Princes Highway Bridge. The Review of Environmental Factors for this undertaking provides useful information (Peter Spurway and Associates Pty. Ltd., 2006). An audit of the implementation of the existing Estuary Management Plan was completed by Eurobodalla Shire Council in 2018 and is provided as Appendix D. The audit is discussed where relevant throughout this document.

A recent flood study for Wagonga Inlet has been completed (WMA Water, 2016) and a floodplain management study is presently being prepared. A prior flood assessment was completed by Gary Blumberg and Associates (2002) following flooding of Narooma Flats in January, 1999.

A search was also undertaken to identify any research that had occurred more recently and was therefore unlikely to have been captured by the previous CZMP development process. Relative to the other two sites, Wagonga Inlet has received comparatively more attention.

Overall water and sediment quality in the estuary seem to have been good. Dafforn et al. (2012) indicated that the estuary has quite good sediment quality, although there was some evidence of elevated Nickel. Similarly, Birch et al. (2015) indicated that concentrations of copper and zinc are slightly more elevated at sites closer to the entrance.

The estuary's ongoing response to construction of the entrance breakwaters between 1976-1978 has been investigated. Nielsen and Gordon (2015, 2008) estimated that tides in the main basin of the estuary could evolve to match the tidal range of the ocean, although this would seemingly take over 120 years. They also reported that there had

been a decrease in seagrass of some 57% during a 25-year period after entrance training. Furthermore, there has been a three-fold increase in the rate of ongoing expansion of mangrove stands, with this being prominent in the upper reaches of the estuary. This has been matched by a consequent increase in the rate of salt marsh loss.

Paling and van Keulen (2003) reported on trial seagrass transplantation efforts on the sand flats adjacent to the entrance channel of Wagonga Inlet, indicating encouraging success.

A few reports dealing with a variety of social and heritage issues have also been more recently completed. Rowland and Ulm (2012) reported that around 90% of midden volumes around Wagonga Inlet had been damaged as a result of residential development in Narooma. Norman et al. (2013), as part of a study on coastal adaptation in response to climate change, selected Narooma as one of its case study sites.

1.8 Structure of this Document

The structure of the Scoping Study has considered the relevant requirements outlined in Part B of the NSW Coastal Management Manual, while integrating the need to also consider each estuary separately.

- Chapter 2 summarises key aspects of the legislative, policy and planning context within which the Coastal Management Program will operate. A more comprehensive outline is provided in Appendix F.
- Chapters 3, 4 and 5 deal with each estuary in turn, including an appraisal of the characteristics of the estuaries, the key management issues, the preliminary risk assessment, identification of a "purpose" for the CMP insofar as it deals with that estuary, and a gap analysis and recommendations for further detailed studies prior to preparation of the CMP.
- Chapter 6 discusses the requirement for a planning proposal to alter mapping of different coastal management areas within the Coastal Management (2018) SEPP.
- Chapter 7 describes the consultation activities that should occur during preparation of the CMP.
- Chapter 8 presents the preliminary business case, including the recommended scope of the CMP, the steps required to prepare the CMP, the roles and responsibilities of different parties and the expected cost of additional studies to complete the CMP.
- Chapter 9 summarises the outcomes of the Scoping Study, including a summary of the effectiveness of current management approaches

Table 2 cross references the key components of the Scoping Study with the relevant sections of this report.

Table 3 Location of Key Components of the Scoping Study

Key Component[7]	Relevant Sections of this Report
1. A description of the strategic context of coastal management.	9.1
2. The purpose, vision, and objectives of the CMP.	9.1
3. The scope of the CMP, including management issues and the spatial extent of management areas.	8.2
4. A review of the effectiveness of current management practices and arrangements, including identification of changes required to manage the relevant coastal management areas effectively.	9.3
5. Details of roles and responsibilities and how the council will be working with other councils or public authorities – particularly where coastal sediment compartments or an estuary catchment is shared between councils.	8.3
6. Results of a first-pass risk assessment and details of where action is required including any additional studies that are proposed to fill knowledge gaps.	3.3 (Moruya), 4.3 (Mummuga), 5.3 (Wagonga) and 9.2 (Summary)
7. A stakeholder and community engagement strategy. If council intends to prepare a planning proposal, the engagement strategy is also advised to consider the requirements set out in relevant guidelines for preparing a planning proposal.	7
8. A preliminary business case to prepare a CMP.	8
9. A forward plan for subsequent stages of the CMP process – including any fast-track proposals and how the stages will align with council's IP&R framework.	8.5

[7] Reference, Section 1.10 of Part B of (NSW Government, 2018b)

2 Framework and Requirements for a Scoping Study

2.1 Introduction

This chapter outlines the context within which a Coastal Management Program, and its associated Scoping Study, needs to be prepared. A far more detailed assessment of the legislative and policy framework is provided in Appendix F. Appendix F also contains information relating to the demographic, economic and cultural context of the community surrounding the estuaries. For brevity, the following abbreviations are used in this chapter:

BC Act:	*Biodiversity Conservation Act 2016*
CM Act:	*Coastal Management Act 2016*, which commenced on 3rd April, 2018
CMM:	Coastal Management Manual, which guides the development of Coastal Management Programs under the CM Act
CMP:	A Coastal Management Program, which aims to support the long-term strategic management of the Coast in accordance with the CM Act
CM SEPP:	*State Environmental Planning Policy (Coastal Management) 2018* which commenced on 3rd April, 2018
CL Act:	*Crown Lands Act 1989* (Now repealed)
CLM Act:	*Crown Lands Management Act 2016*
CP Act:	*Coastal Protection Act 1979,* which was repealed by the CM Act
EP&A Act:	*Environmental Planning and Assessment Act 1979*
FM Act	*Fisheries Management Act 1994*
LG Act:	*Local Government Act 1993*
MEM Act:	*Marine Estate Management Act 2014*
NPW Act	*National Parks and Wildlife Act 1974*

2.2 NSW Coastal Management Manual

The NSW coastal management manual (CMM) outlines the way in which coastal management programs (CMPs) are to be prepared, adopted, and subsequently managed by local councils and public authorities in New South Wales. Part A of the CMM imposes mandatory requirements for the preparation and management of CMPs. Part B provides more detailed guidance on the preparation and management of CMPs, including adherence to an adaptive risk management process, the completion of studies to address information gaps, the role of state government and the NSW Coastal Council, and the integration of a CMP into Council's Integrated Planning and Reporting (IP&R) framework under the *Local Government Act 1993*.

The manual seeks to facilitate ecologically sustainable development and promote sustainable land use planning in the coastal zone. The manual encourages:

- Development that is not inappropriately exposed to hazards.
- Land use where risks can be mitigated, and residual risks are addressed.
- Development which does not increase risks or threats elsewhere.

CMPs are to be long-term, strategic, and coordinated, focusing on achieving the objects of the CM Act. A CMP should provide for the input of councils, public authorities, and local communities in achieving a balanced set of management actions. A CMP should build on previous work completed in preparing a coastal zone management plan under the, now repealed, *Coastal Protection Act 1979*. In preparing a CMP, previous work is expected to be updated to consider changes, amongst other things, to the social character of the local community.

The following sections contain a summary of the most relevant information for consideration by this Scoping Study.

2.3 The CMP Process

A 5-stage process is outlined by the CMM as shown in Figure 5.

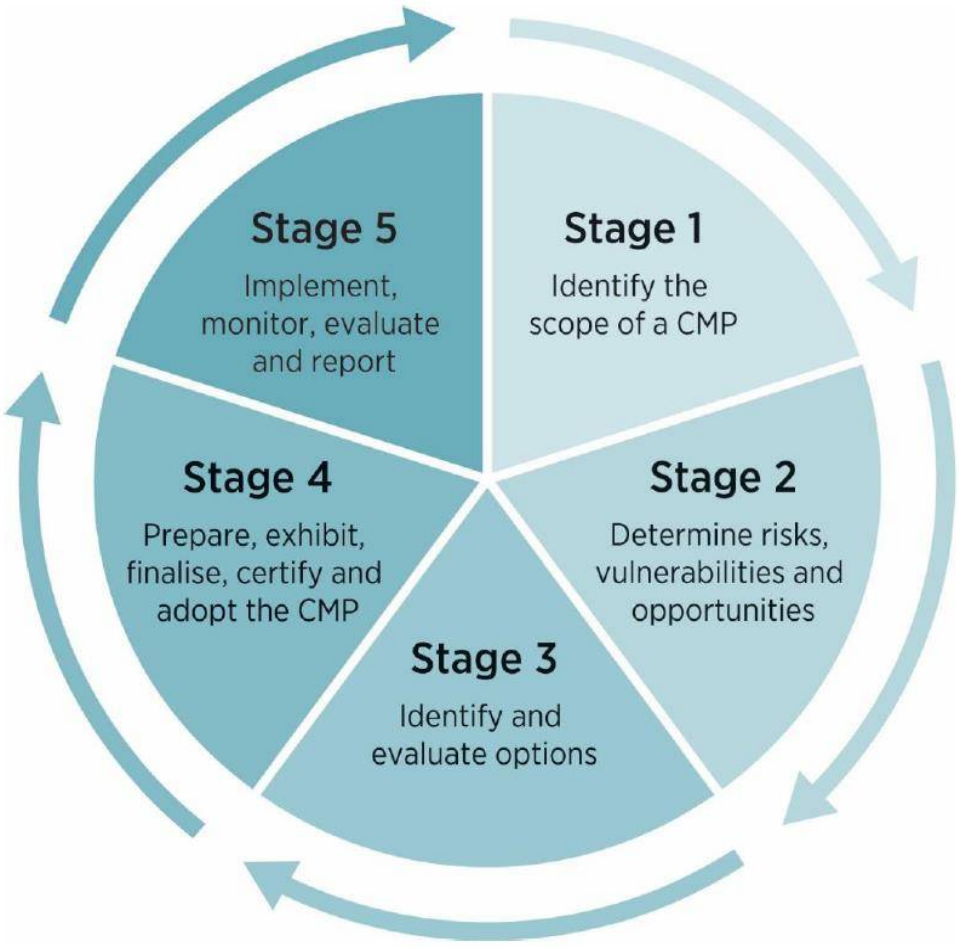

Figure 5 Stages in Preparing and Implementing a CMP (Source: NSW Government, 2018a)

Given the significant amount of effort already expended in the preparation of CZMPs across NSW, it is possible that Stages 2 and 3, which involve detailed studies and analyses could be 'fast-tracked'. Accordingly, the scoping study (Stage 1) is important in setting the scope and process to be followed in preparing the CMP. Fast-tracking would only be appropriate where existing actions are performing well and remain appropriate despite changing circumstances. As part of Stage 5, Councils need to report on the outcomes and ongoing action associated with the CMP as part of their Integrated Planning and Reporting framework. It is possible that a CMP may recommend modification of the boundaries of a coastal management area. In this case the Minister for Planning has the authority to make a Local Environmental Plan that modifies the boundaries in the Coastal Management SEPP, subject to the gateway process.

It is possible that other public authorities (e.g. Roads and Maritime Authority, NSW Department of Primary Industry) are assigned responsibility for different coastal management actions identified in a CMP. If this is the case, it is important that the public authority agrees to take on that responsibility before the CMP is finalised.

2.4 Mandatory Requirements of a CMP

The CM Act imposes requirements on the preparation, adoption, implementation, amendment, and review of CMPs. These mandatory requirements are laid out in the CMM (Part A) with other content in Parts A and B of the Manual comprising *guidance* for the development and operation of CMPs.

The mandatory requirements of relevance to the preparation of a CMP are reproduced in Appendix B. These elaborate on the statutory requirements of the CM Act and deal with:

- The purpose, scope and focus of a CMP.
- The area that a CMP covers.
- How a CMP is to be prepared.
- Key issues to be identified in a CMP.
- Requirements for the business plan in the CMP.
- Requirements for preparing a CMP when it includes a proposed or mapped coastal vulnerability area.
- Requirements for taking coastal change into account when preparing a CMP.
- Format and content required of a CMP.
- Community engagement and consultation.

Other mandatory requirements in the CMM deal with the adoption, certification, gazettal, review, amendment, and replacement of CMPs, and the requirements for monitoring, reporting and record keeping during operation of the CMP.

2.5 Marine Estate Management Act 2014

The MEM Act was introduced in response to an audit which recommended a new approach to the sustainable management of the entire marine estate, including the existing marine parks. It is jointly administered by the Minister for Primary Industries and the Minister for the Environment.

The MEM Act lists its objectives as:

a) to provide for the management of the marine estate of New South Wales consistent with the principles of ecologically sustainable development in a manner that:

(i) promotes a biologically diverse, healthy, and productive marine estate, and

(ii) facilitates:

-economic opportunities for the people of New South Wales, including opportunities for regional communities, and

-the cultural, social and recreational use of the marine estate, and

-the maintenance of ecosystem integrity, and

-the use of the marine estate for scientific research and education,

b) *to promote the co-ordination of the exercise, by public authorities, of functions in relation to the marine estate,*

c) *to provide for the declaration and management of a comprehensive system of marine parks and aquatic reserves.*

The Marine Estate includes the ocean, estuaries, coastal wetlands (saltmarsh, mangroves, seagrass), coastline including Sydney beaches, dunes and headlands, coastal lakes and lagoons connected to the ocean, and islands including Lord Howe Island. It extends seaward out to 3 nautical miles from the coast and offshore islands, and from the Queensland border to the Victorian border.

The MEM Act establishes the Marine Estate Management Authority, which is tasked with, among other things, undertaking the assessment of threats and risks to the marine estate and to prepare a marine estate management strategy. A draft marine estate management strategy was placed on public exhibition between October and December 2017. The final strategy was finalised in 2018. The strategy is a high-level document that doesn't provide site specific management guidance.

2.6 South East and Tablelands Regional Plan 2036

The Regional Plan (RP) was published by NSW Planning and Environment (2017). The RP has a scope which extends beyond the bounds of the LGA and looks at a much wider range of issues. The CMP which arises from the process being followed by Council should be consistent with the RP. In particular, the RP:

- Recognises that the protection of coastal lakes and estuaries is essential to long-term sustainability and prosperity.
- Recognises the importance of shellfish to the local economy, including tourism opportunities.
- Requires that the aquaculture catchments be *"protected from urban development and other activities that can negatively impact water quality"*. This is of importance to Wagonga Inlet.
- Some estuaries (e.g. Mummuga Lake) have been mapped as "high environmental value lands" and are particularly susceptible to the effect of land use development. The catchments are not considered suitable for intense uses such as housing

subdivisions. Where it is not possible to avoid impacts, councils will need to consider managing or offsetting those impacts.

- Recognises that planning of any new urban release or infill needs to consider the impact that sea level rise would have on flooding. This is of importance when considering the coastal vulnerability area. Councils are primarily responsible for planning for flood risk management under the requirements of the NSW Floodplain Development Manual and the development of coastal management programs to identify areas affected by coastal hazards. Councils should make hazard & risk information available to the Community to help them deal with the effects of sea level rise.

- Recognises that First Nations People have strong links to Country and should be involved in protecting and preserving their heritage. This is of some interest where heritage items are threatened by processes associated with estuary management, such as sea-level rise, and relevant studies should be undertaken.

The RP notes that the Eurobodalla LGA population is expected to grow by 2200 people by 2036. Due to trends in decreasing household size, an additional 3,000 dwellings are projected over the same period. The RP notes that there is sufficient land appropriately zoned but that the growth needs to be managed in a manner sensitive to the environment. Moruya and Narooma are expected to grow as local centres, although Batemans Bay will continue to be the main commercial centre.

2.7 What is a Scoping Study?

The primary purpose of a scoping study (Stage 1 of the process) is to identify the required focus for a new CMP, and the steps required in preparing that CMP. A scoping study considers existing information to review progress made in managing issues in coastal areas (for example, via a pre-existing estuary management plan or coastal zone management plan). New analytical studies are not undertaken as part of the scoping study, these are undertaken as part of Stage 2 of the process. The CMM outlines a wide range of aims, tasks, benefits and outcomes that will characterise the scoping study process. These include:

- Gathering an understanding of the community and identifying stakeholders. Developing an engagement strategy for later stages and beginning development of a shared understanding of the existing coastal management situation. Identify the organisations and communities that need to be involved in the CMP process and who holds responsibility for various issues that are likely to be involved.

- Determining the strategic context of coastal management for the area being considered and establishing the purpose, vision, and objectives of the CMP, identifying an appropriate scope, and expected key outcomes from the CMP.
- Determining the spatial extent of management areas (and which of the four management areas) need to be considered by the CMP. It is possible that planning proposals will need to be prepared to amend the extents of coastal management areas.
- Considering where coastal management areas overlap and how the hierarchy of management objectives outlined in the CM Act would operate.
- Reviewing the issues already identified, current coastal management arrangements and progress with existing actions. Determining where further or different action is required via a first-pass risk assessment.
- Identifying the knowledge gaps and preparing the business case for filling those gaps. The business case will also include a forward program for subsequent stages for preparing the coastal management program and may include a fast-tracking pathway.

The CMM elaborates in some detail on the steps which might be undertaken in preparing a scoping study. Where appropriate, the CMM guidance has been applied and the following chapters of this document describes those steps with reference to the subject estuaries.

3 Moruya River

3.1 Background

The present section deals with the various characteristics of the estuary, including the physical characteristics such as the catchment, hydraulic and sediment processes, water quality, ecological processes, and habitat. Also reported are issues relating to community values, land use and the specified coastal management areas.

3.1.1 Catchment Characteristics

The Moruya River (Deua River in its freshwater reaches) catchment is shown in Figure 6. The catchment area is around 1450km$^{2.}$ Most of the upper catchment is contained within Deua National Park, with parts of the lower catchment contained within Wandera State Forest (west of the estuary) and within Mogo State Forest (north of the estuary). The highest point of the catchment is near the south western corner, within Deua National Park, at Dampier Lookout (~1240m). The town of Araluen is located near the north western corner of the catchment within an area cleared for agriculture, which sits outside the Eurobodalla LGA, in Queanbeyan-Palerang.

The Deua River comprises the freshwater reaches of the river beyond the tidal limit, around 20km upstream from the ocean entrance. Around 2km downstream of the tidal limit, Wamban/Candoin Creek discharges into the estuary, draining a small area to the south. A further 8km downstream, Mogendoura Creek flows into the western side of the estuary draining the small Mogendoura agricultural locality. Downstream of Mogendoura, the river exits the foothills of the upper catchment, opening into estuarine floodplains which contain Moruya itself, along with coastal wetlands associated with Malabar Creek, Racecourse (and Ryans) Creek and The Anchorage (see Figure 2 for locations). Downstream of The Anchorage, the topography narrows the floodplain to the width of the river, which constrains the passage of floodwater. Within its downstream 2.5km, the river widens again, before exiting to the ocean at Moruya Heads. Areas contained within Eurobodalla National Park exist along the coastal fringe to the south of the ocean entrance.

3.1.2 Key Habitat Extent, Health and Protection

The extent of estuarine macrophytes (as mapped by Elgin Associates, 2018) and zoning for the Batemans Marine Park (BMP) within the Moruya Estuary are shown in Figure 7. The entire main channel of the estuary, including Mogendoura, Wamban and Candoin Creeks to their tidal limits, is within the *General Purpose Zone* of the BMP. The BMP extends from the estuary into Racecourse/Ryans Creek and the Anchorage. The area surrounding Malabar Creek and Lagoon to the north of the estuary is classified as a *Sanctuary Zone*, providing the highest level of protection.

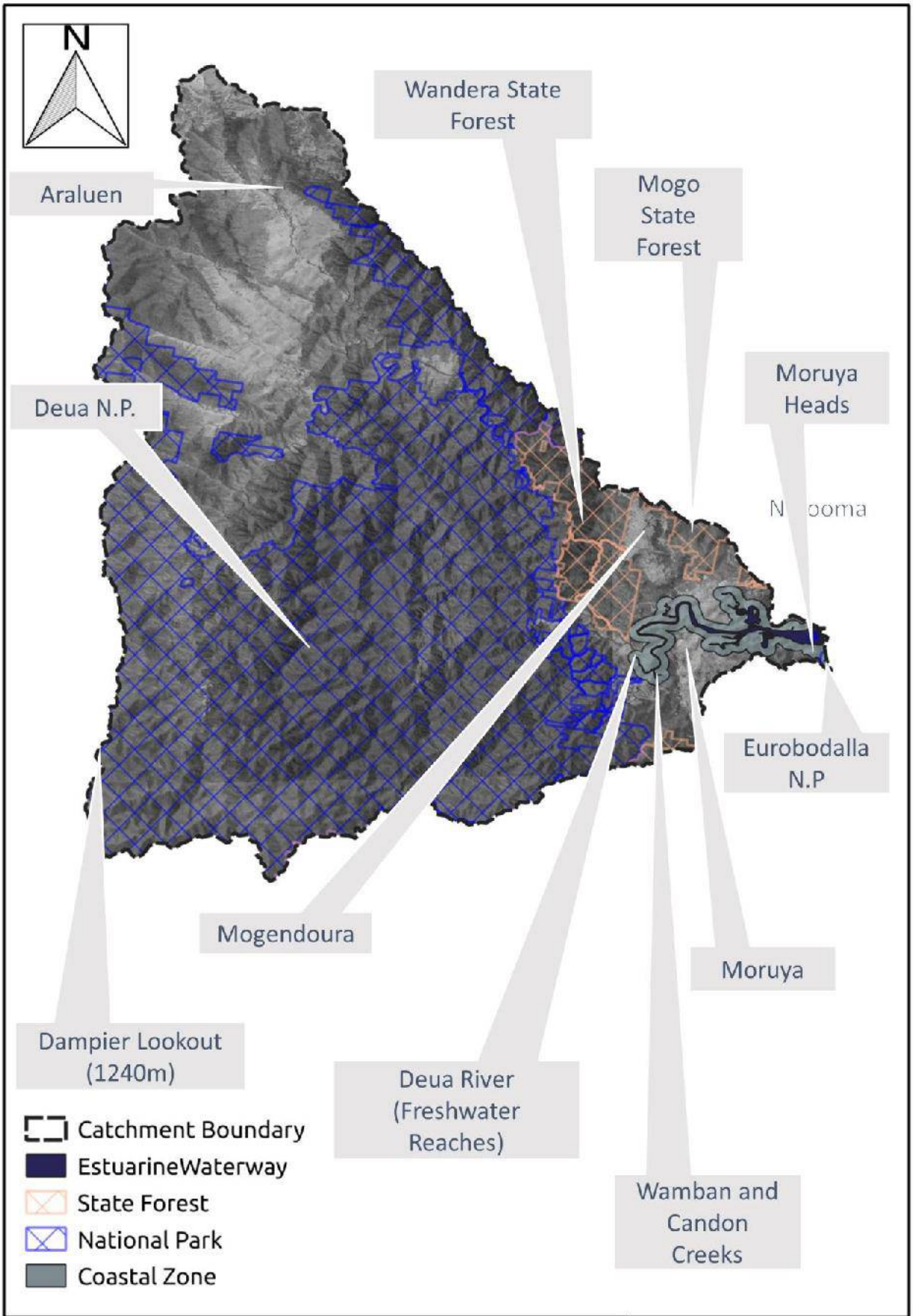

Figure 6: Moruya Catchment Landuse

0 3 6 9 12 km

APPROX SCALE

Coastal Management Program for Moruya River, Mummuga Lake and Wagonga Inlet	REV A	DRAWN DJW	CHECK DJW
GIS File:/Projects/P00053 CMPsforMoruya/Outgoing/Figures/Figures6Through14.qgs			Salients

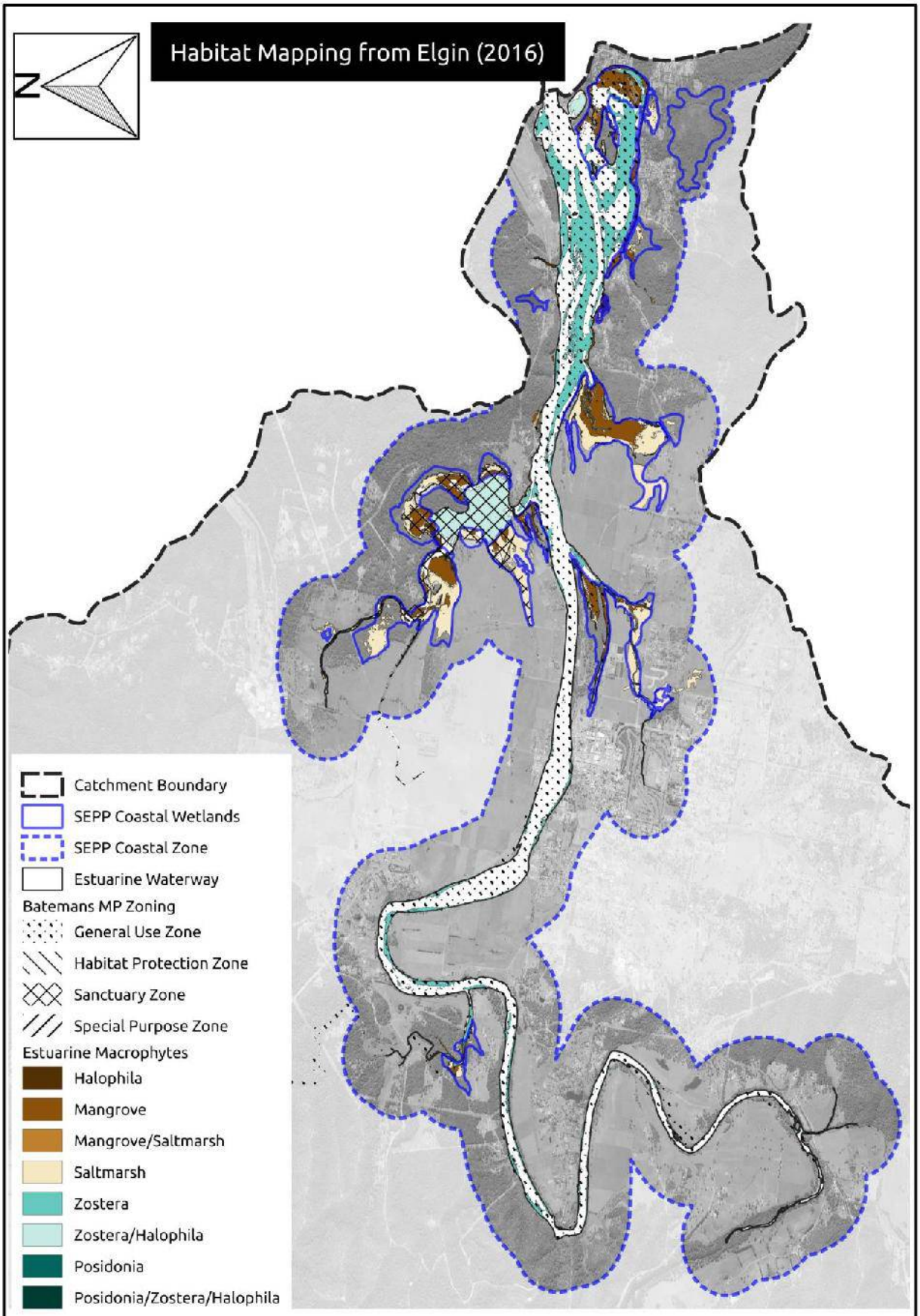

Figure 7: Mapped Estuarine Habitat - Moruya Estuary

0 0.5 1 1.5 2 km

APPROX SCALE

Coastal Management Program for Moruya River, Mummuga Lake and Wagonga Inlet

REV	DRAWN	CHECK
A	DJW	DJW

GIS File:/Projects/P00053 CMPsforMoruya/Outgoing/Figures/Figures7 10 13.qgs

Salients

Within the estuarine reaches upstream of Moruya, there are numerous patches of *Zostera* on shoals and adjacent to the foreshores, most commonly along straight sections and along the inside of river bends. There are also isolated and small stands of mangroves along these reaches. Within the middle reaches of the estuary, containing the Moruya floodplain, *Zostera* occurs in isolated, thin margins along the foreshores. However, within the areas downstream of Malabar Creek, the distribution of *Zostera* becomes more expansive, covering a large proportion of the channel between there and the ocean entrance.

A small wetland complex on Mogendoura Creek, just upstream of its confluence with the Moruya River, contains a mixture of *Zostera* in the channel, mangroves adjacent to the channel and saltmarsh fringes. The CM SEPP boundary of this coastal wetland could be expanded to better capture the extent of vegetation, particularly some patches of saltmarsh.

Around the Racecourse/Ryans Creek wetland, areas of mapped macrophytes show *Zostera* within the main tidal channels, patches of mangroves flanking the waterways, and saltmarsh around the fringes in upstream areas that are inundated by the tides less frequently. The BMP zoning tends to follow the main tidal channels through this wetland but misses much of the intertidal zone. The CM SEPP coastal wetland area tends to provide a good match to the recent macrophyte mapping, except for the most upstream extents of Racecourse Creek, where patches of saltmarsh are presently missed.

The zonation of macrophytes within the intertidal area of The Anchorage is like that around Racecourse/Ryans Creek, although the areas of macrophytes are significantly larger here. In this instance, the CM SEPP mapping provides close coverage of the existing macrophyte areas. Of interest is that the mapped Coastal Wetland is divided by South Head Road. It will be important to ensure proper tidal connectivity is provided below this road and that the coastal wetland proximity area covers this region, meaning that this is sufficiently addressed by the provisions of the CM SEPP.

Several smaller patches of coastal wetland vegetation exist further downstream along the southern side of the Moruya Estuary, and these have all been reasonably well covered by the existing CM SEPP mapping. Areas missed include Quandolo Island and patches of *Zostera* and mangroves immediately south of the southern entrance breakwater, although both areas are contained within the Eurobodalla National Park.

Within Malabar Creek/Malabar Lagoon, the wetland vegetation has a more complex mix. The bed of the Lagoon contains a *Zostera/Halophila* mix. The mapped areas of vegetation that fringe the Lagoon are well covered by the CM SEPP boundaries, but there are areas of saltmarsh that are missed in the most upstream reaches of Malabar Creek. Those areas are also not captured by the BMP *Sanctuary Zone* boundaries, which follow the main tidal channels of the creeks and main waterbody of the lagoon.

The most recent assessment of changes in estuarine macrophytes in Moruya River was undertaken by Elgin Associates (2018). They compared mapping from 2017 and 2012 and found that overall seagrass distribution and extent had increased in the Moruya River. They did, however, find that the macrophyte *Ruppia* had completely disappeared from the Moruya River.

Similarly, mangrove distribution was noted to have increased, although this may be attributed to more extensive field validation. Similarly, it was suspected that an increase in saltmarsh was due to more rigorous field work, although Elgin Associates acknowledged that this may also be a result of the exclusion of grazing from some areas.

Elgin Associates (2018) found that, while the areas of *Zostera* and *Halophila* were significant, their condition was poor – most likely due to siltation and elevated turbidity. They recommended:

- Biennial monitoring of condition and siltation rates.
- Working with private landholders to reduce cattle access and revegetation of bare banks.

The background information report which informed the threat and risk assessment for the Marine Estate Management Strategy (MEMA, 2017) also reviewed the historic abundance of estuarine macrophytes in the Moruya River. They found, based on a review of mapping between 1985 and 2013, that:

- The Moruya River Estuary contained around 80ha of saltmarsh and the area had increased since 1985. 80ha represented 6.3% of the total for the southern region (Shellharbour to the Victorian Border) and 1.1% of the total for the state.
- The estuary contained around 59.4ha of mangroves and the area had increased since 1985. 59.4ha represented 3.52% of the total for the southern region and 0.46% of the total for the state.
- The estuary contained around 130.4ha of seagrass and the area had increased since 1985. 130.4ha represented 3.72% of the total for the southern region and 0.84% of the total for the state.

Vegetation fringing the estuary and within the coastal zone, where not included in coastal wetland nor cleared for agriculture, comprises a mixture of dry and wet sclerophyll forests in the upper reaches of the estuary (i.e. upstream of Mogendoura Creek). The middle reaches of the estuary, around the Moruya floodplain are typically cleared. Where the estuary narrows downstream of The Anchorage, vegetation is dominated by wet sclerophyll forests on both sides of the river. Further downstream the northern banks of the estuary, between the waterway and the Airport, contains areas of dry sclerophyll forests.

3.1.3 Physical Features and Processes

MEMA (2017) summarises some key features of the Moruya River Estuary. The estuary has an open water area of around 3.7km^2 and a total water way area of around 6.1km^2. The average depth is around 1.90m. The tidal limit is some 21km upstream of the entrance, and a negligible percentage of the total surface water flow (1.4%) is extracted from the river. Water quality in the Moruya River is consistently better than the acceptable trigger levels for this type of estuary.

The Moruya River was surveyed by the Department of Land and Water Conservation in April 2000. At that time, the river channel thalweg was typically around -3m AHD in areas upstream of Malabar Creek, deepening to -4 to -5m AHD downstream. Localised, significantly deeper scour holes are also present. Shoals are also a common feature, with elevations of between -1 to -2m AHD. Upstream of Glenduart, the survey comprised cross sections, and these indicate a typical distribution of depths getting shallower with distance upstream, with elevations typically at -1.0 to -2.0m AHD, but with significant scour holes (-4.0m to -6.5m AHD) occurring around the outside of bends.

The river is known to have been subject to dredging in the past to maintain clear access for ships to Moruya, which was an important inland port. However, it appears that the need for dredging may have been exacerbated by hydraulic sluicing as part of gold mining operations in the 1800s. Typically, the geomorphic impact of these types of activities can take centuries to fully evolve. It is uncertain to what extent these activities continue to influence depths in the river to this day.

A tidal gauging was undertaken by Manly Hydraulics Laboratory at the same time as the survey. Results from that gauging exercise indicated that, for a tidal range of some 1.45m in the ocean, the tidal range at the entrance to Malabar Creek was around 1.2m. The tidal response remained similar all the way upstream to Mogendoura Creek. The tidal prism calculated near the entrance for this gauging exercise was 4.8 x 10^6 m^3 (4.88 x 10^6m^3) for the flood (ebb) tide.

Manly Hydraulics Laboratory (2012), analysed available tidal records from the Moruya River to derive tidal planes. Two gauges were analysed, from downstream of Moruya Bridge (record from 1997-98 through 2009-10) and from Moruya Hospital, upstream of Moruya Bridge (record from 1991-92 through 2009-10). The resulting, averaged tidal planes were determined as shown in Table 4. These show very similar values (tidal planes downstream of the bridge tend to be ~0.01m above those at the Hospital). The mean spring tidal range at Moruya (~1.03m) is around 90% of that determined offshore of Batemans Bay (~1.15m).

Table 4 Tidal Planes at Moruya (in m AHD) from Manly Hydraulics Laboratory (2012)

Tidal Planes	Moruya Bridge (m AHD)	Moruya Hospital (m AHD)
High High Water Spring Solstices	0.865	0.854
Mean High Water Springs	0.559	0.551
Mean High Water	0.470	0.462
Mean High Water Neaps	0.381	0.374
Mean Sea Level	0.042	0.034
Mean Low Water Neaps	-0.297	-0.306
Mean Low Water	-0.386	-0.395
Mean Low Water Springs	-0.475	-0.483
Indian Springs Low Water	-0.693	-0.700

Patterson Britton and Partners (2004) found that flood behaviour varied significantly between "frequent" (5% to 10% AEP floods or more frequent) and "less frequent" floods. During frequent floods, flows are initially contained within the riverbanks, with inundation beginning through water backing up through the wetlands which fringe the lower reaches of the estuary. As floodwaters rise, the southern riverbank downstream of Moruya is overtopped. The northern floodplain is initially overtopped to the west of Moruya, and the overtopping water combines with backwater flooding from Malabar lagoon to completely inundate the northern floodplain. During "frequent" flood events, around 2% of flow is conveyed across the northern floodplain and 8% is conveyed across the southern floodplain.

For more severe floods, the depth of flow over the riverbanks can be as much as 3m, and the northern floodplain conveys around 40% of the total discharge. In comparison, the southern floodplain conveys around 15% of the total discharge, with flood depths of two metres or more. The CBD of Moruya is typically flooded through backwater from further downstream.

The most recent flood study of the Moruya River (Worley Parsons, 2010) determined the design flood levels shown in Table 5.

Table 5 Design Flood Levels for the Moruya River (in m AHD from Worley Parsons (2010))

Location	5% AEP	1% AEP	Extreme
Kiora	10.60	12.00	15.08
Mogendoura Creek	6.85	7.78	9.63
Moruya Bridge (U/S)	4.10	5.14	7.60
Moruya Heads	2.17	3.54	5.65

Both flooding and tidal behaviour will be affected by climate change. At the present time, it appears that climate change has only been considered in the context of extreme flooding for the Moruya River.

Council has historically published report cards on water quality for the Moruya River. Report cards are provided for three periods, with water quality monitored at four different locations within the estuary. The results for different parameters were as discussed below:

Ecosystem Health: The overall health of the ecosystem was assessed as being very good in 2010/11, based on readings of chlorophyll-a, turbidity and increases in estuarine vegetation distribution. In 2014-15, the aquatic health was also assessed as being between good to very good.

Recreational Use: In 2014-15, water quality for recreational use was typically suitable for swimming. However, there were occasions where faecal contamination was detected. In 2016-17 water quality was considered suitable for recreational use most of the time. The results of faecal sampling indicated a significant improvement on the preceding 5 years.

Turbidity: Water clarity of the estuary was rated as very good in 2010-11 with 9% of total samples exceeding guideline values. In comparison, turbidity during 2014-15 was somewhat worse, with nearly 20% of samples exceeding guideline values. In 2016-17, turbidity levels were graded from very good to fair throughout the estuary, only exceeding guideline values for less than 10% of the time.

Chlorophyll-a: For chlorophyll-a (an indicator of microscopic algae) the Moruya River received a very good rating in 2010-11 with only 8% of the total samples exceeding guideline values, and these exceedances being only marginal. In comparison, during 2014-15, around 30% of samples exceeded the acceptable levels of chlorophyll-a. In 2016-17, chlorophyll-a levels were graded from very good to good throughout the estuary, which was a significant improvement on the results from 2014-15.

Dissolved Oxygen: During 2014-15 samples of dissolved oxygen showed a marked improvement on previous years, with around 75% of samples being within guideline

values, compared to less than 50% for preceding years. During 2016-17, dissolved oxygen values showed improvement again, with around 80% of samples being within the guideline range.

pH: During 2014-15 pH readings were within the recommended range for nearly 75% of the time, which was around the same level of compliance for the preceding three years. During 2016-17, pH values showed improvement with around 90% of samples being within the guideline range.

Overall, the water quality monitoring results support the findings of MEMA (2017), where it was concluded that the water quality in the Moruya River was reasonable. It should be noted, however, that water quality can fluctuate markedly in response to seasonal rainfall.

3.1.4 Land Zoning

Land zoning from the current Eurobodalla Local Environmental Plan (2012) is shown in Figure 8. Land use within the coastal zone upstream of Moruya is dominated by Primary Production (including small lot primary production) and Environmental Living, further away from the river. Along some reaches, a strip of foreshore land is set aside for Environmental Conservation. As of mid-2019, there are some isolated areas of *Deferred Matter* lands, which continue to be treated as Rural Lands under the *Rural Local Environmental Plan 1987*. By the time the CMP is completed, this matter will have been resolved and the Rural LEP will no longer have relevance.

Within the middle reaches of the river, zoning on the northern side of the river is dominated by Primary Production, except for the Large Lot Residential subdivision at Glenduart. On the southern side of the river, Moruya contains a mix of private (golf course) and public (parklands) recreation, medium and low-density residential areas, the town centre, plus areas for business expansion and environmental protection. Those environmental protection areas do not presently cover the full extent of the mapped CM SEPP wetlands, and it may be desirable to have this altered. The area east of Moruya is again dominated by primary production.

Further downstream, Environmental Protection areas associated with "The Anchorage" and Malabar Lagoon/Creek are similarly inconsistent with the CM SEPP wetlands although they do cover similar areas. To the east of The Anchorage and leading to Moruya Heads, land use is dominated by a mix of Environmental Living, Medium Density Residential and Environmental Conservation, with some *Deferred Matter* Areas. At Moruya Heads, a large area of CM SEPP wetland is presently zoned as waterway.

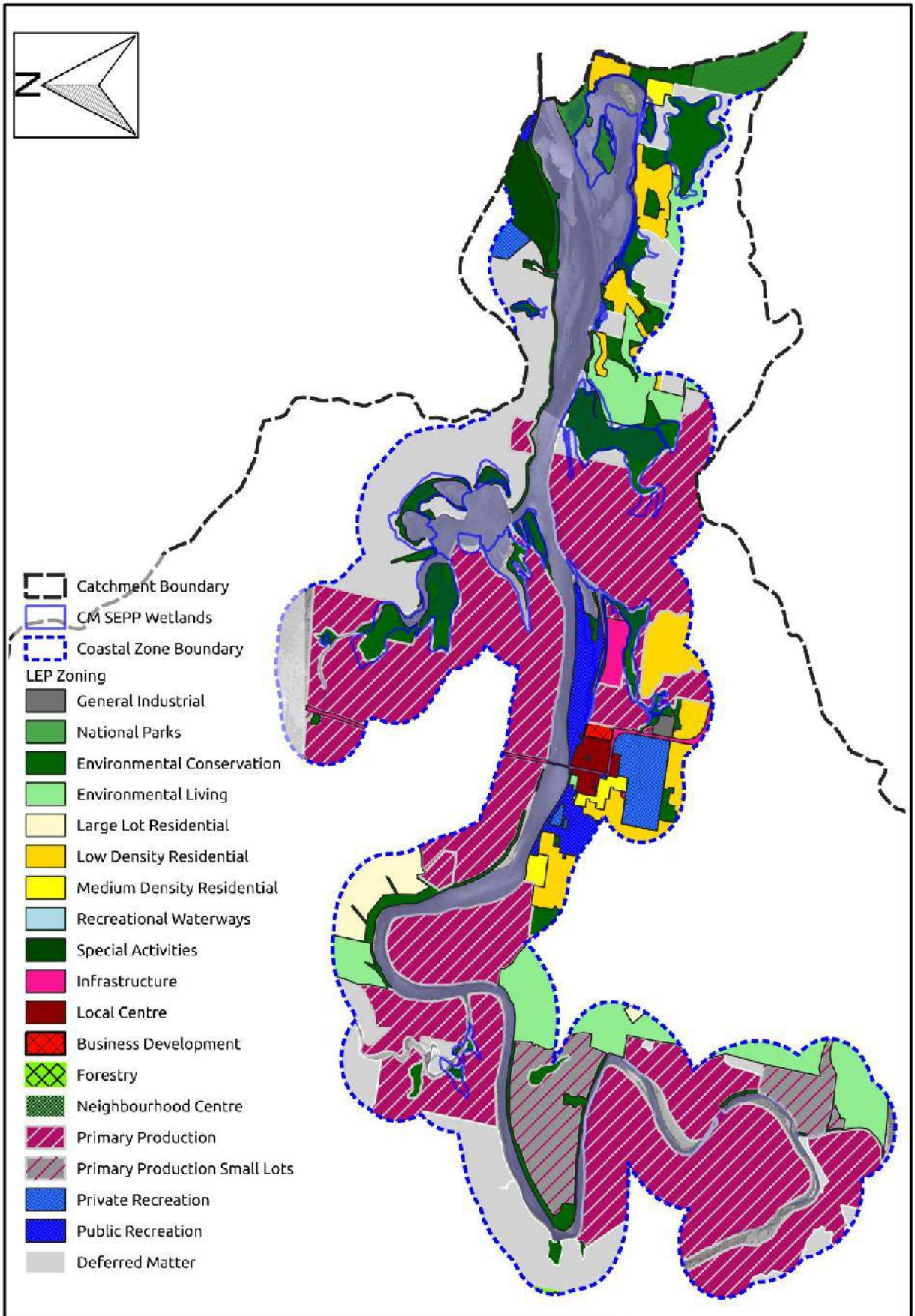

Figure 8: Land Zoning - Moruya Estuary

0 0.5 1 1.5 2 km

APPROX SCALE

Coastal Management Program for Moruya River, Mummuga Lake and Wagonga Inlet

REV	DRAWN	CHECK
A	DJW	DJW

GIS File:/Projects/P00053 CMPsforMoruya/Outgoing/Figures/Figures8 11 14.qgs

Salients

To the north of the downstream reaches of the estuary, there exist fringing areas of Environmental Conservation plus a large *Special Activities* area set aside for the Airport. There is a large *Deferred Matter* area between the Airport and Malabar Lagoon, which is presently forested. One parcel of forested land to the west and north of the Airport is zoned for private recreation, associated with the Moruya Racecourse which exists further to the north, but outside of the coastal zone.

3.2 Issues and Actions identified from Preliminary Consultation and Existing Information

3.2.1 Preliminary Consultation

A community workshop/drop-in session was held in the afternoon of June 5, 2018. Due to inclement weather, the venue needed to be changed and attendance was insufficient to be of value. For this reason, a further session was held at the Moruya Farmers Markets on July 10, 2018. In addition to these community workshops, a meeting with government stakeholders was held on June 7th, 2018 in Narooma. That meeting was attended by representatives of the National Parks and Wildlife Service, Batemans Bay Marine Park, OEH, South Coast Local Land Services and members of the study team.

3.2.2 Existing Information

During the review of background information and site inspections undertaken by the study team during the week of June 4-8, several other issues were identified. In some instances, these reflect those issues raised during preliminary consultation, but our review has helped to clarify those issues further.

3.2.3 Issues Identified

Throughout the remainder of this section, findings have been classified in accordance with the four different coastal management areas. The identified issues that may warrant further consideration are as follows:

<u>Issues Relating to Coastal Wetlands</u>

1. What preparations are being made for sea level rise and a potential increase in the intensity of large storms?
2. A concern that proposed changes to the Rural Lands Strategy will impact on coastal wetlands. The mapping associated with that strategy needs to be consistent with Environmental Conservation Zoning and the extent of coastal wetlands in the SEPP.
3. Grazing of cattle in Environmental Conservation or Coastal Management SEPP wetlands should not be allowed.

4. A broad concern that environmental protections are "being reduced".
5. There have been issues in getting property owners to commit to fencing around Malabar Lagoon.
6. Middens are known to be present around Malabar Lagoon, but their precise locations are uncertain. How are these to be managed?
7. There are informal stock crossings in Douga Ck (tributary of Malabar Lagoon) and there may be a need to investigate, assess what can be done.
8. Evidence of some mangrove die back along South Head Road.
9. There have been known issues with acid sulfate soil, particularly to the west of Malabar Lagoon (areas that drain into Malabar Lagoon).
10. The coastal zone wetland mapping probably needs to be adjusted to match the most recent vegetation mapping by Elgin Associates. Mapping around Ryans Creek and Malabar Lagoon do not fully capture important habitats in their upstream reaches.
11. The wetland associated with Malabar Lagoon & Creek is very important, but minimal information is available. It appears that this wetland could justifiably have a standalone study to help inform strategies to fence, exclude stock and allow for the migration of salt marsh into upstream areas. Given the importance of this wetland and considering that the tidal hydraulics of the wetland are not understood, some field data collection may be justified. Finer mapping of the CM SEPP boundaries and a variable width buffer zone may be warranted, accounting for slopes, adjacent topography, and natural depressions. Acid sulfate soils are also reportedly present in upper reaches.
12. There is a coastal wetland mapped at 480 North Head Road which may be a false positive.

<u>Issues Relating to Coastal Environment Areas</u>

13. Concerns were raised relating to the possibility that the estuary has shallowed over the past 20 years, and whether this should be investigated.
14. What preparations are being made for sea level rise and a potential increase in the intensity of large storms?
15. A need to ensure that water quality continues to be protected at a good level.
16. Kayaking is an important recreational use of the waterway.
17. Concerns about the apparent lack of riparian vegetation along stretches of the river. A desire to improve riparian buffers in general. During restoration works, it is

common to have landholders agree to around 5-10 m of protected width, but 30m is far more desirable.

18. Ongoing maintenance is required for riparian restoration works to be successful, but funding is scarce.
19. A broad concern that environmental protections are "being reduced".
20. A desire for protections along the Deua river catchment to continue and to ensure that riverbanks and steep slopes are not cleared. Properties along Araluen Road have been highlighted as issues.
21. There are noted issues with bare areas on banks in Wamban Creek.
22. There is existing riparian land presently leased to a landholder where the lease should be allowed to elapse so that a 30m riparian buffer can be established.
23. Stock access to the riverbank in upstream areas is a problem, particularly if there is a desire to restore riparian vegetation.
24. Some concern expressed that "entrance modifications" are causing high tides to rise.
25. There is significant commercial fishing access to the Moruya Estuary using a range of methods.
26. Concerns relating to the increasing rock lining of downstream reaches of the river, where ecologically friendly bank stabilisation methods are preferable.
27. There has been some experimentation with varied foreshore protection methods upstream of the Moruya Bridge.
28. Community access to foreshores (e.g. fishing platforms) have been put forward as a means of preventing uncontrolled access to riverbanks, which causes erosion.
29. Some concern that on-site wastewater systems are causing problems.
30. Concern that urban stormwater drainage should be "best practice".
31. There is a desire to consider the needs of migratory waders and foraging sites.
32. There appears to be enough concern to warrant the examination of sedimentation throughout the estuary, including the movement of slugs of sand through the upper estuary, and a review of infilling and the movement of shoals at the entrance.
33. An understanding of the ongoing maintenance requirements for the training walls and a strategy for future maintenance/replacement. Responsibility for these training walls will need to be established.

Issues Relating to Coastal Use Areas

34. The Pilot Station at Moruya Heads is important for European cultural heritage. BoM presently has a residential tenancy there.

There are other issues that are associated with the preparation of a CMP, but which are not readily relatable to a particular coastal management area. For example, there is some concern about sources of funding and how the CMP will interact with planning for the Batemans Marine Park (currently under review). Furthermore, there is a native title claim over the entire south coast region at the present time. It should also be noted that activities in the catchment and further upstream in the catchment sit outside the coastal zone but can be considered during the preparation of a CMP as appropriate.

3.2.4 Review and Audit of Existing Estuary Management Study and Plan

The existing EMP and its related management study (Worley Parsons, 2009b, 2009a) were examined, and the implementation of the actions identified by that plan has been audited by Eurobodalla Shire Council (Appendix C).

The audit, as provided, is incomplete. A review of progress is provided for those actions classified as "Planning Controls and Policies" (PCP) and "On-ground Works" (OGW), but no information is provided beyond the tables presented in the EMP (Worley Parsons, 2009a) for actions classified as "Investigation and Research" (IR) or "Education and Community Involvement" (EC). We note that ongoing proactive monitoring of the progress of EMPs (or CZMPs) within NSW has not always been given high priority. Previous guidelines suggested a "review" of progress towards the end of the identified implementation period (noted to typically be between 5 and 10 years in OEH, 2013) or "on a regular basis" (NSW Government, 1992).

The shift in focus of the management instruments away from "plans" towards "programs" implies that a more rigorous and proactive monitoring of progress will be necessary. Furthermore, it is a requirement to implement actions within the new coastal management programs under the IP&R framework (as set out by the *Local Government Act 1993*).

For the review within this Scoping Study, we have considered those actions identified as being either incomplete, ongoing, or abandoned with a discussion of reasons as appropriate. The actions have been categorised considering the extent and objectives of the current coastal management areas for which they are relevant.

Actions relating to the location and Objectives of Coastal Wetland Area

- **PCP-1:** *Incorporate SEPP-14 Wetlands and EECs into land use mapping:* SEPP-14 wetlands were converted to E2 lands under the Eurobodalla LEP. While there was a planning proposal exhibited during the first half of 2018 to make grazing an exempt development in E2 wetlands, this does not seem to have (yet) been

incorporated into the Eurobodalla LEP[8]. The boundaries of the E2 lands should now be updated to reflect boundaries of the CM SEPP wetlands. Furthermore, the CM SEPP explicitly requires development consent if marine vegetation is to be harmed. Mangroves and seagrass are protected from harm under the FM Act 1994 and Coastal Saltmarsh is classified as an endangered ecological community under the BC Act 2016. The protection of mangroves, seagrass and saltmarsh is a high priority given that habitat extent and health is a key driver of ecosystem functioning.

- **PCP-7**: *Investigate rezoning or strategic purchase of land to account for impacts of climate change on estuary processes and development & Incorporate into LEP*. Rising sea levels will encourage the upslope migration of estuarine vegetation such as saltmarsh and mangroves. The mapping contained within the CM SEPP effectively rezones this land. Furthermore, provisions within legislation protect estuarine vegetation. Some refined mapping of the existing habitat extents indicated by the CM SEPP may be required to enable effective migration of individual areas as sea levels rise.

- **OGW-3**: *Construct a boardwalk through Ryans Creek wetland to consolidate pedestrian access*. This project has not commenced and may need to be re-examined in the context of the new CM SEPP.

Actions relating to the location and Objectives of the Coastal Vulnerability Area

- **PCP-7:** *Investigate rezoning or strategic purchase of land to account for impacts of climate change on estuary processes and development & Incorporate into LEP*. Rising sea levels may eventually make some land unsuitable for its present use or uninhabitable due to an increased frequency of tidal inundation. This issue may need to be investigated in the first instance by establishing the extent of the coastal vulnerability area associated with tidal inundation (not yet mapped). The existing action has not been actively pursued. Zoning for acquisition is inappropriate and acquisition on a voluntary basis is probably the only way this will work.

- **OGW-1:** *Maintain rock protection walls along the lower estuary:* Council reports that this is ongoing, and that funding is currently being sought for additional works.

Actions relating to the location and Objectives of the Coastal Environment Area

- **PCP-**4: *Audit erosion and sediment controls for new developments over a previous 4-year period*. It seems that, while well intentioned, a retrospective audit is an impractical way to address this issue. Development related erosion and sediment controls are largely temporary in nature. The issue seems better addressed through compliance and Eurobodalla Shire Council does have a Soil and Water Management Code which should be applied for all development within the coastal zone. That code

[8] https://www.legislation.nsw.gov.au/#/view/EPI/2012/333/sch2, accessed 17 November 2018.

could be enhanced through reference to industry standard practice such as the *Blue Book* (Landcom, 2004).

- **PCP-6**: *Incorporate appropriate stormwater quality management measures for the expanding North Moruya in a revised Urban Stormwater Quality Management Plan.* We have received no indication as to whether this action has been pursued.

- **PCP-8**: *Develop a stormwater operations manual for Council's outdoor staff and machinery operators.* This has been completed, but some follow up may be necessary to consider how well the manual is being adopted.

- **PCP-10:** *Develop a Boating Management Plan for Moruya River:* Information provided by Council implies that this is no longer applicable. While the CMM implies that such an action could be recommended by the CMP, it seems most likely that responsibility for this would sit with either the NSW Roads and Maritime Service and/or the Department of Industry (Crown Lands). Council's role would traditionally extend to providing waterside facilities that encourage access to the waterway (boat ramps, jetties, wharves & pontoons etc.). Council should make sure that any proposed works and additional facilities do not conflict with the new CMP objectives. Except where facilities have been specifically identified as part of the data collated during this Scoping Study, this does not seem to be a particularly concerning issue for the Moruya Estuary.

- **PCP-**11: *Coordinate with Eurobodalla Bush Fire Management Committee to incorporate recommendations relating to riparian corridors in the Bush Fire Risk Management Plan:* It is expected that this will be difficult to achieve. Bush fire management requirements will likely override those of a coastal management plan. Ongoing consultation may help resolve competing program objectives.

- **PCP-12:** *Ensure Council Planning staff are briefed on the Estuary Management Plan:* It appears that this was initially addressed but may have not been followed through more recently. Under the new coastal management regime, the EP&A Act requires that a CMP and/or the CM SEPP are considered in development decisions.

- **PCP-14/OGW-7:** *Acquire a 30m wide strip of riparian land on the Northern bank of the Moruya River between the Bridge and Glenduart / construct a pedestrian walkway:* This action seems to have been abandoned, most likely because of the cost and difficulties involved with purchasing private land. Instead, Council and LLS have been working with individual landowners to continue restricting cattle access. A revised program should reflect the current management intent.

- **OGW-4:** *Formalise foreshore facilities and close informal boat ramp at popular recreation area on North Head Drive 600m west of Malabar Weir:* Council indicates that this action has not commenced, and, during site inspections, there was no indication of any issues at this location. This action may no longer be warranted.

- **OGW-5:** *Seek funding to remediate high priority fish barriers in the Moruya River Catchment:* There is limited information on whether this action has been implemented. However, there are known locations which may benefit from work through a Habitat Action Grant from DPI Fisheries.

- **OGW-7**: *Install vessel pump-out facilities, potentially at Moruya Town Wharf*. There seems to be limited appetite to implement this. Furthermore, faecal contamination appears to have improved in recent years in the absence of this action. This has not been highlighted as an issue during research for this Scoping Study.

- **OGW-8**: *Offer incentives relating to stock control measures in the vicinity of Mogendoura:* LLS is presently acting on these types of issues throughout the estuary.

- **OGW**-9: *Incorporate canoe/kayak launching area into Yarragee Reserve:* Council has assessed that this action is not required as the nature of the beach already provides a suitable environment for launching.

- **OGW-10:** *Install storage facilities for oyster growers at Pilot Station Backwater:* Following investigation, it seems there is limited desire or requirement for such facilities in these locations.

- **OGW-**11: *Install BBQ facilities at Yarragee Reserve and Ryans Creek Parkland:* This action has been assessed as no longer relevant by Council.

Actions relating to the location and Objectives of the Coastal Use Area

- **PCP-**13**:** *Improve compliance with restrictions on camping in the Moruya River riparian zone and near the mouth of Ryans Creek:* It appears that this action is ongoing, with regulations in place at North Head and access to camping adjacent to the mouth of Ryans Creek being limited.

3.3 Discussion of Key Assets, Estuarine Values, Threats and Risks

3.3.1 Introduction

The preceding section provides information on the concerns that have been expressed both in the past and discovered during initial consultation and investigations completed as part of the scoping study. In addition, those actions which have been undertaken as part of previous estuary or coastal zone management plans have been discussed. The present section aims to filter this information using the objectives of the CM Act.

The prior information needs to now be considered in the context of the new coastal management framework for New South Wales. The sections which follow briefly summarise the preliminary risk assessment completed for this Scoping Study (Appendix E outlines the methodology and outcomes). The risk assessment was

framed around the four coastal management areas and the objectives of the CM Act relating to them.

The key findings of the risk assessment have been used to formulate the purpose for the new CMP as discussed in Section 3.4.

The character of the Moruya River and the values held by the community are largely encapsulated by the quiet, rural nature of the floodplain surrounding Moruya. The area is used for primary production (oyster farming, commercial fishing, beef production, an expanding market garden and fresh local produce sector) and the town of Moruya supports small business, tourism, and government services. The health and community services sectors are the fasted growing services in Moruya town centre.

The coastal wetland areas which fringe the lower estuary are important environmental features, including Malabar Creek / Lagoon, which is zoned for Sanctuary as part of the Batemans Marine Park.

Recreational activities along the river are primarily passive, including kayaking, boating, swimming, and recreational fishing. However, water skiing, wakeboarding and personal watercraft have also been reported.

While the river entrance is permanently trained, there continue to be morphological issues associated with shallow shoals near the entrance. At the upstream reaches of the estuary, there is some concern that mobile shoals derived from fluvial sediments are moving into the estuary and that these reaches are shallowing over time.

3.3.2 Coastal Wetlands Area

Coastal wetlands as defined under the SEPP have a high value placed upon them. The mapped wetland at Malabar Creek / Lagoon has the added importance of being a Sanctuary Zone inside the Batemans Marine Park.

While concerns have been raised about the impact of Eurobodalla's Rural Lands Strategy on coastal wetlands, it seems unlikely that this will be a driving issue, as the provisions of the CM SEPP override those of Eurobodalla's LEP. Of potentially more importance is ensuring compliance or cooperation from landowners in appropriately managing wetlands that exist on their property.

Sea level rise will prompt coastal wetland vegetation to migrate upslope to retain a favourable water level environment. This impact will be widespread, and we are confident it is going to occur, albeit at relatively slow rates over an extended timeframe. For that reason, the risk arising from this process is considered "extreme".

Several "high" and "moderate" risks are associated with poor understanding of the environment surrounding Malabar Creek / Lagoon and further study is warranted. Furthermore, there is a strong argument to revisit the mapping of coastal wetland

mapping included in the SEPP based on more contemporary, ground truthed mapping of estuarine macrophytes.

3.3.3 Coastal Environment Area

Of the three estuaries being considered in this Scoping Study, the Moruya Estuary is unique in that it remains open for commercial fishing. Somewhat related to this is that the estuarine floodplain surrounding Moruya is used primarily for agriculture. Moruya was previously an important river port, and for this reason, the entrance to the river is trained and the channel downstream of Moruya has been dredged in the past for navigation.

A key risk associated with the Moruya Estuary is the rehabilitation of riparian zones. While there have been significant efforts to improve the riverbanks, continuing funding sources are uncertain, particularly for maintenance. Currently, there is no overarching strategy which is monitored and updated with time to assess performance of any rehabilitation works and to assist in targeting new areas for rehabilitation.

Protected migratory wader species are commonly sighted within the downstream reaches of the estuary. The possibility that their habitat may be compromised by sea level rise, development or other human activities does not seem to have featured significantly in development of the existing management plan. This warrants further investigation.

Otherwise, changes to the bathymetry and tidal response of the estuary following training of the entrance have been raised as concerns. These issues could be investigated during preparation of the CMP. Similarly, the ongoing maintenance effort, responsibilities and plans for future repairs of the training walls in the lower estuary should be addressed.

Other risks that require some attention relate to access to the estuary for recreational activities and the impact of settlements on water quality in the estuary via runoff, at present and in the future, based on projected growth rates.

3.3.4 Coastal Use Area

Management of the coastal use area is unlikely to represent a key issue for management of the estuary. Key historical sites, such as the Pilots Station and Moruya Quarry appear to be appropriately managed at present.

As part of the CMP preparation, it will be necessary to review areas that are proposed for changes to development intensity, and whether additional development controls are required.

3.4 Identification of CMP "Purpose" for Moruya River

With reference to the risk assessment contained in Appendix E, the key objectives that are to be addressed by the CMP for Moruya River are:

Assuming that the coastal wetland area is to be included in the CMP:

> *"to protect coastal wetlands and littoral rainforests in their natural state, including their biological diversity and ecosystem integrity"*

Initially this objective can be addressed by updating the current CM SEPP mapping for coastal wetlands to reflect more recent, field verified mapping.

> *to promote the rehabilitation and restoration of degraded coastal wetlands and littoral rainforests.*

This objective can be partly addressed by updating the current CM SEPP mapping and by continuing cooperation with landowners to exclude stock from wetland areas, such as saltmarsh.

> *to improve the resilience of coastal wetlands and littoral rainforests to the impacts of climate change, including opportunities for migration.*

As part of improved mapping for the CM SEPP, it is proposed that a more rigorous representation of the buffer zone is prepared, which considers topography in assessing migration pathways.

Assuming that the coastal environment area is to be included in the CMP:

> *to protect and enhance the coastal environmental values and natural processes of coastal waters, estuaries, coastal lakes and coastal lagoons, and enhance natural character, scenic value, biological diversity and ecosystem integrity.*
>
> *to maintain the presence of beaches, dunes and the natural features of foreshores, taking into account the beach system operating at the relevant place.*

These objectives can be addressed by continuing efforts to rehabilitate riverine foreshores, educate landowners and excluding stock. However, a more coordinated effort may be required. While that work has occurred on an opportunistic basis reliant on the cooperation of landholders, more rigorous records, monitoring, evaluation, and maintenance will assist. A further concern raised during this Scoping Study is the well-being of migratory waders. Some study is likely warranted to better understand the areas used by those birds protected by legislation, particularly in the vicinity of Moruya Heads. The fate of the habitat they use should be assessed for a future including sea level rise.

We consider it unwarranted that the coastal use area be included in the CMP for the Moruya River Estuary. The reason for this is that development is low intensity and no

significant issues have been identified that significantly impact the coastal use objectives and that are not presently now covered by of the CM Act, and the default NSW guideline document for coastal design (Coastal Council of NSW, 2003).

The above objectives relate to any "extreme" or "high" risk issues that have been identified through the preliminary risk assessment (Appendix E). There are also moderate risk issues that could be addressed if easy or inexpensive. In developing the CMP, each of these should be assessed for ease of implementation.

Considering the above objectives, it is worthwhile comparing these against the identified management objectives of the existing Estuary Management Plan (Worley Parsons, 2009a). Those were:

1. Maintain existing good water quality.
2. Protect and restore riparian vegetation.
3. Protect and preserve aquatic habitats (including seagrasses and saltmarsh).
4. Restrict stock access to foreshore and wetland areas.
5. Rehabilitate eroded sections of the riverbank and damaged sections of existing bank stabilisation works.
6. Consider and manage the impacts of climate change on estuary processes.
7. Improve education and awareness of estuary issues.
8. Increase connectivity of foreshore habitats (wildlife corridors).
9. Reduce and prevent further sedimentation of the estuary.
10. Understand, sustain, and improve fish productivity in the estuary.
11. Improve foreshore access and facilities for recreation.
12. Provide for sustainable development of the estuary.
13. Promote sustainable tourism for the estuary.
14. Tighter enforcement of development controls.
15. Protect and restore Aboriginal and European heritage.
16. Resolve conflicts between development controls and other policies.
17. Maintain and enhance visual aesthetics and quiet rural lifestyle.
18. Promote sustainable industry for the catchment and floodplain.

These objectives are mainly 'high level' but still relevant to the estuary, and covered by the risk assessment outlined in Appendix E. However, the approach of this Scoping Study has been to limit the CMP scope to the objectives for each coastal management area outlined in the CM Act. Accordingly, some of the prior objectives now will only form a secondary concern of the CMP such as:

- Tighter enforcement of development controls.
- Promote sustainable industry for the catchment and floodplain.
- Promote sustainable tourism for the estuary.

Furthermore, there are some actions which are of interest to the CMP but are already adequately covered by the responsibilities of state government, such as "*Understand, sustain and improve fish productivity in the estuary*" – which is clearly a responsibility of NSW DPI (Fisheries) and the Batemans Marine Park. Adding complexity by introducing actions into the CMP is considered counterproductive. At the risk of the CMP seeming light in terms of the quantity of actions, it is considered practicable to focus the CMP on fewer actions which are clearly the responsibility of Council and largely within Council's control. The actions to be listed in the CMP must be affordable, programmed and implemented. This does not eliminate the need for Council to consult with and support the actions of other arms of state government, including NSW Fisheries, Batemans Marine Park, RMS and DoI (Crown Lands) in achieving positive outcomes for the estuary.

3.5 Gap Analysis and Recommended Approach in Development of CMP

Considering the objectives of the previous Estuary Management Plan (Worley Parsons, 2009a) it is clear that work has progressed in achieving the following objectives:

1. Maintain existing good water quality.
2. Protect and restore riparian vegetation.
3. Protect and preserve aquatic habitats (including seagrasses and saltmarsh).
4. Restrict stock access to foreshore and wetland areas.
5. Rehabilitate eroded sections of the riverbank and damaged sections of existing bank stabilisation works.

However, except for the first objective, monitoring, evaluation, and reporting activities have been limited. These objectives continue, but a more strategic and monitored approach is recommended. That monitoring should drive future activity in implementing the program.

Several of the objectives are either no longer valid, impractical, or much better addressed through other processes and programs, these include:

1. Understand, sustain, and improve fish productivity in the estuary.
2. Provide for sustainable development of the estuary.
3. Promote sustainable tourism for the estuary.
4. Tighter enforcement of development controls.
5. Protect and restore Aboriginal and European heritage.
6. Maintain and enhance visual aesthetics and quiet rural lifestyle.
7. Promote sustainable industry for the catchment and floodplain.

The remaining objectives remain relevant to a new CMP but require either more effort or a different approach.

The risk assessment (Appendix E) contains commentary, associated with each risk, with some discussion on potential additional studies and/or actions that could be undertaken to address data gaps during both the preparation and operation of a CMP for Moruya River. A short list of these studies and/or actions, comprising those relating to “high” and “extreme” risks was prepared and provided to representatives of Eurobodalla Council and the Office of Environment and Heritage. That list and the potential costs of for those studies was the subject of discussions between the study team, Council and OEH to consolidate and refine the approach for each of the "high" and "extreme" risks during the CMP process.

However, due to issues outlined in the Executive Summary, none of these additional studies could be funded as part of Stages 2 or 3 during preparation of the CMP. Accordingly, these additional studies have been carried forward to be executed as actions within the CMP.

Table 6 Proposed Approach to Addressing "Extreme" and "High" ranked Estuary Management Risks associated with Moruya River

Relevant Risks (Appendix E) and CM Area	Risk Ranking	Required Additional Study
M1 (Wetlands) M10(Wetlands)	Extreme High	Update CM SEPP (Wetlands) Mapping: Maps should be prepared to better represent the extent of existing Coastal Wetlands, as mapped and assessed by Elgin Associates (2018). Furthermore, the associated proximity area for wetlands should be derived incorporating topographical constraints, not the linear spatial buffer applied in the present mapping. In this way, the buffer will focus on lower lying areas that are important to enable the migration of wetlands with sea level rise. The coastal vulnerability mapping (see next row) will need to be completed to ascertain the potential extent of migration with a future sea level rise scenario.
M13(Vulnerability)	Extreme	Tidal Inundation Mapping: This requires an understanding of how the tidal planes along the river might change given a sea level rise scenario. While there is an existing flood model of the river (developed using the RMA software, Worley Parsons (2010)) results from a prior tidal gauging of the river (5 April 2000) indicates that the tidal range between the Entrance and Mogendoura Creek varied only slightly (typically between highs of 0.7m AHD and lows of 0.3m AHD, with the range varying by less than a few cm). By extension, key present-day tidal planes can be derived by analysis of the water level record at Moruya, and these tidal planes should be reasonably representative along this length of the river. Furthermore, a good first pass estimate of changes to tidal planes can be derived by adding an amount for future sea level rise to the current tidal planes. This will provide a suitable mapping product for assessing potential migration pathways for coastal wetlands (see previous row). Eurobodalla Shire Council proposes completing formal Coastal Vulnerability (Tidal Inundation) Mapping during a forthcoming review of the floodplain risk management plan for the Moruya River. When this occurs, a more detailed representation which better addresses hydrodynamics in the side creeks and upper reaches of the Estuary (upstream of Mogendoura Creek) will be possible, and the analysis proposed here could then be updated.
M5 (Wetlands) M6 (Wetlands) M11(Wetlands)	High High High	Malabar Lagoon Processes Study: It appears that overall estuarine processes in Malabar Lagoon are poorly understood and this is of some concern given its importance as a Sanctuary Zone in the Batemans Marine Park. While a detailed processes study may be warranted, the updated wetlands mapping will provide an important precursor to identify the critical areas for management. It is expected that this information could feed into a subsequent study (as part of the CMP) including: (i) a preliminary assessment of acid sulfate soils generating capacity in the surrounds of the creek and lagoon and consideration as to whether the risk will increase with sea level rise. (ii) installation of a water level recorder (temporarily) to gain an understanding of how the weir under North Head Drive affects hydraulics. (iii) an indigenous cultural assessment to identify locations of middens to ensure adequate management and protection. (iv) inspection of tributary creek lines to assess stability and whether these are contributing sediment to the lagoon and/or whether any ameliorative works are warranted. (v) installation of a temporary water quality recorder to enable a baseline assessment of water quality conditions within the lagoon. It is considered that this processes study would be of most interest to the Batemans Marine Park, and to assist in providing a reasonable level of background understanding

Relevant Risks (Appendix E) and CM Area	Risk Ranking	Required Additional Study
		to negotiate with landowners and promote the fencing of areas to exclude livestock. For these reasons, responsibility for this action will likely rest with the Marine Park.
M24 (Environment)	High	Literature/Data Compilation of Migratory Wader Use: As part of preparation for the CMP, more research must be undertaken to determine the extent to which shorebird habitat at the entrance to Moruya River is presently being managed. It is possible that NPWS presently has such a strategy and it is not desirable that the CMP process overlaps this. Depending on what is available, an action of the CMP may include the background review of existing data, including databases held by state government and any relevant citizen science sources to assess the regional importance of available migratory wader habitat and to provide indicators as to whether there are management strategies that may be considered to enhance / protect / expand upon the available habitat in future, particularly under a sea level rise scenario.

4 Mummuga Lake

4.1 Background

Unlike the Moruya River and Wagonga Inlet, an estuary management plan has not been previously prepared for Mummuga Lake. The existing Plan of Management for Eurobodalla National Park (NSW National Parks and Wildlife Service, 2000) proposed the preparation of an estuary management plan and an interim lagoon opening strategy for Mummuga Lake. To our knowledge, only the opening strategy has been developed, and a Review of Environmental Factors for artificial opening of Mummuga Lake (and other lakes within the Park) has been reviewed (Department of Environment and Conservation, 2007).

4.1.1 Catchment Characteristics

The Mummuga Lake catchment is shown in Figure 9. The catchment is around 27.5km^2 and oriented approximately east-west with a length of 10km and a width of (typically) around 3km. Most of the upper (western) catchment is contained within the Bodalla State Forest. Importantly, the estuarine waterway and areas to the north east of the estuary are contained within Eurobodalla National Park. Catchment elevations are below 200m, with the maximum height occurring adjacent to the southern boundary of the catchment. The main tributary, Lawler's Creek, drains the catchment into the western edge of Mummuga Lake.

Spring Creek drains the catchment to the south of the lake, flowing into Mummuga Lake to the east of Evans Point and dividing the settled areas of Dalmeny, which fringe the southern shoreline of the lake.

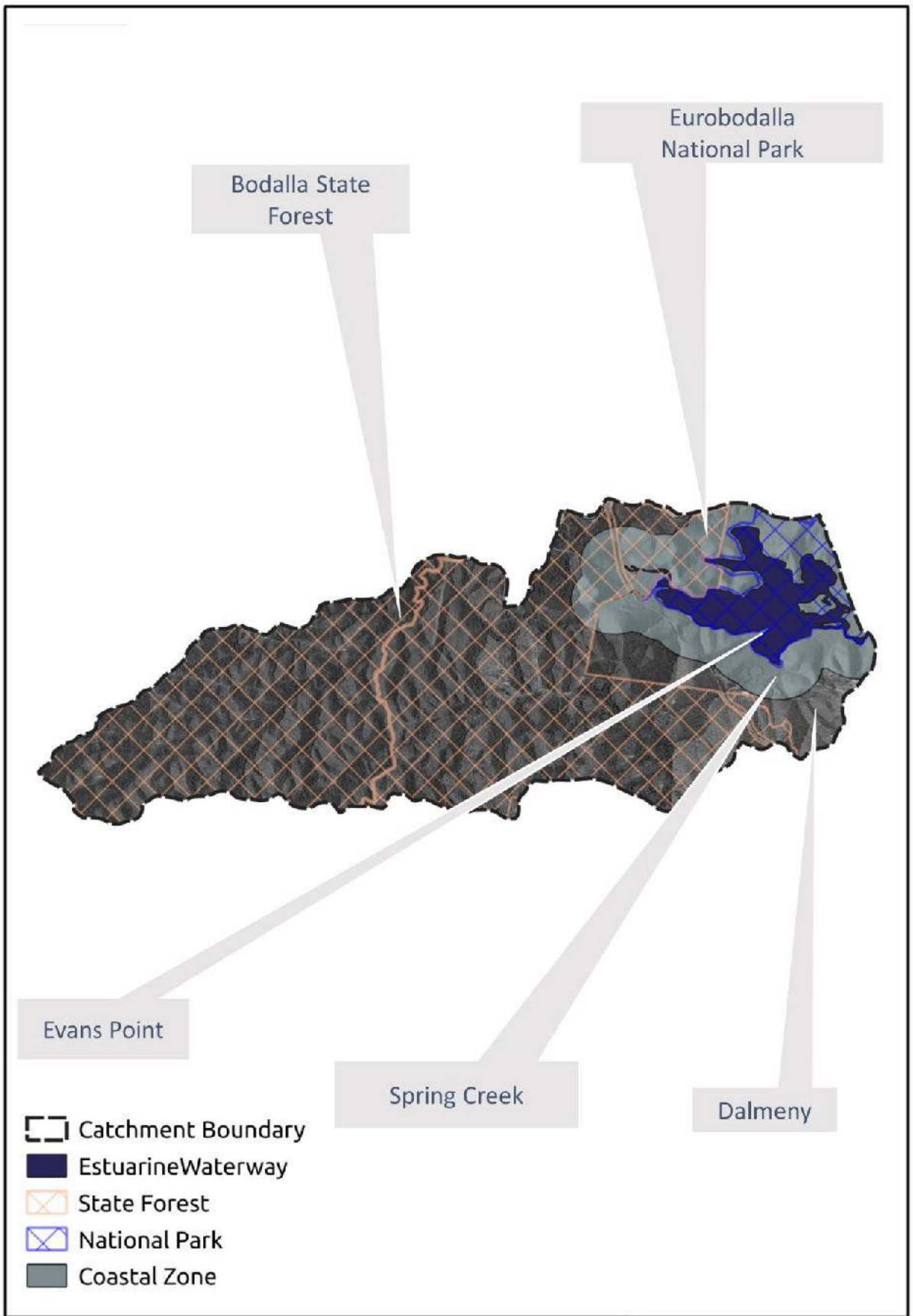

Figure 9: Mummuga Catchment Landuse

0 0.5 1 1.5 2 km

Coastal Management Program for Moruya River, Mummuga Lake and Wagonga Inlet	REV A	DRAWN DJW	CHECK DJW	Salients
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4.1.2 Key Habitat Extent and Health

The mapped extent of estuarine macrophytes, provided to us by Council for 2012, is the most recent data available for Mummuga Lake. We understand that this mapping was completed by the NSW Department of Primary Industries (Fisheries). The extent of estuarine macrophytes and zoning for the Batemans Marine Park (BMP) within Mummuga Lake are shown in Figure 10. The BMP covers almost all the estuary, *as a habitat protection zone,* except for the creek lines which feed the alluvial delta at the western side of the lake.

An almost continuous fringe of *Zostera* is present around the main body of the lake. It is narrow in many locations but becomes more expansive near locations where creeks flow into the estuary (Lawlers Creek from the west, Spring Creek from the south) and within the upstream reaches of the flood tide delta. Mapped coastal wetland areas associated with Amherst Island largely miss the areas of saltmarsh mapped in 2012, although an area of combined mangrove and saltmarsh is present. Mapping of macrophytes in Mummuga Lake should be upgraded to confirm the appropriateness of existing coastal wetland boundaries. There also exist areas of saltmarsh directly offshore of the southern shoreline of the entrance channel. Site inspection of these areas during the preparation of this study indicated that some of these are highly disturbed by uncontrolled public access.

The background information report which informed the threat and risk assessment for the Marine Estate Management Strategy (MEMA, 2017) also reviewed the historic abundance of estuarine macrophytes in Mummuga Lake. They found, based on a review of mapping between 1985 and 2013, that:

- Mummuga Lake contained around 2.14ha of saltmarsh, which reduced alarmingly by around 65% (loss of 3.35ha) between 1985 and 2006. 2.14ha represented 0.17% of the total for the southern region (Shellharbour to the Victorian Border) and 0.03% of the total for the state.
- The lake contained around 1.34ha of mangroves and the area, having increased from zero since 1985. 1.34ha represented 0.08% of the total for the southern region and 0.01% of the total for the state.
- The lake contained around 32.5ha of seagrass and the area had increased since 1985 (29.4ha). 32.5ha represented 0.93% of the total for the southern region and 0.21% of the total for the state.

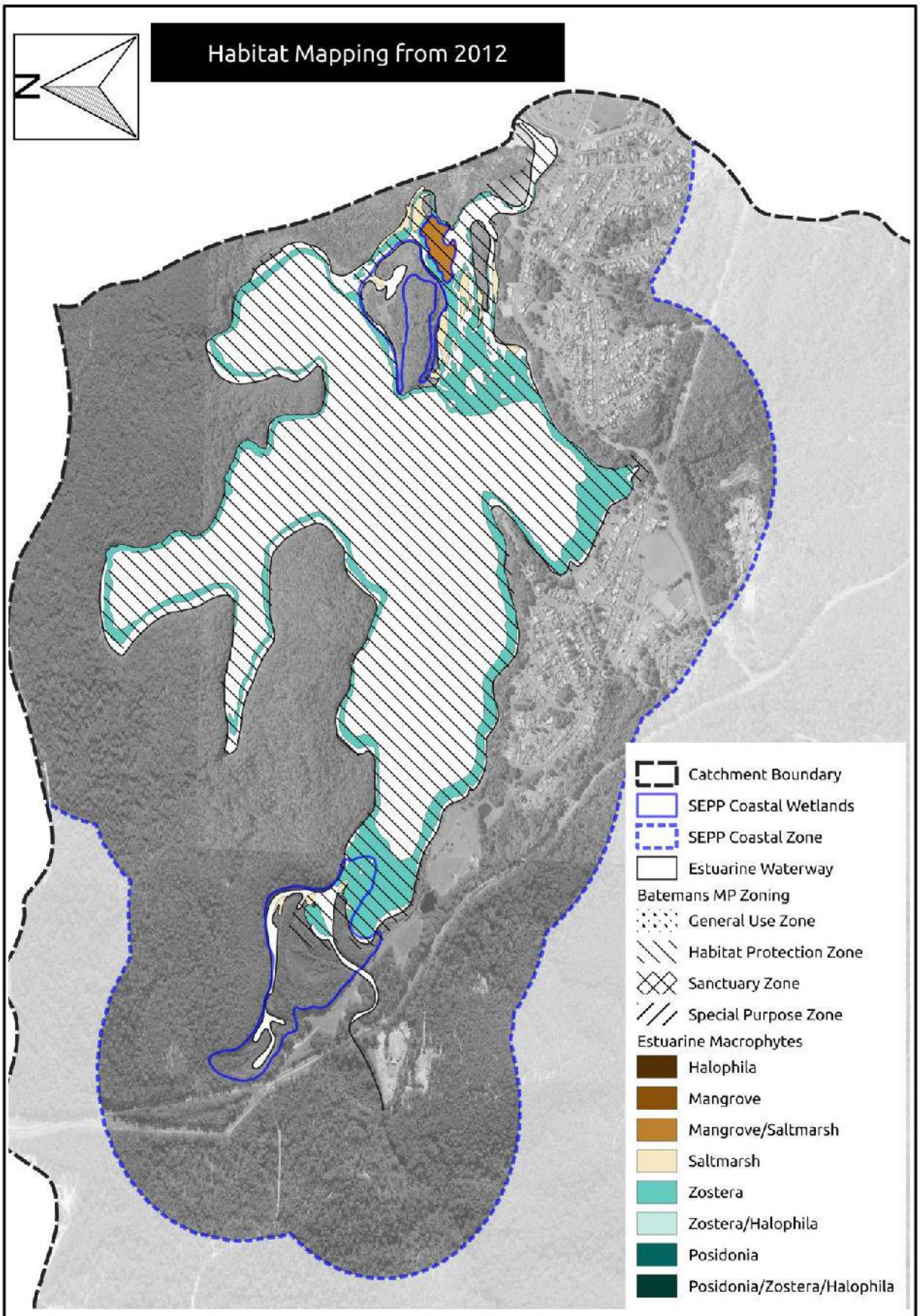

Figure 10: Mapped Estuarine Habitat - Mummuga Lake

0 150 300 450 600 m

APPROX SCALE

Coastal Management Program for Moruya River, Mummuga Lake and Wagonga Inlet

REV	DRAWN	CHECK
A	DJW	DJW

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Salients

Much of the terrestrial vegetation surrounding the northern and western edges of the estuary is within Bodalla State Forest or Eurobodalla National Park. In some areas to the south, and near the ocean entrance, vegetation has been cleared for public recreation. Otherwise, where not comprising estuarine macrophytes, the vegetation typically comprises wet sclerophyll forest, particularly behind the residential areas of Dalmeny.

4.1.3 Physical Features and Processes

Overall, Mummuga Lake has received little detailed attention, and data collected regarding the estuarine features of the lake are sparse.

MEMA (2017) summarises some key features of Mummuga Lake. The lake has an open water area of around 1.3km^2 and a total water way area of around 1.7km^2. The average depth is around 1.0m. The tidal limit is some 3.6km upstream of the entrance.

The lake is an intermittently opening saline lagoon. While the lake is intermittently open, at the time of an inspection in June 2018, it had been reportedly open for around 5 years.

The form of the lake is consistent with it being an intermediately evolved intermittently opened lagoon. The entrance channel of the lake (Lawlers Creek) is shallow, particularly in its upstream reaches. It winds through the flood tide delta and there are several minor channels which spread from the main channel and wrap around features including Amherst Island and a smaller, minor island adjacent to the southern foreshore of the entrance compartment. The sedimentation patterns at the dropover into the main body of the lake are consistent with sand being continuously delivered from the coast to infill the lake. Most of the lake waterway comprises the main estuarine basin which is somewhat deeper. Exceptions to this occur notably at the locations where Lawlers Creek flows into the western side of the lake, and Spring Creek into the southern side. In these locations, sediment from the catchment is being supplied as these deltas slowly expand into the lake. A hydrosurvey of Lake Mummuga was completed by the Office of Environment and Heritage in April 2013, covering the entire entrance channel and main body of the waterway.

The entrance channel exits to the ocean immediately to the north of Mummuga Head. It is very common for entrances to intermittent saline lakes to locate against the northern side of a rocky headland in this way within New South Wales, as this produces the most stable entrance and sheltering from the dominant south south easterly wave climate. Historical aerial photographs indicated the presence of a wash over fan, in 1967, some distance to the north of the entrance, but this feature was temporary and has gradually revegetated.

Historically, water level records have not been recorded within Mummuga Lake. Management of entrance opening was discussed in the review of environmental

factors for entrance management within the Eurobodalla National Park (Department of Environment and Conservation, 2007). The REF provides two indicators for entrance management: (i) When the water level in the lake begins to inundate properties in Mort Avenue, Dalmeny, monitoring of the situation intensifies and entrance opening may occur in certain circumstances – including ecological monitoring; and (ii) When the water level reaches, or is likely to imminently reach, the level of a marker on the footbridge across the entrance channel, set at 1.175m AHD, the entrance is opened as a matter of urgency.

WMA Water (2016) prepared a comprehensive flood study of Dalmeny and Mummuga Lake. The way in which an intermittent entrance is treated in a flood model can have a significant effect on simulated flood levels in the lake. For the historical model simulations, the entrance was modelled as closed, with that entrance configuration apparently not simulated as changing throughout the opening event, except for one event from 2014, when the entrance was assumed to be open. Inspection of aerial and satellite imagery available through Google Earth, and covering the period between 2002 and 2018, indicated that the entrance was closed in three out of eight photographs. The limited data indicates that the entrance is open more often than closed, but that historically, a closed entrance exacerbates flooding levels.

Sensitivity testing by WMA Water (2016) indicated that, if the entrance was considered to open dynamically during the simulated event, the amount of time taken to breakout could affect peak water levels. For the most severe historical event (14-15 February 2010, which was considered either greater than or equal to a 1% AEP event) simulated water levels in the lake were affected by around 0.1m.

Design flood levels within Mummuga Lake, as determined by WMA Water, are presented in Table 7.

Table 7 Design Flood Levels for Mummuga Lake (in m AHD from WMA Water (2016))

Location	20% AEP	10% AEP	5% AEP	2% AEP	1% AEP	0.5% AEP	PMF
Pedestrian Footbridge	2.0	2.2	2.4	2.6	2.8	3.0	3.8
Spring Creek at Mort Ave	2.0	2.2	2.5	2.7	2.9	3.1	4.0
Lawlers Ck at Princes Hwy	3.1	3.2	3.4	3.5	3.7	3.8	4.8

Both flooding and tidal behaviour will be affected by climate change. At the present time, it appears that climate change has only been considered in the context of extreme flooding for Mummuga Lake. In the case of Mummuga Lake, if a tidal inundation coastal vulnerability zone is to be derived, it will be necessary to consider the influence of climate change on entrance barrier heights.

It appears that readily available water quality information from Mummuga Lake is sparse and limited to seasonal sampling of bacteriological monitoring to assess safety for primary contact activities.

MEMA (2017) indicated that water quality in Mummuga Lake is consistently better than the acceptable trigger levels for this type of estuary for chlorophyll-a, and typically good overall and for turbidity. These assessments appear to be based on data from OEH which is not freely available.

The MEMA report notes that the lake has a low level of catchment disturbance and that a negligible amount of surface flow (0.1%) is extracted.

4.1.4 Land Zoning

Land zoning from the current Eurobodalla Local Environmental Plan (2012) is shown in Figure 11. Land use comprises National Park in the north eastern corner and within some parcels around the margins of the lake. Parcels between the Bodalla State Forest and Eurobodalla National Park are classified as Environmental Conservation Lands. The alluvial delta of Lawlers Creek is also classified for Environmental Conservation, but the zoned area does not cover the same extent as the CM SEPP boundaries in this area.

To the south of the lake, near the entrance compartment, land along the foreshore fringe is zoned for Public Recreation, including foreshore parklands, vegetated foreshore areas, car parking and a campground. Further east, a strip of Environmental Conservation extends along the foreshore, across Spring Creek, around Evans Point and in front of the western residential area of Dalmeny. The remaining residential areas comprise a mix of low and medium density residential, interspersed with patches of Environmental Conservation, public and private recreation (Including Dalmeny Sporting Club).

The Princes Highway intersects the westernmost parts of the Mummuga Lake coastal zone. To its west, there exists a significant parcel of "*Deferred Matter*" land, which continues to be treated as "*Rural Lands*" under Eurobodalla's *Rural Local Environmental Plan 1987*. As of early 2019, Council is presently in the process of rezoning the Deferred Matter lands and the process is nearing completion. By the time the CMP is prepared, this matter will have been resolved and the Deferred Matter will no longer apply.

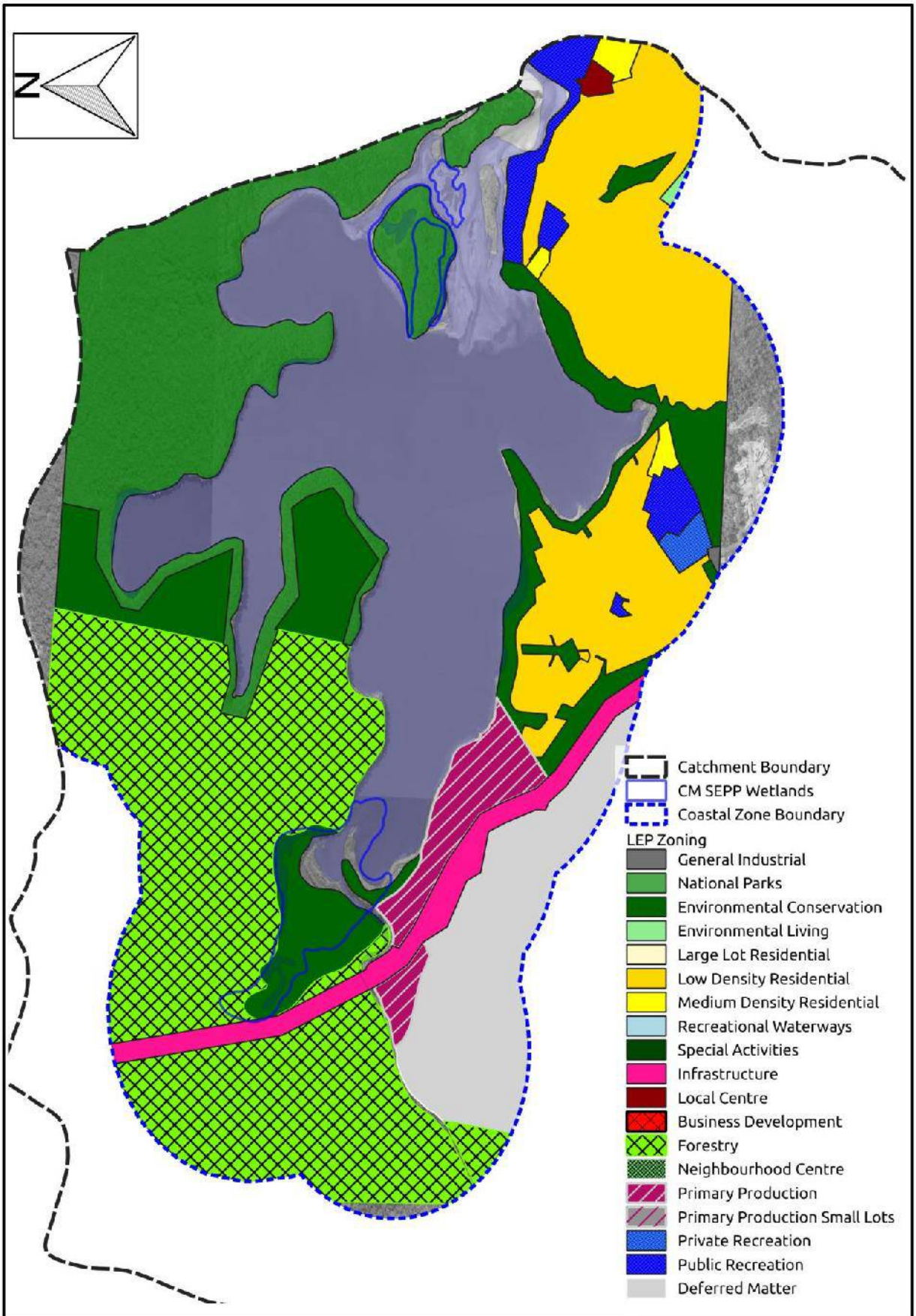

Figure 11: Mapped Estuarine Habitat - Mummuga Lake

0 150 300 450 600 m

APPROX SCALE

Coastal Management Program for Moruya River, Mummuga Lake and Wagonga Inlet

REV	DRAWN	CHECK
A	DJW	DJW

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Salients

At its western edge, but east of the Princes Highway, Dalmeny's residential area abuts a region zoned for Primary Production. Across the Highway, but to the south of Lawlers Creek, a smaller parcel of land is similarly zoned, and presently used for a sawmill.

4.2 Issues and Actions identified from Preliminary Consultation and Existing Information

4.2.1 Preliminary Consultation

A community workshop/drop-in session was held in the afternoon of June 6, 2018, at the Narooma Library. In addition to the community workshop, a meeting with government stakeholders was held on June 7th, 2018 in Narooma. That meeting was attended by representatives of the National Parks and Wildlife Service, Batemans Bay Marine Park, OEH, South Coast Local Land Services and members of the study team.

4.2.2 Existing Information

During the review of background information and a site inspection undertaken by the study team on June 5, several other issues were identified. In some instances, these reflect those issues raised during preliminary consultation, but our review has helped to clarify those issues further.

4.2.3 Issues Identified

Throughout the remainder of this section, findings have been classified in accordance with different coastal management areas. The issues identified issues are as follows:

<u>Issues Relating to Coastal Wetlands</u>

1. A need to update mapping of estuarine macrophytes to better represent conditions as they are today.
2. A need to update the extents of the coastal wetland area, and Environmental Conservation zoning to better reflect the extents identified by mapping of estuarine vegetation.

<u>Issues Relating to Coastal Environment Area</u>

3. Recent (~last decade) works to establish/restore saltmarsh to the rear of properties on Myuna and Attunga Streets. Initially, there were substantial problems with landowners mowing the saltmarsh. This activity is illegal for a range of reasons; the land is public land, and saltmarsh is legally classified as an endangered ecological community (EEC). More recently the action has met with some success and most, but not all, property owners help by not mowing the area set aside for this purpose. However, there is an issue of maintenance and lawn grasses are

invading the established saltmarsh beds in some locations. This needs to be investigated.

4. That stormwater runoff is causing pollution and erosion.
5. That prawning with drag nets should be banned as it damages the environment. As Mummuga Lake is both a "Habitat Protection Zone" and "Recreational Fishing Haven", prawning by drag net is allowed. There are some concerns regarding compliance in Mummuga Lake, where no commercial fishing is allowed.
6. A concern that siltation in Mummuga Lake is caused by premature opening (i.e. opening when the water level gets high, but there is no follow up rainfall to help carve a channel.
7. A perception in the community that the present mouth of the estuary was created by Council blasting the rock out and that opening used to occur a few hundred metres up the beach.
8. A concern that artificial opening has ruined prawning in Mummuga Lake.
9. A range of concerns associated with illegal fishing and a drop in crayfish numbers.
10. A concern that there is too much freshwater runoff after storms, killing off crayfish and abalone, with some dead animals washing ashore. This includes concern that the amount of freshwater runoff will increase with further development.
11. A concern that informal access of the waterway by boats is causing erosion.
12. A general concern for estuarine health.
13. There are areas of salt marsh that require better protection. A significant patch of saltmarsh exists off Mort Avenue and uncontrolled vehicular access is preventing this patch from thriving. Furthermore, around the boat ramp, areas where saltmarsh species exist is overzealously mown and or used for overflow parking.
14. In Mummuga Lake there is some conflict between development, the expansion of tourism and achieving more environmentally sustainable solutions.
15. There are potential issues with rubbish from stormwater outlets.
16. Due to multiple layers of management, there is a lack of certainty around responsibility for various aspects of estuarine management. For example, aspects of the southern waterway and fringes of the lake come under the jurisdiction of Eurobodalla National Park, Batemans Bay National Park, NSW Maritime, NSW Fisheries and Eurobodalla Shire Council.

17. Along the southern boundary of the entrance channel, to the west of the footbridge across the creek, it appears that selected trees may have been poisoned to enhance views.

Issues Relating to Coastal Use Area

18. A desire for water skiing and jet skis to be banned from Mummuga Lake and moved to Corunna Lake, arguing that the small size of the lake means that these activities can dominate and effectively "shut down" the lake. It is argued that the size of the lake makes recreational fishing a more appropriate use. There is presently uncertainty associated with difficulties in understanding how water skiing is presently allowed in the lake, with permission presently available from both RMS and National Parks. This may need investigation.

19. A desire for the boat ramp at Evans Point to be upgraded (concrete ramp and pontoon) to replace the existing gravel ramp. At present, the boat ramp is poor and there is limited manoeuvring space, forcing vehicles to traverse unsealed areas causing bare earth and erosion.

20. There is an equity issue associated with apparent clearing of bush between three properties along Attunga St, down to the waterline, reportedly approved by Council as a fire hazard reduction strategy, whereas adjacent properties have not been allowed to clear behind their properties. This needs to be confirmed with Council records. During site inspection, the foreshore was littered with a mixture of seagrass wrack and lawn clippings in that area.

21. A desire for more access to the foreshore in the vicinity of Mummuga Lake Drive, including clearing weeds from foreshore areas and a reduction in feral pests. Important habitat such as nesting sites for sea eagles, should be carefully retained.

22. A desire for more picnicking facilities at the boat ramp has been expressed.

23. Dogs are not allowed in the National Park and signage may be required to advertise this fact. There are generally difficulties in defining jurisdictions near the interface of land and water and between the water in the waterway and the actual bed of the waterway. This makes compliance difficult. Furthermore, NSW Fisheries may own the seagrass beds and saltmarsh vegetation.

24. Private, non-engineered jetties (without permits) presently extend over the national park.

25. While access is provided to the rocky foreshore at the entrance, there has been a need to protect middens in this area. Informal access down the face of the slope near the entrance may pose a safety risk and likely threatens any other middens present.

26. Stormwater discharges directly into the entrance channel adjacent to areas used for sheltered primary contact recreation. There is an opportunity to rationalise and improve this stormwater discharge.

27. Some concern has been expressed regarding the discharge from the recently developed industrial area south of the western residential area of Dalmeny, and that this might be contributing sediment to the alluvial delta of Spring Creek.

4.3 Discussion of Key Assets, Estuarine Values, Threats and Risks

4.3.1 Introduction

The preceding section provides information on the concerns that have been expressed both in the past and discovered during initial consultation and investigations completed as part of the Scoping Study. The present section aims to filter this information using the objectives of the CM Act.

One of the difficulties in interpreting the prior information is that it needs to now be considered in the context of the new coastal management framework for New South Wales. The sections which follow comprise a summary of the preliminary risk assessment completed for this Scoping Study (Appendix E outlines the methodology and outcomes). The risk assessment was framed around the four coastal management areas and the objectives of the CM Act relating to them.

The key findings of the risk assessment have been used to formulate the purpose for the new CMP as discussed in Section 4.4.

The character of Mummuga Lake and the values held by the community are largely encapsulated by the quiet, primarily residential settlement of Dalmeny along the southern foreshore, which has an outlook across the water to the largely forested northern catchment. The bed of the lake is within Eurobodalla National Park and the lake is a Habitat Protection Zone within the Batemans Marine Park. Commercial fishing is not allowed within Mummuga Lake (since 2002), although jet skis and powered vessels are. The entrance is artificially opened by the National Parks and Wildlife Service to keep water levels in Dalmeny low. The lake is known to have significance to First Nations People.

There are few directly concerning risks that could be identified as requiring attention in the short term. However, the small size of the waterway has meant that available data are scarce. The absence of an existing management plan also means that there are no established criteria to ascertain whether the lake is being appropriately managed at the present time.

Areas of the settlement of Dalmeny are already flood prone and this is likely to increase with time as sea levels rise. It seems important that this issue is investigated,

potentially alongside the mapping of a coastal vulnerability zone associated with tidal inundation.

The estuary has some value for recreational use, with boating and kayaking occurring on the waterway itself, and the entrance channel used by families for swimming and fishing.

4.3.2 Coastal Wetlands Area

The CM SEPP coastal wetlands area associated with Mummuga Lake is almost entirely contained within either the Eurobodalla National Park or the Bodalla State Forest. Accordingly, management of those areas is better covered by management arrangements for the national park and state forest.

However, in terms of assessing the health of the estuary, there is some value in completing updated macrophyte mapping of the lake, and the designated CM SEPP areas, to determine how vegetation has changed over the past 6-7 years. A decision can then be made as to whether the SEPP boundaries need to be adjusted. This may need to be completed in cooperation with the National Parks and Wildlife Service. Council will need to clarify the extent of CM SEPP over which they can have influence. This is expected to be limited to a small portion of the wetland across the western alluvial delta of Lawlers Creek.

4.3.3 Coastal Environment Area

For a small system, Mummuga Lake has a disproportionate number of extreme and high risks. This likely results from there being a limited amount of data available for the system. Water quality and water level data from within the lake are limited, meaning that a monitoring and evaluation strategy for these two items should be implemented.

Saltmarsh habitat along the southern foreshore is considered to have an intrinsic value that needs to be maintained. This includes an area of existing rehabilitation requiring ongoing maintenance to the rear of Myuna and Attunga Streets, and a relatively large expanse of saltmarsh accessible from Mort Avenue which needs the exclusion of vehicular traffic.

The southern foreshores along the ocean entrance to the lake are eroding in places and a cohesive strategy for managing the erosion is required. Management of the entrance opening is also a concern and, while the entrance opening strategy needs to be revisited, this is primarily the responsibility of the National Parks and Wildlife Service. Similarly, concerns regarding illegal fishing in the lake are managed through the compliance activities of NSW Fisheries.

Formal boat access to the estuary is limited, although the size of the waterway and shallow entrance channel means that it is probably unsuitable for intensive boating activities. Where evidence of informal boat access to the waterway is present, this should be addressed, and the existing boat ramp at Evans Point should be improved to formalise parking, seal areas of bare earth and prevent driving and/or mowing of areas of saltmarsh.

4.3.4 Coastal Use Area

There are a few concerns relating to coastal use, with two key themes arising:

- Water quality and the role of the stormwater system in delivering pollutants and fresh water to the lake is not well understood, with this understanding required to better manage stormwater runoff.
- The management of access to the lake's edge and waterway for both powered and non-powered watercraft, pedestrians, residents (via illegal structures) and dogs (which are not allowed). These issues arise from having a residential area immediately adjacent to a Lake which is in the National Park. An access plan could be considered to address these issues jointly by the National Parks and Wildlife Service and Eurobodalla Council.

4.4 Identification of CMP "Purpose" for Mummuga Lake

With reference to the risk assessment contained in Appendix E, the key objectives that are to be addressed by the CMP for Mummuga Lake are:

<u>The need to include the coastal wetland area in a CMP for Mummuga Lake is limited:</u>

This arises from the coastal wetlands being mostly contained within the Eurobodalla National Park and Bodalla State Forest – lands which are not controlled by Council and/or distant from the residential area of Dalmeny. The only potential action that might be considered is to upgrade mapping of the estuarine macrophytes in the estuary, although this should probably be completed in consultation with either State Forests or the National Parks and Wildlife Service.

<u>Assuming that the coastal environment area is to be included in the CMP:</u>

> *to protect and enhance the coastal environmental values and natural processes of coastal waters, estuaries, coastal lakes and coastal lagoons, and enhance natural character, scenic value, biological diversity and ecosystem integrity.*

Key actions to address these issues relate to protecting and enhancing areas of saltmarsh vegetation. Strengthened compliance to combat the illegal mowing of saltmarsh areas could be considered.

> *to maintain and improve water quality and estuary health.*

Actions to understand the baseline water quality and factors which influence that water quality within Mummuga Lake are likely to be required. Without understanding these, the ability to undertake suitably informed actions which achieve this objective are limited.

Assuming that the coastal use area is to be included in the CMP:

> *to protect and enhance the scenic, social and cultural values of the coast (including) ensuring that urban design, including water sensitive urban design, is supported and incorporated into development activities, and*

The coastal use area is of relatively greater importance for Mummuga Lake, given the relative dominance of Dalmeny, compared to the size of the estuary. To support the water quality objectives, it is important that the impact of stormwater runoff on the estuary is better understood.

Furthermore, there is an existing conflict between use of the waterway for jet skiing and towable water sports, and more passive recreational pursuits that are enjoyed by many who use and live around Mummuga Lake. Actions which address this conflict are largely beyond the control of Council (within the National Park), but public education and other management actions (for example, recommendation of an alternate site such as Corunna Lake for these activities) may interact with this issue to ensure a cooperative and holistic approach is applied. Future use of the lake for motorised water sports needs to be considered.

The above objectives relate to any extreme or high-risk issues that have been identified through the preliminary risk assessment (Appendix E). There are also a wide range of moderate risk issues that could also be addressed if easy or inexpensive. In developing the CMP, each of these should be assessed for ease of implementation.

Given the limited funding available, it is important that the CMP focusses on actions that are clearly the responsibility of Council and largely within Council's control. This does not eliminate the need for Council to support the actions of other arms of state government, including NSW Fisheries, Batemans Marine Park, RMS and NPWS in achieving positive outcomes for the estuary.

4.5 Gap Analysis and Recommended Approach in Development of CMP

No existing management plan exists for Mummuga Lake, and management has tended to be in a piecemeal, as required basis. The risk assessment (Appendix E) contains commentary, associated with each risk, with some discussion on potential additional studies and/or actions that could be undertaken to address data gaps during both the preparation and operation of a CMP for Mummuga Lake. A short list of these studies and/or actions, comprising those relating to high and extreme risks,

was prepared, and provided to representatives of Eurobodalla Council and the Office of Environment and Heritage. That list and the potential costs of those studies was the subject of discussions between the study team, Council and OEH to consolidate and refine the approach for each of the high and extreme risks during the CMP process and the approach agreed upon is presented in Table 8.

However, due to issues outlined in the Executive Summary, none of these additional studies could be funded as part of Stages 2 or 3 during preparation of the CMP. Accordingly, these additional studies have been carried forward to be executed as actions within the CMP. It was considered that all studies to support moderate risks could be postponed and included in actions that form part of the CMP.

Table 8 Proposed Approach to Addressing "Extreme" and "High" ranked Estuary Management Risks associated with Mummuga Lake

Relevant Risks (Appendix E) and CM Area	Risk Ranking	Recommended Additional Study
Mu3 (Environment)	High	Mummuga Entrance Foreshore Management Assessment and Strategy: A detailed assessment of erosion processes along the southern foreshore of the Mummuga Entrance Channel is warranted. This study would involve (i) a review of historical aerial photography to map notable changes; (ii) detailed engineer's inspection of existing protective works, stormwater outlets and informal access (iii) development of a holistic strategy for managing the erosion issue along the southern foreshore – including conceptual cross sections, cost estimates and recommended staging. At present, Council is in the process of updating Plans of Management for Crown reserves across the LGA. The crown reserve at the entrance to Mummuga Lake extends upstream to the tennis courts and is likely to address issues associated with foreshore access, protection of middens and stormwater etc. The strategy to be developed as part of the CMP would deal primarily with protection for erosion and will involve the development of basic cross section concepts that could be adopted along the foreshore to provide safety.
Mu5 (Environment) Mu12 (Use)	High High	Water Quality and Catchment Runoff Study: OEH is presently preparing a broad scale analysis of diffuse source pollution risk, from which subcatchments maps are to be developed. For each subcatchment, the level of present risk to estuarine health is being determined and preliminary maps have been prepared. However, key to understanding and interpreting these findings will be understanding how the modelling to derive risk levels was undertaken. At present, only limited documentation on the methods applied, in the form of a 'framework' document (OEH, 2017) are available. The next step in this process will be to gather understanding of the input data, and how the modelling has been completed for the Mummuga Estuary to enable the specification of informed actions that target key areas and likely issues regarding water quality risk. A minor study to investigate these issues should be undertaken during Stage 2 of the project. It is expected that targeted studies may be recommended as actions under the CMP.

5 Wagonga Inlet

5.1 Background

The present section deals with the characteristics of the estuary, including the physical characteristics such as the catchment, hydraulic and sediment processes, water quality, ecological processes, and habitat. Also reported are issues relating to community values, land tenure and the specified coastal management areas.

5.1.1 Catchment Characteristics

The Wagonga Inlet catchment is shown in Figure 12. The catchment is around 100km^2 in size. Most of the upper catchment is contained within the Bodalla State Forest, with a minor portion of the southernmost extent of the catchment contained within Gulaga National Park. The National Park also contains the highest point of the catchment, at Mt Gulaga (~800m). Except those areas within Gulaga National Park, the catchment elevations are typically below 250m.

Around 6km upstream from the ocean entrance, the estuary splits into two arms: Punkally Creek, which drains the southern parts of the catchment, including Mount Gulaga, and Brice's Bay which ultimately splits into its two main tributaries; and Billa Bilba and Burrimbidgee Creeks. These creeks drain the western portions of the catchment. The township of Narooma straddles the entrance of Wagonga Inlet, where the Princes Highway bridge crosses the waterway.

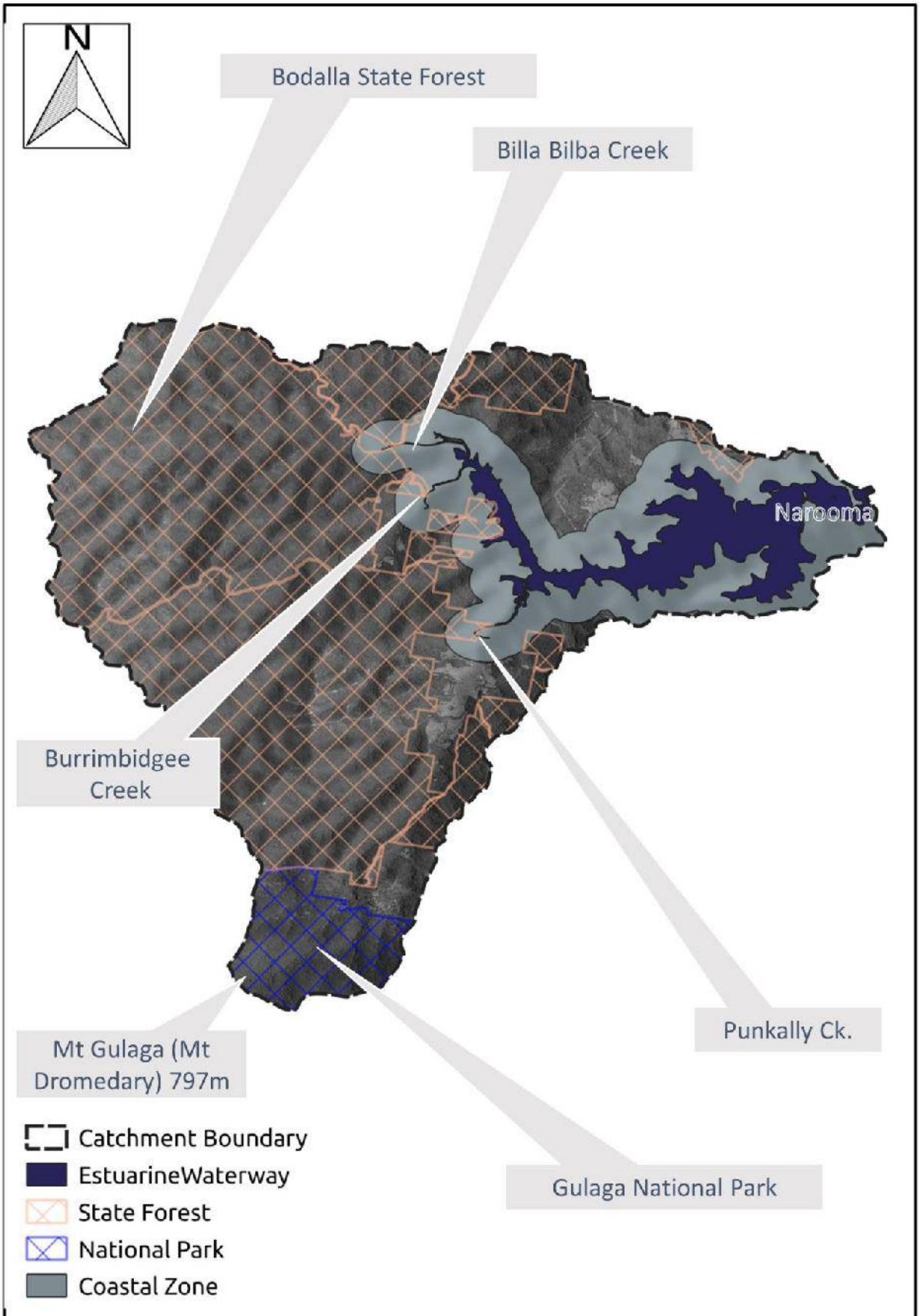

Figure 12: Wagonga Catchment Landuse

0 1 2 3 4 km

APPROX SCALE

Coastal Management Program for Moruya River, Mummuga Lake and Wagonga Inlet	REV A	DRAWN DJW	CHECK DJW
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Salients

5.1.2 Key Habitat Extent and Health

The extent of estuarine macrophytes (as mapped by Elgin Associates (2018)) and zoning for the Batemans Marine Park (BMP) within Wagonga Inlet are shown in Figure 13. The entire main waterbody of the estuary, including the main channels of Punkally, Billa Bilba and Burrimbidgee Creeks, is contained within the boundaries of the BMP. The estuary contains several *Sanctuary Zones:*

- The entire estuarine reach of Punkally Creek, including Hobbs Bay. At the downstream end of the creek, the boundaries of the sanctuary zone do not match the present-day plan form of the creek, indicating that there has been significant morphological change since the boundaries were determined. Similarly, the CM SEPP wetland area does not fully capture the downstream nor upstream reaches of vegetation, as mapped in 2017, and associated with coastal wetlands. Oyster leases exist both within the Sanctuary Zone (and the coastal wetland) and just beyond its northern extents. This wetland includes a diverse complex of mangrove, mixed mangrove/saltmarsh, and saltmarsh.
- An area adjacent to the northern foreshore, stretching between Freshwater and Clark's Bays (inclusive). The area contains a continuous fringe of *Posidonia*, and mangroves at the head of small embayments, sometimes associated with small patches of saltmarsh.
- The south-western arm of Forsters Bay, which includes a subaqueous fringe of *Posidonia* with patches of mangroves in small embayments and along the shoreline.

The estuary also contains three *Special Purpose Zones* associated with:

- The Narooma Wharf.
- An area spanning the foreshore either side and north of the Princes Highway bridge, containing maritime infrastructure such as pontoons and oyster sheds.
- An area extending from the western side of the southern end of the Princes Highway bridge, to the west and south along the eastern foreshore for some 1.5km. The northern 800m of this reach contains a stand of mangroves, which are mostly covered by a mapped area of CM SEPP coastal wetland.

Beyond the CM SEPP coastal wetland described in the previous dot point, and the one associated with Punkally Creek, there is a third wetland in the upstream reaches of Brices Bay. The mapped area includes mangroves, mixed mangrove/saltmarsh, and small patches of saltmarsh at its furthest upstream reaches. The wetland encompasses all the mapped areas of saltmarsh and mangrove (Elgin Associates, 2018). Immediately downstream of the mapped area, there exist patches of *Halophila* and mixed *Zostera/Halophila.*

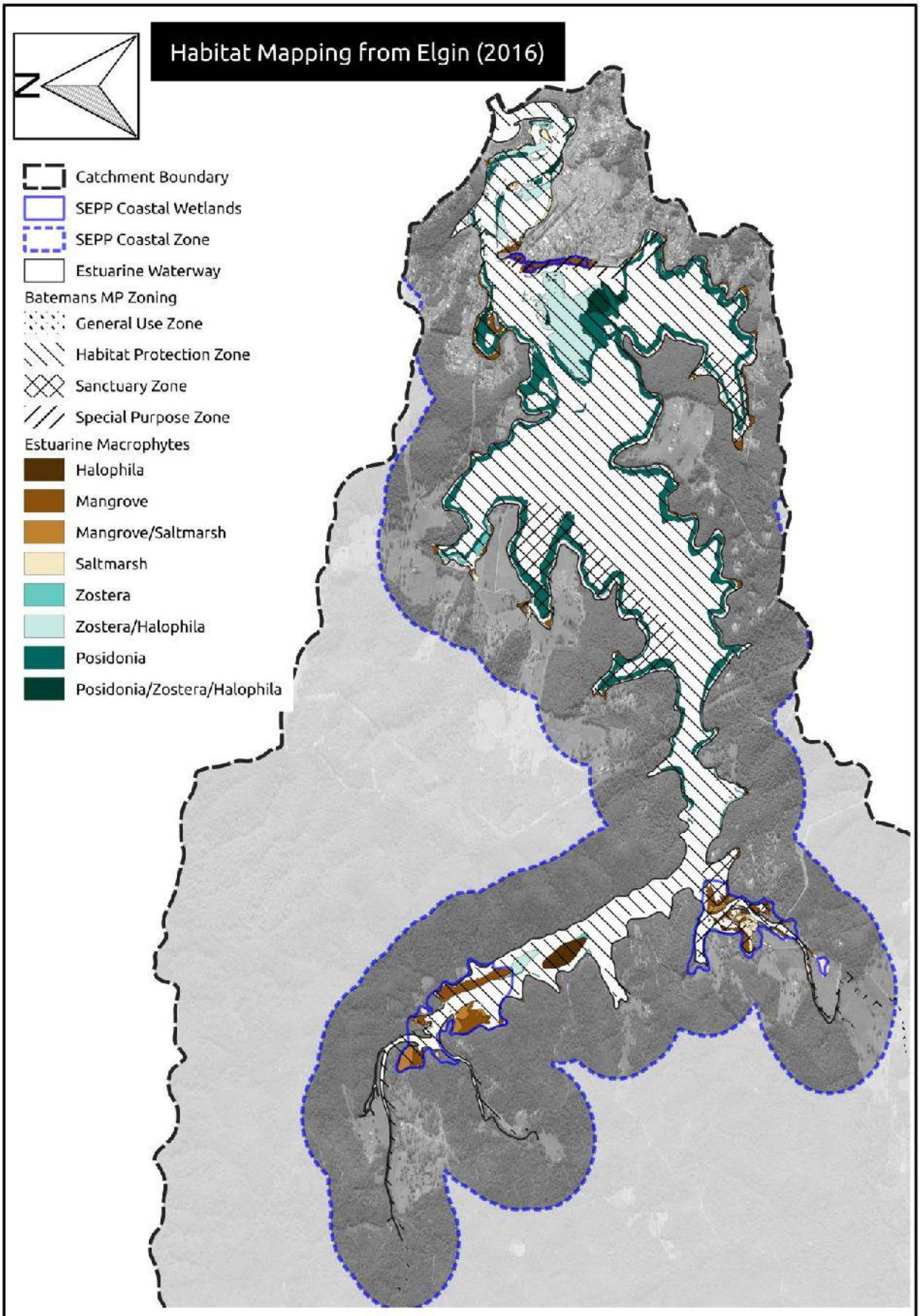

Figure 13: Mapped Estuarine Habitat - Wagonga Inlet

0 0.4 0.8 1.2 1.6 km

APPROX SCALE

Coastal Management Program for Moruya River, Mummuga Lake and Wagonga Inlet

REV	DRAWN	CHECK
A	DJW	DJW

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Salients

One of the more remarkable features of the estuary is the presence of *Posidonia* which extends from around Honeymoon and Freshwater Bays in unbroken fringes along the northern and southern foreshores of the estuary. These extend almost all the way to the Princes Highway bridge, including the entire foreshore of Forsters Bay, and there are large patches in embayments to the north of the entrance flood tide delta (including behind Lewis Island) and along the western/southern edge of the flood tide delta (northern part of Forsters Bay). Across the flood tide delta to the west and south of the bridge, there are also large, mixed beds of *Halophila/Zostera* and *Halophila/Zostera/ Posidonia*.

Often associated with the fringe of *Posidonia* are small patches of mangroves, particularly at the head of small embayments and, occasionally, an adjacent fringe of *Zostera* is present, immediately at the shoreline, such as in Barlows Bay and in Forsters Bay. Patches of saltmarsh are present but typically small, reflecting the steep topography of the adjacent foreshore. For this reason, saltmarsh in Wagonga Inlet is particularly threatened by changes to the water level environment, including sea level rise and ongoing growth of the tidal range in response to training of the entrance in the 1970s.

Stands of mangroves exist in the embayment behind Lewis Island, adjacent to the Island itself, and along the foreshore fringing Riverview Road.

Downstream of the Princes Highway, the fringe of *Posidonia* is more fragmented, and large patches of mixed *Zostera/Halophila* are present, particularly within the intertidal areas behind the internal training walls of the entrance. Also present are some patches of saltmarsh, even further landward. Of note is a long, accessible fringe of saltmarsh along the foreshore reserve adjacent to the Narooma "Easts" Caravan Park. This length of foreshore is gradually being colonised by both saltmarsh and mangroves, with a notable stand of mangroves colonising the western edge of the foreshore, adjacent to the Princes Highway and the southern end of the Princes Highway bridge.

As noted above, Wagonga Inlet is used for oyster farming with leases present near the confluence of Brices Bay and Punkally Creek, at the western end of the estuary.

The most recent assessment of changes in estuarine macrophytes in Wagonga Inlet has been undertaken by Elgin Associates (2018). They compared mapping from 2017 and 2012 and found that overall seagrass distribution and extent had increased in Wagonga Inlet. They found that there had been a large increase in the amount of mapped *Halophila. Halophila* is the first species that would be expected to recolonise after sand flats are stabilised or water quality improves. Further monitoring may reveal that *Zostera* begins to also colonise these areas.

Similarly, mangrove distribution was noted to have increased (at least between 2013 and 2018), although this may be attributed to more extensive field validation. A decline

in saltmarsh occurred in Wagonga Inlet, noting that there is an ongoing colonisation of saltmarsh habitat by mangroves within estuaries along the NSW coast. There was close to a 2000% increase in mangrove/saltmarsh habitat area in Wagonga Inlet. Mowing, trampling, and driving over saltmarsh were also seen as key threatening processes to saltmarsh.

The background information report which informed the threat and risk assessment for the Marine Estate Management Strategy (MEMA, 2017) also reviewed the historic abundance of estuarine macrophytes in Wagonga Inlet. They found, based on a review of mapping between 1985 and 2013, that:

- Wagonga Inlet contained around 2.33ha of saltmarsh and the area had reduced by close to 60% since 1985. 2.33ha represented 0.18% of the total for the southern region (Shellharbour to the Victorian Border) and 0.03% of the total for the state. The protection of saltmarsh is a priority for Wagonga Inlet.
- The estuary contained around 19.71ha of mangroves and the area had decreased by some 20% since 1985. 19.71ha represented 1.17% of the total for the southern region and 0.15% of the total for the state.
- The estuary contained around 80.9ha of seagrass and the area had decreased by close to 50% since 1985. 80.9ha represented 2.31% of the total for the southern region and 0.52% of the total for the state. When considered in isolation, the amount of *Posidonia* had decreased by around one third between 1985 and 2013, with the losses occurring prior to 2002. The estuary contained 60ha in total (6.4% of that in the southern regions and 2.66% of that occurring in the state).

The changes to vegetation extents are not readily explained without further study, although sedimentation and an increasing tidal range inside the estuary have been advanced as possible causes. The loss of estuarine macrophytes is a concern for the estuary.

Vegetation fringing the estuary, where not included in coastal wetland nor cleared for agriculture, comprises a mixture of dry and wet sclerophyll rainforests in the upper reaches of the estuary, with some patches of rainforest interspersed within the areas of wet sclerophyll rainforest. Wet sclerophyll forests are typically found on steeper slopes with dry sclerophyll forests more commonly found on ridge lines. A band of rainforest patches also exist to the east of Honeymoon Bay, both to the north and south of the Inlet and interspersed with wet sclerophyll forests.

In the eastern parts of the coastal zone, remnant vegetation is dominated by wet sclerophyll forest. Similarly, remaining vegetation is more fragmented and patchier with distances further east, culminating with the town of Narooma, which has been extensively cleared.

Peter Spurway and Associates (2006) reported that the inlet contained a variety of attached alga including Neptune's necklace, bubble weed and kelp, with patches of sargassum attached to subtidal rocks forming the training walls.

5.1.3 Physical Features and Processes

MEMA (2017) summarises some key features of Wagonga Inlet. The estuary has an open water area of around 5.9km^2 and a total waterway area of around 7.0km^2. The average depth is around 5.7m (below mean sea level). The tidal limit is some 11.5km upstream of the entrance.

Wagonga Inlet was surveyed by the Department of Land and Water Conservation in May 1997. While the entrance channel is still responding dramatically to the construction of training walls and breakwaters in the 1970s, the survey is still reasonably representative of conditions today. Between the entrance breakwaters, bed elevations of between -6 to -7m below AHD were surveyed, and it was found that the channel gradually shallowed with distance upstream, reaching a minimum depth with bed elevations at around -2m AHD just downstream of the bridge. At this location, the survey also picked up a sill of submerged rock, spanning across the channel. A scour hole at -6.0m AHD was recorded underneath the bridge. Further upstream, the channel was recorded as shallowing rapidly. Bathymetry opposite Lewis Island is complicated and particularly shallow. It appears that the path taken by the ebb tides (adjacent to Lewis Island) differs from the path taken by the flood tide channel. Maximum depth at mid-tide in this region would have been around 1.0m below AHD. Further upstream of this area, the bathymetry again deepened to around -5m AHD, before shallowing rapidly at the point where the flood tide delta discharged into the main estuarine basin. Extensive shoaled areas exist adjacent to the entrance channel both upstream of the Bridge (south of the channel) and downstream of the bridge (south and east of a bend in the channel, behind a training wall).

The deepest part of the estuarine basin (~-16.0m AHD) existed just upstream of the flood tide delta dropover. Depth of the estuary slowly decreases with distance westward along its main arm, deepening slightly where the estuary narrows between Paradise and Honeymoon Points. Maximum depths at the confluence of Brices Bay and Punkally Creek are typically around -4.0 to -3.0m AHD.

Forsters Bay is a separate arm of the estuary, located to the south of the flood tide delta and Shell Point. Tidal exchange between the main estuary and Forsters Bay is constrained by a narrow gap between the flood tide delta and Shell Point. Bed elevations in Forsters Bay are as low as -14.0m AHD, just south of the flood tide delta, and the bay narrows gradually with distance south (further upstream) into the bay.

The ongoing impact of entrance training has been discussed extensively by Nielsen and Gordon (2015, 2008), who noted that the spring tide range in the main basin of the

estuary increased from around 52% of the ocean range in 1997 to around 56% of the ocean range in 2009. This increase in tidal range was linked to the ongoing upslope migration of mangroves and their invasion of saltmarsh habitat. However, this issue is likely to be exacerbated by ongoing sea level rise along the New South Wales coast. Nielsen and Gordon indicated that it may take more than 120 years before the entrance channel stabilises.

There have been ongoing issues with shallow water in the entrance channel. A review of environmental factors for proposed dredging works in the entrance was prepared by Peter Spurway and Associates (2006). The work included the dredging of sand from shallow areas and placement of that sand into shallow channels to redirect tidal flows. The project also involved lowering of the pile of rocks downstream of the bridge.

The dredging aimed to, apparently, increase the capacity of both the ebb and flood tide channels in the vicinity of Lewis Island, in the shallowing area outlined above. The proposed dredging works were small scale (a total of 12,000m^3). The dredging program was managed by Council in 2006 with grant funding provide by the then Department of Natural Resources (DNR). While no monitoring has followed the work, our initial assessment is that any benefits would have been short lived. We know from discussions on site, at Lewis Island, that issues with this part of the channel continue.

The REF does contain some sediment data that may prove useful. The sediment samples taken from the flood tide delta in the vicinity of the works indicated clean marine sands with D_{50} grain sizes varying between 0.31 and 0.44mm.

A tidal gauging was undertaken by Manly Hydraulics Laboratory on 3rd December 1986. However, it is expected that this would no longer be indicative of the response of the estuary at the present time.

Manly Hydraulics Laboratory (2012), analysed available tidal records from the Wagonga Inlet to derive tidal planes. Two gauges were analysed, from Narooma Wharf (record from 1996-97 through 2007-8) and from Barlows Bay, upstream of the flood tide delta (record from 1991-92 through 2009-10). The resulting, averaged tidal planes were determined as shown in Table 9. These show the expected patterns (tidal range inside the waterway is smaller than that close to the entrance and mean sea level inside the waterway is superelevated above that closer to the entrance). The mean spring tidal range inside Wagonga Inlet (~0.67m) is around 60% of that determined offshore of Batemans Bay (~1.15m, representative of the ocean range). In comparison, the spring tidal range at Narooma Jetty (0.851) was around 74% of the Batemans Bay range.

Table 9 Tidal Planes in Wagonga Inlet (in m AHD from Manly Hydraulics Laboratory (2012)

Tidal Planes	Narooma Jetty	Barlows Bay
High High Water Spring Solstices	0.667	0.640
Mean High Water Springs	0.399	0.376
Mean High Water	0.325	0.324
Mean High Water Neaps	0.251	0.272
Mean Sea Level	-0.026	0.040
Mean Low Water Neaps	-0.304	-0.192
Mean Low Water	-0.378	-0.245
Mean Low Water Springs	-0.452	-0.297
Indian Springs Low Water	-0.643	-0.485

WMA Water (2016) prepared a comprehensive flood study of Narooma and Wagonga Inlet. Based on their modelling results, they found that the 20% AEP event is mainly contained within the main waterway areas, excepting properties in Barlows Bay. Shallow overland inundation also occurs through Narooma Flat area. For increasingly rare events, the extent and depth increases. In the 5% AEP event, properties around Lynch Street become inundated.

For the 2% AEP event, widespread inundation occurs across Narooma Flat, averaging 0.3m. Depths for the PMF exceed 1-2m throughout Narooma Flat area. Design flood levels for Barlows Bay and Narooma Wharf are presented in Table 10

Table 10 Design Flood Levels for Wagonga Inlet (in m AHD from WMA Water (2016))

Location	20% AEP	10% AEP	5% AEP	2% AEP	1% AEP	0.5% AEP	PMF
Barlows Bay	1.1	1.1	1.2	2.0	2.1	2.2	3.3
Narooma Public Wharf	1.0	1.0	1.1	1.9	2.0	2.1	3.0

Both flooding and tidal behaviour will be affected by climate change. At the present time, it appears that climate change has only been considered in the context of extreme flooding for Wagonga Inlet. In the case of Wagonga Inlet, if the tidal inundation coastal vulnerability area is to be derived, it will be necessary to consider the influence of climate change on tides, alongside increasing tidal ranges due to ongoing changes to the entrance and channel.

Council has historically published report cards on water quality for Wagonga Inlet. Report cards are provided for three periods, with water quality monitored at six different locations within the estuary. The results for different parameters were as discussed below:

Ecosystem Health: The overall health of the ecosystem was assessed as being good in 2010/11, based on readings of chlorophyll-a and turbidity but a reduction in saltmarsh had occurred over time. In 2013-14, the aquatic health was also assessed as being between good to very good.

Recreational Use: In 2013-14, water quality for recreational use was typically suitable for swimming. However, there were occasions when faecal contamination was detected. In 2015-16 water quality was considered suitable for recreational use most of the time. The results of faecal sampling were similar to previous periods.

Turbidity: Water clarity of the estuary was rated as very good in 2010-11, with 4% of total samples exceeding guideline values and only marginally. In 2013-14 clarity was again very good to good. In 2015-16, turbidity levels were graded very good to fair throughout the estuary, only exceeding guideline values for less than 10% of the time.

Chlorophyll-a: For chlorophyll-a (an indicator of microscopic algae), Wagonga Inlet received a very good rating in 2010-11, with only 13% of the total samples exceeding guideline values. The exceedances were most common in two sampling sites within Forsters Bay. In comparison, during 2013-14, around 20% of samples exceeded the acceptable levels of chlorophyll-a. In 2015-16, chlorophyll-a levels were comparable to previous years, with around 20% of samples exceeding guideline values.

Dissolved Oxygen: During 2013-14, samples of dissolved oxygen showed similar behaviour when compared to previous years, with around 60% of samples being within guideline values. Similar results were obtained in 2015-16.

pH: During 2013-14, pH readings were within the recommended range for around 60% of the time, which was comparable to previous years. During 2015-16, pH values were comparable to those recorded in previous years, falling within the guideline range for around 50% of the time.

Overall, the water quality monitoring results indicate that water quality is reasonable in Wagonga Inlet. However, there are indications that water quality in Forsters Bay could be improved. It should be noted, however, that water quality can fluctuate markedly in response to seasonal rainfall.

5.1.4 Land Zoning

Land zoning from the current Eurobodalla Local Environmental Plan (2012) is shown in Figure 14.

As of mid-2019, within the western portions of the coastal zone, land use is presently dominated by "*Deferred Matter*" parcels, meaning that these are to be dealt with as *Rural Lands* under the Eurobodalla *Rural Local Environment Plan 1987*. Council is presently in the process of rezoning the *Deferred Matter* lands and the process is nearing

completion. By the time the CMP is prepared, this matter will have been resolved and the *Rural LEP* will no longer have relevance.

There also exist parcels of land within the Bodalla State Forest (zoned for forestry) and parcels zoned for primary production. Strips of land also exist adjacent to the foreshore. These do not necessarily correspond to the mapped CM SEPP wetland areas in Punkally Creek and Brices Bay.

To the south of the estuary, and east of Flying Fox Bay, land use is characterised by Environmental Living and Large Lot Residential (the minimum lot size is 40ha), before transitioning to areas set aside for low and medium density residential associated with the township of Narooma. There is limited potential for new dwellings within the catchment. The fringing coastal and southern margins of the waterway are often zoned for Environmental Conservation. There is a region of "Recreational Waterway" corresponding to the Special Use Zone of the Marine Park extending southwards from the Princes Highway bridge. Similarly, there are corresponding Recreational Waterway zonings associated with the other two Special Use Zones (refer to Section 5.1.2 for locations). The areas of Narooma to the south of the entrance channel, in addition to residential areas, include parcels of public and private recreation, environment conservation, Local Centre and Infrastructure (Community Facilities and Administration Buildings).

Along the northern foreshore, the mix of Primary Production, Forestry and *Deferred Matter* lands (often with Environmental Conservation along the foreshore) continues eastwards, until the area north of the entrance channel is reached. Of interest is an area of primary production which sits seaward of the Environmental Conservation Area in Barlow's Bay and is used for industries that support the oyster industry. The settled areas north of the entrance include a significant area of low density residential to the rear of Lewis Island, and associated areas of Environmental Conservation. To the east of the Princes Highway bridge, land uses include low density residential, environmental living, and areas of environmental conservation. There is also an area of public recreation associated with a boat ramp on the northern side of the channel.

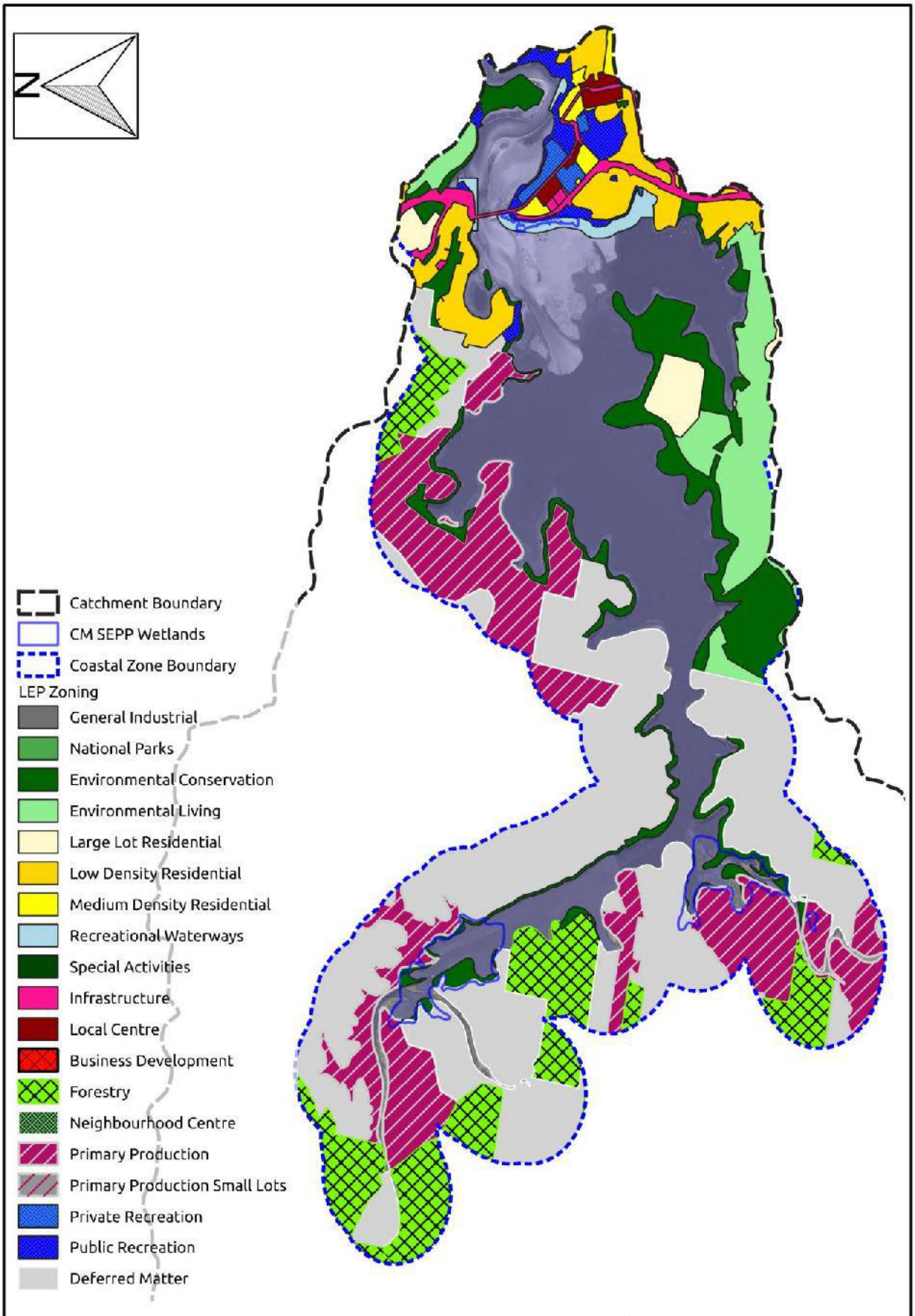

Figure 14: Land Zoning - Wagonga Inlet

0 0.4 0.8 1.2 1.6 km

APPROX SCALE

Coastal Management Program for Moruya River, Mummuga Lake and Wagonga Inlet

REV	DRAWN	CHECK
A	DJW	DJW

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Salients

5.2 Issues and Actions identified from Preliminary Consultation and Existing Information

5.2.1 Preliminary Consultation

A community workshop/drop-in session was held in the afternoon of June 6, 2018, at the Narooma Library. In addition to the community workshop, a meeting with government stakeholders was held on June 7th, 2018 in Narooma. That meeting was attended to by representatives of the National Parks and Wildlife Service, Batemans Bay Marine Park, OEH, South Coast Local Land Services and members of the study team.

5.2.2 Existing Information

During the review of background information and several site inspections undertaken by the study team during the week of June 4-8, several other issues were identified. In some instances, these reflect those issues raised during preliminary consultation, but our review has helped to clarify those issues further.

5.2.3 Issues Identified

Throughout the remainder of this section, findings have been classified in accordance with the four different coastal management areas. The issues identified issues are as follows:

<u>Issues Relating to Coastal Wetlands:</u>

1. A need to update the extents of the coastal wetland area, and Environmental Conservation zoning to better reflect the extents identified by mapping of estuarine vegetation.
2. There are concerns relating to the shrinking of saltmarsh habitat as water levels in the main body of the waterway continue to increase.
3. An opportunity exists to introduce saltmarsh habitat along the foreshore reserve adjacent to the Easts Caravan Park. This is already occurring in and around foreshore protection works which are typically dilapidated and need repair/clean up. Foreshore access could be substantially improved.
4. Mapping of the coastal wetland adjacent to Narooma Flat appears inconsistent with its designation as a *"Special Use Zone"* in the Batemans Marine Park. This classification may need to be revisited.

Issues Relating to Coastal Environment Areas:

5. Coastal Entrance dynamics are a significant issue in the entrance channel, particularly in the vicinity of Lewis Island and upstream of the Princes Highway Bridge. Erosion of Lewis Island is an ongoing problem.

6. There is an opportunity to resurvey the entrance channel of the Inlet, which is known to be changing in response to entrance training and has not been surveyed for more than 20 years. This information is important in terms of monitoring how the entrance is evolving and in trying to find ways of resolving shallow areas and erosion upstream of the Princes Highway bridge.

7. The re-establishment of a water level recorder in the main body of the waterway may be desirable to continue monitoring the evolution of tidal response inside Wagonga Inlet. This is important for areas prone to flooding, such as Narooma Flats.

8. That prawning with drag nets should be banned as it damages the environment. Wagonga Inlet is zoned for either "Habitat Protection" or "Sanctuary" but is not a "Recreational Fishing Haven", therefore prawning by drag net is prohibited. This may indicate an issue with compliance.

9. That historic training of the entrance may be related to problems with siltation. We note that the entrance channel, overall, is getting wider and deeper. However, at some locations along its length as sand moves upstream, areas may be subject to shallowing and navigation problems.

10. That, if dredging occurs in Wagonga Inlet, it be taken away and not dumped in deep holes in the waterway. This seems to reflect what was proposed in the 2000s (Peter Spurway and Associates Pty. Ltd., 2006).

11. A desire for a "sensible strategy" to maintain navigation between the bridge and the main body of Wagonga Inlet. There are significant shallow areas opposite Lewis Island and near the dropover into the main basin.

12. While funding is now available on a 50/50 basis from RMS via Crown Lands, local government is reticent to buy into an issue that has, historically not been their responsibility.

13. A concern that the increase in seal numbers (resulting from a reduction in their natural predators) is influencing estuarine fish stocks, with mulloway and calamari numbers apparently declining. Further research was recommended by an attendee at the community workshop.

14. Navigation markers are poorly positioned at Lewis Island, as are markers offshore of Shell Point.

15. Concerns were raised by a community member relating to sedimentation within Clarks Bay, and the newly colonising area of mangroves. This may be associated with the cleared land around the fringes of this Bay or sediment washing off from unsealed roads. That community member also expressed concerns regarding pollution from septic tanks.

16. There are several issues at the end of Punkally Creek. It is considered possible that agricultural activity in the catchment (buffalo, chickens and pigs have been mentioned) may be contributing nutrients and faecal contamination to the area. Similarly, there is ongoing sedimentation. Both factors are impacting on oyster farming at the lower end of the creek.

17. An opportunity exists to better manage mowing which is restricting saltmarsh habitat from expanding adjacent to Narooma Flats.

18. Historically, poor water quality has been assumed to be occurring in Forsters Bay. It appears likely that this was true, and little has been done in recent years to try and improve that. An overall study of stormwater might be required, noting that stormwater outlet tidal flap gates are reported as typically non-operational.

Issues Relating to Coastal Use Areas:

19. A concern regarding the safety (and noise) of sea plane operations in Forsters Bay and the possibility that there will be a collision with a boat. A suggestion that operations be relocated to a less busy location such as Corunna Lake.

20. A general concern for boating facilities around the inlet, including a lack of facilities at boat ramps, such as pontoons, jetties, and refuelling options around Wagonga Inlet in general. The use of the pilot station jetty by the public was raised as a potential option and several boat ramps were noted to be in a poor state of repair.

21. A concern that there are no public moorings for visiting vessels and the damage anchoring may cause to seagrass beds. Furthermore, there is no berthing available at the town wharf.

22. Related to the lack of facilities, it has been argued that the waterway is underutilised generally, and for tourism.

23. There were reports that the RMS purchases fuel from the Marina (Forsters Bay), which is hindered by shallow depths in the channel upstream of the Princes Highway Bridge.

24. Similarly, any plans for expansion of the Marina are limited by issues with the shallow navigation channel.

25. The public pontoon at the historic Wharf (Brices Bay) needs maintenance. This should probably be completed concurrently with stabilisation of the roads draining to the waterway in this area, as they are reportedly delivering sediment to the waterway and the pontoon is now bottoming out at low tide.

26. A dilapidated jetty at Ringlands Point could be removed.

5.2.4 Review and Audit of Existing Estuary Management Study and Plan

The original Estuary Management Plan (Nelson Consulting, 2001) identified several issues, including:

1. **Entrance Bar:** Water depths over the entrance bar were relatively shallow and under certain conditions, navigation becomes hazardous. Problems were associated with the south east channel becoming shoaled, and accidents tended to occur on an outgoing tide with swell waves of around 1.8m or higher.

2. **Shoaling:** The main area of concern regarding shoaling was upstream of the Princes Highway bridge and hindered boat access into Forsters Bay (at Shell Point). Shallowing of the western end of the main entrance channel was also causing problems. Overall, problems were noted at various locations along the entrance channel, indicating that the entrance was dynamic and continuing to adjust to construction of the training walls in the 1970s.

3. **Erosion and Sedimentation:** Some erosion was noted along the downstream reaches of creeks entering the inlet. Sedimentation along the upper reaches of Wagonga and Punkally Creeks was identified, and it was considered that activities associated with oyster leases may have resulted in channel realignments in these areas.

4. **Water Quality:** Water quality within Wagonga Inlet was noted to be generally good, although there were some indications of localised nutrient enrichment. The importance of good water quality to shellfish production was noted and the data collected at the time deemed inadequate for a proper assessment. With regards to persistent contaminants in sediments, arsenic (potentially from those chemicals used to treat timbers for oyster farming) was highlighted. Stormwater pollution, sewer overflows, onsite wastewater systems, rural runoff and boat refuse were all identified as potential pollutants. Forsters Bay was identified as the area most affected by local stormwater inputs.

5. **Flooding:** Flooding was identified as an issue for the "Narooma Flats", on the eastern foreshore of Forsters Bay. While the potential for flooding is more appropriately examined under the floodplain management process in NSW, low lying areas are more exposed to nuisance inundation and other effects that will be exacerbated by sea level rise.

6. **Waterway Facilities:** Two broad categories of waterway facilities were identified as issues. Firstly, a shortage of boat mooring facilities was noted to the east of the Pacific Highway bridge, including at the Town Wharf. Secondly, a limit on waterway access for public recreation was highlighted. The provision of public access was somewhat constrained by private ownership of foreshore land and the proximity of oyster leases around much of the shoreline. A variety of recommendations for a public jetty, boat ramps, and improvements to existing facilities had been investigated.

Considering these issues, a range of actions were promoted to manage Wagonga Inlet. These actions are outlined below, wherein the numbers refer to the original actions within Nelson Consulting (2001).

Actions Relating to the Location and Objectives of Coastal Wetland Areas:

- **Actions 6.9 and 3.2:** *Install a mangrove boardwalk off Riverside Drive and Include information on the value of mangroves and seagrass in interpretive signage:* These actions have not been completed but have merit. The mangroves off Riverside Drive are now classified as a CM SEPP coastal wetland and the implications of this classification need to be considered.

- **Action 3.4:** *Install survey markers to identify changes in the extent of mangroves:* It may be that other agencies (Marine Park, DPI Fisheries) are looking into this. Furthermore, it is possible that gross changes could now be better captured through review of satellite imagery and/or aerial photography. Macrophyte Mapping was completed in 2017 (Elgin Associates, 2018).

Actions Relating to the Location and Objectives of the Coastal Vulnerability Area:

- **Actions 2**.4 **and 2.5:** *Increase awareness of flood hazard in the Narooma flat area:* These actions are being addressed by Council under the floodplain risk management process for Wagonga Inlet at the same time as drafting of this Scoping Study.

Actions Relating to the Location and Objectives of the Coastal Environment Area:

- **Action 1.1:** *Develop and implement water quality monitoring program to assess changes to water quality within Forsters Bay:* This work is ongoing, and Council reports the results of this to the community.

- **Action 1.2:** *Support initiatives to make holding tanks mandatory for commercial vessels:* Under the *Marine Pollution Regulation 2014,* commercial vessels must either have a holding tank installed or a plan of management as approved by the Minister.

- **Action 1.3:** *Include information on boat pumpout facility in Forsters Bay when the relevant boating map is revised:* It appears that mapping has not been revised since 2009. However, the pumpout facility is advertised on RMS's website.

- **Action 1.5:** *Include sampling sites to identify any changes to run-off/water quality due to the development of Ringlands Estate:* Council has advised that regular testing is being carried out and there has not been a measured decline in water quality.

- **Action 1.6:** *Complete environmental audit to identify practices adversely impacting on water quality:* It is unclear whether this action has been pursued.

- **Action 1.9:** *Investigate improvements to maintenance of Tourist Drive 4 (Wagonga Scenic Drive) and Riverview to reduce sediment wash off:* This action is noted to be ongoing, although site inspection witnessed turbidity associated with runoff from the historic wharf in Brices Bay, which may need to be addressed.

- **Action 1.12:** *Include erosion and sediment controls within a checklist for DCPs and Residential Development Guidelines:* While this has not been specifically completed, Council does check for compliance on development sites regarding erosion and sedimentation controls. Council does have a code for soil and water management, which could be bolstered with reference to industry standard guidelines such as the Blue Book (Landcom, 2004).

- **Action 3.6:** *Control Infestations of the Pacific Oyster*: The management of threats to aquaculture is not a key objective of the CM Act, but productivity of the marine estate is an object of the MEM Act. A CMP may, in some cases support actions that benefit aquaculture. We note, however, that the local oyster growers of Wagonga Inlet and DPI Fisheries have developed a management plan for the Pacific Oyster in Wagonga Inlet. Management of this issue should not be duplicated in the CMP.

- **Action 3.7:** *Undertake recreational fishing survey, potentially as a student project*: It seems unlikely that any data specific to Wagonga Inlet has been collected (MEMA, 2017), although the DPI website reports that a state-wide survey is presently being conducted[9].

- **Action 3.8:** *Encourage clean-up of areas around oyster leases*: This action is reported as being ongoing with a variety of clean-ups being undertaken by various groups. The clean-up of the remains of oyster leases and associated infrastructure needs to be undertaken by growers.

- **Action 3.9:** *Ensure cockle collection does not adversely impact on aquatic habitats.* The main concern of this appears to have been impacts on *Posidonia*. However, Council is uncertain whether this has been pursued. Council has a limited role in compliance with this issue, as responsibility is held by DPI fisheries.

[9] https://www.dpi.nsw.gov.au/fishing/recreational/resources/recreational-fishing-survey, accessed 22/11/2018

- **Action 3.10:** *Investigate harsher penalties for clearing of bushland on Ringlands Estate*: This action is listed as ongoing but is not regarded as a significant issue at present. Over 1,000 trees have been planted with maintenance activities to occur. Car access has been limited to some areas of Ringlands Estate.

- **Action 3.11:** *Prevent private vehicle access to crown reserve adjoining Ringland's estate, maintain as bushfire access and walking track*. Council has planted more than 1,000 trees to regenerate the site and requires follow up maintenance. Car access has been limited to some areas of Ringlands estate.

- **Action 3.12:** *Develop management plan for rainforest at Flying Fox Bay and northern end of Mill Bay.* This action is listed as ongoing.

- **Action 3.13 through 3.17:** *Increase the extent of foreshore buffer zones.* Council continues to work on this matter, although it appears that only limited progress has been made on these Actions. There is a reported swap of a parcel of road reserve for foreshore land. Most of the public foreshore land is presently zoned E2 as are the (previous) SEPP-14 wetland extents.

- **Action 5.1:** *Monitor channel depths near the bridge and provide regular reports*. While this was identified as a high priority, we are unaware of any survey being undertaken in the past 20 years. The NSW Roads and Maritime Service is responsible for navigation but provides money to the Department of Industry's Crown Lands Division to undertake dredging in priority waterways. Priority waterways are those which require ongoing dredging to maintain navigation to state owned ports or harbours. Discussions with Crown Lands staff has confirmed that only the entrance channel downstream of the public wharf would qualify for priority funding. However, funding for navigation dredging at non-priority locations will be funded jointly with local councils on a 50/50 basis. To provide an idea of funding, a total of $8 million (over 4 years) was announced for funding by the NSW government in 2017. Of that amount, $2 million was for priority locations and $6 million for 50/50 funding under the "Rescuing our Waterways" program. At present, the state-wide funding is heavily constrained, and the provision of safe navigation and the support of navigation is not within Council's broad responsibilities.

- **Actions 5.2, 5.3 and 5.5:** *Survey areas including channel at Shell Point and along the foreshore in Forsters Bay and review need for dredging*. While these were assessed as being high priorities, it appears that little has happened apart from consultation with Crown Lands and RMS. Given the limited state-wide funding available, the state government is seemingly reluctant to spend money on these items. Once maintenance dredging is undertaken, there is often a community expectation that it will be ongoing.

- **Action 5.4**: *Remove rocks downstream of highway bridge*. This was one subject of a review of environmental factors by Peter Spurway and Associates (2006). Council has advised that these works were completed and we note that there is no longer an indication of a "danger buoy" on the Boating Map for the Area (NSW Maritime, 2009) which implies that this issue is no longer of concern.

- **Action 6.1**: *Maintain open water areas for visual amenity and recreational boating by discouraging intensification of oyster leases and appropriately relocating silted leases*. Responsibility for this action was assigned to NSW Fisheries and it appears that this has not been completed.

- **Action 6.2**: *Prepare mooring plan for Wagonga Inlet.* Responsibility for this action was assigned to NSW Maritime (RMS) and it appears that this has not commenced.

- **Actions 6.4 and 6.5:** *Manage Boating to Avoid Conflicts.* This includes activities such as speed restrictions and preventing anchoring in *Posidonia* beds. Some of these activities have been completed, but the extent to which this relates to active implementation of the CZMP is unclear.

- **Action 6.11**: *Reconstruct existing Jetty at Ringlands Point.* Based on site inspection, this jetty is now completely dilapidated, and a lack of interest would seem to indicate that this structure could now be removed from the foreshore.

- **Action 6.12**: *Construct jetty associated facilities plus formalise and seal car park for southern boat ramp at Forsters Bay.* Car parking seems to have been sealed with a rubbish bin provided. A fish-cleaning table, wash down hose, and lighting do not seem to have been provided yet.

- **Action 6.13**: *Widen sand ramp near NSW Fisheries Building*. This has not happened and seems unlikely as access is difficult for reversing. A boat ramp some 500m away has recently been upgraded. Given that there is a close, viable alternative for boat launching, it is no longer considered worthwhile pursuing this action.

Actions Relating to the Location and Objectives of the Coastal Use Area:

- **Action 2.1:** *Provide visually unobtrusive viewing points around the Inlet.* The provision of access to the foreshore is important under the CM Act and considering the ageing community at Narooma, accessibility is an important issue. The boardwalk has been extended and pathways have been constructed around the foreshore at Quota Park.

- **Actions 2.2 and 2.3:** *Encourage attractive building design compatible with the visual qualities of the inlet*. It appears that these two actions can be largely addressed through reference and compliance with the Coastal Design Guidelines for NSW (Coastal Council of NSW, 2003), which is extensively referenced in the CMM. Furthermore, the CM Act provides controls over the bulk, scale, and nature of

development in the coastal use area. The existing controls should be enough to ensure that Council planning staff consider these issues under the normal development approval process.

- **Action 4.1:** *Prepare Narooma Town/Bar Rock brochure.* There is no indication whether this was completed. The value of this should probably be revisited given that brochures have been largely superseded by more modern modes of information delivery such as social media.

- **Action 4.**4: *Investigate means to address erosion of the midden at the Wagonga Picnic Area and other sites as necessary.* It is unclear whether this action has been pursued.

- **Action 4.5**: *Liaise with property owner to gain access to Wagonga Cemetery to undertake repairs*. It appears that this action is largely superseded by a management plan for the cemetery developed in 2014[10]. This action need not be pursued further.

- **Actions 5.6, 5.7 and 5.8***: Actions relating to Entrance Bar Management and Safety*. A close read of the CM Act and the CMM indicates that these issues do not readily fall within the scope of a CMP, except in the case where watercourse entrance stability is an overriding concern and it interacts with public safety. These actions were assigned to parties such as Waterways (Now RMS) and the Royal Volunteer Coastal Patrol. It appears that no progress has been made with these actions.

- **Actions 5.9:** *Explore possibility of Historic Pilots Wharf being used by Royal Volunteer Coastal Patrol.* At the present time, it appears that the RVCP's vessel is moored at Mills Bay. The RVCP may need to be contacted to ensure that this arrangement is still satisfactory.

- **Action 6.3:** *Extend town wharf towards swimming pool including pumpout facilities.* Based on review of recent aerial photographs, this action has not been addressed.

- **Action 6.8**: *Encourage Responsible Dog exercising:* This action is now covered by an overall strategy for designated off leash areas across the shire[11]

5.3 Discussion of Key Assets, Estuarine Values and Threats

5.3.1 Introduction

The preceding section provides information on the concerns that have been expressed both in the past and discovered during initial consultation and investigations completed as part of the scoping study. In addition, those actions which have been

[10] http://www.esc.nsw.gov.au/living-in/about/culture-and-heritage/strategies-and-plans/wagonga-cemetery-management-plan/Wagonga-Cemetery-Management-Plan.pdf

[11] http://www.esc.nsw.gov.au/living-in/about/for-pet-owners/dogs-on-beaches

undertaken as part of previous estuary or coastal zone management plans have been discussed. The present section aims to filter this information using the objectives of the CM Act.

One of the difficulties in interpreting the prior information is that it needs to now be considered in the context of the new coastal management framework for New South Wales. The sections which follow comprise a summary of the preliminary risk assessment completed for this Scoping Study (Appendix E outlines the methodology and outcomes). The risk assessment was framed around the four coastal management areas and the objectives of the CM Act relating to them.

The key findings of the risk assessment have been used to formulate the purpose for the new CMP as discussed in Section 5.4.

The character of Wagonga Inlet and the values held by the community are diverse. The entrance area, including the trained entrance, public wharf and surrounding residential area and town, demonstrates a focus on boating activities, tourism, and the emerging needs of an ageing population. Further inside the entrance, including waterside developments in Forsters Bay and Barlows Bay, the focus shifts towards supporting agricultural activity, particularly the oyster farming industry. There is some concern that the estuarine basin of Wagonga Inlet is therefore underutilised with respect to tourist activities, although this may also be related to the navigability of the entrance channel.

Commercial fishing is not permitted in Wagonga Inlet, and there are several sanctuary zones where recreational fishing is also prohibited. The Inlet is also used for tow sports and jet skis, alongside sail boats and other non-powered craft. Wagonga Inlet is one of the key oyster producing estuaries on the south coast.

These competing uses of the estuary must be balanced in preparing a CMP.

5.3.2 Coastal Wetlands Area

Key risks associated with coastal wetlands revolve around trying to retain the presence of salt marsh inside the Inlet as water levels rise due to both climate change and training of the entrance. The risk associated with disappearing saltmarsh has been assessed as extreme. To properly manage these assets, it will be important for the coastal wetland mapping to be updated to reflect the most recent estuarine macrophyte vegetation mapping undertaken in Wagonga Inlet.

There are also issues with inconsistent classification / zoning of a coastal wetland along the foreshores of Narooma Flats which needs to be resolved.

5.3.3 Coastal Environment Area

Key risks within the coastal environment area surrounding Wagonga Inlet relate to the morphodynamics of the entrance channel. Following construction of twin breakwaters at the entrance to the Inlet in the mid-late 1970s, sand within the Inlet has been activated, with the entrance channel scouring. There has subsequently been a flood tide dominated transport of sand along the channel, with sediment depositing at the dropover into the main estuarine basin to the west of the Princes Highway. The process is one that has been experienced at numerous coastal lake entrances in NSW, including Lake Macquarie, Wallis Lake and, more recently, Lake Illawarra.

While the channel is eroding overall, this does not mean that erosion is uniform along the channel. In fact, the erosion process typically comprises the movement of a series of sand waves upstream along the channel with some reaches deepening, and others shallowing at any given point in time. Most recently, the issues have been experienced in the vicinity of Lewis Island (foreshore eroding) and the adjacent channel (shallowing). The issue is clearly of concern to sections of the community and has flow on effects to the local economy and for boating safety.

Management of navigation in the channel is not a key responsibility of Council and is better managed by RMS (responsible for boating safety) alongside Crown Lands (which owns the bed of the channel). Regardless, the issue was raised previously and appears to have not been rigorously addressed. It is likely that a detailed morphological study will eventually be required to answer whether dredging of the channel is justified and, if so, who would be the main beneficiaries and who should pay for the work (cost-benefit). Once undertaken, the community is likely to expect repeated dredging campaigns to maintain the channel. An updated hydrographic survey of the entrance would provide useful data to support a study alongside a permanent water level recorder(s), with suggested locations being Barlows Bay and Forsters Bay.

A second key risk is associated with activities within the Punkally Creek catchment. At the present time, there are known issues with bacteriological contamination and sedimentation in the lower reaches of the creek. Targeted investigations to ascertain the source of pollutants and to identify potential management strategies are warranted. It seems likely that responsibility for this work would reside with Council and Local Land Services, and we understand that work to assess this situation has recently commenced.

Other risks also relate to the impact of activities in the catchment. Firstly, water quality within Forsters Bay has been identified as an issue previously, and it appears that relatively poorer water quality may still be experienced in Forsters Bay from time to time. The precise reasons for this are not well understood at the present time and investigation of this issue may be warranted. Secondly, there is evidence of issues from

unsealed roads delivering sediment to the waterway in Clarks Bay and at the site of the Historic Wharf in Brices Bay.

A concern regarding the impact of the seal population has also been noted, but it is difficult to see how this could be addressed through a CMP. Seals are protected from harm under NSW law.

5.3.4 Coastal Use Area

Within the coastal use area, the only identified high risk is related to the use of the sea plane in Forsters Bay. We have limited information regarding this issue, and it will require a small amount of investigation to assess whether this is a high-risk activity or not. A suitable management strategy (if any) should be able to be easily determined as part of the CMP. Implementation of any recommendations may fall outside of Council's jurisdiction (Department of Lands, CASA).

Other issues relate to boating infrastructure within Wagonga Inlet. Users and commercial interests report a lack of infrastructure, particularly in the eastern part of the Inlet. While facilities at existing structures might readily be improved, the introduction of new facilities would require careful consideration to determine whether an intensification of boating on Wagonga Inlet is desirable. This is an issue which may be best answered in consultation with RMS, NSW Fisheries and Crown Lands. Council has expressed a preference to consolidate and improve existing facilities.

Improvement works for the landing pontoon at the historic wharf in Brices Bay should also be investigated, as it sits on the bed and is warped at low tide levels. The present condition is deteriorating with fender strips missing.

5.4 Identification of CMP "Purpose" for Wagonga Inlet

With reference to the risk assessment contained in Appendix E, the key objectives that are to be addressed by the CMP for Wagonga Inlet are:

<u>Assuming that the coastal wetland area is to be included in the CMP:</u>

> *to protect coastal wetlands and littoral rainforests in their natural state, including their biological diversity and ecosystem integrity*

This objective can be addressed by updating the current CM SEPP mapping for coastal wetlands to reflect more recent, field verified mapping. Furthermore, some work is required in ensuring that there is consistency regarding the treatment of a CM SEPP wetland adjacent to Narooma Flats.

> *to promote the rehabilitation and restoration of degraded coastal wetlands and littoral rainforests.*

to improve the resilience of coastal wetlands and littoral rainforests to the impacts of climate change, including opportunities for migration.

In addition to updating the CM SEPP mapping, actions which enable saltmarsh to thrive in areas behind the training walls at Wagonga Inlet should be considered, to assist in maintaining the presence of saltmarsh in the Inlet and to compensate for losses that are occurring as a result of high tides reaching higher levels in Wagonga Inlet.

As part of improved mapping for the CM SEPP, it is proposed that a more rigorous representation of the buffer zone, which considers topography in assessing potential migration pathways. A future snapshot could be completed relatively easily with appropriate tidal modelling results from the FRMS process.

Assuming that the coastal environment area is to be included in the CMP:

to protect and enhance the coastal environmental values and natural processes of coastal waters, estuaries, coastal lakes and coastal lagoons, and enhance natural character, scenic value"

A targeted investigation to examine the source of pollutants to the downstream reaches of Punkally Creek is warranted. The primary concern regarding this is the impact on oyster leases and responsibility may be best managed by the Batemans Marine Park and Local Land Services.

"to support the social and cultural values of coastal waters, estuaries, coastal lakes and coastal lagoons, biological diversity and ecosystem integrity."

Morphological change in the entrance to Wagonga Inlet is not yet well understood. As a first step, a survey of the entrance compartment and reinstallation of a water level recorder (or recorders) within the main body of the entrance is required before a study to assess whether dredging/reconfiguration of the entrance and/or intensification of boat use throughout the estuary is desirable. While the water level recorder has some additional benefit with regards to flooding around the fringes of the waterbody, navigation and management of the training walls including any morphological impact from their construction is more commonly managed by Crown Lands, possibly using funding provided by RMS.

A study to investigate the processes contributing to erosion at Lewis Island is warranted to manage this island adjacent to the entrance channel.

Assuming that the coastal use area is to be included in the CMP:

to protect and enhance the scenic, social, and cultural values of the coast by ensuring that:

(i) the type, bulk, scale, and size of development is appropriate for the location and natural scenic quality of the coast

The only high-risk issue identified related to the operation of a sea plane from Forsters Bay. While this needs to be investigated, it is probably debatable as to whether this is a concern that the CMP should be managing. If concerns are shown to be justified, then Council may choose to bring this to the attention of the other government instrumentalities involved. However, some of the moderate risks identified, relating to boating infrastructure, may warrant additional consideration.

The above objectives primarily relate to any extreme or high-risk issues that have been identified through the preliminary risk assessment (Appendix E). There are also a wide range of moderate risk issues that could also be considered if easily addressed and/or inexpensive. In developing the CMP, each of these should be assessed for ease of implementation.

Considering the above objectives, it is worthwhile comparing these against the identified management objectives of the existing Estuary Management Plan (Eurobodalla Shire Council, 2010). Those were:

- Improvement of the quality of run-off from urban and rural areas.
- Maintenance of the scenic views and vistas to and from Wagonga Inlet.
- Ensuring development is compatible with natural hazards.
- Increasing awareness of the values of natural communities in general and the habitat values of wetlands.
- Appropriate management of aquatic resources.
- Provide a vegetated buffer zone around the entire inlet.
- Increasing awareness of Aboriginal and European sites and local history.
- Prevention of deterioration of Aboriginal middens and other archaeological sites.
- Maintenance of navigation channels.
- Improving boat safety awareness.

There is substantial overlap between these pre-existing objectives and the purpose outlined in the preceding paragraphs. However, the approach of this Scoping Study has been to limit the CMP scope to the objectives for each coastal management area outlined in the CM Act. Accordingly, some of the prior objectives now will only form a secondary concern of the CMP such as:

- Increasing awareness of Aboriginal and European sites and local history (which is largely the domain of the National Parks and Wildlife service), including understanding the threats that might arise from erosion and recession in future (i.e. if within coastal vulnerability areas).

- Improving boat safety awareness (the responsibility of the NSW Roads and Maritime Service).
- Appropriate management of aquatic resources (largely the responsibility of NSW DPI Fisheries and the Batemans Marine Park).

Adding complexity by introducing actions into the CMP that are already the responsibility of other state government agencies is considered counterproductive. At the risk of the CMP seeming light in terms of the quantity of actions, it is considered practicable to focus the CMP on fewer actions which are clearly the responsibility of Council and largely within Council's control. The primary outcomes of the CMP must be affordable and implemented. This does not eliminate the need for Council to support the actions of other arms of state government, including NSW Fisheries, Batemans Marine Park, RMS, and Crown Lands in achieving positive outcomes for the estuary.

5.5 Gap Analysis and Recommended Approach in Development of CMP

Considering the objectives of the previous estuary management plan (Eurobodalla Shire Council, 2010) it is clear that some effort has gone into achieving the following objectives:

1. Improvement of the quality of run-off from urban and rural areas.
2. Ensuring development is compatible with natural hazards.
3. Appropriate management of aquatic resources.
4. Increasing awareness of Aboriginal and European sites and local history.
5. Maintenance of navigation channels.
6. Provide a vegetated buffer zone around the entire inlet.
7. Prevention of deterioration of Aboriginal middens and other archaeological sites.

However, monitoring, evaluation and reporting activities have been limited. These objectives will continue but, in some cases, they are better managed through processes that already exist in the absence of a CMP and are the responsibility of state agencies.

Some objectives, such as improved boat safety awareness, are much better addressed through other processes and programs. The remaining objectives remain relevant to a new CMP but require either more effort or a different approach.

The risk assessment (Appendix E) contains commentary associated with each risk, with some discussion on potential additional studies and/or actions that could be

undertaken to address data gaps during both the preparation and operation of a CMP for Wagonga Inlet. A short list of these studies and/or actions, comprising those relating to high and extreme risks was prepared and provided to representatives of Eurobodalla Council and the Office of Environment and Heritage. That list and the potential costs of for those studies was the subject of discussions between the study team, Council and OEH to consolidate and refine the approach for each of the high and extreme risks during the CMP process and the approach agreed upon is presented in Table 11.

However, due to issues outlined in the Executive Summary, none of these additional studies could be funded as part of Stages 2 or 3 during preparation of the CMP. Accordingly, these additional studies have been carried forward to be executed as actions within the CMP.

It was considered that studies to support moderate risks could be postponed and included in actions that form part of the CMP.

Table 11 Proposed Approach to Addressing "Extreme" and "High" ranked Estuary Management Risks associated with Wagonga Inlet

Relevant Risks (Appendix E) and CM Area	Risk Ranking	Required Additional Study
W1 (Wetlands) W2 (Wetlands)	Extreme Extreme	Update CM SEPP (Wetlands) Mapping: Maps should be prepared that better represent the extent of existing coastal wetlands, as mapped and assessed by Elgin Associates (2018). The associated proximity area for wetlands should be derived incorporating topographical constraints, not the linear spatial buffer applied in the present mapping. In this way, the buffer will focus on lower lying areas that are important to enable the migration of wetlands with sea level rise and increasing tidal range. The coastal vulnerability mapping (see next row) will need to be completed to ascertain the potential extent of migration with a future sea level rise scenario.
W5 (Vulnerability) W2 (Wetlands)	Extreme Extreme	Derive Coastal Vulnerability (Tidal Inundation) Mapping: This requires an understanding of how the tidal planes within the waterway will change, given a sea level rise scenario. This mapping is presently being undertaken as part of the Floodplain Risk Management Study being completed for the Narooma Waterways. Modelling used to derive the maps should include a robust assessment of how the entrance channel will continue to change in response to construction of the entrance breakwaters in the 1970s. The extents assessed will then need to be put forward as part of a planning proposal.
W4 (Vulnerability) W7 (Environment)	High High	Wagonga Inlet Entrance Morphodynamic Study: The entrance channel is evolving relatively rapidly following training and requires data collection to properly assess. It is recommended that a hydrosurvey of the entrance channel, which has not been completed for over 20 years, be completed. Two water level recorders should be installed at Barlows and Forsters Bays for at least a few months and possibly long term, to assess how tidal response in the inlet is evolving. The hydrosurvey should extend across the shallows and into Forsters Bay to assess how bathymetry has evolved opposite Shell Point. These two sets of data would

Relevant Risks (Appendix E) and CM Area	Risk Ranking	Required Additional Study
		enable a more detailed appreciation of recent inlet evolution and corresponding impacts to be determined. Following preliminary review of these requirements by OEH, we understand that the possibility of having a survey completed soon is to be investigated. For preparation of the CMP, if possible, a comparison between the two hydrosurveys will be made alongside the provision of a discussion of ongoing processes and the way in which this is manifesting in areas such as Lewis Island. This will enable the specification of more targeted actions as part of the CMP, potentially including: (i) Using the existing flood model of Wagonga Inlet to assess tidal and flood velocities adjacent to Lewis Island. (ii) Wind wave and boat wake calculations to assess the foreshore wave climate at Lewis Island. (iii) Use of the outcomes from (i) and (ii) to design foreshore protection works for Lewis Island (if warranted) and/or the conceptual assessment of dredging options for the inlet upstream of Princes Highway bridge (if warranted). Responsibility for these types of studies and the ensuing works is problematic along the NSW coast, with Council, RMS and DoI all having an interest in these works. Available government funding is limited. However, it seems important that this receives attention, as it has been highlighted as an issue for the community for some time and has received limited consideration to date.
W11 (Environment)	High	Punkally Creek Catchment Assessment: An assessment of sediment, nutrient and pathogen sources contributing to poor water quality at the downstream end of Punkally Creek is required. This will require an audit of agricultural uses, an aerial photographic assessment of recent changes in channel morphology and an assessment of bare/unfenced foreshores where livestock may be contributing to bank erosion. During the preparation of this Scoping Study, LLS has initiated some investigation into these issues. During preparation of the CMP we will revisit this issue, liaising with LLS to determine progress and whether additional management strategies are warranted.

6 Planning Proposal: Expected Changes Required to Coastal Management Area Mapping

6.1 Description of the Planning Proposal Process

One role of this Scoping Study is to determine whether a planning proposal should be prepared to amend both the coastal management area maps and the Local Environment Plan; and to facilitate such planning proposal/s and CMP preparation to proceed. Planning proposals follow the "Gateway" processes of the NSW Department of Planning. A planning proposal which alters the boundaries of the coastal management area would require the following steps:

1. Preparation: Council prepares the planning proposal.
2. Gateway: The Planning Minister decides whether the planning proposal can proceed.
3. Consultation: The planning proposal is publicly exhibited as directed by the Minister. A public hearing may be held.
4. Assessment: Submissions from exhibition of the planning proposal are reviewed and a draft change to the local environment plan is made.
5. Publication: With the Minister's approval, the revised LEP is 'made' via publication on the NSW legislation website.

A planning proposal is required to propose amendments to maps contained within:

- Council's LEP.
- the CM SEPP.

The planning proposal is required to explain the intended effect of the instrument and set out the justification. The planning proposal should include:

1. A statement of objectives for the instrument (or modifications thereof).
2. An explanation of the provisions to be included.
3. The justification for (1) and (2) and the process for their implementation.
4. The maps to be adopted.
5. The community consultation that is to be undertaken before the modified planning instrument is "made". A default public exhibition of 28 days is indicated in Section 3.34 of the *EP&A Act 1979.*

The requirements for a planning proposal are outlined in more detail within NSW Department of Planning and Environment (2016).

During "Stage 2" of the process outlined in the CMM, studies of risks and vulnerabilities should be undertaken to assess and justify (establish the "strategic merit") of any changes required in the maps. These will enable a planning proposal to be submitted to the minister for "Gateway Determination" when the CMP is submitted.

There are identified potential shortcomings in the Coastal SEPP mapping for the three estuaries subject to this scoping study, most notably the absence of coastal vulnerability mapping for the tidal inundation hazard. As there were limited follow up funds to complete the necessary studies to inform any modification of the SEPP mapping, it was decided that those studies would form actions within the CMP. Accordingly, a planning proposal is not proposed until those studies are completed.

7 Recommended Strategy for Ongoing Consultation

This Scoping Study has been prepared as part of an overall project to prepare a Coastal Management Program for Moruya River, Mummuga Lake and Wagonga Inlet. As such, it was necessary for Salients to estimate the amount of consultation that would be required throughout the study, before having a thorough understanding of the issues associated with the three subject estuaries. The degree of consultation originally proposed by Salients is summarised in Section 7.1.

7.1 Initially Proposed

Consultation was to comprise two versions of an online survey, delivered through Google Forms. The structure and format of questions would be made available to Council and OEH staff, for comment, prior to it going live.

The proposed first version of the survey was geared towards community members and required selection of a single focus estuary. Community members would have registered with an email address to receive an invitation to complete the survey with Council advertising the availability of the survey more broadly and providing a link for registration on their web page.

The second version of the survey was to be designed for stakeholder representatives who, by default, would have completed the survey for all three estuaries. In addition, questions regarding appropriate sources of funding were proposed in this version of the survey.

Proposed survey questions would have been geared towards dealing with the management of risk, levels of risk tolerance, prioritisation of management issues, and suggestions relating to how management issues might be addressed. The outcomes of the survey instrument would have been analysed to augment the findings of Stages 2 and 3.

7.2 Further Consideration and Consultation Requirements

As we have progressed through the preparation of this Scoping Study, particularly following the requirements of the finalised Coastal Management Manual, it became apparent that some changes to the way the consultation should occur would be more appropriate. The approach ultimately adopted should comprise the following:

- A simplified survey instrument geared solely for the community but generally following the approach outlined in the preceding section.
- Consultation with government stakeholders would proceed on a one-to-one basis. This was considered more effective given the need to initiate discussions about

funding and ultimately to achieve agreement on funding arrangements and responsibilities for different management actions as part of the CMP.

- Additional face to face, on-site consultation with non-state government stakeholder organisations, particularly Local Aboriginal Land Councils.

8 Preliminary Business Case

8.1 Introduction

The purpose of this business case is to support those activities which need to be completed in preparing a coastal management program (CMP) for three estuaries in the Eurobodalla Local Government Area: Moruya River, Mummuga Lake and Wagonga Inlet. The successful proposal for preparing the CMP was dated February 5, 2018. That proposal was based on a consultation draft of the Coastal Management Manual (CMM), prepared in 2015. At the time, that document was the best indicator available to assess what the CMP preparation process would comprise. The contract was awarded to Salients in early March 2018. The CMM was released on April 3, 2018, and this Scoping Study was prepared using the guidance of that document. The CMP preparation process is presented in Figure 5.

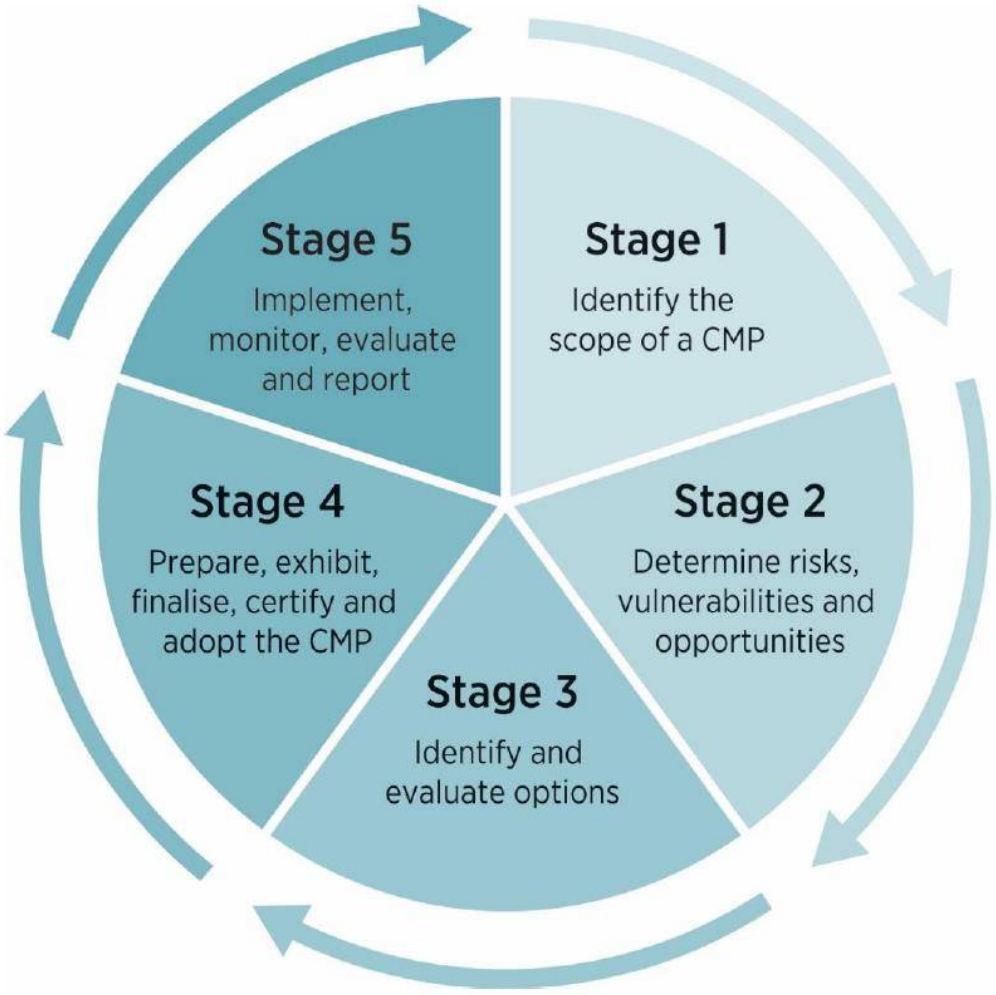


Figure 15 Stages in Preparing and Implementing a CMP (Source: NSW Government, 2018a)

There are some important points that need to be highlighted to inform this business case:

- The project covers Stages 1-3 and parts of Stage 4 of the process. Salients could not be certain of the requirements for Stages 2 and 3 (in particular) at the time the proposal was written. The tasks required for Stage 2 and 3 depend on the findings of Stage 1 (this study). At the time of the proposal, Council and OEH had prepared draft scoping studies for both the Moruya River and Wagonga Inlet. Based on those documents (which were noted to be incomplete) and the presence of pre-existing plans for those two estuaries, it was assumed that the CMP preparation could be "fast-tracked" with respect to those two estuaries. Some allowance was made for additional studies related to Mummuga Lake, with those studies to be confirmed by the scoping study.
- The Scoping Study has been prepared in accordance with the finalised CMM (April 2018), which differs markedly from the consultation draft version of the CMM that was used as a basis for the original study brief. For that reason, substantial work has been required to add to the draft scoping studies prepared by Council, and the focus and scope of studies required during Stages 2 of the CMP preparation also differ from what would have been completed under the consultation draft.
- At proposal stage, it was expected that the coastal vulnerability area would be mapped and released when the CMM was finalised (and the Coastal Management SEPP maps became active). This has not occurred.

For these reasons, a series of detailed studies were outlined and recommended for completion during the preparation of this Scoping Study. Those requirements are outlined in Sections 3.5, 4.5, and 5.5 for Moruya River, Mummuga Lake and Wagonga Inlet respectively. The scope of those "detailed studies" exceeds that originally proposed, and the possibility of completing these studies as part of "Stage 2" of the CMP process needed to be considered.

Following discussions with DPE and Council, it was determined to not be feasible to commit to the completion of all studies due to funding limitations arising largely driven by the bushfire emergency on the South Coast of NSW over the summer of 2019/20 and the global COVID-19 pandemic which followed soon after. Only limited additional studies were completed, associated with understanding and documenting analyses completed by the NSW state government, relating to:

(i) Catchment water quality risk.

(ii) Estuarine tidal inundation and sea level rise.

Where expenditure on these studies could not be justified during preparation of the CMP, the additional work is essential and needs to be addressed by actions in the CMP or through some other process. This needs to be considered as the CMP is developed.

8.2 Recommended Scope of CMP

Under the CM Act, Council has an obligation to prepare CMPs to cover its entire coastal zone. An implied time frame for transitioning older style plans to CMPs, under the CM Act, is 31 December 2021.

Furthermore, the grants funding package which accompanied the coastal management reforms in NSW will only extend to the 2020-21 financial year. At the present time, it is advantageous for Councils to complete required studies as part of their CMP preparation, so that grant applications for the implementation of works can be submitted before the end of this period.

Eurobodalla Council has expressed a desire to have a single, comprehensive CMP covering all estuaries in the LGA, with the CMP for these three estuaries being the base document which will be added to for other estuaries. The approach seems eminently sensible and has the potential to speed progress through the preparation of the CMP. To be comprehensive, the CMP should ideally cover the entire coastal zone (all four coastal management areas) associated with the three estuaries. However, based on our background review, the focus will vary from estuary to estuary. This is based on our preliminary risk assessment (Appendix E) and, considering the extreme and high level risks identified therein, the focus of the CMP is likely to be as shown in Table 12.

Table 12 Expected Focus of Coastal Management Program

ESTUARY	COASTAL MANAGEMENT AREA		
	Wetlands	Environment	Use
Moruya River	High	Moderate	Minor
Mummuga Lake	Minor	Moderate	Moderate
Wagonga Inlet	Very High	High	Moderate

As discussed, the coastal vulnerability area relating to tidal inundation has not been defined, and at present it is therefore not possible to realistically assess the full suite of risks that might be associated with this issue.

Council wishes to formally define the coastal vulnerability (tidal inundation) area through the NSW Floodplain Risk Management Process. This will be partly achieved

during the time frame over which the CMP is prepared, but it is not expected that the coastal vulnerability area will be properly prepared, along with necessary up-front community consultation, in time for this to be given complete treatment during CMP preparation.

The CMP will need to consider a range of risks, many of which include the potential for changes, such as those related to sea level rise and population growth over periods of 20, 50 and 100 years. The CMP will build upon the preliminary risk assessment completed as part of this Scoping Study.

Following our review of background information, the issues associated with each of the estuaries, the history of implementation, and the age of existing plans and studies, we do not recommend that progress through the process of Figure 15 be fast tracked for any of the three estuaries.

We consider that there are "extreme" and "high" level risks associated with all three estuaries, which should have further detailed studies completed as part of the CMP process. Due to limited funding for CMP development, these studies will need to comprise actions in the CMP.

8.3 Roles and Responsibilities

Considering the way in which the coastal management framework is now constructed, and our review of those activities which were not completed as part of previous management plans, we will aim to take a particularly focussed approach to the CMP. It seems practical that the CMP, a document over which Council is responsible, should focus on those activities and management responsibilities over which Council exerts the dominant control.

While there is scope within CMPs to have other organisations "sign on" to provide funding and assistance, we suspect that this may be difficult to achieve in practice. The reasons for this difficulty are that the state governance environment is constantly changing, with funding priorities shifting and department and agency structures and responsibilities adapting. This makes it difficult to guarantee funding, particularly when funding is filtered through a system of contestable grants. Most funding programs are run on an annual cycle with no guarantee of future funding.

A pragmatic approach would aim to have agencies, at the local level, confirm that they will take control over those broad activities for which they have legislative control, but to cooperate closely with other agencies to manage the estuary holistically.

As an example, a memorandum of understanding between all agencies could be signed that:

- Confirms their responsibilities (e.g. RMS & Crown Lands are responsible for managing boating, dredging navigable channels and managing the bed of Crown Waterways; DPI Fisheries and the Batemans Marine Park are responsible for research relating to the productivity of fisheries and compliance).
- Commits to participating in regular meetings (say on a bimonthly interval) of a stakeholder committee group, to be convened by Council. These meetings would provide a forum for sharing information, ensuring collaboration and, when needed, to adjust the memorandum of understanding. It is not envisaged that community members would be included in this committee.

A key aim of this approach is to limit the number of extraneous actions included in a CMP which may increase the weight of the document, but mainly operate to cause confusion over who should be taking responsibility for ensuring that actions are completed. Again, the emphasis must be on a CMP that can and will be implemented.

8.4 Expected Benefits and Costs

The purpose of this business case is to support preparation of the CMP for the three estuaries. In terms of benefits, it is not yet possible to quantify the benefits associated with the additional activities proposed herein. The activities outlined here are those needed to develop a baseline understanding of what could be required to manage the coastal zone and achieve the objectives of the CM Act. The benefits are therefore those that are intrinsic in following the coastal management framework – gaining a better understanding of the coastal zone so that it can be better managed now and into the future.

We have outlined those studies that we recommend are required to make informed decisions about the types of management actions that will be required to address "high" and "extreme" risks from our assessment. In comparison, if "moderate" risks require additional studies, those studies can be included as actions in the CMP.

The studies required to prepare the CMP are discussed in detail in sections 3.5, 4.5, and 5.5, respectively for the Moruya River, Mummuga Lake and Wagonga Inlet Estuaries. A preliminary cost estimate for completion of those studies is outlined in Table 13.

Table 13 Recommended Stage 2 Studies and Costs for Completion

Required Study and Key Steps	Indicative Consultancy Cost ($ ex. GST)
Derive Interim Tidal Inundation Mapping for Moruya River: - Harmonic analysis of Moruya water level record to determine tidal planes. - Determine zones of reliability (e.g. Upstream of Mogendoura Creek, the water level recorder may not be representative). - Prepare GIS layers to show extent of inundation for tidal planes of relevance for estuarine macrophytes, for both existing condition and with future sea level rise.	$3,200
Update CM SEPP (Wetlands) Mapping (Including Field Work for Mummuga Lake): - Field exercise at Mummuga Lake, including initial examination of aerial photography. - GIS analysis of location parameters (elevation, slope, connectivity) for various macrophyte communities, determination of conditions conducive to macrophyte communities. - Determine relevant future sea level rise tidal plane inundation benchmarks (relating to 20, 50 and 100 years). - Importation of relevant future inundation mapping from prior tasks. - Application of rules to future conditions to project future expansion potential. - Preparation of report and maps to support planning proposal.	$17,250
Mummuga Entrance Foreshore Management Assessment and Strategy: - Review / consult with Council on PoM for Crown Reserve Management. - Confirm boundaries and management responsibilities. - Detailed field investigation with measurements, photographs, and GPS records. - Break foreshore into different precincts for foreshore protection. - Determine design conditions. - Develop representative design sketches and report.	$8,750
Water Quality Risk Assessment Analysis: - Discuss methodology used in risk assessment mapping process with OEH (Mummuga Lake and Wagonga Inlet only), obtain input data if possible, for interrogation. - Prepare documentation of the results, explaining the key driving factors for sub-catchments assessed as being high risk and recommending areas that may need further consideration.	$3,600
Wagonga Inlet Preliminary Morphodynamic Assessment: - Review key documentation pre. 2001 (Date of Nelson Consulting EMP) - Import selected historical aerial photography into GIS and undertake aerial photograph interpretation - Import two historical hydrosurveys into GIS and compare - Prepare interpretive report on history, likely future changes, and possibilities for management.	$6,250

***Includes analysis of bathymetric change. Assume that updated hydrosurvey to be provided by OEH.**

The total for additional studies ($39,050 GST exclusive) is significantly greater than the $9,100 allowed for in the proposal. The reasons for the increase are outlined in the dot points in Section 8.1.

As noted above, due to severe constraints on Council funding, these studies will be postponed and included as actions in the CMP.

8.5 Recommended Steps for CMP Completion

8.5.1 Further Consultation

Consistent with Section 7.2, the following consultation activities are to be undertaken:

- A simplified survey instrument geared solely for the community but generally following the approach outlined in the preceding section.
- Consultation with government stakeholders would proceed on a one-to-one basis. This was considered more effective given the need to initiate discussions about funding and ultimately to achieve agreement on funding arrangements and responsibilities for different management actions as part of the CMP.
- Additional face to face, on-site consultation with non-state government stakeholder organisations, particularly Local Aboriginal Land Councils.

8.5.2 Stage 2: Determine Risks, Vulnerabilities and Opportunities

Stage 2 of the process outlined in the manual revolves around the identification and assessment of risk. The approach to be adopted will follow the guidance of ISO 31000, building on Appendix E with the results being updated to incorporate the findings of the limited additional study, associated with understanding and documenting analyses completed by the NSW state government relating to:

- catchment water quality risk.
- estuarine tidal inundation and sea level rise.

As per Salients original proposal, a qualitative approach will be adopted for risk assessment. This assumes that no *"high risk, high complexity"* issues will need to be assessed. Such issues would warrant more detailed analysis (and detailed cost benefit analyses during Stage 3) if the guidance provided in the CMM is to be followed, and this has not been allowed for in Salients proposal.

8.5.3 Stage 3: Identify and Evaluate Options

Tasks in Stage 3 will comprise:

- Compiling a list of potential management options for inclusion in the new CMP, including any relevant and achievable options outstanding from the existing plans alongside any potential new options, particularly those that could be used to assess new and emerging issues.
- Completing a risk assessment for the different management options wherein we will upgrade the risk assessment developed over the course of the study, to take account of the impact that potential options would have on the risk profile.

- Estimating the costs for implementation and maintenance and completing a simplified cost benefit analysis for any options where this has not already been completed.

Based on the outcomes from both the cost-benefit and risk assessment, a list of preferred options would be recommended for carriage through the CMP.

8.5.4 Stage 4: Prepare, Exhibit, Finalise, Certify and Adopt the CMP

Stage 4 of the process is considered in two Parts. The first (Part A) comprises those aspects to be completed by Salients under the present contract, and Part B the remaining tasks of Stage 4.

Part A tasks comprise the following:

- **Compile Summarised Background Information for CMP.** This will comprise initial compilation of the program, utilising work previously completed and following, where relevant, the format outlined in the Manual.
- **Assess and Assign Responsibilities.** The CMP actions are to be assessed to determine which parties are best placed to take responsibility for various actions, considering who the beneficiaries of various actions will be, who has legal responsibility and who is best placed to fund and/or implement those actions. This will involve communications with relevant organisations to seek in principle, written agreement that the organisation is willing to carry out the responsibilities assigned to them.
- **Prepare Implementation Details and Business Plan**. A summary timeline and cost estimates for program implementation should then be developed along with a business plan. This will include maps and a Gantt chart illustrating timing, responsibilities, integration within Council's IP&R framework and a strategy for monitoring and review.
- **Internal Review of CMP.** Council would then undertake an internal review of the CMP. Following revision, the CMP will be ready for exhibition.
- **Exhibition.** The draft CMP will then be reviewed, and submissions considered, with that process detailed in a submissions report which will discuss how any changes have been made.
- **Finalisation.** Following internal review of the submissions report, the CMP will be finalised to carry forward to certification.

Part B will comprise activities associated with certifying and adopting the CMP. As there is limited experience with this process under the new coastal management framework in NSW, it is not possible to estimate how long this might take. Similarly,

the timeline expected for any tasks associated with Stage 5 of the new process (Implement, Monitor, Evaluate and Report) cannot be ascertained until the actions of the CMP are finalised.

9 Scoping Study Summary

9.1 Summary of Effectiveness of Current Management Practices

Both Wagonga Inlet and Moruya River have existing, but outdated management plans (respectively: Eurobodalla Shire Council, 2010; Worley Parsons, 2009a). Audits of the implementation of those plans were prepared by Council, and these are presented in Appendices C (Moruya) and D (Wagonga). In comparison, estuarine issues at Mummuga Lake have been managed in a piecemeal manner.

The audits were reviewed by the study team and two broad observations are made:

- While there has been a tendency for Council to internally review implementation of the plan and update the plan as necessary, past practice in NSW has been to complete this at long intervals (5 years or greater). This makes it difficult to ascertain how and when actions are being completed with reference to execution of the plan. In some instances, clear reference back to the existing plan appears to be missing. An example of this is bank stabilisation works along the Moruya River, which have been extensive, but largely carried out in an opportunistic manner by LLS with no clear records kept.

- It was common for existing plans to contain actions that organisations external to Council were best placed to complete, through either legislative, jurisdictional, or funding opportunities. Unfortunately, many of these have proven very difficult for Council to force action upon. There are two key reasons for this: (i) there has been previously no mechanism for completion of actions to be enforced; and (ii) the legislative, jurisdictional or funding environment changes continuously within state government, and responsibilities that are not clearly laid out tend to be forgotten or disregarded as this occurs.

The new framework for coastal management in NSW has the potential to address these problems through the seeking of written concurrence for actions assigned to organisations external to Councils and by enforcing more regular monitoring, evaluation and reporting, by placing new CMPs under the umbrella of Council's Integrated Planning and Reporting framework.

9.2 Outcomes from First Pass Risk Assessment

Risks were identified through a combined review of background information, site inspection and community workshop/drop-in sessions held at Narooma (for Mummuga Lake and Wagonga Inlet) and at the Moruya Riverside Markets (Moruya River). These risks were assessed qualitatively.

The complete preliminary risk assessment tables for all three estuaries are presented in Appendix E. Table 14 tabulates the assessment of those risks, divided into each risk

category for each estuary. Each estuary had a similar distribution of high and extreme risks. A larger number of moderate and low risks were identified for Moruya River. We have surmised that the key reason for this was the attendance at the Moruya workshop of enthusiastic individuals who discussed multiple potential concerns.

Table 14 Tabulation of Identified Risks

Estuary	Risk Ranking				
	Extreme	High	Moderate	Low	Total
Moruya River	2	6	12	4	24
Mummuga Lake	1	6	6	1	14
Wagonga Inlet	3	5	5	1	14

9.3 Strategic Context and Purpose for CMP

As outlined in the next section, more study is required for each subject estuary, and it is not recommended that CMP preparation be fast-tracked (by skipping Stages 2 and 3 of the process). Consequently, it is not yet possible to finalise the "purpose", "vision" and "objectives" for the CMP. It will be important that the results of a proposed community survey be considered and incorporated before the overarching principles governing the CMP are finalised. Initially, our risk assessment has considered all the objectives outlined in the CM Act, which are also listed in Appendix A.

Considering the distribution of the "high" and "extreme" risks of Table 14 across the different coastal management areas defined by the CM Act, the expected degree of focus of the CMP across the coastal wetlands, coastal environment and coastal use areas is outlined in Table 15. The coastal vulnerability area has been excluded from Table 14, as the current absence of mapping for this area makes it difficult to incorporate at the present time. Council is intending to develop mapping under the Floodplain Risk Management process and the results of this will be used, as relevant, to inform other actions associated with, for example, coastal wetland and coastal environment areas. While coastal vulnerability is not expected to be a key focus at the present time, the possibility for its incorporation into the CMP in a more rigorous manner at a later stage will need to be considered.

Table 15 Expected Focus of Coastal Management Program

ESTUARY	COASTAL MANAGEMENT AREA		
	Wetlands	Environment	Use
Moruya River	High	Moderate	Minor
Mummuga Lake	Minor	Moderate	Moderate
Wagonga Inlet	Very High	High	Moderate

9.4 Additional Studies Required

A draft, preliminary list of studies required to fill knowledge gaps associated with the "extreme" and "high" ranked risks was provided to representatives of Council and OEH for consideration and discussion. Ultimately, most of these could not be incorporated into Stage 2 of the CMP process, and only limited additional study is proposed. This additional study is associated with understanding and documenting analyses completed by the NSW state government relating to:

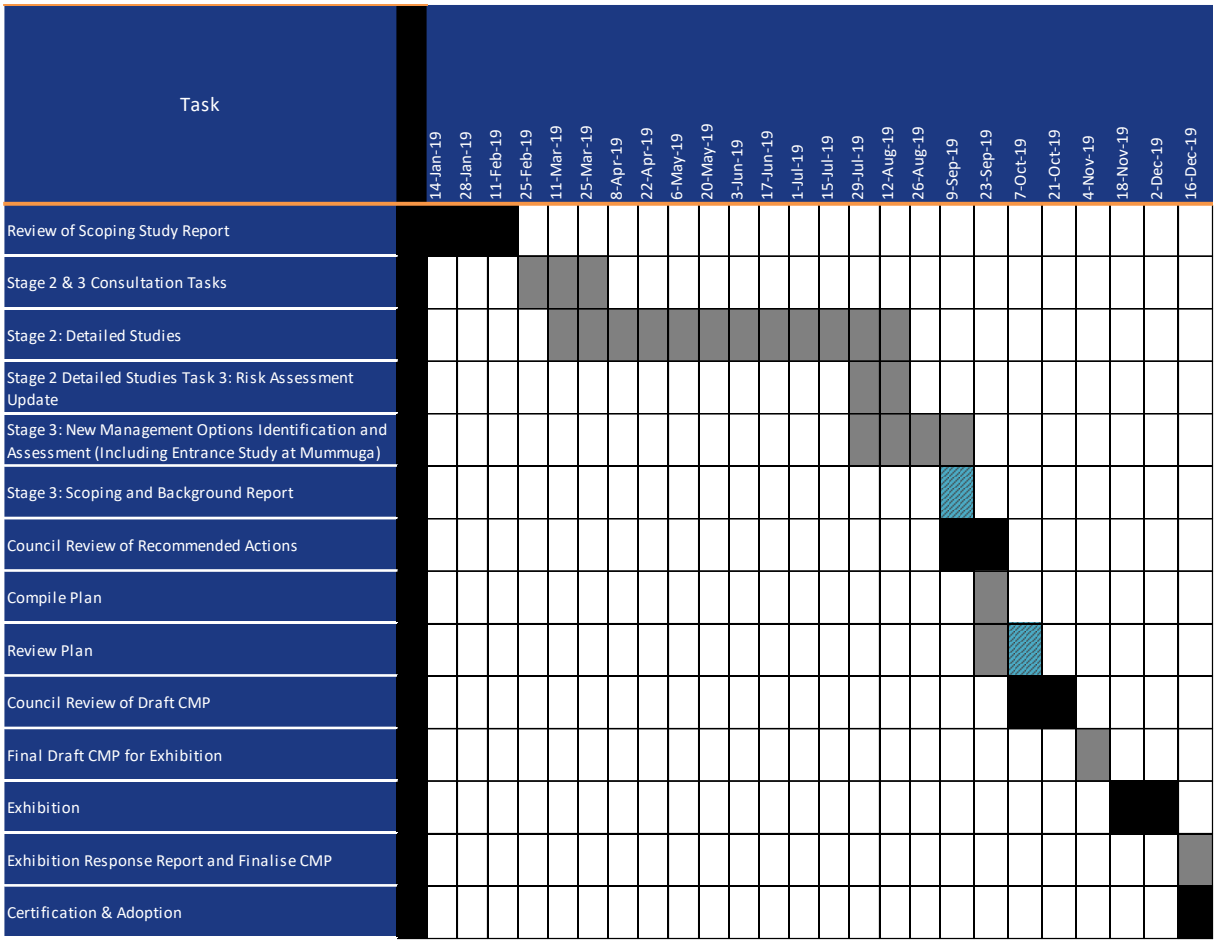
- Catchment water quality risk.
- Estuarine tidal inundation and sea level rise.

These analyses will inform some of the associated management options.

9.5 Moving Forward

The recommended steps for CMP finalisation (prior to certification and adoption) are outlined in Table 16. These steps, and a discussion of roles and responsibilities of different organisations are included in the business plan provided in Section 8.

Table 16 Program for CMP Preparation – At Final Draft Scoping Study Stage



Additional consultation, to be completed as the first task subsequent to Council's review and acceptance of the Scoping Study Report, including finalisation of the way forward, will include an online survey for both community members and stakeholder organisations, and additional, one-on-one discussions between the study team members and representatives of stakeholder organisations to help establish priorities and likely responsibilities for actions in the final CMP.

<u>September 2020 Addendum</u>: Following the delays outlined elsewhere in this scoping study, it is clear that the tasks in Table 16 were not going to be achieved within the indicated timeframe. Work had, as of September 2020 progressed towards the consultation and additional study tasks. A Draft ECMP was expected to be delivered by Early December 2020.

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Appendix A Coastal Management Act, 2016: Management Objectives for Coastal Management Areas

Management Objectives for Coastal Wetlands and Littoral Rainforests Area
(a) to protect coastal wetlands and littoral rainforests in their natural state, including their biological diversity and ecosystem integrity.
(b) to promote the rehabilitation and restoration of degraded coastal wetlands and littoral rainforests.
(c) to improve the resilience of coastal wetlands and littoral rainforests to the impacts of climate change, including opportunities for migration.
(d) to support the social and cultural values of coastal wetlands and littoral rainforests.
(e) to promote the objectives of State policies and programs for wetlands or littoral rainforest management.

Management Objectives for Coastal Vulnerability Area
(a) to ensure public safety and prevent risks to human life.
(b) to mitigate current and future risk from coastal hazards by taking into account the effects of coastal processes and climate change.
(c) to maintain the presence of beaches, dunes and the natural features of foreshores, taking into account the beach system operating at the relevant place.
(d) to maintain public access, amenity and use of beaches and foreshores.
(e) to encourage land use that reduces exposure to risks from coastal hazards, including through siting, design, construction and operational decisions.
(f) to adopt coastal management strategies that reduce exposure to coastal hazards: (i) in the first instance and wherever possible, by restoring or enhancing natural defences including coastal dunes, vegetation and wetlands, and (ii) if that is not sufficient, by taking other action to reduce exposure to those coastal hazards,
(g) if taking that other action to reduce exposure to coastal hazards: (i) to avoid significant degradation of biological diversity and ecosystem integrity, and (ii) to avoid significant degradation of or disruption to ecological, biophysical, geological and geomorphological coastal processes, and (iii) to avoid significant degradation of or disruption to beach and foreshore amenity, and social and cultural values, and (iv) to avoid adverse impacts on adjoining land, resources or assets, and (v) to provide for the restoration of a beach, or land adjacent to the beach, if any increased erosion of the beach or adjacent land is caused by actions to reduce exposure to coastal hazards,
(h) to prioritise actions that support the continued functionality of essential infrastructure during and immediately after a coastal hazard emergency
(i) to improve the resilience of coastal development and communities by improving adaptive capacity and reducing reliance on emergency responses.

Management Objectives for Coastal Environment Area
(a) to protect and enhance the coastal environmental values and natural processes of coastal waters, estuaries, coastal lakes and coastal lagoons, and enhance natural character, scenic value, biological diversity and ecosystem integrity.
(b) to reduce threats to and improve the resilience of coastal waters, estuaries, coastal lakes and coastal lagoons, including in response to climate change.
(c) to maintain and improve water quality and estuary health.
(d) to support the social and cultural values of coastal waters, estuaries, coastal lakes and coastal lagoons.
(e) to maintain the presence of beaches, dunes and the natural features of foreshores, taking into account the beach system operating at the relevant place.
(f) to maintain and, where practicable, improve public access, amenity and use of beaches, foreshores, headlands and rock platforms.

Management Objectives for Coastal Use Area
(a) to protect and enhance the scenic, social and cultural values of the coast by ensuring that: (i) the type, bulk, scale and size of development is appropriate for the location and natural scenic quality of the coast, and (ii) adverse impacts of development on cultural and built environment heritage are avoided or mitigated, and (iii) urban design, including water sensitive urban design, is supported and incorporated into development activities, and (iv) adequate public open space is provided, including for recreational activities and associated infrastructure, and (v) the use of the surf zone is considered.
(b) to accommodate both urbanised and natural stretches of coastline.

Appendix B Mandatory Requirements of a Coastal Management Program

The purpose, scope and focus of a CMP (Mandatory Requirements 2 & 3)
A CMP is to consider a range of timeframes and planning horizons including immediate, 20 years, 50 years, 100 years and (if council considers it relevant based on expert advice) beyond.
A CMP is to consider a broad range of coastal management issues and management actions with a focus on achieving the objects and objectives of the CM Act.
The area that a CMP Covers (Mandatory Requirements 4 & 5)
A CMP must include the rationale for selecting the area to be covered by a CMP and identify whether it applies to: (i) all or part of the coastal zone of one local government area; or (ii) all or part of the coastal zone of adjoining local government areas that share a coastal sediment compartment or estuary (where adjoining local government areas share a coastal sediment compartment or estuary - refer to Schedule 1 of the CM Act - a CMP that addresses an area comprising that coastal sediment compartment or estuary must reflect this regional context).
A CMP must identify: (i) any proposed amendments to mapping of the relevant coastal management areas; (ii) evidence to support any proposed amendments or additions to the area of the four coastal management areas in the relevant area; and (iii) information about these proposed amendments that can support the preparation of a planning proposal and, in particular, that could be forwarded along with a planning proposal to the Greater Sydney Commission (if the planning proposal relates to the Greater Sydney Region) or the Minister (for elsewhere) to inform a Gateway determination under section 3.34 of the EP&A Act.

Preparing a CMP (Mandatory Requirements 6 & 7)

During preparation of a CMP, a council is to:

(i) identify the scope of the CMP;

(ii) determine and assess coastal risks, vulnerabilities and opportunities (including without limitation risks to environmental, social and economic values and benefits); and

(iii) evaluate and select coastal management options.

Note: These requirements correspond to the first three stages of the five-stage risk management process for the preparation and implementation of a CMP. These requirements are in addition to the specific requirements during preparation in the CM Act. Guidance for preparation is provided in Part B of the manual.

A council may choose not to repeat steps (or parts of steps) in subparagraphs (ii) or (iii) of mandatory requirement 6 for the area the subject of the proposed CMP (or parts of that area) if those tasks have already been undertaken for the coastal management of that area, provided that council first considers:

(i) whether the existing assessment of coastal risks, vulnerabilities and opportunities, or the existing evaluation of coastal management options, that council proposes to rely on enables council to prepare the CMP in accordance with mandatory requirement 8 below and sections 14 and 15 of the CM Act;

(ii) the effectiveness of the existing coastal management of that area; and

(iii) whether any circumstances concerning the coastal management of that area have changed.

Key issues to be identified (Mandatory Requirement 8)

A CMP must:

(i) provide a description of how the objects of the CM Act have been considered and promoted in preparing the CMP;

(ii) provide a description of how the objectives of the coastal management areas covered by the CMP have been given effect to in preparing the CMP;

(iii) identify the key coastal management issues affecting the areas to which the CMP is to apply and how these have been considered;

(iv) identify any coastal management actions required to address those key coastal management issues in an integrated and strategic manner;

(v) identify how the coastal management actions in (iv) have been considered and evaluated (including, without limitation, how council has evaluated the coastal management actions in light of the functions and responsibilities council has under legislation other than the CM Act);

(vi) identify any environmental protection works, on land identified as 'coastal wetlands' or 'littoral rainforests' on the Coastal Wetlands and Littoral Rainforests Area Map under the CM SEPP, that are proposed to be carried out by or on behalf of a public authority;

(vii) identify any coastal protection works that are proposed to be carried out by or on behalf of a public authority;

(viii) set out the recommended timing for the proposed coastal management actions;

(ix) identify a proposed monitoring, evaluation and reporting program in relation to the CMP, including by identifying key indicators, trigger points and thresholds relevant to the CMP; and

(x) include a business plan.

Requirements for the business plan in the CMP (Mandatory Requirement 9)
The business plan included in the CMP must identify: (i) all proposed coastal management actions identified elsewhere in the CMP; (ii) the full proposed capital, operational and maintenance costs, and recommended timing, of proposed coastal management actions; (iii) any proposed cost-sharing arrangements and any other viable funding mechanisms for the proposed coastal management actions to ensure delivery of those actions is consistent with the timing for their implementation under the CMP; and (iv) the distribution of costs and benefits of all proposed coastal management actions
Requirements for preparing a CMP which includes a proposed or mapped coastal vulnerability area (Mandatory Requirements 10 and 11)
Where coastal hazards have been identified in a coastal management area, a CMP must identify proposed coastal management actions for those hazards.
If the CM Act requires that a coastal zone emergency action subplan be prepared, it must identify any requirements for how emergency coastal protection works, within the meaning of the CM SEPP, are to be carried out. Note: Emergency Coastal Protection Works are defined in Clause 19(4) of the CM SEPP
Requirements for taking coastal change into account when preparing a CMP (Mandatory Requirements 12 and 13)
A CMP must demonstrate how a council has considered: (i) projected population growth and demographic changes; and (ii) projected use of coastal land for infrastructure, housing, commercial, recreational and conservation purposes.

A CMP must demonstrate how a council has considered:

(i) current and future risks, at timeframes of immediate, 20 years, 50 years, 100 years and (if council considers it relevant based on expert advice) beyond;

(ii) (if council considers it relevant) current and future risks of potentially high consequence, low probability events that may affect the relevant area;

(iii) the effects of projected climate change and how it may affect the relevant area;

(iv) the local and regional scale effects of coastal processes; and

(v) the ambulatory and dynamic nature of the shoreline and how it may affect the relevant area.

Format and content required of a CMP (Mandatory Requirement 14)

A CMP is to include the following sections:

(i) Executive summary.

(ii) Introduction.

(iii) A snapshot of issues.

(iv) Actions to be implemented by the council or by public authorities.

(v) Whether the CMP identifies recommended changes to the relevant planning controls, including any proposed maps.

(vi) A business plan.

(vii) Coastal zone emergency action subplan, if the CM Act requires that subplan to be prepared.

(viii) Monitoring, evaluation and reporting program.

(ix) Maps.

(x) Reference list.

Community Engagement and Consultation (Mandatory Requirement 15)
A draft CMP must be exhibited for public inspection at the main offices of the councils of all local government areas within the area to which the CMP applies, during the ordinary hours of those offices, for a period of not less than 28 calendar days before it is adopted. This mandatory requirement does not prevent community consultation, or other consultation, in other ways.

Appendix C Audit of Moruya / Deua River Estuary Management Plan (Eurobodalla Shire Council, 2018)

TABLE 3: PLANNING CONTROLS AND POLICIES - IMPLEMENTATION SCHEDULE (REFER FIGURE 5)

ITEM	RECOMMENDED STRATEGY	OBJECTIVES TARGETED	PRIORITY RANKING	ACTIONS	Progress and Comments
PCP-1	Incorporate all areas of SEPP 14 Wetlands and Endangered Ecological Communities into land use mapping as part of review of the Local Environmental Plan (*LEP*).	- Protect and restore riparian vegetation - Restrict stock access to foreshore and wetland areas - Increase connectivity of foreshore habitats (wildlife corridors) - Provide for sustainable development of the estuary - Resolve conflicts between development controls and other policies	H	1. Review latest mapping for SEPP 14 Wetlands and Validated and Potential EECs (refer **Strategy IR-4**) in reference to existing land use mapping to identify Environmental Protection areas that are currently not accommodated by existing Rural and Urban LEPs. 2. Updated land use mapping for revised LEP to incorporate sensitive communities into environmental protection areas, as required by the South Coast Regional Strategy (2007). 3. Where appropriate, incorporate recommendations from the recent study by Eco Logical Australia (ESC, 2007c) into land use mapping for Urban Expansion Zones. These include constraints on development of areas of EECs in 'moderate to good' condition and potential 'biolinks'. 4. Council staff from Moruya / Deua River Estuary Management Committee to review draft land use mapping produced for the revised LEP. 5. Council planning staff to report potential changes in mapping to Moruya / Deua River Estuary Management Committee during public exhibition of the LEP.	Where do I start? This was completed with wetlands being zoned E2. These zones remain but a recent planning proposal has amended the allowable use to allow grazing of wetlands.
PCP-2	Incorporate requirements of Council's Acid Sulfate Soils (ASS) Policy into revised Local Environmental Plan (*LEP*).	- Maintain existing good water quality - Protect and preserve aquatic habitats (including seagrasses and saltmarsh) - Provide for sustainable development of the estuary	H	1. Incorporate details currently contained in Council's ASS Policy into revised LEP, including latest extent mapping for all classes of ASS. 2. Council planning staff to advise when LEP completed.	Done - local clause and mapping overlay
PCP-3	Incorporate requirements and recommendations from Riparian Corridor Objective Setting (*RCOS*) report (*2006*) into revised Local Environmental Plan (*LEP*).	- Protect and restore riparian vegetation - Increase connectivity of foreshore habitats (wildlife corridors) - Provide for sustainable development of the estuary - Resolve conflicts between development controls and other policies	H	1. Extract relevant recommendations regarding the management of Core Riparian Zones and vegetated buffers from 2006 report prepared by DNR, including the appropriate positioning of all future services such as footpaths and cycleways. 2. Incorporate RCOS recommendations into revised LEP. 3. Committee member from DECC to review draft version of LEP and advise of any changes required. 4. Council planning staff to advise when LEP completed.	Done – Stream categories mapped in LEP.
PCP-4	Undertake an audit every 2 years of erosion and sediment controls for all new developments constructed in the previous 4 year period.	- Reduce and prevent further sedimentation of the estuary - Maintain existing good water quality - Tighter enforcement of development controls - Protect and preserve aquatic habitats (including seagrasses and saltmarsh)	H	1. Establish auditing program, including auditing methods and training for Council staff. 2. Determine list of new developments constructed in the last 2 or 4 years. 3. Undertake audits of identified sites according to development consent conditions regarding permanent and temporary (if applicable) Erosion & Sediment Control requirements. 4. Issue warnings / penalties for where Erosion & Sediment Controls have not been satisfactorily maintained or implemented.	Not commenced
PCP-5	Develop a Water Sensitive Urban Design Policy for Eurobodalla Shire.	- Maintain existing good water quality - Reduce and prevent further sedimentation of the estuary - Provide for sustainable development of the estuary - Consider and manage the impacts of climate change on estuary processes	H	1. Appropriate Council officer to report to the Committee every 6 months regarding progress of development of WSUD Policy. 2. Moruya River Estuary Management Committee to provide input to develop and review WSUD Policy if required. 3. WSUD policy to aim to minimise pollutants to the estuary and consider the potential impacts of climate change (e.g., changes in catchment hydrology).	Done – Eurobodalla Integrated watercycle mgt plan
PCP-6	Incorporate appropriate stormwater quality management measures for the expanding North Moruya Industrial Estate into the next revision of the Urban Stormwater Quality Management Plan for Eurobodalla Shire.	- Maintain existing good water quality - Reduce and prevent further sedimentation of the estuary - Provide for sustainable development of the estuary	H	1. Develop stormwater quality management measures for industrial areas to be included in the revised USQMP in conjunction with requirements of the new Development Control Plan for Industrial Developments (as recommended in the Moruya Structure Plan, 2007). 2. Infrastructure Planning Engineer to periodically report to Committee regarding status of new USQMP.	
PCP-7	Investigate the rezoning or strategic purchase of land to account for potential impacts of climate change on estuary processes and development, and incorporate findings into revised Local Environmental Plan (*LEP*).	- Consider and manage the impacts of climate change on estuary processes - Protect and restore riparian vegetation - Protect and preserve aquatic habitats (including seagrasses and saltmarsh) - Provide for sustainable development of the estuary	H	1. Monitor developments in sea level rise predictions from the Intergovernmental Panel on Climate Change (IPCC) and associated research from CSIRO and the Australian Greenhouse Office. 2. Investigate appropriate flood planning levels for development considering climate change projections. 3. Investigate and identify areas suitable for relocation/migration of coastal vegetation, saltmarshes and Endangered Ecological Communities (EECs) that may be threatened by sea level rise. Indicative areas that may be susceptible to inundation are shown in **Figure 6**. It is envisaged that adjacent landward strips of the foreshore could be identified as suitable for vegetation migration. 4. Investigate and confirm areas of existing urban development and future urban expansion that may be threatened by sea level rise. Refer to **Figure 6** for suggested areas. 5. Revise land use mapping or investigate strategic purchase of land to provide buffer zones for vegetation migration and to ensure that future development is outside of areas potentially impacted by sea level rise. 6. Incorporate revised land use mapping and recommendations into new LEP in accordance with the findings of the investigations outlined above. 7. As required, update relevant development controls to account for sea level rise, including design freeboards for sewerage and stormwater infrastructure, dwellings, sea walls and recreational facilities.	Not commenced
PCP-8	Develop a stormwater operations manual for Council's outdoor staff and machinery operators.	- Reduce and prevent further sedimentation of the estuary - Maintain existing good water quality - Improve education and awareness of estuary issues - Maintain and enhance visual aesthetics and quiet rural lifestyle	H	1. Lobby for funding to create operations manual, with support from Roads and Recreation department. 2. Incorporate requirements for proper implementation of erosion and sediment control measures for construction and roadworks sites. 3. Conduct a training workshop every 12 months to account for turn over in staff.	

TABLE 3: PLANNING CONTROLS AND POLICIES - IMPLEMENTATION SCHEDULE (REFER FIGURE 5)

ITEM	RECOMMENDED STRATEGY	OBJECTIVES TARGETED	PRIORITY RANKING	ACTIONS	ESTIMATED COST
PCP-9	Implement Landscape Concept Plan for Glenduart Riverside Reserve.	- Protect and restore Aboriginal and European heritage - Protect and restore riparian vegetation - Improve foreshore access and facilities for recreation - Maintain and enhance visual aesthetics and quiet rural lifestyle	H	1. Landscape Concept Plan is to incorporate access locations and fire mitigation measures. 2. Modify and develop concept designs for rehabilitation based on results of Aboriginal sites assessment. 3. Prepare detail designs for rehabilitation works, if required.	Done
PCP-10	Develop a Boating Management Plan for Moruya River.	- Improve foreshore access and facilities for recreation - Protect and preserve aquatic habitats (including seagrasses and saltmarsh) - Promote sustainable tourism for the estuary - Maintain and enhance visual aesthetics and quiet rural lifestyle - Consider and manage the impacts of climate change on estuary processes	H	1. NSW Maritime to continue to monitor any conflict between users of the estuary and report to Committee on any developments. 2. Moruya River to be the next estuary within the Batemans Bay NSW Maritime Patrol Area to be considered for a Boating Management Plan. NSW Maritime to report regularly to Committee. 3. NSW Maritime to report to the Committee on the status of development and implementation of the Clyde River Boating Management Plan. 4. NSW Maritime to monitor any long term changes in the location and extent of shoals that may arise due to climate change. The impact on navigation within the estuary, if any, is to be considered when preparing the Boating Management Plan. 5. Investigate impact of wakeboarding on shoreline erosion. If required, implement measures to manage wakeboarding activity to minimise further erosion.	NA
PCP-11	Coordinate with Eurobodalla Bush Fire Management Committee to update the Eurobodalla Bush Fire Risk Management Plan to incorporate recommendations contained in the Draft Rural Lands Strategy (November 2005) by Council and the report, "Riparian Corridor Objective Setting for Selected Streams between Batemans Bay and Moruya" prepared by DNR and ESC (in Draft, September 2005).	- Protect and restore riparian vegetation - Increase connectivity of foreshore habitats (wildlife corridors) - Provide for sustainable development of the estuary - Resolve conflicts between development controls and other policies	M	1. Update the Plan to exclude the Core Riparian Zone and Vegetated Buffer from the Asset Protection Zone for new developments meaning that vegetation clearing is not permitted for asset protection or strategic fire management within: - 100 metres of the shore of Moruya River (Category 1); - 50 metres of the shore of Wamban Creek (Category 1); - 40 metres of the shore of Malabar, Dooga, Gilmores, Candoin, Mogendoura, or Racecourse Creeks and other unnamed creeks (Category 2); and, - 20 metres of the shore of other minor streams (Category 3). 2. Representative from Eurobodalla Bush Fire Management Committee to report to Estuary Management Committee when Plan has been updated.	
PCP-12	Ensure Council planning staff are briefed on the contents of the Moruya / Deua River Estuary Management Plan and are aware of the impacts of planning decisions on estuary water quality and recent changes in legislation and policies for urban development along the estuary.	- Maintain existing good water quality - Provide for sustainable development of the estuary - Promote sustainable industry for the catchment and floodplain - Improve education and awareness of estuary issues	M	1. Strategy to target new staff arriving at Council. 2. Undertake training activities every 6 months, including a one-day seminar and distribution of a brief training manual.	Done but not monitored or updated
PCP-13	Increase enforcement of restrictions on camping in the Moruya River riparian zone. Program to target areas adjacent to North Head Camping Area and the rehabilitated reserve near the mouth of Ryans Creek.	- Reduce and prevent further sedimentation of the estuary - Protect and restore riparian vegetation - Maintain existing good water quality - Tighter enforcement of development controls - Promote sustainable tourism for the estuary	M	1. Undertake survey and site inspections to determine and document the most popular sites for illegal camping. 2. Erect up to 30 new signs at identified sites to warn campers of penalties against illegal camping activities and illegal overnight stays. 3. Incorporate camping exclusion zone along the foreshore in the vicinity of North Head on Council's existing brochure: 'Bush Camping by the Beach'. 4. Increase patrolling by Council Rangers at the documented target sites, particularly during warmer months and in the evenings. 5. Refer **Strategy BFR-1** in Bank and Foreshore Rehabilitation Plan.	Ongoing
PCP-14	Purchase / obtain access to 30 metre wide strip of riparian land on the foreshore of Moruya River upstream from the River Breeze Caravan Park. Acquirement of land would allow connectivity of the foreshore reserve between Moruya Bridge and Glenduart Reserve, thereby allowing **Strategy OGW-7** to be implemented.	- Protect and restore riparian vegetation - Increase connectivity of foreshore habitats (wildlife corridors) - Improve foreshore access and facilities for recreation - Restrict stock access to foreshore and wetland areas	L	1. Investigate options to establish easement across land or negotiate access without changing land tenure. 2. If required, negotiate with landholders to determine a suitable price for purchase of the land and the provision of any works to move stock fencing. 2. Purchase / acquire land and undertake any required works.	Not commenced and unlikely to proceed

* Cost estimates are based on Patterson Britton & Partner's experience and judgement as a firm of practising professional engineers familiar with the construction industry.
Cost estimates can NOT be guaranteed as we have no control over Contractor's prices, market forces and competitive bids from tenderers.
Cost estimates may exclude items which should be considered in a cost plan. Examples of such items are design fees, project management fees, authority approval fees, contractors risk and project contingencies (*e.g. to account for construction and site conditions, weather conditions, ground conditions and unknown services*).
Cost estimates by Patterson Britton & Partners are not to be relied upon. If a reliable cost estimate is required, then an appropriately qualified Quantity Surveyor should be engaged.

TABLE 4: ON-GROUND WORKS - IMPLEMENTATION SCHEDULE (REFER FIGURES 7 AND 8)

ITEM	RECOMMENDED STRATEGY	OBJECTIVES TARGETED	PRIORITY RANKING	ACTIONS	Progress	PROJECTED DATE FOR COMMENCEMENT
OGW-1	Maintain rock protection walls along the lower estuary.	- Rehabilitate eroded sections of the riverbank and damaged sections of existing bank stabilisation works - Reduce and prevent further sedimentation of the estuary - Protect and restore riparian vegetation - Improve foreshore access and facilities for recreation - Consider and manage the impacts of climate change on estuary processes	H	1. Develop procedures and determine locations for assessment of the condition of rock protection walls. 2. Undertake survey and assessment of existing rock walls. 3. Identify and prioritise sites for rehabilitation works. 4. Develop concept and detail designs for high priority rehabilitation works. Impacts on riparian vegetation should be considered. 5. Seek funding to undertake high priority rehabilitation works. 6. Future maintenance works are to consider the potential impacts of climate change on the structural stability of the walls and management response is to be adjusted accordingly.	Ongoing – flood program funding has been applied adjacent to bridge on Nth shore	2009
OGW-2	Repair or replace Quarry Wharf.	- Improve foreshore access and facilities for recreation - Promote sustainable tourism for the estuary - Protect and restore Aboriginal and European heritage	H	1. Council to assess Development Application by Dept of Lands to demolish Quarry Wharf. 2. If DA is approved, Council to take ownership of the site once wharf has been demolished. Apply to NSW Maritime for funding assistance to construct pontoon wharf for recreational boating. 3. If DA is denied on the grounds of heritage value, negotiate with Dept of Lands for restoration of the wharf prior to Council taking ownership.	complete	2009
OGW-3	Construct a boardwalk through Ryans Creek wetland to consolidate pedestrian access and protect riparian vegetation.	- Improve foreshore access and facilities for recreation - Protect and restore riparian vegetation - Promote sustainable tourism for the estuary - Protect and restore Aboriginal and European heritage	M	1. Develop concept design for boardwalk alignment and construction features. Incorporate future plans to extend the cycleway from South Head to Moruya which would involve a bridge over Ryans Creek (refer **Strategy IR-7**). 2. Consult with community and Local Aboriginal Land Councils regarding concept design. 3. Undertake environmental assessment of the proposed works and seek funding and approvals. 4. Prepare detail design and construct boardwalk.	Not commenced	2010
OGW-4	Formalise foreshore facilities and close informal boat ramp at popular recreation area on North Head Drive, 600 metres west of Malabar Weir.	- Improve foreshore access and facilities for recreation - Promote sustainable tourism for the estuary - Reduce and prevent further sedimentation of the estuary	M	1. Develop concept design to formalise facilities for the area between North Head Drive and the existing natural beach on Moruya River. 2. Liaise with recreational users of the beach, particularly waterskiing families, to obtain feedback regarding the concept design. 3. Undertake works to formalise the gravel parking area beside North Head Drive and to provide garbage bins near the foreshore. Bollards or boulders to be installed to restrict access the existing beach by vehicles that currently use it for launching boats.	Not commenced	2012
OGW-5	Seek funding to remediate high priority fish barriers in the Moruya River catchment, as identified in the report by NSW DPI titled, *'Reducing the impact of road crossings on aquatic habitat in coastal waterways - Southern Rivers, NSW'* .	- Understand, sustain and improve fish productivity in the estuary - Protect and preserve aquatic habitats (including seagrasses and saltmarsh) - Maintain existing good water quality - Consider and manage the impacts of climate change on estuary processes	M	1. Obtain details of the causeway assessments and recommendations for each priority site from Department of Primary Industries. 2. Prepare concept designs for additional culverts or a bridge at the Neringla Road causeway at Telowar Creek. 3. Prepare concept designs for increasing the size of culverts at the Dwyers Creek Road crossing of Candoin Creek. 4. Designs are to consider the impacts of climate change on fish passage, including migration of fish habitat as a result of changed flow regimes and sea level rise. 5. Seek funding to undertake detail design and construction of proposed remediation works.		2012
OGW-6	Install vessel pump-out facilities, potentially at Moruya Town Wharf.	- Promote sustainable tourism for the estuary - Maintain existing good water quality - Improve foreshore access and facilities for recreation	M	1. Determine the best location and layout for facilities, including wastewater pump-out, fuel supply and water supply. 2. Undertake a comprehensive environmental impact assessment for the potential facilities, including the impact of accident scenarios and spills on water quality and aquatic life. This is also to include consideration of the increased vessel traffic along Moruya River resulting from the facilities. 3. Undertake consultation with local community regarding the proposed facilities. 4. Subject to environmental approval and community feedback, prepare designs for the proposed systems. 5. Construct facilities and associated infrastructure such as footpaths and amenities.	Not commenced – unlikely to occur	2012
OGW-7	Construct a combined pedestrian walkway and cycleway along north bank of Moruya River between River Breeze Caravan Park and Glenduart Riverside Reserve (2.4 km).	- Improve foreshore access and facilities for recreation - Protect and restore riparian vegetation - Promote sustainable tourism for the estuary - Maintain and enhance visual aesthetics and quiet rural lifestyle	L	1. Construction of walkway/cycleway will require permission from the Crown and will be subject to obtaining access to private property along the foreshore (refer **Strategy PCP-14**) or will require permission from landholders. 2. Investigate methods and materials to construct walkway/cycleway along foreshore with alignment not further than 5 metres landward from the existing fence between riparian vegetation and privately owned / leased land. 3. Provide formalised access to viewing platforms at the foreshore every 500 metres. 4. Undertake works in conjunction with vegetation management activities in the riparian zone (refer **Strategy BFR-9**). Ensure that works do not impact on existing or future riparian vegetation.	Not commenced – relies on purchase of private land. Unlikely to happen..	2013
OGW-8	Offer incentives to landholders at Mogendoura to provide stock control measures to prevent stock access to the foreshore and natural beach on the north bank of Moruya River upstream from the confluence with Mogendoura Creek.	- Restrict stock access to foreshore and wetland areas - Protect and restore riparian vegetation - Reduce and prevent further sedimentation of the estuary - Improve foreshore access and facilities for recreation	L	1. Determine whether stock access is causing significant degradation of the riparian vegetation and the natural beach. 2. If required, encourage landholders to enter into Property Vegetation Plans with SRCMA under the Eurobodalla Biodiversity Program (refer **Strategy ECI-4**). 3. If suitable, install stock fencing to prohibit stock access to the foreshore and natural beach.	Previously CMA and now LLS have worked with some of these landholders	2013
OGW-9	Incorporate canoe / kayak launching area into Yarragee Reserve Plan of Management (September 2006).	- Improve foreshore access and facilities for recreation - Protect and restore riparian vegetation - Promote sustainable tourism for the estuary	L	1. Update the works schedule detailed in the Plan of Management to provide a foreshore pathway with sufficient width to allow pedestrian transport of recreational water craft to the beach. 2. Prevent vehicular access to the beach by installing bollards at the widened pathway. Undertake revegetation works as shown in the landscaping plan from the Yarragee Reserve Plan of Management. 3. Council's Environment Team to report to Committee to provide updates on the status of work at Yarragee Reserve.	Not needed. Beach area is good launching site.	2013

TABLE 4: ON-GROUND WORKS - IMPLEMENTATION SCHEDULE (REFER FIGURES 7 AND 8)

ITEM	RECOMMENDED STRATEGY	OBJECTIVES TARGETED	PRIORITY RANKING	ACTIONS	ESTIMATED COST	PROJECTED DATE FOR COMMENCEMENT
OGW-10	Install storage facilities for oyster growers at Pilot Station Backwater.	- Maintain and enhance visual aesthetics and quiet rural lifestyle - Promote sustainable industry for the catchment and floodplain - Protect and preserve aquatic habitats (including seagrasses and saltmarsh) - Improve foreshore access and facilities for recreation	L	1. Undertake consultation with oyster spat farmers at Pilot Station Backwater to determine the likely demand for small-scale storage facilities for oyster growing materials. 2. Undertake general consultation with the community at Moruya Heads to gauge public support for the installation of storage facilities. 3. If required, apply for funding to erect up to five small storage structures. It is envisaged that the dimensions of facilities would not exceed 2 metres in length/width and 1.5 metres in height. Facilities should be permanently fastened to the ground to avoid theft, vandalism and loss of materials.	Discuss with growers. Most are not punt based and don't require storage and sheds.	2014
OGW-11	Install BBQ facilities at Yarragee Reserve and Ryans Creek Parkland adjacent to proposed carpark and wetland areas.	- Improve foreshore access and facilities for recreation - Promote sustainable tourism for the estuary - Protect and restore Aboriginal and European heritage	L	1. Investigate feasibility of installing appropriate gas BBQ facilities. 2. Install up to three BBQs at each location to compliment low key level of amenities such as bins and park furniture, to be installed at Yarragee Reserve and Ryans Creek Parkland in accordance with the relevant Plans of Management.	No longer relevant	2014

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TABLE 5: INVESTIGATION AND RESEARCH - IMPLEMENTATION SCHEDULE (REFER FIGURE 9)

ITEM	RECOMMENDED STRATEGY	OBJECTIVES TARGETED	PRIORITY RANKING	ACTIONS	ESTIMATED COST	SUGGESTED RESPONSIBILITY	PROJECTED DATE FOR COMMENCEMENT
IR-1	Investigate the potential impacts of climate change on the Moruya River estuary.	- Consider and manage the impacts of climate change on estuary processes - Provide for sustainable development of the estuary	H	1. Monitor information from IPCC, CSIRO, DECC and other information relating to climate change predictions for the South Coast of NSW. 2. Work with state and federal governments, universities and industry groups to fund investigations into the potential impacts of climate change on the natural and built assets within and around the estuary.	$50,000	ESC and DECC	2009
IR-2	Undertake an audit of all foreshore structures on Moruya River and its tributaries, addressing the condition and legality of structures.	- Maintain and enhance visual aesthetics and quiet rural lifestyle - Improve foreshore access and facilities for recreation - Protect and restore riparian vegetation	H	1. DoL to undertake audit internally or commission independent party to undertake audit. 2. If required, independent party to undertake audit and report to Council and Dept of Lands. 3. Use results of audit to identify illegal structures, including any disused and derelict oyster leases. 4. Request that landholders appropriately modify or remove any illegal foreshore structures on their properties. 5. Remove illegal structures on public foreshore land with funding assistance from the Dept of Lands.	$12,000	ESC and Department of Lands	2009
IR-3	Undertake audit of stock fencing surrounding SEPP 14 Wetlands, Endangered Ecological Communities (*EECs*), mangroves and saltmarsh areas. Investigations to focus on wetlands and EECs at Malabar Lagoon, The Anchorage, Ryans Creek and Mogendoura Creek.	- Restrict stock access to foreshore and wetland areas - Protect and restore riparian vegetation - Reduce and prevent further sedimentation of the estuary - Maintain existing good water quality	H	1. Audit fencing and stock access at rural properties surrounding wetland areas. 2. If stock fencing found to be in need of repair or replacement on private land, encourage landholder to enter into a Property Vegetation Plan with SRCMA (refer **Strategy ECI-4**). 3. Repair or install appropriate stock fencing on public land if found to be inadequate. Seek funding assistance from SRCMA.	$25,000	ESC and SRCMA	2009
IR-4	Compile GIS mapping and information from all previous investigations and works to clearly identify existing Endangered Ecological Communities (*EECs*) within the Moruya River catchment.	- Increase connectivity of foreshore habitats (wildlife corridors) - Protect and restore riparian vegetation - Provide for sustainable development of the estuary	H	1. Council's GIS team to update all mapping for EECs, including the compilation and merging of previously estimated EEC extents and recently ground-truthed vegetation extents (ESC 2007c). 2. Council's GIS system to be updated to incorporate and display all works previously undertaken by Council and SRCMA to protect and rehabilitate areas of EECs. 3. Prepare report to show all current mapping for EECs and location of previous rehabilitation works. Report to also identify locations where ground-truthing is required for estimated EEC extents, and to prioritise the location and type of future on-ground works for Council and SRCMA to undertake.	$10,000	ESC and SRCMA (with assistance from DECC)	2010
IR-5	Undertake an audit of infrastructure within the Moruya River catchment, such as unsealed roads and tracks in order to identify point sources of sediment and pollutants.	- Reduce and prevent further sedimentation of the estuary - Maintain existing good water quality	H	1. Compile an inventory of all Council owned, National Parks and State Forests unsealed roads and tracks within the Moruya River catchment. 2. Develop criteria for assessment of infrastructure, such as soil type, site slope and potential for sediment mobilisation and proximity to waterways. 3. Undertake site inspections to audit and assess sites. 4. Use results of audit to develop a list of priority sites for erosion and sediment control works along roads and tracks. 5. As suggested by Fu, Field and Newham (2006), investment of funds for sediment control may be more effective within the Donalds Creek sub-catchment. 6. Apply for funding assistance from SRCMA to design and implement appropriate sediment control measures.	$30,000	ESC (with assistance from SRCMA and DECC)	2010
IR-6	Undertake audit of stock fencing along riparian zone between Princes Highway and tidal limit of Moruya River.	- Restrict stock access to foreshore and wetland areas - Protect and restore riparian vegetation - Reduce and prevent further sedimentation of the estuary - Maintain existing good water quality	H	1. Commission independent party to undertake audit of fencing for properties fronting Moruya River or the riparian zone. 2. If stock fencing found to be inadequate on private land, encourage landholder to enter into a Property Vegetation Plan with SRCMA (refer **Strategy ECI-4**). 3. Identify encroachments into and illegal use of public foreshore land. 4. Order cessation of illegal uses of public land. 5. Repair or install appropriate stock fencing on public land if found to be inadequate. Seek funding assistance from SRCMA.	$30,000	ESC and SRCMA	2010
IR-7	Investigate the feasibility of constructing a pedestrian / cycleway between Ryans Creek and Preddys Wharf as part of the cycleway linking South Head to Moruya Township.	- Improve foreshore access and facilities for recreation - Promote sustainable tourism for the estuary - Maintain and enhance visual aesthetics and quiet rural lifestyle	M	1. Prepare a preliminary concept design for the cycleway alignment. Take into account any previously cleared corridors through the Ryans Creek wetland, special design features such as a bridge over Ryans Creek and bank and foreshore management options identified in the Bank and Foreshore Rehabilitation Plan (refer **Appendix A**). 2. Investigate the social benefit of constructing the cycleway link by undertaking community consultation to gauge interest and support for the concept design. 3. Undertake a detailed assessment of the environmental impact of the cycleway and of the cost for construction, including for the bridge over Ryans Creek. 4. If found feasible, apply for further funding to undertake detail design and construction of the cycleway.	$25,000	ESC and DECC	2012
IR-8	Undertake investigations to determine the feasibility of installing additional boat moorings at North Head, and if appropriate, install moorings.	- Promote sustainable tourism for the estuary - Improve foreshore access and facilities for recreation	L	1. Develop basic concept design for mooring layout and access requirements. 2. Undertake environmental impact assessment for the proposed facilities, including the impact of moorings and increased boat traffic on valuable seagrass beds and water quality in the vicinity of North Head. 3. Undertake assessment of the impact of additional moorings from a planning perspective. 4. Undertake consultation with local community regarding the proposed facilities. 5. If there are no significant environmental impacts and community feedback is supportive, prepare detail designs for the proposed moorings. 6. Install moorings and construct associated infrastructure such as the access-way, gates and amenities.	$60,000	ESC and NSW Maritime (with assistance from DECC)	2013
IR-9	Undertake a detailed survey of the extent and concentration of benthic flora and fauna in the estuary downstream from Kiora Bridge.	- Understand, sustain and improve fish productivity in the estuary - Protect and preserve aquatic habitats (including seagrasses and saltmarsh)	L	1. Approach local Universities for any opportunities to undertake investigations as part of a undergraduate or post-graduate research project. 2. Use results from survey in conjunction with results from fisheries data gained through work for **Strategy M-3** to determine any potential impacts of benthic flora and fauna on fish habitats and therefore fish populations.	$20,000	DPI and ESC (with assistance from Universities, and DECC)	2014

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TABLE 6: EDUCATION AND COMMUNITY INVOLVEMENT - IMPLEMENTATION SCHEDULE (REFER FIGURE 10)

ITEM	RECOMMENDED STRATEGY	OBJECTIVES TARGETED	PRIORITY RANKING	ACTIONS	ESTIMATED COST	SUGGESTED RESPONSIBILITY	PROJECTED DATE FOR COMMENCEMENT
ECI-1	Prepare and distribute community education material that outlines the importance of estuary processes and details of permitted activities for Crown and Council land on the foreshore of Moruya River and its tributaries.	- Improve education and awareness of estuary issues - Maintain existing good water quality - Improve foreshore access and facilities for recreation - Protect and restore riparian vegetation - Consider and manage the impacts of climate change on estuary processes	H	1. Prepare information material containing a brief summary of estuary processes and the potentially adverse impacts of stormwater pollution, vegetation clearing and unapproved development on the health of the Moruya River Estuary. 2. Include examples of permitted and prohibited activities for public land at the foreshore to Moruya River and tributaries. Include graphics and photographs where appropriate. 3. Material is to include details of the penalties that offenders may face if they undertake prohibited activities and development works on public land, such as the construction of dams and fencing, without approval. 4. Material is to include commentary on the potential impacts of climate change and sea level rise on estuary processes, to raise awareness of climate change issues. 5. Deliver material in a variety of ways, including brochures and digital information on Council's website, when and where appropriate. 6. Conduct targeted education campaigns to specific audiences where appropriate, including at the North Moruya Industrial Estate and local schools.	$12,000	ESC MPA DECC SRCMA	2009
ECI-2	Develop a community education program targeted at riparian landowners to raise awareness of the importance of riparian vegetation.	- Improve education and awareness of estuary issues - Protect and restore riparian vegetation - Increase connectivity of foreshore habitats (wildlife corridors) - Consider and manage the impacts of climate change on estuary processes - Maintain existing good water quality	H	1. Prepare fact sheets and brochures that show examples of acceptable and prohibited vegetation clearing in the riparian zone. Include details of the penalties applicable for illegal activities and contact information to report illegal vegetation clearing. Periodically distribute fact sheets to riparian landholders. 2. Prepare and distribute a foreshore planting guide to inform riparian landholders of appropriate native species for the riparian zone. Digital copy to be made available on Council's website. 3. Prepare and distribute an information brochure to encourage riparian landowners to enter into Voluntary Conservation Agreements (VCA), Property Vegetation Plans or other conservation agreements, specifically targeted towards providing foreshore areas for landward migration of saltmarsh and other riparian vegetation in response to sea level rise (refer susceptible areas shown in **Figure 6**). 4. Conduct field days at demonstration sites to educate riparian landholders (and the greater community) on appropriate vegetation species and planting techniques.	$12,000 + $10,000 / year	ESC SRCMA Landcare DECC	2009
ECI-3	Review the format and terms of reference of the Moruya / Deua Estuary Advisory Committee with a view to create a Coastal Advisory Committee that incorporates the management of the Moruya / Deua River Estuary as well as the surrounding coastline.	- Proper implementation of the Estuary Management Plan will target all objectives	H	1. Appoint a Coastal Advisory Committee Coordinator under a part-time agreement, subject to work load. 2. Committee to meet annually to assess the progress of implementation of the Estuary Management Plan and determine works for the immediate future. 3. Committee Coordinator and relevant Committee members are to report on the status of specific projects and works.	$25,000 / year	SRCMA ESC	2009
ECI-4	Develop a targeted campaign to encourage rural landholders to enter into Property Vegetation Plans with Council and the Southern Rivers Catchment Management Authority as part of the Eurobodalla Biodiversity Program.	- Promote sustainable industry for the catchment and floodplain - Improve education and awareness of estuary issues - Reduce and prevent further sedimentation of the estuary - Restrict stock access to foreshore and wetland areas - Maintain existing good water quality - Consider and manage the impacts of climate change on estuary processes	H	1. Work with SRCMA to develop and distribute an information brochure that clearly outlines the process of developing and implementing a Property Vegetation Plan, including the level of funding and other incentives offered through SRCMA and Council. 2. Invite rural landholders within the Moruya/Deua River catchment to attend information nights and field days to demonstrate the benefits of entering into a Property Vegetation Plan. 3. Encourage landholders to enter into 10-year management agreements with Council and SRCMA.	$10,000 / year	SRCMA ESC Landcare	2009
ECI-5	Distribute copies of the Final Moruya / Deua Estuary Management Plan to local community groups and businesses to attract funding, sponsorship and volunteers.	- Improve education and awareness of estuary issues	H	1. Distribute copies of the final Estuary Management Plan (EMP) document to local community groups such as Landcare groups, Apex, Rotary and Scouts to call for volunteers to assist in semi-skilled works and non-technical investigations as part of the strategies detailed above. 2. Distribute copies of the EMP to local businesses to attract funding support or sponsorship to undertake the above strategies (or part thereof). 3. Make a digital copy of the EMP available on Council's website for any interested parties to download.	$3,000	ESC	2009

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Appendix D Audit of Wagonga Inlet Estuary Management Plan (Eurobodalla Shire Council, 2018)

5.1 Goal: to protect water quality within the inlet for human health and to maintain a healthy ecosystem

Objective: To gain a better understanding of water quality and compliance with guidelines

Strategy		Action	Priority	Responsibility	
Assess changes to water quality within Forsters Bay	1.1	Develop and implement water quality monitoring program (see **Section 6.1** for more details) including testing for chlorophyll-a (to assess ecosystem health) and bacteria (to assess compliance with ANZECC & NH&MRC guidelines for primary contact recreation – a sampling and analysis program currently exists for oysters as part of the NSW Shellfish Quality Assurance Program (SQAP).	high	**ESC**, DLWC, Wagonga SQAP	Ongoing program. Also estuary health reports

Objective: To minimise discharge of effluent from commercial and recreational vessels

Strategy		Action	Priority	Responsibility	
Increase awareness of appropriate means	1.2	Support initiatives to make holding tanks mandatory for commercial vessels.	high	EMC	RMS
of disposal of effluent from boats	1.3	Include information on boat pumpout facility in Forsters Bay when Waterways Map is revised.	medium	Waterways	

Objective: To improve the quality of run-off from urban and rural areas

Strategy		Action	Priority	Responsibility	
Ensure the inlet is not affected by seepage from septic tanks	1.4	Continue to carry out environmental audits of septic tanks within the catchment of the inlet to identify poor performance and any illegal discharges. Notify owners of required actions, eg desludging, pumpout.	high	ESC	Council has ongoing OSMS inspection program. Orders can be served to fix and maintain faulty systems.
	1.5	As part of the water quality monitoring program for Forsters Bay (see **Section 6.1**) include sampling sites to identify any changes to run-off/water quality due to the development of Ringlands Estate.	high	ESC	
Identify and address possible pollutant sources	1.6	Carry out an environmental audit of businesses around the inlet to identify practices which adversely impact on water quality – prepare educational package on appropriate site management practices (see **Section 6.1**).	medium	ESC	
	1.7	Continue actions to minimise sewer overflows at Narooma, eg pressure cleaning mains of tree roots, pump draw down tests.	ongoing	ESC	

Strategy		Action	Priority	Responsibility	
Manage land use/development to prevent accelerated input of sediments from the catchment	1.8	Encourage the formation of a Landcare group to assist in developing vegetated buffer zones around tributary creeks, as well as promoting erosion control, planting programs, exclusion of stock, protection of SEPP No. 14 wetlands, noxious weed control and feral animal control.	medium	**DLWC**, ESC, RLPB, EMC	Narooma Landcare group extended to new areas; Lewis Island group formed. LLS funded projects with private properties.
	1.9	Investigate improvements to maintenance/design of Tourist Drive 4 and Riverview Road including sealing sections of these roads where they cross major creeks to reduce sediment wash-off during storm events (already included in Council's roadworks program).	medium	ESC	Ongoing This is the source we noted near the old jetty
	1.10	Report any incidences of sediment laden run-off (and other water pollution) to ESC or EPA.	as they arise	members of EMC	Ongoing
Improve fish cleaning facilities	1.11	Upgrade existing tables and, depending on availability of services, provide lighting, wash down hose and rubbish bins for the disposal of fish offal and litter at Town Wharf and Apex Park.	high	ESC	Done. Boat ramp and facilities updated
Include additional guidelines relating to water quality in DCPs	1.12	When DCPs and Residential Design and Development Guidelines are updated include reference to erosion and sediment controls in 'Checklist' section for the lodgment of development applications.	medium	ESC	Not within scope of a DCP but council does inspect devt sites for compliance of sed controls.
	1.13	Prepare DCP which includes guidelines relating to development impacts on water quality.	medium	ESC	Done. WSUD incorporated in council guidelines

5.2 Goal: to ensure future development does not detract from the values of the inlet and is appropriately designed

Objective: To maintain the scenic views and vistas to and from Wagonga Inlet

Strategy		Action	Priority	Responsibility	
Provide visually unobtrusive viewing points around the inlet	2.1	As per *Narooma Foreshore and Townscape Masterplan* provide additional boardwalks/platforms to increase opportunities to view the inlet while minimising impacts on foreshore vegetation (see actions under **6.9** and **6.10**). Consult with LALC on route selection and siting of structures.	medium	ESC	
Encourage attractive building design compatible with the visual qualities of the inlet	2.2	Continue to promote existing residential design and development guidelines. Consideration could also be given to introducing annual Shire wide design awards.	ongoing	ESC	
	2.3	Develop DCP for Coastal Villages which includes attractive building design guidelines for foreshore areas.	high	ESC Coastal design guide	

Objective: To ensure development is compatible with natural hazards

Strategy		Action	Priority	Responsibility	
Increase awareness of flood hazard in the Narooma 'flat area'	2.4	Review design floor levels and development controls in view of the results of the *Wagonga Inlet Flooding Investigation* (GBA 1999).	high	ESC	Done and underway. FS complete. FRMSP
	2.5	When DCPs and Residential Design and Development Guidelines are updated include reference to flood protection.	medium	ESC	

5.3 Goal: to conserve the natural ecological communities and their component flora and fauna

Objective: To increase awareness of the values of natural communities in general and, in particular, the habitat values of wetlands

Strategy		Action	Priority	Responsibility	
Provide information on natural communities and component species	3.1	Develop community education program that includes information on the protection of shorebirds, migratory species and wetlands and management of vegetation communities.	medium	**NPWS**, **ESC**	Ongoing community education through Landcare events, enviro education stalls and workshops
Publicise the link between mangroves and seagrasses and fish numbers	3.2	Include information on the fish nursery and habitat values of mangroves and seagrasses in interpretive signage for proposed boardwalk off Riverside Drive at Forsters Bay (see **6.9**).	high	**ESC**, Fisheries	
	3.3	Where mangrove clearing is evident, letter-box drop foreshore residents with information from NSW Fisheries habitat management and fish conservation guidelines and details of penalties for illegal clearing.	as required	Fisheries	Not done (Was this an issue?)Illegal clearing issues dealt with through ESC and EPA processes
Monitor changes in mangroves and seagrasses	3.4	Install survey markers to identify changes in the extent of mangroves (possible student project).	medium	**EMC**, ESC, Fisheries	Need to liaise with MPA. May have been commnenced?
	3.5	Repeat seagrass surveys (Forsters Bay beds a priority) to monitor health (as an indicator of nutrient levels) and changes in distribution. See **Section 6.1** for more details.	medium	**EMC**, ESC, Fisheries	Macrophyte mapping completed 2016

Objective: To appropriately manage aquatic resources

Strategy		Action	Priority	Responsibility	
Control infestations of the Pacific Oyster	3.6	Continue to regularly inspect leases and rocky foreshores and remove Pacific Oysters to protect the existing aquaculture industry from the problems experienced in other NSW estuaries. Liaise with Navy divers to provide assistance.	medium	**Fisheries**, Wagonga Oyster Farmers	volunteers have cleared but the program may not have continued

Strategy		Action	Priority	Responsibility	
Collect base-line data on recreational fishing	3.7	Undertake recreational fishing survey to gain an understanding of the magnitude of the recreational finfish catch and harvesting of intertidal animals. Liaise with universities as possible student project.	low	**Fisheries**, EMC, SGFC	Check with Sham
Encourage clean-up of areas around oyster leases	3.8	Include particular problem areas (eg walking track from Ringlands Point) in 'Clean up Australia' day program and liaise with oyster farmers to gain their participation.	high	**ESC**, Fisheries, Wagonga Oyster Farmers	Marine Debris clean ups undertaken by various groups, ongoing
Ensure cockle collection does not adversely impact on aquatic habitats	3.9	Continue to employ gathering practices which do not impact adversely on strapweed beds. Continue to assess the feasibility and sustainability of cockle collection within the estuary.	high	**Fisheries**, commercial fisher	**?**

Objective: To provide a vegetated buffer zone around the entire inlet

Strategy		Action	Priority	Responsibility	
Preserve bushland around Wagonga Inlet	3.10	Investigate mechanisms to impose harsher penalties for breaches of development consent and Council's Tree Preservation Order relating to clearing of bushland on Ringlands Estate.	high	ESC	Ongoing
Control damage to vegetation resulting from vehicle access	3.11	Close track on Crown Reserve adjoining Ringlands Estate to private vehicles. Maintain as emergency bushfire access, access for weed control and walking track.	high	ESC	Ongoing
Actively manage remnant bushland of conservation significance	3.12	Develop bushland management plan and weed control program for the rainforest at Flying Fox Bay and remnant vegetation at the northern end of Mill Bay.	medium	ESC	Initial work done, and bush regen ongoing maintenance
Increase the extent of foreshore buffer zones	3.13	As per Council's Policy, continue to pursue opportunities to transfer foreshore land into public ownership through conditions of development/subdivision consent, for: - land zoned 2ec around Forsters Bay - land zoned Rural 1(a) around Barlows and Clarks Bays, Freshwater Bay/Paradise Point, and between Honeymoon Point and Hobbs Point - land zoned "Further Investigation for Rural C" between Brices Bay and Punkally Creek.	ongoing	ESC	1 swap of road reserve for foreshore land
	3.14	Change zoning of unused road reserves around inlet to 6(a) eg: - road reserve on south-western side of Forsters Bay.	low	ESC	Not done
	3.15	Rezone SEPP 14 wetland No. 126 (between Punkally and Burrimbidgee Creeks) to 7(a) Environmental Protection - Wetland	high	ESC	

Strategy		Action	Priority	Responsibility	
Increase the extent of foreshore buffer zones (continued)	3.16	Map riparian buffer zones in Rural 1(c) small holdings zones for better protection.	high	ESC	
	3.17	In conjunction with current/future review of LEPs consider introduction of an environmental protection zone for riparian buffers, shorebird nesting and feeding areas, regionally uncommon vegetation and wildlife corridors.	as arises	ESC	Foreshore land in public ownership is predominantly E2. Parks and open space are RE1 Public Open space.

Objective: To encourage community participation in the management of foreshore reserves

Strategy		Action	Priority	Responsibility	
Establish volunteer bush regeneration group(s)	3.18	Develop a program for weed control along the Princess Highway/Centenary Drive (as per *Masterplan*) and advertise/approach existing community groups for volunteers to become involved. Resources may also be available through the Green Corps and Natural Heritage Trust. Extend program to other areas as interest develops.	medium	ESC	Done and ongoing

5.4 Goal: to protect and increase recognition of Aboriginal and European heritage

Objective: To increase awareness of Aboriginal and European sites and local history

Strategy		Action	Priority	Responsibility	
Continue to develop and seek sponsorship for walking track brochures	4.1	Prepare Narooma Town/Bar Rock brochure (funding has been received).	high	**HS**, ESC	
Develop design guidelines and program for the installation of interpretive signs	4.2	Install interpretive signs at: - points of interest along *Mitchell's Mill Walk and Ringland's Rotary Walk* - log ramp (skids) at Wagonga Picnic Area - at points of interest along proposed Narooma Town/Bar Rock walk – develop major interpretive signage for Rotary Park covering both Aboriginal and European heritage (including *Lady Darling* wreck).	medium	**ESC**, HS Forests HS, LALC, **ESC**, NPWS	Underway – Eurobodalla signage strategy

Objective: To prevent deterioration of Aboriginal middens and other archaeological sites

Strategy		Action	Priority	Responsibility	
Maintain involvement of LALC in foreshore/catch-ment works	4.3	Refer to recommendations contained in Navin Officer (1997) and continue to involve Aboriginal sites officer in the planning for, and construction of, foreshore paths and other recreational facilities (eg proposed access from Mill Bay to Apex Park), as well as logging operations/management of Bodalla State Forest.	ongoing	**ESC**, NPWS, **Forests**	**Ongoing**
Protect middens and other sites	4.4	Investigate means to address erosion of the midden at the Wagonga Picnic Area and other sites as necessary.	as needed	**LALC**, **Forests**	LALC may have done this. Need to follow this up with OEH Narooma.

Objective: To conserve the remains of early European settlement and industry

Strategy		Action	Priority	Responsibility	
Ensure access is available to heritage relics for conservation, and where appropriate, interpretation	4.5	Liaise with property owner to gain access to Wagonga Cemetery to repair fence and headstones as and when required.	high	**ESC**, HS	

5.5 Goal: to improve boat navigation and safety

Objective: To maintain navigation channels

Strategy		Action	Priority	Responsibility	
Assess adequacy of navigation channel depths and impacts of shoaling	5.1	Monitor channel depths (by depth sounder) upstream and downstream of the bridge and provide regular reports to the EMC.	high	RMS	ESC has contacted RMS/Crown about dredging. 50% grants available but Crown will dredge to extent of servicing their own wharf.
	5.2	Provide detailed channel surveys (including channel at Shell Point) and depth comparisons at appropriate intervals.	high	DLWC	

	5.3	Monitor continuing sand intrusion into Forsters Bay and its impacts on Taylors Boatramp and adjacent private jetties. This is to include details on the frequency and volume of sand removed from the boatramp by Council.	high	DLWC, ESC	Not done
Maintain adequate depths for commercial and recreational vessels to enter Forsters Bay	5.4	Remove rocks at danger buoy, downstream of the highway bridge.	high	**Waterways**, **DLWC**, ESC	RMS/Crown approached.
	5.5	Review need for dredging navigation channels. If required, prepare environmental impact assessment report. See **Section 6.2** for more details.	high (ongoing)	**ESC**, DLWC	**See above.**

Objective: To improve boat safety awareness

Strategy		Action	Priority	Responsibility	
Improve dissemination of information on bar conditions and boat safety	5.6	Continue to include articles on correct procedures for putting to sea and crossing the bar in the *Narooma News*, *This Month on the Sapphire & Eurobodalla Coast* and other tourist/fishing publications.	ongoing	**RVCP**, ENC, Fisheries, **Waterways**, CoC	**Not our scope or problem**
	5.7	Prepare and distribute information on boating safety tips (such as those prepared by the RVCP in the past) so that they are available at caravan parks, motels and other tourist accommodation.	high	**RVCP**, CoC, **Waterways**	
	5.8	Explore opportunities for the implementation of a trial 'bar watch' system including dissemination of information via digital display boards and hazard ranking lights. See **Section 6.1** for more details. Funding assistance for this system may be available under Waterway's Asset Development and Management Program (WADAMP).	high	ESC, RVCP, **Waterways**	
	5.9	Explore opportunities for repair of Old Pilots Wharf for use by RVCP, subject to funding availability (works to be sympathetic to heritage significance of structure and could include interpretive signage).	high	**RVCP**, Waterways	

5.6 Goal: in keeping with conservation values, ensure equitable use of the inlet's waterway and recreational resources

Objective: To balance the commercial and recreational uses of the inlet

Strategy		Action	Priority	Responsibility	
Maintain open water areas within the inlet for recreational boating and visual amenity	6.1	Continue current closure on new leases. Assessment of applications to the Minister for relocation of silted leases to take account of areas of ecological significance (see **Figures 3.1a** and **3.1b**), navigation channels and access to/from boat launching and foreshore picnic areas.	as arises	Fisheries	Not done
	6.2	Prepare mooring plan for Wagonga Inlet (with input from EMC and with reference to areas of ecological significance, see **Figures 3.1a** and **3.1b**) identifying existing/future mooring areas (public/private) and the maximum number of moorings per area.	high	Waterways	Not commenced

Objective: To promote foreshore facilities that cater for commercial, tourism and public use

Strategy		Action	Priority	Responsibility	
Extend Town Wharf	6.3	Prepare design report for the extension of Town Wharf towards the swimming pool. Include boat pumpout facilities, see **Section 6.1** for more details. A preliminary concept showing public/commercial space is shown in **Figure 5.1**. Funding may be available through the Federal Government's Regional Assistance Program. DLWC and Waterways funding is available for public wharves.	high	ESC, DLWC, commercial operators, Waterways	

Objective: To address potential conflicts between recreational users and between recreational use and ecological values/commercial use of the inlet

Strategy		Action	Priority	Responsibility	
Manage boating to avoid conflicts	6.4	Review existing boating controls and impacts of vessel operation with reference to **Figures 3.1a** and **3.1b**, areas of ecological significance.	in hand	**Waterways**, EMC, ESC	
	6.5	Implement appropriate boating controls (and associated advisory/educational signage at boat launching areas) based on the following principles: - reduced boat speeds upstream of Honeymoon Point to minimise boat wash, effects on oyster leases, SEPP No.14 wetlands and other sensitive foreshore lands - no anchoring in seagrass beds - reduced boat speeds over large beds of strapweed *Posidonia australis* (see **Figure 3.1a** and **3.1b**) - reduced boat speeds (ie noise levels) adjacent to areas of ecological significance consistent with use as passive recreational areas.	medium	Waterways	Some of these have been done – noticed restrictions when we did surveys
Manage foreshore reserves in accordance with their ecological values	6.6	Development of reserves identified as being of ecological significance to be restricted to low impact recreational and educational activities, eg bushwalking, nature study and only basic facilities to be provided, ie unsealed walking tracks, 'bushland' picnic areas.	medium	ESC	Recreational and Open Space Strategy completed
	6.7	Consider exclusion of dogs from areas of high native animal habitat value (eg shorebird breeding and feeding areas) and exercise of dogs on-leash only, in other areas of ecological significance.	high	ESC	Companion Animals Management Plan in development
Encourage responsible dog exercising	6.8	Monitor impacts of off-leash dog exercise on passive use of reserves. Consider installation of 'dog litter bins'.	ongoing	ESC	

Objective: To improve public facilities and foreshore access to the inlet

Strategy		Action	Priority	Responsibility	
Provide viewing/fishing platforms and boardwalks	6.9	As per the *Narooma Foreshore & Townscape Masterplan* install mangrove boardwalk off Riverside Drive.	medium	ESC	Not commenced – leave in.
	6.10	As per *Masterplan* construct walkway under bridge and extend *Masterplan* to north-western side of bridge (old ferry approach) to address bank erosion, formalise area for fishing/viewing and provide interpretive sign. See **Section 6.1** for indicative costs per metre for boardwalks.	low	ESC	Done on Northern shore (walkway under bridge)
Provide more public jetties	6.11	Reconstruct existing jetty at Ringlands Point (note that open mesh decking would be required to minimise impacts on strapweed beds (Posidonia australis)	high	ESC	Change to Remove Jetty. Currently junk.
	6.12	Construct jetty, provide fish cleaning table, wash down hose, lighting and bins and formalise and seal carpark to southern boat ramp at Forsters Bay Funding is available through DLWC and Waterways programs for public wharves and jetties. Indicative costs per metre are provided in **Section 6.1**.	low	ESC	Boatramp and carpark is good but will need to field validate other actions
Improve access for launching sailboats etc	6.13	Widen sand ramp near NSW Fisheries building so more than one boat can be launched at a time.	high	**ESC**, SC	This won't happen. Difficult access for reversing**.** Alternative at sth end of Forsters Bay.