Final Report

Coastal Management Program for the Woolgoolga Region Estuaries

The City of Coffs Harbour

21 June 2023

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ACKNOWLEDGEMENT OF COUNTRY

The City of Coffs Harbour and Water Technology acknowledge the traditional custodians of the land, the Gumbaynggirr people, who have cared for this land since time immemorial. We pay our respects to their elders, past, present, and emerging, and commit ourselves to a future with reconciliation and renewal at its heart.

EXECUTIVE SUMMARY

Overview of the CMP

The estuaries of Darkum Creek, Woolgoolga Lake, Willis Creek and Hearnes Lake (hereby referred to as the "Woolgoolga Region estuaries") provide a wide range of social, cultural, environmental and economic benefits for the Coffs Harbour region.

Situated within the bounds of the Solitary Islands Marine Park and adjacent to Coffs Coast Regional Park, these Intermittently Closed and Open Lakes and Lagoons (ICOLLs) provide a stunning natural environment, a multitude of recreational opportunities and are a cornerstone of the coastal lifestyle that is so highly valued by the local community and visitors alike. They are also part of a wider coastal zone that supports the regional economy as a pillar of tourism, and a vital resource for a growing agriculture sector.

However, the estuaries are facing increasing pressures from natural hazards, urban development, upper catchment agricultural land usage, and climate change. In order to address these risks, a Coastal Management Program (CMP) has been prepared for the estuaries, in line with the NSW Coastal Management Framework.

The Woolgoolga Region Estuaries CMP comprises a program of integrated management actions that are intended to address key issues, and harness new opportunities. It outlines specific actions that are to be implemented over a forward 10-year management timeframe. In doing so, the CMP seeks to achieve the objects of the *Coastal Management Act 2016* (CM Act), and preserve the social, cultural, economic and environmental values of the estuaries.

This program has been developed in accordance with the five-stage process for developing and implementing a CMP, as detailed in the Coastal Management Manual (OEH, 2018a). The completed stages supporting this CMP include the preparation of:

- ***Stage 1**: Woolgoolga Region Estuaries Stage 1 – Scoping Study Report* (Water Technology, 2020): This included a review of relevant background information, a first pass risk assessment, a data gap analysis, and formulation of a plan for the CMP development.
- ***Stage 2**: Woolgoolga Region Estuaries CMP Stage 2 – Risks, Vulnerabilities and Opportunities Report* (Water Technology, 2021a): This included a detailed assessment of the various threats and risks affecting the environmental, social and economic assets and values of the estuaries.
- ***Stage 3**: Woolgoolga Region Estuaries CMP Stage 3 – Identify and Evaluate Options Report* (Water Technology, 2021b): This included stakeholder engagement and options analysis in order to identify and prioritise coastal management actions that can effectively address issues and risks, take advantage of opportunities, and give effect to the objectives of the CM Act.

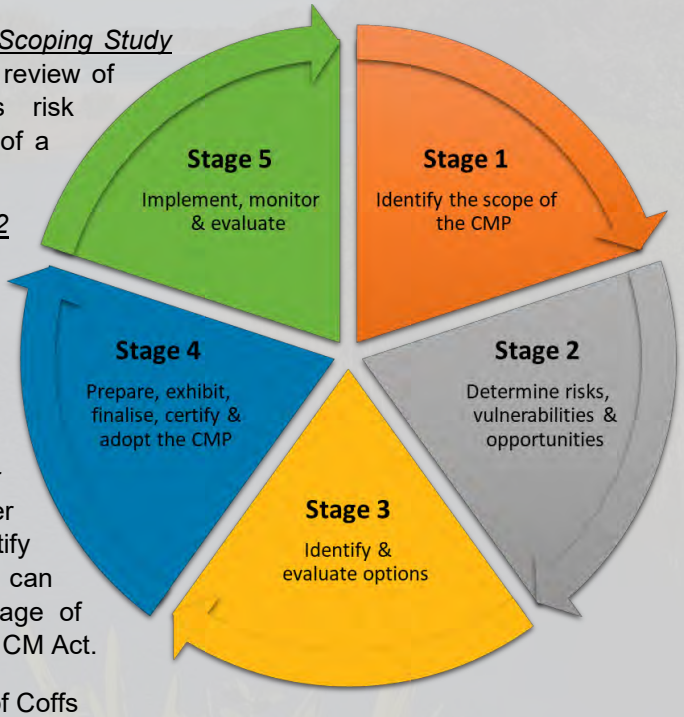

Figure EX-1 The CMP process

This document has been prepared on behalf of the City of Coffs Harbour (the City) with funding and technical support from the NSW Department of Planning and Environment (DPE), and in consultation with various state agencies and other relevant stakeholders.

The Woolgoolga Region Estuaries

The CMP covers and applies to the coastal zone (as legally defined in the CM Act and the State Environmental Planning Policy (Resilience and Hazards) 2021) of the estuary waterways and foreshores of:

- Darkum Creek
- Woolgoolga Lake
- Willis Creek
- Hearnes Lake

The estuaries are all classified as ICOLLs, and go through periods where their entrances can be either closed or open to the ocean. The state of the entrance is based on the balance between coastal processes that act to fill the entrances with marine sand, and catchment-based processes that act to periodically scour them out. Like many ICOLLs, they are highly complex (and sensitive) hydrological and ecological systems, and are heavily impacted by the various forms of land use across their contributing catchments.

Figure EX-2 Darkum Creek

The Woolgoolga Region Estuaries are highly valued for the natural ecosystems and biodiversity values they provide. The extensive range of aquatic and riparian habitat across the estuary systems includes mangroves, seagrass beds, saltmarsh, oyster reefs, and intertidal rocky shores. These habitats support a diverse assemblage of ecosystems including species of fish, crustaceans, birds, reptiles and mammals. This habitat value is crucial, as it is estimated that 70% of coastal fish species in south-eastern Australia need to move through estuaries to complete their life cycle (Copeland & Pollard, 1996). Community consultation undertaken as part of this study identified that the biodiversity and water quality of the study area are highly valued by the local community.

The foreshore areas and waterways of the estuaries provide spectacular scenic amenity and a vast array of recreational opportunities for locals and visitors alike. This includes water-based activities such as kayaking, canoeing and fishing, as well as land-based recreational activities such as exercise, nature observation, and relaxation. The estuaries also for part of the Solitary Islands Marine Park, which possesses wider touristic and educational value.

Figure EX-3 Woolgoolga Lake

Land use across the various estuary sub-catchments is diverse. The lower catchments of the estuaries are typically occupied by urban centres, comprising residential zones and some industrial lands, whilst the upper catchments flowing into each estuary comprise significant areas of National Park, State Forest bushland, and a growing agricultural sector - comprised largely of intense plant

agriculture (IPA). The IPA sector is a significant contributor to the local economy and a major employer across the region. The estuaries and their tributaries provide irrigation water supply for agricultural producers across the catchment, and play an important role in ensuring adequate water quality for agricultural use. The estuaries themselves are also utilised by the commercial and recreational fishing industries – and healthy estuaries critically underpin these local industries.

The estuaries also possess a rich and continuing Aboriginal cultural heritage, with cultural history extending back more than 40,000 years. The coastal zone has high cultural and spiritual significance to its traditional owners, and Aboriginal cultural heritage across the study area is dynamic, comprising both physical (tangible) and non-physical (intangible) elements.

Vision and Objectives for the CMP

A local vision statement has been developed for the CMP to help stakeholders identify with the future of the four estuaries, and foster commitment to its implementation. The Vision for the CMP is:

"To provide strategic direction and specific focus for the short and long-term sustainable management of Darkum Creek, Woolgoolga Lake, Willis Creek and Hearnes Lake – in order to preserve and enhance their social, cultural, economic and environmental values"

A suite of objectives has been developed for the CMP, in order to ensure that the program recognises and protects the environmental, social, cultural and economic values of the study area. These objectives have been developed ensuring consistency and alignment with a range of local, regional, and state policies and plans – including the CM Act.

Key Management Issues

The various issues affecting the health and amenity of the Woolgoolga Region Estuaries have been assessed in detail in Stage 2 of the CMP. Key management issues include:

- *Coastal inundation:* There are a number of communities around the various foreshores of the study area that are affected by event-based inundation – including tidal inundation ("sunny-day flooding"), catchment based flooding, and coastal storm tide inundation. Inundation impacts are expected to become both more severe and more frequent over time due to the impacts of climate change and sea level rise.
- *Water quality*: Being ICOLLs, water quality within these estuaries is particularly vulnerable to catchment runoff, as they lack the mechanism of regular tidal flushing when the estuary entrances are closed. Water quality grades from The Northern Rivers Aquatic Ecosystem Health Monitoring Program (Ecohealth) have indicated that water quality in the study area has historically been rated as poor to moderate, and is influenced by:
  - *Urban and industrial runoff:* Which may contain a range of pollutants, including sediment, nutrients, heavy metals, hydrocarbons, chemical compounds and gross pollutants. While the study area catchments are relatively small, the intensity of urban development within them has the potential to impact the sensitive receiving systems of the estuaries.
  - *Agricultural runoff*: The overall proportion of agricultural land usage across the estuary catchments is high, and the historical impacts of agricultural runoff to these estuaries over many decades has affected the water and sediment quality. Agricultural land usage can result in the export of a range of potential contaminants to waterways including nutrients, herbicides, pesticides, sediment and organic matter. Further complicating this issue is the use of recycled water from the City's "purple pipe" recycled water distribution network across the Coffs Harbour LGA. Irrigation with recycled water can result in excess nutrient loads being directed in the estuaries, due to the cumulative impacts of fertigation and the build-up of nutrients from multiple farming systems.

- *Water extraction:* Surface and groundwater extraction have also been identified by stakeholders and the community as a key issue – and changes to the volume, timing and quality of freshwater inflow from the upper catchment have significant impacts on estuary health. It is likely that over coming decades, population growth and increased development will lead to increasing pressure for additional water extraction to occur across the study area catchments - and any increase in uptake could have significant impacts on estuary and ecosystem health.
- *Biodiversity and habitat loss*: This includes the impacts of increased foreshore development, land clearing and weed invasion. The impacts of these stressors are expected to increase over time due to population growth, increased urban development, and climate change impacts.
- *Preservation of aboriginal cultural heritage*: Aboriginal cultural heritage values are currently threatened by increased development across the coastal zone, water extraction for commercial and agricultural uses, and information gaps regarding intangible and tangible cultural heritage.
- *Climate change impacts*: The estuaries will also come under increasing pressure over the coming decades from a range of projected climate change impacts, including mean sea level rise, ocean (and estuarine) temperature increase, ocean acidification, altered storm frequency and severity, altered hydrologic and hydrodynamic regimes; and habitat migration and squeeze.

Management Actions

One of the key objectives of the CMP process is to facilitate a coordinated approach to the addressing of issues and risks through a “systems” based approach to coastal management. With this in mind, this CMP has attempted to the greatest extent possible to develop a program of management actions that is highly integrated, and which can be enacted through an achievable and coordinated implementation schedule.

In Stage 3 of the CMP, management actions were identified and prioritised through stakeholder and community engagement, expert professional analysis and insight, and a review of the historical management of the estuaries. Based on this assessment, a total of 16 actions have been included in the program of the certifiable CMP.

Additionally, the process of developing this CMP has included the identification of 3 actions located across the broader catchment area that will provide substantial benefits to estuary health within the coastal zone. However, as these actions are located outside of the legally defined coastal zone (see Section 1.3), they are to be delivered externally to the certifiable CMP - and are separate from programs, projects or activities delivered as part of the certified CMP. These actions have been listed in a separate action table in this document in order to ensure that linkages to the certifiable CMP are maintained, and that actions are delivered in an integrated manner to address relevant risks and threats identified in the coastal zone.

Most of the CMP actions are to be implemented by the City, however some will be the primary responsibility of other public authorities. A summary of the actions is provided in Figure EX-4, along with linked to related plans and strategies (both local and state). This schematic demonstrates the integrated nature of the program. Actions are broadly categorised as:

- Estuary Health Monitoring and Data Collection;
- Environmental Programs and Works;
- Education and Planning; and
- Research and Innovation.

For each action, this CMP provides a summary of the tasks involved, roles and responsibilities, costs and timeframes for delivery, and well as objectives and performance indicators. A Business Plan has been developed for the CMP which outlines the estimated cost of the actions, recommended cost-sharing arrangements and other potential funding mechanisms.

Management actions have been developed for a ten-year period and have been aligned with the City's four-year Delivery Programs (DP) under the NSW Integrated Planning and Reporting (IP&R) Framework.

This CMP is considered a 'living document' that is to be reviewed and updated over time. A strategic review of the CMP should occur at least once every ten years to assess the effectiveness of the CMP in achieving its objectives and to incorporate changes in light of new information, technology and understanding of the estuary systems.

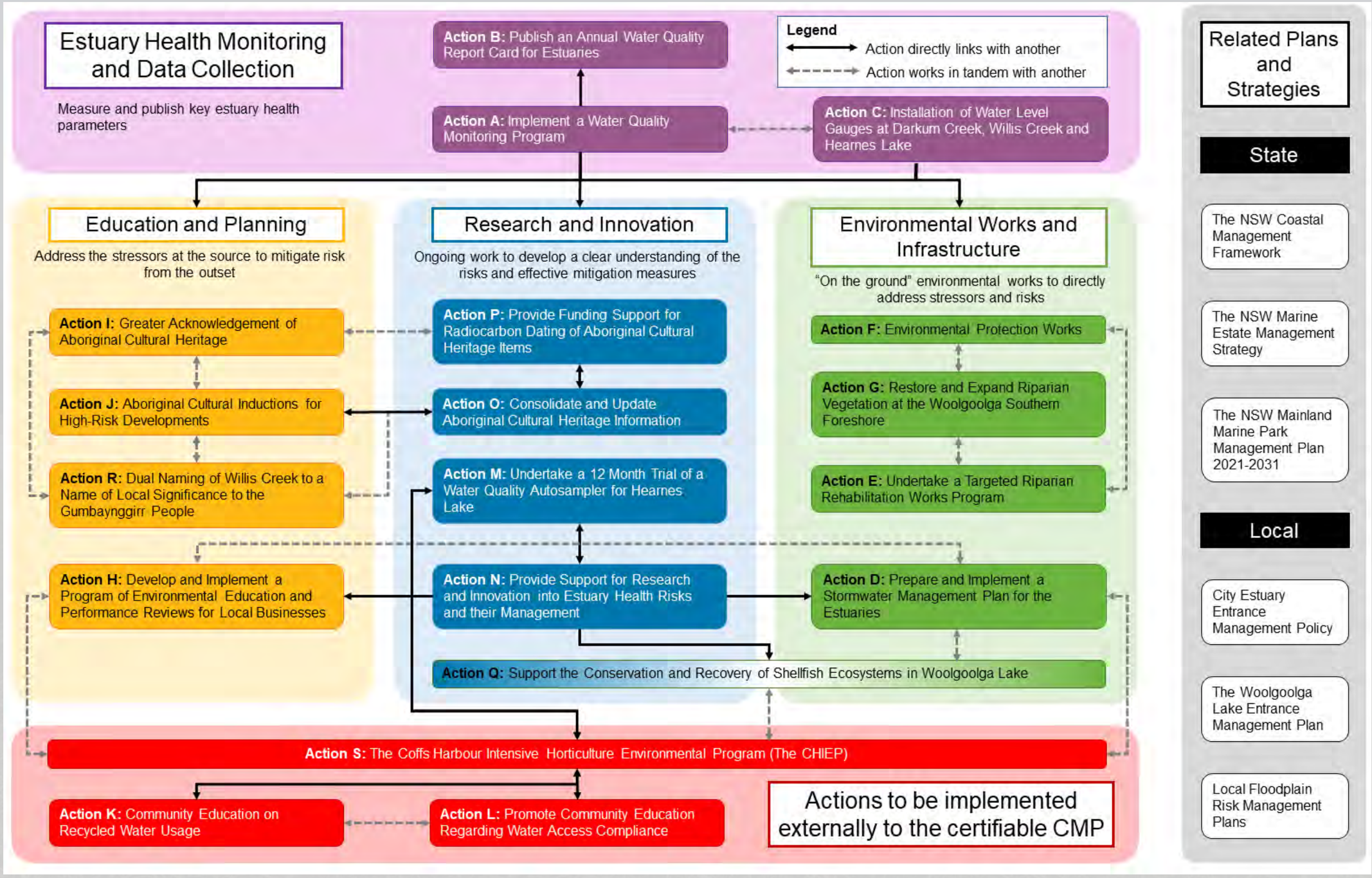

Figure EX-4 The integrated management actions of the CMP

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GLOSSARY AND ABBREVIATIONS

Term	Definition
ANZECC	Australian and New Zealand Environment and Conservation Council – that provides governments and communities with a set of tools for assessing and managing ambient water quality and sediment quality in natural and semi-natural water resources.
Biodiversity	The variety and variability of wildlife (both plants and animals) and habitats. Biodiversity is typically a measure of variation at the genetic, species, and ecosystem level.
BOD	Biological oxygen demand.
BOM	The Australian Bureau of Meteorology.
Catchment area	The area which drains naturally to a river, reservoir, or other body of water.
CHDLALC	Coffs Harbour District Local Aboriginal Land Council.
CHRL	Coffs Harbour Regional Landcare.
Chlorophyll-a	An indicator of phytoplankton biomass.
The City	The City of Coffs Harbour
Climate change	The long-term change (decades or longer) in pattern of weather, and related changes in oceans, land surfaces and ice sheets.
CM Act	*NSW Coastal Management Act 2016.*
CMA	Coastal Management Area.
CMP	Coastal Management Program.
Coastal inundation	The temporary and permanent flooding of a portion of land within the coastal zone.
Contaminant	Substances or groups of substances that are toxic, likely to bioaccumulate and/or give cause for concern.
CVA	Coastal Vulnerability Area.
CZMP	Coastal Zone Management Plan – a plan for managing the coastal zone developed under the old (now superseded) coastal management framework for NSW. Now replaced by CMPs.
Dissolved Oxygen	Oxygen dissolved in the water (oxygen saturation). Often abbreviated to DO
DPI	NSW Department of Primary Industries
DPE	The NSW Department of Planning and Environment.
Ecosystem	A dynamic complex of plant, animal and micro-organism communities and their nonliving environment interacting as a functioning unit.
Endangered Ecological Communities (EEC)	An assemblage of species occupying a particular area, listed as endangered under relevant State and Federal legislation.
Entrance management	Includes artificial opening of entrances, managing the configuration, height or location of the beach berm to facilitate entrance opening at a level lower than the natural range.
EPW	Environmental Protection Works

Term	Definition
Erosion	The removal of land by natural forces such as waves, tidal currents and / or littoral currents.
Estuarine macrophytes	Vegetation that can grow emergent, submerged or floating within the water of estuarine environments e.g., saltmarsh, mangroves, and seagrass.
Estuarine vegetation	Vegetation found in the sub- tidal zone, inter-tidal zone, and riparian vegetation which include seagrasses, mangroves, and saltmarsh.
Estuary	The section of a river affected by tidal activity where fresh water from the river mixes with saltwater from the ocean.
Eutrophication	Excessive richness of nutrients in a lake or other body of water, frequently due to run-off from the land, which causes a dense growth of plant life.
Faecal Coliforms	An indicator for sewage contamination and human pathogens in marine waters.
Flood tide delta	Deposit of marine sediment (usually sand) within a coastal embayment that has formed at the landward side of a tidal inlet by rising (or flood) tidal currents and wave action.
Foreshore	The area of shore between low and high tide marks and land adjacent thereto.
Geomorphology	A branch of physical geography encompassing the formation of the earth's surface, including the distribution of land and water.
Gross pollutant trap (GPT)	A filter that catches stormwater pollution before it has a chance to enter the waterways. GPTs catch most of the litter and silt but don't stop chemicals going into the environment.
Groundwater	Water that is located beneath the earth's surface accumulated from rain and rivers that penetrates the ground through soils and rocks where it is then stored.
HHWSS	High High Water Solstice Springs. The HHWSS tidal plane was originally defined as the level beyond which tides seldom reach. It is consistent with predicted levels for higher (king) tides but is slightly lower than highest astronomical tide (HAT).
Hydrodynamic	Relates to the specific scientific principles that deal with the motion of fluids and the forces acting on solid bodies immersed in fluids, and in motion relative to them.
ICOLL	Intermittently Closed and Open Lakes and Lagoons.
Intertidal zone	The region of the foreshore that is above the water at LAT but submerged at HAT.
Inundation (estuarine)	Rising waters caused by a combination of catchment flood waters (from rainfall) and/or oceanic waters (from tides and high sea levels that occur during storms).
IPA	Intensive Plant Agriculture. IPA typically incudes cultivation of irrigated crops (other than pasture or fodder crops), horticulture, turf farming and/or viticulture.
IPCC	Intergovernmental Panel on Climate Change. A scientific and intergovernmental body under the auspices of the United Nations, set up at the request of member governments, dedicated to the task of providing the world with an objective, scientific view of climate change and its political and economic impacts.
IP&R	NSW Integrated Planning and Reporting Framework
LEP	Local Environmental Plan
LGA	Local Government Area.
LLS	NSW Local Land Services – a stage government agency within the Department of Regional NSW

Term	Definition
MEMA	Marine Estate Management Authority
MEMS	Marine Estate Management Strategy
MHL	Manly Hydraulics Laboratory.
MSL	Mean Sea Level. The mean level of the sea over a long period (preferably 18.6 years) or the mean level which would exist in the absence of tides.
NOx	A form of dissolved inorganic nitrogen made up of nitrate and nitrite.
NPWS	The NSW National Parks and Wildlife Service.
Nutrient cycling	The movement and exchange of organic and inorganic matter back into the production of matter.
Resilience	The ability of a system (in this case natural systems and states, and human systems along the coast) to 'bounce back' after a hazard or threatening event, returning to some quasi-stable state and maintaining functions, processes and services.
RH SEPP	State Environmental Planning Policy (Resilience and Hazards) 2021
Riparian	Of, on or relating to the banks of a watercourse
Risk	Chance of something happening that will have an impact. It is measured in terms of consequences and likelihood.
Runoff	That proportion of rainfall that drains off the land's surface.
SCU	Southern Cross University.
Sedimentation	The settling of particles (such as sand, silt or mud) out of the water column onto the bed of a waterbody.
Sediment Compartment	A coastal compartment is an area in which coastal processes, and their effects on the geology of the coast, are broadly homogeneous. The compartment boundary is usually a feature such as a headland or river mouth which effectively divides the compartment and its processes from its neighbour.
SEPP	State Environmental Planning Policy.
SIMP	Solitary Islands Marine Park.
Storm surge	The increase in coastal water levels caused by the barometric and wind set-up effects of storms. Barometric set-up refers to the increase in coastal water levels associated with the lower atmospheric pressures characteristic of storms. Wind set-up refers to the increase in coastal water levels caused by an onshore wind driving water shorewards and piling it up against the coast.
Storm tides	The total observed sea level during a storm, which is the combination of storm surge and normal astronomical tide.
Storm tide inundation	Flooding of coastal land due to inundation from storm tides. Inundation generally persists for the duration of a high tide, though it may persist longer in extreme cases.
Tidal currents	Currents caused by the incoming (ebb) or outgoing (flood) tide (see Tide). Tidal currents are typically the main current within estuaries, particularly in the entrance area where tidal currents transport marine sediments (sand).
Tide	The periodic rise and fall of the water of oceans, seas, bays, etc., caused mainly by the gravitational interactions between the Earth, Moon and Sun.
Tributary	A stream or river that flows into a larger stream or lake.

Term	Definition
WAL	A water access license. A WAL is generally required to extract water from rivers or aquifers to use for irrigation, industrial or commercial purposes. They are managed by WaterNSW under the terms of the Coffs Harbour Water Sharing Plan 2009.
Wave dominated barrier estuary	A coastal bedrock embayment that has been partially infilled by sediment from both the catchment and marine sources, in which waves are the dominant force shaping the local geomorphology.
Wetland	Areas of land that are partly or periodically saturated by water, including marshes, swamps etc.
Wind waves	All waves are generated by wind, however the term “wind waves” is associated with small, short period (3-5 second) waves that are generated locally within a small fetch. Wind waves can be generated on smaller water bodies such as lakes, lagoons, or tidal inlets.
WRL	The University of NSW Water Research Laboratory.
WRP	Water Reclamation Plant.
WSUD	Water Sensitive Urban Design.

1 INTRODUCTION

1.1 Purpose of this Coastal Management Program

The purpose of the Coastal Management Program (CMP) is to establish an integrated program for the coordinated management of Darkum Creek, Woolgoolga Lake, Willis Creek and Hearnes Lake - hereby referred to as the *Woolgoolga Region estuaries*. The CMP applies to the legally defined "coastal zone" of the estuaries, however it considers the estuary catchments and the associated issues that affect the health and values of the coastal zone.

The Woolgoolga Region Estuaries CMP comprises a program of integrated management actions that are intended to address key issues, and harness new opportunities. It outlines specific actions that are to be implemented over a forward 10-year management timeframe. In doing so, the CMP seeks to achieve the objects of the *Coastal Management Act 2016* (CM Act), and preserve the social, cultural, economic and environmental values of the estuaries. Clear details for how actions will be implemented, funded, monitored, and reviewed are given in this CMP.

This CMP considers the range of timeframes (immediate, 20 years, 50 years, 100 years) where appropriate, as required by the CM Act. Longer-term pressures such as climate change and population growth have been considered in the formulation of management actions, to ensure resilience against future threats and the conservation of the values of the estuaries for future generations.

The Woolgoolga Region Estuaries CMP has been prepared in accordance with the mandatory requirements for CMPs specified in the CM Act, and the NSW Coastal Management Manual (OEH, 2018e). This document has been prepared on behalf of the City of Coffs Harbour (the City) with funding and technical support from the NSW Department of Planning and Environment (DPE), and in consultation with various state agencies and other relevant stakeholders.

1.2 Overview of the Coffs Harbour Suite of CMPs

Whilst this CMP sets out a management program for Darkum Creek, Woolgoolga Lake, Willis Creek and Hearnes Lake – it is important to note that this is only one of several CMPs to be implemented by the City.

The Coffs Harbour Local Government Area (LGA) coastal zone comprises over 78 km of open coast and 12 major estuaries. In order to effectively manage its coastal zone, the City has determined to undertake a suite of five (5) discrete, but interlinked CMPs that collectively cover the coastal zone of its LGA - as depicted in Figure 1-1. They comprise:

- A CMP for the Coffs Harbour Open Coastline; and
- A series of four (4) CMPs that collectively cover the 12 major estuaries of the LGA. This geographic distribution of CMPs aims to achieve management and resource efficiencies by grouping adjacent estuaries that possess relatively similar issues and risks. The groupings include (from north to south):
  - Pipe Clay, Corindi and Arrawarra Estuaries;
  - **This CMP:** The Woolgoolga Region Estuaries (Darkum Creek, Woolgoolga Lake, Willis Creek and Hearnes Lake);
  - The Central Coffs Estuaries (Moonee Creek, Coffs Creek, and Boambee-Newport Creek); and
  - Bonville and Pine Creek Estuary.

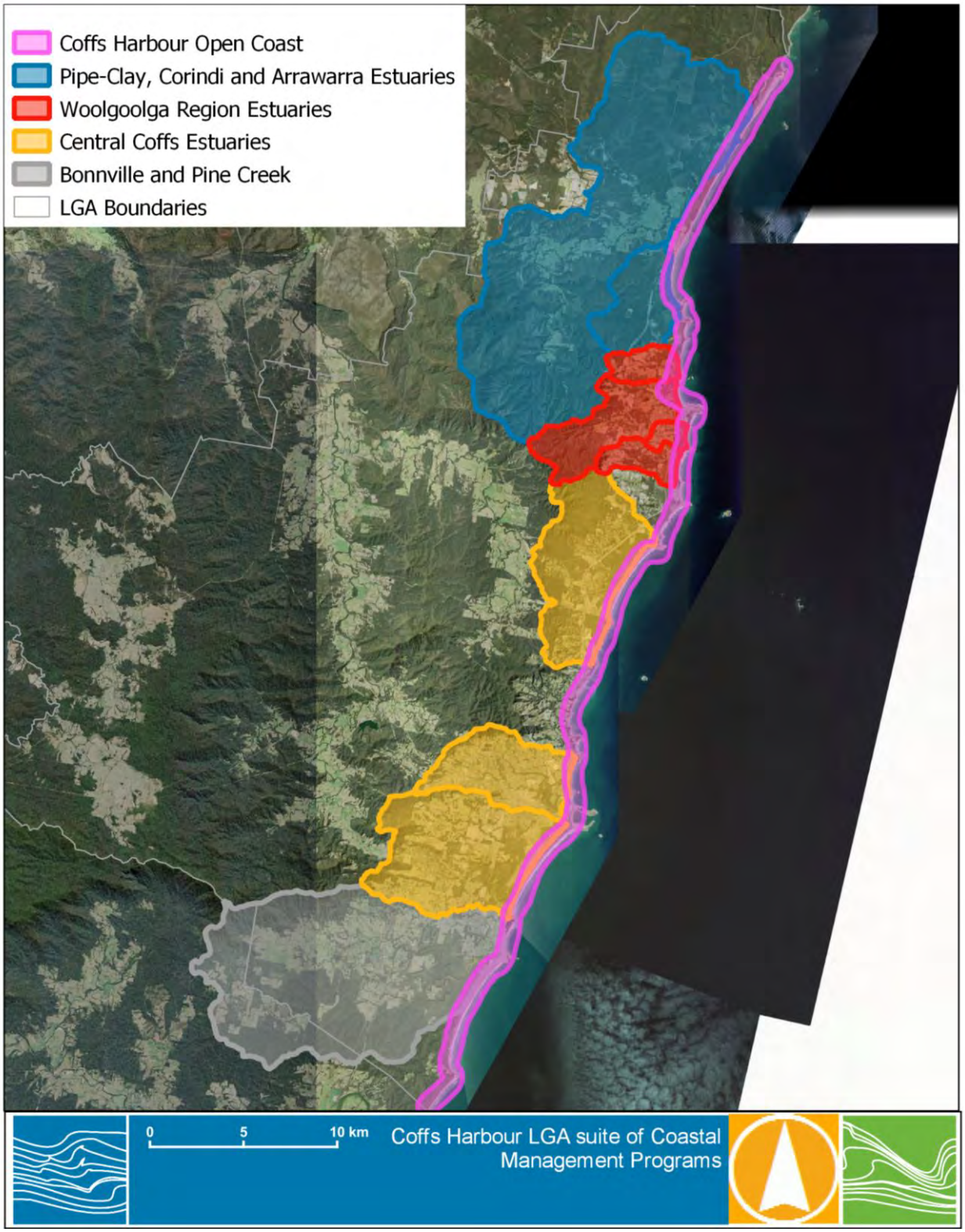


Figure 1-1 The suite of Coffs Harbour LGA CMPs

When determining the optimal spatial scale of a CMP, it is important to consider the need to balance the required level of detail, with desired level of management efficiency.

A single CMP that covers the entirety of the Coffs Harbour coastal zone (including the entire coastline and all 12 major estuaries) would be so large in scale that it would lack the detail required to adequately address smaller, localised issues. Alternatively, the preparation of a CMP for each individual estuary and/or coastal compartment would result in the City having to prepare and implement more than a dozen CMPs. This would result in an inefficient process that is unwieldy and overly complicated to implement. Furthermore, smaller scale CMPs may lack the ability to effectively address larger scale issues, or issues that are common across various parts of the coastal zone.

Therefore, the current suite of CMPs is intended to strike a practical balance for effective management. It has been developed with a strong consideration to the performance of historical management plans, the prevailing coastal zone issues, and relevant stakeholder groups.

1.3 The Area Covered by this CMP

1.3.1 Legislative Considerations

The overall objects of CM Act seek to protect and enhance the environmental values and natural processes of the coastal zone. Where the coastal waters, estuaries, coastal lakes, and coastal lagoons are concerned, it is recognised that the health of coastal catchments is critical to the overall health of the coast and marine environment - including the social, economic and cultural benefits derived from good catchment health.

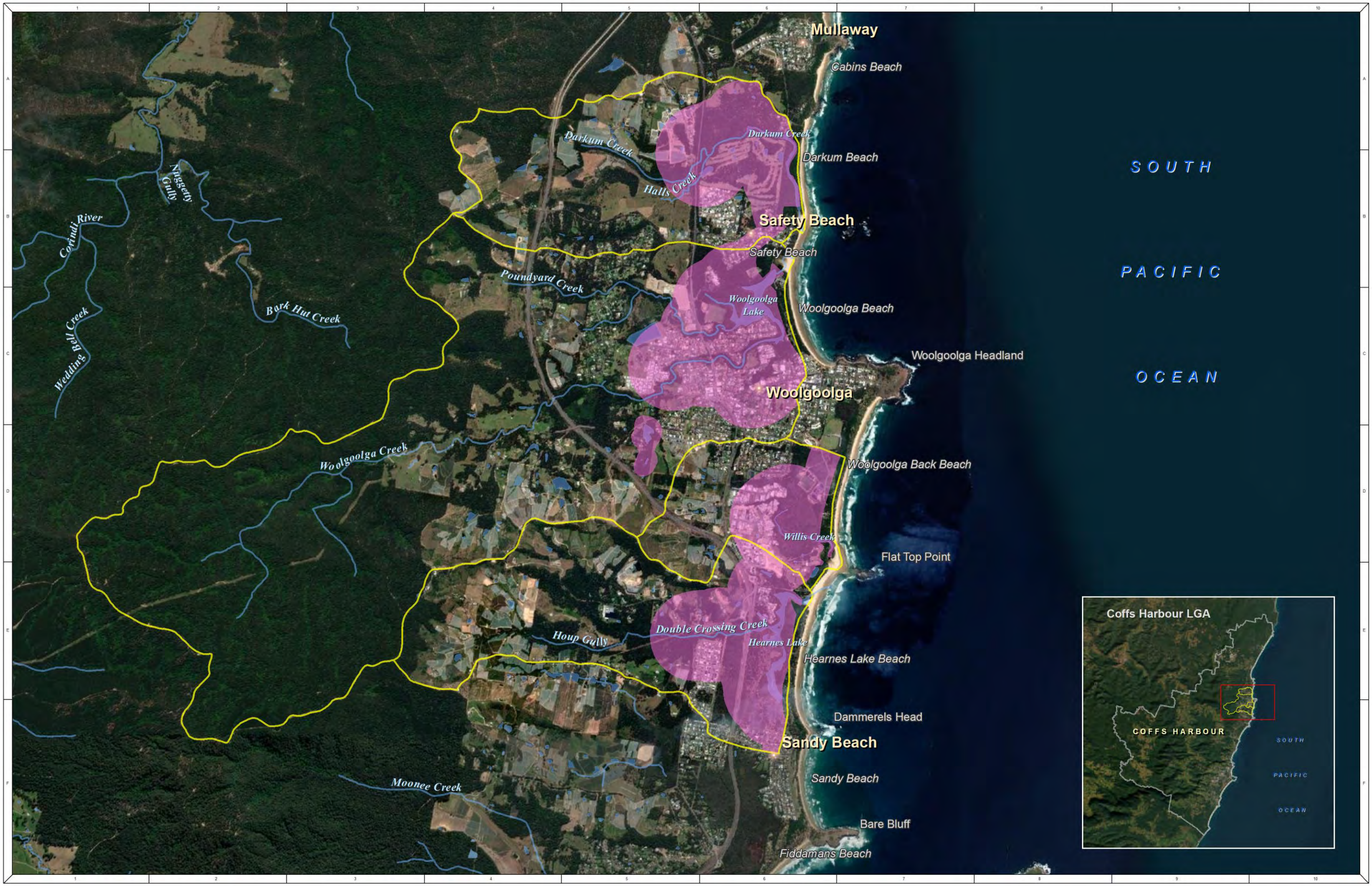
Therefore, best practice estuary management requires a “systems” approach that takes into account the important physical and ecological systems that extend across the contributing catchment area and may impact the health and values of the coastal zone. Whilst a systems-based approach to estuary management is beneficial, there are some legislative considerations that affect the legally defined study area of the CMP. They are:

- Section 12 of the CM Act outlines the purpose of a coastal management program, being ‘to set the long-term strategy for the coordinated management of land within the coastal zone with a focus on achieving the objects of this Act’
- Section 13(2) of the CM Act specifies that, ‘a Coastal Management Program may be made in relation to the whole, or any part of the area included within the coastal zone’.

In considering the statutory requirements, there is no provision in the CM Act for land or actions to be included in a CMP, where that land or those actions reside outside the “coastal zone” - which is legally defined in the CM Act as the envelope extent of the four coastal management areas mapped in the Resilience and Hazards SEPP (2021), and depicted in Figure 1-2 . These coastal management areas are discussed further, and mapped, in Section 1.3.4.

For the Woolgoolga Region estuaries, it is acknowledged that the defined coastal zone is generally only a portion of the catchment. However, as is required under the CM Act, the focus of a CMP must be directed to activities contained within the defined coastal zone. For development of this CMP, the implications of this are:

- The study area of the CMP must be comprised only of the legally defined coastal zone depicted in Figure 1-2.
- Any actions that are to be included in the certified CMP document must be located within the legally defined coastal zone.
- Whilst the CMP should describe areas outside the coastal zone (i.e., the broader catchment areas) and the effects these areas may have on land within the coastal zone - these areas should be distinguished from the area to which a CMP applies.
- Broader catchment-based actions that are located outside of the coastal zone are to be clearly identified and distinguished from those actions that are to be delivered as part of the certified CMP.



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The Broader Catchment Area
CMP Study Area (the area to which this CMP applies)

0 0.5 1 2 Kilometers

1:40,000 @ A3

WATER TECHNOLOGY
COFFS HARBOUR CITY COUNCIL

Figure 1-2: The Legally Defined Coastal Zone
Darkum Creek, Woolgoolga Lake, Willis Creek and Hearnes Lake CMP

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1.3.2 The Woolgoolga Region Estuaries

The CMP study area covers the coastal zone of four (4) successive wave-dominated, barrier estuaries located within the Woolgoolga area of the LGA, comprising the following listed from north to south:

- Darkum Creek
- Woolgoolga Lake
- Willis Creek
- Hearnes Lake

Generally speaking, these four estuaries are relatively small in area and relatively shallow, and they are all classified as Intermittently Closed and Open Lakes and Lagoons (ICOLLs). They have small but steep catchments that contain undeveloped bushland, intense agricultural use, and localised pockets of urban development. The estuaries are each considered part of the Solitary Islands Marine Park and are zoned as a Habitat Protection Zone up to their tidal limits.

Darkum Creek is a relatively small and remote coastal estuary that is situated in between the suburbs of Mullaway and Safety Beach, with an entrance located at the southern end of Darkum Beach. The total catchment area of Darkum Creek is 6 km² with a waterway area of around 0.1 km². The estuary also receives Halls Creek to the south-west (GeoLINK, 2011b).

Figure 1-3 Darkum Creek (source: DPE, 2020)

The upper catchment contains large areas of cleared land and at times intense agricultural use. The estuary entrance and downstream reach is bordered by Coffs Coast Regional Park, and the Woolgoolga Returned Services Golf Course adjoins a large section in between the coast and Solitary Islands Way, located on the south side of the estuary.

Figure 1-4 Woolgoolga Lake (source: DPE, 2020)

Woolgoolga Lake, situated in between the suburbs of Safety Beach and Woolgoolga, is a wave-dominated barrier estuary with a pronounced flood tide delta and an entrance located at northern Woolgoolga Beach. The total catchment area of the estuary is 21 km² with a waterway area of around 0.4 km². Woolgoolga Lake is fed primarily by Woolgoolga Creek and Poundyard Creek. The major tributary of Jarrett Creek merges with Woolgoolga Creek around 400 m upstream of the lake (BMT WBM, 2012).

The catchment area of Woolgoolga Lake includes a significant area of state forest across the upper catchment, with the mid catchment dominated by agricultural use (banana plantations and intensive plant agriculture). Residential development and the commercial centre of Woolgoolga occupy a significant proportion of the lower catchment (GeoLINK, 2011c).

Willis Creek (sometimes referred to as Flat Top Point Creek) is situated south of the Woolgoolga township, with an entrance located at Flat Top Point. Willis Creek is a small estuary (with a waterway area of around 0.04 km^2), and has a smaller catchment than the other three estuaries, at only 2.6 km^2.

The catchment is unique relative to the other estuaries in that it contains a small industrial complex located on the eastern side of the Pacific Highway, and the catchment area downstream of the tidal limit includes the Woolgoolga Water Reclamation Plant (GeoLINK, 2011d). The lower reaches of the estuary catchment include Coffs Coast Regional Park.

Figure 1-5 Willis Creek (source: Google Earth)

Figure 1-6 Hearnes Lake (source: DPE, 2020)

Hearnes Lake (sometimes spelled “Hearns Lake") is bounded by Woolgoolga to the north and Sandy Beach to the south. The estuary is relatively small and shallow, with a catchment area of 6.6 km^2 and a waterway area of 0.1 km^2. The lake receives Double Crossing Creek to the west. The entrance is located at the northern end of Hearnes Lake beach, just south of Flat Top Point and the Willis Creek entrance.

At present, development within the Hearnes Lake catchment area mostly comprises agricultural land uses, with minimal urban development generally limited to the Sandy Beach township (WBM Oceanics Australia, 2006). Coffs Coast Regional Park bounds the estuary body to the east.

Notably, the estuary waterways are included in the bounds of the Solitary Islands Marine Park (SIMP), which extends north from Coffs Harbour to the Sandon River along about 100 km of coastline. The boundaries of the SIMP extend across estuary waters up to the mean high-water mark, and out to three nautical miles offshore. The four Woolgoolga Region Estuaries are designated as habitat protection zone.

There is a variety of aquatic and riparian vegetation present across the study area. The most common estuarine habitats are vegetated areas such as mangroves, seagrass and saltmarsh and non-vegetative areas such as sand, mud and gravel bars, and rocky reefs. The extensive range of aquatic and riparian habitat across the estuary system supports a diverse assemblage of species, including a number of threatened and protected species.

Figure 1-7 SIMP at Willis Creek

1.3.3 Estuary Snapshot

A snapshot of the Woolgoolga Region Estuaries is presented in Table 1-1. This table provides an overview of physical characteristics for the estuaries, including estuary evolution, catchment land usage and hydrology, and estuarine habitat parameters (Water Technology, 2021a).

Table 1-1 Estuary snapshot

Category	Parameter	Darkum Creek	Woolgoolga Lake	Willis Creek	Hearnes Lake
Geomorphology	Estuary Type	ICOLL	ICOLL	ICOLL	ICOLL
	Evolution Stage	Mature	Intermediate	Mature	Intermediate
Physical Parameters	Waterbody Area (ha)	9.9	37.6	3.6	10
	Estuary Volume (ML)	16	67	4.7	38
	Average Depth (m)	0.3	0.4	0.2	0.4
	Foreshore Perimeter (km)	2.9	4.5	2.1	4.6
	Catchment Area (ha)	610	2100	260	660
Catchment Land Usage	Agriculture	47.9%	23.5%	35.6%	43.6%
	Forest/Undisturbed	21.4%	55.6%	19.4%	28.1%
	Industrial	0.4%	0.5%	21.5%	2.1%
	Urban	21.6%	9.2%	20.9%	10.2%
	Rural Residential	4.2%	5.5%	2.5%	3.4%
	Other	4.6%	5.7%	0.2%	12.6%
Catchment Hydrology	Annual Rainfall (mm/yr)	1,211	1,233	1,232	1,243
	Average Annual Flow (ML/yr)	2,180	6,514	872	1,792
	WAL Licenced Water Extraction (ML/yr)	0	384	0	119
Estuarine Ecology	Seagrass area (ha)	1.3	0.0	0.0	0.0
	Mangrove area (ha)	1.0	0.6	0.9	0.3
	Saltmarsh area (ha)	0.1	0	1.6	4.5
	Oyster reef area (ha)	0.0	0.3	0.0	0.0

1.3.4 Coastal Management Areas

In accordance with the CM Act, this CMP gives effect to the management objectives for the four coastal management areas that define the coastal zone of the study area. Each area has different characteristics and objectives and may overlap, and the CM Act provides the definition and objectives for each of the management areas. The State Environmental Planning Policy (Resilience and Hazards) 2021 (RH SEPP) provides development controls for each of the management areas, and state-wide mapping of the areas. The four coastal management areas as defined by the CM Act are:

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

The RH SEPP includes adopted maps for three (3) of these zones. The RH SEPP mapping of coastal environment, coastal use, and coastal wetlands and littoral rainforests areas are provided in Figure 1-16 and Figure 1-17.

Mapping for the coastal vulnerability area has not been provided from the SEPP, and no such coastal vulnerability area (CVA) map yet exists for the study area. It is understood that the City will only be seeking to incorporate its coastal erosion and recession mapping into the SEPP as the CVA across its LGA. The issues and management actions related to the CVA in the study area will therefore be addressed in the forthcoming City of Coffs Harbour Open Coast CMP, and development of the CVA is outside the scope of this CMP.

Nonetheless, it is recognised that the Woolgoolga Region Estuaries are subject to coastal hazards and that the scope of this CMP also covers managing coastal vulnerability. The estuaries are subject to coastal hazards including foreshore erosion, tidal inundation (otherwise termed "sunny day flooding"), storm tide inundation, and inundation due to catchment rainfall. The latter is currently managed through the NSW floodplain risk management framework, and therefore the management of that risk is not duplicated by this CMP.

Proposed Amendments to Coastal Management Areas

This CMP does not propose any amendments to the existing mapping of coastal management areas currently gazetted with the RH SEPP.

1.4 Vision and Objectives

1.4.1 Vision

A local vision statement has been developed to help stakeholders identify with the future of the four estuaries, encourage a sense of community ownership of the actions in the CMP, and foster commitment to its preparation and implementation. The Vision Statement for this CMP has been developed in consultation with the City of Coffs Harbour, and is consistent with the Vision Statements prepared for the other CMPs across the study area. The Vision for the CMP is:

"To provide strategic direction and specific focus for the short- and long-term sustainable management of Darkum Creek, Woolgoolga Lake, Willis Creek and Hearnes Lake – in order to preserve and enhance their social, cultural, economic and environmental values"

1.4.2 Objectives

A suite of objectives has been developed for the CMP, in order to ensure that the program recognises and protects the environmental, social, cultural and economic values of the study area. Objectives have been developed ensuring consistency and compatibility with the objects set forth in the *NSW Coastal Management Act 2016* (the CM Act). This ensures that the objects and intent of the CM Act are explicitly considered and promoted through the management actions developed in the CMP.

The objectives of the CMP have also been developed in consideration of the objectives set forth in relevant legislation, planning instruments and policies, such as:

- *The NSW Marine Estate Management Act 2014* (the MEM Act);
- The State Environmental Planning Policy (Resilience and Hazards) 2021;
- The Marine Estate Management Strategy (MEMA, 2018);
- The Draft Management Plan for the NSW Mainland Marine Park Network 2021–2031;
- The North Coast Regional Plan 2036 (DPE, 2017);
- The North Coast Local Land Services Local Strategic Plan 2016-2021 (LLS, 2016);
- The MyCoffs Community Strategic Plan (Coffs Harbour City Council, 2016a);
- The objectives put forth for other CMPs within the Coffs Harbour LGA, including the Bonville and Pine Creek CMP (Cardno, 2019a), the Central Coffs Estuaries CMP (Water Technology, 2021c), and the Arrawarra, Corindi River & Pipe Clay Lake CMP (Cardno, 2019b);
- The NSW Water Quality and River Flow Objectives (NSW Government, 1999), and the Marine Quality Objectives for NSW Ocean Waters (DEC, 2005);
- The NSW Marine Estate Threat and Risk Assessment (BMT WBM, 2017);
- The NSW Risk-based Framework for Considering Waterway Health Outcomes in Strategic Land-use Planning Decisions (OEH, 2017); and
- The Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ, 2000);

These values of the study area, and the objectives for the CMP are summarised in Table 1-2. Appendix A provides a matrix summarising how each of these objectives have been addressed through the derivation and implementation of the CMP, as well as the objectives of the CM Act (both overall objects and the objects for the individual coastal management areas), and the MEM Act.

Table 1-2 CMP values and objectives

Values	Objectives
Water Quality	a. to maintain and protect water quality across the system and its impacts on environmental, social, cultural, and economic values - including ecological condition, recreational amenity and agricultural uses;
Natural Ecosystems and Biodiversity	b. to protect and enhance the integrity and resilience of the environmental values of the Darkum Creek, Woolgoolga Lake, Willis Creek and Hearnes Lake estuaries for current and future generations;
Social and Recreational Amenity	c. to support the social and cultural values of the estuaries and maintain public access and recreational amenity; d. to maintain the health, safety and wellbeing of those using the estuaries and catchment (both directly and indirectly); e. to maintain and preserve the unique scenic amenity and natural character of the estuaries;

Values	Objectives
Cultural Heritage	f. to acknowledge Aboriginal peoples' spiritual, social, customary and economic use of the study area g. to protect and preserve the Aboriginal cultural heritage of the marine estate and coastal zone;
Research and Education Value	h. to encourage and facilitate research and monitoring – and to maintain scientific and educational values of the study area;
Economic Prosperity and Agricultural Productivity	i. to recognise the Coffs Harbour coastal zone as a vital economic resource for the region and to support sustainable coastal economies;
Coordinated and Effective Management of the Coastal Zone	j. to mitigate and manage current and future risks from population growth, urbanisation and coastal hazards, taking into account the effects of climate change; k. to facilitate appropriate management of the coastal zone through ecologically sustainable development, and the promotion of sustainable land use planning and decision-making that is consistent with regional and local strategic plans; l. to ensure co-ordination of the policies and activities of the relevant government and public authorities relating to the coastal zone - and to facilitate the proper integration of their management activities across all levels of government; m. to maintain meaningful engagement with the community, and to support public participation in coastal management and planning, and to foster greater public awareness, education and understanding of coastal processes and management actions; n. to support the objects of the Marine Estate Management Act 2014; and o. to align with the NSW Risk-based Framework for Considering Waterway Health Outcomes in Strategic Land-use Planning Decisions.

1.5 The NSW Coastal Management Framework

1.5.1 The Framework

The NSW coast provides a multitude of values and uses for the community. However, the coastal zone is under increasing pressure from a growing population, urbanisation, natural hazards and climate change (OEH, 2018b). Planning for coastal communities must carefully balance the need to provide jobs, housing, community facilities and transport for a changing population while maintaining the unique qualities and managing risks associated with development along the State's coastlines (DPIE, 2019).

Sustainable management of the coastal zone often involves councils, their communities and public authorities balancing a diverse range of challenges and opportunities. The context is one of rapid environmental, social and economic change along with dynamic coastal processes affecting the open coast, estuaries and coastal lakes (OEH, 2018b).

In order to plan for development, protect environmental assets and manage coastal hazards across the state, the NSW Government has implemented the *NSW Coastal Management Framework*, which includes new

legislation and planning policy, and aims to provide an integrated framework for coastal management across the state.

Key components of the framework include:

- *Coastal Management Act 2016* (CM Act): An act that provides for the integrated management of the coastal environment of New South Wales, consistent with the principles of ecologically sustainable development, for the social, cultural and economic wellbeing of the people of the state.
- *Marine Estate Management Act 2014* (MEM Act): An act that provides for the management of the marine estate of New South Wales in a manner that promotes a biologically diverse, healthy and productive marine estate and which facilitates the economic cultural, social and recreational use of the marine estate, scientific research, education and management of marine parks.
- *State Environmental Planning Policy (Resilience and Hazards) 2021* (RH SEPP): One of the key environmental planning instruments for land use planning in the coastal zone. It gives effect to the objectives of the CM Act 2016 and delivers the statutory management objectives of the act by specifying how development proposals are to be assessed if they fall within the coastal zone.
- The implementation of *Coastal Management Programs* (CMPs): A five stage coastal management process intended to set the long-term strategy for the coordinated management of the coastal zone for a given region.
- The *NSW Coastal Management Manual* (The Manual): A manual that sets forth mandatory requirements and provides guidance to coastal councils in connection with the preparation, development, adoption, implementation, amendment, and review of CMPs.
- The *NSW Coastal Council:* It is responsible for advising the Minister on coastal issues, as well as reviewing and approving local council CMPs.
- The *NSW Coastal and Estuary Grants Program:* It provides technical and financial support to local government to help manage the coastal zone.

A schematic of the NSW Coastal Management Framework is provided in Figure 1-8.

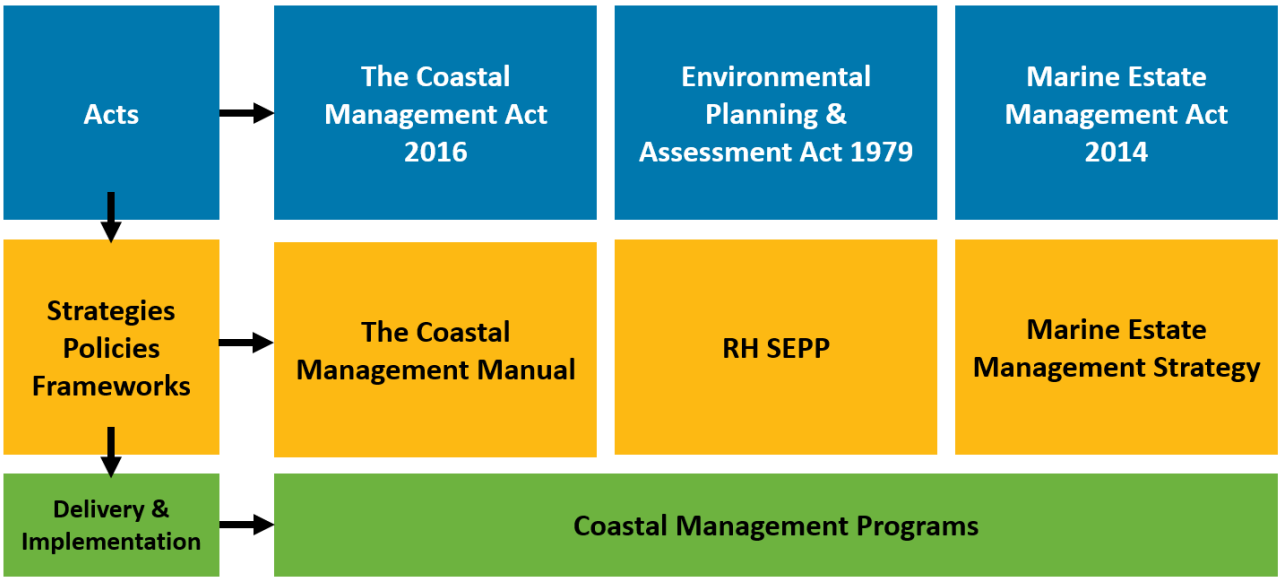

Figure 1-8 The NSW coastal management framework

1.5.2 Coastal Management Programs

The purpose of a CMP is to set the long-term strategy for the coordinated management of the coastal zone of a given area. It should focus on achieving coastal management objectives at a local level, whilst also achieving the broader objects of the CM Act. A CMP provides an opportunity for councils, public authorities and local communities to clearly identify and balance competing interests and priorities in the coastal zone.

A CMP is prepared through a five-stage risk management process as described in the NSW Coastal Management Manual, and depicted in Figure 1-9. This process is intended to help councils and their communities to identify and manage risks to the environmental, social and economic values of the coast (OEH, 2018b). The Manual sets forth mandatory requirements for CMPs, and provides guidance regarding their preparation, development, adoption, implementation, and review.

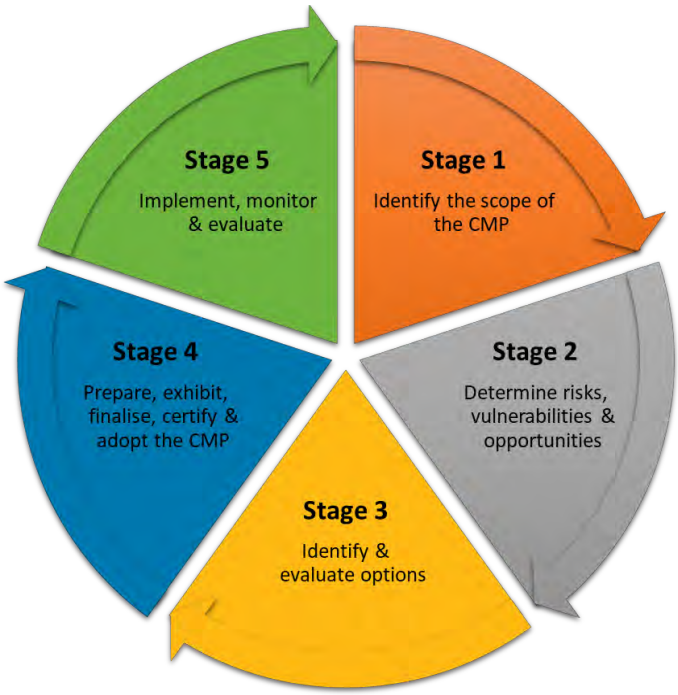

Figure 1-9 The CMP process

The Manual provides information to help councils evaluate and select management actions that are feasible and effective in managing the coastal environment. These actions are then incorporated into councils' land use planning instruments and Integrated Planning and Reporting (IP&R) Framework, established under the *Local Government Act 1993*.

Under the Coastal Management framework, the City may (or must do so if directed by the Minister) prepare a CMP, or a series of CMPs, for its coastline and coastal estuaries.

1.5.3 Development of this CMP

As per the requirements of the NSW Coastal Management Manual (OEH, 2018b; OEH, 2018c; OEH, 2018d; OEH, 2018e; OEH, 2018f), this CMP has been developed in a staged approach. A brief summary of these reports is provided below, however the reader is directed to those documents for further information.

- ***Stage 1**: Woolgoolga Region Estuaries Stage 1 – Scoping Study Report* (Water Technology, 2020): Stage 1 included a review of relevant background information, a first pass risk assessment, a data gap analysis, and a forward program for the CMP. This report was finalised in September 2020.
- ***Stage 2**: Woolgoolga Region Estuaries CMP Stage 2 – Risks, Vulnerabilities and Opportunities Report* (Water Technology, 2021a): Stage 2 included a detailed assessment the various threats and risks affecting the environmental, social and economic assets and values of the estuaries. This report was finalised in April 2021.
- ***Stage 3**: Woolgoolga Region Estuaries CMP Stage 3 – Identify and Evaluate Options Report* (Water Technology, 2021b): Stage 3 included stakeholder engagement and options analysis in order to identify and prioritise coastal management actions that can effectively address issues and risks, take advantage of opportunities, and give effect to the objectives of the *Coastal Management Act 2016*. This report was finalised in September 2021.

A number of previous studies have supported the preparation of this CMP, in addition to the above companion documents. This has included historical studies and plans prepared under the previous coastal management framework.

1.6 Management Context

1.6.1 Governance Context

The current governance of the estuary systems is multi-layered, with the catchments, foreshores, and waterways of the study area (and associated assets) owned and managed by a number of stakeholders across multiple levels of government. One of the objectives of the CMP is to facilitate the integration of management responsibilities across the study area, including the City, land managers and public authorities.

Local Government

The City of Coffs Harbour has a central role in managing the waterways, foreshore and catchment of the study area estuaries. City responsibilities generally relate to management of coastal and estuarine issues, coastal zone land and assets, and strategic planning.

The City is responsible for preparation of a suite of CMPs that set out the long-term strategy for management of the coastal zone in its LGA.

Section 355 of the *Local Government Act 1993* makes provision for some council functions to be exercised by a committee. Subsequently, the City has established a number of committees, with many involving community members. The Coffs Harbour *Coastal Estuary Management Advisory Committee (CEMAC)* has been established to provide strategic advice to the City in relation to coastal and estuary management. The purpose of the committee is to provide advice and feedback to the City that represents broad stakeholder interest of the LGA's coastal zone. The committee provides ongoing sharing of information and ideas, and facilitates local stakeholder oversight of coastal and estuary projects. The committee is comprised of City representatives, community stakeholder groups and representatives of a number of state government agencies, including:

- The City of Coffs Harbour
- DPE (E&H)
- DPE (Crown Lands)
- DPE (NPWS)
- DPI Agriculture
- DPI Fisheries
- LLS North Coast
- TfNSW (Maritime)
- NSW SES
- Southern Cross University
- Coffs Harbour Regional Landcare
- Coffs Harbour and District LALC
- Community Representatives

The committee generally meets four times per year.

State Government

There are over fifteen (15) state government agencies with management roles and responsibilities across the study area that are relevant to the CMP. These agencies are spread across four (4) separate government departments (or clusters). These agencies and their position within the wider NSW state government organisational structure are depicted in Figure 1-10.

Some of these agencies have a land and asset management role, whilst others are issues based. A brief summary of the roles and responsibilities of the most relevant state government departments and agencies is provided below. Additional detail is provided in the Stage 1 Scoping Study (Water Technology, 2020).

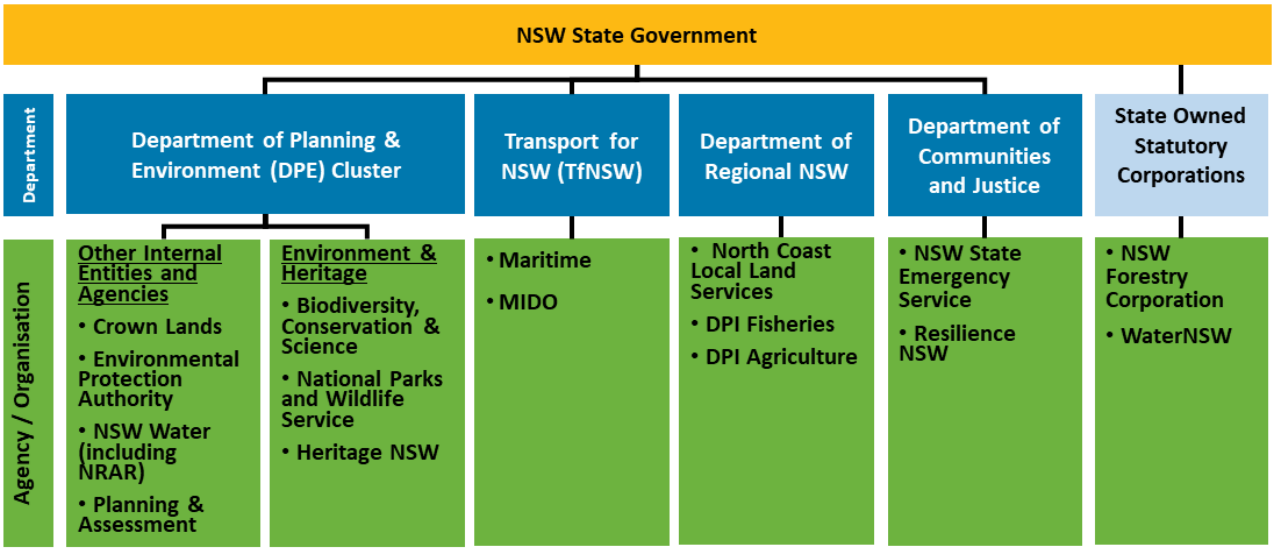

Figure 1-10 NSW State Government agencies with coastal management roles

The Marine Estate Management Authority (MEMA) advises the NSW government on the management of the NSW marine estate, and coordinates policies and programs for maintaining and improving the marine environment. The Authority brings together the heads of the NSW government agencies with key marine estate responsibilities – including DPE (Planning, EES), DPI Fisheries, and TfNSW (MEMA, 2019).

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Many of these CMP stakeholder organisations are positioned within DPE, and their responsibilities across the study area relate to land and asset management, issues management, and planning and assessment. Within DPE, the *Environment and Heritage Group* (E&H), has absorbed the responsibilities of the former Office of Environment and Heritage (OEH). DPE (E&H) is responsible for administering the CM Act, and provides oversight of the State's coastal management program. Within the DPE (E&H) organisation structure, the *Biodiversity Conservation and Science Directorate* provides oversight in the development of each council's CMPs, and provides data and technical advice as needed. It also administers the Coastal and Estuary Grants Program that provides funding for councils to prepare and implement their CMPs.

Within the DPE (E&H) organisation structure, lies the *NSW National Parks and Wildlife Service* (NPWS), which is responsible for management of the *National Parks and Wildlife Act 1974* and management of national parks and reserves across the study area – including Coffs Coast Regional Park. NPWS responsibilities across the areas involve a wide range of activities, including active conservation and habitat protection, fire management, management of tourism and visitation, research, and education. It is also responsible for management and protection of Aboriginal cultural heritage and European heritage across its land tenure.

The Department of Planning & Environment - *Crown Lands* (Crown Lands) is responsible for the administration and / or management of Crown land under the *Crown Land Management Act 2016*. Crown land includes submerged Crown land, seabed and subsoil to three nautical miles from the coastline of NSW that is within the limits of the coastal waters of the State. Crown land includes much of the submerged land within the estuaries and intertidal areas (below mean high water mark) of the Woolgoolga Region estuaries, as well as several foreshore reserves and beaches (for example Woolgoolga Beach, Hearnes Lake Beach and Safety Beach). Several of the coastal Crown reserves and foreshores in the study area are under the management of the City for various purposes including Holiday Parks and Surf Life Saving Clubs.

Department of Primary Industries – Fisheries (DPI Fisheries) is responsible for administering the *Fisheries Management Act 1994* and ensures decisions made about land management and development avoids and minimises impacts on fisheries resources. Its responsibilities also include the licensing of recreational fishers, enforcement of bag limits, and permits for commercial fishing activities. It is responsible for threatened species conservation and marine vegetation protection (including mangroves, saltmarsh and seagrass) across the waterways of the study area. Fisheries also administer the *Marine Estate Management Act 2014* in coordination with the NSW Marine Estate Management Authority (MEMA). DPI Fisheries is also responsible for the management of SIMP, including administering permit requirements for all organised, commercial and habitat activities that occur anywhere within the Woolgoolga Region Estuaries and providing advice to minimise any impact from development in their catchments.

The Department of Primary Industries – Agriculture (DPI Agriculture) is responsible for increasing the productivity and resilience of the agricultural sector in NSW. It does this through agricultural productivity research across livestock, plants and natural resource management areas, as well as providing education and training.

North Coast Local Land Services (NCLLS) was established under the *Local Land Services Act 2013* to provide agricultural production advice, biosecurity, natural resource management and emergency management functions cross the North Coast region (LLS, 2019). NCLLS engages in regional and sub-catchment NRM planning, training and education for the community in areas such as farm management practices, as well as environmental monitoring of horticultural practices. NCLLS also delivers grant and funding programs to support natural resource management and sustainable agriculture activities. The NCLLS region extends from Tweed Shire Council in the north to Port Macquarie-Hastings Council in the south.

The Transport for NSW (TfNSW) cluster comprises an extended network of agencies. TfNSW sets the strategic direction for transport and works in partnership with government transport operating agencies and private service providers to deliver improved transport outcomes for the community and economy of NSW.

Maritime sits within TfNSW as the state's maritime safety regulator for commercial and recreational vessels and their operators. Maritime's role within TfNSW is to promote safe, responsible and sustainable use of waterways, including but not limited to the enforcement of safe on-water vessel practices, the administration of recreational vessel licenses and vessel registrations, and provision of guidance for safe navigation.

It is also responsible for the direct delivery of a number of maritime infrastructure projects as well as investment in many others across the state. Other responsibilities include property administration, policy development, strategic planning and infrastructure management related to commercial and recreational boating – including some of the boat ramps and public jetties, wharves and pontoons across the study area (noting that most boat ramps are generally owned and managed by councils).

The Maritime Infrastructure Delivery Office (MIDO) sits within Maritime and is a joint initiative between the former agencies of Roads and Maritime Services and the Department of Industry to improve the coordination and delivery of coastal and boating infrastructure programs and projects across NSW that support recreational boating, fishing, tourism and a range of other commercial activities. The MIDO is responsible for delivering key projects and programs including TfNSW's Boating Now Program, DPE's Coastal Infrastructure Program,

Rescuing our Waterways dredging program and a number of major projects including the La Perouse to Kurnell Ferry Wharf and Eden Safe Harbour projects.

Traditional Owner Groups

The Coffs Harbour Region has a rich and continuing Aboriginal heritage. The traditional custodians of the area are the Gumbaynggirr people, who have a cultural history extending more than 40,000 years - forming one of the largest coastal Aboriginal Nations in New South Wales. The Gumbaynggirr Nation stretches from the Nambucca Valley in the south to around the Clarence River in the north and to the Great Dividing Range in the west.

Coffs Harbour District *Local Aboriginal Land Council* (CHDLALC) has a degree of governance and interface with the City, as well as the various State and Federal Government bodies. LALCs have a right to be informed in the planning, protection and preservation of cultural sites and areas under the *NSW Aboriginal Land Rights Act 1983* on land within their boundaries. The CHDLALC aims to achieve long term economic and social solutions for the Aboriginal communities, and to conserve and maintain cultural and heritage land management. The CHDLALC boundaries extend from Red Rock in the north to south of Urunga (Oyster Creek), encompassing Nana Glen, Ulong and Fermont to the east, and Bellingen to the west.

The Garby Elders are a tribal group who recognise the lands and seas from Moonee northward along the coast past Wooli and inland to the east bank of the Orara River. This group was established in 1997 to empower the local Aboriginal Traditional Custodians (Coffs Harbour City Council, 2019d).

Non-governmental Organisations

There are a number of other non-governmental organisations (NGOs) that operate across the study area. These organisations include educational institutions, industry groups, landcare and bushcare groups, and community and resident groups and businesses.

Coffs Harbour Regional Landcare (CHRL) is an incorporated not for profit community organisation acting as the umbrella group for volunteers across the Coffs Harbour LGA. It assists members and the general public with their natural resource management activities, and pursues funding assistance for projects, practical assistance, and education and training across the study area.

Southern Cross University (SCU) is highly involved in technical research across the Coffs Harbour LGA relating to marine science and ecology. SCU has a position in the Coffs Harbour CEMAC and works with the City to undertake research projects that inform City management and planning. Recent studies include investigations of local Intensive Plant Agriculture on the Coffs Harbour coastal estuaries. The National Marine Science Centre (NMSC) within SCU is home to the Solitary Islands Aquarium.

There are also a number of active community groups across the study area, including the Woolgoolga Lake Working Group (WLWG), the Northern Beaches Residents Association (NBRA), and the Sandy Beach Action Group.

1.6.2 Statutory Context

The legislation and policy governing management of study area is complex, and includes acts and policies from all levels of government. A brief overview of the most relevant acts is provided herein for context, however more information can be found in the Stage 1 Scoping Study (Water Technology, 2020).

Coastal Management Act 2016

The CM Act establishes the framework and sets forth the objectives for coastal management in New South Wales. The purpose of the CM Act is to manage the use and development of the coastal environment in an ecologically sustainable way, for the social, cultural and economic well-being of the people of New South Wales (DPIE, 2019a).

The CM Act lists a series of management objects that must be considered when developing a CMP (refer to Part 3 of the Act). There are also objectives provided for each of the four coastal management areas.

The objectives in the CM Act have been considered and addressed in this CMP in the following ways:

- The Vision, and Objectives of this CMP are based on, and consistent with, the objectives set forth in the CM Act (See Section 1.4).
- Stage 1 of the CMP has considered the State and regional policies and plans prescribed by the Act;
- Stage 2 of the CMP (Water Technology, 2021a) has assessed in detail the various coastal zone issues, and hazards outlined in the CM Act.
- Stage 3 of the CMP (Water Technology, 2021b) has involved a high level of consultation with the community and relevant stakeholders in order to develop a series of management actions intended to address these issues and risks in an integrated and strategic manner. In doing so, the suite of actions:
  - Promotes the objects of the Act; and
  - Gives effect to the management objectives for the coastal management areas covered by the program.
- Stage 4 of the CMP has been developed in consistency with the statutory requirements of the Act, and the mandatory requirements set out in NSW Coastal Management Manual.

State Environmental Planning Policy (Resilience and Hazards) 2021

State Environmental Planning Policy (Resilience and Hazards) 2021updates and consolidates into one integrated policy a series of previously enforced SEPPs, including: SEPP 14 (Coastal Wetlands), SEPP 26 (Littoral Rainforests) and SEPP 71 (Coastal Protection), including clause 5.5. of the Standard Instrument – Principal Local Environmental Plan.

The RH SEPP streamlines coastal development assessment requirements, identifies development controls for consent authorities to apply to each coastal management area to achieve the objectives of the CM Act, and establishes the approval pathway for coastal protection works (DPIE, 2019).

State-wide mapping that accompanies the RH SEPP is available for the coastal wetlands and littoral rainforest area, the coastal environment area, and the coastal use area. The mapping of coastal vulnerability areas is undertaken as part of CMP development, based on either existing coastal hazard mapping, or mapping to be developed during Stage 2 of the CMP.

Marine Estate Management Act 2014

The *Marine Estate Management Act 2014* (MEM Act) forms part of the NSW Marine Estate Management Framework. The framework comprises statutory instruments, strategies, assessment, plans and policy settings, and is administered under the auspices of the Marine Estate Management Authority (MEMA).

The objective of the MEM Act is to provide for strategic and integrated management of the NSW marine estate, including the marine waters, coasts and estuaries. The MEM Act promotes a biologically diverse, healthy and productive marine estate, and facilitates the economic cultural, social and recreational use of the marine estate,

scientific research, education and management of marine parks. The key legislative instruments under the MEM Act include:

- Marine Estate Management Regulation 2017; and
- Marine Estate Management (Management Rules) Regulation 1999.

As all four of the estuaries are located within the SIMP there are a number of special legislative protections and requirements that apply to the estuaries under the MEM Act and regulations. Under Section 56 of the MEM Act, for any development on land that is in the locality of a marine park, the consent authority must take into consideration the Act and potential impacts on the marine park.

Furthermore, marine park legislative requirements require that certain activities require consent (in the form of a marine park permit), including:

- Interference or damage to any part of habitat (Clause 1.16);
- Commercial (Clause 1.32) or research activities (Clause 1.31); and
- Organised sporting, educational or recreational activities (Clause 1.34).

The above requirements mean that CMP actions: A, C, D, E, F, G, M, N, and Q will require consent in the form of a marine park permit under marine estate legislation before implementation can commence.

1.6.3 Related Plans and their Linkages to the CMP

It is important to note that there are a range of external (and/or parallel) plans and programs that are relevant to the CMP – and these are implemented at a local, state, and federal level. A summary of these plans is outlined in the Stage 1 Scoping Study (Water Technology, 2021). Those of particular relevance to keys issues across the study area are summarised below.

The Coffs Harbour Estuary Entrance Management Policy

The City has developed an overarching *Entrance Management Policy* that addresses the management of the numerous ICOLLs that are located across the Coffs Harbour LGA. The purpose of the policy is to establish a clear framework for decision making around ICOLL entrance management, and to define which ICOLLs will / will not be artificially managed, and under what circumstances. The overarching approach of the policy is to advocate the general principle of minimal intervention. The NSW Government supports minimal interference with ICOLL entrances, and advocates natural processes being allowed to operate to the greatest extent possible (DPIE, 2021).

Within this framework, a series of Entrance Management Plans have been developed for ICOLLs that require artificial intervention for flood mitigation purposes. Consequently, an Entrance Management Plan has been developed for Woolgoolga Lake (Coffs Harbour City Council, 2019b). The purpose of the plan is to provide the City with the criteria for artificially intervening at the estuary entrance (through management of the berm height), and a process for undertaking the works. The aim of the plan is to responsibly manage the flooding of low-lying infrastructure and private property in a way that allows the lake to function as naturally as possible.

There are no site-specific entrance management plans developed for Darkum Creek, Willis Creek, or Hearnes Lake. Rather, a minimal intervention approach is adopted for these estuaries as outlined in the LGA-wide policy. This CMP has not identified any changes required to the current policy. However, it is noted that entrance morphodynamic processes are likely to be affected over the coming decades by sea level rise – and so it is recommended that the policy (as it relates to the Woolgoolga Region Estuaries) is reviewed at least every 10 years as part of the CMP Monitoring, Evaluation, and Reporting Process (see Section 6).

Floodplain Risk Management Plans

As ICOLLs, the Woolgoolga Region Estuaries are prone to catchment-based flooding. The inundation of low-lying assets and emergency planning for flood risk are addressed through the City's Floodplain Risk Management Process. This process aims to effectively manage inundation risk in accordance with the NSW Government Floodplain Development Manual (NSW Government, 2005) and the NSW Flood Prone Land Policy. Relevant Flood Risk Management Studies and Plans (FRMSPs) across the study area include:

- The Woolgoolga Floodplain Risk Management Study and Plan (BMT WBM, 2016); and
- The Coffs Harbour Northern LGA Flood Study, which will provide the City with fully updated modelling and detailed flood data for the greater Northern Coffs LGA catchments. This new study will cover the catchments of Darkum Creek, Willis Creek and Hearnes Lake, and is due for completion in 2023/24. It is anticipated that a similar FRMSP will eventually be developed once the Flood Study has been completed.

Management of this flood risk (including future risk associated with sea level rise impacts on catchment flooding) is currently directed by, and funded through, these FRMSPs and the NSW Floodplain Management Program.

The Draft NSW Mainland Marine Park Management Plan 2021-2031

The NSW Government has been developing a network management plan for the 5 mainland marine parks, including SIMP, which delivers on the requirements of the MEM Act 2014. The statutory management plan delivers a new approach to marine park management and sets a new direction for the mainland marine park network in NSW over 10 years. Several actions in the Draft NSW Mainland Marine Park Network Management Plan (DPI, 2021) link with, and complement, actions proposed in this CMP.

1.6.4 Social and Economic Context

Coffs Harbour is a growing regional centre, and a key hub for the State's mid-north coast. Whilst the region has historically been a popular spot for retirement, in recent decades it has continued to attract residents as traditional economic sectors such as agriculture and tourism have expanded into education, health, and professional services.

The Coffs Harbour LGA's population is forecast to grow to over 96,000 from 2020 to 2036 (CommunityID, 2020), an increase of around 23% – see Table 1-3. This equates to an annual growth of around 1.3%, which is on par with the national average. However, Table 1-3 also shows that the local population growth for the Woolgoolga area (including the four estuary catchments) is expected to be above average population relative to the rest of the LGA - with growth of over 40% forecast between 2020 and 2036 (CommunityID, 2020). This growth will require significant changes to the built environment that will place additional pressure on the Woolgoolga Region estuaries. Development forecasts for the four study area catchments indicate that an increase of over 1,300 residential dwellings may be expected from 2020 to 2036 (CommunityID, 2020).

Table 1-3 Population centres across the study area (source: Community ID, 2020)

Statistical Area	Localities	Population 2020	Population 2036
Northern Beaches	Arrawarra, Arrawarra Headland, Corindi Beach, Mullaway, Red Rock and Safety Beach	4,988	5,939 (+19%)
Woolgoolga	Woolgoolga	5,671	7,872 (+40%)
Sandy Beach	Sandy Beach, Emerald beach	4,669	5,959 (+27%)
Statistical Area sub-total		15,328	19,770 (29%)
Coffs Harbour LGA Total		77,800	96,000 (+23%)

1.7 Coastal Zone Emergency Action Subplan (CZEAS)

The CM Act requires that a Coastal Zone Emergency Action Subplan (CZEAS) be included in the CMP if the study area contains land within the CVA and beach erosion, coastal inundation or cliff instability is occurring on that land. The CM Act identifies specific emergency management considerations associated with beach erosion, coastal inundation, and cliff instability. Specifically, Section 15 (3) of the CM Act states that:

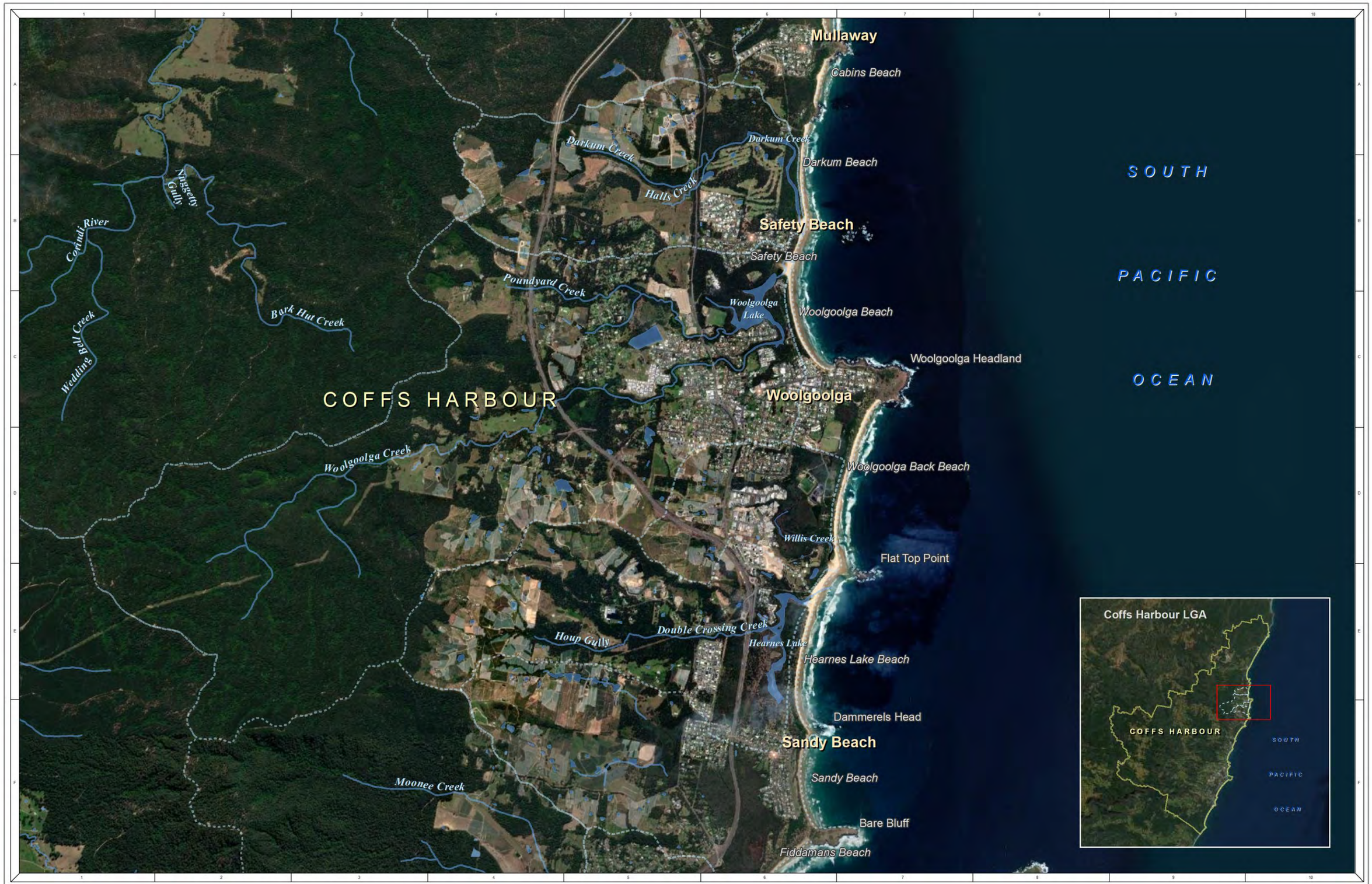
> *"A **coastal zone emergency action subplan** is a plan that outlines the roles and responsibilities of all public authorities (including the local council) in response to emergencies immediately preceding or during periods of **beach erosion**, **coastal inundation** or **cliff instability**, where the beach erosion, coastal inundation or cliff instability occurs through storm activity or an extreme or irregular event"*

The Woolgoolga Region Estuaries are subject to the coastal hazards of beach erosion, coastal inundation and cliff instability within the CVA. Consequently, a CZEAS has been prepared in accordance with the mandatory requirements for CZEAS' specified in the CM Act and accompanying NSW Coastal Management Manual (OEH, 2018a). The CZEAS for the Woolgoolga Region Estuaries is contained in Appendix D.

1.8 Study Area Maps

The following maps are provided in this Section:

- Figure 1-11 Locality plan for the Woolgoolga Region Estuaries
- Figure 1-12 Locality plan and land tenure for Darkum Creek
- Figure 1-13 Locality plan and land tenure for Woolgoolga Lake
- Figure 1-14 Locality plan and land tenure for Willis Creek
- Figure 1-15 Locality plan and land tenure for Hearnes Lake
- Figure 1-16 Coastal Environment Area and Coastal Use Area
- Figure 1-17 Coastal Wetlands and Littoral Rainforests
- Figure 1-18 Primary and secondary coastal sediment compartments



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Sub-Catchment Waterways / Waterbodies

0 0.5 1 2 Kilometers

1:40,000 @ A3

WATER TECHNOLOGY

COFFS HARBOUR CITY COUNCIL

Figure 1-11: Locality Plan
Darkum Creek, Woolgoolga Lake, Willis Creek and Hearnes Lake CMP

REFERENCE: M:\21010147_Woolgoolga_CMP_Stages2_4\Spatial\Workspaces\Final\Figures\21010147_Locality_Map.mxd
DATE: 20/10/2015 SHEET: of DRAWING NUMBER

Coffs Coast Regional Park

Mullaway

SOUTH PACIFIC OCEAN

Darkum Creek

Solitary Islands Marine Park: Habitat Protection Zone

Darkum Beach

Woolgoolga

Darkum Creek

Halls Creek

Safety Beach

Safety Beach

Coffs Harbour LGA

COFFS HARBOUR

SOUTH PACIFIC OCEAN

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N W E S

CMP Study Area
Sub-Catchment
Council Reserve
Crown Land Reserve
NPWS Estate
NSW Marine Protected Area and Crown Waterway
State Forest
Cadastre

0 0.125 0.25 0.5 Kilometers

1:8,000 @ A3

WATER TECHNOLOGY

COFFS HARBOUR CITY COUNCIL

Figure 1-12: Darkum Creek Estuary and Land Tenure

Darkum Creek, Woolgoolga Lake, Willis Creek and Hearnes Lake CMP

REFERENCE: M:\21010147_Woolgoolga_CMP_Stages2_4\Spatial\Workspaces\Final\figures\21010147_LandTenure_DarkumCreek.mxd

DATE: 23/05/2023 SHEET: of DRAWING NUMBER:

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CMP Study Area
Sub-Catchment
Council Reserve
Crown Land Reserve
NPWS Estate
NSW Marine Protected Area and Crown Waterway
State Forest
Cadastre

0 0.15 0.3 0.6 Kilometers

1:10,000 @ A3

WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

COFFS HARBOUR CITY COUNCIL

Figure 1-13: Woolgoolga Lake Estuary and Land Tenure
Darkum Creek, Woolgoolga Lake, Willis Creek and Hearnes Lake CMP

REFERENCE: M:\21010147_Woolgoolga_CMP_Stages2_4\Spatial\Workspaces\FinalFigures\21010147_LandTenure_WoolgoolgaLake.mxd
DATE: 23/05/2023 SHEET: of DRAWING NUMBER:

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CMP Study Area
Sub-Catchment
Council Reserve
Crown Land Reserve
NPWS Estate
NSW Marine Protected Area and Crown Waterway
State Forest
Cadastre

0 0.125 0.25 0.5 Kilometers

1:8,000 @ A3

WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

COFFS HARBOUR CITY COUNCIL

Figure 1-14: Willis Creek Estuary and Land Tenure
Darkum Creek, Woolgoolga Lake, Willis Creek and Hearnes Lake CMP

REFERENCE: M:\21010147_Woolgoolga_CMP_Stages2_4\Spatial\Workspaces\F-trial\Figures\21010147_LandTenure_WillisCreek.mxd
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N
W
E
S

CMP Study Area
Sub-Catchment
Council Reserve
Crown Land Reserve
NPWS Estate
NSW Marine Protected Area and Crown Waterway
State Forest
Cadastre

0 0.175 0.35 0.7 Kilometers

1:12,500 @ A3

WATER TECHNOLOGY
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Figure 1-15: Hearnes Lake Estuary and Land Tenure

Darkum Creek, Woolgoolga Lake, Willis Creek and Hearnes Lake CMP

REFERENCE: M:\21010147_Woolgoolga_CMP_Stages2_4\SpatialWorkspaces\FinalFigures\21010147_LandTenure_HearnesLake.mxd

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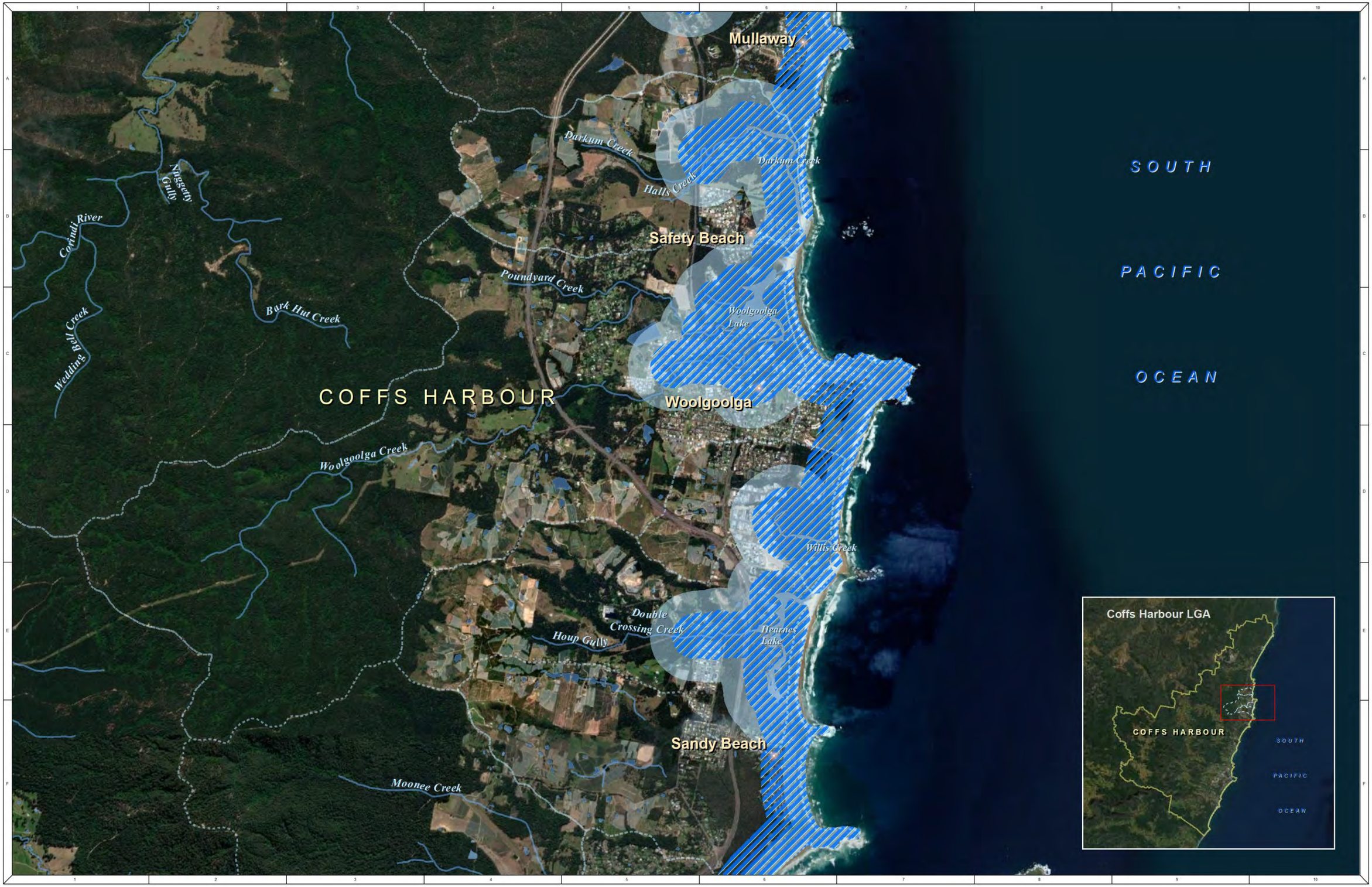

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Sub-Catchment | Coastal Use Area | Coastal Environment Area

0 0.5 1 2 Kilometers

1:40,000 @ A3

WATER TECHNOLOGY

COFFS HARBOUR CITY COUNCIL

Figure 1-16: Coastal Environment Area and Coastal Use Area
Darkum Creek, Woolgoolga Lake, Willis Creek and Hearnes Lake CMP

REFERENCE: M:\21010147_Woolgoolga_CMP_Stages2_4\Spatial\Workspaces\Final\Figures\21010147_Coastal_Use_Environment_Areas.mxd
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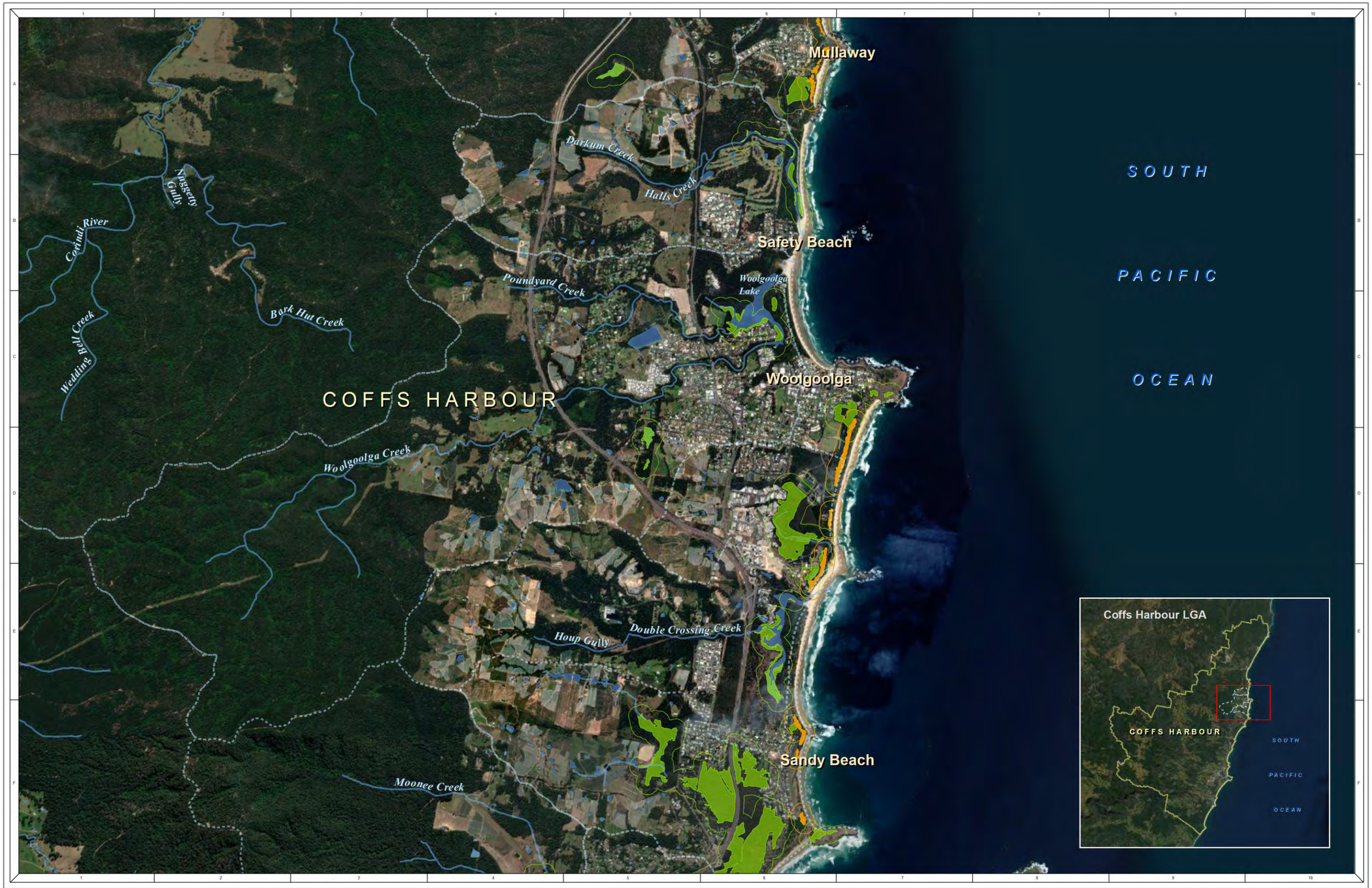

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N
W E
S

Littoral Rainforest
Littoral Rainforest Proximity Area
Coastal Wetland
Coastal Wetland Proximity Area
Sub-Catchment

0 0.5 1 2 Kilometers

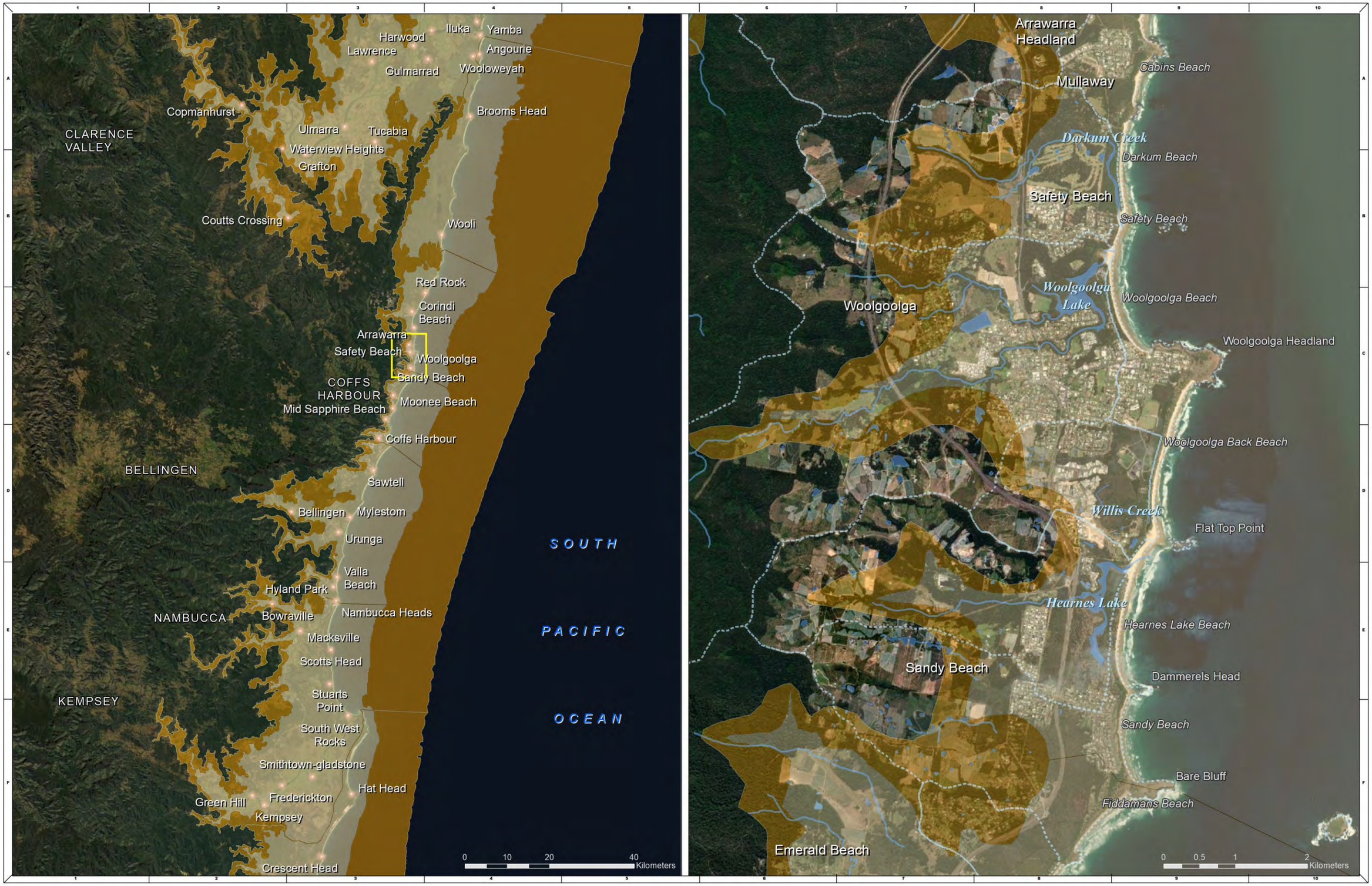
1:40,000 @ A3

WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

COFFS HARBOUR CITY COUNCIL

Figure 1-17: Coastal Wetlands and Littoral Rainforests
Darkum Creek, Woolgoolga Lake, Willis Creek and Hearnes Lake CMP

REFERENCE: M:\21010147_Woolgoolga_CMP_Stages2_4\Spatial\Workspaces\FinalFigures\21010147_Wetlands_Littoral_Rainforest.mxd
DATE: 27/06/2022 SHEET: a1 DRAWING NUMBER:



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N W E S

Sub-Catchment
Waterways / Waterbodies
Primary Sediment Compartment
Secondary Sediment Compartment

WATER TECHNOLOGY
COFFS HARBOUR CITY COUNCIL

Figure 1-18: Sediment Compartments
Darkum Creek, Woolgoolga Lake, Willis Creek and Hearnes Lake CMP

REFERENCE M:\21010147_Woolgoolga_CMP_Stages2_4\Spatial\Workspaces\FinalFigures\21010147_SedimentCompartments.mxd
DATE 27/10/2022 SHEET of DRAWING NUMBER

2 SNAPSHOT OF ISSUES

The major issues affecting the environmental, social, cultural and economic values of the Woolgoolga Region Estuaries have been assessed in detail in the *Woolgoolga Region Estuaries CMP Stage 2 – Risks, Vulnerabilities and Opportunities Report* (Water Technology, 2021a).

This assessment included a robust analysis of both current and emerging risks, and was undertaken in alignment with the risks and threats identified in the NSW Marine Estate Threat and Risk Assessment (TARA) (BMT WBM, 2017) – and included strong consideration of stressors identified in the TARA as high priority stressors.

As required by the CM Act, emerging risks have been considered over a range of forward planning timeframes including 20 years (the year 2042), 50 years (2072), 100 years (2122). The reader is directed to the Stage 2 report for full detail; however, a brief summary is provided herein.

2.1 Coastal and Estuarine Hazards

Coastal Geomorphology and Entrance Dynamics

The CMP study area is situated within the "NSW Northern Rivers" primary sediment compartment, which extends from Yamba in the north to Laggers Point in the south and spans the Kempsey Shire, Nambucca, Bellingen, Coffs Harbour, and Clarence Valley LGAs. Within this primary sediment compartment, the study area is situated wholly within the "Wooli-Coffs Coast" secondary coastal sediment compartment, as listed in Schedule 1 of the CM Act - which extends from the Wooli Wooli River in the north, to Bare Bluff in the south. The primary and secondary sediment compartments of the Coffs Harbour Coastal zone are depicted in Figure 1-18.

The coastal plain of Coffs Harbour is punctuated by a number of estuaries, which originate in the coastal ranges and flow across the narrow alluvial plains towards the sea. Most of these streams form creeks and lakes behind the open coast beaches dunes, with the mouths of the various waterways affected by the ebb and flow of marine sediments.

As a result, the estuaries of the study area are classified as ICOLLs, which means that their connection to the ocean is intermittent, and based on the balance between catchment flows that tend to keep estuaries open, and coastal processes which act to keep them closed. In this way, the ambulatory and dynamic nature of coastal sediment transport processes has a significant impact on the connectivity of the estuaries to the ocean – which has subsequently effects on coastal hazards (inundation and erosion) and estuarine water quality across the study area.

As for all ICOLLs located in urban areas, entrance management is a significant issue across the study area estuaries. The City currently implements an overarching *Entrance Management Policy* that covers the numerous ICOLLs that are located across the Coffs Harbour LGA – and this is discussed in Section 1.6.3.

Coastal Storm Impacts

The Coffs Harbour coastal zone is periodically exposed to storm activity originating in the sub-tropics of the north and the mid-latitudes of the south. To the north are tropical cyclones, which occur during the summer months with depressions developing into easterly troughs. Further south, low pressure systems such as cut-off lows, migratory lows and east coast lows are a major source of severe weather, particularly in the colder months (WBM Oceanics Australia, 2006; BMT WBM, 2016).

These systems are all capable of generating storm surges, severe wave conditions, storm erosion and catchment flooding across the coastal zone. Flooding and inundation in the estuaries may occur independently

due to oceanic storms or catchment flooding, but may also occur due to a combination of both derived from the same meteorological event. As ICOLLs, the duration and severity of flooding is often governed by the state of the entrance condition (i.e., open or closed, and the height of the entrance berm).

Coastal and Catchment Inundation

There are limited historical flood records available for the study area estuaries. Coastal hazard studies (BMT WBM, 2011) and local catchment flood studies (BMT WBM, 2012) indicate that there are a number of communities around the various foreshores of the study area that are affected by event-based inundation to various levels of severity and risk.

Figure 2-1 Woolgoolga Lake flooding event in 2011 (source: Coffs Coast Advocate)

Coastal storm tide inundation was mapped for each of the four estuaries as part of the Coffs Harbour Coastal Processes and Hazards Definition Study (BMT WBM, 2011). This mapping shows that there are a number of communities around the various foreshores of the study area that are affected by storm-related coastal inundation, particularly under future sea-level rise, including:

- *Darkum Creek:* While the inundation extents tend to be limited to vegetated and undeveloped areas, some impacts are observed at Safety Beach, including Woolgoolga RSL Golf Club (around 30 ha of inundation), and along Baroona St and Ocean Links Cl.
- *Woolgoolga Lake:* Inundation of low-lying areas behind Woolgoolga Beach extends around Woolgoolga Lake and into developed areas behind the southern part of the beach, south of the lake, for the 'almost certain' probability within an immediate timeframe. By 2100, the 'unlikely' and 'rare' scenarios suggest expanded inundation across developed areas in Woolgoolga on the southern slopes to the lake, including much of northern Woolgoolga east of Solitary Islands Way. This includes dozens of properties around Melaleuca Ave and the entirety of the Sunset Caravan Park. It also includes the community in between Woolgoolga Creek and Beach Street, and the Woolgoolga township along Market Street.
- *Willis Creek:* Some areas of the Woolgoolga Water Reclamation Plant may be inundated, along with industrial estates that border the creek along Bosworth Rd and Hawke Dr.
- *Hearnes Lake:* Within the immediate timeframe, inundation of Back Beach areas is facilitated through Hearnes Lake, with the 'almost certain' to 'rare' probability water levels covering a similar extent, generally over the footprint of the lake behind Hearnes Lake and Woolgoolga Back Beaches. Inundation is likely to affect the Caravan Park south of Hearnes Lake Road, as well as the row of properties that border the southern fringes of the lake along Pine Crescent and Maple Rd (as well as the location of the proposed Hearnes Lake subdivision at the end of Ti-Tree Road).

Furthermore, the risk associated with coastal and catchment inundation will increase over the coming decades as mean sea level (and lake levels) increases, and the entrance berm of these estuaries migrates upwards and landwards in response. For the Woolgoolga Region Estuaries, this will require adaptation to progressively rising estuary water levels over the coming decades, in line with sea level rise (SLR).

As discussed in Section 1.6.3, the inundation of low-lying assets and emergency planning for flood risk are addressed through the City's Floodplain Risk Management Process.

Tidal Inundation

Tidal inundation (often referred to as “sunny-day flooding”) refers to periodic inundation of low-lying estuarine foreshores due to these processes, and is a fundamental driver of wetland function. The NSW Estuary Tidal Inundation Exposure Assessment (OEH, 2018g) has identified land and infrastructure around the estuaries that is at risk from inundation under a range of sea level rise scenarios. The results of this assessment show that for the four estuaries, the risk to properties and roads associated with tidal inundation is relatively low. For all of the estuaries, the number of affected properties is less than five for a 0.5 m sea level rise (SLR) scenario, and less than 20 properties for up to 1.0 m of SLR. However, the mapping indicates that vulnerability to tidal inundation is higher at Woolgoolga Lake, with a number of hotspots that may become exposed at +1.0 to +1.5 m of future sea-level rise.

2.2 Estuarine Water Quality

As ICOLLs, water quality within these estuaries is particularly vulnerable to catchment inputs, as they lack the mechanism of regular tidal flushing when the estuary entrances are closed. The ecological values of these estuaries are particularly important given their location within the Solitary Islands Marine Park.

Land uses across the study area catchments are varied. The lower catchments are occupied by urban centres, industrial precincts and Coffs Coast Regional Park, while the upper catchments comprise significant areas of State Forest and agricultural land that is predominantly utilised for Intensive Plant Agriculture (IPA), cucumber horticulture and banana plantations. Catchment runoff from these land uses has a major impact on estuarine water quality.

Figure 2-2 Water quality investigations by SCU

The Northern Rivers Aquatic Ecosystem Health Monitoring Program (Ecohealth) water quality scores for the Woolgoolga Region Estuaries indicate that water quality in the study area is rated as poor to moderate (noting some inter-estuary variance). Water quality scores for the estuaries are provided in Table 2-1.

Table 2-1 Ecohealth water quality scores for study area estuaries

Location	2011	2015	2020
Darkum Creek	D+	C+	C+
Woolgoolga Lake (Entrance)	C+	D+	C+
Woolgoolga Lake (Body)	D	C-	C+
Willis Creek	-	F	D+
Hearnes Lake	C-	C-	D+

Urban and Industrial Runoff

Catchment runoff and associated urban stormwater discharge are a major source of water quality issues across the study area. Urban runoff may contain a range of pollutants, including sediment, nutrients, heavy metals, hydrocarbons, chemical compounds and gross pollutants (GeoLINK, 2011a). While the study area

catchments are relatively small, the intensity of urban development within them has the potential to impact sensitive receiving systems of the estuaries.

The estuaries are affected by runoff from urban centres across their lower catchments that include the townships of Woolgoolga, Sandy Beach and Safety Beach – with the highest impacts observed in Woolgoolga Lake and Willis Creek. Willis Creek is also impacted by runoff from the Woolgoolga Industrial Estate (see Figure 2-3), which contains light industry such as automotive yards, car washes, concrete batching and landscaping supplies.

If left unmanaged, these issues are likely to become more prominent over time as significant population growth and intensification of urban development is planned for the study area over coming decades.

Additionally, Willis Creek has historically been exposed to rare overflow events from the Woolgoolga Water Reclamation Plant (WWRP) wet weather balance pond - around every 5 to 10 years on average (GeoLINK, 2011d).

Figure 2-3 The Woolgoolga industrial precinct

Agricultural Runoff

The Coffs Harbour region has been an agricultural hub for over 100 years. Whilst the region has historically been a major banana producing area in Australia, in recent decades the agricultural production in the Coffs Harbour has shifted towards Intense Plant Agriculture (IPA), including blueberries, cucumbers, macadamias, tomatoes and other vegetables – see Figure 2-4. The overall proportion of agricultural land usage across the estuary catchments is high.

Agricultural land usage can result in the increased export of a range of potential contaminants to waterways including nutrients, herbicides, pesticides, sediment and organic matter. Both historical and contemporary agricultural operations have affected estuarine water and sediment quality in the estuaries – and consequently, agricultural runoff has been identified as a key estuary health issue.

Numerous studies have been undertaken over the last 10 years assessing the response of the study area estuaries to catchment land usage and horticultural runoff. Many of these studies have found significant nitrate and nitrite (NO_X) levels within Hearnes Lake, well in excess of ANZECC trigger values. In some instances, these levels were amongst the highest reported for catchments on the east coast of Australia. These assessments indicate that following wet weather, nitrogen loads in runoff were more than 500 times higher than recorded in base flows during dry periods, demonstrating the amount of fertiliser in runoff from intensive land uses upstream of the estuaries and subsequent runoff during rain events (White, Santos, Conrad, & Sanders, 2018). Research suggests that the estuaries in the study region can assimilate nitrogen during dry conditions but lose this ability during high flow conditions when large nitrogen loads enter the system.

Figure 2-4 Agricultural land usage in the Hearnes Lake catchment

Further complicating this issue is the use of recycled water from the City's "purple pipe" recycled water distribution network across the Coffs Harbour LGA. This recycled water is currently supplied free of charge to nearly 60 end users across the LGA, including commercial and agricultural operators. Recycled water treated through primary, secondary, and tertiary processes may still contain chemical and biological contaminants, including faecal coliforms, nitrogen and phosphorus, which will have impacts on downstream estuarine water quality.

2.3 Land Use Intensification and Environmental Impacts

Sediment Contamination

Historical studies and reports have indicated that there are ongoing sediment contamination issues within the four study area estuaries. These issues largely relate to past and present catchment land usage, including urban, industrial, and agricultural runoff. Analysis by Southern Cross University (SCU) showed that trace metals (As, Cd, Cu, Pb, Zn and Cr) and nitrogen (N) had increased fluxes into the sediments of Hearnes Lake in the last 15 years, which was primarily related to increased erosion of soils rather than chemical contamination. Phosphorus enrichment in bed sediments increased by nine-fold and sediment fluxes by over forty-fold (up to 12.6 mg m-2 yr-1) during the expansion of IPA within the catchment since 2002 (Conrad, Sanders, Santos, & White, 2018). Whilst no corresponding study has examined sediment quality within Darkum Creek, Woolgoolga Lake or Willis Creek, it is considered highly likely that similar issues extend to these estuaries owing to their similar distribution of catchment land usage.

Water Extraction

Surface and groundwater extraction have also been identified by stakeholders and the community as a key issue. Freshwater inflows are an essential determinant of the health of estuaries, and therefore changes to the volume, timing and quality of freshwater inflow from the upper catchment can have significant impacts on estuary health, particularly during dry times. This can have flow on impacts to recreational water use,

recreational fishing and the commercial fishing and tourism industries. Water extraction can also modify the natural opening / closing regime of ICOLLs – as it can reduce the volume of freshwater flows reaching an estuary, and therefore reduce the frequency of entrance breakouts

The NSW Marine Estate Threat and Risk Assessment (BMT WBM, 2017) has identified *modified freshwater flows* in estuaries as the 6th greatest threat to environmental values of the marine estate in the northern region of NSW, which includes the Solitary Islands Marine Park. Modified hydrology/hydraulics and flow regime has also been identified as a priority threat to social, cultural and economic values. Mechanisms that alter natural flow regimes of rivers and streams has been listed as a key threatening process under the *Fisheries Management Act 1994*.

Under the *Water Sharing Plan for the Coffs Harbour Area Unregulated and Alluvial Water Sources 2009* there are around 50 water extraction licences across the estuary catchments that allow local users to extract water from rivers or aquifers for irrigation, industrial or commercial purposes (predominantly across the Hearnes Lake and Woolgoolga catchments). As of late 2021, the Coffs Harbour water sharing plan was still under review. In addition to water extraction licences, in October 2021 the NSW Government announced that the amount of rainwater landholders in coastal-draining catchments of NSW can capture in farm dams without a licence will increase from 10% of the average regional rainwater runoff to 30%. There is also community concern about compliance with water management rules following some high rates of non-compliance in recent audits.

It is likely that over coming decades, population growth, increased development, and this increase to Coastal Harvestable Rights will lead to increasing pressure for additional water extraction to occur across the estuary catchments. Water management decisions should recognise that freshwater inflows are an essential requirement for the maintenance of estuarine and coastal ecosystems and any increase in uptake could have significant impacts on estuary and ecosystem health. Any changes to water extraction/harvesting limits should be carefully considered, evidence based and be accompanied by detailed and robust estuarine hydrological and ecological assessments prior to being implemented, with reviews undertaken as required.

Biodiversity and Habitat Loss

There is a variety of riparian and estuarine vegetation across the study area, including, seagrass, saltmarsh and mangroves (see Figure 2-5). They provide significant water quality and ecosystem health benefits, such as nutrient uptake, pollution filtration, bank stability, decreasing runoff, and increased habitat diversity.

Figure 2-5 Mangrove habitat in Woolgoolga Lake

The habitat value of the estuaries is significant, and it is estimated that 70% of coastal fish species in south-eastern Australia need to move through estuaries to complete their life cycle (Copeland & Pollard, 1996).

However, these habitats are vulnerable to the impacts of increased foreshore development, land clearing and weed invasion. The Coffs Harbour LGA population is predicted to grow substantially over coming decades. This growth will require significant changes to the built environment which will place additional pressure on the Woolgoolga Region Estuaries in the form of urban development pressures.

A foreshore weeds assessment was undertaken as part of this study, and identified that weeds were observed widely across the study area estuaries. The major weed species identified include bitou bush (*Chrysanthemoides monilifera*), coastal morning glory (*Ipomoea cairica*), groundsel (*Baccharis halimifolia*), pink lantana (*Lantana camara*), camphor laurel (*Cinnamomun camphora*), winter cassia (*Senna pendula glabrata*), ground asparagus (*Asparagus aethiopicus*) and noogoora burr (*Xanthium occidentale*) – see Figure 2-6.

Figure 2-6 Winter Cassia on the shores of Woolgoolga Lake

Estuarine habitats and biodiversity will also be affected over coming decades by the landward migration of coastal wetlands in response to rising sea levels (known as habitat squeeze), and this is discussed in Section 2.4.

Shellfish ecosystems, also known as shellfish or oyster reefs or beds, can also be found in the study area. These complex, three dimensional dense aggregations of shellfish provide food, shelter and protection for a diverse range of marine creatures including important recreational and commercial fish species. Natural oyster reefs also help improve water quality by filtering and cleaning the water and can protect shorelines from wave erosion. Notably, the Leaf Oyster *(Isognomon ephippium*) population within Woolgoolga Lake has regional significance, as it is understood to be one of the largest known Leaf Oyster populations across the 300 km stretch from Brunswick Heads to Nambucca Heads. Engagement with DPI Fisheries and SCU during development of the CMP indicates that shellfish ecosystems within Woolgoolga Lake have experienced decline and degradation over recent decades – specifically the Leaf Oyster, and Sydney Rock Oyster (*Saccostrea glomerata)* populations within the estuary – see Figure 2-7.

Figure 2-7 Leaf Oysters in Woolgoolga Lake (source: SURG, 2021)

Preservation of Aboriginal Cultural Heritage

The Coffs Harbour Region has a rich and continuing Aboriginal cultural heritage, with cultural history extending back more than 40,000 years. It is dynamic and includes both tangible and intangible elements. Discussions with Traditional Owners during Stages 2 and 3 have indicated that Aboriginal cultural heritage values are currently threatened by increased development across the estuary catchments, water extraction from

commercial and agricultural uses, and information gaps regarding tangible heritage items and artifacts. The CMP therefore represents an opportunity to respond to the concerns and needs of Aboriginal stakeholders, with appropriate resourcing of their roles in defining the values of, and caring for, their heritage.

2.4 Climate Change Impacts

The estuaries will also come under increasing pressure over the coming decades from a range of projected climate change impacts. These are detailed in the Stage 2 report and include:

- *Ocean (and estuarine) temperature increase:* Estuaries are impacted by both changes in local coastal catchment conditions, as well as ocean warming. Scanes et al. (2020) found that estuary temperatures in South-Eastern Australia have increased by an average of ~2.1°C between 2007 and 2019, with higher rates of warming in shallow lagoons and rivers compared to deeper lakes and waterways. Ecological systems are threatened by sustained high temperatures that exceed the thermal thresholds of their species. The broader Coffs Coast may expect a tropicalisation of its ecosystems as a result of warming water temperatures, as warm-water species migrate further south down Australia's east coast (Verges, et al., 2014).
- *Ocean acidification:* Ocean acidification has various impacts on the different components of estuarine ecosystems. It may cause dissolution of shells and other calcareous structures, and has the potential to disrupt marine food chains by disrupting phytoplankton communities. In addition to the ecological impacts, increased acidity may affect physical and chemical estuarine processes by altering metal solubility and thus water chemistry.
- *Altered storm frequency and severity:* In general, both the frequency and severity of damaging storms is predicted to increase under climate change conditions.
- *Altered hydrologic and hydrodynamic regimes:* The predicted reduction in total rainfall, combined with an increase in evaporation, is likely to result in a reduction in the frequency of entrance breakouts (as it would take longer for the ICOLL to fill to the entrance berm height and breakout) with climate change. The net upwards shift in typical water levels of the ICOLL (commensurate with sea level rise), combined with the generally flat topography of fringing lands means that ICOLLs will store a larger volume of water before breaching of the entrance. See Figure 2-8 for a conceptual drawing of the landward and upward shift in berm profile. This would retard, to some extent, the water level response of the estuary to catchment runoff inflows and reduce the frequency of entrance breakouts (Haines & Thom, 2007; Hanslow, Davis, You, & Zastawny, 2000).

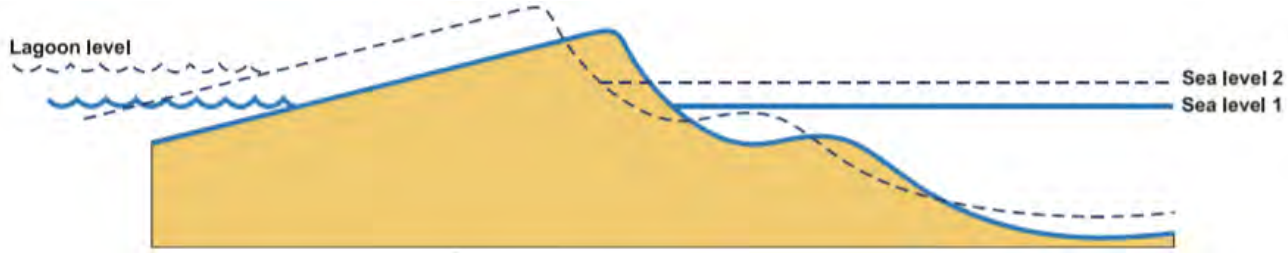


Figure 2-8 Projected response of ICOLL entrance berms due to sea level rise (Hanslow, Davis, You, & Zastawny, 2000).

- *Habitat migration and 'squeeze':* Landward migration of low-lying intertidal habitats such as mangroves, saltmarshes, mudflats, sand banks, and rocky shorelines will occur in response to rising sea levels (Glamore, Rayner, & Rahman, 2016). However, existing and future coastal development will form a barrier to wetland migration in some areas, resulting in habitat squeeze (Oppenheimer, et al., 2019). This will have significant repercussions for estuarine ecology, most notably fringing wetlands and saltmarsh communities (Haines & Thom, 2007).

2.5 Risk Summary

A summary of the present-day risks and their stressor levels across the study area estuaries is provided in Table 2-2. It shows that there are numerous threats and stressors facing the study area estuaries. The evolution of these risks over the coming decades as the climate changes is described in further detail in the Stage 2 report.

Table 2-2 Summary of Stage 2 Risk Assessment – present-day risks

Threat	Stressor	Darkum Creek	Woolgoolga Lake	Willis Creek	Hearnes Lake
Coastal and Estuarine Hazards	Tidal inundation	Moderate	Moderate	Moderate	Moderate
	Coastal storm tide inundation	Moderate	Moderate	Moderate	Moderate
	Combined coastal and catchment flooding	Moderate	High	Moderate	Moderate
	Bushfire water quality impacts	Low	Moderate	Low	Low
	Climate change impacts[#]	High	High	High	High
Estuarine Water Quality	Urban stormwater runoff	Very High	Very High	Very High	Very High
	Industrial runoff	Moderate	Moderate	Very High	Moderate
	Sewage effluent and septic runoff	Moderate	Moderate	High	Moderate
	Recycled water usage	Very High	Very High	Very High	Very High
	Agricultural runoff	Very High	Very High	Very High	Very High
Land Use Intensification	Sediment contamination and pollution	High	High	High	High
	Acid sulfate soils	Moderate	Moderate	Moderate	Moderate
	Sedimentation	Moderate	Moderate	Moderate	Moderate
	Modified freshwater flows (including surface and groundwater extraction)	High	Very High	High	Very High
	Loss of riparian and aquatic habitat and biodiversity	High	High	High	High
	Foreshore weeds and introduced species	High	High	High	High
	Loss of Aboriginal cultural heritage values	High	High	High	High
	User group conflict and waterway access	Low	Low	Low	Low
Governance and Planning	Entrance management	Low	Moderate	Low	Moderate
	Lack of compliance with regulations and/or lack of regulation effort	Very High	Very High	Very High	Very High
	Incomplete coastal process information	Moderate	Low	Moderate	Moderate
	Incomplete water quality information	High	High	High	High

[#] These risks are reported for the 100-year time frame, and represent the worst-case rating amongst the various stressors discussed in Section 2.4

3 STAKEHOLDER AND COMMUNITY ENGAGEMENT

During Stage 1 of the CMP, Water Technology prepared a comprehensive Community and Stakeholder Engagement Strategy that outlined the timing, content, and engagement methods to be utilised during Stages 2 to 4 of the CMP. The strategy was developed in accordance with CMP Engagement Guidelines (OEH, 2018a), the City of Coffs Harbour Community Participation and Engagement Plan (Coffs Harbour City Council, 2019a), and the use of the International Association for Public Participation (IAP2) guidelines.

This strategy has been implemented through the development of the CMP - which has involved a robust regime of stakeholder and community engagement integrated through all stages. A summary of the engagement process for the CMP is depicted in Figure 3-1 and described in Section 3.1 to 3.4.

Figure 3-1 Snapshot of CMP engagement process

3.1 The Have Your Say Page

At the commencement of Stage 1 of the CMP, the City established a *Have Your Say Coffs Harbour* page for the project. Through Stages 1 to 4 of the CMP the webpage has served as a central repository for the community that contains project information, updates, and pathways for direct engagement. It has included:

- **Background:** An overarching description of the project, and background to the CMP process - including the intent of the CMP, who is involved, and how it is developed. This has also been provided in the form of project summary videos, to clearly explain the project to the community.
- **Updates:** Updates on project progress as each stage of the CMP has evolved. This has been in the form of periodic project bulletins.
- **Key project deliverables:** including publishing the Stage 1 and Stage 2 Reports for public consumption.
- **Engagement materials:** including project posters that provide succinct summaries of the preliminary options included in the “Long-List”.

- **Engagement facilitation:** Information pertaining to community consultation events, and avenues for engagement - including links to the online survey.

3.2 Stage 1

The community and stakeholder engagement undertaken during Stage 1 comprised the following:

- *A Stakeholder Engagement Workshop* was held during the 19 February meeting of CEMAC. This workshop was an opportunity for stakeholders to contribute and have their say regarding the planning for, and implementation of, the CMP. The workshop was highly interactive and participatory. It included an initial presentation to the CEMAC in order to provide background and context, and was then followed by a series of open forum, round-table discussion sessions covering the issues and risks across the study area.
- *A series of "walk-and-talk" community consultation sessions* were held on the 17, 18 and 20 February 2020. The purpose of these sessions was to harness the local knowledge of the issues and risks facing each of the estuaries, on an estuary-by-estuary basis. Each session was attended by around four to six members of the local community, as well as members of the City of Coffs Harbour, DPE (E&H), DPI Fisheries and the CMP project team. The sessions were around 1½ to 2 hours in duration, and involved a walking tour of each estuary, where local residents could direct attention to local issues and risks.
- *An online community survey* was posted in order to obtain direct community input during the Scoping Study. The survey was accessed via the "Have Your Say" page that was established for the project. The purpose of the community values survey was to obtain a snapshot of:
  - How often locals visit the estuaries and what activities they engage in whilst there;
  - What the local community considers to be the most important ecological, social, cultural, aesthetic, recreational, and economic values of the study area; and
  - Community perceptions of key issues and attitudes towards potential management options.

3.3 Stages 2 and 3

3.3.1 Community Engagement

Direct community consultation was undertaken during Stage 3 in the form of an online community survey, which was conducted in parallel with other engagement tasks. The purpose of the survey was to ask the community for their assistance in:

- Providing feedback on some of the management options that were proposed by the project team; and.
- Providing suggestions and opinions regarding additional management options that could be included in the CMP.

Links to the survey were posted on the *Have Your Say* webpage for the project and advertised on the City's social media accounts.

The survey was open from 10 June 2021 until 18 July 2021, a period of over five weeks. In total, 103 responses were received. A complete register of responses is provided in the Stage 3 Report (Water Technology, 2021b).

For those who preferred face to face engagement, a community drop-in session was held to garner input for the Stage 3 options identification and assessment process.

During this session, community members were encouraged to drop by any time during the allotted hours. The venue was fitted out with a series of A1 posters that described each of the options, their intent, and their proposed benefits. Community members were provided opportunities to provided verbal and written feedback

(via feedback forms) on each of the options, and the project in general. Furthermore, community members provided a number of additional options for consideration in the CMP based on their local values and aspirations for the coastal zone.

Robust in-person discussions were held between community members and members of the project team from the City, and Water Technology. Community members were also directed to the *Have Your Say* page and the online survey where that feedback method was preferred.

Attendance was considered to be "low" to "medium", noting venue capacity limitations and community confidence/sentiment associated with in-person engagement and associated COVID-19 protocols and health risks. Nonetheless, several community members from the Woolgoolga Lake Working Group (WLWG) were in attendance, and provided significant local insights, comments and endorsements of many of the proposed options.

3.3.2 Engagement with Traditional Owners

As part of Stages 2 and 3 of the CMP, a multi-phase engagement process was undertaken with Traditional Owners groups, including representatives from the Coffs Harbour and District Local Aboriginal Land Council (CHDLALC), and Gumbaynggirr Cultural Knowledge Holders (including the Garby Elders).

At the commencement of Stage 2 of the CMP, a consultation was held between local elders and representatives from the City, DPE (E&H), and the project team. The meeting was held on Tuesday 19 January 2021 at the CHDLALC office at the Wongala Estate, Coffs Harbour. The purpose of the engagement was to:

- Follow up from the Stage 1 engagement process by providing a project update/briefing with important background into the CMP process and the process for engagement throughout.
- Garner local knowledge regarding the various study area values and risks. Discussion was had regarding all manner of risks and values; however, a particular emphasis was placed on discussing the significant tangible and intangible Aboriginal cultural heritage across the study area and the Coffs Harbour LGA more generally.
- To emphasise that the CMP is an opportunity for improved collaboration and to address some key issues affecting the estuaries.

During Stage 3 of the CMP, consultation was held between local elders, representatives from the City and the project team. The meeting was held on Friday 18 June 2021, at the Wongala Estate. The purpose of the engagement was to:

- Follow-up on the Stage 2 engagement, and outline how previous discussions had translated into management options proposed for the Stage 3 "Long-List".
- Discuss all of the proposed options in the Long-List, with a particular emphasis on those that related to the preservation and protection of Aboriginal cultural heritage.
- Discuss other potential options for inclusion in the Long-List and Options Assessment.

Discussions were highly productive and generally supportive of the proposed options. Feedback received from stakeholders was incorporated into the options assessment as a key component of the Acceptability Assessment. Outcomes are discussed in detail in the Stage 3 report (Water Technology, 2021b).

3.3.3 Engagement with Horticultural Industry Groups and the Department of Primary Industries

During Stages 2 and 3 of the CMP, a concerted effort was made to meaningfully engage with representatives from the local horticulture industry. Discussions and negotiations held between stakeholders and the local

community demonstrated significant in-principal support for the certain management options utilising the industry's involvement. The objectives of this engagement process were to:

- Establish an equitable dialogue between relevant stakeholders from industry and government;
- Discuss issues related to horticulture across the Coffs Harbour LGA, in relation to their impacts on the social, environmental, and cultural values of the coastal zone; and
- Utilise a partnership based, collaborate approach to develop an environmental program for Intensive Horticulture across the LGA.

This process was facilitated by the project team, and culminated in the development of *The Coffs Harbour Intensive Horticulture Environmental Program* (CHIEP). More detail regarding this engagement process can be found in the Stage 3 report (Water Technology, 2021b).

3.3.4 Engagement with Public Authorities

During Stage 3, a stakeholder engagement workshop was held in order to facilitate the involvement of relevant public authorities for the identification and evaluation of management options.

The workshop was held during the 17 June 2021 meeting of the CEMAC In total, 12 stakeholders attended the day, from a number of different organisations, including the City, DPE (E&H), Crown Lands, DPI (Blueberry Horticulture Unit), DPI Fisheries, Solitary Islands Marine Park, Southern Cross University, Coffs Harbour Regional Landcare, as well as a number of community representatives. Noted apologies for the meeting included TfNSW (Maritime), North Coast Local Land Services (NCLLS), and National Parks and Wildlife Service (NPWS). Feedback from NPWS was later garnered through the community survey.

The purpose of the workshop was to ask stakeholders for their help to provide feedback on some of the management options that were proposed by the project team to date, as well as to utilise insights of local issues and context for recommendations of additional management options that could be considered for inclusion in the CMP. The workshop was highly interactive and participatory. It included an initial presentation to the CEMAC in order to provide background and context, and was followed by a series of open forum discussion sessions. Feedback received from stakeholders was incorporated into the options assessment as a key component of the Acceptability Assessment, and more information can be found in the Stage 3 report (Water Technology, 2021b).

3.4 Stage 4

City, DPE and CEMAC Review

During Stage 4 submission process, the Draft CMP document was submitted to the City, DPE, and CEMAC for comment and review. Those agencies that are assigned actions in the CMP, were sent a request for written support for these actions.

Public Exhibition

In accordance with the CM Act, it is a mandatory requirement of the CMP process that a draft CMP be publicly exhibited for a period of not less than 28 calendar days.

This document was exhibited during for 28 calendar days during March of 2022. A number of responses were received, and subsequently a reply to submissions report was prepared.

4 MANAGEMENT ACTIONS

4.1 Selection of Management Actions

Stage 3 of the CMP process involved the development of management actions to address the risks and issues identified in Stage 2. A key objective of the CMP is to utilise a strategic and practical approach to developing management actions. During Stages 1 and 2 of the CMP, engagement with the City indicated that previous estuary specific Coastal Zone Management Plans (CZMPs) for the study area have historically contained long "wish-lists" of management actions that have proven difficult to implement, given City budget and resourcing limitations. The City has found that process has not been sustainable or fit-for-purpose and resulted in a long list of unimplemented actions that have left both the City and the community alike frustrated at the pace of progress.

Therefore, the approach to the CMP has been to develop a succinct program that can be enacted holistically through a more achievable and coordinated implementation schedule. Management actions included in the program have been rationalised and prioritised by a robust, comprehensive and transparent decision-making framework. The framework adopted in the CMP was developed in order to make sound comparisons between each option and to rank options in a transparent and unbiased manner - in order to identify those that have the greatest overall benefit for management of the estuaries.

In the first instance, a "long-list" of 24 potential management options was developed in Stage 3 of the CMP. This list was developed based on the study team's coastal management expertise, the outcomes of community and stakeholder engagement, and a review of previous coastal zone management plans for the estuaries.

These potential management options were then assessed and prioritised using a 3-phase options assessment process, as outlined in the NSW Coastal Management Manual and shown in Figure 4-1. Based on this assessment, a total of 16 actions were adopted for inclusion in the program.

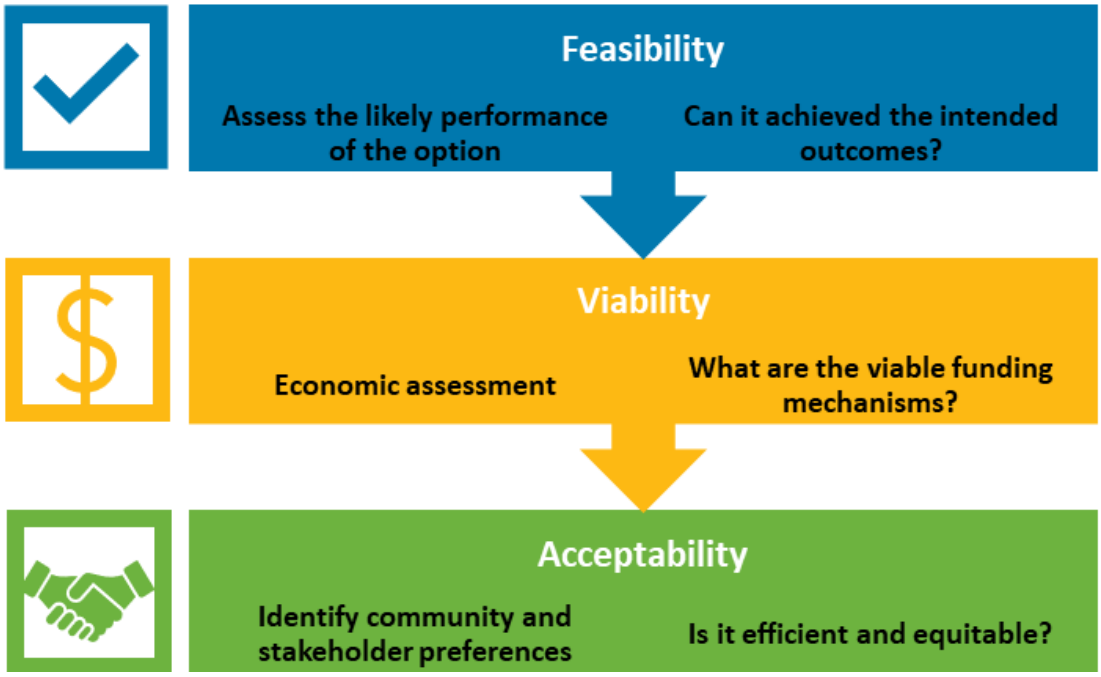


Figure 4-1 The options assessment process

4.2 Overview of Management Actions

4.2.1 An Integrated Approach

One of the key objectives of the CMP process is to facilitate a coordinated approach to the management of coastal issues. With this in mind, the development of this CMP has attempted to develop a program of management actions that is highly integrated – as opposed to one that contains only discrete, or stand-alone actions. The benefits of a coordinated and integrated approach are:

- The synergy of multiple actions working together improves the ability to tackle complex and/or large-scale issues (such as estuarine water quality);
- The integration of multiple actions towards a single goal or outcome helps maintain focus, and increase the likelihood of success;
- Improving the coordination and collaboration between the various government agencies that have responsibilities for delivering the actions (lead or supporting);
- The integration and coordination of City and public authority delivery programs;
- Harness time, cost and resource efficiencies by reducing potential for double-up, or overlap of management actions; and
- The integration of upper catchment management actions and robust, estuary-based water quality monitoring helps to provide a shared (and contemporaneous) understanding of catchment activities, and impacts downstream estuary health.

A summary of the actions is provided in Figure 4-2. This schematic demonstrates the integrated nature of the program. Actions to be implemented by the City are broadly categorised as:

- Estuary Health Monitoring and Data Collection (see Section 4.3.1);
- Environmental Programs and Works (see Section 4.3.2);
- Education and Planning (see Section 4.3.3); and
- Research and Innovation (see Section 4.3.4).

4.2.2 Action Snapshots

Management actions to be implemented by the City are outlined in Section 4.3, with actions to be delivered to by other public authorities outlined in Section 4.4. These sections provide a summary of each management action, including:

- Location/scale of the action.
- The lead organisation responsible for implementation and any relevant supporting agencies.
- The priority of the action: See Section 4.2.3 for how this was determined.
- Stressors addressed: The key estuary stressors and risk that the action is intended to address.
- Objective(s) and performance indicators: The overall objective(s) of the action, and relevant performance indicators. These have been broken down into:
  - Short Term Objectives and Indicators: These generally relate to whether the action has been implemented as intended.
  - Medium to Long Term Objectives and Indicators: These generally relate to whether the intended medium-long benefits of the action are being realised, and are achieving their intended outcome.
- Description of the action - an outline of the scope of works required.

- Estimated costs – including capital costs and any ongoing maintenance costs.
- A quick snapshot of potential funding mechanisms. Further detail regarding funding mechanisms is provided in the Business Plan in Section 5.
- Integrated links to other actions: The keys links to other actions in the CMP that should be considered before, during, and after implementation.

Where applicable, maps have been provided with relevant action snapshots, in order to ensure geographical focus for on-ground works.

4.2.3 Prioritisation of Actions

Given the City's limited funding and resources, a key element of CMP implementation is the prioritisation and rationalisation of management actions. This is particularly important when considering that the City will need to develop an LGA-wide Action Plan that outlines a prioritisation process for implementing actions across all five (5) of its CMPs (see Section 1.2). This overall suite of CMPs will likely include dozens or even hundreds of actions, and so a logical and coherent approach to prioritisation is needed.

With this in mind, this CMP has set forth a methodology for prioritisation of management actions – based on a logical Action Priority Matrix. This considers both the importance and the urgency of each individual action in order to develop a coherent plan for prioritisation.

For this task, the "Importance" of each action has been assigned a score out of ten (10) based on how critical implementing that action is towards achieving the overall goals of the CMP:

- **Critical (8-10)**: Those that are critical for addressing key risks and the long-term effective management of the estuaries. These actions are critical for successful implementation of the CMP;
- **High (4-7)**: Those considered of high importance, or high impact, in addressing risks and opportunities; and
- **Medium (1-3)**: Those that whilst still important, are considered to be moderately effective or impactful in terms of addressing risks and opportunities.

The second consideration is the "Urgency" of the various actions. This consideration acknowledges that whilst some actions may be highly important to success of the CMP, they may not need to be (or perhaps may not be able to be) implemented immediately. This could be due to budget or resourcing limitations, or the need to schedule some actions first in order to allow others to proceed effectively. The latter consideration is particularly important considering that the CMP has been purposefully developed as an integrated program of linked actions. The urgency of the actions has been assigned a score out of three (3) based on the following criteria:

- **Pressing (3)**: Actions that require immediate attention and implementation, or actions that affect the critical path of other actions (i.e., are a prerequisite for other actions) and therefore need to be implemented in the short term;
- **Moderate / Dependant (2)**: Actions that are of moderate urgency, or are dependent on the implementation of other actions before they can commence; and
- **Opportunistic (1)**: Actions that do not have an immediately pressing timeframe for implementation, but rather can be implemented opportunistically as resources and funding become available.

The Action Priority Matrix is provided in Table 4-1. It provides a process to generate a Priority Score for each action. The Priority Score can be banded in order to outline an approximate timeframe for implementation and alignment with the City's four-year Delivery Program (DP) under the NSW Integrated Planning and Reporting (IP&R) Framework:

- **High Priority** (score of 24-30): To be implemented in the short term - within 3 years

- **Medium Priority** (score of 8-23): To be implemented in the medium term - within 6 years
- **Low Priority** (score of 1-8): To be implemented in the long term - within 10 years

It should be noted that this process is intended to provide a broad indication of action priority. However, it is acknowledged that this may not marry with the "on the ground" reality over the forward CMP timeframe, and a flexible approach to undertaking works should be adopted as grants and funding opportunities arise from time to time that may allow some options to be progressed ahead of others.

It should also be acknowledged that some of the actions whose urgency is listed as "Opportunistic" may provide an opportunity for "quick, easy wins" throughout the process, particularly those that require minimal cost or effort to implement. Therefore, the City should remain vigilant for opportunities to implement these actions as they may arise.

Table 4-1 The action priority matrix

Priority			Urgency		
			Pressing	Medium / Dependant	Opportunistic
			3	2	1
Importance	Critical	10	30	20	10
		9	27	18	9
		8	24	16	8
	High	7	21	14	7
		6	18	12	6
		5	15	10	5
	Medium	4	12	8	4
		3	9	6	3
		2	6	4	2
		1	3	2	1

High Priority
Medium Priority
Low Priority

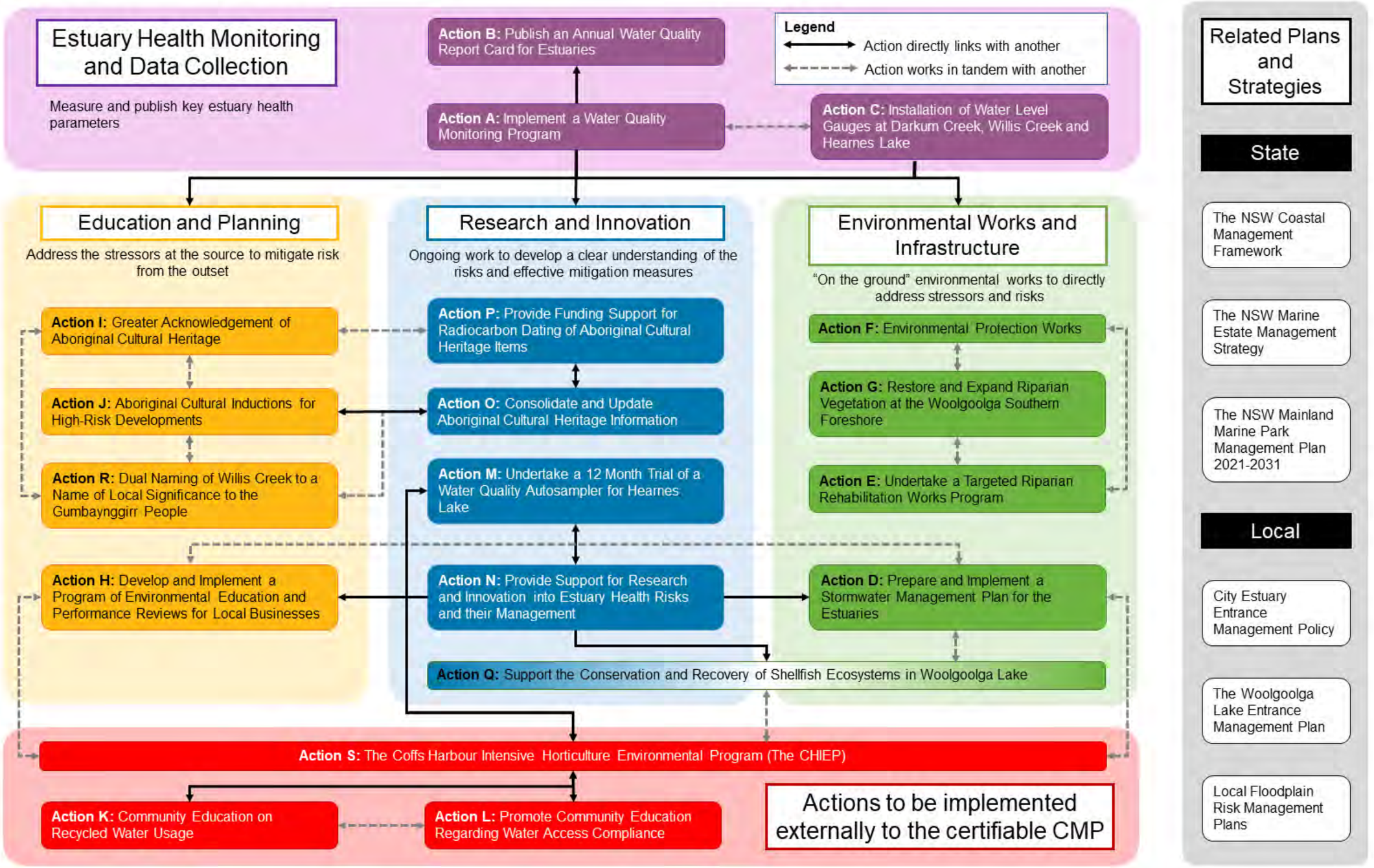


Figure 4-2 Overview of CMP management actions

4.3 Actions to be Implemented by the City of Coffs Harbour

4.3.1 Estuary Health Monitoring and Data Collection

Action A	**Implement a Water Quality Monitoring Program**		
Location/Scale	All four of the Woolgoolga Region Estuaries		
Lead Organisation	The City	**Supporting Organisations**	DPE (E&H)
Importance	9 (High)	**Urgency**	3 (Pressing)
Priority	**High**	**Timeframe**	Short: Within 3 Years
Stressors Addressed	▪ Urban stormwater runoff – **Very High Risk** ▪ Industrial runoff – **Moderate Risk** ▪ Sewage effluent and septic runoff – **Moderate Risk** ▪ Recycled water usage – **Very High Risk** ▪ Agricultural runoff – **Very High Risk** ▪ Incomplete water quality information – **High Risk**		
MER Criteria ↘	**Short Term**	**Medium to Long Term**	
Objective(s)	▪ To improve spatial and temporal resolution of the existing water quality dataset across the estuaries.	▪ To further develop the understanding of water quality issues, and provide a useful dataset upon which to inform effective and targeted management decisions.	
Performance Indicators	▪ Program implemented and data collected as per scope.	▪ Collected data is of tangible benefit from a research and management perspective.	
Description	As discussed in the Stage 1 Scoping Study (Water Technology, 2020) there are a number of coastal and estuary monitoring programs in effect across the study area. The predominant source of water quality monitoring comes from the Northern Rivers Aquatic Ecosystem Health Monitoring Program (Ecohealth), which is a catchment based estuarine and freshwater monitoring and reporting program currently being implemented by the City (Ryder, et al., 2016). The key components of the Ecohealth program operate on an approximately two-year cycle. Sampling for water quality is undertaken twice a season for 12 months out of every two years. Previously, Ecohealth monitoring was undertaken monthly for a12-month period every four years. Recent cycles of monthly monitoring were undertaken in 2010/11, 2014/15, 2019/20 and 2020/21. There are seven (7) Ecohealth monitoring sites in the study area including Darkum Creek (1 estuarine), Woolgoolga Creek (2 estuarine, 1 freshwater), Willis Creek (1 estuarine), and Hearnes Lake (1 estuarine, 1 freshwater). Whilst this data provides a baseline dataset for estuary health and water quality, spatial and temporal data gaps remain that inhibit the ability to understand cause and effect of catchment management practices (urban, industrial, and agricultural) and estuarine water quality. Similarly, the lack of spatial resolution makes it challenging to link catchment land use practices to water quality impacts. Additional monitoring sites that are strategically located to establish links between cause and effect would provide a significantly improved dataset to inform estuary management. Therefore, to address the spatial and temporal gaps, a robust water quality monitoring program should be implemented. This program should build on the existing Ecohealth Program by using existing monitoring, paired with a suite of additional strategically selected sites. Frequency of sampling for the program should be monthly. The increased sampling frequency will allow the City to establish an ambient water quality		

Action A	Implement a Water Quality Monitoring Program
	dataset from which seasonal and inter-annual trends can be identified, and estuary health tracked over time. It is also recommended that event-based water quality monitoring be undertaken after a rainfall trigger of 80 mm in 24 hours. The event-based monitoring is vital to understanding nutrient and sediment loads coming off the catchment, thereby allowing potential links between land use and water quality to be identified. As mentioned previously, the current Ecohealth water quality dataset is limited by the low number of sampling locations that prevent upstream and downstream trends being identified. Consequently, it is recommended that the number of monitoring sites be increased. Monitoring sites should be located throughout the estuary adjacent to different land uses so that upstream-downstream trends can be identified, and linkages made between land use and water quality. In addition to the existing seven (7) Ecohealth monitoring sites, another eleven (11) sites should be included, and monitoring undertaken throughout the estuaries, as shown in Figure 4-3. The monthly monitoring should include the following analytes: ▪ Physical indicators: Temperature, dissolved oxygen (%), conductivity, salinity, pH, turbidity, secchi depth ▪ Nitrogen: total nitrogen (TN), nitrogen oxides (NOx), ammonia (NH_3) and total kjeldahl nitrogen (TKN) ▪ Phosphorus: Total phosphorus (TP) and soluble reactive phosphorus (SRP) ▪ Chlorophyll-a ▪ Total suspended solids Quarterly monitoring should include the additional following analytes: ▪ Heavy metal suite: Ca, Cd, Cr, K, Mg, Na, Ni, Pb, Zn, Cu, As, Fe, Mn, Al ▪ Pesticides and herbicides ▪ Biochemical oxygen demand ▪ Faecal coliforms Rainfall trigger-based sampling should be undertaken for all parameters outlined above. When sampling occurs, it should also be noted whether the estuary entrance is closed or open, to provide a broader context. Costs associated with this option include monthly sampling and water quality monitoring program laboratory costs. It is anticipated that the program would be commissioned and funded for an initial four (4) year implementation period. After four years, the program would be reviewed, and its efficacy and benefits assessed. From here, the program could potentially be extended for an additional period. As discussed in Section 1.6.2, the legislative requirements of the MEM Act dictate that this action will require consent from DPI Fisheries in the form of a marine park permit.
Estimated Costs	▪ Annual Cost: $65,000 per year ▪ It is anticipated that the program would be commissioned and funded for an initial four (4) year implementation period, with potential to renew for an additional four years based on a review of the program.
Potential Sources of Funding	▪ City: Operational and Delivery Plan Process & E Levy. ▪ NSW Coastal and Estuary Grants Program.

Action A	Implement a Water Quality Monitoring Program
Integrated Links to Other Actions	▪ This action will be highly integrated with almost every other action in the program as it will be used to provide a strong indicator of estuary health. ▪ Action B - Publish an Annual Water Quality Report Card for Estuaries: will use the water quality monitoring data to produce report cards. ▪ Action C - Installation of Water Level Gauges at Darkum Creek, Willis Creek and Hearnes Lake: can provide an equivalent dataset of water levels (indicating estuary opening and closing regime) in order to further assess the impacts of entrance condition on water quality. ▪ Action M - Undertake a 12 Month Trial of a Water Quality Autosampler for Hearnes Lake: can be collated with this dataset to provide a holistic dataset of ambient and event-based water quality. ▪ Action N - Provide Support for Research and Innovation into Estuary Health Risks and their Management: can utilise this data in research projects in order to provide greater research into estuary health. ▪ Action S: The Coffs Harbour Intensive Horticulture Environmental Program: will include on-farm water quality monitoring that can provide upper catchment water quality data for comparison and analysis – to further assess cause and effect.

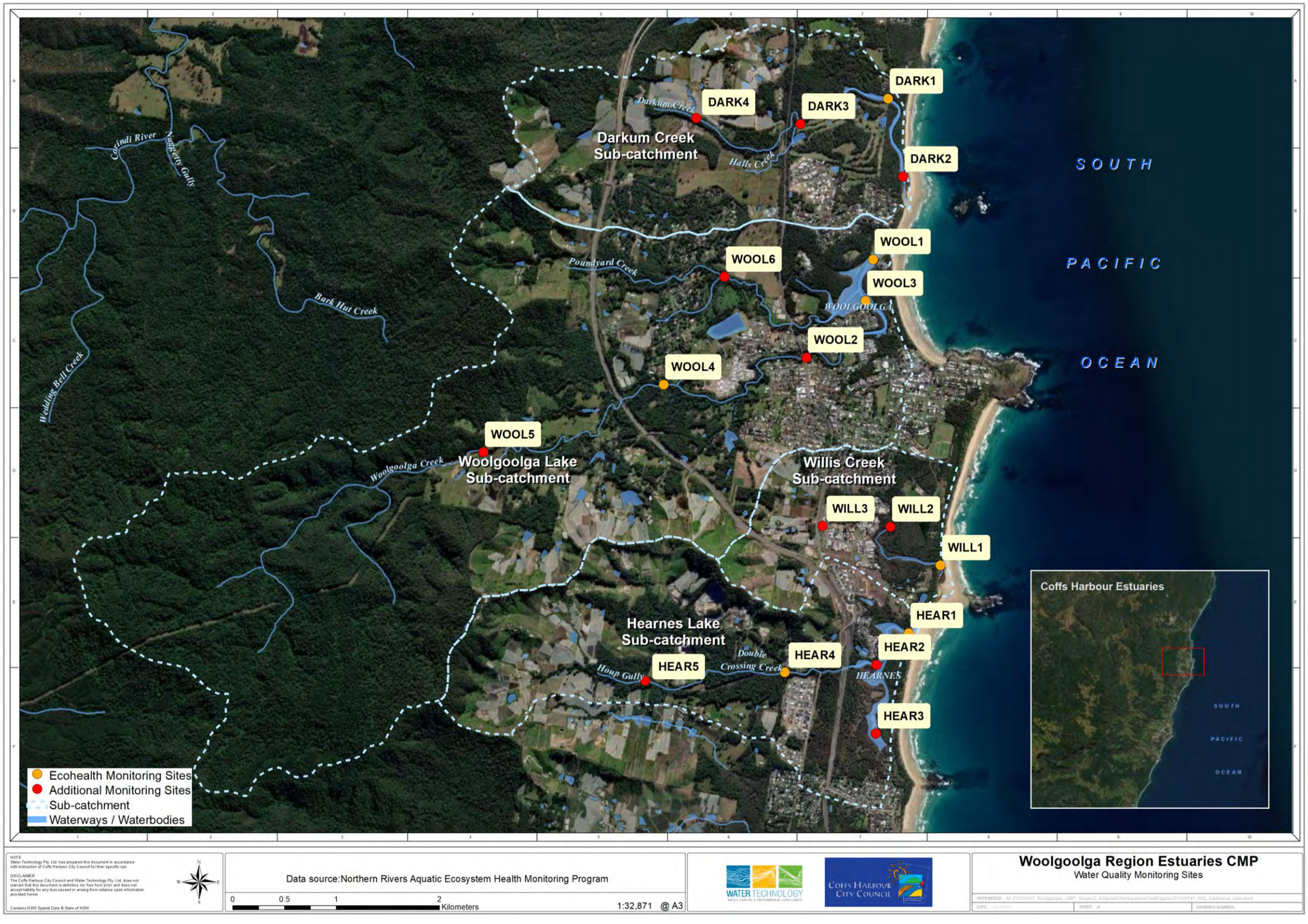


Figure 4-3 Water quality monitoring program – proposed monitoring sites

Action B	Implement an Annual Water Quality Report Card for the Estuaries		
Location/Scale	All four of the Woolgoolga Region Estuaries		
Lead Organisation	The City	**Supporting Organisations**	DPE (E&H)
Importance	8 (Critical)	**Urgency**	3 (Pressing)
Priority	**High**	**Timeframe**	Short: Within 3 Years
Stressors Addressed	▪ Urban stormwater runoff – **Very High Risk** ▪ Industrial runoff – **Moderate Risk** ▪ Sewage effluent and septic runoff – **Moderate Risk** ▪ Recycled water usage – **Very High Risk** ▪ Agricultural runoff – **Very High Risk** ▪ Incomplete water quality information – **High Risk**		
MER Criteria ↘	**Short Term**	**Medium to Long Term**	
Objective(s)	▪ To provide the community with an up-to-date status of water quality in the estuaries in an easy-to-understand format.	▪ To provide the City with an easy-to-understand snapshot of water quality in the estuaries over time, and an indicator to monitor and evaluate the performance of the CMP.	
Performance Indicators	▪ Program implemented as per scope.	▪ Scorecards are considered to provide meaningful benefit for these purposes, relative to their cost. ▪ Scorecards are valued by the community for the information they provide.	
Description	In conjunction with the Water Quality Monitoring Program outlined in Action A, this data is to be analysed, with the results published in the form of an Annual Water Quality Report Card for the Woolgoolga Region Estuaries. These report cards are to be published annually by the City, and may include the following information: ▪ The City's water quality objectives. ▪ Water Quality Scores or Grades for each estuary. This should be based on a transparent scoring system that assesses compliance of various water quality parameters with the City's water quality objectives - similar to the water quality grades provided in the Ecohealth Program (Ryder, et al., 2016) and those recently developed by DPE (E&H). ▪ Examples of management actions being taken by the City and local community groups to achieve the long-term vision for the estuaries. ▪ Education of the local community to inform them of how they can contribute to improving estuary health and water quality. Community engagement during Stage 1 and Stage 3 of the CMP indicated a strong desire in the community for greater understanding and transparency regarding estuarine water quality in the study area. The report cards would provide the community with an up-to-date status of water quality in the estuaries, and use simple scoring systems and metrics to provide this in a readily understandable and digestible format There are demonstrated examples of successful programs of Annual Water Quality Report Cards across the mid-northern NSW coast – including by Tweed Shire Council and Mid-Coast Council. Tweed Shire Council produces an annual water quality report card for the Tweed's waterways, including estuaries, catchment and coastal creeks. The report card rates the quality of waterways across the Shire and highlights the projects that Council and		

Action B	Implement an Annual Water Quality Report Card for the Estuaries
	the community implement to manage it. An example of the report card can be found at Tweed Councils website: https://www.tweed.nsw.gov.au/NaturalEnvironment. Similar reporting systems are in place in South East Queensland through the Healthy Land and Water Report Card System and Portal: https://hlw.org.au/report-card/ . Foundational work to establish a state-wide estuaries monitoring program was completed for the NSW Monitoring Reporting and Evaluation Program. This monitoring work is now continued through the Marine Estate Management Strategy. To this end, DPE has established a waterway health report card system that the City could use. It is understood that this system is currently used by Tweed Shire Council and Mid-Coast Council (amongst possibly others), and it is DPE's stated goal to expand this report card system to other local councils and state agencies (DPIE, 2021). This action should initially be implemented across the Woolgoolga Region Estuaries as a smaller scale trial program (or "proof of concept") – and if successful, this monitoring and reporting system could be implemented across the wider LGA suite of estuaries. It should be noted that the Ecohealth program is currently developing a web-based reporting tool in order to provide the local community with easy-to-understand monitoring outcomes from the program. There may be scope to link with the program from a reporting perspective.
Estimated Costs	▪ Annual Costs: $20,000 per year for data analysis and reporting.
Potential Sources of Funding	▪ City: Operational and Delivery Plan Process & E Levy. ▪ NSW Coastal and Estuary Grants Program.
Integrated Links to Other Actions	▪ Action A - Implement a Water Quality Monitoring Program: will provide data to inform these report cards.

Action C	Installation of Water Level Gauges at Darkum Creek, Willis Creek and Hearnes Lake		
Location/Scale	Darkum Creek, Willis Creek and Hearnes Lake		
Lead Organisation	The City	**Supporting Organisations**	DPE (E&H)
Importance	8 (Critical)	**Urgency**	3 (Pressing)
Priority	**High**	**Timeframe**	Short: Within 3 Years
Stressors Addressed	▪ Combined Coastal and Catchment Flooding – **High Risk** ▪ Tidal Inundation (Including Future Sea Level Rise) – **Moderate Risk** ▪ Incomplete Coastal Process Information – **Moderate Risk**		
MER Criteria ↘	**Short Term**	**Medium to Long Term**	
Objective(s)	▪ To improve management of estuarine flood risk by monitoring & publishing water levels in real time.	▪ To provide a dataset to improve the long-term management of inundation risk and understanding of physical processes (including water levels, hydrodynamics and entrance opening / closing regime).	
Performance Indicators	▪ Program implemented and data published as per scope.	▪ Collected data is of tangible benefit from a research and management perspective.	
Description	Presently, Manly Hydraulic Laboratory (MHL) manage nine water level gauges across the 12 major estuaries of the Coffs Harbour LGA, including two within Woolgoolga Lake. This data is collected by MHL on behalf of DPE (E&H). However, no such water level gauges are presently in place within the Darkum Creek, Willis Creek and Hearnes Lake estuary systems. This action therefore involves the installation of a permanent water level gauge within these three estuaries. The exact position of the gauge within each of the estuaries should be determined in consultation with MHL based on an assessment of a strategic location that can achieve the objectives outlined above, whilst maintaining a practical location for installation and maintenance. Preliminary analyses suggest that potential locations could include: ▪ Darkum Creek: The pedestrian footbridge across the creek at the end of Darkum Road. ▪ Willis Creek: Around 250-300 m upstream from the estuary entrance - in the vicinity of the vehicular access track down and car park at the end of Crosserly Road. ▪ Hearnes Lake: At Double Crossing Creek around 250 m upstream of the Pacific Hwy Road bridge near the end of Seashell Ave and Waterway Drive. This location should be considered strategically with the location of the water quality autosampler (Action M). If this water level gauge and the autosampler are co-located, then this will provide the ability to assess sediment and nutrient loads entering the estuary. The data collected by the gauge will form a historical record that can provide information regarding estuarine water levels, and through interpretation, estuary entrance condition (consideration could also be given to the inclusion of a flow gauge, in order to provide insights regarding freshwater flows into the estuaries). Furthermore, water level data can be transmitted and published through the MHL web page, as it is for other estuaries in the Coffs Harbour LGA. This will help to manage and mitigate estuarine flood risk by providing publicly available water levels in real time.		

Action C	Installation of Water Level Gauges at Darkum Creek, Willis Creek and Hearnes Lake
	As discussed in Section 1.6.2, the legislative requirements of the MEM Act dictate that this action will require consent from DPI Fisheries in the form of a marine park permit.
Estimated Costs	▪ Capital Cost: $25,000 per gauge ▪ Maintenance Costs: $3,000 per year, per gauge
Potential Sources of Funding	▪ City: Operational and Delivery Plan Process & E Levy. ▪ NSW Coastal and Estuary Grants Program.
Integrated Links to Other Actions	▪ Action A - Implement a Water Quality Monitoring Program: can provide a dataset of water quality, that in conjunction with this water level data, can be used to further assess the impacts of entrance condition on water quality. ▪ Action M - Undertake a 12 Month Trial of a Water Quality Autosampler for Hearnes Lake: If the water level gauge in Hearnes Lake and the autosampler are strategically co-located, then this will provide the ability to assess sediment and nutrient loads entering the estuary. ▪ In this way, this action also supports Action N - Provide Support for Research and Innovation into Estuary Health Risks and their Management – as it will provide a beneficial dataset to further such research.

4.3.2 Environmental Programs and Works

Action D	**Prepare and Implement a Stormwater Management Plan for the Woolgoolga Region Estuaries**		
Location/Scale	All four of the Woolgoolga Region Estuaries		
Lead Organisation	The City	**Supporting Organisations**	DPE (E&H)
Importance	9 (Critical)	**Urgency**	3 (Pressing)
Priority	**High**	**Timeframe**	Short: Within 3 Years
Stressors Addressed	▪ Urban stormwater runoff – **Very High Risk** ▪ Industrial runoff – **High Risk**		
MER Criteria ↘	**Short Term**	**Medium to Long Term**	
Objective(s)	▪ To identify opportunities for upgrading and/or maintenance of specific assets in order to improve estuary health outcomes.	▪ To improve the health and amenity of the coastal zone through improved stormwater management practices.	
Performance Indicators	▪ Stormwater Management Plan delivered as per scope.	▪ Long term reduction in gross-pollutants and improvement in monitored levels of analytes listed in Action A.	
Description	This action involves preparation and implementation of a Stormwater Management Plan (SMP) to address impacts affecting the health of the Woolgoolga Region Estuaries. The objectives of the SMP will be to: ▪ Undertake a review of the stormwater network, and the City's stormwater assets that discharge into the four estuaries; ▪ Identify and prioritise opportunities for upgrading and/or maintenance of specific assets within the coastal zone in order to improve estuary health outcomes. ▪ Consider potential changes to population and catchment land usage over a forward planning period of 50 years, and in doing so mitigate the impacts of future population growth on urban stormwater runoff across the coastal zone. Preparation of the SMP will involve the following tasks: ▪ Establish project framework: Set forth the aim, objectives and scope of the SMP, and identify relevant stakeholders' roles and responsibilities ▪ Identify characteristics and condition: Assess the current and proposed land use activities– land use types/zoning, including major infrastructure and likely/potential point sources of pollution. This is critical to understanding the current stormwater threats from certain land use types and likely impacts associated with future changes in land use. This should also include an assessment of climate and rainfall (both existing conditions and projected climate change impacts). ▪ Identify existing stormwater management systems, practices and processes: This should include evaluation of the City's stormwater drainage network and existing management practices. It includes assessment of existing WSUD interventions, including gross pollutant traps (GPTs) across the coastal zone and their effectiveness. ▪ Assessment of condition: This task includes the use of water quality modelling (using MUSIC or a similar modelling application) to estimate pollution generation, and identify priority sub-areas based on current and future changes. This component of the SMP process includes defining priority management issues to be addressed by actions in the plan.		

<table>
<tr><th>Action D</th><th>Prepare and Implement a Stormwater Management Plan for the Woolgoolga Region Estuaries</th></tr>
<tr><td></td><td>

Identify management options: This includes the derivation of a long list of WSUD options to improve urban stormwater quality in the Woolgoolga region. It should also include:

An analysis of land available for WSUD infrastructure.
Assessment of site constraints and opportunities, capital and maintenance costs, and other benefits (e.g., urban cooling, improved aesthetics etc.).
Derivation of a short-list of WSUD options across the coastal zone in consultation with key project stakeholders.

Preparation of an implementation plan: The implementation plan should clearly define responsibilities, costs, timeframes for implementation, and Key Performance Indicators (KPIs) for each of the recommended actions.

In order to guide the scope of the SMP, a high-level assessment of the City's stormwater networks has been undertaken to identify potential locations to place GPTs. In total, 11 locations were identified (see Figure 4-4 and Figure 4-5). These locations were generally downstream of common hotspot areas for runoff (such as commercial and industrial land uses), downstream of establishing/newly established developments (e.g., residential estates), and upstream of flood storage infrastructure (e.g., detention basins).
As discussed in Section 1.6.2, the legislative requirements of the MEM Act dictate that any works stemming from this plan may require consent from DPI Fisheries in the form of a marine park permit – depending on the nature of the works.
</td></tr>
<tr><td>Estimated Costs</td><td>

Capital Cost: $50,000 - $75,000 (to engage external consultant)
Total cost of implementation is unknown until plan is developed.
Potential costs for bioretention basins may vary from $20,000 - $200,000.
Potential Costs of GPTs (per unit) may be of the order of:

<table>
<tr><th></th><th>Proprietary Systems</th><th>Trash nets / racks or Pit Inserts</th></tr>
<tr><td>Construction Cost ($)[1]</td><td>$50,000 – 130,000</td><td>$11,000 – 55,000</td></tr>
<tr><td>Generalised Annual Maintenance Cost ($/year/ha)[2]</td><td>$100 – 2,000</td><td>$30 – 150</td></tr>
</table>
</td></tr>
<tr><td>Potential Sources of Funding</td><td>

City: Operational and Delivery Plan Process & E Levy.
NSW Coastal and Estuary Grants Program.
Development Servicing Plans (for implementation).
Stormwater Management Service Charge (for implementation).

</td></tr>
<tr><td>Integrated Links to Other Actions</td><td>

This action works in tandem with the following actions to reduce the impacts of runoff on estuarine water quality:

Action H - Develop and Implement a Program of Environmental Education and Performance Reviews for Local Businesses
Action S - The Coffs Harbour Intensive Horticulture Environmental Program (The CHIEP)

</td></tr>
</table>

[1] Based on base cost estimates for GPTs given in IPART (2014)
[2] Based on a field data collection of GPTs in Blacktown City Council. Dehghan-Khalaji et al. (2016), Auditing and Maintenance Costing of Gross Pollutant Traps.

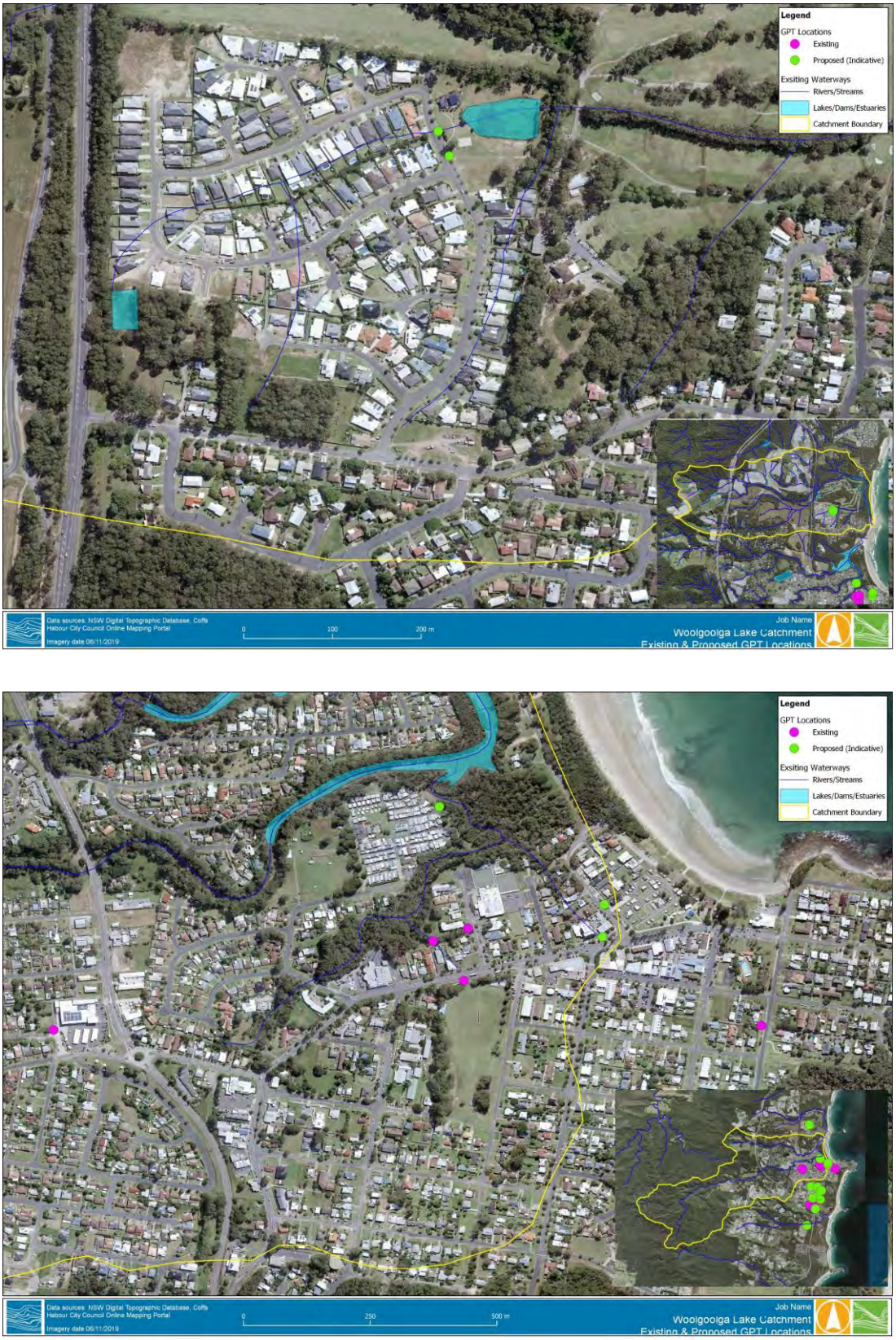


Figure 4-4 Potential GPT locations in the Darkum Creek (Top) and Woolgoolga Lake (Bottom) catchments

Figure 4-5 Potential GPT locations at Willis Creek (Top) and Hearnes Lake (Bottom) catchments

Action E	Undertake a Targeted Riparian Rehabilitation Works Program		
Location/Scale	All four of the Woolgoolga Region Estuaries		
Lead Organisation	The City NPWS	**Supporting Organisations**	CHDLALC (Darrunda Wajaarr Rangers) DPI Fisheries
Importance	8 (Critical)	**Urgency**	3 (Pressing)
Priority	**High**	**Timeframe**	Short: Within 3 Years
Stressors Addressed	▪ Invasive flora pest species (e.g., riparian, and aquatic weeds) – **High Risk** ▪ Disturbance of coastal wetlands, including riparian & aquatic habitat – **Moderate Risk** ▪ Loss of Aboriginal cultural heritage values – **High Risk**		
MER Criteria ↘	**Short Term**	**Medium to Long Term**	
Objective(s)	▪ To implement an initial round of rehabilitation to improve the condition of riparian vegetation and reduce the spread of weeds.	▪ To manage both the spread and introduction of weeds across the foreshore of the four estuaries, and improve the long-term condition of riparian vegetation. ▪ To establish a working relationship with the Darrunda Wajaarr Rangers for the management of sea country in the study area.	
Performance Indicators	▪ Works implemented as per scope.	▪ Monitoring undertaken for this action shows improved riparian condition relative to the baseline mapping from Stage 2.	
Description	This action includes the implementation of a targeted riparian rehabilitation works program – with the aim of managing both the spread and introduction of weeds across the foreshore of the four estuaries (see Figure 4-6), and improve the condition of riparian vegetation across the Coastal Zone. Importantly, these works also present an opportunity to work with the Darrunda Wajaarr Rangers, a small ranger team operated by the CHDLALC who focus on environmental management to increase the conservation values of Gumbaynggirr country – and use this ongoing program to facilitate cultural land management practices across the riparian zone.  **Figure 4-6 Foreshore weeds identified during Stage 2 (Water Technology, 2021a)** The program should utilise a targeted weed control program prioritising high value riparian areas, particularly those that overlay the presence of weeds with Threatened Ecological Communities (TEC's) using the most relevant Plant Community Type (PCT)		

Action E	Undertake a Targeted Riparian Rehabilitation Works Program
	mapping available at the time. This will require a "targeting multi-species" approach, along with both follow up control and planting of native vegetation suited to that PCT. The program should include the following components: ▪ Identify bush crews and trained contractors to carry out the work. Estuarine and riparian areas are highly sensitive environments. As such, weed control work in these environments needs to be undertaken by specialist bush regenerators with skills in plant identification and knowledge of appropriate methods of control of weeds near waterways. The Darrunda Wajaarr Rangers are a highly capable and experienced team with significant insights into the local land and sea country. Undertake targeted weed control program prioritising high threat weeds, areas of high biodiversity value and Aboriginal cultural heritage value. Two main points are noted in consultation with the Coffs Harbour & District Local Aboriginal Land Council and Garby Elders: – Garby Elders do not support aerial spraying of any noxious weeds on the estuary foreshores, as this has a detrimental effect on the environment and food sources which are gathered and collected within these areas. – Garby Elders recommend that these areas be rehabilitated with Native Coastal Wattle and other species that are distinctive to the local area. ▪ Monitoring should be undertaken annually for the first five years, then biennially for the remainder of the CMP timeframe. ▪ At the end of each monitoring campaign, a brief monitoring report should be produced with pictorial photographs and mapping; and ▪ Provide information to the public (especially those with properties backing onto waterways) about what they can do to assist, their obligations and weed identification kits. By working with Darrunda Wajaarr Rangers, this management action is also highly aligned with Initiative #4 of the Marine Estate Management Strategy (MEMA, 2018) – which includes *Working with Aboriginal communities in the management of Sea Country to reduce threats and risks to Aboriginal cultural heritage.* Specifically: ▪ Action 4.1: Work with Aboriginal communities to evaluate current arrangements for Aboriginal involvement in Sea Country management and decision-making and establish and implement a framework to ensure the involvement of Aboriginal people is effective and appropriate. ▪ Action 4.2: Work with Aboriginal communities to identify the cultural values of Sea Country to improve the incorporation of values into decision-making on the marine estate ▪ Action 4.3 Increase Aboriginal participation in Sea Country management, planning and monitoring through employment and training of Aboriginal people at a regional and local level.
Estimated Costs	▪ Capital Cost: $40,000 per estuary, including follow up monitoring ▪ Ongoing Cost: $10,000 for follow-up monitoring campaigns (per campaign).
Potential Sources of Funding	▪ NSW Marine Estate Management Strategy ▪ City: Operational and Delivery Plan Process & E Levy. ▪ NSW Coastal and Estuary Grants Program. ▪ NPWS.
Integrated Links to Other Actions	▪ This action works in tandem with the following actions to improve riparian vegetation condition and biodiversity: – Action G - Restore and Expand Riparian Vegetation at the Woolgoolga Southern Foreshore

Action E	Undertake a Targeted Riparian Rehabilitation Works Program
	▪ This action can leverage off the success of the following actions that aim to reduce nutrient flows in to estuaries that exacerbate the growth of riparian weeds: – Action D - Prepare and Implement a Stormwater Management Plan for the Estuaries – Action H - Develop and Implement a Program of Environmental Education and Performance Reviews for Local Businesses – Action K - Community Education on Recycled Water Usage – Action S - The Coffs Harbour Intensive Horticulture Environmental Program (The CHIEP)

Action F	Environmental Protection Works		
Location/Scale	All four of the Woolgoolga Region Estuaries		
Lead Organisation	The City	**Supporting Organisations**	NPWS DPI Fisheries Crown Lands
Importance	9 (Critical)	**Urgency**	3 (Pressing)
Priority	**High**	**Timeframe**	Short: Within 3 Years
Stressors Addressed	▪ Foreshore weeds and introduced species – **High Risk** ▪ Foreshore development & loss of riparian habitat – **Moderate Risk**		
MER Criteria ↘	**Short Term**	**Medium to Long Term**	
Objective(s)	▪ To enable Environmental Protection Works to be undertaken by relevant by Public Authorities under Part 5 of the EP&A Act.		
Performance Indicators	▪ Action is included in gazetted CMP and becomes active as a management tool.	▪ Action is considered to provide tangible benefit for the City for streamlining the management of EPW across the study area.	
Description	This action is intended to enable Environmental Protection Works (EPW) to be undertaken in Coastal Wetland and Littoral Rainforest Areas (a defined by clause 10 of the RH SEPP) within the Study Area by Public Authorities under Part 5, of the *Environmental Planning and Assessment Act 1979* (EP&A Act). This action has been included in the CMP for Bonville and Pine Creek (Cardno, 2019a) and it is understood the City intends to include this action across a number of its CMPs. The following notes apply to this action (Cardno, 2019a): ▪ EPW include those works that would meet the definition in the LEP, that is: "*environmental protection works means works associated with the rehabilitation of land towards its natural state or any work to protect land from environmental degradation, and includes bush regeneration works, wetland protection works, erosion protection works, dune restoration works and the like, but does not include coastal protection works*"; ▪ EPW can also include minor ground cultivation (where there is no risk of disturbing Acid Sulfate Soils) to support tree planting/regeneration. ▪ EPW are typical activities undertaken by public authorities on an as needs basis as part of their general environmental management works; ▪ An important consideration for any vegetation removal in the Coastal Wetland and Littoral Rainforest Area (which may form part of EPW), is that it may trigger a Biodiversity Development Assessment Report (BDAR) under the BC Act (this does not include marine vegetation protected under the *Fisheries Management Act 1994*). ▪ Other works not including EPW in the Coastal Wetland and Littoral Rainforest Area would be deemed Designated Development under the EP&A Act. The following activities meet the definition of EPW: revegetation works, weed control, dune rehabilitation, bush regeneration, erosion control*; and bank protection and stabilisation*. For those items marked with an asterisk (*), the primary intent of the works must be other than for coastal protection. For example, the works may be intended to protect the health of a waterway by preventing erosion and sedimentation, to re-establish riparian vegetation and/or improve its growth and retention, to provide fish habitat, etc. As discussed in Section 1.6.2, the legislative requirements of the MEM Act dictate that any such works may require consent from DPI Fisheries in the form of a marine park permit – depending on the nature of the works.		

Action F	Environmental Protection Works
Estimated Costs	▪ Already subject to ongoing funding by the City (e.g., Environment Levy) ▪ Potential costs $20,000 to $200,000 depending on the project scope.
Potential Sources of Funding	▪ City: Operational and Delivery Plan Process & E Levy.

Action G	Restore and Expand Riparian Vegetation at the Woolgoolga Southern Foreshore		
Location/Scale	Woolgoolga Lake		
Lead Organisation	The City	**Supporting Organisations**	DPI Fisheries Coffs Harbour Regional Landcare (subject to grant funding)
Importance	3 (Medium)	**Urgency**	2 (Medium / Dependant)
Priority	**Low**	**Timeframe**	Long: Within 10 Years
Stressors Addressed	▪ Foreshore development & loss of riparian habitat – **High Risk** ▪ Foreshore weeds and introduced species – **High Risk**		
MER Criteria ↘	**Short Term**	**Medium to Long Term**	
Objective(s)	▪ To restore and expand riparian vegetation at the Woolgoolga Southern Foreshore. ▪ To create a defined edge between the pedestrian accessway and foreshore vegetation.	▪ To improve biodiversity and foreshore habitat in this location.	
Performance Indicators	▪ Works implemented as per scope.	▪ Coverage of riparian vegetation improved relative to baseline (pre-CMP) condition baseline.	
Description	At the southern foreshore of Woolgoolga Lake, adjacent to the residential community of Sunset Lakes Estate, there is a lack of appropriate riparian vegetation. This area is City Reserve DP 728227, zoned as RE1 (Public Recreation). This area of riparian vegetation can be improved in order to promote estuary health, bank stability, visual amenity, and biodiversity by: ▪ Installing a defined edge between mown land and riparian vegetation that results in a reduced mown extent within the public reserve and increased riparian vegetated area. This defined edge may be a pathway, bollards or a simple “pegged boundary” and will help reduce unnecessary impacts to riparian vegetation; ▪ Actively re-establishing riparian vegetation along the foreshore by extending vegetated areas along the footpaths with native riparian species, and implementing a weed management program to facilitate the growth of native riparian plants; and ▪ Encouraging residents to incorporate native vegetation in private gardens. The action should also consider management and identification of the encroachment of structures onto adjacent riparian Crown Land. In order to be effectively implemented, this action would need to leverage off the Woolgoolga Place and Movement Plan. Implementation of that plan would serve as a trigger to implement this Action. If that plan establishes a path network through this reserve, then the path should be used as the defined edge for revegetation works. Therefore, this action is subject to the outcomes of the Place and Movement Plan, and the scope and implementation of the plan would be based on those outcomes. An action map depicting the location and potential extent of the works is provided in Figure 4-7. As discussed in Section 1.6.2, the legislative requirements of the MEM Act dictate that any such works may require consent from DPI Fisheries in the form of a marine park permit – depending on the nature of the works.		

Action G	Restore and Expand Riparian Vegetation at the Woolgoolga Southern Foreshore
	Implementation of the Action should involve engagement with local residents who live in and use the area, particularly in regard to the type and distribution of appropriate riparian vegetation.
Estimated Costs	▪ Capital Costs: $20,000 for the establishment of defined edge and initial re-establishment of riparian vegetation. ▪ Staff time for management and consultation.
Potential Sources of Funding	▪ City: Operational and Delivery Plan Process & E Levy. ▪ NSW Coastal and Estuary Grants Program. ▪ Other environmental restoration programs.
Integrated Links to Other Actions	▪ This action works in tandem with the following actions to improve riparian vegetation condition and biodiversity: – Action E - Undertake a Targeted Riparian Rehabilitation Works Program

Figure 4-7 Riparian revegetation extent at the southern Woolgoolga Lake foreshore

4.3.3 Education and Planning

Action H	**Develop and Undertake a Program of Environmental Education and Performance Reviews for Local Businesses**		
Location/Scale	All four of the Woolgoolga Region Estuaries		
Lead Organisation	The City	**Supporting Organisations**	DPE (E&H)
Importance	8 (Critical)	**Urgency**	2 (Medium / Dependant)
Priority	**Medium**	**Timeframe**	Medium: Within 6 Years
Stressors Addressed	▪ Urban and Industrial runoff – **Very High Risk** ▪ Sediment contamination and pollution – **High Risk** ▪ Sedimentation – **Moderate Risk**		
MER Criteria ↘	**Short Term**	**Medium to Long Term**	
Objective(s)	▪ To improve the environmental practices of local businesses, as they relate to downstream estuary health.	▪ To reduce the impacts of urban and industrial runoff on water quality and estuary health.	
Performance Indicators	▪ Uptake of the program by businesses in the study area (particularly the Woolgoolga Industrial Precinct).	▪ Long term improvement in monitored levels of analytes listed in Action A.	
Description	This action involves developing a program of Environmental Education and Performance Reviews for local businesses across the coastal zone. The program should combine a performance review program with a review of best environmental management practices - in order to encourage improved environmental performance by local businesses and operators. ▪ Education: The program should strive to provide environmental guidance and information to understand what is required and adopt a more proactive role in protecting the environment and human health. Development of the program can utilise a range of information, advice, and guidelines available from the NSW EPA Guidelines, including the *Better Practice Guidelines for Waste Management and Recycling in Commercial and Industrial Facilities* (NSW EPA, 2012). Environmental education should involve: – Sediment and erosion control; – Stormwater and runoff management; – Fertiliser practices; – Hazardous substance, chemical and waste management; – Emergency response to spills; – General housekeeping; and – Riparian zone vegetation management. ▪ Performance reviews and audits: The program should also include periodic performance reviews, in order to provide ongoing support for environmental management. The reviews should assess premises against relevant environmental guidelines, development approval conditions, and statutory requirements - in order to ensure impacts to the environment are appropriately and adequately mitigated. ▪ Recognition: Furthermore, the program should incentivise uptake and good practices through a recognition scheme that rewards operators who demonstrate		

Action H	Develop and Undertake a Program of Environmental Education and Performance Reviews for Local Businesses
	industry standard best practice. Providing recognition will help local businesses enhance their reputation and boost their competitive advantage.
Estimated Costs	▪ Capital Cost: $50,000 (including design of campaign/program, signage and materials, and initial implementation). ▪ $20,000 for follow up, after which ongoing implementation resorts to the City's Environmental Health Officers;
Potential Sources of Funding	▪ City: Operational and Delivery Plan Process & E Levy. ▪ NSW Coastal and Estuary Grants Program. ▪ The Coffs Harbour Protection of the Environment Trust
Integrated Links to Other Actions	▪ This action works in tandem with the following actions to reduce the impacts of runoff on estuarine water quality: – Action D - Prepare and Implement a Stormwater Management Plan for the Woolgoolga Region Estuaries – Action S - The Coffs Harbour Intensive Horticulture Environmental Program (The CHIEP)

Action I	Greater Acknowledgement of Aboriginal Cultural Heritage		
Location/Scale	All four of the Woolgoolga Region Estuaries		
Lead Organisation	The City	**Supporting Organisations**	CHDLALC and Garby Elders DPE (E&H) DPI Fisheries NPWS
Importance	4 (Medium)	**Urgency**	1 (Opportunistic)
Priority	**Low**	**Timeframe**	Long: Within 10 Years
Stressors Addressed	▪ Loss of Aboriginal cultural heritage values – **High Risk**		
MER Criteria ↘	**Short Term**	**Medium to Long Term**	
Objective(s)	▪ To acknowledge the Traditional Owners spiritual, social, customary and economic use of the study area – and provide a mechanism for the preservation of cultural heritage across the coastal zone.	▪ To improve the community knowledge and understanding of the Aboriginal cultural values of the coastal zone and marine estate.	
Performance Indicators	▪ Works implemented as per scope.	▪ Signs are valued by the community for the information they provide.	
Description	This action involves working with traditional owners to identify culturally appropriate ways to better acknowledge the Aboriginal cultural heritage of the study area. This could take the form of educational materials or dedicated signage located at strategic locations along the estuary foreshores. Similar signage has already been installed at estuary foreshore locations across the LGA, including at Reflections Holiday Park at Boambee Creek Reserve, which was championed by NSW Crown Holiday Parks Trust in partnership with local elders (Medianet, 2017) – see Figure 4-8.  **Figure 4-8 The Buwanbi story board at Reflections Boambee Creek Reserve (Medianet, 2017)** The tasks associated with this action include:		

Action I	Greater Acknowledgement of Aboriginal Cultural Heritage
	▪ Engagement with Traditional Owners groups, including CHDLALC, in order to determine the best ways to improve acknowledgement of cultural heritage (education materials, signage or other). ▪ If considering signage, then determination of appropriate and effective locations for implementation. A preliminary assessment indicates a total of 2 to 4 signs across the study area – located at foreshore / waterway access points with high pedestrian traffic, would be ideal. Potential locations for signage include: – Darkum Creek Access Point at Ocean Dr and Baroona St; – Woolgoolga Lakeside Holiday Park; – South Street Carpark at Willis Lake Entrance; and – Hearnes Lake Road beach access point. ▪ Engagement with relevant land managers including NPWS and Crown Lands, regarding approvals and funding. ▪ Implementation / installation of the signage, and annual maintenance.
Estimated Costs	▪ Capital Cost: $15,000 (preparation of materials, printing, and installation of signage) ▪ Maintenance Costs: Approx. $1,000 per year
Potential Sources of Funding	▪ City: Operational and Delivery Plan Process & E Levy. ▪ NSW Coastal and Estuary Grants Program. ▪ The NSW Heritage Grants Program.
Integrated Links to Other Actions	▪ Action O - Consolidate and Update Aboriginal Cultural Heritage Information: can provide information that can inform the content of this signage. ▪ Action R – Dual naming of Willis Creek using name of local significance to the Gumbaynggirr people: works in tandem with this action to promote Aboriginal cultural heritage values of the coastal zone and marine estate.

Action J	Aboriginal Cultural Inductions for High-Risk Developments		
Location/Scale	All four of the Woolgoolga Region Estuaries		
Lead Organisation	The City	**Supporting Organisations**	CHDLALC
Importance	7 (High)	**Urgency**	2 (Medium / Dependant)
Priority	**Medium**	**Timeframe**	Medium: Within 6 Years
Stressors Addressed	▪ Loss of Aboriginal cultural heritage values – **High Risk**		
MER Criteria ↘	**Short Term**	**Medium to Long Term**	
Objective(s)	▪ To reduce the potential impacts of development across the coastal zone on Aboriginal cultural heritage.	▪ To protect and preserve the Aboriginal cultural heritage of the marine estate and coastal zone.	
Performance Indicators	▪ Action implemented as per scope.	▪ Action is practical to implement, and considered to provide tangible benefit for the City and the LALC for planning and heritage protection.	
Description	The City is currently progressing the development of the *Coffs Harbour Aboriginal Cultural Heritage Planning and Assessment Toolkit*. One of the objectives of this project is to improve the management practices for Aboriginal cultural heritage in the City's planning and assessment processes (Virtus Heritage, 2021). The toolkit sets out pathways for development where a proponent is undertaking an activity that may harm Aboriginal Cultural Heritage (ACH) – as identified by the ACH mapping developed as part of the toolkit. Development on land within these mapped areas typically requires an ACH assessment, which will often include cultural awareness inductions for workers as a recommendation within the ACH assessment. This will in turn be applied as a condition of approval for developments that will involve significant sub-surface disturbance, earthworks and excavation. Therefore, in consultation with CHDLALC, it is proposed that the CMP be used as a vehicle to reinforce this process through a three-stage process of Aboriginal cultural inductions for development activity that may harm ACH across the study area coastal zone. This could include developers working with an Aboriginal sites officer across three (3) stages of a development project: ▪ *Pre Works*: Developers and contractors receiving an induction by an authorised local Aboriginal representative before any excavation is carried out. Inductions would be delivered by Gumbaynggirr descendants and/or an elder with recognised cultural heritage expertise to all personnel involved in ground disturbance work. The induction could include a history of the area, how to identify potential artefacts, middens and other tangible heritage items, and the legal obligations of site workers. ▪ *During Works*: Having an authorised local Aboriginal representative on-site to oversee and supervise the excavation / construction work. This would help with the identification of tangible heritage items, and to make sure that potential finds aren't overlooked – as even with the induction process contractors who are not suitably trained in cultural heritage may still oversee significant physical heritage items. ▪ *After Works*: This could involve an agreement of repatriation, and may include travel for community representatives to collect ancestral remains and secret sacred objects. Terms of repatriation would need to be agreed upon in the pre-works stage. The tasks associated with this action include: ▪ Using the City's ACH toolkit to determine a trigger or threshold for initiating the need for the induction process.		

Action J	Aboriginal Cultural Inductions for High-Risk Developments
	▪ Engagement with Traditional Owners and CHDLALC to develop an agenda and associated material for induction. ▪ Ongoing implementation and review of the program, as part of the Aboriginal Cultural Heritage (ACH) toolkit implementation. Implementation of this action should be cognisant of Native Title and the requirements of the *Commonwealth Native Title Act 1993*.
Estimated Costs	▪ Cost: City Staff Time
Potential Sources of Funding	▪ As per the (Draft) Coffs Harbour Aboriginal Cultural Heritage Management Toolkit, the cost of the induction process would be borne by development proponents, facilitated through the City.
Integrated Links to Other Actions	▪ Action O - Consolidate and Update Aboriginal Cultural Heritage Information: can provide information relating to the location of tangible heritage sites and artifacts that can inform the need to trigger this process

4.3.4 Research and Innovation

Action M	**Undertake a 12 Month Trial of a Water Quality Autosampler for Hearnes Lake**		
Location/Scale	All four of the Woolgoolga Region Estuaries		
Lead Organisation	The City	**Supporting Organisations**	DPE (E&H)
Importance	6 (Medium)	**Urgency**	2 (Medium / Dependant)
Priority	**Medium**	**Timeframe**	Medium Term: Within 6 Years
Stressors Addressed	▪ Urban stormwater runoff – **Very High Risk** ▪ Industrial runoff – **Moderate Risk** ▪ Sewage effluent and septic runoff – **Moderate Risk** ▪ Recycled water usage – **Very High Risk** ▪ Agricultural runoff – **Very High Risk** ▪ Incomplete water quality information – **High Risk**		
MER Criteria ↘	**Short Term**	**Medium to Long Term**	
Objective(s)	▪ To generate technical data that can provide insights into the estuarine water quality and response to rainfall events, and the impacts of catchment land usage.	▪ To further develop the understanding of water quality issues, and provide a useful dataset upon which to inform effective and targeted management decisions.	
Performance Indicators	▪ Program implemented and data collected as per scope.	▪ Collected data is of tangible benefit from a research and management perspective.	
Description	This action involves the installation and operation of a Water Quality Autosampler device – which is to be positioned in Hearnes Lake, within the coastal zone. The program is to be undertaken for a 12-month trial period. If the trial proves to be effective and value for money, then the trial period can be extended. Automated sampling devices are used to collect water samples when it is not possible to collect them manually. They are unmanned water sampling devices that can be pre-programmed to collect samples continuously or on a flow-related or time-related basis. Such an arrangement is ideal for collecting stormwater runoff, for example, and collection can be triggered by the commencement of water flow. Commercially available automatic sampling devices consist of a pump system, a controller and an array of sample bottles within a housing. Most instruments have a fixed number of purpose-made glass or polyethylene sample bottles fitted around the circumference of the housing. The auto sampler should measure flow, and collect samples to be analysed for a speciated nutrient suite (TN, TKN, NH_3, NO_x, TP and SRP). Ideally, the autosampler should be positioned at a location somewhere in Hearnes Lake or Double Crossing Creek, so that the outputs can align with the research undertaken by Southern Cross University in the Hearnes Lake estuary. Samples can be captured hourly for several hours to measure nutrient concentrations and loads coming off the catchment in response to rainfall events. Samples can then be collected at a later date from the sampler and sent to the laboratory for analysis. The tasks in this action include: ▪ Assessment of a suitable location for the device, including a review of: – Catchment land use and desired data outputs for research; – Ability to dovetail with existing research work and studies;		

Action M	Undertake a 12 Month Trial of a Water Quality Autosampler for Hearnes Lake
	– The location of water level gauges (Action C) and other water quality monitoring sites (Action A) to support data interpretation and improve outputs/analysis; – The need for a housing structure and power source; – Access for sample collection and device maintenance; and – The potential for vandalism and other damage. ▪ Procurement of a suitable auto sampling device. ▪ Ongoing sample collection after relevant rainfall events – noting that delayed collection may compromise the integrity of samples collected by automatic devices. Therefore, this normally requires that samples be collected and processed as soon as possible after the event. ▪ Maintenance: Sampling units must be routinely inspected for evidence of insects in the intake and breathing tubes - a common reason for missed samples (and contamination). Sampling intakes and exhaust tubes should be replaced or thoroughly washed with laboratory supplied ultra-pure water at regular time intervals (monthly or sooner as required) to avoid blockages and contamination. ▪ Ongoing data analysis and the delivery of a summary report at the end of the 12-month trial period. This summary report should include: – Project methodology and details of the autosampler device and its installation; – Overview of collected data; – Summary of and key findings and recommendations; and – Provision of all raw data to the City. As discussed in Section 1.6.2, the legislative requirements of the MEM Act dictate that this action will require consent from DPI Fisheries in the form of a marine park permit.
Estimated Costs	▪ Capital Cost: $65,000 for a one-year deployment
Potential Sources of Funding	▪ City: Operational and Delivery Plan Process & E Levy. ▪ NSW Coastal and Estuary Grants Program.
Integrated Links to Other Actions	▪ Action A - Implement a Water Quality Monitoring Program: can be collated with this dataset to provide a holistic dataset of ambient and event-based water quality. ▪ Action B - Publish an Annual Water Quality Report Card for Estuaries: can be used to publish findings from this trial, including estuary water quality response to rainfall events ▪ Action C: Installation of Water Level Gauges at Darkum Creek, Willis Creek and Hearnes Lake: If the water level gauge in Hearnes Lake and the autosampler are strategically co-located, then this can provide the ability to assess sediment and nutrient loads entering the estuary. ▪ Action N - Provide Support for Research and Innovation into Estuary Health Risks and their Management: the data from the autosampler should be used in estuary health research projects in order to maximise use of the data and benefits of the action. ▪ Action S - The CHIEP: On-farm water quality monitoring from the CHIEP can be integrated with this data in order to provide a strong understanding of the relationship between catchment land usage and estuarine water quality response to rainfall events. Furthermore, research that utilises this data (Action N) can then help derive innovative on-farm management solutions for uptake by local operators through the CHIEP.

Action N	Provide Support for Research and Innovation into Estuary Health Risks and their Management		
Location/Scale	All four of the Woolgoolga Region Estuaries		
Lead Organisation	The City	**Supporting Organisations**	DPE (E&H) NC LLS
Importance	7 (High)	**Urgency**	3 (Pressing)
Priority	**Medium**	**Timeframe**	Medium Term: Within 6 Years
Stressors Addressed	▪ Potentially any of the stressors outlined in the Stage 2 Report.		
MER Criteria ↘	**Short Term**	**Medium to Long Term**	
Objective(s)	▪ To encourage and facilitate research and monitoring – and to maintain scientific and educational values of the study area.	▪ To increase the understanding of estuary health risks, their causes, and effective management actions ▪ To provide a body of knowledge upon which to inform effective and targeted management decisions.	
Performance Indicators	▪ Action implemented as per scope.	▪ Research output is of tangible benefit from a management perspective.	
Description	The City currently employs an Environmental Levy as a means of funding various kinds of environmental management works. The levy currently raises around $1.3 million p.a for local environmental works, at an average cost of $44 per rate payer (Coffs Harbour City Council, 2021). The Environmental Levy fund is allocated in two streams: ▪ 75% to Major Strategic Projects; and ▪ 25% to the Environmental Levy Grants program for community groups and non-government organisations. Some of the major strategic projects include CMPs, and biodiversity and rehabilitation projects (as just a few examples). Major Strategic Projects also include innovation and research projects, which in recent years have included research undertaken by Southern Cross University (SCU) regarding estuarine water quality and catchment land usage in the Coffs Harbour LGA. This research has significantly enhanced the understanding of key issues affecting the estuaries and potential solutions to address these risks. One such example is the prototype development and trial of wood chip "bioreactors" (Figure 4-9) to help manage excess nutrient run-off (White, et al., 2021a). This management action would allow this research to continue in the short to medium term, and continue to enhance the knowledge base regarding these issues. The City currently provides funding of $40,000 p.a. for research and innovation projects. Therefore, the CMP represents an opportunity to provide a means of maintaining and enhancing funding for this research and innovation work. If included in a certified CMP, the City's financial assistance for research and innovation may be augmented with 2:1 funding from DPE through the Coast and Estuary Grants Program, which will facilitate significant additional science and research to be undertaken in the study area, however, it is noted that applications will be lodged and assessed based on their merit in meeting the objectives of the Coastal and Estuary Grants Program.		

Action N	Provide Support for Research and Innovation into Estuary Health Risks and their Management
	 Figure 4-9 Wood-chip bioreactor at Sandy Beach in the Hearnes Lake catchment
Estimated Costs	▪ Approximate Cost: Up to $120,000 p.a.
Potential Sources of Funding	▪ City: Operational and Delivery Plan Process & E Levy. ▪ NSW Coastal and Estuary Grants Program. ▪ North Coast Local Land Services.
Integrated Links to Other Actions	▪ Action N - Undertake a 12 Month Trial of a Water Quality Autosampler for Hearnes Lake: the data from the autosampler should be used in estuary health research projects in order to better understanding estuary health risks and effective and innovative management responses. ▪ Action S - The CHIEP: can be used as a way of implementing innovative solutions that stem from this research. A good example is of this the development of wood chip "bioreactors", which could be rolled out to operators for uptake through the CHIEP. However, it could also apply to other innovations and solutions that stem from this research.

Action O	Consolidate and Update Aboriginal Cultural Heritage Information		
Location/Scale	All four of the Woolgoolga Region Estuaries		
Lead Organisation	The City	**Supporting Organisations**	CHDLALC and Garby Elders DPE (E&H) DPI Fisheries
Importance	7 (High)	**Urgency**	3 (Pressing)
Priority	**Medium**	**Timeframe**	Medium Term: Within 6 Years
Stressors Addressed	▪ Loss of Aboriginal cultural heritage values – **High Risk**		
MER Criteria ↘	**Short Term**	**Medium to Long Term**	
Objective(s)	▪ To fill information gaps within the LGA-wide Aboriginal Cultural Heritage Map across the coastal zone, and in doing so increase local understanding of Aboriginal cultural heritage within the coastal zone.	▪ To increase understanding of Aboriginal cultural heritage, and preserve the Aboriginal cultural heritage values of the marine estate and coastal zone.	
Performance Indicators	▪ Action implemented as per scope.	▪ Outputs provide value to both Traditional Owners groups, and the City - from a research and management perspective.	
Description	The City, in collaboration with the former NSW Office of Environment and Heritage, has developed an Aboriginal Cultural Heritage (ACH) Map for the Coffs Harbour Local Government Area (LGA). This process has included cultural information and mapping which Gumbaynggirr people shared with the City, NSW Planning and Environment, and consultants Ian Fox and Consultants and Virtus Heritage (Virtus Heritage, 2021). However, it is noted that this mapping is dynamic, and will require updating over time. Furthermore, it is understood that there are identified gaps in this mapping which require attention for action and integration. The purpose of this action is to undertake an updated cultural heritage survey of the coastal zone– and in doing so fill identified information gaps within the LGA-wide Aboriginal Cultural Heritage Map across the coastal zone. It is anticipated that there would be three main tasks for this action: ▪ Aboriginal community engagement: Consultation with the Traditional Owners and knowledge holders is an integral part of the process of investigating and assessing Aboriginal cultural heritage. ▪ A desktop review of background information, including an assessment of existing information and mapping, review of the physical setting and landscape description, review of local histories of the Traditional Owners, and material evidence of Aboriginal land use in the study area coastal zone. ▪ An Aboriginal cultural heritage assessment: In consultation and engagement with Aboriginal (and other relevant) stakeholders, to ensure due diligence and statutory requirements are met. The assessment should include: – Survey field work, including recording of cultural heritage sites, objects, or features. – Detailed documentation of findings, including management recommendations and associated mapping.		

Action O	Consolidate and Update Aboriginal Cultural Heritage Information
	The survey should employ historical documentary research, field work and community engagement to explore the range and diversity of historical themes associated with the survey area, and to identify places and areas of heritage significance. Consequently, an updated Aboriginal cultural heritage survey can provide a proactive and structured way to improve the understanding of local Aboriginal cultural heritage values, and collect necessary evidence to inform heritage registers and planning schemes - with a view to preparing a more comprehensive list of heritage items for eventual insertion into Schedule 5 of the City of Coffs Harbour Local Environmental Plan 2013 (LEP 2013). The results of a heritage survey can be used by the City and/or the State Government to make decisions about heritage protection, such as which places to enter into a local heritage register and which heritage areas to protect under the local government planning controls.
Estimated Costs	▪ Capital Cost: Approximately $65,000
Potential Sources of Funding	▪ City: Operational and Delivery Plan Process & E Levy. ▪ NSW Coastal and Estuary Grants Program. ▪ The NSW Heritage Grants Program.
Integrated Links to Other Actions	▪ Action I - Greater Acknowledgement of Aboriginal Cultural Heritage: This survey can provide information that can inform the development of the signage. ▪ Action J - Cultural Awareness Inductions for Major Developments: This survey can be used to provide information relating to the location of tangible heritage sites and artifacts that can inform the need to trigger that process. ▪ Action P - Provide Funding Support for Radiocarbon Dating of Aboriginal cultural heritage Items: Can be used to provide funding for the radiocarbon dating of tangible heritage items and artifacts discovered by the survey.

Action P	Provide Funding Support for Radiocarbon Dating of Aboriginal Cultural Heritage Items		
Location/Scale	All four of the Woolgoolga Region Estuaries		
Lead Organisation	The City	**Supporting Organisations**	CHDLALC and Garby Elders DPE (E&H) DPI Fisheries NPWS
Importance	7 (High)	**Urgency**	1 (Opportunistic)
Priority	**Low**	**Timeframe**	Medium Term
Stressors Addressed	▪ Loss of Aboriginal cultural heritage values – **High Risk**		
MER Criteria ↘	**Short Term**	**Medium to Long Term**	
Objective(s)	▪ To provide a mechanism for the enhancement of Aboriginal cultural heritage across the marine estate and the coastal zone.	▪ To enhance the local knowledge of Aboriginal history, and demonstrate the evolution and development of Aboriginal culture over tens of thousands of years.	
Performance Indicators	▪ Action implemented when opportunities arise (including from Action O).	▪ Outputs provide value to both Traditional Owners groups, and the City - from a research and management perspective.	
Description	Engagement with the Coffs Harbour LALC during Stage 2 of the CMP indicated that artefacts and middens across coastal zone are of the utmost importance to the local Aboriginal community. In the last few years, some significant artefacts have been found in Hearnes Lake, as well as in Moonee Creek (the estuary adjacent to Hearnes Lake). In fact, in the Moonee Creek catchment, an area first described by North (1964) as an 'axe factory' is known to exist. This site was discovered in the 1960s and over 1,000 stone artefacts were recorded. The site has since been destroyed by European settlement activities such as sand mining, however a collection of artefacts from the 'axe factory' is currently housed in the Australian Museum. The Coffs Harbour LALC is also currently in possession of Aboriginal artefacts and other tangible heritage items from across the study area and adjacent estuaries. The CMP could therefore be used to assist in funding of radiocarbon dating of Aboriginal artefacts found across the study area coastal zone. Radiocarbon dating is a well-known method for determining the age of materials up to the age of ~ 50,000 years. Radiocarbon dating analyses may be carried out on diverse natural materials such as lake sediments, groundwater and surface waters, tree rings, ice-cores, corals, soils and air. Radiocarbon dating analyses are undertaken by Australian National University (ANU) and the Australian Nuclear Science and Technology Organisation, (ANSTO) to determine the age of ancient artefacts and to shed light on lives of the first people in Australia. ANTSO are a statutory body of the Australian government. As for Action O, this management action is highly aligned with Initiative #4 of the Marine Estate Management Strategy (MEMA, 2018) – which includes *Working with Aboriginal communities in the management of Sea Country to reduce threats and risks to Aboriginal cultural heritage.* Specifically, Action 4.2 of the MEMS states: ▪ Action 4.2: Work with Aboriginal communities to identify the cultural values of Sea Country to improve the incorporation of values into decision-making on the marine estate		

Action P	Provide Funding Support for Radiocarbon Dating of Aboriginal Cultural Heritage Items
	Furthermore, the State-wide Threat and Risk Assessment (TARA) identified that Aboriginal cultural heritage values within the marine estate are at high risk from a range of threats. Therefore, this action can use the CMP to preserve and protect Aboriginal cultural heritage across the marine estate and the coastal zone.
Estimated Costs	▪ Costs would be dependent upon the nature and number of artefacts to be tested. ▪ Indicative estimates for radiocarbon dating are around $500-1,000 per analysis. However, in consultation with ANTSO, it is understood that up to 10 tests may be required per analysis in order to have adequate confidence in results. ▪ Therefore, analysis of a particular item may cost between $5,000-$10,000. ▪ A nominal forward cost estimate, assuming one item is tested per year for ten years is included in the Business Case.
Potential Sources of Funding	▪ City: Operational and Delivery Plan Process & E Levy. ▪ NSW Coastal and Estuary Grants Program. ▪ The NSW Heritage Grants Program.
Integrated Links to Other Actions	▪ Action O - Consolidate and Update Aboriginal Cultural Heritage Information: The survey can provide heritage items and artefacts for radiocarbon dating analysis.

4.4 Actions to be Implemented by Public Authorities other than the City

Action Q	**Support the Conservation and Recovery of Shellfish Ecosystems in Woolgoolga Lake**		
Location/Scale	Woolgoolga Lake		
Lead Organisation	DPI Fisheries	**Supporting Organisations**	The City (Component 1: Education)
Importance	9 (Critical)	**Urgency**	2 (Medium / Dependant)
Priority	**Medium**	**Timeframe**	Medium Term: Within 6 Years
Stressors Addressed	▪ Urban stormwater runoff – **Very High Risk** ▪ Industrial runoff – **Moderate Risk** ▪ Agricultural runoff - **Very High Risk** ▪ Foreshore development and loss of aquatic & riparian habitat – **Moderate Risk** ▪ Loss of Aboriginal cultural heritage values – **High Risk** ▪ Climate change impacts - **High Risk**		
MER Criteria ⇲	**Short Term**	**Medium to Long Term**	
Objective(s)	▪ To undertake Component #1 and #2 of this Action. ▪ To gain sufficient insights regarding the mechanisms for enhancing natural recruitment and survivorship in the local Leaf Oyster population, and clearly set forth targeted management actions for the restoration of Woolgoolga Shellfish Ecosystems.	▪ To support the conservation and recovery of shellfish ecosystems in Woolgoolga Lake – specifically the Leaf Oysters (*Isognomon ephippium*), and Sydney Rock Oyster (*Saccostrea glomerata*) populations within the estuary.	
Performance Indicators	▪ Development of management actions that allow progression to Component #3.	▪ This component of the action will need to establish its own detailed MER process, based on outcomes of research in Component #2.	
Description	Engagement with DPI Fisheries and Southern Cross University (SCU) during development of the CMP indicated that shellfish ecosystems of Leaf Oysters (*Isognomon ephippium*), and Sydney Rock Oyster (*Saccostrea glomerata*) within Woolgoolga Lake have experienced decline and degradation over recent decades– see Figure 4-10, Figure 4-11, and Figure 4-12. Notably, the Leaf Oyster population within Woolgoolga Lake has regional significance, as it is understood to be one of the only Leaf Oyster populations across the 300 km stretch from Brunswick Heads to Nambucca Heads. Furthermore, Community Engagement during Stage 3 indicated that the local community places a high level of value on these ecosystems, and a strong desire to restore and maintain them for future generations.		

Action Q	Support the Conservation and Recovery of Shellfish Ecosystems in Woolgoolga Lake

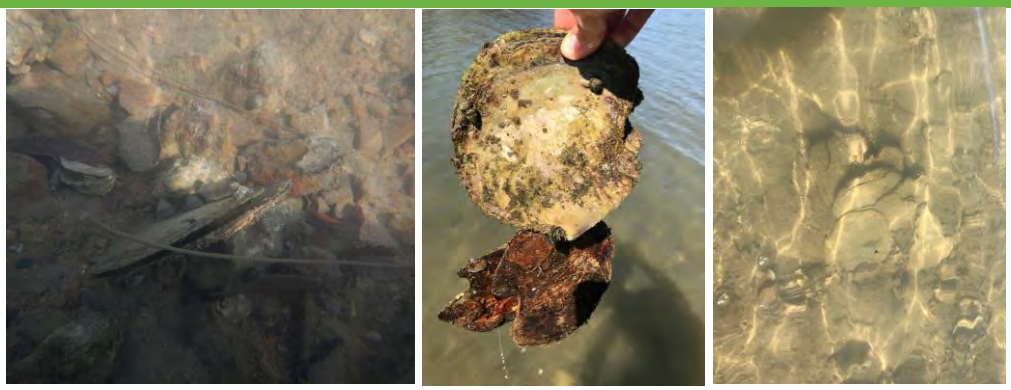


Figure 4-10 Leaf Oyster beds in Woolgoolga Lake. Image provided by the WLWG

Figure 4-11 Sydney Rock Oyster beds in Woolgoolga Lake. Image provided by WLWG

Discussions during Stage 3 with DPI Fisheries and Southern Cross University indicated that there is potential to investigate mechanisms for enhancing natural recruitment and survivorship in the local Leaf Oyster population, and that Woolgoolga Lake could be a prime site for Leaf Oyster reef enhancement - in combination with some restoration of Sydney Rock Oysters in the higher tide zone (which may also help buffer the Leaf Oyster population). However, before any restoration project could feasibly commence, more research is required about the species in terms of recruitment and spat production.

Leaf Oyster populations in NSW estuaries have been the subject of a recent study by DPI Fisheries and Southern Cross University (Benthotage, Cole, Schulz, & Benkendorff, 2021). This study is building knowledge around the ecology of Leaf Oyster beds and their potential application for shellfish reef restoration projects. Further studies on Leaf Oysters are planned with a specific focus on the Woolgoolga Lake population. Therefore, the option would seek to build on this knowledge base, and subsequently include community education, and physical habitat restoration works.

This action includes the following components:

- Component 1: Education: Raise the profile of shellfish ecosystems by increasing education and communication on their function and value to coastal communities. The City can take the lead on this initiative, with support from DPI and SCU. This can take the form of community signage and information disseminated through the City's website and social media accounts. This can also be linked with other options in the CMP related to implementation of educational signage. This may also include a local information session/open air field day at the Lake.

Action Q	Support the Conservation and Recovery of Shellfish Ecosystems in Woolgoolga Lake
	▪ Component 2: Research: Prioritise and allocate resources for research and baseline mapping to determine the location, extent and vulnerability of remaining shellfish ecosystems in Woolgoolga Lake. This work should leverage off the existing body of work undertaken by NSW DPI Fisheries, and Southern Cross University. This research should provide further insights regarding recruitment and spat production, and clearly set forth targeted management actions for the restoration of Woolgoolga Shellfish Ecosystems. This component links closely with CMP *Option 16 - Provide Support for Research and Innovation for Estuary Health Risks and Management*. ▪ Component 3: Restoration: DPI Fisheries to invest in and develop local restoration projects for native oyster species in Woolgoolga Lake. Oyster reef restoration introduces hard substrate (sterile shells and/or rock such as limestone) to the estuary or nearshore floor, in an area of good natural settlement rates of oyster larvae. Over time, given the right conditions, these juvenile oysters spat grow and reproduce, creating a self-sustaining complex ecosystem with all the attributes of a natural oyster reef (NSW DPI, 2021). Oyster reef restoration is a relatively new idea in Australia with native reef-forming species oysters, including Flat Oysters (*Ostrea angasi*) and Sydney Rock Oysters, typically used for restoration work. Research by NSW DPI Fisheries, and Southern Cross University (Benthotage, Cole, Schulz, & Benkendorff, 2021) is examining whether native Leaf Oysters can potentially be used in restoration projects. Examples of shellfish reef restoration projects in NSW include: ▪ Port Stephens Pilot Shellfish Reef Restoration Project: Undertaken between 2019 and 2021, NSW DPI has taken the first step in an ambitious restoration project - the first large-scale oyster reef restoration project in NSW waters[1]. This included the restoration of a new intertidal Sydney rock oyster reef, located in Port Stephens. Preliminary results have indicated that the project has performed highly in social, economic, and environmental areas (NSW DPI, 2021). ▪ OceanWatch “Living Shoreline” projects: Including those undertaken at the Macleay River, Hastings River, Brisbane Water, Sydney Harbour[2]. ▪ This action is aligned with Initiative 1 of the Marine Estate Management Strategy (MEMA, 2018): Improving water quality and reducing litter. As discussed in Section 1.6.2, the legislative requirements of the MEM Act dictate that this action will require consent from DPI Fisheries in the form of a marine park permit.
Estimated Costs	▪ Component 1: Education: Around $20,000 (linked to other options in this CMP) ▪ Component 2: Research: Up to $25,000 (subject to MEMS funding) to undertake necessary research and develop targeted management actions (Funding for this can be linked to other Option 16 in this CMP regarding research and innovation). Furthermore, monitoring of the project can leverage off in-kind support from the community in terms of monitoring. ▪ Component 3: Restoration: Up to $220,000 (subject to MEMS funding) - noting the cost of the Port Stephens Pilot Project was $700,000.
Potential Sources of Funding	▪ The City (for Component 1: Community Education) ▪ There are significant opportunities and scope to apply for partnership funds for many components of this work (particularly for components 2 and 3): – Flagship Habitat Action Grants;

[1] https://www.marine.nsw.gov.au/strategy-implementation/water-quality-and-litter/oyster-reef-restoration/
[2] https://www.shellfishrestoration.org.au/the-solution/australian-projects/

Action Q	Support the Conservation and Recovery of Shellfish Ecosystems in Woolgoolga Lake
	– The Nature Conservancy (TNC), Australia- Reef Builder Grants; – The Marine Estate Management Strategy (MEMS) NSW Shellfish Reef Restoration Program. ▪ Other environmental restoration programs.
Integrated Links to Other Actions	▪ Action N - Provide Support for Research and Innovation into Estuary Health Risks and their Management: can be used as a direct mechanism to provide funding support for Component 2 of this action. In this way these two actions can be directly linked. ▪ The likelihood of this action being successfully realised can be enhanced by the implementation of other actions that will improve estuarine water quality. Including: – Action D - Prepare and Implement a Stormwater Management Plan for the Estuaries – Action H - Develop and Implement a Program of Environmental Education and Performance Reviews for Local Businesses – Action S - The Coffs Harbour Intensive Horticulture Environmental Program (CHIEP)

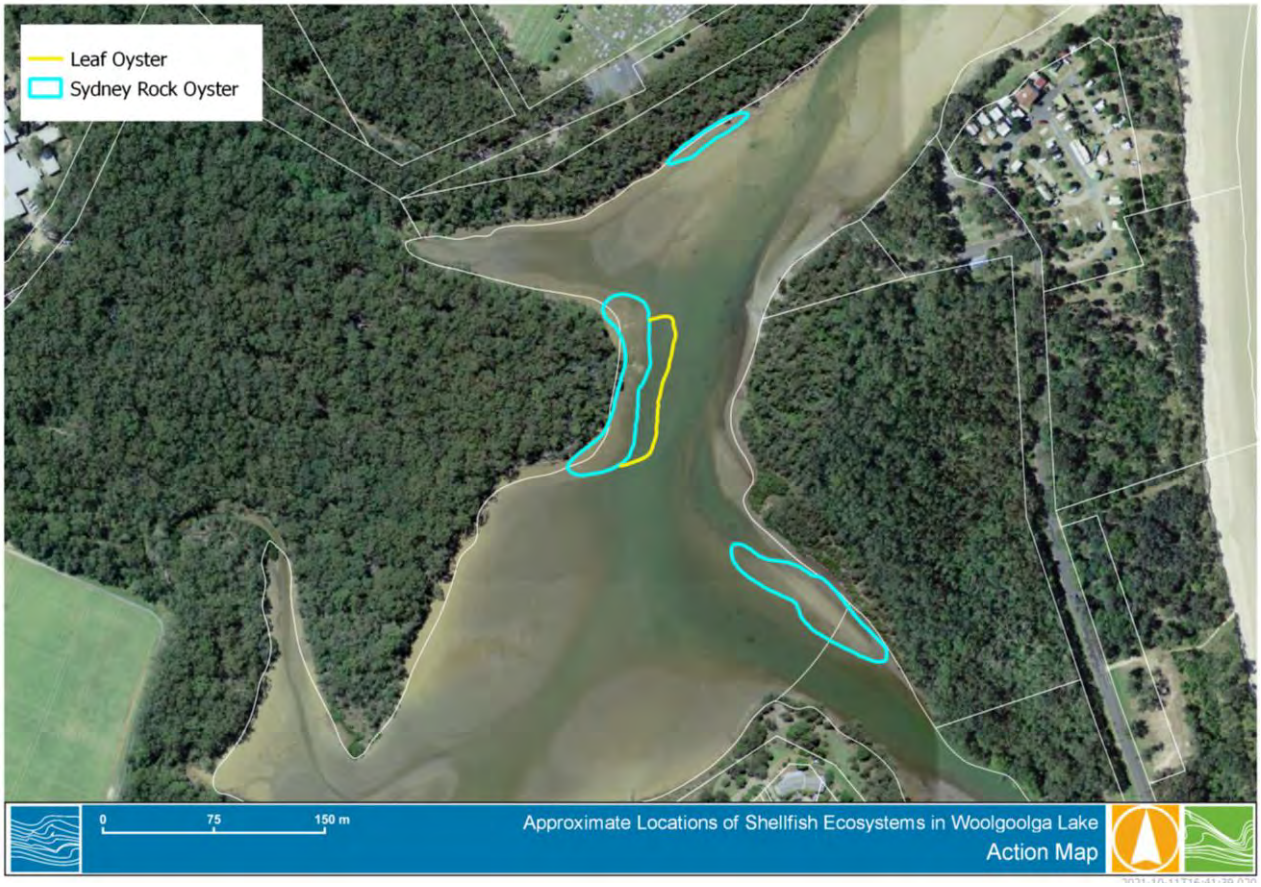


Figure 4-12 Approximate locations of shellfish ecosystem in Woolgoolga Lake (for greater detail, refer to NSW DPI Fisheries and SCU)

Action R	Dual Naming of Willis Creek using a Name of Local Significance to the Gumbaynggirr People		
Location/Scale	Willis Creek		
Lead Organisation	DPI Fisheries, in partnership with Traditional Owners	**Supporting Organisations**	Garby Elders CHDLALC The City
Importance	8 (Critical)	**Urgency**	1 (Opportunistic)
Priority	**Medium**	**Timeframe**	Medium Term: Within 6 Years
Stressors Addressed	▪ Loss of Aboriginal cultural heritage values – **High Risk**		
Objective(s)	▪ To preserve traditional names and language of the Gumbaynggirr people, and preserve Aboriginal cultural values of the marine estate.		
Performance Indicators	▪ Action implemented as per scope.		
Description	This action involves renaming Willis Creek to a name of local significance to the Gumbaynggirr people. This could be undertaken through the state-based dual naming system prescribed by the NSW Geographical Naming Board (GNB). The New South Wales Government is committed to recognising Aboriginal cultural heritage by registering original place names given by Aboriginal people so that they sit side by side with existing European names (GNB, 2021). Since June 2001, the government has supported a dual naming policy for geographical features and cultural sites. This system acknowledges the significance of Aboriginal culture and, in doing so, represents a meaningful contribution to the process of reconciliation in NSW. The dual naming system applies to already named geographical features such as creeks, lakes, and beaches – specifically those cultural and environmental features of significance to the local Aboriginal community. Once a dual name proposal is assigned, signposts, maps and directories relating to the area will feature both names. The location and spelling of a name reside in the hands of the traditional owner or the organisation that represents them (GNB, 2021). Under the *Geographical Names Act 1966*, the Geographical Names Board (GNB) has the power to assign names to places. Anyone can submit a dual naming proposal to the GNB; however, all submissions should have the written support of Traditional Owners, CHDLALC, The City of Coffs Harbour and DPI Fisheries as manager of the Solitary Islands Marine Park. This action is consistent with the Draft NSW Mainland Marine Park Management Plan 2021-2031 Action 4.2c *Work with Traditional Owners to identify traditional Aboriginal names for each marine park and include local Aboriginal language in marine park education material*. Subsequently, DPI Fisheries intends to explore options for dual naming with Traditional Owners across the NSW marine park network. DPI Fisheries will lead this action in partnership with Traditional Owners as a dual naming pilot for the Solitary Islands Marine Park that may be expanded to other sites or marine parks across NSW.		
Estimated Costs	▪ Capital Cost: $2,000 for media advertisements and public consultation. ▪ Additional Capital Costs will be associated with updating of signage and communications material. ▪ Otherwise, the action to be delivered in-kind with costs for staff time contributed by relevant agencies and organisations		

Action R	Dual Naming of Willis Creek using a Name of Local Significance to the Gumbaynggirr People
Potential Sources of Funding	▪ DPI-Fisheries cash and in-kind for dual naming process only. ▪ Additional funding to be sourced by all land managers for any costs associated with updating of signage and communications material.
Integrated Links to Other Actions	▪ Action I - Install Signage with Aboriginal Cultural Heritage Information: works in tandem with this action to promote Aboriginal cultural heritage values of the marine estate.

4.5 Actions to be Implemented Externally to the Certified CMP

The process of developing this CMP has included the identification of 3 actions located across the broader catchment area that will provide substantial benefits to estuary health within coastal zone. These actions are located outside of the legally defined coastal zone (see Section 1.3), and therefore are to be delivered externally to the certifiable CMP - and are separate from programs, projects or activities delivered as part of the certified CMP.

These actions have been listed in a separate action table in this document in order to ensure that linkages to the certifiable CMP are maintained, and that actions are delivered in an integrated manner to address relevant risks and threats identified in the coastal zone.

Action K	**Community Education on Recycled Water Usage**		
Location/Scale	All four of the Woolgoolga Region Estuaries		
Lead Organisation	The City	**Supporting Organisations**	N/A
Importance	5 (High)	**Urgency**	2 (Medium / Dependant)
Priority	**Medium**	**Timeframe**	Medium Term: Within 6 Years
Stressors Addressed	▪ Recycled water usage – **Very High Risk** ▪ Agricultural runoff – **Very High Risk** ▪ Modified freshwater flows – **Very High Risk**		
MER Criteria ↘	**Short Term**	**Medium to Long Term**	
Objective(s)	▪ To provide recycled water users with the information needed to understand recycled water issues and implement positive practice change.	▪ To reduce the impacts of recycled water usage on downstream water quality and estuary health.	
Performance Indicators	▪ Education materials developed and disseminated as per action scope.	▪ Long term reduction in monitored levels of Nitrates and Phosphates in Action A.	
Description	This action comprises an educational campaign to inform community members about responsible and sustainable recycled water usage practices, and subsequent downstream environmental impacts. The campaign should be designed by the City's environmental and wastewater services officers – but could notionally include the following components: ▪ Information provided on the City's website and through social media channels; ▪ Information provided within the recycled water End User Agreement documents; ▪ Direct mail-out of literature to those end users within the City's end user database; ▪ Strategic information signage provided at the recycled water tanker fill-point located off Stadium Drive. The strategy messaging deployed for this campaign should include: ▪ What is recycled water? ▪ How it can be used in agriculture / horticulture. ▪ Potential hazards and environmental impacts of using recycled water. ▪ Recommendations for safe and sustainable use of recycled water. Similar educational information has been prepared by other water managers, such as Hunter Water[3]. Additionally, Land and Water Australia has a wealth of information on irrigation and related environmental management issues regarding the use of recycled water (LWA, 2021). This information should also be provided in common languages used by local horticulture operators, in order to maximise effectiveness.		
Estimated Costs	▪ Capital Cost: $15,000 (City Staff Time and allowance of $10,000 for design of campaign/program, and $5,000 for signage and materials). ▪ Annual costs: Approx. $5,000 per year for ongoing implementation		

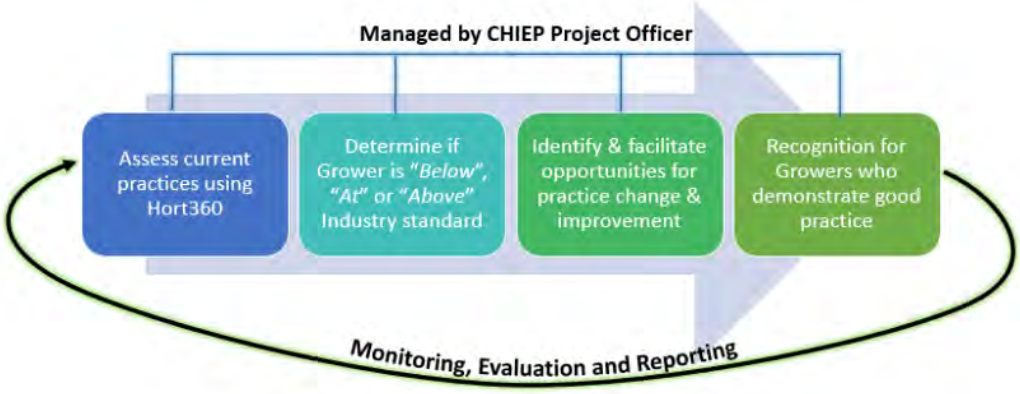
[3] https://www.hunterwater.com.au/documents/assets/src/uploads/documents/Fact-Sheets/Recycled-Water/recycled-water-agricultural.pdf

Action K	Community Education on Recycled Water Usage
Potential Sources of Funding	▪ City: Operational and Delivery Plan Process & E Levy.
Integrated Links to Other Actions	▪ Action S - The Coffs Harbour Intensive Horticulture Environmental Program (The CHIEP): works in tandem with this action – as that program will work with local horticulture operators in order to improve on-farm practices, including responsible and efficient use of recycled water. ▪ Action L - Promote Community Education Regarding Water Access Compliance works in tandem with this action as it involves community education around responsible water usage across the catchment.

Action L	Promote Community Education Regarding Water Access Compliance		
Location/Scale	All four of the Woolgoolga Region Estuaries		
Lead Organisation	The City	**Supporting Organisations**	N/A
Importance	3 (Medium)	**Urgency**	1 (Opportunistic)
Priority	**Low**	**Timeframe**	Long Term: Within 10 Years
Stressors Addressed	▪ Modified freshwater flows – **Very High Risk**		
MER Criteria ↘	**Short Term**	**Medium to Long Term**	
Objective(s)	▪ To provide water users with the information needed to understand water extraction issues and implement positive practice change.	▪ To reduce the impacts of water extraction and modified freshwater flows on estuary function and health. ▪ To help facilitate long-term positive practice change.	
Performance Indicators	▪ Action implemented as per action scope.	▪ Future compliance campaigns by NRAR show improved compliance across the catchments.	
Description	Stage 2 of the CMP identified that a major risk across the study area is the lack of compliance of users with the terms of their Water Access Licence (WAL) conditions. Lack of compliance can often be based on a lack of understanding of good practice and licence conditions. At present, all compliance activity with regard to Water Access Licences is the responsibility of the Natural Resources Access Regulator (NRAR), which is an agency within the DPE Water Group (NSW Water). NRAR also provides education campaigns at both regional, and state-wide levels. Presently, NRAR is rolling out the "Know the Rules" campaign – in order to help water users understand how they can access and utilise water in accordance with the rules of the *Water Management Act 2000* and other relevant legislation. This action therefore comprises promotion of this existing, publicly available information through the City's various communication mediums – such as its webpage, social media and other resources. The "Know the Rules" campaign features a series of short videos, fact sheets and other information. The City could advance this educational campaign by promoting this content, and in doing so help to educate the local user base. It includes: ▪ An interactive compliance guidance tool to help users understand what they need to do to ensure their water take is compliant; ▪ Video content showing users how to find a water access licence and approval; ▪ Fact sheets explaining fair and responsible use of our water resources and how to comply with water management laws; and ▪ The Waterfront land e-tool, which is an interactive web-based tool that aims to help applicants and consultants determine the definition of waterfront land under the controlled activity provisions of the *Water Management Act 2000*. Tasks for this action include: ▪ Identification of appropriate mediums for dissemination of this material; ▪ Review of available content for promotion and dissemination; and ▪ Ongoing implementation.		
Estimated Costs	▪ Capital Cost: $0 (City Staff Time for promotion of existing materials on their website and social media platforms)		

Action L	Promote Community Education Regarding Water Access Compliance
Potential Sources of Funding	▪ N/A
Integrated Links to Other Actions	▪ Action S- The Coffs Harbour Intensive Horticulture Environmental Program (The CHIEP): works in tandem with this action – as that program will work with local horticulture operators in order to improve on-farm practices, including water extraction across the catchment. ▪ Action K - Community Education on Recycled Water Usage: works in tandem with this action as it involves community education around responsible water usage across the catchment.

Action S	The Coffs Harbour Intensive Horticulture Environmental Program (CHIEP)		
Location/Scale	The Coffs Harbour LGA		
Lead Organisation	Local Land Services	**Supporting Organisations**	The City DPE (E&H) DPI Agriculture
Importance	10 (Critical)	**Urgency**	3 (Pressing)
Priority	**High**	**Timeframe**	Short Term: Within 3 Years
Stressors Addressed	▪ Recycled water usage – **Very High Risk** ▪ Agricultural runoff – **Very High Risk** ▪ Sedimentation contamination and pollution – **High Risk** ▪ Sedimentation – **Moderate Risk** ▪ Modified freshwater flows – **Very High Risk** ▪ Lack of compliance with regulations and/or lack of regulation effort – **Very High Risk** ▪ Incomplete water quality information – **High Risk**		
Objective(s)	▪ To empower local horticulture operators across the LGA through targeted extension, technical assistance and grants to improve on-farm management practices, and in doing so, reduce the impacts of horticulture on downstream estuary health. ▪ To establish a framework for cooperation, collaboration and commitment between industry groups, growers, and public authorities. ▪ To maintain the economic, environmental, and social values of the estuaries and their catchments.		
Performance Indicators	▪ The CHIEP includes its own monitoring, evaluation and reporting program. And this process should be summarised and rolled into the MER for the CMP where applicable and practical.		
Description	The CHIEP would utilise a partnership based, collaborative approach to encourage and enable Intensive Horticulture operators across the Coffs Harbour LGA to adopt enhanced land management practices – with a focus on improving downstream estuary health outcomes. The CHIEP would be a voluntary or "opt-in" program that empowers local growers through extension, technical assistance and grant based incentives. The Program aims to affect meaningful change, providing a mechanism where growers see the benefits from their efforts in delivering biodiversity and sustainability services for their farms, the environment and the broader community. The concept for the CHIEP has been developed through a deliberate and facilitated stakeholder engagement and negotiation process. Relevant stakeholders involved in the development process have included Industry Groups (Berries Australia, Oz Group, Costa Group), The City of Coffs Harbour, relevant state government agencies (DPI Agriculture – Blueberry Horticulture Unit, North Coast Local Land Services and DPE (E&H). Discussions and negotiations held between these parties have demonstrated significant in-principal support for the CHIEP concept. The intention is for the CHIEP to be applied across the entire Coffs Harbour LGA, and not be confined to the four study area catchments. The CHIEP is described in more detail in the concept document provided in Appendix C. However, a brief summary is provided below. The aim of the CHIEP will be to provide local growers and land managers with the tools and resources to develop whole-of-farm practices that lead to productive and sustainable systems. The CHIEP will include a number of key components:		

Action S	The Coffs Harbour Intensive Horticulture Environmental Program (CHIEP)
	▪ A *dedicated full-time technical officer* to manage the deployment, and then ongoing management of the program; ▪ Deployment of an accessible, web-based, *good practice management tool* using the established *Hort360* program. Utilisation of this tool can lead to the development of a recognition scheme for local growers who demonstrate good practice farm management; ▪ A *competitive grants program* that allows growers to apply for funding of up to $10,000 to improve on-farm management practices, and harness innovative solutions; ▪ A *monitoring and reporting program* in order to track progress of the program against key performance criteria. By utilising the four components above through an extension and adoption program, the CHIEP will work with local growers to identify opportunities for practice change and improvement - and provide an avenue for potential funding assistance to facilitate those changes, see Figure 4-13.  Figure 4-13 The approach of the CHIEP This development process has occurred over the first half of 2021. Discussions and negotiations held between parties named herein have demonstrated significant in principal support for the CHIEP concept.
Estimated Costs	▪ Around $1.6 million over a 5-year period, which includes: – Access to a Hort360 Licence, and customisation of Hort360 modules specific to the CHIEP. – Funding of the CHIEP project officer (full time) – including salary, on-costs, and operational costs for 5 years. – Grants (nominally 60 applicants at $10,000 per grant). ▪ If approved as an action in the CMP, the next step will be to source funding for the package.
Potential Sources of Funding	▪ The concept document in Appendix C outlines potential funding sources.
Integrated Links to Other Actions	▪ Action A - Implement a Water Quality Monitoring Program: will provide a lower estuary indication of water quality that can be compared to, and analysed with, on-farm water quality monitoring provided as part of the CHIEP. This will help to further assess cause and effect across the catchment.

Action S	The Coffs Harbour Intensive Horticulture Environmental Program (CHIEP)
	▪ This action works in tandem with the following actions to reduce the impacts of runoff on estuarine water quality: – Action D - Prepare and Implement a Stormwater Management Plan for the Woolgoolga Region Estuaries – Action H - Develop and Implement a Program of Environmental Education and Performance Reviews for Local Businesses ▪ This action works in tandem with the following actions to improve water usage and compliance across the upper catchments: – Action K: Community Education on Recycled Water Usage – Action L: Promote Community Education Regarding Water Access Compliance ▪ This action can be used to drive success in the following actions: – Action E - Undertake a Targeted Riparian Rehabilitation Works Program, as success of the CHIEP in reducing nutrient flows in to estuaries should mitigate the growth of riparian weeds. – Action Q - Support the Conservation and Recovery of Shellfish Ecosystems in Woolgoolga Lake, as the success of the CHIEP in improving downstream water quality will significantly improve the likelihood of success in restoration of these shellfish ecosystems. ▪ This action works directly with Action N - Provide Support for Research and Innovation into Estuary Health Risks and their Management: The output of research can provide tangible innovations and ideas that can be incorporated into the CHIEP for rollout across the catchment to local operators.

4.6 Implementation of CMP Actions

4.6.1 Actions to be Implemented by the City

Under Sections 22 of the CM Act, CMP actions that are to be implemented by the City are to be given effect through the Integrated Planning and Reporting (IP&R) Framework, which is required to conform to the state-based Integrated Planning and Reporting (IP&R) structure mandated in the *Local Government Act 1993*. This framework is depicted in Figure 4-14.

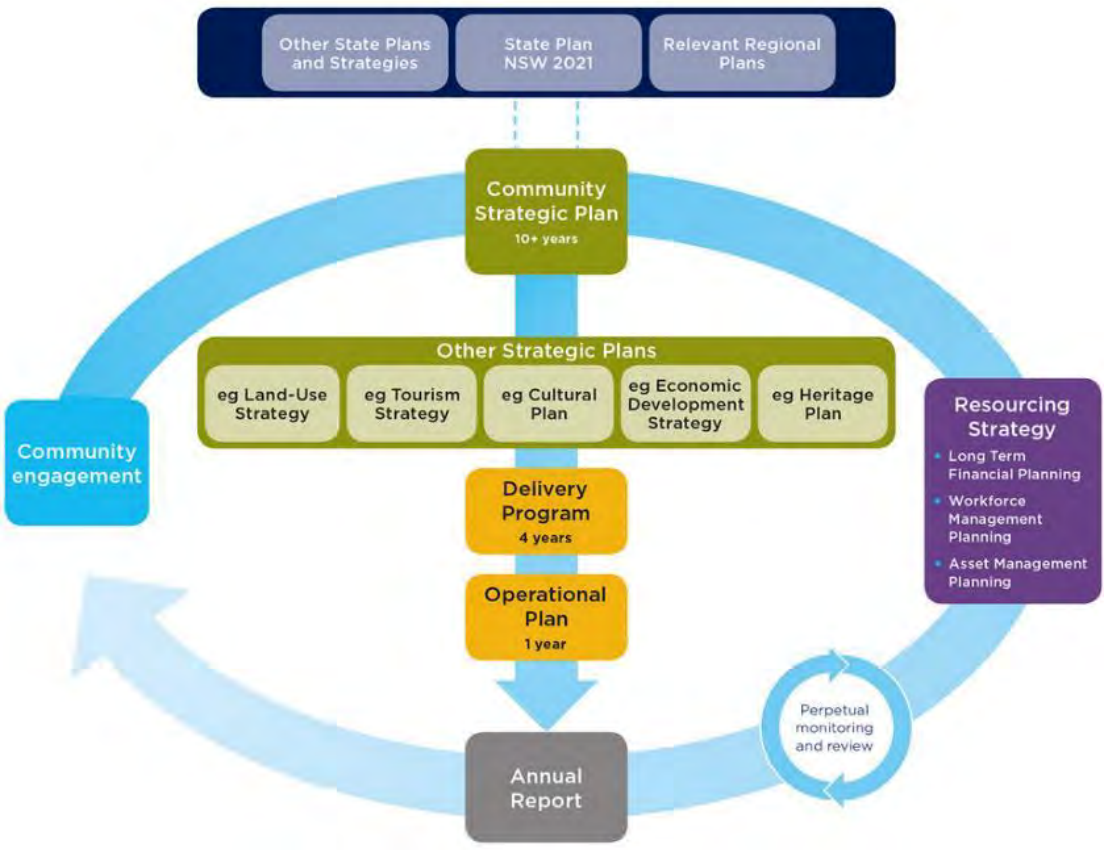


Figure 4-14 Integrated Planning and Reporting Framework (Source: NSW OLG, 2019)

Table 4-2 shows how the CMP process informs, and is informed by, the elements of the IP&R framework.

Table 4-2 Relationship between the IP&R Framework and the CMP

IP&R Component	Purpose	CMP Implementation & Linkage
MyCoffs Community Strategic Plan (CSP) ***10+ years***	The CSP forms the overarching, visionary document that translates the community's key priorities and aspirations into long-term strategic goals that guide the future direction of the LGA. The Plan represents the highest level of strategic planning undertaken by a local council.	The CMP must reflect and support implementation of the CSP. Under the CM Act, the objectives and management actions developed as part of CMPs are required to be strategically aligned with the objectives and strategies outlined in the CSP.

IP&R Component	Purpose	CMP Implementation & Linkage
Delivery Program *4 years*	The Delivery Program is a four (4) year program that translates the strategic objectives of the Community Strategic Plan into actions. It is a fixed four-year program, which is a statement of commitment from each newly elected Council. It identifies all key activities a council has committed to undertake over its four-year life cycle.	Forthcoming and ongoing CMP actions for the relevant 4-year period must be included in the associated delivery program.
Resourcing Strategy *4 years*	The Resourcing Strategy supports the delivery program and outlines the resources required to implement it. It is therefore a critical link when translating strategic objectives into actions. The Resourcing Strategy generally consists of three inter-related elements: Long-Term Financial Planning, Asset Management Planning and Workforce Planning.	Resourcing implications of the CMP should be reflected in the Resourcing Strategy and CMP actions relating to City assets should be considered in the Asset Management Plan.
Operational Plan *Annual*	The Operational Plan is generated over shorter, one-year planning timeframes and provides the detail of the Delivery Program, identifying the individual projects and activities that will be undertaken in a specific year to achieve the commitments of the program.	Forthcoming and ongoing CMP actions are scheduled into each years' operational plan.
Annual Report *Annual*	The City is required to deliver an Annual Report to document their progress in implementing the Delivery Program and Operational Plan activities over each financial year.	The annual report is a mechanism to report on the progress of each CMP actions listed in the Delivery Program and Operational Plan.

The business plan in Section 5 outlines how each of the management actions may be implemented with the City IP&R framework. While some actions may be identified as a priority for implementation in the CMP, it is recognised that the Plan needs to retain sufficient flexibility such that the City (or other responsible agencies) may implement any of the management actions at any time on an opportunistic basis, regardless of their priority. Such an opportunity may arise where, for example, funding becomes available through a specific grant or funding program (Cardno, 2019a).

4.6.2 Actions to be Implemented by Public Authorities other than the City

Sections 23 of the CM Act set out the obligations for public authorities for the implementation of a CMP:

1) Public authorities (other than local councils) are to have regard to coastal management programs to the extent that those programs are relevant to the exercise of their functions.

2) In particular, those public authorities are to have regard to relevant coastal management programs and the coastal management manual in the preparation, development and review of, and the contents of, any plans of management that those public authorities are required to produce and, in doing so, are to have regard to the objects of the Act.

5 BUSINESS PLAN

The business plan outlines the key components of the funding strategy for the CMP, including the cost of the proposed actions, proposed cost-sharing arrangements and other potential funding mechanisms. It has been prepared in accordance with the requirements of the NSW Coastal Management Manual (OEH, 2018e).

The actions in this Business Plan relate only to those actions that are located in the legally defined coastal zone, as defined by the RH SEPP (see Section 1.3.1). Actions that relate to the broader catchment area of the estuaries are listed in Table 5-3 – and those actions do not form part of the certified CMP.

5.1 The Benefits of Implementing the Woolgoolga Region Estuaries CMP

The Woolgoolga Region Estuaries are important environmental, social and economic assets for The City of Coffs Harbour. These estuaries possess significant environmental values and are major contributors to the social and cultural wellbeing of the community. They are also an economic resource and contribute to the local economy in many important ways (Water Technology, 2020), some of which include:

- *The economic value of the ecosystem services provided by the estuaries is approximately **$5m p.a.** (high level estimate only)*
- *The social and environmental values of the estuaries contribute to local tourist visitation. The study area includes Solitary Islands Marine Park and Coffs Coast Regional Park and these assets comprise a major tourist drawcard for the region. The economic value of tourism and domestic day trips across the LGA is estimated at **$45m p.a**.*
- *The value of associated industries that utilise the estuaries (including IPA, and commercial fishing) is over **$170m p.a.** (across the LGA)*

There are a range of threats and stressors that currently present a risk to the environmental, social and economic values of the study area – and the estuaries will come under increasing pressure over coming decades from urbanisation, agricultural land use, and climate change.

The CMP will set the long-term strategy for the coordinated management of the estuaries. Investment in the Woolgoolga Region Estuaries CMP provides an opportunity to directly improve and preserve the water quality, environmental habitats, cultural values and recreational amenity of the estuaries - and in doing so, bring significant public benefits.

5.2 Potential Funding Mechanisms

Sustainable funding and financing arrangements for management actions will be established in consultation with key stakeholders. Funding for management actions may be gained from various sources, including the City's internal funds, competitive State Government grant programs and local third parties.

5.2.1 City Funding

The City funding is allocated based on the Resource Strategy, Long Term Financial Plan, which supports the Delivery Program (four-yearly) and the Operational Plan (yearly) under the IP&R Framework.

City Ordinary Rates

Key funding sources for the City are statutory rates and charges (e.g., water, sewer and waste), which can be applied to private landowners and businesses. Ordinary rates fund a range of City operations and services, and therefore may also be a key revenue stream to support the implementation of activities recommended in this CMP. According to the Coffs Harbour 2021/22 Delivery Program Budget (Coffs Harbour City Council, 2021), the City's annual revenue from ordinary rates and charges is around $150 million per year.

Environmental Levy

The City currently implements the Environmental Levy as a means of funding environmental management works. The levy currently raises around $1.3 million per annum for local environmental works at an average cost of $44 per rate payer (Coffs Harbour City Council, 2021). Revenue from The Environmental Levy is allocated in two streams:

- 75% is allocated to Major Strategic Projects. Some of the major strategic projects include CMPs, and biodiversity and rehabilitation projects (as just a few examples). Major Strategic Projects also include innovation and research projects, which in recent years have included research undertaken by SCU regarding estuarine water quality and catchment land usage in the Coffs Harbour LGA.
- 25% is allocated to the Environmental Levy Grants program. Under the Program, competitive grants are available for projects starting from 1 July each financial year, worth between $2,000 and $25,000 per project. Grants may be awarded to community and other organisations to undertake activities or research that support these objectives (e.g., Landcare groups).

5.2.2 External Sources of Funding

It will not be possible for the City to implement all actions identified in this CMP without additional sources of funding. As such, the identification of grants and the submission of successful funding applications is an important component of this CMP.

There are a range of other funding mechanisms available for financing the implementation of the CMP. For example, the City has the opportunity to take advantage of various state grant programs, as listed in Table 5-1. The quantity of this funding cannot be accurately quantified until such time as it is awarded. It should be noted that this is not an exhaustive list of all funding opportunities, and that over the ten-year lifecycle of the CMP additional or new funding sources may become available.

Table 5-1 Summary of potential funding sources of the CMP

Funding Source	Details / Description
State Government	
NSW Coastal and Estuary Grants Program	The costs associated with delivery of the CMP can be partly funded by the NSW Coastal and Estuary Grants Program administered by DPE. The program supports coastal and estuary planning projects and the implementation of works identified in certified CMPs. Funding is available under five funding streams: ▪ A planning stream: for planning and studies including investigation, design and cost-benefit analyses for infrastructure works recommended in a certified CMP; and. ▪ Four (4) implementation streams – one for each of the coastal management areas. The focus of these streams are projects that manage risks from coastal hazards, and improve the health of estuaries, wetlands and littoral rainforests across New South Wales. For projects that address a documented action in a certified CMP funding is $2 from the State Government for every $1 provided by the City. Certification of this CMP will facilitate eligibility for funding of many of the actions proposed in this CMP under the program.
Marine Estate Management Strategy	A number of management actions in the CMP may be eligible for funding under the NSW Marine Estate Management Strategy (MEMS). The MEMS provides an overarching, strategic approach to the coordination and management of the marine estate through to 2028.

Funding Source	Details / Description
	The management of priority threats is grouped into nine (9) management initiatives that summarise the objectives, benefits, threats, stressors and proposed management actions. An implementation plan (developed by the Authority's member agencies in consultation with key stakeholders) articulates the management actions in more detail. CMPs are key delivery mechanisms for the MEMS, and a number of actions have been identified as potentially being eligible for MEMS funding under the following initiatives: ▪ Initiative #1: Improving water quality and reducing litter – The Coffs Harbour Intensive Horticulture Environmental Program (The CHIEP) ▪ Initiative #2: Delivering healthy coastal habitats with sustainable use and development – CMP Action Q (funding also potentially available through the MEMS Shellfish Reef Restoration Program). ▪ Initiative #4: Protecting the Aboriginal cultural values of the marine estate – CMP Action B, Action M, and Action R
Increasing Resilience to Climate Change Program	This is a partnership program between Local Government NSW (LGNSW) and NSW Department of Planning and Environment (EES) – Coast and Estuaries to encourage implementation of actions to address identified climate risks, and enhanced adaptive capacity across the state.
Saving our Species program	Administered by DPE, the Saving our Species (SoS) sets out the NSW Government's threatened species management plan. The main objectives of SoS are to increase the number of threatened species that are secure in the wild in New South Wales for 100 years, and control the key threats facing the states threatened plants and animals.
Flagship Fish Habitat Rehabilitation Grants	Administered by DPI Fisheries, the Flagship Fish Habitat Rehabilitation Grant program offers grants of up to $360,000 for individual projects that significantly enhance fish habitat, water quality and fish passage opportunities within the coastal catchments of NSW. The program builds on the existing Habitat Action Grants and seeks to tackle much larger scale projects that require higher levels of funding assistance. Potential Actions in this CMP which could be eligible include: ▪ Action Q: Support the Conservation and Recovery of Shellfish Ecosystems in Woolgoolga Lake.
NSW Heritage Grants	This program is administered by DPE and aims to fund projects that provide sustainable, long-term heritage benefits and provide public benefit and enjoyment from heritage. Funding may be available for the management of heritage items in the coastal environment. Areas of interest include: ▪ Aboriginal Cultural Heritage grants ▪ Caring for State Heritage grants ▪ Community Heritage grants ▪ Grants for local government Potential Actions in this CMP which could be eligible include: ▪ Action K: Consolidate and Update Aboriginal Cultural Heritage Information; and ▪ Action L: Provide Funding Support for Radiocarbon Dating of Aboriginal Cultural Heritage Items
NSW Environment Trust Grants	Funding is available under the NSW Environment Trust to a broad range of organisations for projects that enhance the environment of NSW. Grants may be awarded for on ground rehabilitation and improvement works, research applications, land acquisition, waste reduction and promotion of environmental education.

Funding Source	Details / Description
	The NSW Environment Trust is an independent statutory body established by the NSW Government to make and supervise the environment grants. The Trust is administered by OEH. Suitable coastal management grant applications may relate to dune care, for example. Potential Actions in this CMP which could be eligible include: ▪ The Coffs Harbour Intensive Horticulture Environmental Program (The CHIEP)
Crown Reserves Improvement Fund Program	Administered by DPE (Crown Lands), the Crown Reserves Improvement Fund Program provides financial support for the development, maintenance and improvement of Crown reserves. Funding under this program is subject to a competitive grant application process and eligibility requirements which may change from year to year and in accordance with departmental priorities.
Coffs Harbour Environmental Trust	The Coffs Harbour Protection of the Environment Trust was established through Prosper Coffs Harbour Limited (PCH Ltd) to provide a source of funding to promote protection and enhancement of the natural environment within the Coffs Harbour local government area. The Trust has direct linkages to the 'MyCoffs' Community Strategic Plan that was developed by the City of Coffs Harbour. However, as PCH Ltd is a separate legal entity, the Trust provides another mechanism for further research, promotion and funding support. The purpose of the Trust is to support the environmental initiatives that directly involve the Coffs Harbour community in activities that address one or more of the five areas: ▪ Targeted rehabilitation and restoration- landscape corridors, bush regeneration and rehabilitation. ▪ Acquisition of high conservation lands. ▪ Biodiversity incentives. ▪ Community involvement and ownership. ▪ Improving our knowledge and understanding of the environment Recent examples of funding support from the trust include bank stabilisation works at the Woolgoolga Lakeside Reserve.

Agencies responsible for the delivery of actions in this CMP have been consulted during its development and have indicated their support. However, delivery of the actions will depend on the availability of funding which is yet to be confirmed. Despite the priority of each action listed in the CMP, the timeframe of implementation will be influenced by the availability of resources and funding.

5.3 Cost-Benefit Distribution

As per the Coastal Management Manual (OEH, 2018d), an analysis of the distribution of costs and benefits to the City, public authorities, stakeholders and the environment is recommended when preparing a CMP. During Options Assessments undertaken in Stage 3 (Water Technology, 2021b), a multi-criteria analysis was undertaken in order to assess the direct and indirect impact of each potential option on identified threats, weighted towards the level of threat. Through this process, actions in the CMP have been developed with the primarily aim to benefit estuary health. None of the recommended actions aim to benefit private interests, although they may do so indirectly as a consequence of improved estuary health (e.g., to commercial businesses in the nearby area including tourism operators and hospitality).

There are no actions within the CMP that aim to directly benefit private interests. Therefore, no public-private cost sharing arrangements are required.

5.4 Implementation Plan

The Business Plan summarised in Table 5-2 provides the following information:

- Action ID and Name;
- Responsibilities – including the lead agency for implementation and any supporting agencies;
- Priority and timeframe for delivery;
- Forward cost estimates – which have been discretised into the forthcoming Delivery Program (DP) periods of the City of Coffs Harbour IP&R framework;
- Potential funding mechanisms; and
- The private vs public benefit distribution of the action.

Actions that relate to the broader catchment area of the estuaries are listed in Table 5-3 – and those actions do not form part of the certified CMP.

Despite the nominated priority and expected timeframe of each action, the implementation of actions will be largely controlled by the availability of resources and the prioritisation across all of the City's functions via the Operational and Delivery Plans.

5.5 The City's LGA Wide CMP Action Implementation Plan

Once the City's entire suite of CMPs has been developed, it will be necessary to formulate an LGA-wide action plan that prioritises and rationalises actions from all of them for implementation. The prioritisation methodology described in Section 4.2.3 could be used as a basis for this, with an LGA-wide Action Implementation Database (see Section 6.3) used to track progress and outcomes.

Table 5-2 Business Plan for the CMP

Information		Responsibilities		Delivery					Capital (C), Operational (O), and Maintenance (M) Costs ($000) - and estimated timing															Benefit Distribution
ID	Action Name	Lead Agency	Supporting Agencies	Import-ance	Urge-ncy	Priority Score	Priority	Delivery Timeframe	C/O/M	DP 2022-2026		Delivery Program 2026-2030				Delivery Program 2030-2034				Sub-total 10yr Cost	Total 10yr Cost	DP 2022-2026	DP 2026-2030	DP 2030-2034	Potential Sources of Funding	
										Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10							
Actions to be Implemented by the City of Coffs Harbour																										
Estuary Health Monitoring and Data Collection																										
A	Implement a Water Quality Monitoring Program	The City	DPE(E&H)	9	3	27	High	Short Term: Within 3 Years	C:											$0	**$260**	$130	$130	$0	1, 2	100% public
									O:	$65	$65	$65	$65							$260						
									M:											$0						
B	Publish an Annual Water Quality Report Card for Estuaries	The City	DPE(E&H)	8	3	24	High	Short Term: Within 3 Years	C:											$0	**$80**	$40	$40	$0	1,2	100% public
									O:	$20	$20	$20	$20							$80						
									M:											$0						
C	Installation of Water Level Gauges at Darkum Creek, Willis Creek and Hearnes Lake	The City	DPE(E&H)	8	3	24	High	Short Term: Within 3 Years	C:	$75										$75	**$156**	$75	$36	$36	1,2	100% public
									O:											$0						
									M:		$9	$9	$9	$9	$9	$9	$9	$9	$9	$81						
Environmental Works and Infrastructure																										
D	Prepare and Implement a Stormwater Management Plan for the Estuaries	The City	DPE(E&H)	9	3	27	High	Short Term: Within 3 Years	C:	$75	*Variable - based on outcomes*									$75	**$75^**	$75^	$0^	$0^	1, 2, 4, 5	100% public
									O:											Variable^						
									M:											Variable^						
E	Undertake a Targeted Riparian Rehabilitation Works Program	The City NPWS	CHDLALC DPI Fisheries	8	3	24	High	Short Term: Within 3 Years	C:	$80	$80									$160	**$190**	$160	$10	$20	3,1,6	100% public
									O:					$10		$10		$10		$30						
									M:											$0						
F	Environmental Protection Works	The City	NPWS DPI Fisheries Crown Lands	9	3	27	High	Short Term: Within 3 Years	C:	*Variable - as needed basis*										Variable*	**Variable***	$0*	$0*	$0*	1	100% public
									O:											Variable*						
									M:											Variable*						
G	Restore and Expand Riparian Vegetation at the Woolgoolga Southern Foreshore	The City	DPI Fisheries CHRLC	3	2	6	Low	Long Term: Within 10 Years	C:					$20						$20	**$20**	$0	$20	$0	1, 2, 7	100% public
									O:											$0						
									M:											$0						
Education and Planning																										
H	Develop and Implement a Program of Environmental Education and Performance Reviews for Local Businesses	The City	DPE(E&H)	8	2	16	Medium	Medium Term: Within 6 Years	C:			$50								$50	**$70**	$0	$70	$0	1, 2, 8	100% public
									O:					$20						$20						
									M:											$0						
I	Greater Acknowledgement of Aboriginal Cultural Heritage	The City	CHDLALC DPE(E&H) DPI Fisheries NPWS	4	1	4	Low	Long Term: Within 10 Years	C:						$15					$15	**$19**	$0	$15	$4	1, 2, 9	100% public
									O:											$0						
									M:							$1	$1	$1	$1	$4						
J	Aboriginal Cultural Inductions for High-Risk Developments	The City	CHDLALC	7	2	14	Medium	Medium Term: Within 6 Years	C:											$0	**$0**	$0	$0	$0	10	100% public
									O:											$0						
									M:											$0						

Information		Responsibilities		Delivery					Capital (C), Operational (O), and Maintenance (M) Costs ($000) - and estimated timing																Benefit Distribution
ID	Action Name	Lead Agency	Supporting Agencies	Import-ance	Urge-ncy	Priority Score	Priority	Delivery Timeframe	C/O/M	DP 2022-2026		Delivery Program 2026-2030				Delivery Program 2030-2034				Sub-total 10yr Cost	Total 10yr Cost	DP 2022-2026	DP 2026-2030	DP 2030-2034	Potential Sources of Funding	
										Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10							
Actions to be Implemented by the City of Coffs Harbour																										
Research and Innovation																										
M	Undertake a 12 Month Trial of a Water Quality Autosampler for Hearnes Lake	The City	DPE(E&H)	6	2	12	**Medium**	Medium Term: Within 6 Years	C:		$65									$65	**$65**	$65	$0	$0	1, 2	100% public
									O:											$0						
									M:											$0						
N	Provide Support for Research and Innovation into Estuary Health Risks and their Management	The City	DPE(E&H)	7	3	21	**Medium**	Medium Term: Within 6 Years	C:											$0	**$1,200**	$240	$480	$480	1, 2, 11	100% public
									O:	$120	$120	$120	$120	$120	$120	$120	$120	$120	$120	$1,200						
									M:											$0						
O	Consolidate and Update Aboriginal Cultural Heritage Information	The City	CHDLALC DPE(E&H)	7	3	21	**Medium**	Medium Term: Within 6 Years	C:			$65								$65	**$65**	$0	$65	$0	1, 2, 9	100% public
									O:											$0						
									M:											$0						
P	Provide Funding Support for Radiocarbon Dating of Indigenous Heritage Items	The City	CHDLALC DPE(E&H) NPWS	7	1	7	**Low**	Long Term: Within 10 Years	C:											$0	**$80**	$0	$40	$40	1, 2, 9	100% public
									O:			$10	$10	$10	$10	$10	$10	$10	$10	$80						
									M:											$0						
Actions to be Implemented by Public Authorities																										
Q	Support the Conservation and Recovery of Shellfish Ecosystems in Woolgoolga Lake	DPI Fisheries	The City	9	2	18	**Medium**	Medium Term: Within 6 Years	C:			$20	$25		$225					$270	**$270**	$0	$270	$0	12, 13, 14, 15, 1	100% public
									O:											$0						
									M:											$0						
R	Dual naming of Willis Creek, using a name of local significance to the Gumbaynggirr people	DPI Fisheries Traditional Owners	Garby Elders CHDLALC The City	8	1	8	**Medium**	Medium Term: Within 6 Years	C:	$2										$2	**$2**	$2	$0	$0	15	100% public
									O:											$0						
									M:											$0						
							Subtotal			**$437**	**$359**	**$359**	**$249**	**$189**	**$379**	**$150**	**$140**	**$150**	**$140**	**$2,552**		**$787**	**$1,176**	**$580**		

^ Variable – based on outcomes of the plan. An indicative range of costs for the construction of bioretention basins, and installation of pollution control devices such as GPTs are provided in the Action D table in Section 4.3.2.

* Variable – based on project scope. The potential costs for EPW projects are provided in the Action F table in Section 4.3.2

Table 5-3 Program of actions to be implemented externally to the certifiable CMP

Information		Responsibilities		Delivery					Capital (C), Operational (O), and Maintenance (M) Costs ($000) - and estimated timing															Benefit Distribution
ID	Action Name	Lead Agency	Supporting Agencies	Import-ance	Urge-ncy	Priority Score	Priority	Delivery Timeframe	C/O/M	DP 2022-2026		Delivery Program 2026-2030				Delivery Program 2030-2034				Sub-total 10yr Cost	Total 10yr Cost	DP 2022-2026	DP 2026-2030	DP 2030-2034	Potential Sources of Funding	
										Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10							
Actions to be Implemented Externally to the Certified CMP																										
K	Community Education on Recycled Water Usage	The City	N/A	5	2	10	**Medium**	Medium Term: Within 6 Years	C:	$15										$15	**$60**	$20	$20	$20	1	100% public
									O:		$5	$5	$5	$5	$5	$5	$5	$5	$5	$45					
									M:											$0						
L	Promote Community Education Regarding Water Access Compliance	The City	N/A	3	1	3	**Low**	Long Term: Within 10 Years	C:											$0	**$0**	$0	$0	$0	1	100% public
									O:											$0						
									M:											$0						
S	The Coffs Harbour Intensive Horticulture Environmental Program (The CHIEP)	NC LLS	The City DPI Agriculture DPE(E&H)	10	3	30	**High**	Short Term: Within 3 Years	C:											$0	**$1,600**	$640	$960	$0	3,16	100% public
									O:	$320	$320	$320	$320	$320						$1,600						
									M:											$0						
							Subtotal			**$335**	**$325**	**$325**	**$325**	**$325**	**$5**	**$5**	**$5**	**$5**	**$5**	**$1,660**		**$660**	**$980**	**$20**		

Funding Legend for Table 5-2 and Table 5-3

1 City Operational and Delivery Plan Process & E Levy.
2 NSW C&E Grants Program.
3 NSW Marine Estate Management Strategy.
4 Development Servicing Plans (for implementation).
5 Stormwater Management Service Charge (for implementation)
6 NPWS operating budget
7 Other environmental restoration programs.
8 The Coffs Harbour Protection of the Environment Trust
9 The NSW Heritage Grants Program.
10 Costs of the process to be borne by development proponents.
11 NC LLS
12 Flagship Habitat Action Grants
13 The Nature Conservancy (TNC), Australia- Reef Builder Grants
14 The Marine Estate Management Strategy (MEMS) Shellfish Reef Restoration Program
15 DPI Fisheries
16 Environmental Trust Grants

6 MONITORING, EVALUATION AND REPORTING

6.1 CMP Monitoring and Evaluation Requirements

Monitoring, evaluation and reporting (MER) is an essential component of any CMP, and is a mandatory requirement for CMPs under the CM Act. The purpose of the MER component is to monitor progress towards implementing the coastal management actions outlined in the CMP, and to assess the performance of the CMP in achieving its intended outcomes, and the objects of the CM Act.

6.2 Overview of the Monitoring and Evaluation Process

The MER process for the CMP should be fit-for-purpose and focus on the information needed to evaluate the status of coastal management actions and their outcomes. As per the NSW Coastal Management Manual (OEH, 2018f), key elements of a MER program should consider the outcomes that the CMP is trying to achieve over the short, medium, and long term. The proposed MER program has followed the structure of a "Program Logic Model", that describes how the program is intended to work by linking activities with outputs, intermediate impacts and longer-term outcomes. The program logic model supports a systematic and integrated approach to CMP planning, implementation and evaluation. There is a logical flow to this process, which is summarised in Figure 6-1 below. It comprises:

- *Component 1: The implementation status of the CMP actions.* The MER should constantly monitor and evaluate the implementation of the management actions – see Section 6.3.
  - It aims to answer the question: "Has the program of management actions been implemented in accordance with the implementation plan?"
- *Component 2: Relevant environmental parameters* (indicators of estuary health). As per Section 1.4, one of the main goals of the CMP is to improve the environmental and social values of the estuaries. Therefore, the MER should also include a component that monitors key estuary health indicators – see Section 6.4.
  - It aims to answer the question: "Has the implementation of individual management actions, and the integrated CMP more generally, resulted in an improvement in estuary health and the social / cultural values of the study area?".
- *Component 3: The performance of the CMP in terms of meeting the objects of the CM Act*. This includes a holistic review of the CMP and its performance against its long-term objectives – see Section 6.5.
  - It aims to answer the questions – based on the outcomes of Components 1 and 2:
    - "Has the CMP more broadly achieved its intended objectives?"
    - "How has the CMP made a difference?" and
    - "Has the level of risk associated with the various stressors facing the estuaries been reduced?".

The three components of the MER are described in more detail in Section 6.3 to 6.5.

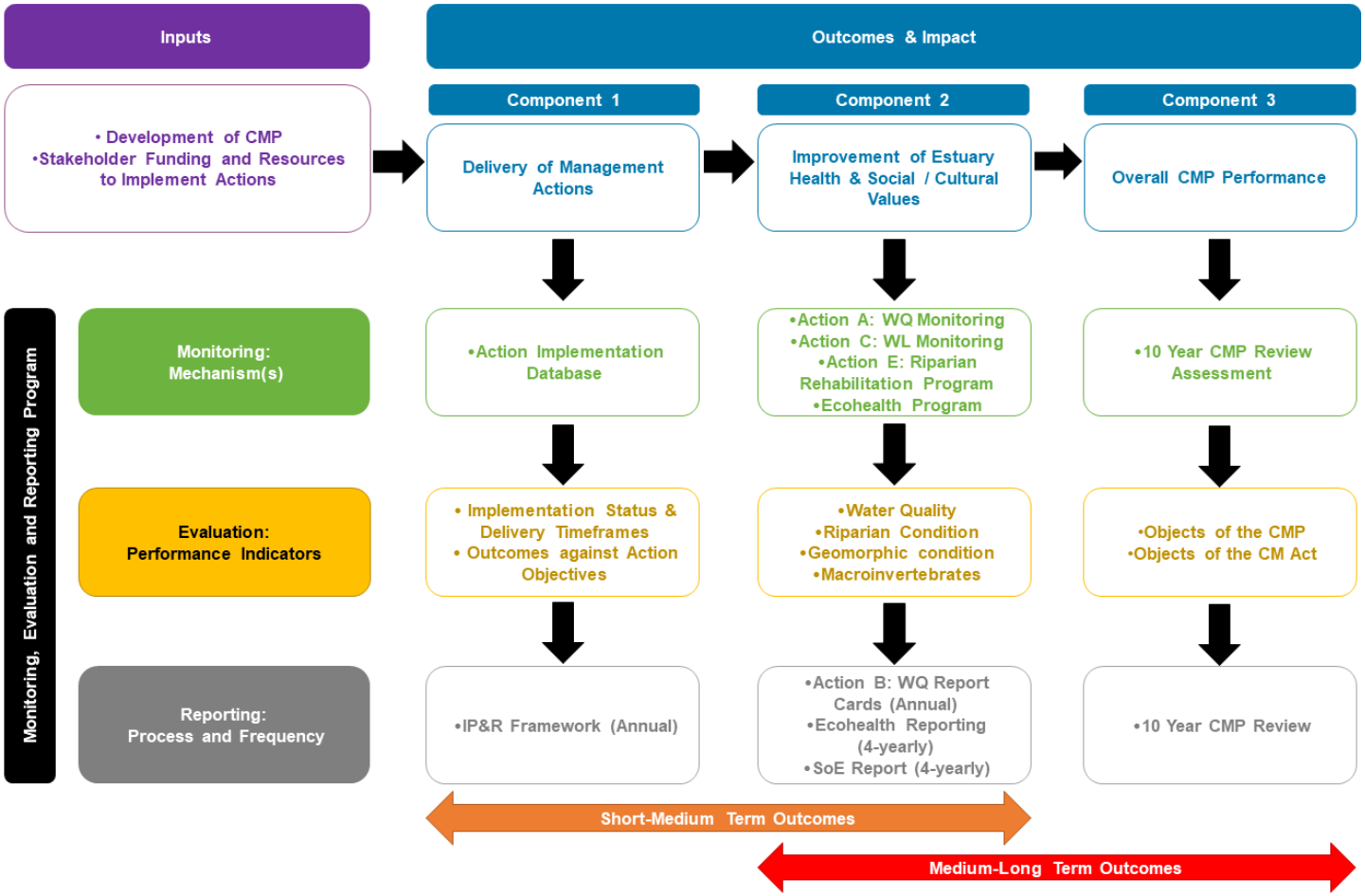


Figure 6-1 Overview of MER program for the CMP

6.3 Component 1: Delivery of Management Actions

Monitoring

In the first instance, the City and relevant stakeholders will need to monitor the implementation status of the various CMP actions - including which actions have been implemented, the progress of actions, barriers and issues, allocated funding and resources, and timeline of implementation.

It is recommended that an *Action Implementation Database* (AID) be maintained to monitor the status of the various CMP actions, and support the CMP requirements. A preliminary example of a proposed AID is presented in Appendix B. The fields include information relating the practical implementation of the works, and the overall status of the action. For each action, a monitoring designation should be provided regarding the current status of that action using one of five (5) categories:

- *Completed:* Where discrete (one-off) actions items have been completed and no further actions are required.
- *Implemented and Ongoing:* Where actions have an ongoing component and are currently being implemented.
- *In progress/Incomplete:* This includes actions that are in progress or not yet finalised.
- *Not Yet Commenced/Outstanding:* Where outstanding actions have not yet commenced - but have been marked for future implementation.
- *No Longer Applicable:* Where actions are no longer applicable due to changed circumstances or superseding actions from other management plans.

Dates of commencement and practical completion should also be monitored and recorded.

Evaluation and Reporting

Each action itemised in this CMP has both a short and long-term objective – as well as a series of corresponding performance indicators. Each CMP action should be evaluated for its performance in achieving its objectives, using the established indicators. These should be recorded in the AID.

The IP&R reporting system (including annual operational reporting and longer interval strategic reporting) provides the opportunity to formally report on monitoring of coastal management and its outcomes. The City delivers an Annual Report to document their progress in implementing their Four-Year Delivery Program and Annual Operational Plan activities over each financial year. This provides for a yearly evaluation of the implementation status of each action in the CMP.

Where actions have not been included in the IP&R Framework, a yearly evaluation of those CMP actions by the officer(s) responsible for facilitating implementation of the CMP is recommended. This may be undertaken through the annual review of the Business Plan (see Section 5), or as a separate process.

6.4 Component 2: Environmental Parameters and Indicators

Monitoring

A key component of the MER process will be to utilise physical datasets that can provide an indication of estuary health, and track the progress of the CMP towards key achieving intended outcomes.

It should be noted that while the monitoring of environmental indicators is important to ascertain the health of the estuary – it cannot always be reliably used to determine the short term “success” of individual management actions. This is because the physical and chemical processes affecting estuary health and water quality respond to both short term stressors across the catchment, as well as to longer term historical legacy impacts.

For this reason, estuary health indicators can demonstrate variability over short-, medium- and long-term cycles that may range from several days, to years or even decades. Furthermore, the cause and effect of such variability may not always be readily understood, nor easily detected in a short-term dataset. In this context, linking short to medium term changes in estuary health indicators to specific catchment-based stressors, or the impact of CMP management actions, can often be fraught with complexity.

Nonetheless, over the *long term*, the monitoring of key estuary health indicators is the most efficient and practical way to assess the overall performance of the CMP at achieving its outcomes. Assessing outcomes over the short to medium term will require consideration of the physical and chemical process context, and expert technical judgement.

With this in mind, a pragmatic approach to monitoring and evaluation is proposed at this stage in the CMP process. There are a number of coastal and estuary monitoring programs in effect across the study area that can provide this – including those proposed to be undertaken as part of the CMP process, and those delivered outside of the CMP.

- Within the CMP, *Action A: Water quality monitoring program* is intended to provide an ongoing monitoring and evaluation of estuarine water quality. This includes monitoring a range of water quality indicators on a monthly basis, and other indicators on a quarterly basis. This is intended to provide an ongoing dataset of ambient water quality. However, the proposed program also includes event-based water quality monitoring when rainfall triggers are exceeded. It includes a range of indicators intended to assess the potential impacts of catchment land use across the study area, and will provide a strong estuarine water quality assessment data base. The program includes monitoring at eighteen (18) locations across the study area, as depicted in Figure 4-3.
- Within the CMP: *Action E Targeted Riparian Rehabilitation Works Program* is intended to include an ongoing monitoring program of riparian condition. Once the initial on-ground works are undertaken, the program will include ongoing assessments, undertaken annually for the first five years, then biennially for the remainder of the CMP timeframe.
- It is noted that assessing estuary ecosystem health based on water quality indicators alone is somewhat limited. Therefore, the MER for the CMP should also utilise monitoring undertaken external to the CMP process for other indicators that are important for estuary health. This should include the existing *Northern Rivers Aquatic Ecosystem Health Monitoring Program (Ecohealth)*. As part of the program, assessment of several key indicators of aquatic ecosystem health is undertaken - including riparian vegetation, geomorphic condition, and macroinvertebrates. Sampling is generally undertaken by staff from the University of New England (UNE) who are trained in Ecohealth sampling procedures, including for water quality, aquatic macroinvertebrates, riparian condition and geomorphic condition (Ryder, et al., 2016). The key components of the Ecohealth program operate on an approximately two-year cycle. There are seven (7) Ecohealth monitoring sites in the study area including Darkum Creek (1 estuarine), Woolgoolga Creek (2 estuarine, 1 freshwater), Willis Creek (1 estuarine), and Hearnes Lake (1 estuarine, 1 freshwater). Information regarding these sites is summarised in Ryder et al (2016), and depicted in Figure 4-3. This monitoring program would continue to be delivered through Ecohealth, but the information can be used by the City to track estuary health over time, and monitor progress of the CMP towards achieving its intended outcomes.
- It should be noted that a range of other CMP actions are also associated with monitoring of various environmental parameters, and these can also be used to assist in tracking estuary health and provide contextual information to inform the evaluation of the performance of CMP actions. They include:
  - *Action C: Installation of Water Level Gauges at Darkum Creek, Willis Creek and Hearnes Lake* – This should also include consideration of the current water level monitoring undertaken at Woolgoolga Lake.

- *Action M: Undertake a 12 Month Trial of a Water Quality Autosampler for Hearnes Lake* – which will include a 12-month period of trigger-based water quality monitoring that can be used to assess estuary health.
- *External Action: The Coffs Harbour Intensive Horticulture Environmental Program (The CHIEP)* – which will include upper catchment, on-farm water quality monitoring.

Additional monitoring metrics may include the mapping of the extent of seagrass, saltmarsh and mangroves habitats. These habitats will come under increasing stress from sea level rise and habitat squeeze over the next 10 years. During the CMP review process, the latest available mapping should be utilised in order to determine changes to habitat extent, using the present-day mapping of RH SEPP Coastal Wetlands as a benchmark. Where state-based mapping is not available, desktop mapping studies may be utilised.

Evaluation and Reporting

The evaluation and reporting process for the environmental parameters can be delivered along the same lines as the monitoring:

- Water Quality: Evaluation and Reporting on water quality can be undertaken as part of *CMP Action B: Publish an Annual Water Quality Report Card for Estuaries*.
- Riparian Condition: Evaluation and Reporting for this CMP *Action E: Targeted Riparian Rehabilitation Program* can be undertaken within the action delivery. At the end of each monitoring campaign, a brief monitoring report should be produced with pictorial photographs and mapping.
- Ecohealth: Ecohealth produces two main products including a comprehensive technical assessment of riverine health report and an easily interpreted report card summarising the Ecohealth Report findings and displaying this information in an easy-to-understand visual format.

An overview of the monitoring and reporting of environmental parameters for the CMP is provided in Table 6-1.

Table 6-1 Monitoring of environmental parameters

Monitoring Program	Indicators	Monitoring Locations	Monitoring Frequency	Reporting Frequency
CMP Action A: Water Quality Monitoring Program	Water Quality	Eighteen (18) locations as depicted in Figure 4-3.	▪ Some indicators monthly ▪ Other indicators quarterly ▪ All indicators after rainfall event triggers	Annual Water Quality Report Card (Action B)
CMP Action E: Targeted Riparian Rehabilitation Program	Riparian Condition	Around 2-4 sites per estuary.	▪ Annually for first five years ▪ Biennially for seconds five years	Post-monitoring reporting.
Ecohealth Program	Riparian Condition	Seven (7) locations as depicted in Figure 4-3.	▪ Once every four years.	Four-Yearly with the publishing of the Ecohealth Report
	Freshwater macroinvertebrates		▪ Twice a year, once every four years	
	Geomorphic condition		▪ Once every four years	

A summary of these environmental parameters may also be reported as part of the City's State of the Environment (SoE) reporting associated with the IP&R Framework. The content and format of SoE reports is up to councils, however the minimum requirement is to measure and report on the progress of the environmental goals in the City's Community Strategic Plan (CSP) in the year of Council elections as per requirements in the *Local Government Act 1993*.

6.5 Component 3: Achievement of Objects of the CMP and CM Act

Generally speaking, the CMP should be viewed as a 'living document' that is reviewed and updated over time. Whilst a review of the performance of the actions within the CMP occur on an annual basis (as per the City's IP&R framework), a key component of the MER process is to undertake a strategic review and stocktake of the of the CMP at designated timeframes to assess its overall performance.

The CM Act (Section 18(1)) and NSW Coastal Management Manual requires the City to ensure that the CMP is reviewed at least once every 10 years. However, it should be noted that it may be reviewed and/or updated sooner for any reason, including if there are significant new circumstances which need to be considered.

The review of the CMP should be undertaken through a formalised process, and represents a significant opportunity to assess the overall performance of the CMP in meetings its objectives. At a broad level, the review should consider, as a minimum:

- The extent to which the CMP has achieved its objectives;
- The extent to which the CMP has achieved the objectives of the CM Act; and
- The performance of the CMP as an instrument for improving coastal management.

Review of Key Issues

The primary mechanism for gauging whether the CMP has been successful should be the re-evaluation of the threats and risks across the study area through a repeat of the Stage 2 Risk Assessment (Water Technology, 2021a). Controls that assist with managing the threats should be included when assessing the level of risk, particularly those actions that have or are being implemented through the CMP. There are three specific questions to be answered:

- Has the level of risk changed?
- Have the very high or high threats been adequately managed?
- Are there any new or emerging threats that need to be captured?

During this process, particular focus should be given to evolving or emerging risks – including those associated with climate change. These such as the impacts of sea level rise on inundation risk, and habitat squeeze and migration. This may also include changes to catchment based risks and threats associated with changes catchment land usage.

Assess CMP Performance

This will subsequently include a formal review of the implemented management strategies. The review should include a granular assessment of:

- The status of CMP actions, including the extent to which actions proposed to be wholly implemented within that 10-year period have been implemented;
- Identification of the CMP's successes, highlights, limitations, and any barriers to the effective implementation;
- Where applicable, the identification of possible avenues for increasing the effectiveness of the CMP;

- Consideration of any new or updated scientific knowledge, including data garnered and compiled from the monitoring programs set forth in the CMP; and
- The progress of any actions and commitments which continue beyond the original 10-year timeframe.

If the need arises, new actions or items can also be added to the CMP as part of the review process. Any such changes to the CMP would need to be endorsed by stakeholders and relevant government agencies, as well as the community.

7 CONCLUDING REMARKS

This CMP for the Woolgoolga Region Estuaries has been prepared by Water Technology on behalf of the City of Coffs Harbour, in accordance with the requirements of the *Coastal Management Act 2016* and the Coastal Management Manual (2018).

This CMP should be viewed as a 'living document' that is reviewed and updated over time. A strategic review of the CMP should occur at least once every ten years to assess the effectiveness of the CMP in achieving its objectives.

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APPENDIX A
MATRIX OF CMP OBJECTIVES AND ACTIONS

Table A-1: How the integrated CMP and its actions achieve the CMP Objectives

Values	Objectives	Implementation of the integrated CMP	Estuary Health Monitoring and Data Collection			Environmental Programs and Works				Education and Planning			Research and Innovation				Actions to be Implemented by Public Authorities		Actions to be Implemented Externally to the Certified CMP		
			A	B	C	D	E	F	G	H	I	J	M	N	O	P	Q	R	S	K	L
			Implement a Water Quality Monitoring Program	Publish an Annual Water Quality Report Card for Estuaries	Installation of Water Level Gauges at Darkum Creek, Willis Creek and Hearnes Lake	Prepare and Implement a Stormwater Management Plan for the Estuaries	Undertake a Targeted Riparian Rehabilitation Works Program	Environmental Protection Works	Restore and Expand Riparian Vegetation at the Woolgoolga Southern Foreshore	Develop and Implement a Program of Environmental Education and Performance Reviews for Local Businesses	Install Signage with Indigenous Cultural Heritage Information	Indigenous Cultural Inductions for High-Risk Developments	Undertake a 12 Month Trial of a Water Quality Autosampler for Hearnes Lake	Provide Support for Research and Innovation into Estuary Health Risks and their Management	Consolidate and Update Indigenous Heritage Information	Provide Funding Support for Radiocarbon Dating of Indigenous Heritage Items	Support the Conservation and Recovery of Shellfish Ecosystems in Woolgoolga Lake	Rename Willis Creek to a name of local significance to the Gumbaynggirr people	The Coffs Harbour Intensive Horticulture Environmental Program (The CHIEP)	Community Education on Recycled Water Usage	Promote Community Education Regarding Water Access Compliance
Water Quality	a. to maintain and protect water quality across the system and its impacts on environmental, social and economic values - including ecological condition, recreational amenity and agricultural uses;		✓	✓		✓		✓		✓			✓	✓			✓		✓	✓	✓
Natural Ecosystems and Biodiversity	b. to protect and enhance the integrity and resilience of the environmental values of the Darkum Creek, Woolgoolga Lake, Willis Creek and Hearnes Lake estuaries for current and future generations;		✓	✓	✓	✓	✓	✓	✓	✓			✓	✓			✓		✓	✓	✓
Social and Recreational Amenity	c. to support the social and cultural values of the estuaries and maintain public access and recreational amenity;					✓	✓	✓		✓			✓	✓			✓		✓	✓	✓
	d. to maintain the health, safety and wellbeing of those using the estuaries and catchment (both directly and indirectly);		✓	✓	✓	✓		✓		✓			✓	✓			✓		✓	✓	✓
	e. to maintain and preserve the unique scenic amenity and natural character of the estuaries;					✓	✓	✓	✓								✓		✓	✓	✓
Cultural Heritage	f. to acknowledge Aboriginal peoples' spiritual, social, customary and economic use of the study area						✓	✓			✓	✓			✓	✓		✓			
	g. to protect and preserve the Aboriginal cultural heritage of the marine estate and coastal zone;						✓	✓			✓	✓			✓	✓		✓			
Research and Education Value	h. to encourage and facilitate research and monitoring – and to maintain scientific and educational values of the study area;		✓	✓	✓			✓					✓	✓	✓	✓	✓		✓		
Economic Prosperity and Agricultural Productivity	i. to recognise the Coffs Harbour coastal zone as a vital economic resource for the region and to support sustainable coastal economies;					✓				✓									✓	✓	✓

Values	Objectives	Implementation of the integrated CMP	Estuary Health Monitoring and Data Collection			Environmental Programs and Works				Education and Planning			Research and Innovation				Actions to be Implemented by Public Authorities		Actions to be Implemented Externally to the Certified CMP		
			A	B	C	D	E	F	G	H	I	J	M	N	O	P	Q	R	S	K	L
			Implement a Water Quality Monitoring Program	Publish an Annual Water Quality Report Card for Estuaries	Installation of Water Level Gauges at Darkum Creek, Willis Creek and Hearnes Lake	Prepare and Implement a Stormwater Management Plan for the Estuaries	Undertake a Targeted Riparian Rehabilitation Works Program	Environmental Protection Works	Restore and Expand Riparian Vegetation at the Woolgoolga Southern Foreshore	Develop and Implement a Program of Environmental Education and Performance Reviews for Local Businesses	Install Signage with Indigenous Cultural Heritage Information	Indigenous Cultural Inductions for High-Risk Developments	Undertake a 12 Month Trial of a Water Quality Autosampler for Hearnes Lake	Provide Support for Research and Innovation into Estuary Health Risks and their Management	Consolidate and Update Indigenous Heritage Information	Provide Funding Support for Radiocarbon Dating of Indigenous Heritage Items	Support the Conservation and Recovery of Shellfish Ecosystems in Woolgoolga Lake	Rename Willis Creek to a name of local significance to the Gumbaynggirr people	The Coffs Harbour Intensive Horticulture Environmental Program (The CHIEP)	Community Education on Recycled Water Usage	Promote Community Education Regarding Water Access Compliance
Coordinated and Effective Management of the Coastal Zone	j. to mitigate and manage current and future risks from population growth, urbanisation and coastal hazards, taking into account the effects of climate change;		✓		✓	✓	✓	✓	✓	✓		✓	✓	✓			✓		✓	✓	✓
	k. to facilitate appropriate management of the coastal zone through ecologically sustainable development, and the promotion of sustainable land use planning and decision-making that is consistent with regional and local strategic plans;					✓		✓	✓	✓		✓							✓	✓	✓
	l. to ensure co-ordination of the policies and activities of the relevant government and public authorities relating to the coastal zone - and to facilitate the proper integration of their management activities across all levels of government;	✓										✓					✓		✓	✓	✓
	m. to maintain meaningful engagement with the community, and to support public participation in coastal management and planning, and to foster greater public awareness, education and understanding of coastal processes and management actions;	✓	✓	✓	✓		✓			✓	✓	✓					✓	✓	✓	✓	✓
	n. to support the objects of the Marine Estate Management Act 2014; and	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	o. to align with the NSW Risk-based Framework for Considering Waterway Health Outcomes in Strategic Land-use Planning Decisions.		✓	✓		✓			✓				✓	✓			✓	✓	✓	✓	✓

Table A-2: How the integrated CMP and its actions achieve the Objects of the CM Act

Objectives	Implementation of the integrated CMP	Estuary Health Monitoring and Data Collection			Environmental Programs and Works				Education and Planning			Research and Innovation				Actions to be Implemented by Public Authorities		Actions to be Implemented Externally to the Certified CMP		
		A	B	C	D	E	F	G	H	I	J	M	N	O	P	Q	R	S	K	L
		Implement a Water Quality Monitoring Program	Publish an Annual Water Quality Report Card for Estuaries	Installation of Water Level Gauges at Darkum Creek, Willis Creek and Hearnes Lake	Prepare and Implement a Stormwater Management Plan for the Estuaries	Undertake a Targeted Riparian Rehabilitation Works Program	Environmental Protection Works	Restore and Expand Riparian Vegetation at the Woolgoolga Southern Foreshore	Develop and Implement a Program of Environmental Education and Performance Reviews for Local Businesses	Install Signage with Indigenous Cultural Heritage Information	Indigenous Cultural Inductions for High-Risk Developments	Undertake a 12 Month Trial of a Water Quality Autosampler for Hearnes Lake	Provide Support for Research and Innovation into Estuary Health Risks and their Management	Consolidate and Update Indigenous Heritage Information	Provide Funding Support for Radiocarbon Dating of Indigenous Heritage Items	Support the Conservation and Recovery of Shellfish Ecosystems in Woolgoolga Lake	Rename Willis Creek to a name of local significance to the Gumbaynggirr people	The Coffs Harbour Intensive Horticulture Environmental Program (The CHIEP)	Community Education on Recycled Water Usage	Promote Community Education Regarding Water Access Compliance
a. to protect and enhance natural coastal processes and coastal environmental values including natural character, scenic value, biological diversity and ecosystem integrity and resilience		✓	✓	✓	✓	✓	✓	✓	✓			✓	✓			✓		✓	✓	✓
b. to support the social and cultural values of the estuaries and maintain public access and recreational amenity;					✓	✓	✓		✓			✓	✓			✓		✓	✓	✓
c. to acknowledge Aboriginal peoples' spiritual, social, customary and economic use of the study area						✓	✓			✓	✓			✓	✓		✓			
d. to recognise the coastal zone as a vital economic zone and to support sustainable coastal economies					✓				✓									✓	✓	✓
e. to facilitate ecologically sustainable development in the coastal zone and promote sustainable land use planning decision-making					✓		✓	✓	✓		✓							✓	✓	✓
f. to mitigate current and future risks from coastal hazards, taking into account the effects of climate change				✓	✓		✓						✓							
g. to recognise that the local and regional scale effects of coastal processes, and the inherently ambulatory and dynamic nature of the shoreline, may result in the loss of coastal land to the sea (including estuaries and other arms of the sea), and to manage coastal use and development accordingly				✓			✓						✓							

Objectives	Implementation of the integrated CMP	Estuary Health Monitoring and Data Collection			Environmental Programs and Works				Education and Planning			Research and Innovation				Actions to be Implemented by Public Authorities		Actions to be Implemented Externally to the Certified CMP		
		A	B	C	D	E	F	G	H	I	J	M	N	O	P	Q	R	S	K	L
		Implement a Water Quality Monitoring Program	Publish an Annual Water Quality Report Card for Estuaries	Installation of Water Level Gauges at Darkum Creek, Willis Creek and Hearnes Lake	Prepare and Implement a Stormwater Management Plan for the Estuaries	Undertake a Targeted Riparian Rehabilitation Works Program	Environmental Protection Works	Restore and Expand Riparian Vegetation at the Woolgoolga Southern Foreshore	Develop and Implement a Program of Environmental Education and Performance Reviews for Local Businesses	Install Signage with Indigenous Cultural Heritage Information	Indigenous Cultural Inductions for High-Risk Developments	Undertake a 12 Month Trial of a Water Quality Autosampler for Hearnes Lake	Provide Support for Research and Innovation into Estuary Health Risks and their Management	Consolidate and Update Indigenous Heritage Information	Provide Funding Support for Radiocarbon Dating of Indigenous Heritage Items	Support the Conservation and Recovery of Shellfish Ecosystems in Woolgoolga Lake	Rename Willis Creek to a name of local significance to the Gumbaynggirr people	The Coffs Harbour Intensive Horticulture Environmental Program (The CHIEP)	Community Education on Recycled Water Usage	Promote Community Education Regarding Water Access Compliance
h. to promote integrated and co-ordinated coastal planning, management and reporting	✓																			
i. to encourage and promote plans and strategies to improve the resilience of coastal assets to the impacts of an uncertain climate future including impacts of extreme storm events	✓			✓			✓						✓							
j. to ensure co-ordination of the policies and activities of government and public authorities relating to the coastal zone and to facilitate the proper integration of their management activities	✓																	✓		
k. to support public participation in coastal management and planning and greater public awareness, education and understanding of coastal processes and management actions	✓	✓	✓	✓		✓			✓	✓	✓					✓	✓	✓	✓	✓
l. to facilitate the identification of land in the coastal zone for acquisition by public or local authorities in order to promote the protection, enhancement, maintenance and restoration of the environment of the coastal zone	✓												✓							
m. to support the objects of the Marine Estate Management Act 2014; and	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table A-3: How the integrated CMP and its actions achieve the Objects for Coastal Management Areas within the CM Act

Objectives	Implementation of the integrated CMP	Estuary Health Monitoring and Data Collection			Environmental Programs and Works				Education and Planning			Research and Innovation				Actions to be Implemented by Public Authorities		Actions to be Implemented Externally to the Certified CMP		
		A Implement a Water Quality Monitoring Program	B Publish an Annual Water Quality Report Card for Estuaries	C Installation of Water Level Gauges at Darkum Creek, Willis Creek and Hearnes Lake	D Prepare and Implement a Stormwater Management Plan for the Estuaries	E Undertake a Targeted Riparian Rehabilitation Works Program	F Environmental Protection Works	G Restore and Expand Riparian Vegetation at the Woolgoolga Southern Foreshore	H Develop and Implement a Program of Environmental Education and Performance Reviews for Local Business	I Install Signage with Indigenous Cultural Heritage Information	J Indigenous Cultural Inductions for High-Risk Developments	M Undertake a 12 Month Trial of a Water Quality Autosampler for Hearnes Lake	N Provide Support for Research and Innovation into Estuary Health Risks and their Management	O Consolidate and Update Indigenous Heritage Information	P Provide Funding Support for Radiocarbon Dating of Indigenous Heritage Items	Q Support the Conservation and Recovery of Shellfish Ecosystems in Woolgoolga Lake	R Rename Willis Creek to a name of local significance to the Gumbaynggirr people	S The Coffs Harbour Intensive Horticulture Environmental Program (The CHIEP)	K Community Education on Recycled Water Usage	L Promote Community Education Regarding Water Access Compliance
Coastal Wetlands and Littoral Rainforests																				
(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.	✓																			
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,	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Objectives	Implementation of the integrated CMP	Estuary Health Monitoring and Data Collection			Environmental Programs and Works				Education and Planning			Research and Innovation				Actions to be Implemented by Public Authorities		Actions to be Implemented Externally to the Certified CMP		
		A Implement a Water Quality Monitoring Program	B Publish an Annual Water Quality Report Card for Estuaries	C Installation of Water Level Gauges at Darkum Creek, Willis Creek and Hearnes Lake	D Prepare and Implement a Stormwater Management Plan for the Estuaries	E Undertake a Targeted Riparian Rehabilitation Works Program	F Environmental Protection Works	G Restore and Expand Riparian Vegetation at the Woolgoolga Southern Foreshore	H Develop and Implement a Program of Environmental Education and Performance Reviews for Local Business	I Install Signage with Indigenous Cultural Heritage Information	J Indigenous Cultural Inductions for High-Risk Developments	M Undertake a 12 Month Trial of a Water Quality Autosampler for Hearnes Lake	N Provide Support for Research and Innovation into Estuary Health Risks and their Management	O Consolidate and Update Indigenous Heritage Information	P Provide Funding Support for Radiocarbon Dating of Indigenous Heritage Items	Q Support the Conservation and Recovery of Shellfish Ecosystems in Woolgoolga Lake	R Rename Willis Creek to a name of local significance to the Gumbaynggirr people	S The Coffs Harbour Intensive Horticulture Environmental Program (The CHIEP)	K Community Education on Recycled Water Usage	L Promote Community Education Regarding Water Access Compliance
(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	✓	✓	✓		✓	✓	✓	✓	✓	✓										
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 (N/A)																				
(b) to accommodate both urbanised and natural stretches of coastline	✓					✓		✓					✓				✓		✓	

Table A-4: How the integrated CMP and its actions achieve the Objects of the MEM Act

Objectives	Implementation of the integrated CMP	Estuary Health Monitoring and Data Collection			Environmental Programs and Works				Education and Planning			Research and Innovation				Actions to be Implemented by Public Authorities		Actions to be Implemented Externally to the Certified CMP		
		A Implement a Water Quality Monitoring Program	B Publish an Annual Water Quality Report Card for Estuaries	C Installation of Water Level Gauges at Darkum Creek, Willis Creek and Hearnes Lake	D Prepare and Implement a Stormwater Management Plan for the Estuaries	E Undertake a Targeted Riparian Rehabilitation Works Program	F Environmental Protection Works	G Restore and Expand Riparian Vegetation at the Woolgoolga Southern Foreshore	H Develop and Implement a Program of Environmental Education and Performance Reviews for Local Businesses	I Install Signage with Indigenous Cultural Heritage Information	J Indigenous Cultural Inductions for High-Risk Developments	M Undertake a 12 Month Trial of a Water Quality Autosampler for Hearnes Lake	N Provide Support for Research and Innovation into Estuary Health Risks and their Management	O Consolidate and Update Indigenous Heritage Information	P Provide Funding Support for Radiocarbon Dating of Indigenous Heritage Items	Q Support the Conservation and Recovery of Shellfish Ecosystems in Woolgoolga Lake	R Rename Willis Creek to a name of local significance to the Gumbaynggirr people	S The Coffs Harbour Intensive Horticulture Environmental Program (The CHIEP)	K Community Education on Recycled Water Usage	L Promote Community Education Regarding Water Access Compliance
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	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
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 reserve	✓																			

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APPENDIX B
CMP ACTION IMPLEMENTATION DATABASE

Information		Responsibilities		Delivery Information								Short Term MER			Medium-Long Term MER			Comments and Notes
ID	Action Name	Lead Agency	Supporting Agencies	Importance	Urgency	Priority Score	Priority	Delivery Timeframe	Implementation Status	Date of Commencement	Date of Practical Completion	Objectives	Performance Indicators	Objectives Met? (Yes / Partly / No)	Objectives	Performance Indicators	Objectives Met? (Yes / Partly / No)	
Actions to be Implemented by the City of Coffs Harbour																		
A	Implement a Water Quality Monitoring Program	The City	DPE(E&H)	9	3	27	High	Short Term: Within 3 Years				To improve spatial and temporal resolution of the existing water quality dataset across the estuaries.	Program implemented and data collected as per scope.		To further develop the understanding of water quality issues, and provide a useful dataset upon which to inform effective and targeted management decisions.	Collected data is of tangible benefit from a research and management perspective.		
B	Publish an Annual Water Quality Report Card for Estuaries	The City	DPE(E&H)	8	3	24	High	Short Term: Within 3 Years				To provide the community with an up-to-date status of water quality in the estuaries in an easy to understand format.	Program implemented as per scope.		To provide Council with an easy to understand snapshot of water quality in the estuaries over time, and an indicator to monitor and evaluate the performance of the CMP	Scorecards are considered to provide meaningful benefit for these purposes, relative to their cost. Scorecards are valued by the community for the information they provide.		
C	Installation of Water Level Gauges at Darkum Creek, Willis Creek and Hearnes Lake	The City	DPE(E&H)	8	3	24	High	Short Term: Within 3 Years				To improve of estuarine flood risk by providing a means to monitor & publish water levels in real time.	Program implemented and data published as per scope.		To provide a dataset to improve the long-term management of inundation risk and understanding of physical processes (including water levels, hydrodynamics and entrance opening / closing regime).	Collected data is of tangible benefit from a research and management perspective.		
D	Prepare and Implement a Stormwater Management Plan for the Estuaries	The City	DPE(E&H)	9	3	27	High	Short Term: Within 3 Years				To identify opportunities for upgrading and/or maintenance of specific assets in order to improve estuary health outcomes.	Stormwater Management Plan delivered as per scope.		To improve the health and amenity of the catchment through improved stormwater management practices	Long term reduction in gross-pollutants and improvement in monitored levels of analytes listed in Action A.		
E	Undertake a Targeted Riparian Rehabilitation Works Program	The City NPWS	CHDLALC DPI Fisheries	8	3	24	High	Short Term: Within 3 Years				To implement an initial round of rehabilitation to improve the condition of riparian vegetation and reduce the spread of weeds.	Works implemented as per scope.		To manage both the spread and introduction of weeds across the foreshore of the four estuaries, and improve the long term condition of riparian vegetation. To establish a working relationship with the Darrunda Wajaarr Rangers for the management of sea country in the study area	Monitoring undertaken for this action shows improved riparian condition relative to the baseline mapping from Stage 2.		
F	Environmental Protection Works	The City	NPWS DPI Fisheries Crown Lands	9	3	27	High	Short Term: Within 3 Years				To enable Environmental Protection Works to be undertaken by relevant by Public Authorities under Part 5 of the EP&A Act	Action is included in gazetted CMP and becomes active as a management tool.		To enable Environmental Protection Works to be undertaken by relevant by Public Authorities under Part 5 of the EP&A Act	Action is considered to provide tangible benefit for Council for streamlining the management of EPW across the study area.		
G	Restore and Expand Riparian Vegetation at the Woolgoolga Southern Foreshore	The City	DPI Fisheries CHRLC	3	2	6	Low	Long Term: Within 10 Years				To restore and expand riparian vegetation at the Woolgoolga Southern Foreshore. To create a defined edge between the pedestrian accessway and foreshore vegetation.	Works implemented as per scope		To improve biodiversity and foreshore habitat in this location.	Coverage of riparian vegetation improved relative to baseline (pre-CMP) condition baseline.		
H	Develop and Implement a Program of Environmental Education and Performance Reviews for Local Businesses	The City	DPE(E&H)	8	2	16	Medium	Medium Term: Within 6 Years				To improve the environmental practices of local businesses, as they relate to downstream estuary health	Uptake of the program by businesses in the study area (particularly the Woolgoolga Industrial Precinct).		To reduce the impacts of urban and industrial runoff on water quality and estuary health.	Long term improvement in monitored levels of analytes listed in Action A		
I	Greater Acknowledgement of Aboriginal Cultural Heritage	The City	CHDLALC DPE(E&H) DPI Fisheries NPWS	4	1	4	Low	Long Term: Within 10 Years				To acknowledge the Traditional Owners spiritual, social, customary and economic use of the study area – and provide a mechanism for the preservation of aboriginal cultural heritage across the coastal zone.	Works implemented as per scope.		To improve the community knowledge and understanding of the indigenous cultural values of the coastal zone and marine estate.	Signs are valued by the community for the information they provide.		
J	Aboriginal Cultural Inductions for High-Risk Developments	The City	CHDLALC	7	2	14	Medium	Medium Term: Within 6 Years				To reduce the potential impacts of development across the catchment on indigenous cultural heritage.	Action implemented as per scope		To protect and preserve the Aboriginal cultural heritage of the marine estate and coastal zone.	Action is practical to implement, and considered to provide tangible benefit for Council and the LALC for planning and heritage protection.		
M	Undertake a 12 Month Trial of a Water Quality Autosampler for Hearnes Lake	The City	DPE(E&H)	6	2	12	Medium	Medium Term: Within 6 Years				To generate technical data that can provide insights into the estuarine water quality and response to rainfall events, and the impacts of catchment land usage.	Program implemented and data collected as per scope.		To further develop the understanding of water quality issues, and provide a useful dataset upon which to inform effective and targeted management decisions.	Collected data is of tangible benefit from a research and management perspective.		
N	Provide Support for Research and Innovation into Estuary Health Risks and their Management	The City	DPE(E&H)	7	3	21	Medium	Medium Term: Within 6 Years				To encourage and facilitate research and monitoring – and to maintain scientific and educational values of the study area.	Action implemented as per scope		To increase the understanding of estuary health risks, their causes, and effective management actions. To provide a body of knowledge upon which to inform effective and targeted management decisions.	Research output is of tangible benefit from a management perspective.		
O	Consolidate and Update Aboriginal Cultural Heritage Information	The City	CHDLALC DPE(E&H)	7	3	21	Medium	Medium Term: Within 6 Years				To fill information gaps within the LGA-wide Aboriginal Cultural Heritage Map.	Action implemented as per scope		To increase understanding of indigenous cultural heritage, and preserve the indigenous heritage values of the marine estate and coastal zone	Outputs provide value to both Traditional Owners groups, and Council - from a research and management perspective		
P	Provide Funding Support for Radiocarbon Dating of Indigenous Heritage Items	The City	CHDLALC DPE(E&H) NPWS	7	1	7	Low	Long Term: Within 10 Years				To provide a mechanism for the enhancement of aboriginal cultural heritage across the marine estate and the coastal zone	Action implemented when opportunities arise (including from Action O)		To enhance the local knowledge of indigenous history, and demonstrate the evolution and development of indigenous culture over tens of thousands of years	Outputs provide value to both Traditional Owners groups, and Council - from a research and management perspective		
Actions to be Implemented by Public Authorities																		
Q	Support the Conservation and Recovery of Shellfish Ecosystems in Woolgoolga Lake	DPI Fisheries	The City	9	2	18	Medium	Medium Term: Within 6 Years				To undertake Component #1 and #2 of this Action. To gain sufficient insights regarding the mechanisms for enhancing natural recruitment and survivorship in the local Leaf Oyster population, and clearly set forth targeted management actions for the restoration of Woolgoolga Shellfish Ecosystems	Action implemented as per scope		To support the conservation and recovery of shellfish ecosystems in Woolgoolga Lake – specifically the Leaf Oysters (Isognomon ephippium), and Sydney Rock Oyster (Saccostrea glomerata) populations within the estuary	This component of the action will need to establish its own detailed MER process, based on outcomes of research in Component #2.		
R	Dual naming of Willis Creek, using a name of local significance to the Gumbaynggirr people	DPI Fisheries Traditional Owners	Garby Elders CHDLALC The City	8	1	8	Medium	Medium Term: Within 6 Years				To preserve traditional names and language of the Gumbaynggirr people, and preserve Aboriginal cultural values of the marine estate	Action implemented as per scope		To preserve traditional names and language of the Gumbaynggirr people, and preserve Aboriginal cultural values of the marine estate	Action implemented as per scope		
Actions to be Implemented Externally to the Certified CMP																		
S	The Coffs Harbour Intensive Horticulture Environmental Program (The CHIEP)	NC LLS	The City DPI Agriculture DPE(E&H)	10	3	30	High	Short Term: Within 3 Years				Refer to the CHIEP's project specific objectives, and MER process.						
K	Community Education on Recycled Water Usage	The City	N/A	5	2	10	Medium	Medium Term: Within 6 Years				To provide recycled water users with the information needed to understand recycled water issues and implement positive practice change	Education materials developed and disseminated as per action scope.		To reduce the impacts of recycled water usage across the catchment on downstream water quality and estuary health.	Long term reduction in monitored levels of Nitrates and Phosphates.		
L	Promote Community Education Regarding Water Access Compliance	The City	N/A	3	1	3	Low	Long Term: Within 10 Years				To provide water users with the information needed to understand water extraction issues and implement positive practice change	Action implemented as per scope		To reduce the impacts of water extraction and modified freshwater flows on estuary function and health. To help facilitate long-term positive practice change.	Future compliance campaigns by NRAR show improved compliance across the catchments		

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APPENDIX C
THE CHIEP CONCEPT DOCUMENT

22 July 2021

Our ref: 21010147_B01_V06

Coffs Harbour Intensive Horticulture Environmental Program (CHIEP) – Outline and Business Case

1 BACKGROUND

The Coffs Harbour Region's horticulture industry depends on a biodiverse and well-managed natural resource base. Well managed agricultural landscapes will drive productivity, profitability, and enhance resilience. Furthermore, well implemented on-farm land management practices will reduce potential environmental and social impacts on local waterways and estuaries, which are sensitive receiving systems and provide a wide range of social, cultural, environmental and economic benefits for the Coffs Harbour region. The downstream reaches of these catchments are also located within boundaries of the Solitary Islands Marine Park.

The Coffs Harbour Intensive Horticulture Environmental Program (CHIEP) aims to utilise a partnership based, collaborate approach to incentivise adoption of enhanced on-farm land management practices. The CHIEP will be a voluntary or "opt-in" program that empowers local growers with financial and technical assistance to affect meaningful change, and provide a mechanism where growers are rewarded for their efforts in delivering biodiversity and sustainability services that benefit their both farms, the environment and the broader community.

The plan is for the program to be rolled out across the Coffs Harbour LGA in the first instance, with potential opportunities to expand the geographic remit of the program at a later date if the concept proves successful.

This concept has been developed through a facilitated stakeholder engagement and negotiation process, between Coffs Harbour City Council, relevant state government agencies and industry groups. A summary for the development process for the concept is provided in Section 4 of this document.

2 COMPONENTS OF THE CHIEP

The aim of the CHIEP will be to provide local growers and land managers with the tools and resources to develop whole-of-farm practices that lead to productive and sustainable systems. The CHIEP will include a number of key components:

- Deployment of an accessible, web-based, good practice management tool using the established *Hort360* program. Utilisation of this tool can lead to the development of a recognition scheme for local growers through demonstrated good practice farm management.
- A competitive incentives program that allows growers to apply for funding of up to $10,000 to improve on-farm management practices, and harness innovative solutions;
- A dedicated full-time technical officer to manage the deployment, and then ongoing management of the program; and
- A monitoring and reporting program in order to track progress against key performance criteria.

By utilising the four components above through an extension and adoption program, the CHIEP will work with local growers to identify opportunities for practice change and improvement - and provide an avenue for potential funding assistance to facilitate those changes (see Figure 1).

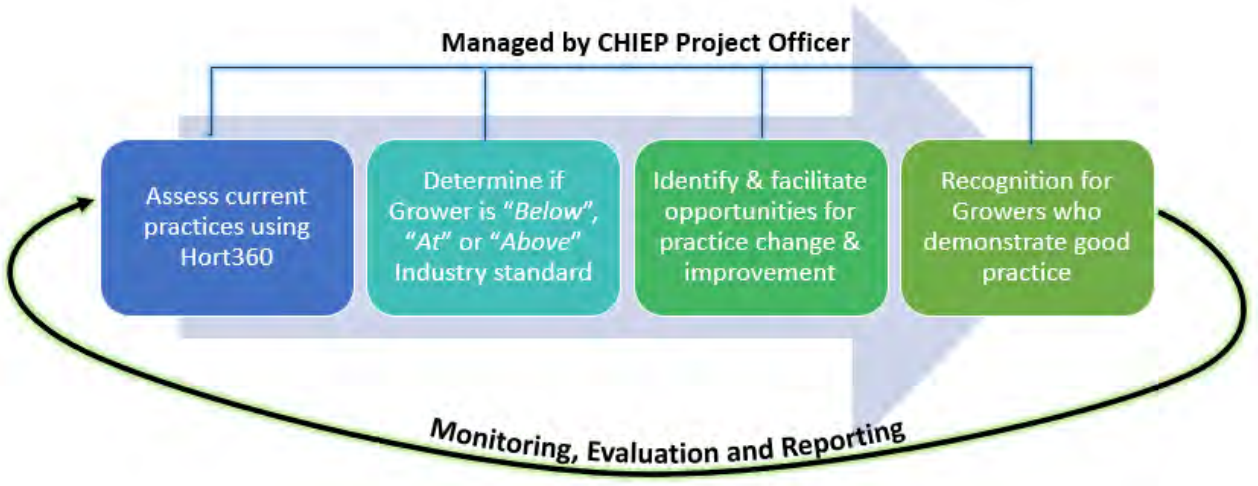

Figure 1 The Approach of the CHIEP

The four main components of the proposed program are outlined below.

2.1 Deployment of a Good Practice Management Program

2.1.1 Hort360

This will involve deployment of Growcom's *Hort360* (https://www.hort360.com.au/) for use by local growers. *Hort360* is an industry leading web-based tool for the horticulture industry that is designed to give production horticulture growers a holistic view of their farm business operations. It is designed and licensed by *Growcom*, and is aligned with the horticulture industry's Freshcare Environmental standards (refer to Freshcare website: https://www.freshcare.com.au/about/).

The *Hort360* dashboard provides operators with an online interface where they can provide information relating to their whole of farm business operations. There are 12 different modules available in the dashboard, related to:

- Energy
- Air
- Erosion Management /Runoff
- Irrigation
- WH&S
- Biosecurity
- Waste
- Nutrient Management
- Better Business
- Biodiversity
- Soil Management
- Pesticide Use

Each module contains somewhere between 10 and 80 questions. For the CHIEP, a bespoke collection of sub-modules can be collated based on only those questions that are specifically targeted towards the needs and issues of local growers. One such collection of sub-modules has already been developed by DPI-Agriculture for the Marine Estate Management Strategy Clean Coastal Catchments project – see Figure 2.

As users answer each question, the interactive system tells you if you are 'below', 'at', or 'above' the industry standard for each practice. If any practice is below the industry standard, users are provided information and resources regarding the necessary actions are required to attain the desired standard. The program will provide users with the opportunity to access technical support, on-farm training, and professional networks. The aim is to provide practical guidelines and advice to help growers and land managers develop whole-of-farm practices that lead to a productive and sustainable system.

Figure 2 An Example of the Hort360 Module

Data that users put in to the program is collated at a macro-level, and can provide decision makers in industry and government with a regional, whole-of-industry snapshot of current practices and associated issues. Data will be collated to help measure progress towards the industry's improved management practices. It can also be used to help identify any research, development and extension, product development and training needs. All data collected will be kept anonymous at a user level to protect the privacy of the grower.

Growcom can provide access to the program for an industry body for a nominal licencing fee, of the order of $10,000. From here, access can be provided to growers who opt-in to the CHIEP free of charge.

Hort360 has a demonstrated, track record of implementation through similar programs – particularly in Northern Queensland, where it used by Great Barrier Reef BMP Program, funded by the Queensland Government. *Hort360* is also utilised in that program to provide a credible recognition pathway for horticulture growers to demonstrate their environmental stewardship and industry good practice. Based on this demonstrated application, there is an opportunity to establish a pilot program for a similar, but smaller scale

public recognition program as part of the CHIEP. Data from *Hort360* could be used to provide recognition to growers with sustainable management practices through a ratings or awards scheme.

It should be noted that *Hort360* has already been tailored for use in the Marine Estate Management Strategy Clean Coastal Catchments project and is supported by the NSW Department of Primary Industries – Agriculture.

Summary of how Hort360 will make a difference:

- *Hort360* is a structured, engineered program that provides growers with an understanding of key issues, and allow them to identify areas where practice can be improved.
- It provides benchmarking tools and incentives for growers to engage in practice change; and
- It will allow for identification of whole-of-industry trends around practice change.

2.1.2 Rollout and Use of Hort360

In the first instance, growers who opt-in to the CHIEP will be provided with a free one-on-one facilitated training session on how to use the program. The session will be facilitated with the local CHIEP officer (see Section 2.2), and/or other personnel from *Growcom* or DPI who are trained in use of the program. The role of the CHIEP officer would be to focus on working with the growers through those modules related to generating water quality benefits downstream. It would not necessarily be the role of the CHIEP officer to work through modules such as WH&S for instance. The role of the CHIEP officer will be crucial in harnessing uptake of Hort360 amongst the local growers.

A key incentive for growers will be using the program to achieve on-farm efficiencies, and consequent financial benefits. Data may be available from the Fertiliser Stewardship Group or from the QLD Paddock to Reef program that can be used to demonstrate the economic benefits of the program to local growers.

2.2 CHIEP Project Management and Project Officer

2.2.1 Project Management

The CHIEP Program will be overseen by a CHIEP Management Committee. It is anticipated that the committee will be made up of representatives from appropriate stakeholder organisations including industry, Council and State Government.

2.2.2 Project Officer

It is envisioned that the program will also include the creation of an ongoing position of a dedicated, fulltime CHIEP project officer. The project officer will be locally based in order to ensure that local needs are understood and to create local trust for uptake of the program. The role should be filled by an officer with a sufficient understanding of agronomy and horticultural management practices. This model has been employed at the Great Barrier Reef for years with long-standing credibility.

The role of the CHIEP officer will be to:

- Lead promotion of the CHIEP;
- Provide a dedicated resource for the day-to-day project management of the CHIEP;
- Provide technical support with the deployment of *Hort360* to local growers, in order to maximise up-take and ongoing application;
- Undertake ongoing engagement with local growers about their current practices and needs;

- Engage with related stakeholders, including Coffs Harbour City Council, the Department of Primary Industries - Agriculture, and the Marine Estate Management Strategy Clean Coastal Catchments project (CCC) Group;
- Manage the Incentives Program application process;
- Manage budgets and financial transactions for the program;
- Monitoring the performance of the project and reporting to stakeholders; and
- Responding to any enquiries about the project from stakeholders and communities.

Critical to the success of the CHIEP will be the ability of the officer to build trust amongst local growers, and develop a strong understanding of the social framework and the unique cultural and social aspects of the local grower base.

Discussions with stakeholders during development of the program have indicated that that while buy in from local growers may be easier if the role is industry based, there are also benefits to locating the officer in government - including access to resources and support, i.e., as per the existing Berry Development Officer position hosted by DPI. The specific location of the role (be it housed in industry or government), will likely be dependent upon the eventual source(s) of funding for the program.

If the CHIEP officer is to be housed within industry, then it should be noted that Berries Australia (BA), in conjunction with the Berry development officer, NSW DPI Horticulture Unit have a strong track record of engaging with growers in relation to intensive horticulture practices. BA is a significant body with the capacity & expertise to house the CHIEP officer.

The CHIEP officer can leverage off the existing technical knowledge and capacity of the Berry Development Officer, who is employed by NSW DPI but is part funded by the berry industry. This role is already developing collaborative research, products, and packages that enhances the sustainability of the berry industry and can provide the CHIEP officer with:

- Mentorship and training of the Hort360 program;
- Support to build and maintain collaborative relationships with stakeholders and partners;
- Local learnings and research insights from the Marine Estate Management Strategy Clean Coastal Catchments project – so that these learnings can be built upon technical support;
- Development and distribution of extension products that target the adoption of relevant and new technologies that will contribute to sustainable farm outcomes.

2.3 CHIEP Competitive Incentives Program

Once growers have had a facilitated session with the CHIEP officer and, through *Hort360,* have identified their priority area(s) for action - growers can then use the CHIEP Incentives Program to submit an application for funding assistance to improve their on-farm practices. The incentives program will be employed as a “kick starter” or initiation point to start the conversation with growers, and facilitate attitudinal shifts and improved management practices. It is generally considered that a competitive grants program is likely to generate better outcomes.

The application process will be managed by the CHIEP officer, but the assessment of applications should be performed by an independent entity, such as the CHIEP Management Committee, which will be made up of representatives from industry and government. The Committee will need to define the criteria for applications, and how the assessments will be made. It is important to note that the CCC grants program currently employs grant application eligibility criteria that can be used as a starting point.

The CHIEP Incentives Program will include incentive funding of up to $10,000 for local growers, which will be available via one of two concurrent funding streams:

- A "Good Practice" Bucket: This bucket will include funding to assist those growers which are benchmarked in *Hort360* with practices 'below' industry standards to increase their management practices to the preferred standard. For example, funding can be used to assist with nutrient runoff management, irrigation design and management, on-farm monitoring and evaluation tools, and implementing best practice fertilizer programs.
- An "Innovation" Bucket: This will provide an avenue for growers whose practices are currently benchmarked by *Hort360* as 'at' or 'above' industry standards to undertake on-farm trials/demonstrations of new and innovative management practices that will provide good environmental outcomes.

The grant program should acknowledge that its primary objective is to improve downstream water quality outcomes. Therefore, the funding should be largely focussed towards the "Good Practice" funding stream. One potential avenue for the program is that t growers who are seeking grant funding under the "Innovation" stream could be directed towards the CCC program for funding and technical assistance.

It is anticipated that growers will need to provide a financial or in-kind contribution to secure incentive program funding.

The initial concept and business case notionally estimates the size of the grants program to be around $500,000 (nominally based on around 50 grants at $10,000 per grant) – however it is acknowledged that this is a preliminary estimate only. The number of grants awarded, and the size of grants awarded, will likely depend on the rate of uptake by growers, and the sources of funding available for the program as it evolves.

2.4 Monitoring and Evaluation

A simple but robust monitoring, evaluation and reporting arrangement will be established as part of the CHIEP. Monitoring should relate not just to physical data monitoring of downstream waterways. Whilst Council's monitoring of estuarine water quality as part of the Ecohealth program and the CMP will provide an indication of estuary health response – it is important to note that water quality in the estuaries responds to short, medium, and long term drivers that make detection of direct estuary response to horticultural practice change a complex and difficult undertaking. Furthermore, the water quality in the estuaries is also impacted by other catchment land uses (urban, industrial, recreational) as well as legacy issues associated with historical practices over many decades (such as banana cultivation). Therefore, in order to monitor the specific impact of the program more closely, it is anticipated that on-farm monitoring will be most effective (see Point 3 below). On-farm water quality monitoring can be undertaken as part of the program, with results aggregated and only reported at a larger geographic scale (to protect confidentiality of growers)

Importantly, the CHIEP should also include monitoring and evaluation of the extension and adoption program. Key elements of the monitoring and evaluation will be:

1. Stakeholder Engagement: Engagement with stakeholders can include simple surveys undertaken by delivery partners after each activity to capture:
    a. Change in attitudes;
    b. Change in understanding; and
    c. Intention to adopt practice change.
2. *Uptake and practice change data from Hort360*: One of the benefits of collecting and collating management practice information through *Hort360* is to determine the extent of change in land management practices that lead to water quality improvement. This allows for identification of trends in management practices over time at a macro-scale.

3. *On farm monitoring*: On farm scale monitoring provides information on the water quality changes related to specific management practices. On-farm models such as Agricultural Production Systems Simulator (APSIM) - currently adopted by the Queensland government and the CSIRO - can be used to corroborate this information. Examples of on-farm monitoring and modelling can be observed in the Northern Queensland *Paddock to Reef Integrated Monitoring, Modelling and Reporting Program*.

3 COSTS AND FUNDING MECHANISMS

3.1 High Order Cost Estimate

An initial, high-order costing of the various components of the project is provided in Table 1 below. This forward cost estimate has been provided over an initial six (6) year planning timeframe.

Table 1 Estimate of CHIEP Program Costs

Component	Cost Estimate
Hort360 Licence	$10,000
Customisation of Hort360 modules specific to CHIEP	$20,000
CHIEP officer - salary, on-costs, and operational costs for 6 years	$720,000
Incentive Grants (nominally 60 applicants at $10,000 per grant)	$600,000
Total	***$1,350,000***

It is anticipated that cost of the program would be realised more or less evenly across this six-year planning timeframe, as per Table 2 below.

Table 2 Projection of Annual CHIEP Program Costs over six-year planning timeframe

Year	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Projected Cost	$225,000	$225,000	$225,000	$225,000	$225,000	$225,000

3.2 Funding Mechanisms

In the first instance, the intention is to package up the CHIEP concept, and then try and achieve funding for the whole package – rather than break the package up into individual components that may be eligible for separate funding streams.

- State government funding may be available from:
  - The NSW Environmental Trust[1] – These are used to fund both long-standing annual programs and one-off, issue-specific programs. Discussions with stakeholders indicates that it is unlikely that the CHIEP will fit neatly into one of the existing grants categories, and therefore the best opportunity to secure ETG funding will be through a through discretionary funding allocation.
  - The Marine Estate Management Strategy.
- Some funding may be available from industry through either in-kind or financial contributions. Hort-Innovation and Hort-Frontiers[2]

[1] https://www.environment.nsw.gov.au/funding-and-support/nsw-environmental-trust
[2] https://www.horticulture.com.au/delivery-partners/funding-consulting-investing/how-hort-frontiers-works/

- Philanthropic grants may be a potential source of funding.

The CHIEP may also be partially funded through Coffs Harbour City Council's local suite of Coastal Management Programs (CMP). There are currently 3 relevant CMPs in development across the Coffs Harbour LGA – and funding could potentially be made available through all three CMPs.

Funding from multiple sources may be facilitated through a proportionate co-funding arrangement. Such cost sharing arrangements would need to be discussed and negotiated with the project partners (such as Coffs Harbour City Council, state government agencies and industry groups).

4 BACKGROUND INTO THE DEVELOPMENT OF THE PROGRAM

The concept development has involved a facilitated engagement and negotiation process between relevant local and state government stakeholders, and horticultural industry groups, including:

- Coffs Harbour City Council
- State Government Agencies, including:
  - Department of Primary Industries (DPI) - Horticulture;
  - Department of Planning and Environment (DPE);
- Industry Groups:
  - Berries Australia;
  - Oz Group;
  - Costa Group.

This development process has occurred over the first half of 2021, and has evolved through a staged process, as per Figure 3.

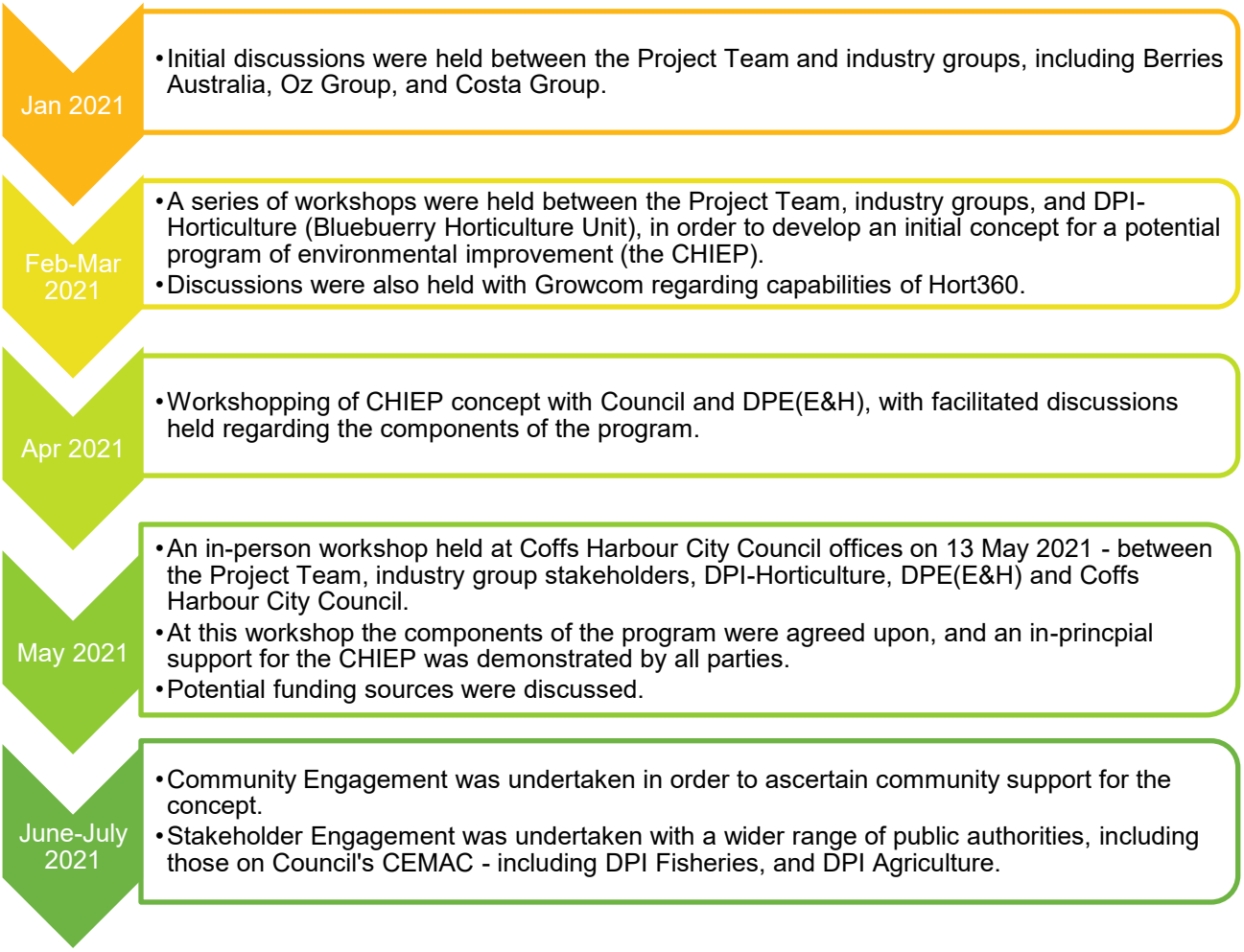

Figure 3 Stakeholder Engagement Process for the CHIEP Concept

Discussions and negotiations held between parties named herein have demonstrated significant in principal support for the CHIEP concept. The intention is to include the CHIEP as a stand-alone action in the Woolgoolga Region Estuaries Coastal Management Program (CMP).

Community Engagement was undertaken in June-July 2021 for Stage 3 of the CMP. This engagement activity has demonstrated community support for the concept, as per Figure 4 below. It shows that over 84% of community respondents support the CHIEP concept for inclusion in the CMP, with less than 4% indicating that they are not supportive.

The concept was also discussed with relevant stakeholders at the June 17th meeting of the Coffs harbour City Council's Coast and Estuary Management Committee (CEMAC). Attendees included representatives from Council, DPI-Horticulture, DPI-Fisheries and Solitary Islands Marine Park, Southern Cross University, Crown Lands, Coffs Harbour Regional Landcare as well as Community Representatives. The workshop demonstrated support for the concept from 100% of attendees. Engagement with representatives from Coffs Local Aboriginal Land Council and the Garby Elders also indicated their support for the concept.

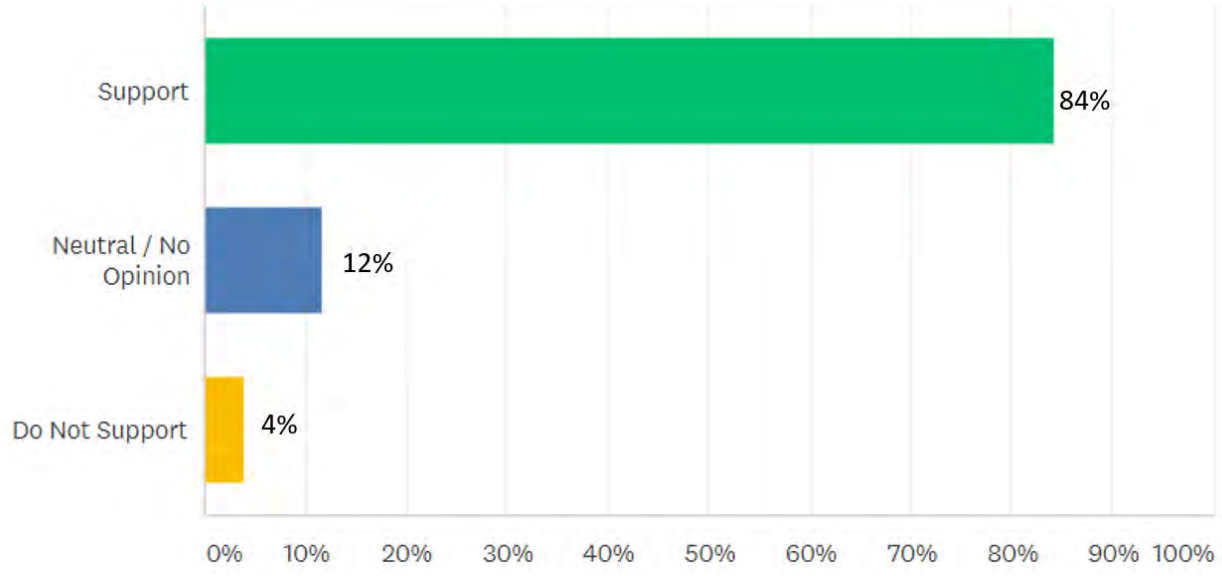

Figure 4 Community Survey for Stage 3 of the CMP – demonstrating community support for the CHIEP Concept

5 CONCLUDING REMARKS AND THE NEXT STEPS

If you have any comments or would like to discuss any information provided in this document, please feel free to contact us at any time.

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WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

APPENDIX D
COASTAL ZONE EMERGENCY ACTION SUBPLAN

WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

Coastal Zone Emergency Action Subplan

Woolgoolga Region Estuaries CMP

City of Coffs Harbour

21 June 2023

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Project Details

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GLOSSARY AND ABBREVIATIONS

Term	Definition
Beach Erosion	Refers to landward movement of the shoreline and/or a reduction in beach volume, usually associated with storm events or a series of events, which occurs within the beach fluctuation zone. Beach erosion occurs due to one or more process drivers; wind, waves, tides, currents, ocean water level, and downslope movement of material due to gravity.
BoM	The Bureau of Meteorology
The City	The City of Coffs Harbour
Cliff instability	Refers to geotechnical instabilities on coastal cliffs and bluffs, including rock falls, slumps, and landslides.
CM Act	*The Coastal Management Act 2016*
Coastal emergency	An emergency due to actual or imminent coastal inundation, coastal erosion, or cliff instability which (a) threatens endangers, or threatens to endanger, the safety or health of persons; or (b) destroys or damages, or threatens to destroy or damage, any property or the natural environment.
Coastal inundation	Coastal inundation occurs when a combination of marine and atmospheric processes raises the water level at the coast above normal elevations, causing land that is usually 'dry' to become inundated by sea water. Alternatively, the elevated water level may result in wave run-up and overtopping of natural or built shoreline structures (e.g., dunes, seawalls).
Coastal protection works	The CM Act defines coastal protection works as: a) beach nourishment b) activities or works to reduce the impact of coastal hazards on land adjacent to tidal waters, including (but not limited to) seawalls, revetments, and groynes.
Combat Agency	The agency identified in this subplan as the agency primarily responsible for controlling the response to a particular emergency. (SERM Act 1989).
CZEAS	Coastal Zone Emergency Action Subplan (this document)
DPE	The NSW Department of Planning and Environment
Estuary	The CM Act defines as any part of a river, lake, lagoon, or coastal creek that is affected by coastal tides, up to the highest astronomical tide.
FRNSW	Fire and Rescue NSW
Local Emergency Operations Controller (LEOCON)	A Police Officer appointed by the District Emergency Operations Controller as the Local Emergency Operations Controller for the Local Government Area.
Regional Emergency Operations Controller (REOCON)	The Region Commander of Police for each Emergency Management Region is appointed as the REOCON. The REOCON is responsible for the overall control and coordination of emergency response operations at Region level for which the REOCON is the designated controller.
SES	The NSW State Emergency Service
SERM Act	*State Emergency and Rescue Management Act 1989*

1 INTRODUCTION

1.1 Background

This Coastal Zone Emergency Action Subplan (CZEAS) forms part of the Woolgoolga Region Estuaries Coastal Management Program (CMP). It has been prepared based on the requirements of:

- *The Coastal Management Act 2016* (the CM Act).
- The NSW Coastal Management Manual (OEH, 2018a).
- The NSW Guideline for preparing a coastal zone emergency action subplan (DPIE, 2019).

1.2 Objectives

This CZEAS details arrangements for the four phases of emergency events (prevention, preparation, response, and recovery) relating to coastal hazards for the Woolgoolga Region Estuaries. The objectives of this CZEAS are to:

- Reduce the risk to public safety, the coastal environment and public assets arising from coastal hazards
- Identify key actions to be carried out by The City before, during and following a coastal emergency to reduce the risk to public safety, the beach environment, and public assets
- Identify the responsibilities of other public authorities during a coastal emergency
- Identify key areas and assets subject to immediate hazards and prioritise actions to reduce the risks to those areas and assets

1.3 What is an Emergency?

An "emergency" is defined in the *State Emergency and Rescue Act 1989* (SERM Act) and the State Disaster Plan as:

> "*An emergency due to an actual or imminent occurrence (such as fire, flood, storm, earthquake, explosion, terrorist act, accident, epidemic or warlike action) which -*
>
> *a) endangers, or threatens to endanger, the safety or health of persons or animals in the State; or*
>
> *b) destroys or damages, or threatens to destroy or damage, any property in the State, or*
>
> *c) causes a failure of, or a significant disruption to, an essential service or infrastructure, being an emergency, which requires a significant and co-ordinated response.*
>
> *For the purposes of the definition of emergency, property in the State includes any part of the environment of the State. Accordingly, a reference in the Act to -*
>
> *a) threats or danger to property includes a reference to threats or danger to the environment, and*
>
> *b) the protection of property includes a reference to the protection of the environment."*

1.4 The Four Phases of Emergency

Both the SERM Act 1989 and the NSW Coastal Management Manual (OEH, 2018a) identify four distinct stages of an emergency - prevention, preparation, response, and recovery (Figure 1-1).

The City's ability to undertake the actions identified in this subplan will be dependent on the availability of resources during emergency events. The actions prescribed must not conflict with or impede the actions of the NSW State Emergency Service (SES) or the NSW Department of Planning & Environment (DPE). All actions must not put personnel staff or volunteers in danger. Emergency management works must not be undertaken during extreme weather unless environmental conditions permit works to be undertaken safely.

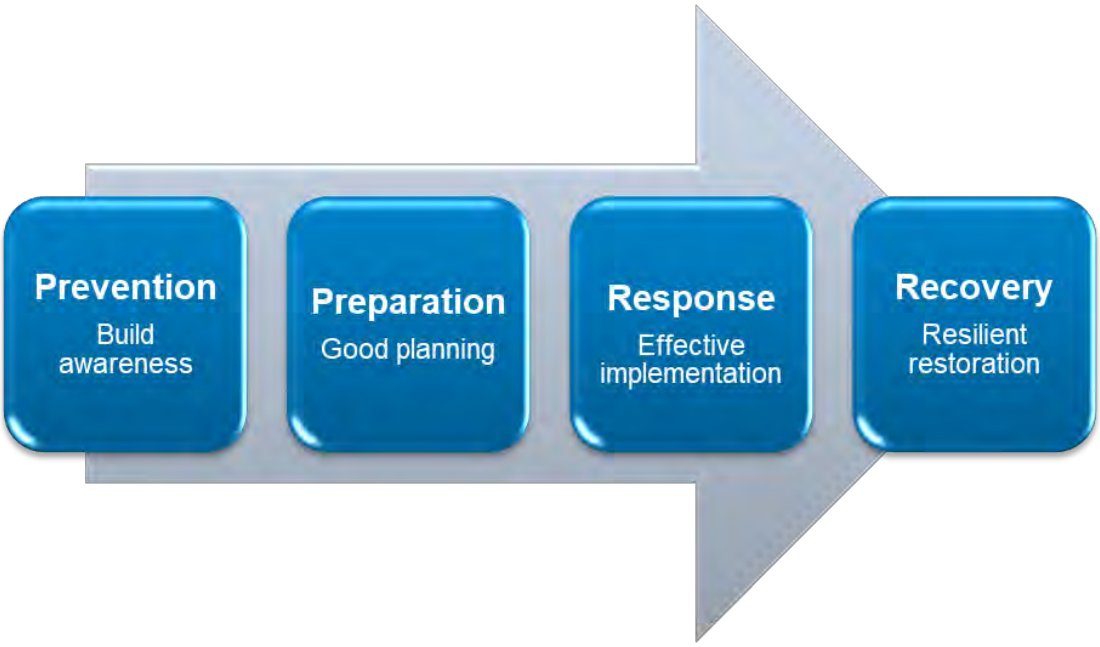

Figure 1-1 Stages of Emergency Planning

1.5 Triggers for Emergency Action

The actions contained in this CZEAS are triggered by the release of a "**Severe Weather Warning for Damaging Surf**" or "**Severe Weather Warning for Storm Tides**" from the Bureau of Meteorology (BoM). This is the same trigger as that used by the SES as a primary test of whether or not they should be involved in a potential coastal erosion (and/or inundation) event. The BoM specifies the following thresholds for issuing warnings for severe weather warnings:

- Sustained winds of gale force (63 km/h) or more
- Wind gusts of 90 km/h or more (100 km/h or more in Tasmania)
- Very heavy rain that may lead to flash flooding
- Abnormally high tides (or storm tides) expected to exceed highest astronomical tide
- Unusually large surf waves expected to cause dangerous conditions on the coast

While the threat remains, a Severe Weather Warning will usually be updated every 6 hours, however more frequent warnings may be issued if required.

New South Wales weather warnings are issued by the BoM and can be found at the following link: www.bom.gov.au/nsw/warnings/. Alternatively, the BoM weather App can show only the weather warnings that apply to the area set by the user.

In addition to the severe weather warning, location specific triggers for when coastal hazards will activate the Response Phase include when coastal hazards are impacting or expected to impact upon key sites and assets are identified in Section 3.

In practice, expert engineering judgement would need to be applied at times of storms to assess when to initiate particular actions as required. This approach relies on regular monitoring of environmental conditions and beach behaviour and seeking appropriate advice when required.

1.6 Consultation

Public authorities involved in the implementation of this CZEAS have been provided a copy of the draft CZEAS for review and comment.

2 SCOPE OF THE CZEAS

2.1 Definitions of Coastal Hazards

The CM Act identifies three types of coastal hazards that should be considered when developing a CZEAS.

- *Beach erosion*: Firstly, not all beach erosion occurring during a storm event provokes a coastal emergency response. Therefore a "beach erosion emergency" in the context of this CZEAS can be defined as an actual or imminent occurrence of a beach erosion event that occurs when wind, waves, currents are removing the sediment that comprises the foreshore and/or frontal dune system, landward of the fully accreted condition. The consequence of such erosion can create risks to public safety, and public and private assets - which requires a coordinated emergency response.
- *Coastal inundation*: Coastal inundation occurs when marine and atmospheric forces combine and raise water levels at the coast (or inside estuaries) above normal elevations causing dry land to be inundated by seawater. Coastal inundation is often associated with storms and results in elevated still water levels (storm surge), wave set-up, wave runup and over-wash flows. Storm surges and powerful waves can also penetrate estuaries giving rise to strong currents or seiching. This may result in the inundation of roads and low-lying land adjacent to estuaries.
- *Cliff instability*: This refers to a variety of geotechnical processes on coastal cliffs and bluffs, including rock fall, slumps, and landslides. Mostly driven by coastal processes such as wave undercutting and overtopping, or by differential weathering of rock layers in cliffs and bluffs or by surface and groundwater flows.

2.2 Legislative Framework and CZEAS Requirements

The scope of this CZEAS is dictated by the requirements of the CM Act and the NSW the *State Emergency and Rescue Management Act 1989* (SERM Act).

The SERM Act 1989

The SERM Act established the overarching framework for emergency management in New South Wales. The SERM Act outlines roles and responsibilities for all emergency management in the state, and specifies:

- That emergency management committees are established at the state, regional and local levels
- That emergency management plans (EMPLANs) are prepared and reviewed at the state, regional and local level
- Arrangements for controlling emergency operations, and
- Responsibilities of emergency operations controllers.

The NSW State Emergency Management Plan 2018 (EMPLAN) describes the NSW approach to emergency management, the governance and coordination arrangements, and roles and responsibilities of agencies. The plan is supported by hazard specific subplans and functional area supporting plans.

The NSW State Emergency Service (NSW SES) is the designated combat agency for management of floods, tsunami, and storms, including severe storms which cause coastal erosion. The NSW SES prepares the State Storm Plan, State Flood Plan and State Tsunami Plan, which are subplans to the EMPLAN.

The CM Act 2016

The CM Act identifies specific emergency management considerations associated with beach erosion, coastal inundation, and cliff instability. Section 15 (3) of the CM Act states that:

> *"A **coastal zone emergency action subplan** is a plan that outlines the roles and responsibilities of all public authorities (including the local council) in response to emergencies immediately preceding or during periods of **beach erosion**, **coastal inundation** or **cliff instability**, where the beach erosion, coastal inundation or cliff instability occurs through storm activity or an extreme or irregular event"*

Mandatory requirements for a CMP, including the preparation of a CZEAS where required, are identified in Part A of the NSW Coastal Management Manual (OEH, 2018a).

When preparing a CZEAS, it is crucial to consider the relationship between the coastal management framework, established by the CM Act, and the broader NSW emergency management framework. This relationship is depicted in Figure 2-1. To this end, Section 15 (4) of the CM Act states that:

> *"A coastal management program **must not** include the following—*
>
> *(a) matters dealt with in any plan made under the State Emergency and Rescue Management Act 1989 in relation to the response to emergencies"*

The purpose of this clause is to ensure that is no duplication or ambiguity of emergency response planning - and to ensure that CZAES is consistent with the emergency management provisions addressed in the state, regional and local emergency management plan (EMPLANs) and state and local flood plans (Figure 2-1).

A summary of the hazards covered in this CZEAS is provided in Table 2-1 below.

Table 2-1 Overview of Hazards Covered in this CZEAS

Hazard	Rationale
Beach Erosion	**Included in this CZEAS** – Beach erosion is defined by The City's existing erosion hazard mapping and associated Coastal Vulnerability Area (CVA). Beach erosion impacts the downstream areas of the estuaries (near the estuary entrances).
Cliff Instability	**Not addressed in this CZEAS** – The CMP study area is not impacted by any defined zone of geotechnical hazard. Therefore, as per the Section 15 (3) of the CM Act, this hazard is not addressed in this CZEAS.
Coastal Inundation	**Not addressed in this CZEAS** – As wave dominated barrier estuaries, the Woolgoolga Region Estuaries are impacted by coastal inundation. Coastal inundation of these estuaries is already addressed in the NSW Flood Plan. Therefore, as per the requirements of Section 15(4) of the CM Act, this matter is not covered under this CZEAS. Additional detail is provided in Section 2.3.

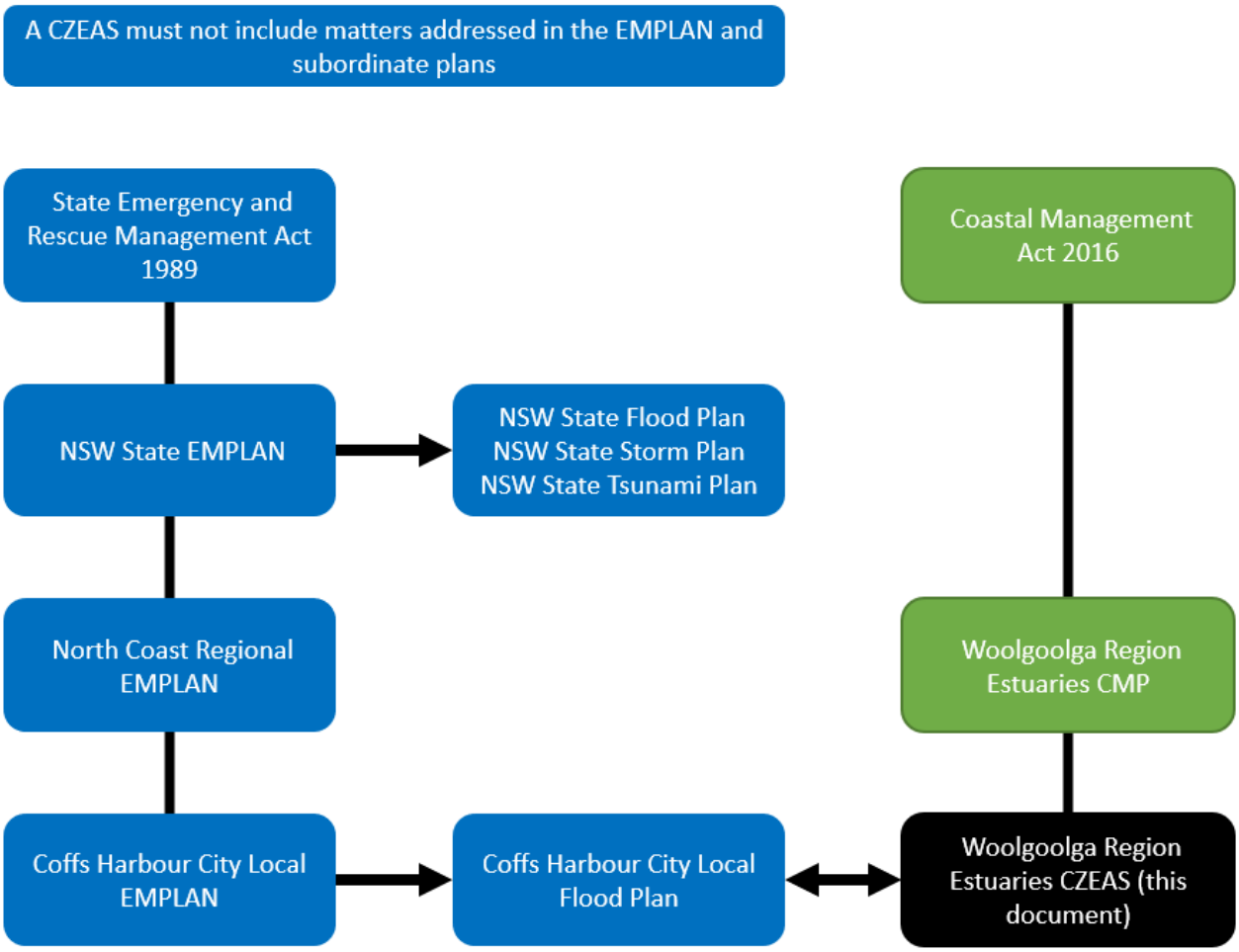

Figure 2-1 Simplified legislative framework for emergency management in NSW and its relationship with coastal management legislation and coastal management programs

2.3 Emergencies not covered in this CZEAS and Relationship to other Emergency Plans

As noted in Section 2.1, the requirements of the CM Act state, this CZEAS ***must not*** cover emergencies that are already dealt with by another plan made under the SERM Act. Subsequently, coastal inundation is not covered by this CZEAS, as coastal inundation of the Woolgoolga Region Estuaries is a matter already dealt with by the NSW Emergency Management Plan (EMPLAN), and its subordinate regional Flood Plans (state, regional, and local). These Flood Plans are described below.

The NSW Flood Plan

The NSW Flood Plan (NSW SES, 2021) sets out the state level multi-agency arrangements for the emergency management of flooding in New South Wales. The NSW Flood Plan is a sub plan to the NSW Emergency Management Plan (EMPLAN) (see Figure 2-1) and is endorsed by the NSW State Emergency Management Committee (SEMC). Section 1.4.2 of the NSW Flood Plan defines “flooding” as:

> "*a relatively high-water level which overtops the natural or artificial banks in any part of a stream, river,* ***estuary****, lake, or dam, and/or local overland flooding associated with drainage before entering a watercourse,* ***and/or coastal inundation resulting from super-elevated sea levels and/or waves (including tsunami) overtopping coastline defences***".

Subsequently, at a strategic level, the emergency management arrangements for prevention, preparation, response, and initial recovery for flooding (which includes coastal inundation) the Woolgoolga Region Estuaries are covered by the NSW Flood Plan.

The Coffs Harbour City Local Flood Plan

The Coffs Harbour City Local Flood Plan (NSW SES, 2017) is a Sub-Plan of the Coffs Harbour City Local Emergency Management Plan (EMPLAN) – see Figure 2-1. The Local Flood Plan specifically covers the local preparedness measures, the conduct of response operations, and the coordination of immediate recovery measures from flooding within the entirety of the City of Coffs Harbour Local Government Area (LGA). It covers operations for all levels of flooding within the LGA – and includes coastal inundation of the Woolgoolga Region Estuaries.

The Coffs Harbour City Local Flood Plan (NSW SES, 2017) sets out, in detail, the following emergency management procedures for:

- **Preparedness:** Development of flood intelligence and warning systems, public education, training, and resources.
- **Response:** Control arrangements, operational management, response strategies, communication systems, road and traffic control, and the management of flood rescue operations, evacuation operations, and resupply operations.
- **Recovery:** Recovery coordination and a local, regional, and state level.

For further information, please refer to the Coffs Harbour City Local Flood Plan (NSW SES, 2017) document.

Implications for the CZEAS

As part of development of this CZEAS, a thorough review of the NSW Flood Plan and the Coffs Harbour City Local Flood Plan has been undertaken to ensure adequate arrangements to manage the immediate risk of coastal inundation are in place. This review has found that:

- Coastal inundation of the Woolgoolga Region Estuaries - as defined by the CM Act and the DPE *Guideline for preparing a coastal zone emergency action subplan* (DPIE, 2019) – is consistent the definition of "Flooding" set out in the NSW Flood Plan and The Coffs Harbour City Local Flood Plan.
- Emergency management arrangements for the coastal inundation of the Woolgoolga Region Estuaries are therefore already dealt with under those Flood Plans, and therefore duplication of those arrangements within this CZEAS is neither desirable nor permissible under Section 15(4) of the CM Act.
- The triggers for emergency action for flooding (including coastal inundation) set out in those plans is consistent with the triggers set out for erosion hazard for this CZEAS.

Furthermore, Section 5.5 of DPE's *Guideline for preparing a coastal zone emergency action subplans* (DPIE, 2019) states that "*Where actions, roles or responsibilities relating to coastal emergencies are covered by the SERM Act framework, the CZEAS should refer to the relevant plan or subplan, rather than duplicate those actions*".

However, it should be noted that issues related to transient wave run-up and overtopping inundation of foreshores are intrinsically linked to coastal erosion hazards. Consequently, some emergency response actions outlined in the CZEAS also relate to wave run-up and overtopping of estuarine foreshore areas.

3 AREAS AT RISK

Open coast beach erosion has historically occurred in the downstream area of the estuary entrances, resulting in undermining and collapse of some foreshore/beach access points, inaccessibility to and from the foreshore and amenities (e.g., holiday parks, boat ramps, car parks etc). This has also resulted in public safety risks presented by a steep erosion scarps and unstable banks.

The purpose of the CZEAS is to define the response to beach erosion hazards for the study area in the present day – as defined by the City's *Immediate Unlikely* beach erosion hazard line. As assessment of at-risk assets and infrastructure has been made by overlaying the *Immediate Unlikely* hazard mapping over the City's asset database. This information is depicted in Appendix A and shows that there are no major built assets or infrastructure located within the study area that are located seawards of the *Immediate Unlikely* hazard.

This is due to the fact that the downstream (seawards) study area boundary for the Woolgoolga Region Estuaries CMP is defined by the Coastal Vulnerability Area – that is, the *2100 Unlikely* beach erosion hazard line. Subsequently, any area seawards of the *2100 Unlikely* beach erosion line will be incorporated into the Open Coast CMP study area. It is considered more appropriate that the open coast CMP consider and describe the coastal hazard management approach for open coast immediate (and longer term) hazard areas and assets affected by coastal hazards along the open coast, in a strategic and integrated manner. The only exception to this is the area at the downstream estuary entrances, where the waterway and riparian margins are included in the study area (see mapping in Appendix A).

4 CITY ROLES AND RESPONSIBILITIES

Roles and responsibilities for the City under this CZEAS are:

- The City is the designated coastal authority with responsibility for care of public land within its care, control, and management.
- The carrying out (or authorising and coordinating) of coastal emergency protective works to protect public assets from coastal erosion is The City's role if it chooses to undertake such measures.
- In practice, typical tasks that The City may undertake (where required) before, during and after a coastal erosion event (besides considering the need for and potentially implementing protective works on public land) are summarised in Section 6.
- Additional responsibilities include:
  - Assist NSW State Emergency Services (SES) with investigations and surveys of coastal erosion risk areas.
  - Liaise with the NSW SES Local Controller to provide advice regarding the need for response actions by the NSW SES such as evacuations.
  - Activate this plan.
- To Assist, at their request, the SES, and the Local Emergency Operations Controller (LEOCON) in dealing with a coastal emergency.
- Provide engineering and other resources required for response and recovery.
- Maintaining and updating the CZEAS, as necessary.
- Provide information on the status of roads and other accessways in the emergency-impacted areas.
- Provide backup radio and other communications.

It should be noted that private landholders are responsible for private land. The City does not have a positive obligation to take particular action to protect private property from erosion events. There is, however, a statutory obligation upon The City to consider any valid development application for erosion protection works which may be lodged by property owners.

5 COMMUNICATION PROTOCOLS

The City will provide information about anticipated coastal emergency events to impacted communities through the following mechanisms:

- Provide routine emergency management briefings to communicate the strategy outlined in this plan including coastal emergency triggers, areas at risk, roles and responsibilities and response action plan.
- Provide emergency management information (in the form of signage and brochures) at local community centres.
- In consultation with the SES and BoM, provide information about approaching coastal emergencies on its website.
- Coordinate with the SES to ensure residents are aware of urgent hazards during emergency events and provide assistance with door-to-door communication as necessary.
- Place barriers and sign at foreshore accessways that are closed due to coastal erosion impacts. Refer to the maps in Appendix A for locations of known foreshore accessways.
- Provide up to date information on The City's website regarding beach accessway closures and re-openings.

6 EMERGENCY RESPONSE PLAN

6.1 Emergency Response Plan Actions

The City's ability to undertake the actions identified in this CZEAS will be dependent on the availability of resources during emergency events. Actions must not put personnel staff or volunteers in danger. Emergency protection works must not be undertaken during extreme weather unless tide variations permit works to be undertaken safely.

The following tables provide a description of the actions to be undertaken during the four phases of a coastal emergency.

Table 6-1 Coastal Emergency Actions: Phase 1 – Prevention

Action	Description	Timing
1.1	■ **Inform:** Make this CZEAS available to all relevant stakeholders identified in Section 4.	Ongoing
1.2	■ **Inform:** Provide advice to the community, landholders, and the NSW SES about the potential for a coastal emergency from beach erosion - and the types of responses that are and are not permitted. ■ **Inform:** Inform the community of The City's intended erosion emergency responses under this CZEAS.	Ongoing
1.3	■ **Review:** Through the Local Emergency Management Committee (LEMC), consult with SES, DPE, Local Police, LEOCON, FRNSW to ensure this CZEAS remains consistent the relevant local, regional, and state-based emergency management plans (see Figure 2-1).	Ongoing
1.4	■ **Review:** Review and update this CZEAS in line with any future updates to the CVA Mapping or CMP implementation.	Ongoing

Table 6-2 Coastal Emergency Actions: Phase 2 – Preparation

Action	Description	Timing
2.1	■ **Prepare:** Prepare an up-to-date list of contact details for key City staff involved in coordinating actions under the CZEAS (include responsibilities of staff who prepare for, manage and coordinate recovery from an erosion emergency event) and individuals from whom The City may need advice, such as DPE staff, or with whom to integrate from other emergency sectors).	Ongoing
2.2	■ **Inform:** Inform City staff about the emergency responses within this plan and ensuring relevant personnel have the copies of the plan.	Ongoing
2.3	■ **Planning:** Ensure signage to close foreshore accessways and signage warning pedestrians of coastal inundation are available for use during coastal emergencies.	Ongoing

Action	Description	Timing
2.4	■ **Planning:** Ensure appropriate plant, equipment and experienced personnel are available for protection of assets at risk.	Ongoing
2.5	■ **Monitoring:** Undertake regular monitoring of coastal conditions, tide, wave height and weather condition forecasts for indication of approaching coastal hazards.	Ongoing
2.6	■ **Monitoring:** Monitor events and triggers that will activate the Response Phase.	Ongoing

Table 6-3 Coastal Emergency Actions: Phase 3 – Response

Action	Description	Timing / Trigger
3.1	■ **Communication:** In conjunction with SES, advise landholders, residents, SLSCs, public authorities and other organisations that a coastal emergency is occurring. Release media information as necessary to keep community informed.	Response Phase Activated
3.2	■ **Preparation:** No actions undertaken should impede, conflict, or overlap with the actions of agencies under the SERM Act unless there is prior agreement between the relevant parties.	Response Phase Activated
3.2	■ **Preparation:** Place appropriate equipment on standby (back up radios, signs, and barricades etc.).	Response Phase Activated
3.3	■ **Closure:** Close off access to potentially affected sites, erect barricades, and signs. Refer to Appendix A for locations of foreshore accessways.	Act if foreshore access is unsafe due to: ■ Damaged accessway steps, slats, platforms, posts etc. ■ A vertical erosion escarpment of greater than 0.5 m in height. ■ Dangerous waves or excessive wave run-up progressing into accessways ■ Otherwise deemed unsafe.

Action	Description	Timing / Trigger
3.4	■ **Closure:** Close roads and affected areas and erect barricades and signs, as necessary. Refer to Appendix A for locations of public roads.	Act if roads or vehicle access tracks are unsafe due to: ■ Coastal erosion resulting in instability or undermining ■ Wave run-up and overtopping likely to cause or likely to cause inundation of areas.
3.5	■ **Closure:** Close public foreshore areas and erect barricades and signs, as necessary. Refer to Appendix A for locations of foreshore areas.	Act if public foreshore reserves areas are unsafe due to: ■ Coastal erosion resulting in instability or undermining ■ Wave run-up and overtopping likely to cause or likely to cause inundation of areas with public access.
3.6	■ **Respond:** Seek specialist coastal engineering advice where required. ■ **Respond:** Seek advice from DPE staff as required.	As required.

Table 6-4 Coastal Emergency Actions: Phase 4 – Recovery

Action	Description	Timing / Trigger
4.1	■ **Inspection:** Conduct/ organise detailed inspections of sites potentially affected by beach erosion and coastal inundation and assess damage to assets and the natural environment. Assess the structural integrity of any damaged infrastructure. Seek professional advice as required.	■ Following an emergency event. Once it is safe to do so.
4.2	■ **Remediation:** Where beach erosion has caused a large escarpment/ drop off (>0.5 m) that presents a risk to assets or has created unsafe access, The City will take action to make the area safe.	■ Following an emergency event. Once it is safe to do so.
4.3	■ **Restoration:** Arrange for permanent repair/removal of damaged assets or the rehabilitation of the environment.	■ Following an emergency event. Once it is safe to do so.
4.4	■ **Remove:** Removal of beach/storm debris that poses high risk to public safety.	■ Following an emergency event. Once it is safe to do so.

Action	Description	Timing / Trigger
4.5	■ **Record:** Record coastal emergency impacts and response actions. Take remedial action where necessary. Maintaining photographic and written records of events and decision-making processes.	■ Following an emergency event. Once it is safe to do so.
4.6	■ **Review:** Critically review this CZEAS and update as necessary to improve the future effectiveness of coastal emergency response actions.	■ Within 2 months of plan activation, or as necessary.

6.2 Review of this CZEAS

As part of the ongoing review and evaluation of this CZEAS, and in an effort to maintain effective emergency response actions, the City is to record the following details after each instance that the plan is activated.

- Details of any erosion, and wave run-up inundation - and the weather conditions under which they were caused including photographs where possible
- The location of assets and infrastructure that were damaged and details of the extent of the damage.
- Details of any emergency protection works undertaken including the cost and the installation date.
- Review and update (if required) the emergency response action plan in consultation with the SES and any other relevant agencies.

7 APPROVALS PATHWAYS

The NSW coastal management framework requires all proposals for coastal protection works to be considered strategically through the development of a CMP. Public authorities can carry out emergency coastal protection works, as exempt development, where these works are in accordance with a CZAES. However, it should be noted that no coastal protection works are provided for under this CZEAS.

8 REFERENCES

DPIE. (2019). *Guideline for preparing a coastal zone emergency action subplan.*

NSW SES. (2017). *Coffs Harbour Local Flood Plan.* Retrieved from https://www.ses.nsw.gov.au/media/1675/plan-coffs-harbour-city-lfp-mar-2015-updated.pdf

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OEH. (2018a). *NSW Coastal Management Manual Part A: Introduction and mandatory requirements for a coastal management program.* Sydney: Office of Environment and Heritage.

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APPENDIX A
CZEAS MAPPING

Data sources:
Contains Vicmap Information © State of Victoria 2021
Imagery date:

0 100 200 m

Hazard Zones and At-Risk Assets

Figure A.1 Darkum Creek Entrance Area

023-04-20T15:17:36.913

Data sources:

Contains NSW SixMaps Information © State of NSW

0 100 200 m

Hazard Zones and At-Risk Assets

Figure A.2 Woolgoolga Lake Entrance Area

023-04-20T15:17:57.884

Legend

- Access Tracks
- Activity Point
- Boating Facility
- Recreational Fixture
- Recreational Asset
- Buildings
- Roads
- CMP Study Area
- Beach Erosion Hazard - Immediate (Unlikely)

South St

Hearnes Lake Rd

Data sources:
Contains Vicmap Information © State of Victoria 2021
Imagery date:

0 100 200 m

Hazard Zones and At-Risk Assets
Figure A.3 Willis Creek and Hearnes Lake Entrance Areas

023-04-20T15:17:11.216

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