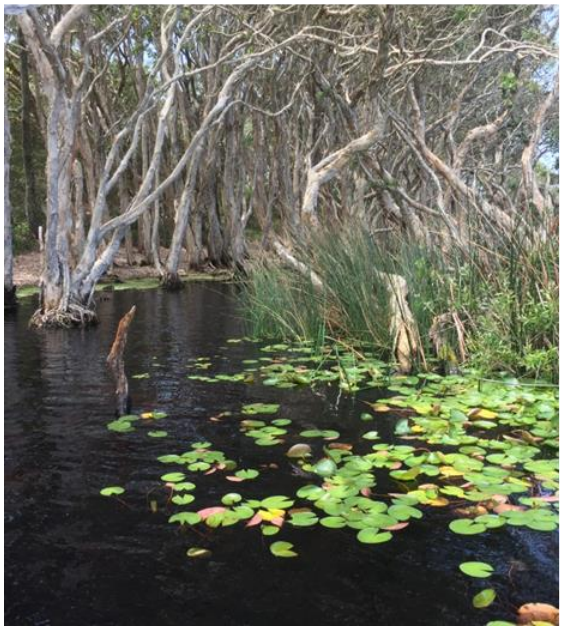
# Lake Ainsworth

# Coastal Management Program



**Final CMP**

**Disclaimer:**

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Front cover photos: Aerial view of Lake Ainsworth, fringing vegetation and sailing boats on the lake

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**18-009 LAKE AINSWORTH COASTAL MANAGEMENT PROGRAM**

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# EXECUTIVE SUMMARY

Lake Ainsworth borders the northern end of Lennox Head in Ballina Shire (Northern NSW) and covers an area of approximately 13 ha. The waterbody is surrounded by residential areas and holiday park facilities to the south, barrier dunes and Seven Mile Beach to the east, Newrybar wetlands and coastal heath to the west and north and sport and recreation facilities to the northeast. The study area for this Coastal Management Program (CMP) incorporates both the surface water and groundwater catchments of Lake Ainsworth covering an area of approximately 87 ha.

This CMP for Lake Ainsworth sets the long-term strategy for the coordinated management of the lake with a focus on achieving the objects of the *Coastal Management Act 2016* (*CM Act).* This CMP supersedes the current *Lake Ainsworth Management Plan* (GeoLINK, 2002).

This CMP has been developed in accordance with Stages 1 to 4 of the five-stage process for developing and implementing a CMP, as detailed in the Coastal Management Manual (OEH, 2018). The completed stages supporting this CMP include the preparation of:

- *Stage 1 Scoping Study* (Hydrosphere Consulting, 2018) which reviewed the status of current issues and management and identifies the focus of the new CMP.
- *Stage 2 Vulnerabilities and Opportunities Study* (Hydrosphere Consulting, 2019a) incorporating detailed studies of the lake to determine and assess coastal risks, vulnerabilities and opportunities and inform future management.
- *Stage 3 Management Options Study* (Hydrosphere Consulting, 2019b) that identified and assessed actions to address coastal management issues in an integrated and strategic manner consistent with provisions in Section 14 and 15 of the *CM Act*.

Lake Ainsworth is a freshwater coastal dune window lake characterised by ‘tea’ coloured water and has long been regarded as an important community asset and tourism drawcard. The lake is utilised for a variety of water and shore-based activities including swimming, paddling and picnicking and is also an important educational resource with a rich cultural history.

Lake Ainsworth was in important ceremonial location and campsite for local Aboriginal people. The Ballina-Lennox Head district retains a strong cultural identity with the dialect subgroup known as the *Nyangbul* People, a sub-group of the broader-based *Bundjalung* people (Remnant Archaeology, 2017). The Broad-leaved Paperbark trees bordering the lake have been identified as culturally significant ‘Song Trees’ by local Aboriginal representatives, and are an iconic feature of the lake, providing shade, visual amenity and habitat for wildlife.

Lake Ainsworth is a unique and sensitive ecosystem providing significant ecological value within the local area and is home to a wide variety of plants and animals. Aquatic plants provide important ecosystem functions in the form of nutrient cycling, nutrient uptake, bank stabilisation, runoff filtration as well as providing food and habitat for aquatic fauna. The variety of habitats within the Lake Ainsworth catchment and the presence of both fresh and salt water in close proximity result in a high diversity of birdlife. An estimated 115 different species of birds have been identified in and adjacent to Lake Ainsworth including a number of migratory, vulnerable, threatened, endangered or critically endangered species under the NSW *Biodiversity Conservation Act 2016* or the Commonwealth *Environment Protection and Biodiversity Act, 1999* (EPBC Act) (BES, 2016; BES, 2017; GeoLINK, 2002; GeoLINK, 2017). Two endangered ecological communities (EECs) listed under the *Biodiversity Conservation Act 2016* have been recorded as occurring within the Lake Ainsworth catchment area: Littoral Rainforest located north east of the Sport and Recreation Centre and Swamp Sclerophyll Forest on coastal floodplains which surrounds the Lake and low-lying area west of the Lake Ainsworth Sport and Recreation Centre.

Preparation of this CMP has included consultation with community and agency stakeholders. This consultation assisted in the understanding of key concerns and issues, priorities for management and development of local management objectives to guide the CMP and the long-term vision for the lake:

> ***"A scenic, healthy lake and surrounds for safe recreation, environmental values, community and culture."***

The health of the lake is of key importance to the community as it significantly affects all other aspects including community uses, cultural significance, as well as having economic flow-on effects for the community.

The key management issues currently affecting the health and amenity of Lake Ainsworth include:

- Blue green algae outbreaks – these have occurred periodically for many years, with records of serious outbreaks dating back to the 1980s. Blue green algae impacts on ecological health and recreational use through swimming closures due to public health risks and this is regarded as the highest priority for management by the community.
- Sediment quality – a survey of lake sediments in 2018 has confirmed the continued presence of a central basin of organic-rich muds in the lake which are acidic, oxygen-deficient, high in organic carbon and nutrient-rich. Testing has also indicated that levels of lead and mercury in sediments exceed ANZECC sediment quality guidelines at several locations. The internal cycling of nutrients and particularly phosphorus from lake sediments was confirmed during Stage 2 as the primary factor exacerbating blooms of blue green algae.
- Sunscreen has been identified as a potentially significant pollutant source contributing to frequently observed oily slicks on the water surface during peak use times, and chemical compounds known to effect ecological health. The potential for sunscreen to contribute to the nutrient load of the lake has also been identified which may add to algal bloom issues.
- In 2018, Beachwatch graded three of the four lake swimming sites as 'poor' in terms of contamination with faecal material. Further work is currently underway to confirm the sources of contamination.
- Foreshore erosion is also a key concern for the community with banks actively eroding which is exacerbated by stormwater flows, water level changes, wind and wave action and high levels of pedestrian access. A number of safety hazards have been identified in the vicinity of access points to the lake including potential for falls and trips, exposed roots and uneven ground.
- Litter can impact amenity and ecological values of the lake particularly during peak visitation periods.
- Concerns have been raised regarding dogs in the lake including faeces being left behind which may contribute to water quality decline and microbiological risk to human health as well as impacts of dogs on native wildlife (e.g. disturbance, injury etc.).
- Parking at the lake during peak times (i.e. school holidays, public holidays and long weekends) has been an issue for many decades and with increasing population and tourism pressures into the future, this impact is likely to increase.
- Overcrowding and overuse of the lake during peak holiday periods places high pressure on facilities, parking, recreational amenity and environmental values. Recent (2017) estimates during peak times reveal that visitor numbers now exceed 10 times the estimated carrying capacity of the lake. The carrying capacity represents the maximum number of visitors the area can accommodate without there being excessive deterioration of the environment or declining visitor satisfaction. One community member summed it up saying the lake is being "*loved to death".*
- Increasing use of the relatively 'untouched' western side of the lake was raised as a key concern for many stakeholders.
- Ocean shoreline recession along Seven Mile Beach is a key risk for the management of Lake Ainsworth. Coastal hazard predictions show the potential for ocean breakthrough to the lake within a

50-year timeframe. Any connection with the ocean is likely to have significant implications for the ecology and public usage of the lake.

- Future lake flooding events may increase with predicted climate change impacts (both in frequency and magnitude).
- There is a general lack of knowledge and understanding of the cultural significance of the lake and many community members have expressed a strong desire to know more about the indigenous history and significance of the lake.
- There are a number of exotic aquatic weeds present within Lake Ainsworth which periodically create nuisance conditions impacting amenity and lake uses.
- A number of exotic aquatic fauna species have been identified in the lake, including typical aquarium species that may have been dumped in the lake, Cane toad and the non-endemic and invasive Redclaw Crayfish.
- The impact of increasing traffic and traffic speed along Camp Drewe Road and concerns about increasing road kill have been raised by the community.
- Riparian vegetation condition varies significantly around the lake with many areas experiencing disturbance through exotic species, a high level of pedestrian traffic, bank erosion, undercutting and exposure of tree roots including culturally significant 'Song Trees' (Broad Leaved Paperbarks) along the foreshore.
- There are also several bare ground areas along foreshores where grass has died, particularly in high use zones in the south-eastern corner, which affects recreational amenity and increases erosion impacts.

This CMP provides a management framework that aims to protect the social, ecological and cultural values associated with the lake and to manage the often conflicting desire for protection of ecological values as well as optimising recreational opportunities. The approach is consistent with the long-term vision, the management objectives and the locally derived community values for the lake. The CMP recognises that the lake has suffered impacts from past and current human use and faces current and future pressures including population increases and natural influences such as flooding, sea level rise and climate change.

The CMP designates general management/use zones around the lake. This approach recognises the key processes influencing the ecological health, recreational amenity and cultural values of the lake as well as key pressures to be faced in the future. Sitting underneath this overall approach are a suite of coastal planning and management actions that have been developed and prioritised based on the assessed risk of the threats to the lake. Actions consist of a combination of studies, investigations and on-ground works and were selected to address the key risks to the lake. Actions are based on professional consideration of the legal, technical and engineering feasibility, the economic viability and the acceptability of actions to the community and stakeholders. Additional management requirements identified to protect the lake from coastal hazard impacts (e.g. coastal recession, oceanic break-through and wave run-up and dune overtopping) have been discussed and will be considered separately in the development of the future Ballina Coastline CMP which will replace the certified the *Ballina coastline CZMP* (GeoLINK, 2016).

A Business Plan has been developed for the CMP which outlines the key components of the funding strategy for the CMP, including the cost of proposed actions, proposed cost-sharing arrangements and other potential funding mechanisms. The CMP actions are expected to be funded through Ballina Shire Council (BSC) and state government contributions, monetary grants and volunteer works by community members and organisations. Management actions have been developed for a ten-year period and have been aligned with Council's four-year Delivery Programs (DP) under the NSW Integrated Planning and Reporting (IP&R) Framework. This CMP and the progress of the management actions will be reviewed to ensure the actions remain relevant and the implementation of the plan is being achieved.

# ACKNOWLEDGEMENT TO COUNTRY

*Ballina Shire Council acknowledges that the traditional Aboriginal custodians of this Country are the Nyangbul People (also spelt Nhangbul), part of the greater regional Bundjalung-Yugambeh language chain and part of the oldest surviving continuous culture in the world.*

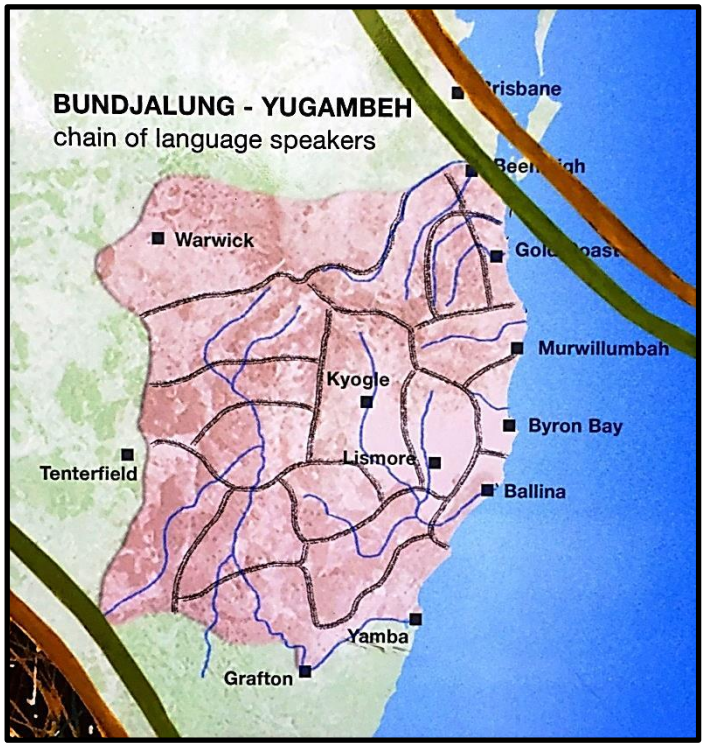


**Plate 1: The Bundjalung-Yugambeh region (sign located at Angels Beach Ballina)**

# CONTENTS

## FIGURES



## PLATES



## TABLES

# 1. INTRODUCTION

## 1.1 Purpose and scope

The purpose of the Lake Ainsworth Coastal Management Program (CMP) is to set the long-term strategy for the coordinated management of the lake with a focus on achieving the objects of the *CM Act.*

This CMP incorporates management actions and strategies to address key threats and support a diversity of uses at the lake into the future. This CMP considers the range of timeframes (immediate, 20 years, 50 years, 100 years) where appropriate as required by the *CM Act*. Management actions have been developed to balance and manage uses so that they are compatible with the environmental, social and economic values of the lake with reference to a ten-year management timeframe reflecting the implementation phase of the CMP. Longer-term pressures such as climate change and sea level rise have been considered in the formulation of management actions to ensure resilience against future threats and the conservation of the values of the lake for future generations.

This CMP has been developed in accordance with Stages 1 to 4 of the five-stage process for developing and implementing a CMP, as detailed in the Coastal Management Manual (OEH, 2018). The completed stages supporting this CMP include the preparation of:

- *Stage 1 Scoping Study* (Hydrosphere Consulting, 2018) which reviewed the status of current issues and management and identifies the focus of the new CMP.
- *Stage 2 Vulnerabilities and Opportunities Study* (Hydrosphere Consulting, 2019a) incorporating detailed studies of the lake to determine and assess coastal risks, vulnerabilities and opportunities and inform future management.
- *Stage 3 Management Options Study* (Hydrosphere Consulting, 2019b) that identified and assessed actions to address coastal management issues in an integrated and strategic manner consistent with provisions in Section 14 and 15 of the *CM Act*.

## 1.2 Area covered by this CMP

Lake Ainsworth is a freshwater coastal dune window lake with naturally acidic (pH 5-7) tannin-stained waters located in the Northern Rivers region of NSW within the Ballina Local Government Area (LGA) (Figure 1). The lake borders the northern end of Lennox Head and covers an area of approximately 13 ha. The waterbody is surrounded by residential areas and holiday park facilities to the south, barrier dunes and Seven Mile Beach to the east, Newrybar wetlands to the west and sport and recreation facilities to the north. The bordering barrier dunes to the east currently prevent ocean water intrusion into the lake.

The boundary of the Lake Ainsworth CMP study area follows the catchment of Lake Ainsworth covering an area of approximately 87 ha (Figure 1). The catchment was defined by the previous Lake Ainsworth Processes Study (AWACS, 1996) and approximates both the surface water and groundwater catchments of the lake, which are the major factors affecting ecological processes and function in this waterbody. While the CMP does consider the impact of coastal hazards from the adjacent coastline, the study area does not encompass the open coast and Seven Mile Beach as this area is dealt with separately in the *Ballina Coastline CZMP* (GeoLINK, 2016) and will be incorporated into the future Ballina Coastline CMP.

This relatively small catchment area contains no major tributaries and is comprised of relatively low relief topography. The majority of the study area is zoned as ‘Deferred Matter’ under the *Ballina Local Environmental Plan* (Ballina LEP 2012) therefore the Ballina LEP 1987 still applies with these areas zoned for ‘Environmental Protection’. The catchment contains pockets of recreation and accommodation areas (Sport and Recreation Centre and Camp Drewe) to the north, picnic areas along the eastern and southern foreshores and a holiday park comprising cabins and campsites to the south. The vegetation surrounding

these areas consists of heathlands and melaleuca wetlands. Natural leaching of humic acids and tannins from these areas enter the lake through groundwater flows which contribute to the characteristic ‘tea’ colour of the water. The catchment area extends predominantly north, parallel to the coastline and away from Lennox Head, and is bordered by a north-south ridge line to the west separating the lake catchment and the Newrybar wetlands.

The Lake Ainsworth catchment area is a popular destination for visitors and locals, providing a natural resource for undertaking various recreational activities such a swimming, kayaking, sailing, fishing, bushwalking, picnics, BBQs, dog walking and bird watching. The waterbody is classed as navigable water under the *Marine Safety Act 1998,* however it’s primarily used by passive craft due to the size, depth and the lack of a public boat ramp. The lake is considered a significant natural icon and drawcard to the area which contributes to the local economy.

Lake Ainsworth was a significant ceremonial location and campsite for local Aboriginal people. The Ballina-Lennox Head district retains a strong cultural identity with the dialect subgroup known as the *Nyangbul* People, a sub-group of the broader-based *Bundjalung* people (Remnant Archaeology, 2017).

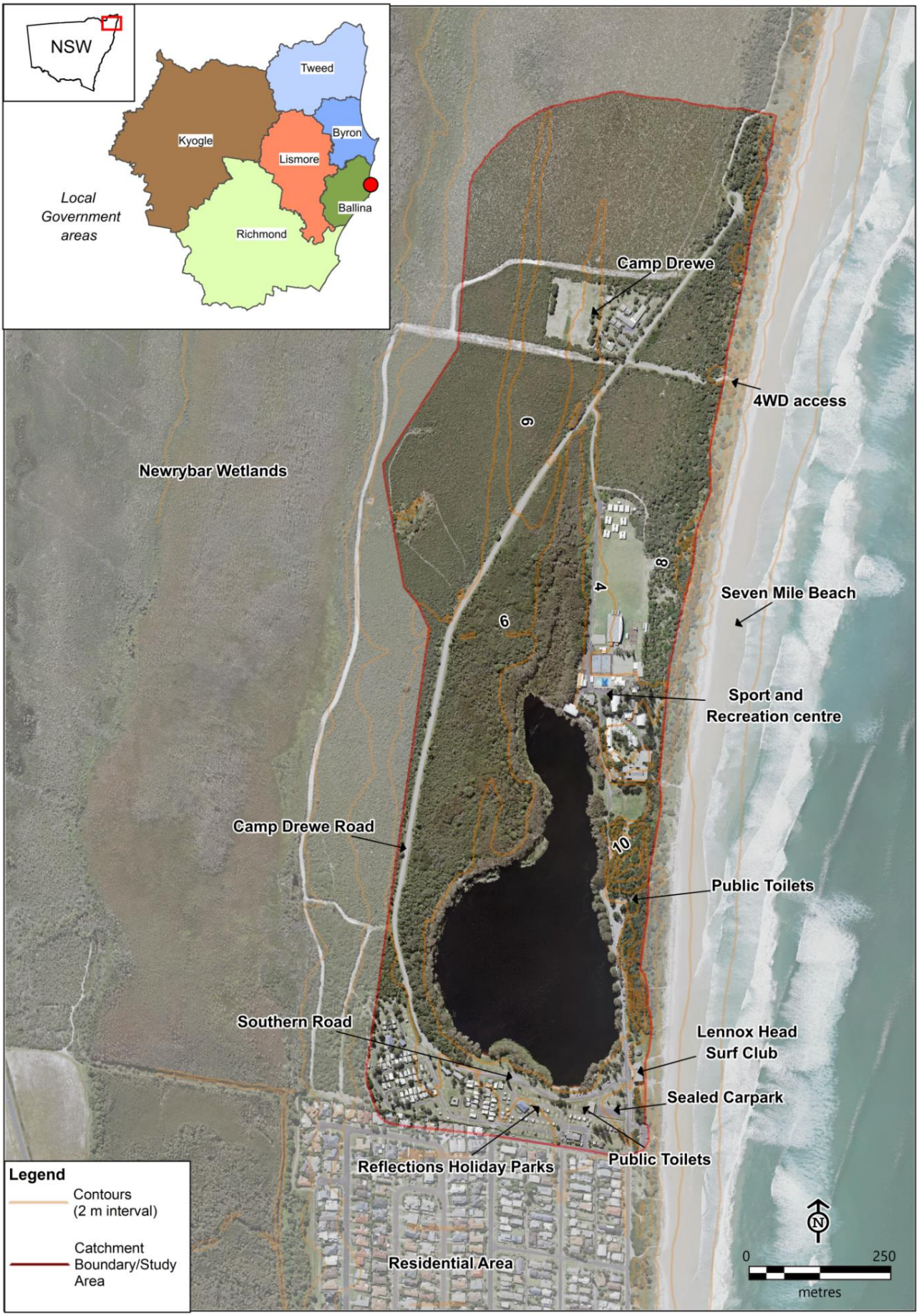


**Figure 1: Lake Ainsworth CMP study area**

### 1.2.1 Social setting, projected population growth and demographic changes

Lake Ainsworth is located in Lennox Head on the far north coast of NSW within the Ballina Shire Council (BSC) area. The area is an attractive place to live and visit but is facing major demographic changes due to population growth and increasing tourism. Population forecasts (Table 1) show an increase of 17.6% (7,668 people) between 2018 and 2036 in the Ballina Shire. Lennox Head is predicted to be one of the fastest growing areas with an almost 30% increase in population forecast over this time, primarily due to the high number of greenfield growth areas (.id, 2017). Tourism is a major industry and visitor numbers to the region are growing with a 34% increase in 2018 visitor numbers compared to 2010 (Destination NSW, 2018). The *Far North Coast Regional Strategy* (DoP, 2006) recognises that population growth and tourism will put increased pressure on natural assets such as Lake Ainsworth and the protection of these highly valued environments is a key challenge for the region.

**Table 1: Ballina Shire population forecasts**

| Location | 2018 | 2036 | Increase |
|---|---|---|---|
| Ballina Shire | 43,570 | 51,238 | 17.6% |
| Lennox Head | 6,643 | 8,613 | 29.6% |

Source: (.id, 2017)

### 1.2.2 Existing management arrangements

The Lake Ainsworth catchment area is comprised mainly of Crown land managed by different appointed trustees (land managers). Figure 9, Section 8 shows the management arrangements for the catchment area separated into the following areas and management categories:

- Land surrounding the eastern, southern and western shore of the lake is Crown land managed by Council. This also includes the land containing the Lennox Head - Alstonville Surf Lifesaving Club (SLSC) and Seven Mile Beach.
- Land south of the lake is Crown land managed by the NSW Crown Holiday Parks Land Manager (trading as Reflections).
- The northern section of the lake waterbody and surrounding reserves is also Crown land managed by the NSW Office of Sport. This area contains the Lake Ainsworth Sport and Recreation Centre.
- The southern two thirds of the lake is submerged Crown land with no appointed Crown land manager – therefore it is managed by DPIE - Crown Lands.
- A small section of submerged Crown land in the lake is used for the aerator program - held under licence by Council.
- North of the area managed by NSW Office of Sport is Camp Drewe on Crown land leased to the Presbyterian Church.
- A Crown road parcel runs along the southern boundary of Camp Drewe.
- The far northern reaches of the catchment contain freehold land managed by Jali Local Aboriginal Land Council (LALC).
- The small section of land at the southern reaches of the catchment is freehold residential land.

There are numerous management programs being implemented by BSC, government agencies, statutory bodies and community groups in parallel with the preparation of the Lake Ainsworth CMP (refer Section 1.6 for details). Many of these initiatives are related to the management of the water quality of Lake Ainsworth, surrounding infrastructure, vegetation, dune stability and foreshore area management. At the time of writing this CMP, BSC are currently undertaking significant foreshore improvement works along the eastern and

southern sides of the lake including closure of the eastern road, erosion rehabilitation, and provision of pathways, picnic tables, barbeques, parking and stormwater treatment devices. This CMP complements and informs existing and proposed plans of management and updates and improves various management strategies with current knowledge and understanding of issues.

### 1.2.3 Projected future use of land within the study area

The projected future use of coastal land within the Lake Ainsworth study area is not expected to change in any substantial way in the foreseeable future. The majority (approx. 88%) of land in the study area is Crown land zoned for Environmental Protection 7(f) (coastal lands) under the Ballina LEP. A small section in the northwest corner of the study area (approx. 7%) is freehold land owned by JALI LALC, also zoned for Environmental Protection 7(l) (habitat) under the Ballina LEP. The Reflections Holiday Park occupies approx. 5% of the study area along the southern shore of the lake and is Crown land zoned for Public Recreation RE1 under the Ballina LEP. A very small section of developed freehold land (<1% of study area) exists along the southern boundary of the study area and is zoned as Low Density (R2) and Medium Density (R3) Residential under the Ballina LEP. Existing facilities and infrastructure are likely to be updated and/or replaced over time, however further development of the catchment areas beyond existing is not anticipated.

While future landuse change is not expected within the Lake Ainsworth catchment, urban areas of Lennox Head are expected to grow significantly in the next two decades (refer Section 1.2.1). Maintaining Lake Ainsworth as a natural area will become increasingly important to balance urban expansion as well as provide environmental protection areas and low-key recreational spaces for public amenity and recreation.

## 1.3 Vision, objectives and strategic direction

### 1.3.1 The vision for Lake Ainsworth

The long-term vision for the lake, the community values, and specific local objectives relevant to those values are based on the following sources of information:

- The values, threats and management priorities identified in the *Stage 1 Scoping Study* (Hydrosphere Consulting 2018) and *Stage 2 Vulnerabilities and Opportunities Study* (Hydrosphere Consulting, 2019a) incorporating the findings of stakeholder consultation.
- The most important attributes for Lake Ainsworth nominated by the community and over 275 unique vision statements provided by the community in the Lake Ainsworth Community Survey reported in *Stage 2 Vulnerabilities and Opportunities Study* (Hydrosphere Consulting, 2019a).
- A Lake Ainsworth CMP Steering Committee Vision Workshop undertaken in June 2019.
- The relevant management objectives set out in the *CM Act* and the objects of the *Marine Estate Management Act 2014*.
- The objectives of the *BSC Community Strategic Plan 2018 - 2028*.

The long-term vision for Lake Ainsworth is shown in Plate 2.


**Plate 2: The long-term vision for Lake Ainsworth**

### 1.3.2 Lake Ainsworth community values and local management objectives

The key values of the estuary held by the local community, along with specific local objectives determined for those values are provided in Table 2. The alignment of these objectives with the objects of CM Act and the objects of the *Marine Estate Management Act 2014* is identified in Appendix 1.

**Table 2: Lake Ainsworth community values and local management objectives**

| Values | Lake Ainsworth local management objectives |
|---|---|
| *Environmental Values* | |
| Water quality | 1. to improve and maintain water quality and ecosystem health of the lake and surrounding habitats.<br>2. to reduce threats and improve the resilience of the lake to all current and future threats. |
| Natural habitats and biodiversity | 3. to protect and enhance the coastal environmental values and natural processes of the lake and enhance natural character, scenic value, biological diversity and ecosystem integrity.<br>4. to encourage and support plans and strategies to improve the health and resilience of the lake and catchment area. |
| *Recreational, Cultural and Community Values* | |
| Scenic quality and amenity | 5. to protect and enhance the recreational, scenic, social and cultural values of the catchment area.<br>(Also linked to objectives 1-4) |
| Public access to and use of the lake and foreshore | 6. to improve and maintain public access and safety, facilities and infrastructure within the catchment area. |

| Values | Lake Ainsworth local management objectives |
|---|---|
| Education, engagement and public opinion | 7. to actively engage with the public to achieve greater awareness, education and understanding of management issues and actions.<br>8. to support public participation in the coastal management and planning process. |
| Aboriginal cultural heritage and practice | 9. to understand, protect and respect the aboriginal heritage value of the lake including aboriginal peoples' spiritual, social, customary and economic use of the catchment area. |
| Coastal risk and adaption to climate change | 10. Identify coastal hazard risks and develop actions that increase the adaptive capacity of land managers, the community and natural systems to the predicted impacts of climate change, including increased storm intensity and sea level rise. |
| *Economic Values* | |
| Local economy, jobs and prosperity | 11. to support integrated and co-ordinated coastal planning, management and reporting (achieving above objectives will contribute to local economic values through enhanced tourism and associated business activity). |

### 1.3.3 Coastal Management Area objectives

The Lake Ainsworth CMP encompasses all four coastal management areas defined in the CM Act. Mapping of coastal management areas has been completed by DPE (2017) and is shown in Section 8. The CMP provides a management framework to guide coastal management and planning for Lake Ainsworth, in response to the relevant objectives for each coastal management area from the *CM Act* (Table 3).

**Table 3: Coastal Management Area objectives adopted from the *Coastal Management Act, 2016***

| Coastal Management Areas | Coastal Management Area objectives |
|---|---|
| CMA1 – Coastal Wetlands and Littoral Rainforests[1] | 1. To protect coastal wetlands and littoral rainforests in their natural state, including their biological diversity and ecosystem integrity.<br>2. To promote the rehabilitation and restoration of degraded coastal wetlands and littoral rainforests.<br>3. To improve the resilience of coastal wetlands and littoral rainforests to the impacts of climate change, including opportunities for migration.<br>4. To support the social and cultural values of coastal wetlands and littoral rainforests.<br>5. To promote the objectives of State policies and programs for wetlands or littoral rainforest management. |
| CMA2 – Coastal Vulnerability Area | 6. Managing current and future risks from foreshore/bank erosion, coastal lake instability and tidal inundation.<br>7. Maintaining public access, use and amenity of foreshores.<br>8. Encourage land use that reduces exposure to coastal hazards over time.<br>9. Avoiding adverse impacts on adjoining land, resources and assets.<br>10. Maintaining essential infrastructure.<br>11. Improving the resilience of coastal communities. |

| Coastal Management Areas | Coastal Management Area objectives |
|---|---|
| CMA 3 – Coastal Environment Area | 12. To protect and enhance the coastal environmental values and natural processes of the estuaries.<br>13. To enhance natural character, scenic value, biological diversity and ecosystem integrity.<br>14. To reduce threats to, and improve the resilience of the estuaries.<br>15. To maintain and improve water quality and estuary health.<br>16. To maintain the presence of natural features of foreshores.<br>17. To maintain and, where practicable, improve public access, amenity and use of estuary foreshores. |
| CMA 4 – Coastal Use Area | 18. To support sustainable coastal economies and ecologically sustainable development.<br>19. To protect and enhance the scenic, social and cultural values of the study area through:<br>• appropriate type, size and scale of development.<br>• providing adequate public open space and associated public infrastructure.<br>• avoiding adverse impacts of development on cultural and built environment heritage. |

1. Objectives also apply to the 'proximity area' surrounding the vegetated area, to ensure that development near the coastal wetlands and littoral rainforest considers downstream effects.

## 1.4 Key stakeholders, their interests and issues

An overview of key stakeholders, their interests and issues, and how they have been consulted as part of the CMP is provided in the following sections.

### 1.4.1 Land managers and government agencies

**Ballina Shire Council (BSC)**

BSC is responsible for the management of the southern, eastern and western foreshore areas of the Lake and adjoining coastal lands to the east. Council also operate the aerator in the lake and conducts regular water quality monitoring and management of blue green algae alerts. BSC received funding through the 2016/17 NSW Government Coastal and Estuary Grants Program to prepare the Lake Ainsworth CMP and is overseeing all aspects of the CMP development.

**Department of Planning, Industry and Environment - Environment, Energy and Science – Coast and Estuaries (EES – Coast and Estuaries)**

EES – Coast and Estuaries works with local councils and communities to maintain or improve the health of estuaries/lakes and enhance associated recreational experiences in NSW. EES – Coast and Estuaries also works closely with local councils and communities to reduce threats from flooding and coastal storms and ensures that people in NSW are well informed about these risks and better equipped to adapt to climate change. EES – Coast and Estuaries has provided funding to Council for the development and preparation of the Lake Ainsworth CMP.

**Department of Planning, Industry and Environment (DPIE - Crown Lands)**

DPIE - Crown Lands is directly responsible for management of the submerged Crown land in the southern portion of the lake. The department is also responsible for managing a Crown reserve to the far north of the lake's catchment. DPIE – Crown Lands' appoints Crown land managers and ensures that Crown land is administered and managed in accordance with the *Crown Land Management Act 2016*. The actions in the CMP that are located on or affect Crown land that is administered by DPIE - Crown Lands, will require authorisations under the *Crown Land Management Act 2016* e.g. leases and licences.

**NSW Office of Sport**

NSW Office of Sport is responsible for the management of the northern portion of the water body, foreshores areas and surrounds to the east, west and north. Lake Ainsworth Sport and Recreation Centre occupies a large area immediately north of the lake and water-based activities on the lake comprise a key element of the Centre's activities. Providing safe access to the water is a key requirement for the Centre which is currently impacted by bank erosion and lake closures due to blue green algae blooms.

**NSW Crown Holiday Parks Land Manager**

Reflections Holiday Park Lennox Head is situated south of the lake. The park offers a range of accommodation options including unpowered and powered sites and lakeside cabins and the natural beauty of the lake and surrounds is a key drawcard for tourists. Water quality and safe water access are key concerns for the Park.

**Jali LALC**

Jali LALC is a community body constituted through the NSW *Aboriginal Land Rights Act 1983*. It represents Aboriginal people from Byron Bay to Evans Head to West Alstonville and offers a range of community services. Jali LALC owns freehold land in the north of the Lake Ainsworth catchment and holds cultural knowledge relevant to Lake Ainsworth. Jali LALC bush regenerators have been undertaking restoration works targeting exotic and invasive vegetation within the Lake Ainsworth catchment area.

**Lennox Head Surf SLSC**

The Lennox Head-Alstonville SLSC is located adjacent to the south-east corner of the lake on BSC managed land.

### 1.4.2 Consultation activities

Achievement of the CMP vision and objectives is reliant on community understanding and effective involvement in the preparation and delivery process. On-going community involvement is required to ensure actions are implemented effectively and in a way that meets community expectations.

A detailed program of community and stakeholder consultation was undertaken during CMP development. Consultation activities included:

- Meetings with the Project Steering Committee made up of the study area land managers and ongoing liaison as required. This group comprised representatives of BSC, DPIE-Crown Lands, NSW Office of Sport, EES - Coast and Estuaries, Reflections Holiday Park, and Lennox Head SLSC. The project team met with the Project Steering Committee throughout the project at key milestones to ensure oversight and involvement at every stage.
- Community online and paper-based survey – There was a strong response to the survey with 327 on-line and 150 hard copy surveys (477 total surveys) completed.
- Project webpage – A project webpage was used to introduce the project, provide a link to the on-line community survey and provide project updates, documents and contact details for further information. The webpage also contained a "Communication Portal" section where the public could provide information and feedback to the project team for consideration. The webpage can be viewed at: www.hydrosphere.com.au/lakeainsworth.
- Media and advertising – various forms of media were utilised to advertise the project and encourage community involvement in the survey and stakeholder meetings including posters, media releases, newspaper articles, radio broadcasts, social media posts, articles in the Lennox Wave (local community magazine) and the BSC Community Connect distributed to Ballina Shire residents.

- Lennox Head market stall - Project staff were present at the market on 9th December 2018 to discuss the project with community members and answer questions.
- Targeted stakeholder consultation with key stakeholder groups including phone calls, email or letters and face-to face meetings - written submissions were provided by members of the community for consideration.
- A community drop-in session was held in November 2018 and provided an opportunity for informal discussions between the community, stakeholders and the project team to discuss issues and obtain feedback during Stage 2 of the CMP. Another community drop-in session will be held during public exhibition of the CMP.
- Notification, registration and face to face meetings with representatives of the local Aboriginal Community to discuss the CMP and to provide an opportunity for informal discussions between community members and the project team about the cultural significance of the lake and potential future management.
- BSC Councillor Workshops at key project stages to provide information and receive feedback.
- Public Display - The Final Draft CMP will be placed on public exhibition. Formal (written) submissions on the Draft CMP will be sought from the community and stakeholder groups. Submissions will be considered in the development of the Final CMP.


**Plate 3: The community survey link provided on project webpage**

### 1.4.3 The local community

The Lake Ainsworth Community Survey (Oct 2018 – Jan 2019) canvassed the local community on a number of topics associated with the lake. The following points provide an overview of community interests and issues expressed through the survey:

- The lake is highly valued for its natural scenic beauty and as a place for relaxation and recreation.
- This natural setting provides an important recreational opportunity with swimming and picnicking/BBQs being the most popular activities followed by paddling activities (canoeing/kayaking/boarding etc.), walking, a place for children/kids parties and wildlife watching/nature appreciation.
- The lake is visited year-round at varying degrees with summer being the most popular season, followed by spring and autumn. While winter was the least popular time, 38% (97) of respondents said they still visited the lake either every day or a few times a week in this season.
- When asked to rate the overall health of the lake, the community gave an average score of 54 out of 100, equating to just slightly better than “neither healthy or unhealthy” on the provided rating scale. The major factors believed to be affecting lake health were cyanobacteria, water quality problems, overcrowding, sunscreen pollution, dogs, rubbish and litter, foreshore erosion and runoff. Many respondents noted that water quality issues and algal blooms were only a problem during summer when overcrowding/over use and hot weather contributed to poor health.
- There were concerns about a number of issues that need to be managed to ensure the health and amenity of the lake into the future. In order of greatest concern, the issues were algal blooms, foreshore erosion, litter, habitat loss, poor water quality, and overcrowding. Over three-quarters of the community provided details of “other” concerns for management consideration including increased use of western side into the future, dogs, low levels of understanding and respect for the lake ecosystem and Aboriginal heritage, lack of education and effective signage, impact of catchment land use, potential future parking issues, anti-social behaviour, not enough garbage bins, population growth pressures, lack of management action and concerns about future changes to the lake’s natural beauty.
- Management priorities matched the main issues perceived by the community with the highest priorities being (in order of priority) improving water quality, protecting/improving natural habitats/wildlife, better public education about protection of the lake's sensitive ecosystem, addressing foreshore erosion, stormwater treatment and reducing amount of litter/rubbish.
- When asked to imagine the lake in 10 years’ time, survey respondents overwhelmingly (89% or respondents) expressed a strong desire for good water quality (no cyanobacteria, no surface scums/safe to swim). Stable foreshores (no erosion) (50%), healthy vegetation (47%) and scenic beauty (45%) and abundant wildlife (40%) were also highly desirable (Figure 2).
- Over half of the survey respondents provided their vision for the lake in 10 years’ in their own words. There were a wide range of responses provided, with the most frequently mentioned aspects related to maintaining and preserving the natural beauty of the lake, improved water quality, no erosion and having a safe, clean and family friendly place accessible to all to enjoy nature in peace. Many respondents expressed a desire for the lake to remain as close to nature as possible without major changes to the current aesthetics and feel of the area. There was a desire for improvements to enhance the natural attributes and address key issues (e.g. water quality, foreshore erosion, algal blooms etc.). There was a broad spectrum of visions for the lake with regard to future access ranging from those wanting to see access increased with more parking, to those wanting no change or reduced parking to help control overcrowding and negative social and environmental impacts. Others envisioned encouragement of alternative transport options such as cycling, walking and shuttle bus services to reduce congestion.

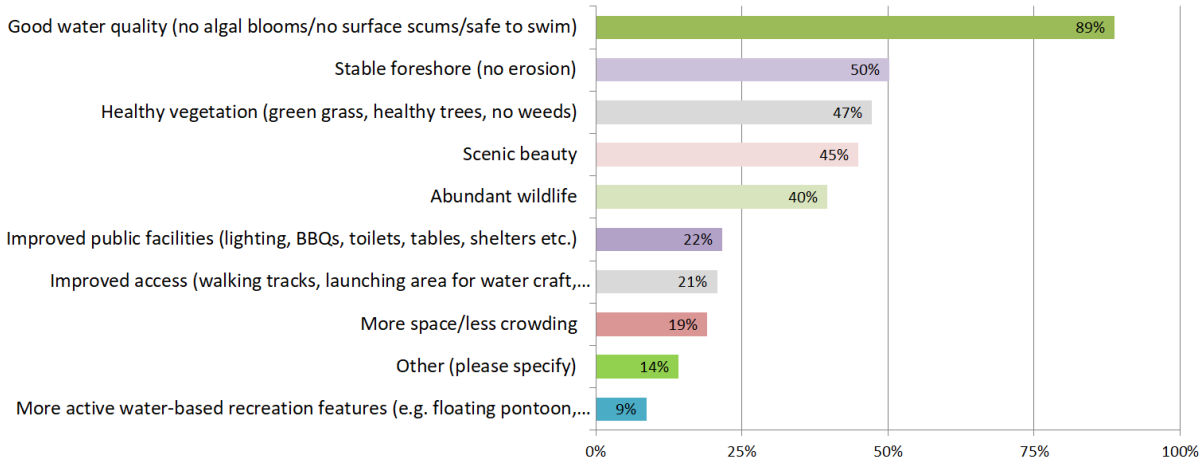


**Figure 2: Community survey results: the desired future state of Lake Ainsworth**

**Plate 4: Lake Ainsworth scenic beauty (Source: BSC, 2017)**

### 1.4.4 Local Aboriginal community representatives

Aboriginal people hold cultural knowledge relevant to determining the cultural significance of the area. The key concerns and interests are water quality (algae, nutrients and sunscreen pollution), bank erosion, protection of flora and fauna especially turtles nesting on western side of road and ducks nesting along western foreshore, the possibility of unexploded bombs at the back of Seven Mile Beach (used historically as bombing range from Evans Head RAAF base), impact of the old Council rubbish tip along the eastern side of Byron Bay Road (Jali land), protection of the western side of the lake due to presence of cultural sites, protection of 'song trees' (melaleucas) along the foreshore that have special cultural significance, the need to keep the area as natural as possible, pests and weeds especially Cane Toads, Ground Asparagus, Bitou Bush and Lantana, the need for education around cultural values and desire for local Aboriginal people to be involved in CMP implementation works such as landscaping and bush regeneration.

### 1.4.5 Lennox Head Landcare

Lennox Head Landcare undertakes vegetation management at the lake and surrounding areas including removal of terrestrial and aquatic weeds, native vegetation plantings, fencing and coastal dune protection works. Key interests and issues nominated by the group in relation to management of Lake Ainsworth were

stormwater treatment, provision of appropriate riparian vegetation, use of suitably durable grass type for high use areas, underground replacement or relocation of power lines to reduce vegetation damage from ongoing maintenance, maintenance of existing buffer between Camp Drewe Road and Lake Ainsworth with modifications to rationalise access tracks, restore fencing to protect lake edges, remove parking space along road, manage road runoff, investigation of introduced flora and fauna species in the lake, need for a management structure to coordinate all agencies, effective signage/notice boards to educate and promote understanding of the natural attributes of the lake, sensitivities and key issues and encouraging low-impact use/practices to protect the lake.

### 1.4.6 Lake Ainsworth Interest Group (LAIG)

The LAIG represents the Ballina Environment Society, Lennox Head Residents' Association and Lennox Head Landcare. The group's key interests and associated issues include water quality and blue-green algae outbreaks, need for an overriding management body to oversee lake management, defining areas of acceptable uses (e.g. boat launching, swimming etc.), western side increasing use pressures, appropriate signage/education (e.g. appropriate behaviour, Aboriginal heritage, keep sunscreens out, litter, name plates for trees and shrubs etc.), parking issues, overcrowding and concerns regarding the planned return of markets to the lake foreshore once foreshore improvement works are complete (e.g. litter, access, loading on top of stormwater swales etc.).

### 1.4.7 Lake Ainsworth Wildlife Watch Lennox Head

This group is dedicated to preserving the wildlife at Lake Ainsworth and maintaining a healthy lake environment and ecosystems. The key concerns for this group are increased traffic on Camp Drewe Road, causing more road kill and particularly putting turtles at risk which are known to cross the road to access the lake, vehicles speeding along the road, water quality including algae and the effects of sunscreen, litter build up and particularly plastics affecting turtles and other wildlife and a lack of research into wildlife populations at Lake Ainsworth.

### 1.4.8 Preserving Lake Ainsworth Inc.

Preserving Lake Ainsworth Inc. is a community group with strong opposition to the planned closure of the eastern road connecting Pacific Parade to the access point to Seven Mile Beach and the Sport and Recreation Centre. Key issues raised by the group include concern about restriction of public access to the lake through closure of the eastern road affecting public use, amenity and social and cultural values, a need for a holistic view of the lake precinct and restoration of the lake, a lack of information from Council and a desire to be involved in all stages of the CMP.

## 1.5 Planning Framework

### 1.5.1 Coastal Management Act 2016

The *CM Act* communicates the NSW Government's vision for coastal management. The Act reflects the vital natural, social, cultural and economic values of our coastal areas and promotes the principles of ecologically sustainable development in managing these values. The legislative and policy framework introduced by recent coastal reforms recognises natural coastal processes and the local and regional dynamic character of the coast and promotes land use planning decisions that accommodate them. The reforms ensure coordinated planning and management of the coast and support public participation in these activities.

The Act provides for the integrated management of the coastal environment of NSW consistent with the principles of ecologically sustainable development for the social, cultural and economic well-being of the people of the state. The Act:

- Establishes high level statutory objectives for integrated coastal management in NSW.
- Defines the NSW coastal zone as being made up of four distinct 'coastal management areas' and sets out specific management objectives for each of those areas.
- Establishes a new independent coastal advisory body, the NSW Coastal Council.
- Requires local councils to embed coastal management within the Integrated Planning and Reporting (IP&R) framework established in the *Local Government Act 1993*. This approach will ensure that coastal management needs inform, and are informed by, councils' overall service delivery, financial and asset management planning responsibilities.
- Provides for public authorities to take into consideration the objectives and processes to achieve integrated management of the NSW coast.

The focus of this CMP is to achieve the thirteen objects of the CM Act through the development of a long-term management strategy. Appendix 1 provides details of how the objects of the *CM Act* have been considered and promoted in preparing this CMP.

### 1.5.2 Coastal Management SEPP

The *CM Act* establishes requirements for the preparation of CMPs. The *State Environmental Planning Policy (Coastal Management) 2018 (CM SEPP)* forms part of the broader land-use planning framework in NSW. This is now the key environmental planning instrument for land-use planning in the coastal zone, and delivers the statutory management objectives for each of the four coastal management areas that make up the coastal zone (and which are set out in the *Coastal Management Act*). The four coastal management areas have been mapped under the *CM SEPP*. Mapping of these areas within the CMP study area are presented in Section 8. The objectives of the *CM SEPP* have been incorporated as objectives for this CMP in Section 1.3.3 and have been considered and promoted in preparing this CMP (refer Appendix 1 for details).

### 1.5.3 Marine Estate Management Act 2014 and Marine Estate Management Strategy 2018 - 2028

The *Coastal Management Act* (s.3(m)) legally supports the objects of the *Marine Estate Management Act 2014*, as the coastal zone forms part of the marine estate. The *Marine Estate Management Act 2014* provides for strategic and integrated management of the whole marine estate – marine waters, coasts and estuaries. The Act does this by:

- Providing for the management of the marine estate consistent with the principles of ecologically sustainable development.
- Establishing two advisory committees, a Marine Estate Management Authority and Marine Estate Expert Knowledge Panel.
- Requiring the development of a Marine Estate Management Strategy to address priority threats identified through threat and risk assessment.
- Facilitating the maintenance of ecological integrity, and economic, social, cultural and scientific opportunities.
- Promoting the coordination of government programs.
- Providing for a comprehensive system of marine parks and aquatic reserves.

The suite of objectives guiding this CMP have been developed ensuring consistency and compatibility with the objects of the *Marine Estate Management Act 2014* (refer to Appendix 1 for details).

### 1.5.4 North Coast Regional Plan 2036

The *North Coast Regional Plan 2036* (DPE, 2017) provides an overarching strategy for the next two decades that reflects community and stakeholder aspirations and opportunities for the North Coast region. The Plan identifies several aims relevant to the Lake Ainsworth study area and this CMP including:

- *Goal 1 – The most stunning environment in NSW*. Lake Ainsworth is one of the identified coastal lake ecosystems in the Plan. The lake provides not only intrinsic value, but contains highly valued natural areas which improve community lifestyles, health and wellbeing. The lake's natural resources contribute to a significant tourism industry which capitalises on the natural assets of the region.
- *Direction 2 - Enhance biodiversity, coastal and aquatic habitats, and water catchments*. Lake Ainsworth is identified as one of the areas of high environmental value that is integral to maintaining the biological diversity of the North Coast. The Plan recommends using an evidence-based approach to protecting important assets that will help to maintain diversity and habitat for flora and fauna.
- *Direction 3 - Manage natural hazards and climate change.* The Plan identifies a number of threats and hazards relevant to Lake Ainsworth including coastal erosion, sea level rise, storms and floods. The Plan acknowledges coastal management programs and associated controls as the key planning mechanism to deal with these hazards, increase all-hazard disaster preparedness and build community capacity and resilience.

### 1.5.5 Integrated Planning and Reporting

The Integrated Planning and Reporting (IP&R) framework is established under Chapter 13 of the *Local Government Act 1993*, and is the main mechanism by which councils comprehensively plan for, and report on, their asset management and service delivery responsibilities within a local government area. The *CM Act* requires that CMPs are given effect through the IP&R framework. This will include performance auditing powers to ensure that programs are appropriately implemented. This means that coastal management programs and identified coastal management activities are aligned with broader community strategic plans, reflect community priorities, and are feasible, financially viable and able to be resourced.

The *Ballina Shire Community Strategic Plan (CSP) 2017-2027 – Our Community Our Future* was finalised in November 2017 and sits above all other Council plans and policies in the planning hierarchy. The CSP identifies the community's main priorities and aspirations for the future to promote a positive lifestyle and improve the amenity for residents and visitors. Council will use this document to guide and inform decision making and planning for at least the next ten years.

The Delivery Program and Operational Plan describes for all key activities to be undertaken by Council during their elected term. The Resourcing Strategy assists Council to translate the outcomes identified in the CSP, for which it is responsible, into actions. Some issues will be the responsibility of Council, some will be the responsibility of other levels of government, and some will rely on input from community groups or individuals.

The CSP Vision for 2027 includes:

- Pristine beaches and clean waterways that are home to a wide range of native flora and fauna.
- The natural beauty of the Ballina Shire is respected and a wide range of people of all ages are able to enjoy the beaches, waterways and hinterland.

The health and preservation of the natural environment was a strong recurring theme from the community engagement undertaken during development of the CSP including:

- Finding a balance between development and the environment.

- Restoring and repairing waterways and areas that have been degraded to maintain aquatic and bird life.
- The importance of peace, serenity and harmony with nature.
- A built environment that meet the shire's needs but not at the expense of the natural environment or the people who live and work in the shire.

The CSP has assisted in guiding the development of the CMP for Lake Ainsworth through its strong emphasis on the health and preservation of the natural environment, driven by community input. The CMP actions have been organised and scheduled with consideration of BSC's IP&R framework, Delivery Program and Operational Plan and associated reporting requirements.

## 1.6 Plans of Management

The Lake Ainsworth catchment area is managed in accordance with the recommendations/ management actions outlined in a number of management plans that address part of or the entire catchment area. These plans include:

- *Lake Ainsworth Management Plan* (GeoLINK, 2002) which has been superseded by this CMP.
- *Lake Ainsworth Crown Reserve Master Plan* (Connell Wagner, 2005).
- *Lake Ainsworth Vegetation Management Plan* (EnviTE NSW, 2007).
- *Ballina Coastal Reserve Precinct Plan 1- North Seven Mile Beach to Lake Ainsworth* (BSC, 2009).
- *Coastal Zone Management Plan for the Ballina Shire Coastline* (GeoLINK, 2016).

In addition to the plans listed above, a draft version of the Lennox Head (Coastal) Vegetation Management Plan (BES, 2016) has been prepared and when adopted will supersede Lake Ainsworth Vegetation Management Plan and associated management actions.

This CMP has been developed through consideration of the existing management arrangements. In some cases this CMP updates and improves various management strategies with current knowledge and understanding of issues. These initiatives and their current status are discussed in the Stage 1 Scoping Study (Hydrosphere Consulting, 2018).

# 2. SNAPSHOT OF ISSUES

The issues currently affecting the health and amenity of Lake Ainsworth are discussed in detail in the *Stage 2 Vulnerabilities and Opportunities Study* (Hydrosphere Consulting, 2019a) and summarised below.

## 2.1 Water quality and blue green algae

Lake Ainsworth is utilised for a variety of water and shore-based activities including swimming, paddling and picnicking and is also an important educational resource with a rich cultural history and significant ecological value. Despite being subject to periodic blooms of blue green algae, the lake is highly valued for its natural scenic beauty and as a place for relaxation and nature-based recreation. Due to its popularity as a recreational asset, many of the issues raised during community consultation for this CMP relate to the community's expectations regarding these recreational pursuits and circumstances that lead to reduced recreational experiences.

A key driver of this CMP is the ongoing concern of increasing nutrient levels and resulting blue green algae outbreaks in the lake (Plate 5). Blue green algae blooms in the lake have occurred periodically for many years, with records of serious outbreaks dating back to the 1980s. Blue green algae impacts on recreational use through swimming closures due to public health risks and this is regarded as the highest priority for management by the community. On average since 2002, blue green algae alerts have been in place at the lake for approximately 86 days/year (24% of the time). Red alerts (high level of toxic blue-green algae) were in place for an average of 7 days/year with many years having no red alerts and some years having as many as 47 days of lake closure (in 2007). Comparison to ANZECC guidelines for aquatic ecosystem health showed a significant exceedance of nutrient and chlorophyll *a* parameters indicating eutrophic conditions. Nutrient levels appear to have increased over time. Current average total phosphorus concentrations (measured from 2015-2018) are almost double the levels measured in 1995 and current dissolved inorganic phosphorus levels are up to four times the levels measured in 1998/99.

Nutrient inputs to the lake can come from atmospheric sources, the catchment via surface runoff, eroded soils and groundwater, fauna and recreational users, as well as internal cycling of nutrients between sediments and biota. The organic-rich muds located in the deeper sections of the lake are considered to be the primary source of nutrients within the water column. During investigations carried out as part of Stage 2, sources of external nutrient input were assessed as minor and the internal cycling of nutrients from lake sediments was confirmed as the primary factor exacerbating blooms of blue green algae.

In 1997 an aerator was installed to destratify the lake and increase dissolved oxygen levels with the aim of reducing nutrient release from bottom sediments and therefore reducing the occurrence of algal blooms. A review of the aerator program was conducted during Stage 2 which indicated that the current program was not effective in preventing nutrient release from sediments and may be having a net negative impact on overall water quality by facilitating nutrient cycling within the lake (refer Hydrosphere Consulting, 2019a for details).

**Plate 5: Cyanobacteria bloom, Lake Ainsworth January 2019**

In 2018, Beachwatch graded three of the four lake swimming sites as ‘poor’ in terms of contamination with harmful bacteria derived from faecal material. The majority of faecal matter is believed to be washed into the lake from land surfaces during rainfall. Further work is underway to confirm the sources of contamination.

## 2.2 Sunscreen pollution

Sunscreen has been identified as a potentially significant pollutant source, not only contributing to frequently observed oily slicks on the water surface during peak times and chemical compounds known to effect ecological health but also as a potential nutrient source contributing to algal blooms. Initial estimations of potential sunscreen load to the lake (i.e. what can be washed off the skin during swimming) equated to approximately 192 L of sunscreen per year (Hydrosphere Consulting, 2019a).

## 2.3 Sediment quality

A survey of lake sediments in 2018 has confirmed the continued presence of a central basin of organic-rich muds in the lake which are acidic, oxygen-deficient, high in organic carbon and nutrient-rich and have levels of lead and mercury which exceed ANZECC sediment quality guidelines at several sites (Plate 6). There has also been an expansion in the total area of these organic-rich muds compared to sediment mapping completed in 1996. The feasibility of dredging and removal of sediments was assessed as part of Stage 3, however a number of constraints were identified that prevented this option from being recommended as part of the CMP (i.e. high cost, high environmental risk, logistical constraints etc.) (Hydrosphere Consulting, 2019b).

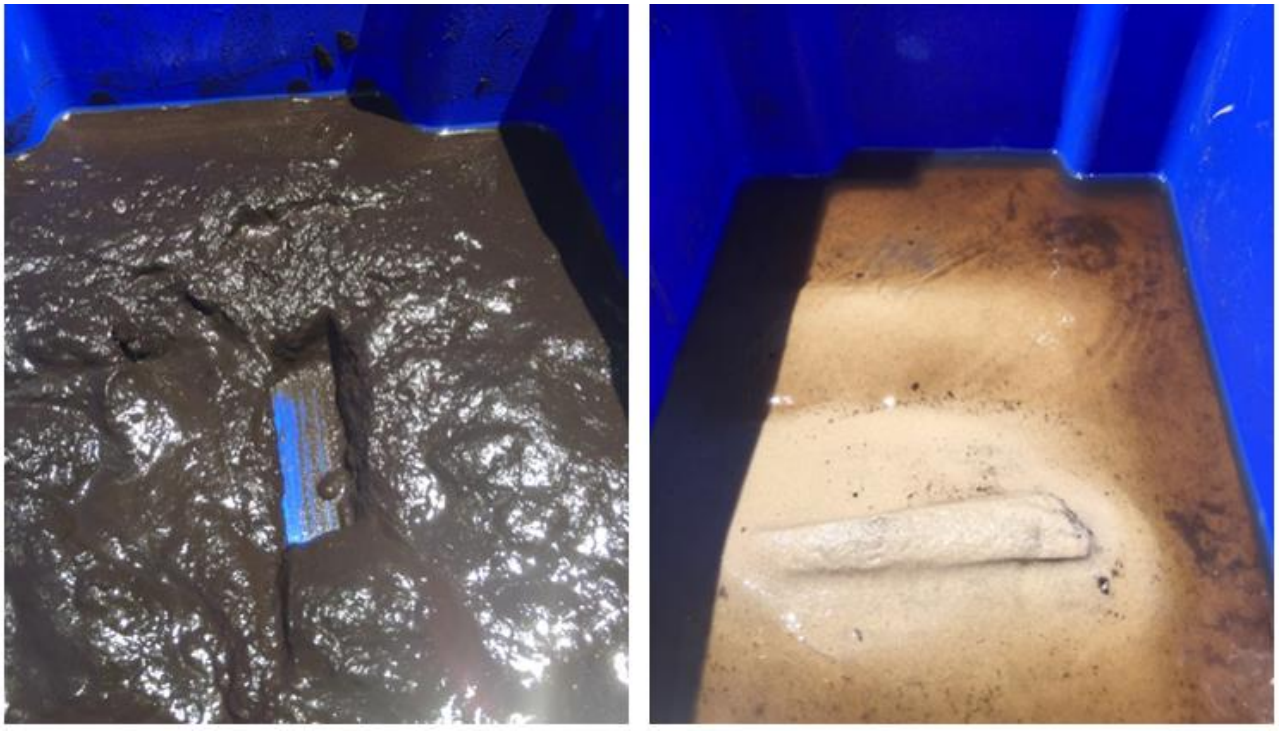

**Plate 6: Main sediment types in Lake Ainsworth: Left: ‘gelatinous’ organic–rich muds, Right: medium sands**

## 2.4 Hydrology and groundwater

Lake water level is determined by a balance between inflows to the lake (direct rainfall, surface runoff and groundwater flows) and outflows (evaporation and groundwater discharge eastward through the dunes to the ocean) (Figure 3). The updated water balance model completed as part of Stage 2 studies indicated that

groundwater outflows vary significantly from year to year and are governed by the balance of inputs and outputs as well as sea level conditions (Hydrosphere Consulting, 2019a).

There is some indication that groundwater outflows have reduced in recent years and recent sediment sampling indicates expansion of organic-rich muds since 1996, which may account for reduced outflows. Climate change is also expected to lead to greater extremes in lake water levels, both low levels due to prolonged dry periods and increased incidents of flooding due to sea level rise and a predicted increase in extreme rainfall and sea level events.

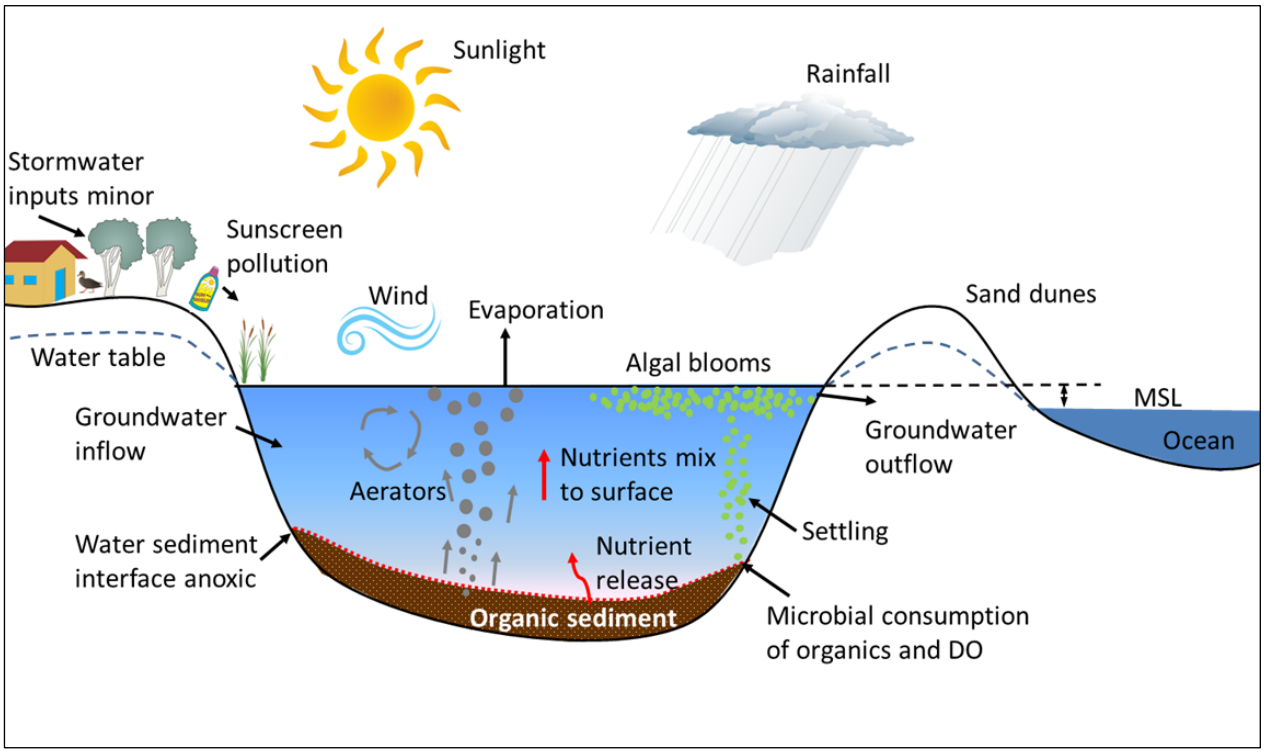


**Figure 3: Conceptual model of Lake Ainsworth hydrology, water quality and dominant processes**

## 2.5 Foreshore erosion

Foreshore erosion is also a key concern for the community with banks actively eroding which is exacerbated by stormwater flows, water level changes, wind action and high levels of pedestrian access (Plate 7). A number of safety hazards have been identified in the vicinity of access points to the lake including potential for falls and trips (due to erosion creating vertical drops up to 0.8 m), exposed roots and uneven ground.


**Plate 7: Foreshore erosion at the lake**

## 2.6 Litter

Litter can impact amenity and ecological values of the lake particularly during peak visitation periods. Provision of recycling bins at the lake was also frequently requested during community engagement.

## 2.7 Dog access

Concerns have been raised regarding dogs being allowed 'off-leash' along lake foreshores and to swim in the Lake despite a no-dog zone being in place for these areas. Key concerns raised were related to dog urine and faeces being left behind which may contribute to water quality decline and microbiological risk to human health as well as impacts of dogs on native wildlife (e.g. disturbance, injury etc.).

## 2.8 Overcrowding

Overcrowding and overuse of the lake during peak holiday periods places high pressure on facilities, parking, recreational amenity and environmental values. Recent (2017) estimates during peak times reveal that visitor numbers now exceed 10 times the estimated carrying capacity of the lake. The carrying capacity represents the maximum number of visitors the area can accommodate without there being excessive deterioration of the environment or declining visitor satisfaction.


**Plate 8: Traffic congestion on the eastern road (Source: Google street view, January 2010)**

## 2.9 Parking

There is insufficient parking at the lake during peak times (i.e. school holidays, public holidays and long weekends). This has been an issue for many decades and with increasing population and tourism pressures into the future, this impact is likely to increase. There is concern that this will result in more cars parking along Camp Drewe Road and subsequently greater use of the western side of the lake as well as increased parking by lake users extending into town. There were also concerns raised about the distance required to walk from new parking areas to the lake, particularly for disabled people and those carrying children and equipment.

## 2.10 Lack of understanding about indigenous cultural significance

There is a general lack of knowledge and understanding among the broader community about the indigenous cultural significance of the lake. Through the community survey, the community has expressed a strong desire to know more about the indigenous history and significance of the lake. Increasing understanding would enhance values for the community and visitors and would also be likely to increase the effectiveness of measures to protect cultural heritage at the lake.

## 2.11 Increasing use of the western side of the lake

Increasing use of the relatively 'untouched' western side of the lake was raised as a key concern for many stakeholders (Plate 9). During consultation it was clear that the community desired the western side of the lake to remain as natural as possible, protecting cultural and environmental values and maintaining visual amenity from the popular recreational areas on the southern and eastern vantage points. Many stakeholders identified impacts as currently occurring in this location through uncontrolled and ad hoc access and stressed the need for urgent management action to address these impacts before irreparable damage is done. The impact of increasing traffic and traffic speed along Camp Drewe Road and concerns about increasing road kill has also been identified by the community.

**Plate 9: Informal access to western side of the lake**

## 2.12 Climate change, coastal hazards and flooding

Ocean shoreline recession along Seven Mile Beach is a key risk for the management of Lake Ainsworth. Coastal hazard predictions show the potential for ocean breakthrough to the lake within a 50-year timeframe (GeoLINK, 2016). Any connection with the ocean is likely to have significant implications for the ecology and public usage of the lake. The risk of significant wave run-up and over-wash of salt water to Lake Ainsworth during heavy seas is currently low, but will increase with continued sea level rise (Plate 10). The highest risk site is at the Lennox Head Surf Club. Actions to address coastline hazard issues are currently addressed in the *Coastal Zone Management Plan for the Ballina Shire Coastline* (CZMP, GeoLINK, 2016) and will be considered again in the development of the future Ballina Coastline CMP.

There is a risk that future lake flooding events (both in frequency and magnitude) will increase with predicted climate change impacts (i.e. increase in mean sea level coupled with an increase in extreme rainfall and sea-

level events). Conversely, increasingly dry winters with increased temperatures as a result of climate change may result in occasional periods of lower lake levels during the latter half of the year than previously seen.

Recent research has indicated that the temperature of estuaries (including lakes, lagoons and rivers) is rising more rapidly than oceans in response of climate change (Scanes *et al.,* 2020). Estuary temperatures along the Australian coastline have increased by 2.16°C on average over 12 years, at a rate of 0.2°C per year. Increased average temperatures in Lake Ainsworth may have implications such as increasing the time that conditions are suitable for algal growth.

**Plate 10: Coastal dune system separating the lake from Seven Mile Beach**

## 2.13 Weeds and pest species

There are a number of exotic aquatic weeds present within Lake Ainsworth which periodically create nuisance conditions impacting amenity and lake uses. A variety of management techniques have been implemented to address exotic weed infestations within the lake, many are ongoing with a high level of success. A number of exotic aquatic fauna species have been identified in the lake, including typical aquarium species that may have been dumped in the lake. Cane toad and the non-endemic and invasive Redclaw crayfish were also identified as pest species in the lake.

## 2.14 Riparian Vegetation

Riparian vegetation condition varies significantly around the lake. A number of factors contribute to riparian vegetation disturbance including clearing, exotic species, a high level of pedestrian traffic, bank erosion and adjacent disturbed areas (e.g., mown exotic grassed areas or roads). Undercutting and exposure of tree roots is impacting tree health and may cause dieback of significant foreshore trees (Plate 11). The Broad-leaved Paperbark trees have been identified as culturally significant ‘Song Trees’ by local Aboriginal

representatives and are an iconic feature of the lake, providing shade, visual amenity and habitat for wildlife. There are also several bare ground areas along foreshores where grass has died, particularly in high use zones in the south-eastern corner, where shading is also affecting grass cover. This not only impacts the aesthetics and recreational values of the area, but also exposes sediment and banks to erosion.

**Plate 11: Exposed roots of mature Broad-leaved Paperbark trees along the south-eastern foreshore**

## 2.15 Issues by Coastal Management Area

This CMP has identified a range of key threats affecting the Lake Ainsworth study area which align with characteristics of the four coastal management areas outlined by the *CM Act* and mapped within the study area (Section 8), being:

- Coastal wetland and littoral rainforest
- Coastal vulnerability
- Coastal environment
- Coastal use

The issues and threats identified in this CMP are relevant to all four coastal management areas and as such, this study recommends that all four coastal management areas are addressed through the CMP process. For coastal hazard management issues relevant to the open coast, this CMP defers to the existing certified *CZMP for the Ballina Shire Coastline* (GeoLINK, 2016).

Table 4 summarises issues relevant to the CMAs in the Lake Ainsworth study area.

**Table 4: Issues relevant to the CMAs in the Lake Ainsworth study area.**

| Coastal Management Areas | Location and extent within the study area | Relevant issues |
|---|---|---|
| CMA1 – Coastal Wetlands and Littoral Rainforests | This CMA exists to the west of the lake covering the Newrybar Swamp. A section of the proximity area is within the catchment to the north of the lake. | • Lake water levels are influenced by and correspond to regional groundwater levels linked to coastal wetland areas to the west of the lake.<br>• Both lake flooding and periods of very low lake levels have been identified as a periodic issue affecting environmental values and community uses. There is a risk that future extreme levels in the lake will increase with predicted climate change impacts |
| CMA2 – Coastal Vulnerability Area | Although mapping is not yet available for this CMA, it is assumed that due to the lake's close proximity to the coast, part, if not all of the study area would comprise this CMA. | • Potential for ocean breakthrough to the lake within a 50-year timeframe<br>• The risk of significant wave run-up and over-wash of salt water to Lake Ainsworth during heavy seas is currently low, but will increase with continued sea level rise. The highest risk site currently is at the Lennox Head Surf Club. |
| CMA 3 – Coastal Environment Area | Covers the entire lake and a large portion of the study area. | • Water quality issues including periodic blooms of blue green algae, high nutrient levels and contamination with harmful bacteria.<br>• Excess aquatic weed growth (i.e. Salvinia, Water Hyacinth).<br>• Weeds and pest species (non-native aquatic and terrestrial species) decreasing the biodiversity values of the lake.<br>• Sediment contamination. |
| CMA 4 – Coastal Use Area | Covers the entire study area. | • Water quality issues affecting primary and secondary contact recreation (swimming and water craft), and visual amenity.<br>• Litter<br>• Foreshore erosion<br>• Exposed/damaged tree roots<br>• Dog faeces being left behind (risk to human health) as well as impacts of dogs off-leash on native wildlife.<br>• Insufficient parking during peak times<br>• Increasing use of the western side of the lake causing damage to sensitive ecosystem.<br>• Lack of knowledge and understanding among the broader community about the indigenous cultural significance of the lake. |

# 3. RISK ASSESSMENT

Section 21 (3) (b) of the *CM Act* requires the application of a risk management process when preparing CMPs and identifying where management actions are required (OEH, 2018). Following the identification of the current key issues within the Lake Ainsworth catchment area, a first-pass (or preliminary) risk assessment and gap analysis was completed as part of the *Stage 1 Scoping Study* (Hydrosphere Consulting, 2018). This assessment prioritised risks and identified those that needed to be further investigated in subsequent stages of the CMP. Following detailed studies completed as part of Stage 2, the risk assessment was refined and updated with new information and included as part of the *Stage 2 Vulnerabilities and Opportunities Study* (Hydrosphere Consulting, 2019a) .

The risk assessment included the following components:

- Assessment of community uses and values.
- Identification of study areas threats and stressors.
- Analysis of the level of risk presented by those threats

The process identifies credible risks, the likelihood of the risk event occurring, the consequences should the event occur, and applies a risk rating (Table 5). This has been completed in accordance with ISO 31000:2018 "*Risk management – Principles and guidelines, provides principles, framework and a process for managing risk*" and employing methodology adapted and modified from the *NSW MEMA TARA* (BMT WBM, 2017).

For each of the identified threats, the following factors have been taken into account:

- How is the threat currently being managed? Have previous management plans addressed this threat?
- How effective are the current management measures, and what is the residual risk (as per the residual risk rating provided)?
- In the future, how is the risk level likely to change (i.e., over 20, 50 and 100 years)? Specifically, how will climate change, increasing development pressures, and population increase impact these risks?

**Table 5: Qualitative Risk Estimation**

| **Likelihood** | **Consequence** | | | | |
|---|---|---|---|---|---|
| | **Insignificant** | **Minor** | **Moderate** | **Major** | **Catastrophic** |
| Almost certain | Medium | High | High | Extreme | Extreme |
| Likely | Medium | Medium | High | High | Extreme |
| Possible | Low | Medium | Medium | High | High |
| Unlikely | Low | Low | Medium | Medium | High |
| Rare | Low | Low | Low | Medium | Medium |

A prioritised list of threats to Lake Ainsworth, and corresponding risk levels identified by the assessment are summarised in Table 6. The prioritised threats outlined in Table 6 were reviewed with respect to the coastal management area extents and their objectives. This review deemed the existing *CM SEPP* mapping to be suitable at present for addressing the high priority issues at Lake Ainsworth.

**Table 6: Prioritised Threats for Lake Ainsworth**

| Management Issue/ Threat | Current Risk | 20yr Risk | 50yr Risk | 100yr Risk |
|---|---|---|---|---|
| Ocean shoreline recession, breakthrough and saline intrusion[1] | Medium | High | Extreme | Extreme |
| Wave run-up and dune overtopping[1] | Medium | High | Extreme | Extreme |
| Foreshore erosion of the lake | High | High | High | High |
| Continued proliferation of blue-green algal species | High | High | High | High |
| Nutrient enrichment | High | High | High | High |
| Car parking adequacy for current and future peak demand [2] | Medium | High | High | High |
| Localised freshwater flooding[1] | Medium | High | High | High |
| Altered lake hydrology and water balance[1] | Medium | High | High | High |
| Increasing use of the relatively 'untouched' western side of lake | Medium | Medium | High | High |
| Microbiological risk to human health | Medium | Medium | Medium | Medium |
| Stormwater impact | Medium | Medium | Medium | Medium |
| Exotic aquatic fauna | Medium | Medium | Medium | Medium |
| Aquatic weeds or unnatural growth | Medium | Medium | Medium | Medium |
| Limited public education/engagement regarding lake issues | Medium | Medium | Medium | Medium |
| Impacts on Aboriginal cultural and heritage value[3] | Unknown | Unknown | Unknown | Unknown |
| Poor riparian vegetation condition [4] | Medium | Low | Low | Low |
| Poor foreshore accessibility [4] | Medium | Low | Low | Low |
| Public safety concerns/risk [4] | Medium | Low | Low | Low |
| Decreased amenity and enjoyment [4] | Medium | Low | Low | Low |
| Reduced aesthetic quality [4] | Medium | Low | Low | Low |
| Spills and contamination [4] | Low | Low | Low | Low |
| Terrestrial weeds | Low | Low | Low | Low |

1. Increasing risk due to climate change impacts (i.e. sea-level rise and storm events). Coastal hazard predictions show the potential for ocean breakthrough to the lake within a 50-year timeframe (GeoLINK, 2016). Appendix 2 details additional management considerations identified to protect the lake from coastal hazard impacts.
2. Parking issues during peak times likely to continue to increase in the future as a result of population growth and increasing tourism in region.
3. Lake Ainsworth is known to have significance to Aboriginal people. The level of risk is to Aboriginal cultural and heritage significance is not currently known.
4. Closure of the Eastern Road in 2019 and foreshore improvement works has reduced the likelihood and consequence of these threats.

# 4. EVALUATION AND SELECTION OF COASTAL MANAGEMENT OPTIONS

Stage 3 of this CMP (documented in Hydrosphere Consulting, 2019b) involved a comprehensive process to identify actions that address coastal management issues in an integrated and strategic manner consistent with provisions in Section 14 and 15 of the *CM Act*. The priority of coastal management actions was evaluated and assigned during this process together with recommended strategic delivery pathways.

The following steps were completed as outlined in the *Coastal Management Manual Stage 3* (OEH, 2019):

- Step 1 – Confirm the strategic direction
- Step 2 – Identify potential management options
- Step 3 - Evaluate potential actions
- Step 4 - Put it together: including development of the business plan. Note that business plan development was completed as part of Stage 4 of the CMP and is included in Section 7.

A broad range of potential management options were identified to address risks identified through the risk assessment process carried out as part of Stages 1 and 2 of the CMP.

The *Stage 2 Vulnerabilities and Opportunities Study* provided a preliminary screening of 69 potential management options to address issues identified through detailed study and stakeholder engagement. The outcome of this assessment was a refined list of options for consideration as part of the Stage 3 options assessment. Each potential management option was described in detail including information on key benefits and risks (documented in Hydrosphere Consulting, 2019b).

The options assessment in Stage 3 involved examination of a total of 38 options which were subject to a multi-criteria cost benefit analysis. The multi-criteria cost benefit analysis involved two parts as follows:

- Cumulative risk mitigation assessment – an assessment of the influence of the option on all threats to the lake, not just the direct threat addressed.
- Cost benefit analysis considering a number of key criteria related to feasibility, viability and acceptability of the option. Nine different criteria were assessed including: effectiveness; technical viability; ecological sustainability; legal / approval risk; capital costs to implement the option initially; ongoing costs per annum; cost-benefit distribution (private vs public benefit); community/stakeholder acceptability; and meeting coastal management objectives (Table 4).

Scores from the above two parts were combined to determine if the option should be recommended for implementation in the CMP. Scores were also used to determine the priority of the action in consultation with the Project Steering Committee. Based upon the multi criteria assessment, options were recommended for implementation as actions in this CMP.

**Table 7: Cost Benefit Analysis Criteria Scoring System**

| Score: | | -1 | 0 | 1 |
|---|---|---|---|---|
| Feasibility | Effectiveness (in addressing direct risks) | Option is unlikely to be effective / substantially reduce targeted risks. | Option will not necessarily reduce targeted risk(s) but will provide important knowledge / data about the risk OR Option will bring a minor reduction in the targeted risk(s). | Option will be very effective in eliminating/ reducing/ remediating its target risk(s). |
| | Technical Viability | Is unlikely to be technically viable without substantial engineering (or other) design investigation and capabilities for implementation. | Is likely to be technically viable at the site, but would require further investigations to clarify. | Is technically viable at the site / location. |
| | Ecological sustainability | Option is likely to have a negative impact on environmental values either directly or indirectly or impacts are unknown. | Not expected to have any influence on environmental values. | Expected to have a net positive impact on environmental values. |
| | Legal/ Approval Risk | Will require an EIS to implement; There is a residual risk that approval will not be obtainable for the proposed works / strategy. | Will require government approvals (e.g. REF) to be implemented. | No or minimal government approvals required to implement. |
| Viability | Capital Costs | Very expensive (>$300,000) | Moderately expensive ($100,000 - $300,000) | Limited cost (<$100,000) |
| | On-going costs | Very expensive (>$150,000 p.a.) | Moderately expensive ($25,000 -$150,000 p.a.) | Limited cost (<$25,000 p.a.) |
| | Cost-benefit distribution (public vs. private) | 100% private benefit | 50% public, 50% private benefit | 100% public benefit |
| Acceptability | Community/ Stakeholder Acceptability | Unlikely to be acceptable to community and politically unpalatable; Extensive community consultation/ education, endorsement by Minister(s) and Council required. | Would be palatable to some, not others (~50/50 response); Briefing to Councillors, GM and community consultation/ education required. | Is very politically palatable, acceptable to community; Minimal consultation/ education required. |
| | Meeting CM objectives | Doesn't not meet any CM objectives. | Meets one of the CM objectives. | Meets multiple (>1) CM objectives. |

# 5. OVERALL MANAGEMENT APPROACH

There is a need to protect the social, ecological and cultural values associated with the lake and to manage the often conflicting desire for protection of ecological values as well as optimising recreational opportunities. One of the key aspects of the management approach for this CMP is to accept that some issues cannot be resolved cost-effectively or without compromise.

Water-based recreation is one of the main uses for Lake Ainsworth, with water quality being recognised as a key factor contributing to this activity. Whilst improving water quality generally and providing easy access for swimming and other water-based pursuits is desirable, this may not be practical, affordable or in keeping with other goals for management. The approach for this CMP, for example, is to encourage swimmers to use areas that are best suited for swimming (close to managed access points, suitable water depths, ease of access) by providing facilities near those locations and concentrating management actions that improve this use in the areas that are most suitable in the long term. In taking this approach, other areas are set aside to achieve other management goals where the focus may be, for instance, ecological and cultural heritage protection.

The management approach therefore attempts to delineate management focus areas around and in the lake in order to efficiently achieve the objectives of this plan. This approach recognises the key processes influencing the ecological health and recreational amenity of the lake as well as key pressures to be faced in the future. Management options have been developed and prioritised on this basis with the key aims of recognising these constraints and optimising future management expenditure. Figure 4 shows the main goals for each area of the lake as described in Figure 4.

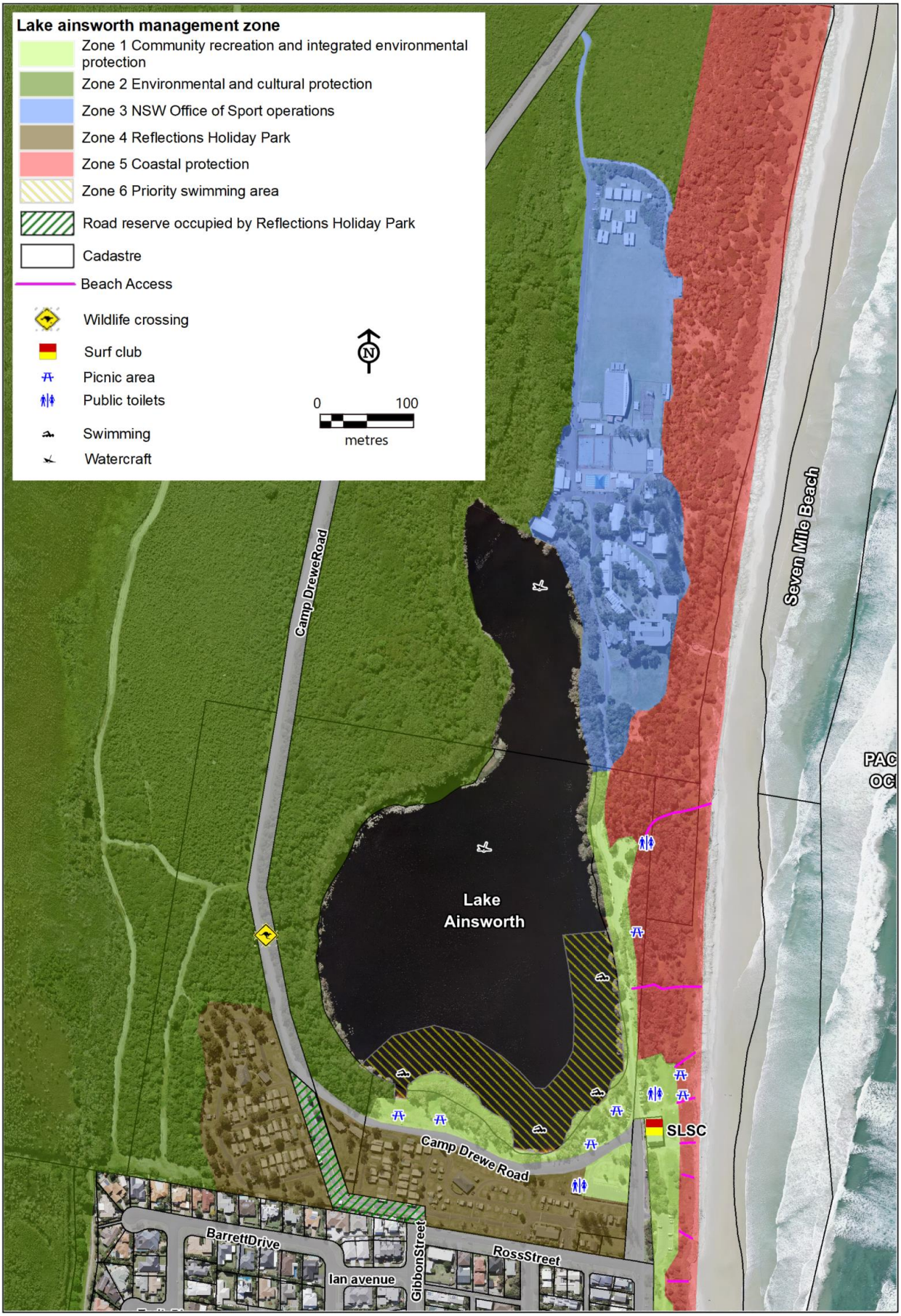


**Figure 4: Lake Ainsworth management zones**

**Map is indicative only. It is to be used solely for illustrative purposes and does not form any part of local, state or federal planning law.*

**Table 8: Summary of management zones, key uses and goals**

| Zone | Location and use | Management goals |
|---|---|---|
| Zone 1 - Community recreation and integrated environmental protection | Crown land managed by Council along the southern foreshore adjacent to Reflections Holiday Park and the eastern foreshore to the border of Zone 3. | Provides improved foreshore access to the lake at key swimming locations, sandy beaches, amenities and a focus of recreational activities. Environmental protection areas are integrated within this zone for riparian vegetation enhancement and stormwater treatment. Pedestrian access is provided along the eastern foreshore with provision for emergency vehicle access if required. |
| Zone 2 - Environmental and cultural heritage protection | Western and northern shorelines and incorporates Crown land areas managed by NSW Office of Sport and Council. | Provides for enhancement of ecological and cultural heritage values with minimal disturbance. Opportunities for nature appreciation and education would be promoted here. The zone is to remain as natural as possible protecting habitat values, water quality and maintaining scenic amenity from recreational areas on the southern and eastern vantage points. Managing access to the western side of the lake will be important to protect this area now and into the future. |
| Zone 3 - NSW Office of Sport operations | Crown land leased and managed by NSW Office of Sport comprising the northern shoreline from the Lakeside conference Centre to the gate along the eastern foreshore. | Recognises the management of these areas for education and recreation by NSW Office of Sport. |
| Zone 4 - Reflections Holiday Park | Land leased and managed by NSW Crown Holiday Parks Land Managers. | Provides for camping and cabin style accommodation and the holiday park. |
| Zone 5 - Coastal protection | Crown land managed by Council and Crown land leased and managed by NSW Office of Sport. | Provides for protection and enhancement of coastal dune areas immediately east of the lake, recognising the vital role dunes play in protecting the lake from ocean shoreline recession, breakthrough and saline intrusion. |
| Zone 6 – Priority swimming area | Key water-based recreation areas extending approximately 50m from the shoreline along the southern and eastern foreshores. | Encourages swimmers to use areas best suited for swimming close to managed access points, suitable water depths and facilities. The focus is on providing safe swimming areas with minimal conflict between users. This is a ‘Go-Slow’ area for passive watercraft such as kayaks, canoes and stand up paddle boards with users to manage their watercraft responsibly and safely around swimmers. The Lake Ainsworth Sport and Recreation Centre will restrict their boating activities to areas outside of Zone 6. |

# 6. MANAGEMENT ACTIONS

Actions have been developed from the short-listed options described in *Stage 3 Management Options Study* (Hydrosphere Consulting, 2019b).

The actions consist of a combination of studies, investigations and on-ground works. Some actions require additional research or assessment prior to implementation of on-ground works. This is to ensure the appropriate effort, funding and geographical focus of on-ground works is undertaken.

Management strategies and actions have been developed for a ten-year period. This CMP and the progress of the management actions should be reviewed to ensure the actions remain relevant and the implementation of the plan is being achieved.

The recommended management actions have been described in terms of:

- Desired Outcome – the specific result to be achieved by implementation of each action.
- Priority Ranking – each action has been assigned a rank and priority according to importance and urgency for implementation. The ranking is based on multi-criteria analysis completed as part of *Stage 3 Management Options Study* (Hydrosphere Consulting, 2019b). The following priority categories have been assigned to the ranking:

**Table 9: Priority Ranking**

| Priority | Description |
|---|---|
| **Fundamental** | Actions that are critical for successful implementation of the CMP and important for long-term effective management of the lake |
| **High** | Actions of high importance in addressing key threats and issues |
| **Medium** | Actions considered of medium importance in addressing threats and issues |

- Issues addressed – management issue or threat addressed by the action (threats derived from the CMP Risk Assessment completed as part of Stage 2).
- Description of Tasks – an outline of the scope of works required.
- Responsibility – the actions identify the Lead Organisation as well as Support Organisation(s). Lead Organisations are responsible for implementation of the action. Support Organisation(s) may be required and/or requested to assist in implementation of the action, either through on-ground works, or as a potential funding or information source.
- Cost Estimate – an estimate of total costs for implementation over the ten-year life of the plan is provided (2020$). Section 7 provides a breakdown of action costs including capital, operational and maintenance costs. Cost estimates cover the tasks listed in the actions (including preliminary investigations, environmental assessment, approvals and implementation) unless otherwise stated. Cost estimates provided in the action descriptions are preliminary only and are based on the best available information.
- Potential Funding – the CMP actions are expected to be funded through Council and State Government contributions, monetary grants and in-kind contributions. Identification of grants and successful application is an important component of this CMP. A summary of potentially relevant and available grant schemes is given in Section 7.1. It is important to note that many grants and funding sources are only available up to a limited budget and as such, the available grants are changing

from year to year. It will be necessary to keep abreast of current funding availability throughout the implementation of the CMP. In most cases it is expected that in-kind contributions will be provided by Council. Collaboration with educational institutions may also provide opportunities for research projects.

Where actions are implemented through an existing program, additional expenditure and funding have not been included. Similarly, where a study/review is required to determine the appropriate level of expenditure, the cost of the review has been estimated in the action planning. Implementation costs should be confirmed by the results of the review.

- Timing – indicative timeframe for implementation and alignment with Council's four year Delivery Program (DP) under the NSW Integrated Planning and Reporting (IP&R) Framework (for more details) which commenced in 2018/19 (2019). Based on the priorities developed in this CMP, timeframes for management actions have been estimated, pending funding availability. The assumed start date for CMP implementation is 1 July 2020, following Council adoption of the Plan. The CMP has a planning timeframe of ten years therefore the duration of the Plan implementation period is from 1 July 2020 to 30 June 2029. Management actions have been scheduled according to the following timeframes:
    - Short term: year 1 – 3 (DP1 2020 – 2022).
    - Medium term: year 4 – 7 (DP2 2023 – 2026).
    - Long term: year 8 – 10 (DP3 2027 - 2029).
    - On-going: starting year 1 and implemented over the ten-year life of the CMP with possible extension beyond that period.

  Actions within the CMP align with Council's key services identified in the BSC *Delivery Program 2019-2023*. Timing of the delivery of actions should be based on the priorities developed for this CMP but will also depend on the availability of funding.
- Location – location of actions within Lake Ainsworth.
- Performance targets – performance targets for each action which can be used to measure the level of success. Identified targets incorporate those consistent with Council's Community Strategic Plan and targets specific to each action where applicable.

The actions are described in the following sections and have been grouped into management units. Figure 5 provides an overview of CMP management actions for Lake Ainsworth.

In addition to management actions to be implemented as part of this CMP, Appendix 2 details additional management considerations identified to protect the lake from coastal hazard impacts (e.g. coastal recession, oceanic break-through and wave run-up and dune overtopping). The *Coastal Zone Management Plan for the Ballina Shire Coastline* (CZMP, GeoLINK, 2016) currently provides a framework for open coast hazard management but will be replaced by a Coastline CMP in the future (i.e. by December 2021).The management requirements identified during the development of this Lake Ainsworth CMP will be considered separately in the development of the future Ballina Coastline CMP.

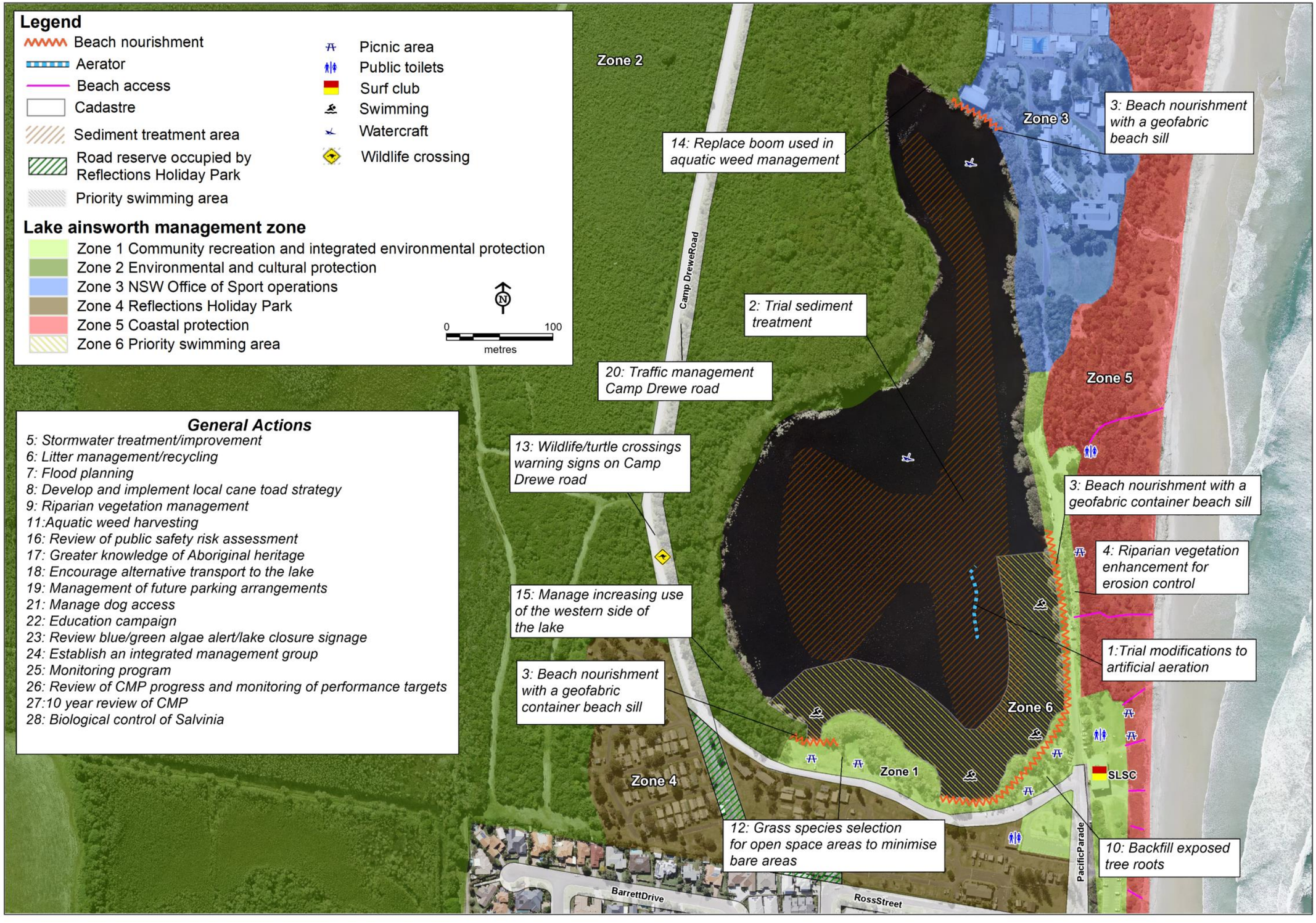


**Figure 5: Summary of Lake Ainsworth CMP management actions**

**Map is indicative only. It is to be used solely for illustrative purposes and does not form any part of local, state or federal planning law.*

## 6.1 Actions to be implemented by Ballina Shire Council

### 6.1.1 Water quality

**Action 1: Trial modifications to artificial aeration**

| | |
|---|---|
| **Desired Outcome** | Determine the best aerator regime for the lake for water quality improvements |
| **Priority ranking** | High (1) |
| **Issues addressed** | • Continued proliferation of blue-green algal species<br>• Nutrient enrichment |
| **DESCRIPTION OF TASKS:** | |

Conduct a trial to test the effects of modifying the aeration program on lake water quality and specifically the incidence of blue green algae blooms. The following modifications are proposed:

1. **Phase 1 Aerator Trial:**
   a. Design monitoring program for the trial to assess the effectiveness of modifications. Design of the monitoring program will need to provide adequate replication of previous monitoring to allow for comparison with previous water quality results under different aerator regimes. Key areas to be assessed include dissolved oxygen levels through the water column (depth profiles) with a focus on the sediment/water interface at a number of locations around the lake. This will be critical to determining the effectiveness of the modified regime and identifying the 'zone of influence' for the aerators. Overall water quality conditions will also be assessed incorporating measurements of blue green algae, nutrients, DO, pH and temperature at surface and at depth (profiles).
   b. Trial spring/ summer aeration program with continuous operation (24 hour aeration, opposed to the current program where aerators operate 12 hours overnight) and monitor conditions.
   c. Trial a gradual start-up procedure in spring to observe the effect on water quality conditions in the initial aerator operation period (i.e. aim to allow acclimation and avoid a major turnover event).
   d. Reporting of trial completed including analysis of monitoring data. Based on the results, further management is to be recommended. This may include:
      - Continuation of the modified regime if water quality improvements were observed,
      - Consider the need for additional diffusers spaced around the lake (if the 'zone of influence' of current aerators is considered inadequate) or
      - If Phase 1 trials do not improve water quality conditions to an acceptable level, move to Phase 2.
2. **Phase 2 Aerator Trial:**
   a. Trial one year without artificial aeration (i.e. turn off aerators). This will allow for the assessment of seasonal changes and comparison with previous water quality conditions under past aerator regimes.
   b. Monitoring as described for Phase 1 above with an additional focus on development of anoxic (low oxygen) zones at depth to provide forewarning of potential low dissolved oxygen events developing under stratified conditions.
   c. Reporting of trial including recommendations for further management.

| | |
|---|---|
| **Lead Organisation** | BSC |
| **Support Organisation** | EES – Coast and Estuaries |
| **Total Cost Estimate (10 yr)** | $110,000 (allowance of $10,000 for extended aerator operation Yr2, $50,000 for monitoring Yr2 & Yr3) |
| **Potential Funding Sources** | BSC, NSW Coastal and Estuary Grants Program, Increasing Resilience to Climate Change program |
| **Timing** | Short term (DP1 2020-2023) |
| **Location** | In-lake, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area |

| | |
|---|---|
| **Performance Targets** | • Design of monitoring program complete prior to spring aeration September 2020.<br>• Phase 1 trial report complete by June 2021.<br>• Phase 2 trial report complete by June 2022. |

### 6.1.2 Sediment management

#### Action 2: Trial sediment treatment

| | |
|---|---|
| **Desired Outcome** | To improve and maintain water quality and ecosystem health of the lake and surrounding habitats |
| **Priority ranking** | High (2) |
| **Issues addressed** | • Continued proliferation of blue-green algal species<br>• Nutrient enrichment |

**DESCRIPTION OF TASKS:**

*The need for this action will be revisited based on the outcomes of Action 1: Trial modifications to artificial aeration.

Conduct a trial to test the suitability and effectiveness of application of a phosphorus binding agent (e.g. Phoslock™) to lake sediments in order to improve water quality and specifically the incidence of blue green algae blooms. The following stages are proposed:

1. Liaison with regulatory authorities including DPI Fisheries and DPIE-Crown Lands to determine and obtain approvals as required.
2. **Phase 1 test-tube study:**
   a. Laboratory tests and simulated lake environments using sediment and water from the lake (i.e. out-of-lake 'test-tube' studies).
   b. The study would determine aspects such as application rates, longevity of treatment, timing and evaluation of potential risks (e.g. effects on colour, water clarity, and water chemistry). If results of the out of lake studies were positive, move to next phase. A report should be finalised to confirm the next steps. This may include recommendations for community consultation and provision of results.
3. **Phase 2 mesocosm study:**
   a. Small-scale in-lake study where areas of the lake are isolated to test how the treatment effects water quality. 'Mesocosms' are routinely used for this purpose to isolate the water column from the lake surface to the lake bottom.
   b. The study would assess the same aspects described for Phase 1 above, but allow for conditions to be assessed in 'real-life' subject to lake conditions (e.g. weather, hydrodynamics, aquatic fauna etc.). Dependant on design and location the study could also allow for the community to observe the process and effects first hand. If results of the in-lake studies were positive, move to next phase.
4. **Phase 3 lake application:**
   a. Typical lake application would involve binding agent granules or slurry being directly added to the water via a barge or boat. The compound is designed to settle out through the water column binding phosphate and eventually collect as a thin (< 2 mm) layer over sediments creating a barrier layer and preventing further phosphorus release.
   b. Monitoring will be required to assess the effectiveness of the treatment. Design of the monitoring program will need to provide adequate replication of previous monitoring to allow for comparison with previous water quality results.

| | |
|---|---|
| **Lead Organisation** | BSC |
| **Support Organisation** | EES – Coast and Estuaries, DPI Fisheries, DPIE-Crown lands |
| **Total Cost Estimate (10 yr)** | $220,000 (allowance of $40,000 for Phase 1 and 2 studies, $160,000 for lake application in Yr4 and $10,000/yr monitoring in Yr4 & Yr5) |

| | |
|---|---|
| **Potential Funding Sources** | BSC, NSW Coastal and Estuary Grants Program, Increasing Resilience to Climate Change program |
| **Timing** | Short-Medium term (DP1 2020-2022 and DP2 2023-2026) |
| **Location** | In-lake, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area |
| **Performance Targets** | • Phase 1 report completed by June 2023.<br>• Phase 2 study established by September 2023.<br>• Phase 3 lake application, assumed to be complete by June 2024, (timing to be confirmed by Phase 2 results). |

### 6.1.3 Bank erosion

**Action 3: Beach nourishment with a geofabric container beach sill**

| | |
|---|---|
| **Desired Outcome** | Improved public safety and amenity of foreshores and stabilisation of bank erosion and riparian vegetation |
| **Priority ranking** | High (3) |
| **Issues addressed** | • Foreshore erosion of the Lake<br>• Foreshore accessibility and public safety |

**DESCRIPTION OF TASKS:**

1. Detailed design of erosion controls including consideration of:
    a. Undertake a review of potential sources of nourishment material suitable for use at Lake Ainsworth. The aim of the review will be to identify a long-term source of suitable sand for on-going work. The review will include an assessment of specific physical criteria (e.g. sand must be of natural origin, specific grain size and shape, colour to match existing sand in place, must be clean and free of contamination, weeds, seeds etc.) as well as costs, transport requirements and approval process. Utilisation of scraped sand from the lake would be much more cost effective and should be considered where this is appropriate and can be achieved without negative impact on environmental and aesthetic values.
    b. The preferred option to nourish the lake's recreational beaches with clean sand and installation of buried geofabric containers along beach faces (i.e. parallel to the shoreline) to act as sills to maintain minimum beach levels and reduce the rate of sand loss.
    c. The size and placement depth of geofabric containers requires detailed design to achieve the most effective configuration. Trials are currently underway at the lake which will help inform further design.
    d. Sill(s) are to be located away from the key recreational use elevations.
    e. Nourishment could also incorporate infilling around exposed tree roots to improve tree health and protect riparian vegetation (refer Action 10: Backfill exposed tree roots).
    f. Clean up of remnant materials/infrastructure such as fencing, log revetment, etc.
    g. Maintenance of erosion controls as informed by the annual erosion monitoring (refer Action 25: Monitoring program).
2. Liaison with regulatory authorities including DPI Fisheries and DPIE-Crown lands to determine and obtain necessary approvals.
3. Undertake environmental assessment and obtain approvals.
4. Seek funding approval.
5. Implementation.

| | |
|---|---|
| **Lead Organisation** | BSC, NSW Office of Sport |
| **Support Organisation** | EES – Coast and Estuaries, DPI Fisheries, DPIE-Crown lands |

| | |
|---|---|
| **Total Cost Estimate (10 yr)** | $265,000 (Allowance of $50,000 for detailed design, $200,000 for nourishment with geobags and $5,000 for maintenance every three years) |
| **Potential Funding Sources** | BSC, NSW Office of Sport, NSW Coastal and Estuary Grants Program, Crown Reserves Improvement Fund Program |
| **Timing** | Short- term initial works (DP1 2020-2022) and ongoing maintenance (DP1 - DP3 2020-2029) |
| **Location** | Zone 1, Zone 2, Zone 3, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area |
| **Performance Targets** | • Detailed design completed by June 2022.<br>• Public safety assessment assigns low risk to all foreshores by June 2023. |

### Action 4: Riparian vegetation enhancement for erosion control

| | |
|---|---|
| **Desired Outcome** | Improved public safety and amenity of foreshores and stabilisation of bank erosion and riparian vegetation |
| **Priority ranking** | High (7) |
| **Issues addressed** | • Foreshore erosion of the Lake<br>• Foreshore accessibility and public safety<br>• Stormwater impact<br>• Poor riparian vegetation condition<br>• Terrestrial weeds<br>• Decreased amenity and enjoyment<br>• Reduced aesthetic quality |

**DESCRIPTION OF TASKS:**

1. Conduct an assessment of riparian vegetation along the eastern and southern foreshores following completion of Foreshore Improvement Works. This assessment will determine areas for further riparian revegetation and/or enhancement along shorelines for greater erosion protection.
2. Plan works considering the balance between access requirements, bank protection and ecological values. Provision for managing access to these areas will need to be considered as part of the design of works.
3. Liaison with DPIE-Crown Lands to determine and obtain approvals as required (e.g. for works on submerged Crown land).
4. Carry out initial works as required (i.e. planting, fencing, access provision).
5. Follow up weed control and maintenance will be needed for at least 3-5 years. Depending on the success of works maintenance may be scaled back as native vegetation becomes established. Riparian Condition Assessment (refer Action 25: Monitoring program) to inform ongoing management.

| | |
|---|---|
| **Lead Organisation** | BSC |
| **Support Organisation** | EES – Coast and Estuaries, DPIE-Crown Lands, Lennox Landcare |
| **Total Cost Estimate (10 yr)** | $70,000 (Allowance of $20,000 for initial planning and planting work, $5,000/yr for ongoing maintenance) |
| **Potential Funding Sources** | BSC, NSW Coastal and Estuary Grants Program, Crown Reserves Improvement Fund Program |
| **Timing** | Short- term initial works (DP1 2020-2022) and ongoing maintenance (DP1 - DP3 2020-2029) |
| **Location** | Zone 1, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area |
| **Performance Targets** | • Riparian assessment completed by June 2021. |

### 6.1.4 Catchment management

**Action 5: Stormwater treatment/improvement**

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|---|---|
| **Desired Outcome(s)** | Best-practice stormwater treatment systems are installed and maintained<br>Continuation of low-impact land management practices in the catchment |
| **Priority ranking** | Medium (17) |
| **Issues addressed** | • Stormwater impact<br>• Spills and contamination<br>• Microbiological risk to human health<br>• Nutrient enrichment<br>• Foreshore erosion of the Lake |

**DESCRIPTION OF TASKS:**

**Stormwater management:**

1. Best practice stormwater treatment and improvement to be implemented during the design, retrofit and/or upgrade of any development including roads and parking facilities in the catchment. Designs to include measures to reduce erosion through management of concentrated overland flows.
2. Land managers to take all opportunities to upgrade stormwater infrastructure to current best practice wherever possible.
3. Regularly assess the condition and performance of stormwater treatment systems and devices (refer Action 25: Monitoring program).
4. On-going maintenance/ asset renewal/ replacement of stormwater treatment systems.

**Land management practices:**

1. Continue practices to prevent grass clippings from entering stormwater drains and/or the lake (e.g. use a catcher when mowing and remove clippings).
2. Continue policy of no fertiliser use within lake foreshore areas and Reflections Holiday Park. Continue best-practice management of fertiliser application to sports oval on NSW Office of Sport managed land including minimising fertiliser use in general and avoiding use before, during or immediately after rainfall. Encourage best-practice management of fertiliser application within all catchment areas including residential areas through Action 22: Education campaign.
3. Continue careful management and use of materials imported to the catchment that may introduce nutrients or contamination (e.g. mulch, compost, soil, blue metal, pesticides and herbicides etc.).
4. Public events within the study area should be supported by an appropriate environmental assessment that addresses and mitigates any potential adverse impacts on the lake and surrounding natural environment. The BSC Policy EO5 *Events on Public Land* (BSC, 2016) details assessment requirements including the scale of events requiring approval and environmental considerations. Specific assessment criteria for the lake includes reference to sensitive lake ecosystems and the need to consider the location of stormwater treatment devices in place in the foreshore (i.e. in-ground bio retention) which are not readily visible and may have their treatment capacity compromised if subjected to compaction by heavy vehicles etc. Consultation with Council stormwater engineers will be required as part of environmental assessment.

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| **Lead Organisation** | BSC |
| **Support Organisation** | NSW Office of Sport, EES – Coast and Estuaries |
| **Total Cost Estimate (10 yr)** | Staff time and allowance of $40,000 for maintenance/ asset renewal/ replacement of stormwater treatment systems |
| **Potential Funding Sources** | BSC, NSW Coastal and Estuary Grants Program, Crown Reserves Improvement Fund Program |
| **Timing** | Ongoing maintenance (DP1 - DP3 2020-2029) |

| | |
|---|---|
| **Location** | Catchment area (all zones), CMA1 – Coastal Wetlands and Littoral Rainforests, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area |
| **Performance Targets** | • Best practice stormwater treatment implemented for all new development.<br>• Water quality monitoring does not indicate stormwater pollution impacts |

### Action 6: Litter management/recycling

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|---|---|
| **Desired Outcome** | Improve waste management and education to reduce litter impacting on amenity, water quality and wildlife. |
| **Priority ranking** | High (8) |
| Issues addressed | • Decreased amenity and enjoyment<br>• Reduced aesthetic quality<br>• Spills and contamination<br>• Stormwater impact |

**DESCRIPTION OF TASKS:**

1. Assess adequacy of general waste bins and waste collections and provide additional bins and collections as required.
2. Provide recycling bins in addition to general waste bins at the lake.
3. During peak times such as long weekends and school holiday periods, consider increased frequency of rubbish collection and/or placement of additional bins (either standard bins or small temporary skip bin, with cover) on site to reduce the likelihood of overflow and litter polluting the lake environment.
4. Acknowledge and support community groups/individuals that regularly clean up litter at the lake.
5. Reinforce messaging through the education program (refer Section 6.1.8 Education).

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| **Lead Organisation** | BSC |
| **Support Organisation** | EES – Coast and Estuaries, North East Waste, Community groups/individuals who regularly clean up litter at the lake |
| **Total Cost Estimate (10 yr)** | $50,000 (Allowance of $5,000/yr for extra bins and collection services during peak times) |
| **Potential Funding Sources** | BSC, NSW Coastal and Estuary Grants Program, NSW EPA Waste Less, Recycle More initiative. |
| **Timing** | Ongoing (DP1 - DP3 2020-2029) |
| **Location** | Lake and surrounds (all zones), CMA1 – Coastal Wetlands and Littoral Rainforests, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area |
| **Performance Targets** | • Recycling bins in place by June 2021.<br>• Reduction in volume of waste collected during Clean up Australia Day |

### 6.1.5 Flooding

**Action 7: Flood planning**

| | |
|---|---|
| **Desired Outcome** | Ensure all development and management actions in the study area are suitable for the location and/or are adaptive to changing flooding risk. |
| **Priority ranking** | Medium (12) |
| **Issues addressed** | • Localised freshwater flooding<br>• Altered lake hydrology and water balance<br>• Climate change impacts<br>• Public safety concerns/risk |
| **DESCRIPTION OF TASKS:** | |
| 1. Future development in the catchment and all actions implemented as part of this CMP will need to consider the potential future flood risk.<br>2. Lake Ainsworth catchment to be included in the review of the *Ballina Floodplain Risk Management Plan* (BMT WBM, 2015). Plan works considering the balance between access requirements, bank protection and ecological values. Provision for managing access to these areas will need to be considered as part of the design of works. | |
| **Lead Organisation** | BSC |
| **Support Organisation** | EES – Coast and Estuaries |
| **Total Cost Estimate (10 yr)** | Staff time |
| **Potential Funding Sources** | n/a |
| **Timing** | Short- term (DP1 2020-2022) |
| **Location** | Flood risk areas identified in *Stage 2 Vulnerabilities and Opportunities Study* (Hydrosphere Consulting, 2019a), CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area |
| **Performance Targets** | • Review of *Ballina Floodplain Risk Management Plan* includes the Lake Ainsworth catchment. |

### 6.1.6 Flora and fauna

**Action 8: Develop and implement local Cane Toad management strategy**

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|---|---|
| **Desired Outcome** | Reduce Cane Toad numbers and their undesirable impacts on native wildlife. |
| **Priority ranking** | Medium (18) |
| **Issues addressed** | • Exotic aquatic fauna<br>• Decreased amenity and enjoyment<br>• Reduced aesthetic quality |
| **DESCRIPTION OF TASKS:** | |
| 1. Develop an integrated local Cane Toad Management Strategy for the lake, considering the range of control methods discussed in *Stage 2 Vulnerabilities and Opportunities Study*. Consult with NSW DPI and NPWS and NSW Office of Sport regarding regional and local cane toad management.<br>2. Implement program.<br>3. Review data, methods and strategy on an annual basis. | |
| **Lead Organisation** | BSC |
| **Support Organisation** | EES – Coast and Estuaries, NPWS, DPI |
| **Total Cost Estimate (10 yr)** | $55,000 (Allowance of $20,000 for strategy development and $5,000/yr for implementation and review) |
| **Potential Funding Sources** | BSC, NSW Coastal and Estuary Grants Program |
| **Timing** | Ongoing (DP1 - DP3 2020-2029) |
| **Location** | Lake and surrounds (all zones), CMA1 – Coastal Wetlands and Littoral Rainforests, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area |
| **Performance Targets** | • Local Cane Toad Management Strategy completed by June 2023.<br>• Annual reviews completed. |

### Action 9: Riparian vegetation management

| | |
|---|---|
| **Desired Outcome** | To improve condition and extent of natural fringing vegetation around lake. |
| **Priority ranking** | Medium (13) |
| **Issues addressed** | • Terrestrial weeds<br>• Poor riparian vegetation condition<br>• Decreased amenity and enjoyment<br>• Reduced aesthetic quality<br>• Impacts on Aboriginal cultural and heritage value |
| **DESCRIPTION OF TASKS:** | |
| 1. Liaison with DPIE-Crown Lands to determine and obtain approvals as required (e.g. for works on submerged Crown land).<br>2. Complete regular maintenance, weed control and enhancement of foreshore vegetation for all foreshores.<br>3. Further planting of shade trees along the southern foreshore.<br>4. Further planting of native reed beds along lake foreshores is also considered appropriate in some areas to assist in ongoing erosion control, managing access, enhancing habitat value and minor nutrient uptake.<br>5. Fencing as required to protect sensitive areas. | |
| **Lead Organisation** | BSC |
| **Support Organisation** | EES – Coast and Estuaries, DPIE-Crown Lands, Lennox Landcare |
| **Total Cost Estimate (10 yr)** | $120,000 (Allowance of $30,000 in the first year to establish new areas including fencing and $10,000/yr for ongoing works weed control and maintenance) |
| **Potential Funding Sources** | BSC, NSW Coastal and Estuary Grants Program, Crown Reserves Improvement Fund Program |
| **Timing** | Ongoing (DP1 - DP3 2020-2029) |
| **Location** | Lake foreshores Zone 1, Zone 2, Zone 3, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area |
| **Performance Targets** | • Riparian condition assessment completed annually shows improved condition ratings. |

### Action 10: Backfill exposed tree roots

| | |
|---|---|
| **Desired Outcome(s)** | To improve the health of Broad-leaved Paperbark trees along lake foreshores<br>To reduce trip hazards, access issues and improve public safety<br>To improve and maintain water quality and ecosystem health of the lake |
| **Priority ranking** | High (4) |
| **Issues addressed** | • Poor riparian vegetation condition<br>• Decreased amenity and enjoyment<br>• Reduced aesthetic quality<br>• Impacts on Aboriginal cultural and heritage value |
| **DESCRIPTION OF TASKS:** | |
| 1. Liaison with DPIE-Crown Lands to determine and obtain approvals as required (e.g. for works on submerged Crown land).<br>2. Backfill exposed roots of mature Broad-leaved Paperbark trees along the south-east foreshore with suitable sand. Ideally the sand should match the natural substrate and have minimal nutrient/fertiliser content. This option can be integrated with the nourishment of the lake's beaches (refer Action 3: Beach nourishment with a geofabric container beach sill).<br>3. Provide vegetation cover over the placed sediment either as turf or native groundcovers will assist in preventing movement of the placed material either through pedestrian access or wind and wave action.<br>4. Temporary fencing may be required to prevent pedestrian access in the short term to allow vegetation cover to establish.<br>5. Monitor tree health and root cover and maintain as needed. | |
| **Lead Organisation** | BSC |
| **Support Organisation** | EES – Coast and Estuaries, DPIE-Crown Lands |
| **Total Cost Estimate (10 yr)** | $56,000 (Allowance of $50,000 for additional backfill, fencing and groundcovers, $2,000 every three years for maintenance) |
| **Potential Funding Sources** | BSC, NSW Coastal and Estuary Grants Program, Crown Reserves Improvement Fund Program |
| **Timing** | Short- term initial works (DP1 2020-2022) and ongoing maintenance (DP1 - DP3 2020-2029) |
| **Location** | Lake foreshores Zone 1, Zone 2, Zone 3, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area |
| **Performance Targets** | • Action 16: Review of public safety risk assessment assigns low risk to all foreshores by June 2021. |

### Action 11: Aquatic weed harvesting

| | |
|---|---|
| **Desired Outcome** | To reduce aquatic weeds and improve recreational opportunities and aesthetics. |
| **Priority ranking** | Medium (21) |
| **Issues addressed** | • Aquatic weeds or unnatural growth<br>• Decreased amenity and enjoyment<br>• Reduced aesthetic quality<br>• Public safety concerns/risk |
| **DESCRIPTION OF TASKS:** | |
| 1. Liaison with DPIE-Crown Lands to determine and obtain approvals as required (e.g. for works on submerged Crown land).<br>2. Continue manual harvest of aquatic weeds from the lake by community volunteers as needed to control outbreaks.<br>3. BSC to continue to assist in removal and disposal of the harvested plants. At times mechanical removal of aquatic weeds will be required to remove major infestations.<br>4. Ensure disposal of weeds to a registered waste facility. Removed wet weeds may be dewatered/dried out prior to disposal as long as the drying process and location limits the reintroduction of nutrients into the lake. If left to decompose on lake shore, rotting vegetation can create aesthetic issues (odour, visual) and nutrients and contaminants may be re-introduced to lake.<br>5. Annual review of program. | |
| **Lead Organisation** | BSC |
| **Support Organisation** | EES – Coast and Estuaries, DPIE-Crown Lands, Lennox Landcare, NSW Office of Sport |
| **Total Cost Estimate (10 yr)** | $10,000 (Allowance of $1,000/yr for transport and disposal of weeds) |
| **Potential Funding Sources** | BSC, NSW Coastal and Estuary Grants Program, Crown Reserves Improvement Fund Program |
| **Timing** | Ongoing (DP1 - DP3 2020-2029) |
| **Location** | In-lake, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area |
| **Performance Targets** | • Annual review of program including assessment of aquatic weed abundance |

### Action 12: Grass species selection for open space areas to minimise bare areas

| | |
|---|---|
| **Desired Outcome** | Enhanced aesthetics, recreational values and protection against erosion. |
| **Priority ranking** | Medium (11) |
| **Issues addressed** | • Decreased amenity and enjoyment<br>• Reduced aesthetic quality<br>• Stormwater impact |
| **DESCRIPTION OF TASKS:** | |
| 1. Monitor success of new turf installed as part of Foreshore Improvement Works.<br>2. If required, complete further investigation of durable grass types for high use areas along the lake foreshore. Ideal characteristics would include being able to withstand dry conditions and high levels of foot traffic, while being shade tolerant and salt resistant. The ability for grasses to spread via runners or wind-dispersed seed and impacts on nearby natural vegetation areas should also be considered.<br>3. Selection of suitable grass species.<br>4. If required, purchase and install alternative turf.<br>5. Provide adequate weed guards/edging to separate turfed areas from natural riparian vegetation and revegetation areas. Edging to extend down into the soil to prevent the spread of underground grass runners invading natural areas. | |
| **Lead Organisation** | BSC |
| **Support Organisation** | Lennox Landcare |
| **Total Cost Estimate (10 yr)** | Staff time, and allowance of $85,000 to replace turf in Zone 1 if required |
| **Potential Funding Sources** | BSC, Crown Reserves Improvement Fund Program |
| **Timing** | Short-Medium term (DP1 2020-2022 and DP2 2023-2026) |
| **Location** | Lake foreshores Zone 1, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area |
| **Performance Targets** | • Recommendations for alternate grass species by June 2023 if current turf unsatisfactory. |

### Action 13: Wildlife/turtle crossing warning signs on Camp Drewe Road

| | |
|---|---|
| **Desired Outcome** | Raise awareness of the presence of native fauna and need for care to be taken to avoid road kill. |
| **Priority ranking** | Medium (14) |
| **Issues addressed** | • Threats to native flora and fauna<br>• Decreased amenity and enjoyment<br>• Reduced aesthetic quality<br>• Limited public education/engagement regarding lake issues |
| **DESCRIPTION OF TASKS:** | |
| 1. Review current signage in consultation with local community and particularly wildlife groups in Lennox Head.<br>2. Design signage and placement considering potential nesting areas, known crossing locations and seasonality.<br>3. Promote and educate through Action 22: Education campaign.<br>4. Monitor road kill (refer Action 25: Monitoring program) and review signage as needed.<br>Linked to Action 20: Traffic management Camp Drewe Road (measures to manage traffic speed) | |
| **Lead Organisation** | BSC |
| **Support Organisation** | EES – Coast and Estuaries, RMS |
| **Total Cost Estimate (10 yr)** | $10,000 (staff time and allowance of $5,000 for new signage and $5,000 for replacement/renewal at Yr5) |
| **Potential Funding Sources** | BSC, NSW Coastal and Estuary Grants Program |
| **Timing** | Short-Medium term (DP1 2020-2022 and DP2 2023-2026) |
| **Location** | Camp Drewe Road, Zone 2, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use |
| **Performance Targets** | • Review complete September 2020.<br>• Signage installed December 2020. |

### Action 14: Replace boom used in aquatic weed management

| | |
|---|---|
| **Desired Outcome** | Allow for effective ongoing control of aquatic weeds when high densities occur. |
| **Priority ranking** | Medium (20) |
| **Issues addressed** | • Aquatic weeds or unnatural growth<br>• Reduced aesthetic quality |
| **DESCRIPTION OF TASKS:** | |
| 1. Determine boom specifications and investigate most effective options.<br>2. Obtain quotes.<br>3. Replace boom. | |
| **Lead Organisation** | BSC |
| **Support Organisation** | EES – Coast and Estuaries |
| **Total Cost Estimate (10 yr)** | $10,000 (Allowance of $10,000 for boom replacement) |
| **Potential Funding Sources** | BSC, NSW Coastal and Estuary Grants Program |
| **Timing** | Short- term (DP1 2020-2022) |
| **Location** | In-lake, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area |
| **Performance Targets** | • Boom replaced by June 2021. |

### 6.1.7 Community uses

**Action 15: Manage increasing use of the western side of the lake to preserve ecosystem values**

| | |
|---|---|
| **Desired Outcome(s)** | To preserve the relatively 'untouched' ecosystem along the western shoreline, while providing formalised access to a limited section in order to reduce impacts resulting from concentrated use.<br>To protect habitat values, water quality, Aboriginal Heritage, scenic values and ecosystem health of the lake. |
| **Priority ranking** | High (10) |
| **Issues addressed** | • Poor riparian vegetation condition<br>• Threats to native flora and fauna<br>• Impacts on Aboriginal cultural and heritage value<br>• Decreased amenity and enjoyment<br>• Reduced aesthetic quality<br>• Poor foreshore accessibility and public safety<br>• Limited public education/engagement regarding lake issues |

**DESCRIPTION OF TASKS:**

1. Undertake interim management of the western side of the lake to manage visitor use in this location including regular ranger patrols and temporary signage to advise of requirements (e.g. dog free area, no overnight staying/camping, remain on existing paths, no littering etc.). Interim measures are ongoing and will continue during the planning and development phases for the western side.
2. Develop an overall concept for the western side of the lake in order to appropriately protect environmental and cultural values while managing increasing visitor pressures.
3. Engineering design: key considerations and priorities would include:
    a. Establishment of ecological and cultural heritage protection areas for the majority of the western side (currently mapped as Zone 2 in Figure 4). Preliminary consultation with BSC and the community indicates that two broad options should be considered further during detailed design:
        - Install a raised boardwalk extending from existing recreation areas of the southern foreshore along the western side of the lake to allow for low impact access. Integrated seating and interpretive signage will enhance amenity and provide opportunities for education. A branching boardwalk connecting Camp Drewe Road to the main boardwalk in the vicinity of existing access may also be considered. All other access tracks to be closed and revegetated to discourage ad hoc access.
        - Install a raised boardwalk as described above which is shorter, terminating in the viewing platform/lookout in the south-west corner of the lake. Seating and interpretive signage could be installed at the viewing platform to enhance amenity and function. This option may have benefits of reduced cost associated with boardwalk construction and reduced impact on the environment through construction works and disturbance of vegetation. All other access tracks to be closed and revegetated to discourage ad hoc access.
    b. Educational facilities and weed management.
    c. Informal parking along Camp Drewe Road will also need to be restricted to manage visitor numbers and access to the western shoreline.
    d. Regardless of whether the above boardwalk options in (a) above are pursued, there is a need to rationalise existing access tracks along the western side of the lake by selecting a preferred access path and formalising this route, while closing off and revegetating the remaining tracks. This may involve removal of existing fencing and provision of formal tracks with fencing as required to direct pedestrians away from sensitive areas (e.g. lake edges).
    e. There is also opportunity for pedestrian/shared path facilities along Camp Drewe Rd with the purpose of providing separation between pedestrians and traffic and increased amenity for dog walkers, bikes etc.
    f. Community consultation including local Aboriginal representatives.

| | |
|---|---|
| 4. Approvals: development consent (and environmental assessment).<br>5. Construction to be staged based on established priorities and available funding. | |
| **Lead Organisation** | BSC |
| **Support Organisation** | EES – Coast and Estuaries, DPIE–Crown Lands |
| **Total Cost Estimate (10 yr)** | $745,000 (Allowance of $25,000 concept development, $75,000 detailed design, approvals and consultation and $645,000 construction based on 200m raised boardwalk with viewing platform) |
| **Potential Funding Sources** | BSC, NSW Coastal and Estuary Grants Program, Crown Reserves Improvement Fund Program |
| **Timing** | Short-Medium term (DP1 2020-2022 and DP2 2023-2026) |
| **Location** | Western side of lake, Zone 2, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area |
| **Performance Targets** | • Monitoring of monitoring western foreshore usage complete by June 2021.<br>• Engineering design complete by June 2022.<br>• Approvals received by December 2022. |

### Action 16: Review of public safety risk assessment

| | |
|---|---|
| **Desired Outcome** | To ensure public safety at lake access points |
| **Priority ranking** | High (5) |
| **Issues addressed** | • Poor foreshore accessibility and public safety<br>• Public safety concerns/risk |
| **DESCRIPTION OF TASKS:** | |
| 1. Once the Lake Ainsworth Foreshore Improvement Works program has been finalised, review and update the public risk assessment completed as part of *Stage 2 Vulnerabilities and Opportunities Study*.<br>2. Based on the results of the updated assessment, recommend actions for any remaining risk areas. | |
| **Lead Organisation** | BSC |
| **Support Organisation** | - |
| **Total Cost Estimate (10 yr)** | $10,000 (Allowance of $5,000 for assessments at Yr2 and Yr7) |
| **Potential Funding Sources** | BSC |
| **Timing** | Short-Medium term (DP1 2020-2022 and DP2 2023-2026) |
| **Location** | Lake foreshores Zone 1, Zone 2, Zone 3, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area |
| **Performance Targets** | • Public safety assessment complete by June 2022. |

### Action 17: Greater acknowledgement of Aboriginal heritage

| | |
|---|---|
| **Desired Outcome** | To identify culturally appropriate ways to better acknowledge the indigenous history of the lake surrounding habitats. |
| **Priority ranking** | High (9) |
| **Issues addressed** | • Impacts on Aboriginal cultural and heritage value<br>• Limited public education/engagement regarding lake issues |
| **DESCRIPTION OF TASKS:** | |
| 1. Planning and design of potential options which may include dedicated signage, educational materials and field days to allow for appropriate acknowledgement.<br>2. Stakeholder engagement: consultation with the range of stakeholders identified during Stage 2 will be important to reflect the diversity of groups and agree on the best way forward.<br>3. Implementation.<br>4. Integrate with Action 22: Education campaign for promotion and dissemination of information. | |
| **Lead Organisation** | BSC |
| **Support Organisation** | EES – Coast and Estuaries |
| **Total Cost Estimate (10 yr)** | $55,000 (Allowance of $40,000 for consultation, planning and concept design, $15,000 for implementation (e.g. signage, educational materials etc.) |
| **Potential Funding Sources** | BSC, NSW Coastal and Estuary Grants Program, Crown Reserves Improvement Fund Program, Commonwealth Community Led Grants |
| **Timing** | Short- term initial planning work (DP1 2020-2022) and ongoing implementation (DP1 - DP3 2020-2029) |
| **Location** | Lake and surrounds (all zones), CMA1 – Coastal Wetlands and Littoral Rainforests, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area |
| **Performance Targets** | • Planning and design and consultation complete by June 2022.<br>• Implementation and education underway by June 2023. |

### Action 18: Encourage alternative transport to the lake

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|---|---|
| **Desired Outcome** | To reduce congestion, parking pressure and vehicle use, leading to enhanced amenity, lower carbon emissions/pollution and increased safety. Encourage exercise and community connectivity with associated increased health benefits. |
| **Priority ranking** | Medium (16) |
| **Issues addressed** | • Parking adequacy for current and future demand<br>• Decreased amenity and enjoyment<br>• Reduced aesthetic quality |
| **DESCRIPTION OF TASKS:** | |
| 1. Improve connectivity of walking and cycling pathways from town to the lake. This includes creating a shared path for both bicycle riders and pedestrians extending from the Lennox Head bus stop along Pacific Parade to the lake. Planning and design will need to consider the following:<br>a. Investigation of the vulnerability to coastal erosion and degree of protection from existing coastal works.<br>b. Impacts on dune vegetation.<br>c. Suitable construction materials for the location.<br>d. Interaction with existing parking arrangements.<br>e. Interaction with and the Surf Club and operational areas.<br>2. Provision of bike racks and mobility scooter parking at the lake.<br>3. Provide a peak time shuttle bus service through town to the lake (i.e. summer holidays, Easter and October long weekends). Suitable pick up locations and timing to be determined during stakeholder consultation.<br>4. Stakeholder engagement: community consultation to determine preferred options and likely uptake.<br>5. Implementation/construction.<br>6. Integrate with Action 22: Education campaign to raise awareness of these additional services and facilities and promote use. | |
| **Lead Organisation** | BSC |
| **Support Organisation** | EES – Coast and Estuaries |
| **Total Cost Estimate (10 yr)** | $515,000 (staff time and allowance of $20,000 for implementation, $295,000 for shared path, $25,000/yr for peak time shuttle bus service) |
| **Potential Funding Sources** | BSC, NSW Coastal and Estuary Grants Program, Crown Reserves Improvement Fund Program |
| **Timing** | Ongoing (DP1 - DP3 2020-2029) |
| **Location** | Lennox Head and Lake surrounds (Zone 1), CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area |
| **Performance Targets** | • Planning and design and consultation complete by June 2023.<br>• Implementation and education underway by June 2024. |

### Action 19: Management of future parking arrangements

| | |
|---|---|
| **Desired Outcome** | To evaluate the extent of parking issues following completion of Foreshore Improvement Works and assist in directing further management effort. |
| **Priority ranking** | High (6) |
| **Issues addressed** | • Parking adequacy for current and future demand<br>• Decreased amenity and enjoyment |
| **DESCRIPTION OF TASKS:** | |
| 1. Review results of car parking monitoring conducted as part of Action 25: Monitoring program<br>2. Based on monitoring results recommend additional parking management.<br>3. Planning and design of new parking arrangements as needed.<br>4. Consideration and approval by BSC Local Traffic committee.<br>5. Implementation. | |
| **Lead Organisation** | BSC |
| **Support Organisation** | EES – Coast and Estuaries |
| **Total Cost Estimate (10 yr)** | Staff time |
| **Potential Funding Sources** | BSC, NSW Coastal and Estuary Grants Program |
| **Timing** | Short-Medium term (DP1 2020-2022 and DP2 2023-2026) |
| **Location** | Parking areas along Camp Drewe Road (Zone 2) and urban areas of Lennox Head, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area |
| **Performance Targets** | • Report on parking monitoring program results completed by June 2022. |

### Action 20: Traffic management Camp Drewe Road

| | |
|---|---|
| **Desired Outcome** | To improve public safety and reduce likelihood of wildlife road kill on Camp Drewe Rd. |
| **Priority ranking** | Medium (15) |
| **Issues addressed** | • Public safety concerns/risk<br>• Threats to native flora and fauna<br>• Limited public education/engagement regarding lake issues |
| **DESCRIPTION OF TASKS:** | |
| 1. Review of appropriate treatments consistent with best practise to improve the road safety for Camp Drewe Road.<br>2. Liaise with RMS regarding suitable speed limits (recommend no higher than current 50km/hr limit).<br>3. Liaise with NSW Police to highlight the issue and ensure enforcement of speed limits (e.g. extra patrols). | |
| **Lead Organisation** | BSC |
| **Support Organisation** | RMS, NSW Police |
| **Total Cost Estimate (10 yr)** | $30,000 (staff time and allowance of $30,000 for road treatments) |
| **Potential Funding Sources** | RMS, BSC |
| **Timing** | Short-Medium term initial review and liaison work (DP1 2020-2022 and DP2 2023-2026) and ongoing (DP1-DP3 2020-2029) |
| **Location** | Camp Drewe Road (Zone 2), CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area |
| **Performance Targets** | • Review complete by June 2021. |

### Action 21: Manage dog access

| | |
|---|---|
| **Desired Outcome** | Reduction in the number of dogs in the lake and foreshore areas, reducing the inputs of urine and faeces to the lake and reduced impacts on native wildlife at the lake. |
| **Priority ranking** | Medium (23) |
| **Issues addressed** | • Microbiological risk to human health<br>• Threats to native flora and fauna<br>• Decreased amenity and enjoyment<br>• Reduced aesthetic quality<br>• Nutrient enrichment<br>• Limited public education/engagement regarding lake issues |

**DESCRIPTION OF TASKS:**

1. Review current dog access arrangements at the lake as documented in the *BSC Companion Animal Management Plan* (BSC, 2017) and consideration of the following:
   a. Continue to provide dog access north of the Lennox Head SLSC to Seven Mile Beach.
   b. Consider removal of the on leash area along the eastern side of the lake, making all lake foreshore areas and immediate surrounds 'dog free'. Access to Seven Mile Beach will be maintained at SLSC track only.
2. Depending on outcomes of review, provide additional signage and education as required.
3. Continue ranger presence and enforcement in the area. The frequency of ongoing ranger patrols to be determined by results of the initial period in summer 2019/20.
4. Encourage dog walkers who drive to Seven Mile Beach to access the off-leash area of beach via the horse track at the end of Camp Drewe Road (north of 4wd track) where parking is plentiful. Achieved through Action 22: Education campaign.
5. Provide educational materials including maps of designated dog/dog-free zones to the general public and at specific locations (e.g. Reflections Holiday Park, Lennox Head SLSC Kiosk, Lennox Head Community Centre etc.) to clearly define the new rules and expectations along with reasons for these changes. Achieved through Action 22: Education campaign.
6. Continue to provide dog poo bag dispensers and waste bins at suitable access points to the off-leash area at Seven Mile Beach and other locations.

| | |
|---|---|
| **Lead Organisation** | BSC |
| **Support Organisation** | EES – Coast and Estuaries |
| **Total Cost Estimate (10 yr)** | $10,000 (staff time and allowance of $10,000 for signage and bins/bags) |
| **Potential Funding Sources** | BSC, NSW Coastal and Estuary Grants Program, Crown Reserves Improvement Fund Program |
| **Timing** | Short-Medium term (DP1 2020-2022 and DP2 2023-2026) and ongoing (DP1-DP3 2020-2029) |
| **Location** | Lake foreshores Zone 1, Zone 2, Zone 3, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area |
| **Performance Targets** | • Review of *BSC Companion Animal Management Plan* (BSC, 2017) completed by June 2021. |

### 6.1.8 Education

#### Action 22: Education campaign

| | |
|---|---|
| **Desired Outcome** | To inform the community about the values of the lake and its unique ecosystem components and sensitivities to human impact. The overall aim is to foster a higher level of understanding, respect and stewardship, translating into positive changes in behaviour. |
| **Priority ranking** | Fundamental |
| **Issues addressed** | • Limited public education/engagement regarding lake issues |

**DESCRIPTION OF TASKS:**

1. The Integrated Management Group (refer **Error! Reference source not found.**) will oversee all stages of the Education c ampaign.
2. Planning: develop a multi-faceted campaign to educate and promote understanding of the natural attributes of the lake, sensitivities and key issues and encouraging low-impact use/practices to protect the lake. Issues to be covered include:
   a. Education about fertiliser use/garden waste management/compost etc. for all catchment land managers and residents to the south of the lake.
   b. Sensitivity of lake ecosystems, need for protection etc.
   c. Groundwater/surface water interactions, emphasising the link between what is added to the surface of land (e.g. fertiliser, manure, herbicides, pesticides etc.) and what can be transported through groundwater flows to the lake.
   d. Types of fertiliser, application rates, timing with rainfall etc.
   e. Information on health risks of exposure to cyanobacteria blooms and revised signage.
   f. Sunscreen pollution:
      • Key risks of sunscreen to human health, water quality and wildlife.
      • Encourage use of more environmentally friendly sunscreen, wear UV resistant clothes instead (e.g. rash shirt etc.), avoid hottest part of day, apply sunscreen 20 minutes before swimming etc.
   g. Promote the key goals of the management zones described in Section 3 (including signage to mark the 'priority swimming areas').
   h. Impacts of dogs on native wildlife and water quality.
   i. Promotion of the horse track at the end of Camp Drewe Road (north of 4wd track) as a place to park and walk dogs on the leash-free beach. The aim is to reduce parking pressure around the lake.
   j. Provide educational materials including maps of designated dog/dog-free zones to the general public and at specific locations (e.g. Reflections Holiday Park, Lennox Head SLSC Kiosk, Lennox Head Community Centre etc.) to clearly define the new rules and expectations along with reasons for these changes
   k. "No Camping/fires" signage along Camp Drewe Road to deter illegal camping and camp fires in bushland.
   l. Pest fish species education - an educative program coupled with facilities for accepting unwanted aquarium fish. Information could include relevant pest species identification information, impacts of aquarium fish releases to the wild, dumping of aquarium fish is prohibited and alternatives to dumping aquarium fish.
   m. Native wildlife present in the area, habitat values and key risks including discussion of what the community and visitors can do to conserve wildlife (i.e. Camp Drewe Road wildlife crossing).
   n. Outcomes of Action 17: Greater acknowledgement of Aboriginal heritage.
   o. Educational programs should target the local community as well as visitors to the area and may involve:
      • Installation of attractive and engaging signage at key locations around the lake (which may replace existing signage).
      • Leaflets/flyers/letterbox drop.
      • Targeted programs for specific groups (e.g. Sport and Recreation Centre, Reflections Holiday Park) including staff and guests at these facilities.

<table>
<tr><td colspan="2">
<ul>
<li>Linkage with and continuation and expansion of existing community messaging relating to lake health</li>
<li>Webpage.</li>
<li>Social media posts and promotion.</li>
<li>Posters.</li>
<li>Information days/activities.</li>
<li>School programs.</li>
<li>Educational videos.</li>
</ul>
3. Consultation with local community groups during design of the program will assist in developing appropriate and relevant information/methods and draw on community educational knowledge and resources.<br>
4. Implement program.<br>
5. Review program on an annual basis.
</td></tr>
<tr><td>Lead Organisation</td><td>BSC</td></tr>
<tr><td>Support Organisation(s)</td><td>EES – Coast and Estuaries, North East Waste, Beachwatch, WaterNSW, representatives of local community groups as relevant.</td></tr>
<tr><td>Total Cost Estimate (10 yr)</td><td>$140,000 (Staff time and allowance of $30,000 for design of campaign, $20,000 for signage and materials, $10,000/yr ongoing implementation)</td></tr>
<tr><td>Potential Funding Sources</td><td>BSC, NSW Coastal and Estuary Grants Program, Crown Reserves Improvement Fund Program, The NSW Environment Trust, NSW EPA Waste Less, Recycle More initiative, Commonwealth Community Led Grants.</td></tr>
<tr><td>Timing</td><td>Short- term initial planning work (DP1 2020-2022) and ongoing implementation (DP1 - DP3 2020-2029)</td></tr>
<tr><td>Location</td><td>n/a</td></tr>
<tr><td>Performance Targets</td><td>• Planning and design and complete by June 2021.<br>• Implementation and education underway by September 2021.</td></tr>
</table>

### Action 23: Review blue green algae alert/lake closure signage

| | |
|---|---|
| **Desired Outcome** | Better communication of risks associated with algal blooms with a view to reducing swimmers during high risk periods. |
| **Priority ranking** | Medium (22) |
| **Issues addressed** | • Public safety concerns/risk |
| **DESCRIPTION OF TASKS:** | |
| 1. Review the current signage including text, images, symbols as well as placement and sizing to ensure effective communication of public health risks.<br>2. Recommend improvements to signage to more effectively communicate public health risks associated with blue green algae blooms as well as complementary actions to promote and educate about the risks of blooms.<br>3. Implement – create new signage and deploy at most effective locations. Promote and educate through Action 22: Education campaign. | |
| **Lead Organisation** | BSC |
| **Support Organisation** | EES – Coast and Estuaries, WaterNSW, NSW Health |
| **Total Cost Estimate (10 yr)** | $5,000 (staff time and $5,000 allowance for new signage) |
| **Potential Funding Sources** | BSC, NSW Coastal and Estuary Grants Program |
| **Timing** | Short- term (DP1 2020-2022) |
| **Location** | Lake swimming locations, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area |
| **Performance Targets** | • Review complete by August 2020.<br>• Implementation new signage by November 2020. |

### 6.1.9 Management and governance

**Action 24: Establish an integrated management group**

| | |
|---|---|
| **Desired Outcome** | To ensure coordinated and cooperative management for ongoing and effective management of the lake. |
| **Priority ranking** | Fundamental |
| **Issues addressed** | Lack of coordinated management body to oversee lake management |
| **DESCRIPTION OF TASKS:** | |
| 1. Establish and document the purpose and scope of the Integrated Management Group.<br>2. Set clear rules and goals including:<br>a. A formal process for member selection in line with BSC's Community Consultation Policy C14 (BSC, 2017) (e.g. call of expressions of interest, selection criteria, declaration of any conflict of interest etc.).<br>b. Definition of the basis for membership (e.g. skills vs representation).<br>c. Definition of membership roles and decision making processes of the group (e.g. voting vs consensus).<br>d. Rules and standards of expected involvement, duties and behaviour.<br>3. Formalise the following key roles as a minimum (other formal roles to be determined as needed):<br>a. Chairperson to chair meetings.<br>b. Secretary to organise and host meetings, distribute minutes and oversee group administration.<br>4. As a minimum, meetings should be held twice a year, and more frequently as required to discuss implementation milestones, funding and emerging issues, etc.<br>5. Explore option for streamlining land management:<br>a. Review options for rationalising the management of Crown land to facilitate more efficient and integrated implementation of the CMP.<br>b. Implement actions that will rationalise, integrate and improve the management of Crown land. | |
| **Lead Organisation** | BSC |
| **Support Organisation(s)** | EES – Coast and Estuaries, NSW Office of Sport, DPIE - Crown Lands, representatives of local community groups as relevant. |
| **Total Cost Estimate (10 yr)** | Staff time |
| **Potential Funding Sources** | n/a |
| **Timing** | Ongoing (DP1 –DP3 2020-2029) |
| **Location** | n/a |
| **Performance Targets** | • Membership of management group and roles appointed by September 2020.<br>• Meetings held twice a year. |

### 6.1.10 Monitoring, Evaluation and Reporting Program

#### Action 25: Monitoring program

| | |
|---|---|
| **Desired Outcome(s)** | To track performance of actions implemented as part of the CMP and allow for timely maintenance and adaptive management measures to be implemented as required.<br>To better understand the level of issues and priority for management. |
| **Priority ranking** | Fundamental |
| **Issues addressed** | • Continued proliferation of blue-green algal species<br>• Nutrient enrichment<br>• Microbiological risk to human health<br>• Spills and contamination<br>• Altered lake hydrology and water balance<br>• Poor riparian vegetation condition<br>• Threats to native flora and fauna<br>• Foreshore erosion of the Lake<br>• Poor foreshore accessibility and public safety<br>• Public safety concerns/risk |

**DESCRIPTION OF TASKS:**

1. Planning: develop a multi-discipline monitoring program to provide better information and inform effective management. Components for inclusion are:
   a. Water quality – ongoing monitoring of water quality to allow for assessment of changes as a result of management actions. This task involves an initial review of current/past monitoring program and documentation of an ongoing water quality monitoring plan.
   b. Blue green algae - continuation of current monitoring in line with National Health and Medical Research Council guidelines (NHMRC, 2008) and existing BSC processes.
   c. Automatic water level and water quality - continuation of current monitoring via the automatic water level and water quality recorder managed by MHL on behalf of EES – Coast and Estuaries. Addition of dissolved oxygen and pH probes to the automatic recorder to allow for real-time monitoring of these aquatic health indicators (particularly important with regard to proposed changes to the aerator program).
   d. Sediment extent - it is proposed that the extent of the organic rich mud sediment be assessed every 5 years by repeating the methodology implemented as part of Stage 2 of the CMP. This will provide information about relative rates of sedimentation over time. If reductions in algal blooms are achieved through other management actions, monitoring sediment extent will allow for an assessment of whether reduced algal blooms reduce the rate of sedimentation.
   e. Hydrology and groundwater – conduct groundwater monitoring in the catchment to replicate that undertaken as part of the 1996 Estuary Processes Study and allow for assessment of current groundwater conditions and more accurate modelling of groundwater outflows and lake water balance completed as part of Stage 2 of the CMP development.
   f. Erosion - monitor the performance of the lake foreshore erosion controls and conduct timely maintenance as required. Formal assessment by repeating the Erosion Assessment conducted as part of Stage 2 studies is recommended annually. The current Foreshore Improvement Works along the southern and eastern foreshores of the lake include formalised pedestrian pathways and wheelchair accessible ramps to the water, coupled with bank erosion amelioration works. It will be necessary to monitor the new access points created to ensure access is functioning as intended, and if necessary, trigger maintenance or further work as required. There is also a need to monitor future access pressure on the western side following closure of the eastern road to minimise/mitigate any worsening of erosion.
   g. Riparian vegetation - Formal assessment by repeating the Riparian Condition Assessment conducted as part of Stage 2 studies is recommended annually, recommendations to inform riparian restoration works.
   h. Investigations of sunscreen pollution – design a monitoring program to provide further information on the

nature of sunscreen pollution and potential impacts on ecology and particularly nutrient concentrations. Monitoring could involve testing lake water for chemicals of concern, assessing the nutrient composition of common sunscreens and/or physical assessment of sunscreen slicks on the lake surface.

i. Investigate sources of Enterococci (faecal contamination) - determine whether wildlife/dogs or human waste is the source of faecal matter to the lake. This investigation is currently underway at the lake. Results will determine whether follow up monitoring is needed.

j. Increasing use of the western side – monitor visitor numbers, access points and subsequent impacts on bank erosion, vegetation, ecosystem values, cultural heritage and amenity (Action 15: Manage increasing use of the western side of the lake). It is recommended that monitoring be conducted over one year to capture seasonal variation. Results will be used to assist in developing concept design for the western foreshore.

k. Parking - monitor car parking patterns following the closure of the eastern road with a focus on assessing parking along Camp Drewe Road and into suburban areas of Lennox Head and subsequent impacts on environmental values, amenity and public safety. Also track the effectiveness of and dog walker use of beach access at the end of Camp Drewe Road. It is recommended that monitoring is conducted over a year to capture seasonal changes in demand. The information will assist in evaluating the extent of the problem and potential further management options for the western side.

l. Assessment of wildlife populations and impact of Camp Drewe Road – This will involve monitoring of all wildlife road fatalities/injuries along Camp Drewe Road with a particular focus on turtles. A register of community sightings should also be established and advertised to encourage community members to share information. Details to be captured include species name/common name, approximate age (e.g. juvenile/adult), date of observation, observation type (e.g. fatality, injury) location (GPS coordinates if possible), photograph, and details of outcome (e.g. transported to vet/ wildlife carer in the case of injury, or disposal in the case of fatality). The location of turtle nesting sites and crossing locations should be determined to assist in placement of any future traffic control structures and signage (Action 13: Wildlife/turtle crossing warning signs on Camp Drewe Road). It would be ideal to monitor over 1 year to capture seasonal changes, and may potentially be a suitable post-graduate student study.

2. Implement monitoring program
3. Review results of program on an annual basis.

| | |
|---|---|
| **Lead Organisation** | BSC |
| **Support Organisation** | EES – Coast and Estuaries, Southern Cross University |
| **Total Cost Estimate (10 yr)** | $343,000 (Total allowance of $73,000 for program design and equipment, $270,000 ongoing implementation across all components over 10 years) |
| **Potential Funding Sources** | BSC, NSW Coastal and Estuary Grants Program, Southern Cross University |
| **Timing** | Initial design short-term (DP1 2020-2022) ongoing implementation (DP1 - DP3 2020-2029) |
| **Location** | All zones, CMA1 – Coastal Wetlands and Littoral Rainforests, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area |
| **Performance Targets** | • Planning and design and complete by June 2021.<br>• Implementation underway by September 2021. |

### Action 26: Review of CMP progress and monitoring of performance targets

| | |
|---|---|
| **Desired Outcome** | Continuous improvement towards the CMP objectives across the full range of issues. |
| **Priority ranking** | Fundamental |
| **Issues addressed** | All issues |
| **DESCRIPTION OF TASKS:** | |
| Documentation of the effectiveness of the proposed actions will be reported as part of Council's State of the Environment (SoE) Reporting and IP&R framework including progress towards the performance targets included for each action. | |
| **Lead Organisation** | BSC |
| **Support Organisation** | EES – Coast and Estuaries, DPI Fisheries, DPIE - Crown Lands, North Coast LLS |
| **Total Cost Estimate (10 year)** | Included in existing Council reporting |
| **Potential Funding Sources** | n/a |
| **Timing** | Annually (IP&R reporting); every three years (SoE reporting) |
| **Location** | Lake Ainsworth |
| **Performance Targets** | • IP&R reporting annually<br>• SoE reporting every three years |

### Action 27: Ten year review of CMP

| | |
|---|---|
| **Desired Outcome** | Management actions and approaches remain appropriate for the long term. |
| **Priority ranking** | Fundamental |
| **Issues addressed** | All issues |
| **DESCRIPTION OF TASKS:** | |
| The CMP and the specified management actions should be reviewed to ensure they are being achieved and are resulting in the desired outcomes. A ten year review (or earlier if warranted by legislative or management changes or improved scientific understanding) of the CMP is required to consider:<br>• Results of the SoE Reporting.<br>• Results of IP&R Reporting.<br>• Review of status of CMP actions including overall success and any barriers to the effective implementation.<br>• Any new or updated scientific knowledge.<br>• Data provided by Action 25: Monitoring program.<br>• Prevailing community attitudes, government policy and strategic planning status. | |
| **Lead Organisation** | BSC |
| **Support Organisation** | EES – Coast and Estuaries, DPI Fisheries, DPIE - Crown Lands, North Coast LLS |
| **Total Cost Estimate (10 year)** | $50,000 (Allowance of $50,000 for review at Yr10) |
| **Potential Funding Sources** | BSC, NSW Coastal and Estuary Grants Program |
| **Timing** | Long term (Yr10, DP3 2027-2029) |
| **Location** | Lake Ainsworth |
| **Performance Targets** | • Review and reporting undertaken by June 2030.<br>• Adoption and gazettal of the amended CMP as required. |

## 6.2 Actions to be undertaken by public authorities

### 6.2.1 Flooding

**Action 28: Flood planning - NSW Office of Sport**

| | |
|---|---|
| **Desired Outcome** | Ensure all development or management option in the study area is suitable for the location and/or is adaptive to changing flooding risk. |
| **Priority ranking** | Medium (12) |
| **Issues addressed** | • Localised freshwater flooding<br>• Altered lake hydrology and water balance<br>• Climate change impacts<br>• Public safety concerns/risk |
| **DESCRIPTION OF TASKS:** | |
| 1. Future development in the catchment and all actions implemented as part of this CMP will need to consider the potential future flood risk.<br>2. Emergency management plans for Lake Ainsworth Sport and Recreation Centre should be updated with future flooding risk and contingencies for the potential closure of Camp Drewe Road due to flooding. | |
| **Lead Organisation** | NSW Office of Sport |
| **Support Organisation** | BSC,EES – Coast and Estuaries |
| **Total Cost Estimate (10 yr)** | Staff time |
| **Potential Funding Sources** | n/a |
| **Timing** | Short- term (DP1 2020-2022) |
| **Location** | Flood risk areas identified in *Stage 2 Vulnerabilities and Opportunities Study* (Hydrosphere Consulting, 2019a), CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area |
| **Performance Targets** | • Emergency management plans for Lake Ainsworth Sport and Recreation Centre updated by June 2021. |

### 6.2.2 Flora and fauna

**Action 29: Biological control of Salvinia**

| | |
|---|---|
| **Desired Outcome** | To provide ongoing control of Salvinia in the lake. |
| **Priority ranking** | Medium (19) |
| **Issues addressed** | • Aquatic weeds or unnatural growth<br>• Decreased amenity and enjoyment<br>• Reduced aesthetic quality |
| **DESCRIPTION OF TASKS:** | |
| 1. DPI to continue biological control of Salvinia at the lake.<br>2. Review results of program on an annual basis. | |
| **Lead Organisation** | DPI |
| **Support Organisation** | BSC, EES – Coast and Estuaries |
| **Total Cost Estimate (10 yr)** | No additional costs |
| **Potential Funding Sources** | n/a |
| **Timing** | On-going (DP1 - DP3 2020-2029) |
| **Location** | In-lake, CMA 3 – Coastal Environment Area, CMA 4 – Coastal Use Area |
| **Performance Targets** | • Annual implementation. |

## 6.3 Whether the CMP identifies recommended changes to the relevant planning controls, including any proposed maps

The Lake Ainsworth CMP encompasses all four coastal management areas defined in the *CM Act*. Mapping of coastal management areas has been completed by DPE (2017) and is shown in Section 8. The CMP provides a management framework to guide coastal management and planning for Lake Ainsworth, in response to the relevant objectives for each coastal management area from the *CM Act* (Table 3). No changes to the current coastal management areas are proposed as part of this CMP.

# 7. 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.

The intent of implementation of this CMP is in meeting the objectives developed for the environmental, social, recreational and commercial values of the lake as identified in Section 1.3. This Business Plan (summarised in Table 10) specifies:

- Action ID number and name.
- Cost estimate.
- Timing.
- Cost benefit distribution – A key driver in meeting these objectives is the protection and improvement of lake health bringing about subsequent public benefits (e.g. through improved recreational potential and amenity) or vice-versa. None of the recommended actions aim to benefit private interests although they may do so indirectly as a consequence of improved lake health (e.g. to commercial businesses in the nearby area including tourism operators and food and beverage outlets). No cost-sharing with private parties has been proposed.
- Economic analysis and funding category – three categories are provided as follows:
    - Category 1 – economic analysis complete, action funded under normal operating budget or existing programs and grants and not expected to impact on current resourcing levels.
    - Category 2 – economic analysis complete, action subject to funding.
    - Category 3 – no economic analysis, action subject to detailed costing, economic analysis and funding.

## 7.1 Funding and resources

The CMP actions are expected to be funded through BSC and state government contributions, monetary grants and volunteer works by community members and organisations.

Some actions are funded under Council's normal operating budgets throughout the ten-year period, or through existing programs and grants, particularly within Delivery Program 1 (up until 2023). Where actions require Council staff resources, actual costs have only been applied where it is expected that implementation will exceed current resourcing levels, in which case, additional funding is required.

Council operates an annual budget primarily through rates and charges (e.g. water, sewer and waste) as well as fees, investment revenues, loans, property management and operating grants. It will not be possible for BSC to implement all actions identified in this CMP without additional sources of funding. As such, identification of grants and the submission of successful funding applications is an important component of this CMP. A list of current possible sources of external federal, state and local funding is provided below. However, it is important to note that many grants and funding sources change year to year, are only available up to a limited budget, or require significant co-funding commitment. It is also important to note that accurate estimates of project costs, particularly for on ground works cannot be developed until survey and design tasks have been completed, with these tasks often incurring significant costs. It will be necessary to keep abreast of current funding availability throughout the implementation of the CMP and take advantage of funding opportunities as they arise. In each case, the precise amount of funding available will not be known until it has been awarded.

Agencies responsible for delivery of actions in this CMP have been consulted during the development of the CMP and have indicated support for the actions. 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.

Certification of this CMP will facilitate eligibility for funding of key actions through the NSW Coastal and Estuary Grants Program. Cost-sharing arrangements for the implementation of actions within a certified CMP are currently provided at ratio of 2:1, with ⅔ of funding provided through the NSW Coastal and Estuary Grants Program and ⅓ of funding to be provided by local Council. Actions will be prioritised for future applications for external funding and contributions from the budgets of relevant Council programs.

Key sources of funding identified for the CMP actions are:

- BSC funds - generated through rates, fees and charges, investment revenues, loans, property management and operating grants.
- NSW Coastal and Estuary Grants Program – provided by the NSW Government and administered by EES – Coast and Estuaries to support local government work to improve the health of NSW coasts and estuaries under several streams:
    - Planning stream – for planning and studies including investigation, design and cost-benefit analyses for infrastructure works recommended in a certified CMP. The funding round for the planning stream is open for 10 months from August-June each year.
    - Implementation stream for each of the four CMAs with priority given to projects that reduce risk from coastal hazards and projects that enhance environmental resilience and the natural environment. Example projects include but are not limited to:
        - Weed management, vegetation rehabilitation, signage and education programs in coastal wetland and littoral rainforest areas (CMA 1).
        - Design and implementation of erosion reduction structures and beach nourishment works in coastal vulnerability areas (CMA 2).
        - Ecosystem health monitoring, community education, stormwater management, revegetation, protection of Aboriginal heritage and riparian corridor management in coastal environment/coastal use areas (CMA 3 and CMA 4).

      The funding round for the implementation stream is open for one month (August-September) each year.
- Increasing Resilience to Climate Change program – a partnership program between Local Government NSW (LGNSW) and EES – Coast and Estuaries to encourage:
    - Implementation of actions to address identified climate risks.
    - Regional consideration of climate change impacts in decision making.
    - Implementation of climate change adaptation actions beyond business-as-usual projects and programs.
    - Enhanced adaptive capacity.
- DPIE – Crown Lands:
    - Crown Reserves Improvement Fund Program for development and maintenance projects and to improve land and facilities on Crown land. 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.
- The NSW Environment Trust – administered by EES – Coast and Estuaries to fund a broad range of projects which enhance the environment of NSW. Relevant streams include environmental education, protecting our places (for the sharing and protection of Aboriginal Cultural knowledge and

the protection, restoration and enhancement of culturally significant Aboriginal Land), research, restoration and rehabilitation projects and waste avoidance and resource recovery.

- NSW EPA Waste Less, Recycle More initiative - a set of programs including “Council Litter Prevention Grants”, managed by the NSW Environment Protection Authority and NSW Environmental Trust. The initiative includes programs for local government, business, industry and the community. Relevant examples of recent grants awarded under the program include “Butt-free Byron Shire” a program aimed at changing littering behaviour through collaborative community engagement, education and enforcement with a focus on cigarette butts (Byron Shire, $100,000). The NSW Government has allocated $802 million over 9 years for Waste Less, Recycle More. The initiative will run until 2020–2021.
- Commonwealth Community Led Grants - Indigenous Advancement Strategy grant funding for Aboriginal people and communities to devise strategies that will support their community and the people living in it and to carry out projects that address an emerging need or opportunity.
- Human resources and in-kind contributions are also, or may be required from:
    - BSC,
    - DPIE – Crown Lands,
    - EES – Coast and Estuaries,
    - NSW Office of Sport,
    - Crown Holiday Parks Land Manager,
    - Lennox Head SLSC,
    - DPI - Fisheries,
    - North East Waste,
    - RMS,
    - NSW Police,
    - North Coast LLS,
    - Jali LALC,
    - Lennox Head Landcare,
    - Other volunteer and community groups,
    - Educational and research institutions (e.g. Southern Cross University).

**Table 10: Business Plan**

| No. | Action/Year | Priority Ranking | Total 10 yr cost | Total 10 yr capital cost | Total 10 yr operational cost | DP1 (2020-2022)[2] | | | DP2 (2023-2026) | | | | DP3 (2027-2029) | | | Funding responsibility | Potential funding stream | Cost benefit distribution (private vs. Public) | Business Plan Category[4] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Yr1 | Yr2 | Yr3 | Yr4 | Yr5 | Yr6 | Yr7 | Yr8 | Yr9 | Yr10 | | | | |
| | | | $'000 | $'000 | $'000 | 2020[1] | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | | | | |
| **Water quality** | | | | | | | | | | | | | | | | | | | |
| 1 | Trial modifications to artificial aeration | High | **110** | | **110** | 60 | 50 | | | | | | | | | BSC, EES | a,b,c | 100% public | 2 |
| **Sediment Management** | | | | | | | | | | | | | | | | | | | |
| 2 | Trial sediment treatment | High | **220** | | **220** | | | 40 | 170 | 10 | | | | | | BSC, EES | a,b,c | 100% public | 2 |
| **Bank Erosion** | | | | | | | | | | | | | | | | | | | |
| 3 | Beach nourishment | High | **260** | **250** | **10** | | 50 | 200 | | | 5 | | | 5 | | BSC, EES, DPIE-CL | a,b,d | 100% public | 2 |
| 4 | Riparian vegetation enhancement for erosion control | High | **65** | **20** | **45** | | 25 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | BSC, EES, DPIE-CL | a,b,d | 100% public | 2 |
| **Catchment Management** | | | | | | | | | | | | | | | | | | | |
| 5 | Stormwater treatment/ improvement | Medium | **40** | | **40** | | | | | 20 | | | | | 20 | BSC, EES, DPIE-CL | a,b,d | 100% public | 2 |
| 6 | Litter management/ recycling | High | **50** | | **50** | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | BSC, EES, EPA | a,b,f | 100% public | 2 |
| **Flooding** | | | | | | | | | | | | | | | | | | | |
| 7 | Flood planning | Medium | | | | no additional cost[3] | | | | | | | | | | | | 100% public | 1 |
| **Flora and Fauna** | | | | | | | | | | | | | | | | | | | |
| 8 | Local Cane Toad management strategy | Medium | **55** | | **55** | | | 20 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | BSC, EES | a,b | 100% public | 2 |
| 9 | Riparian vegetation management | Medium | **110** | **30** | **80** | | 30 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | BSC, EES, DPIE-CL | a,b,d | 100% public | 2 |
| 10 | Backfill exposed tree roots | High | **56** | **50** | **6** | 50 | | 2 | | | 2 | | | 2 | | BSC, EES, DPIE-CL | a,b,d | 100% public | 2 |
| 11 | Aquatic weed harvesting | Medium | **10** | | **10** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | BSC, EES, DPIE-CL | a,b,d | 100% public | 2 |
| 12 | Grass species selection and install | Medium | **85** | **85** | | | | | | 85 | | | | | | BSC, DPIE-CL | a,d | 100% public | 1&2 |
| 13 | Wildlife/ turtle crossing warning signs on Camp Drewe Road | Medium | **10** | **5** | **5** | 5 | | | | 5 | | | | | | BSC, EES | a,b | 100% public | 2 |
| 14 | Replace boom | Medium | **10** | **10** | | 10 | | | | | | | | | | BSC, EES | a,b | 100% public | 1 |
| **Community Uses** | | | | | | | | | | | | | | | | | | | |
| 15 | Manage increasing use of the western side of the lake | High | **745** | **745** | | | 100 | 645 | | | | | | | | BSC, EES, DPIE-CL | a,b,d | 100% public | 2 |
| 16 | Review of public safety risk assessment | High | **10** | | **10** | | 5 | | | | | 5 | | | | BSC, DPIE-CL | a,d | 100% public | 2 |
| 17 | Greater acknowledgement of Aboriginal Heritage | High | **55** | **15** | **40** | | 40 | 15 | | | | | | | | BSC, EES, DPIE-CL | a,b,d,g | 100% public | 2 |
| 18 | Encourage alternative transport to the lake | Medium | **515** | **315** | **200** | | 295 | 45 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | BSC, EES, DPIE-CL | a,b,d | 100% public | 2 |
| 19 | Management of future parking arrangements | High | | | | no additional cost | | | | | | | | | | | | 100% public | 1 |
| 20 | Traffic management Camp Drewe Road | Medium | **30** | **30** | | 30 | | | | | | | | | | BSC | a | 100% public | 2 |
| 21 | Manage dog access | Medium | **10** | **10** | | | 10 | | | | | | | | | BSC, EES, DPIE-CL | a,b,d | 100% public | 2 |
| **Education** | | | | | | | | | | | | | | | | | | | |
| 22 | Education campaign | Fundamental | **140** | **20** | **120** | 30 | 30 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | BSC, EES, DPIE-CL, EPA | a,b,d,e,f,g | 100% public | 2 |
| 23 | Review blue green algae alert/ lake closure signage | Medium | **5** | **5** | | 5 | | | | | | | | | | BSC, EES | a,b | 100% public | 2 |
| **Management and Governance** | | | | | | | | | | | | | | | | | | | |
| 24 | Establish an integrated management group | Fundamental | | | | no additional cost | | | | | | | | | | | | 100% public | 1 |
| **Monitoring, Evaluation and Reporting Program** | | | | | | | | | | | | | | | | | | | |
| 25 | Monitoring program | Fundamental | **343** | **73** | **270** | 58 | 100 | 35 | 25 | 30 | 20 | 15 | 25 | 20 | 15 | BSC, EES, SCU | a,b,h | 100% public | 1&2 |
| 26 | Review of CMP progress | Fundamental | | | | no additional cost | | | | | | | | | | | | 100% public | 1 |
| 27 | 10 year review of CMP | Fundamental | **50** | | **50** | | | | | | | | | | 50 | BSC, EES | a,b | 100% public | 2 |
| **Actions to by Other Public Authorities** | | | | | | | | | | | | | | | | | | | |
| 28 | Flood Planning - NSW Office of Sport | Medium | | | | no additional cost | | | | | | | | | | | | 100% public | 1 |
| 29 | Biological control of Salvinia | Medium | **5** | | **5** | 1 | | 1 | | 1 | | 1 | | 1 | | DPI-Fisheries | i | 100% public | 1 |
| **TOTALS** | | | **2989** | **1663** | **1326** | **255** | **741** | **1034** | **256** | **212** | **88** | **82** | **86** | **89** | **146** | | | | |

Business Plan notes:

1.Years correspond to end of financial year i.e. 2020 is Year 1 (start 1st July 2020, end 30th June 2021) etc.

2.Timing is dependent on Ministers approval of CMP and approval of funding where applicable.

3.Shaded cells - actions with no additional costs allocated as part of this CMP.

4.Business Plan Categories:

> Category 1 – economic analysis complete, action funded under normal operating budget or existing programs and grants and not expected to impact on current resourcing levels.
>
> Category 2 – economic analysis complete, action subject to funding.
>
> Category 3 – no economic analysis, action subject to detailed costing, economic analysis and funding.

Potential Funding Sources:

a. BSC funds

b. NSW Coastal and Estuary Grants Program

c. Increasing Resilience to Climate Change program

d. Crown Reserves Improvement Fund Program

e. The NSW Environment Trust

f. NSW EPA Waste Less, Recycle More initiative

g. Commonwealth Community Led Grants

h. Southern Cross University

i. DPI-Fisheries

Funding is subject to grant availability and approval.

# 8. MAPS

Mapping is provided in the following section as follows:

- Figure 6: Coastal Wetland and Littoral Rainforest Management Area for Lake Ainsworth
- Figure 7: Coastal Environment Management Area for Lake Ainsworth
- Figure 8: Coastal Use Management Area for Lake Ainsworth

  Notes:

  1. The Lake Ainsworth CMP encompasses all four coastal management areas defined in the *CM Act*.
  2. This includes CMA2 – Coastal Vulnerability Area however this CMA is not currently mapped by DPIE (2020). The coastal dune areas directly east of the lake are identified as being subject to current and future coastal hazards in the Ballina Shire Coastline CZMP (GeoLINK, 2016).
  3. No changes to these current coastal management areas are proposed as part of this CMP.

- Figure 9: Existing land management responsibility - The existing land management arrangements within the catchment were interpreted from lot data obtained from the NSW Government spatial services and Land Register data obtained from BSC as well as discussions with Council and DPIE – Crown Lands.

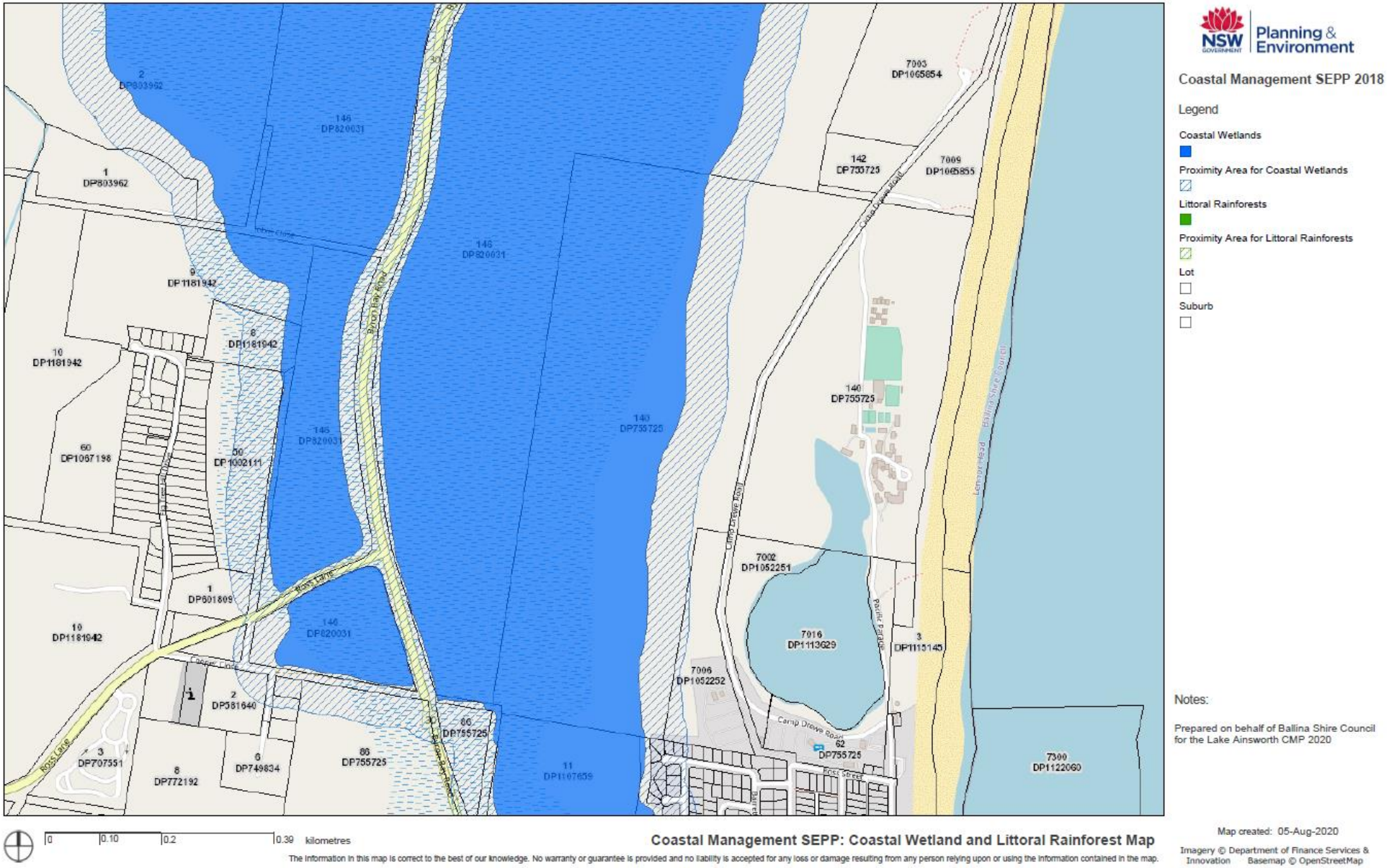


**Figure 6: Coastal Wetland and Littoral Rainforest Management Area for Lake Ainsworth**
Source: DPIE (2020)

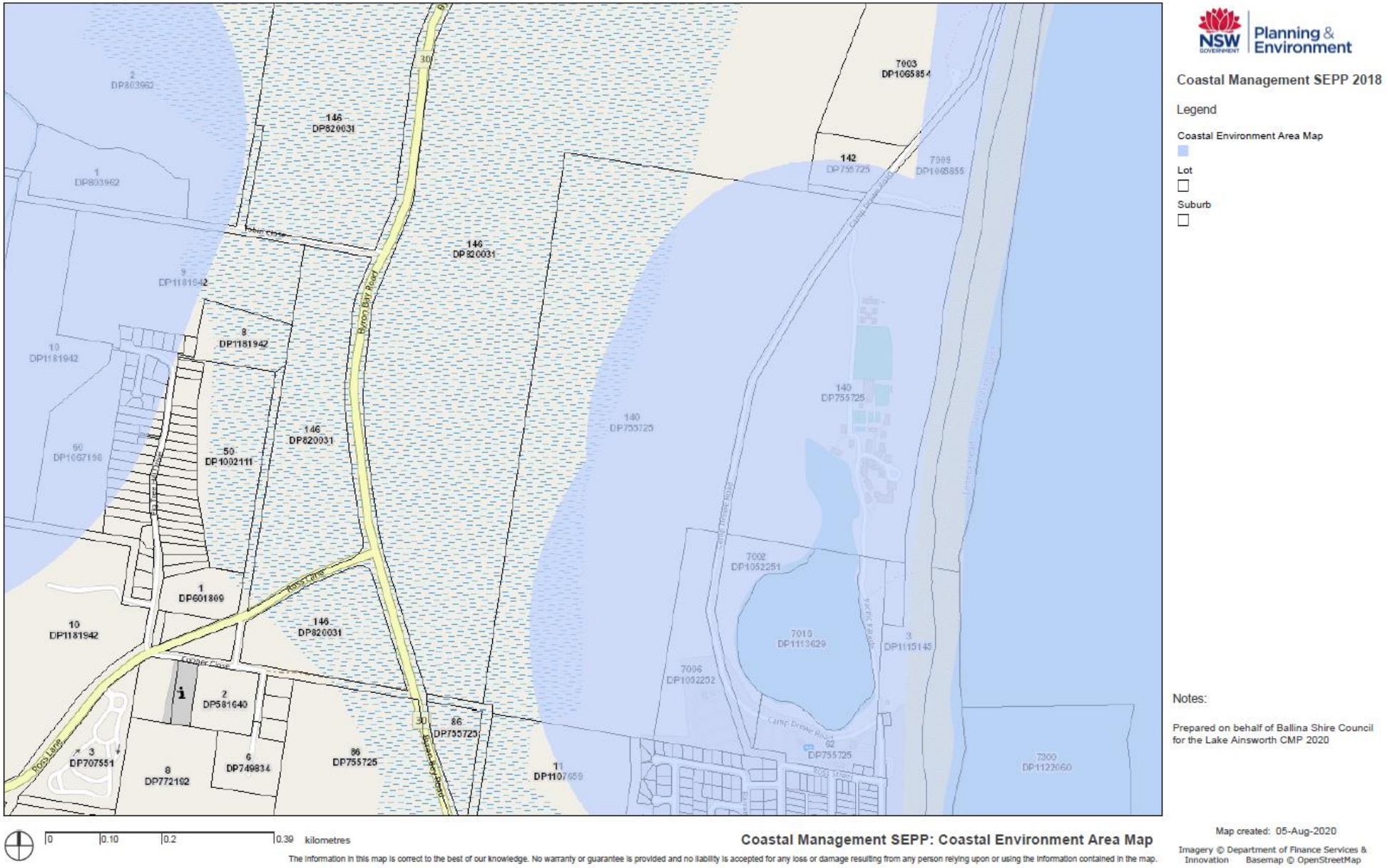


**Figure 7: Coastal Environment Management Area for Lake Ainsworth**
Source: DPIE (2020)

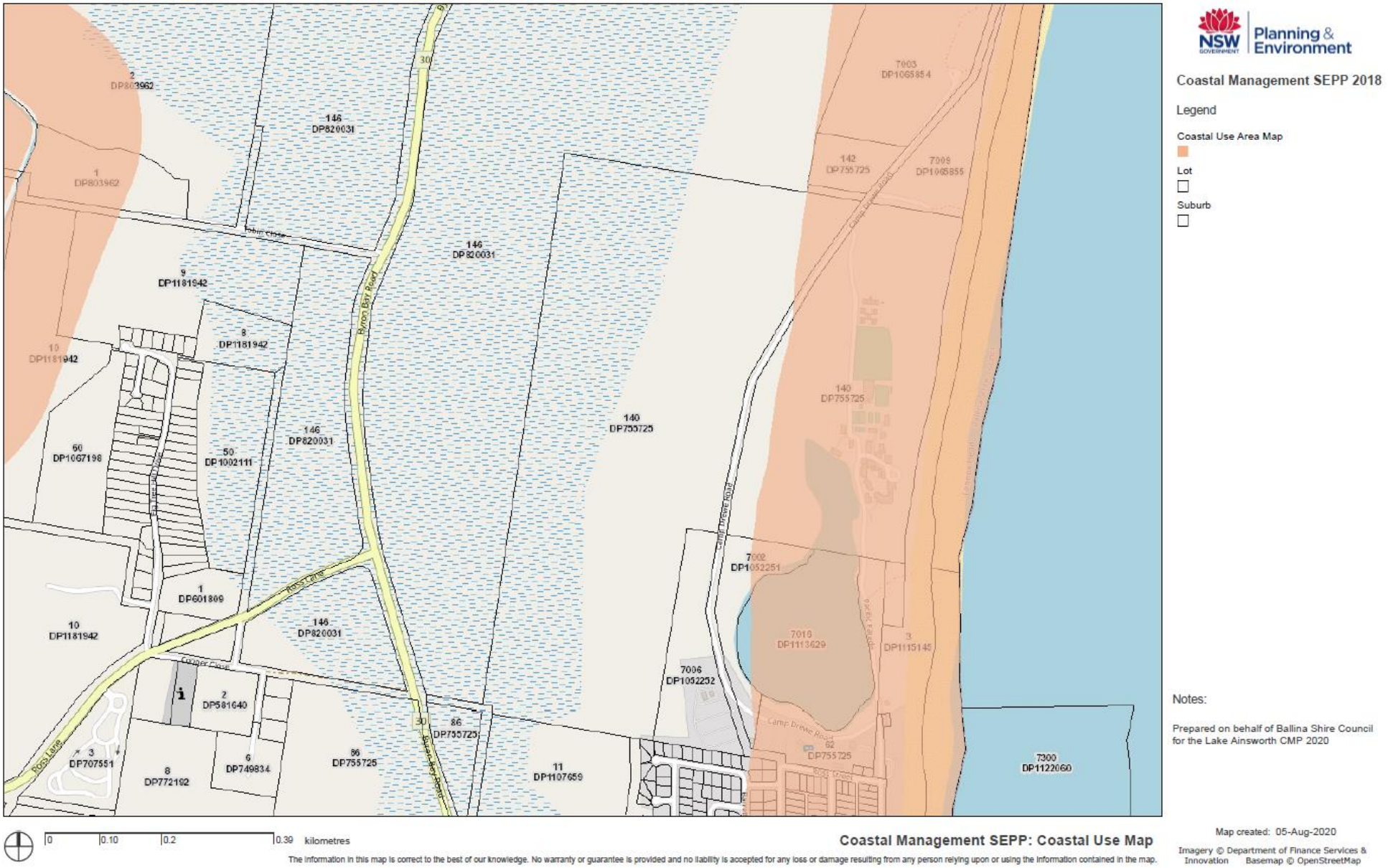


**Figure 8: Coastal Use Management Area for Lake Ainsworth**
Source: DPIE (2020)

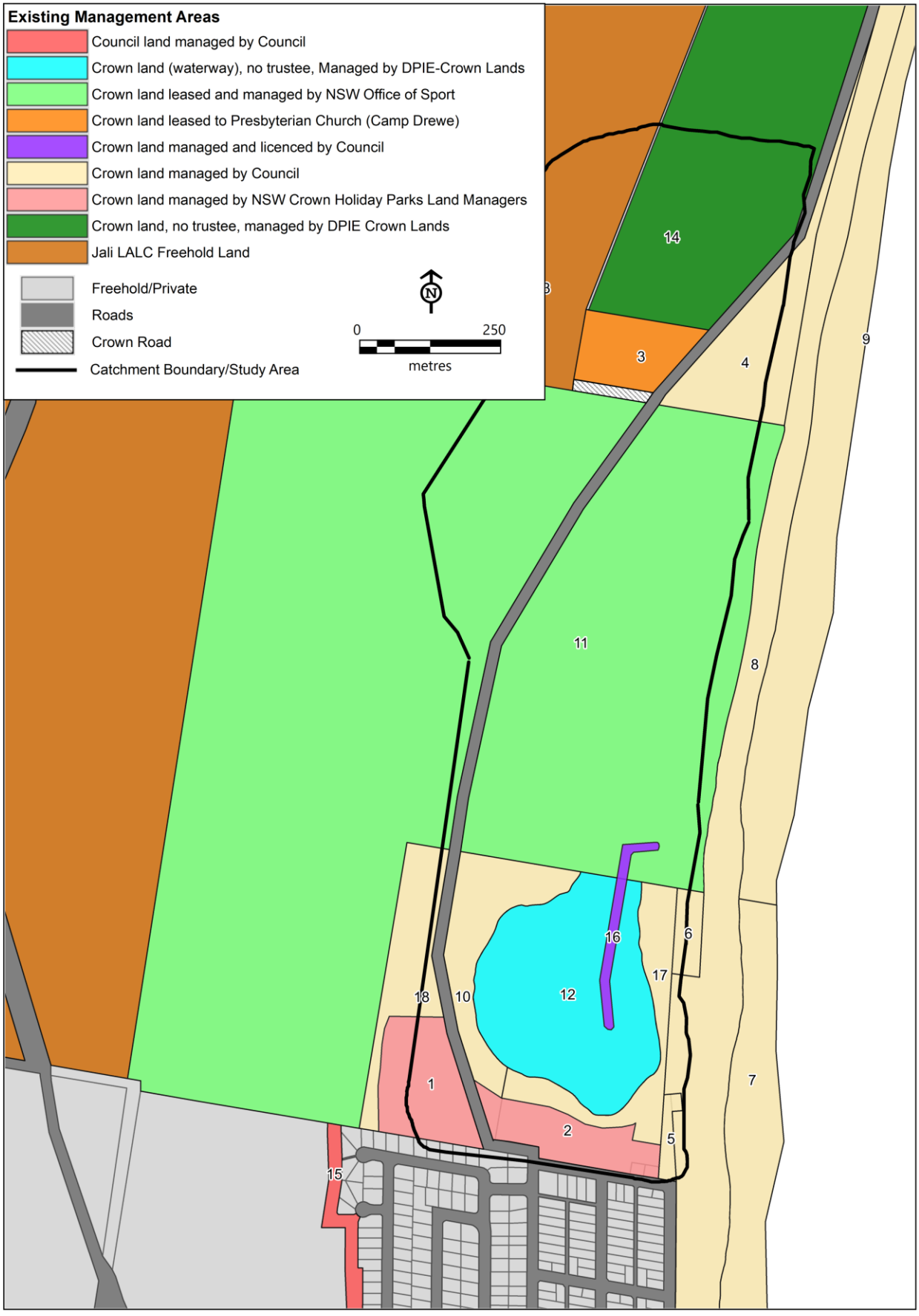


**Figure 9: Existing land management responsibility**

## REFERENCES

.id (2017). *Ballina Shire Population Forecasts*. https://forecast.id.com.au/ballina - accessed May 2018

BES (2016). *Draft Lennox Head (Coastal) Vegetation Management Plan,* Plan prepared by Blackwood Ecological Services for BSC.

BES (2017). *Ecological Assessment – Proposed Lake Ainsworth Foreshore Improvement Works*, Report prepared by Blackwood Ecological Services for BSC.

BMT WBM (2015). *The Ballina Floodplain Risk Management Plan*. Plan prepared o behalf for BSC

BMT WBM (2017). *New South Wales Marine Estate Threat and Risk Assessment Report.* Prepared for the Marine Estate Management Authority.

BSC (2016). *Policy E05: Events on Public Land.*

BSC (2017). *BSC Companion Animal Management Plan.*

BSC (2017). *Policy C14: Community Consultation.*

Destination NSW (2018). *Travel to North Coast NSW Tourism Region Year Ended March 2018.* https://www.destinationnsw.com.au/wp-content/uploads/2018/06/north-coast-nsw-time-series-march-2018.pdf.

DPE (2020). *NSW Department of Planning and Environment Coastal SEPP Mapping Tool*, http://webmap.environment.nsw.gov.au/PlanningHtml5Viewer/?viewer=SEPP_CoastalManagement - August 2020.

DPE (2017). *North Coast Regional plan 2036.*

GeoLINK (2002). *Lake Ainsworth Management Plan.* Plan prepared by GeoLINK on behalf of BSC.

GeoLINK (2016), *Coastal Zone Management Plan for the Ballina Coastline,* Plan prepared by GeoLINK for BSC.

GeoLINK (2017). *Ecological Assessment – Lake Ainsworth Sport and Recreation Centre, Multipurpose Sports Development.*

Hydrosphere Consulting (2018). *Lake Ainsworth Coastal Management Program Stage 1 Scoping Study.* Prepared on behalf of Ballina Shire Council and Office of Environment and Heritage.

Hydrosphere Consulting (2019a). *Lake Ainsworth Coastal Management Program Stage 2 Vulnerabilities and Opportunities Study.* Prepared on behalf of Ballina Shire Council and Office of Environment and Heritage.

Hydrosphere Consulting (2019b). *Lake Ainsworth Coastal Management Program Stage 3 Management Options Study.* Prepared on behalf of Ballina Shire Council and Office of Environment and Heritage.

MEMA (2018). *2018 - 2028 Marine Estate Management Strategy*. https://www.marine.nsw.gov.au/__data/assets/pdf_file/0007/815596/Marine-Estate-Management-Strategy-2018-2028.pdf - August 2019(BSC, 2017). *BSC Companion Animal Management Plan.*

NHMRC (2008). *Guidelines for Managing Risks in Recreational Water*, https://www.nhmrc.gov.au/sites/default/files/images/guidelines-for-managing-risks-in-recreational-water.pdf - August 2019

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

OEH (2019). *NSW Coastal Management Manual Part B: Stage 4 – Prepare, exhibit, finalise, certify and adopt a coastal management program.*

Remnant Archaeology (2017). *An Aboriginal Cultural Heritage Assessment – Lake Ainsworth Foreshore Improvements, Lennox Head, Ballina Local Government Area, New South Wales.*

Scanes, E., Scanes, P.R. & Ross, P.M. (2020) Climate change rapidly warms and acidifies Australian estuaries. *Nat. Commun.* 11, 1803 (2020). https://doi.org/10.1038/s41467-020-15550-z - accessed August 2020.

# GLOSSARY AND ABBREVIATIONS

| | |
|---|---|
| Amenity | A desirable or useful feature or facility of a building or place |
| ANZECC | Australian and New Zealand Environment and Conservation Council-provided 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. |
| Aquatic | Living or growing in water, not on land. |
| BFRMP | Ballina Floodplain Risk Management Plan |
| BOM | Bureau of Meteorology |
| BSC | Ballina Shire Council |
| CBMP | Cape Byron Marine Park |
| CMA | Coastal Management Area |
| CMP | Coastal Management Program |
| CZMP | Coastal Zone Management Plan |
| Dissolved Oxygen | Oxygen dissolved in the water (oxygen saturation). Often abbreviated to DO |
| DP | Council's four year Delivery Program |
| DPE | NSW Department of Planning and Environment |
| DPI Fisheries | Department of Planning, Industry and Environment Regions, Industry, Agriculture and Resources Department of Primary Industries Fisheries |
| DPIE - Crown Lands | Department of Planning, Industry and Environment, formerly DI Lands |
| Ecology | The interactions between organisms and their environment |
| Ecosystem | Refers to all the biological and physical parts of a biological unit (e.g. an estuary, forest, or planet) and their interconnections. |
| EES – Coast and Estuaries | Department of Planning, Industry and Environment - Environment, Energy and Science – Coast and Estuaries, formerly known as OEH Coasts and Estuaries |
| EP&A Act | *Environmental Planning and Assessment Act 1979* |
| EPBC Act | *Environment Protection and Biodiversity Conservation Act 1999* |
| Foreshore Improvement Works | Lake Ainsworth precinct project under construction in 2018/2019. Once completed, the $1.7M investment will include additional barbeques, pathways, picnic tables, formalised parking, erosion rehabilitation and landscaping. |
| Foreshore | That part of the shore that lies between the mean high tide mark and the mean low tide mark |
| Hydrodynamics | The motion of a fluid and interactions with its boundaries |
| Hydrology | The study of water and its properties, including precipitation onto land and returning to oceans |
| IP&R | NSW Integrated Planning and Reporting Framework |
| LEP | Local Environmental Plan |
| LGA | Local Government Area |
| LLS | Local Land Services |
| MEMA | Marine Estate Management Authority |
| MHL | Mainly Hydraulics Laboratory |
| NPWS | National Parks and Wildlife Service |
| OEH | Office of Environment and Heritage (now EES- Coasts and Estuaries) |

| | |
|---|---|
| Riparian | Of, on or relating to the banks of a watercourse |
| SCU | Southern Cross University |
| SEPP | State Environmental Planning Policy |
| SLSC | Surf Life Saving Club |
| SoE | State of Environment |
| Terrestrial | Living or growing on land (not aquatic) |
| The lake | Lake Ainsworth |
| Turbid | Cloudy or dirty (not clear) |
| Turbidity | A measure of the amount of light-attenuating particles in a water body. |
| VMP | Vegetation Management Plan |

# Appendix 1. LINKS TO THE OBJECTS OF THE *COASTAL MANAGEMENT ACT 2016, COASTAL MANGEMENT SEPP 2018* AND THE *MARINE ESTATE MANAGEMENT ACT 2014*

*This Appendix provides more information on the linkages between the CMP with the objects of the:*

- *Coastal Management Act 2016*
- *Coastal Management SEPP 2018*
- *Marine Estate Management Act 2014*

The focus of this CMP is to achieve the 13 objects of the *CM Act* through the development of a long term management strategy. Table 11 identifies linkages between the locally specific objectives developed for the CMP (refer Section 1.3) with the objects of the *CM Act* being:

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

Similarly, the *Marine Estate Management Act 2014* (*MEM Act*) provides several objects, as identified below, for which linkages with the locally specific objectives of this CMP are identified in Table 11:

> *(a) to provide for the management of the marine estate of New South Wales consistent with the principles of ecologically sustainable development in a manner that:*
>
> *(i) promotes a biologically diverse, healthy and productive marine estate, and*
>
> *(ii) facilitates:*
>
> *1) economic opportunities for the people of New South Wales, including opportunities for regional communities, and*
>
> *2) the cultural, social and recreational use of the marine estate, an*
>
> *3) the maintenance of ecosystem integrity, and*
>
> *4) the use of the marine estate for scientific research and education,*

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

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

The *2018 - 2028 Marine Estate Management Strategy* (MEMA, 2018) details how the Marine Estate Management Authority will achieve the vision for the NSW Marine Estate over the next ten years. The Strategy recognises that effective coastal and marine management needs to be holistic, coordinated and evidence-based. The Strategy:

- Sets the policy directions for managing the marine estate as a single continuous system.
- Identifies management priorities based on the findings of the NSW marine estate threat and risk assessment.
- Balances economic growth, use and conservation of the marine estate.

The Strategy coordinates all aspects of marine estate management under one framework. This involves all relevant NSW Government agencies, integration with local government, industry, stakeholders and communities. The final Strategy will be released in 2018, supported by a detailed implementation plan and Marine Integrated Monitoring Program that will monitor the progress of the Strategy's actions and address key knowledge gaps.

Many of the Strategy initiatives and actions are relevant to the management of Lake Ainsworth and have been addressed during the development of this CMP as shown Table 11.

**Table 11: Alignment of the locally specific coastal management values and objectives with the objects of the *CM Act* and the *MEM Act.***

| Values of the CMP Study Area | Locally Specific CMP Objectives | Alignment with objects of the *CM Act* | | | | | | | | | | | | | Alignment with objects of the *MEM Act* | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (i) | (j) | (k) | (l) | (m) | (a)(i) | (a)(ii)1 | (a)(ii)2 | (a)(ii)3 | (a)(ii)4 | (b) | (c) |
| *Environmental Values* | | | | | | | | | | | | | | | | | | | | | |
| Water quality | 1. To improve and maintain water quality and ecosystem health of the lake and surrounding habitats.<br>2. To reduce threats and improve the resilience of the lake to all current and future threats; | ✓ | | | | ✓ | | | ✓ | | ✓ | | | | ✓ | | ✓ | ✓ | | ✓ | |
| Natural habitats and biodiversity | 3. To protect and enhance the coastal environmental values and natural processes of the lake and enhance natural character, scenic value, biological diversity and ecosystem integrity.<br>4. To encourage and support plans and strategies to improve the health and resilience of the lake and catchment area. | ✓ | | | | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | | ✓ | | | ✓ | | ✓ | |
| *Recreational, Cultural and Community Values* | | | | | | | | | | | | | | | | | | | | | |
| Scenic quality and amenity | 5. To protect and enhance the recreational, scenic, social and cultural values of the catchment area (also linked to objectives 1-4) | ✓ | ✓ | | ✓ | | ✓ | ✓ | ✓ | | ✓ | | | | | ✓ | ✓ | | | ✓ | |
| Public access to and use of the river and foreshore | 6. To improve and maintain public access and safety, facilities and infrastructure within the catchment area. | | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | ✓ | ✓ | | | ✓ | |
| Education, engagement and public opinion | 7. To actively engage with the public to achieve greater awareness, education and understanding of management issues and actions.<br>8. To support public participation in the coastal management and planning process. | | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | | ✓ | | ✓ | ✓ | |
| Aboriginal cultural heritage and practice | 9. To understand, protect and respect the aboriginal heritage value of the lake including aboriginal peoples' spiritual, social, customary and economic use of the catchment area. | ✓ | ✓ | ✓ | | | | | ✓ | | ✓ | ✓ | | | | | ✓ | | ✓ | ✓ | |
| Coastal risk and adaption to climate change | 10. Identify coastal hazard risks and develop actions that increase the adaptive capacity of land managers, the community and natural systems to the predicted impacts of climate change, including increased storm intensity and sea level rise. | ✓ | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | | ✓ | ✓ | ✓ | |
| *Economic Values* | | | | | | | | | | | | | | | | | | | | | |
| Local economy, jobs and prosperity | 11. To support integrated and co-ordinated coastal planning, management and reporting<br>(achieving above objectives will contribute to local economic values through enhanced tourism and associated business activity) | | ✓ | | ✓ | | ✓ | | ✓ | ✓ | ✓ | | | | ✓ | ✓ | | ✓ | | ✓ | |

# Appendix 2. COASTAL HAZARD CONSIDERATIONS FOR FUTURE BALLINA COASTLINE CMP

## Coastal hazard issues relevant to Lake Ainsworth

The continued recession of Seven Mile Beach and increased risk of erosion as a consequence of climate change (i.e. sea-level rise and storm events) has the potential to result in periodic or permanent opening of Lake Ainsworth to the sea. This has been identified as a key issue in the *Coastal Zone Management Plan for the Ballina Shire Coastline* (CZMP, GeoLINK, 2016). Oceanic breakthrough to the lake would substantially alter the ecosystem functions of the waterbody and surrounding habitats by changing the salinity, water chemistry and water level regime of the waterbody.

Weather events resulting in storm surges and abnormal waves have the potential to overtop the bordering dune system along Seven Mile Beach at points of low elevation (i.e. beach access tracks). This could result in saline input into Lake Ainsworth, localised flooding along the eastern side of the catchment, localised erosion along the dune system and lake foreshore, and disruption of public use via impeded access. Investigations as part of Stage 2 of this CMP indicated that the risk of significant wave run-up and over-wash of salt water to Lake Ainsworth during heavy seas is currently low, but will increase with continued sea level rise. The highest risk site is at the Surf Club, where risks can be mitigated by temporary minor works as required.

## Actions currently proposed as part of the Ballina Coastline CZMP

Extension of current sea walls along Seven Mile Beach and beach nourishment to provide continuous shoreline protection is recommended in the existing certified CZMP (GeoLINK, 2016). The CZMP recommends protection of landward assets (rather than a 'retreat' option) for the section of coast between Byron Street and the Sport and Recreation Centre. Consideration as part of Stage 2 of this CMP has confirmed that this option is the best option for long-term protection of Lake Ainsworth.

The Emergency Action Subplan in the CZMP (GeoLINK, 2016) sets out a plan for coastal emergencies including responsibilities and actions to prepare for and manage wave run-up and dune overtopping events in Lennox Head north of Byron Street. The actions focus on preventing entry of seawater into buildings, and damage to infrastructure. There is currently no mention of actions (e.g. sand-bagging) to prevent over wash to Lake Ainsworth.

## Additional measures for consideration as part of the future coastline CMP development

The coastline CZMP protection strategy is regarded as sound and fully compatible with the on-going management requirements for Lake Ainsworth. As part of this CMP, a number of additional measures relevant to the ongoing protection of Lake Ainsworth and have been identified which should be considered as part of the future coastline CMP development:

1. The coastline CZMP suggests that any sea wall option protecting Lake Ainsworth could be located further landward than in other areas, however it would be advantageous to protect as much of the dune system as practical, for ecological, aesthetic and risk mitigation purposes (Plate 12). Therefore, a more easterly alignment is preferable where possible.

2. Any works along Seven Mile Beach should consider groundwater outflows from Lake Ainsworth through the dunes and ensure no adverse impacts on lake hydrology (e.g. restriction of outflows, flooding impacts etc.).

3. A response strategy to extreme swell/high water conditions should be formulated to combat the potential for wave run-up and marine over-wash into the Lake Ainsworth basin. It is considered that the only notable current risk is at the Surf Club access ramp area and that a short-term emergency response in this area would be feasible and effective. Given the good accessibility and the proximity to the Surf Club (Plate 13) which itself would also warrant protective measures, a strategy to deploy short-term defences such as sand bags to prevent over wash into the lake and foreshore areas

would mitigate any current risk associated with wave run-up. This should be considered in the development of the coastline CMP Emergency Action Subplan. There is a need for a detailed evaluation of future wave run-up risk associated with sea level rise. Any redevelopment of the Surf Club should consider these aspects in design and construction.

4. Further analysis and correction of discrepancies in recent LiDAR data to ensure an accurate monitoring of coastline sand reserves to the east of Lake Ainsworth. For future acquisition, particular focus should be placed on proper discrimination and classification of LiDAR returns to ensure appropriate analysis can be undertaken.

**Plate 12: Aerial image of the dunes separating the lake from the Pacific Ocean**

**Plate 13: Aerial view of Surf Club and potential over-wash areas 1 and 2**

# Appendix 3. NSW COASTAL MANAGEMENT FRAMEWORK AND MANDATORY REQUIREMENTS

*This appendix lists the mandatory requirements for the preparation of a coastal management program (stages 1 to 4, NSW Coastal Management Manual (OEH, 2018)) and how they have been addressed in this CMP.*

**Table 12: Addressing the Essential Elements of the *NSW Coastal Management Manual (OEH, 2018)***

| **Mandatory Requirements** | | **How this has been addressed in this CMP** |
|---|---|---|
| *Purpose of a coastal management program* | | |
| 2. | A CMP is to consider a range of timeframes and planning horizons including immediate, 20 years, 50 years, 100 years and (if council considers it relevant based on expert advice) beyond. | The timeframe of risks assessed are discussed in *Stage 2 Vulnerabilities and Opportunities Study* (Hydrosphere Consulting, 2019a). |
| 3. | A CMP is to consider a broad range of coastal management issues and management actions with a focus on achieving the objects and objectives of the *CM Act*. | The range of coastal management issues are summarised in Section 2 and discussed in detail in *Stage 1 Scoping Study* (Hydrosphere Consulting 2018) and *Stage 2 Vulnerabilities and Opportunities Study* (Hydrosphere Consulting, 2019a).<br>A broad range of management actions were assessed as part of the *Stage 3 Management Options Study* (Hydrosphere Consulting, 2019b) and refined in Section 6. |
| | The management objectives for the coastal environment area are as follows: | |
| | 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, | This CMP contains a suite of actions to protect and improve the environmental values and natural processes of Lake Ainsworth. The CMP has a focus on addressing the key issues of concern including poor water quality episodes and algal blooms (Actions 1, 2, 5, 6, 25) reducing impacts of public access and controlling foreshore erosion (Actions 3, 4, 10, 13) improving scenic amenity and ecosystem health through riparian plantings, native bushland regeneration activities (Actions 4, 9), and a comprehensive public education campaign (Actions 22, 23). |
| | b) to reduce threats to and improve the resilience of coastal waters, estuaries, coastal lakes and coastal lagoons, including in response to climate change, | This CMP contains actions to address the threat of continued water quality decline through aerator trials (Action 1) and sediment management (Action 2) based on the latest scientific knowledge. Flora and fauna actions include management of invasive species (Action 8, 11, 14). Climate change impacts including flooding and sea level rise threats are addressed through planning actions (Actions 7, 28) and actions to be implemented as part of the upcoming Ballina Coastline CMP. |
| | c) to maintain and improve water quality and estuary health, | Refer b) |
| | d) to support the social and cultural values of coastal waters, estuaries, coastal lakes and coastal lagoons, | Actions 15 to 21 of this CMP support social and cultural values of the lake and address local issues affecting these values. |

| Mandatory Requirements | | How this has been addressed in this CMP |
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| | 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, | Foreshore erosion is addressed in Actions 3 and 4 through beach nourishment and riparian planting activities to maintain sandy beaches at the lake. |
| | f) to maintain and, where practicable, improve public access, amenity and use of beaches, foreshores, headlands and rock platforms. | Public access is improved through foreshore enhancement actions (Actions 3, 4) and managing access to western side of the lake (Action 15). |
| | The management objectives for the coastal use area are as follows: | |
| | (a) to protect and enhance the scenic, social and cultural values of the coast by ensuring that—<br>(i) the type, bulk, scale and size of development is appropriate for the location and natural scenic quality of the coast, and<br>(ii) adverse impacts of development on cultural and built environment heritage are avoided or mitigated, and<br>(iii) urban design, including water sensitive urban design, is supported and incorporated into development activities, and<br>(iv) adequate public open space is provided, including for recreational activities and associated infrastructure, and<br>(v) the use of the surf zone is considered, | Section 1.2.3 discusses that the majority of the CMP study area (approx. 88%) is undeveloped and zoned for environmental protection. While existing facilities and infrastructure in the remaining crown land areas are likely to be updated and/or replaced over time, further development of the catchment areas beyond existing is not anticipated due to continuing zoning and planning controls.<br>Action 5 ensures best-practice stormwater treatment systems are installed and maintained, and the continuation of low-impact land management practices in the catchment.<br>The CMP ensures that adequate public open space is provided for recreational activities and associated infrastructure and that these activities have minimal impact on the natural environment. |
| | (b) to accommodate both urbanised and natural stretches of coastline. | As discussed above, the majority of the CMP study area contains natural stretches of coastal lake and bushland with approx.11% of the area dedicated to Reflections Holiday Park, Lake Ainsworth Sport and recreation Centre and public open spaces and associated roads and infrastructure. Less than 1% of the study area is urbanised. However directly south of the CMP study area, the urban areas of Lennox Head are expected to grow significantly in the next two decades (refer Section 1.2.1). The CMP ensures that Lake Ainsworth is maintained as a natural area which will become increasingly important to balance urban expansion as well as provide environmental protection areas and low-key recreational spaces for public amenity and recreation into the future. |

| **Mandatory Requirements** | | **How this has been addressed in this CMP** |
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| *Where and when a coastal management program is prepared* | | |
| 4. | A CMP must include the rationale for selecting the area to be covered by a CMP and identify whether it applies to:<br>i) all or part of the coastal zone of one local government area; or<br>ii) all or part of the coastal zone of adjoining local government areas that share a coastal sediment compartment or estuary (where adjoining local government areas share a coastal sediment compartment or estuary - refer to Schedule 1 of the *CM Act* - a CMP that addresses an area comprising that coastal sediment compartment or estuary must reflect this regional context) | The rationale for selecting the CMP study area is provided in Section 1.2. |
| 5. | A CMP must identify:<br>i) any proposed amendments to mapping of the relevant coastal management areas;<br>ii) evidence to support any proposed amendments or additions to the area of the four coastal management areas in the relevant area; and<br>iii) information about these proposed amendments that can support the preparation of a planning proposal and, in particular, that could be forwarded along with a planning proposal to the Greater Sydney Commission (if the planning proposal relates to the Greater Sydney Region) or the Minister (for elsewhere) to inform a Gateway determination under section 3.34 of the *EP&A Act.* | No changes to the mapped CMAs are recommended at this time. |
| *How a coastal management program is prepared* | | |
| 6. | During preparation of a CMP, a council is to:<br>i) identify the scope of the CMP;<br>ii) determine and assess coastal risks, vulnerabilities and opportunities (including without limitation risks to environmental, social and economic values and benefits); and<br>iii) evaluate and select coastal management options. | The scope of the CMP was identified in the Brief to Consultants and in the subsequent preparation of the *Stage 1 Scoping Study* (Hydrosphere Consulting, 2018). The range of coastal risks, vulnerabilities and opportunities are discussed in detail in the *Stage 2 Vulnerabilities and Opportunities Study* (Hydrosphere Consulting, 2019a) and summarised in Section 2.<br>A broad range of management actions were assessed as part of the *Stage 3 Management Options Study* (Hydrosphere Consulting, 2019b) and refined in Section 6. |

| **Mandatory Requirements** | | **How this has been addressed in this CMP** |
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| 7. | A council may choose not to repeat steps (or parts of steps) in subparagraphs (ii) or (iii) of mandatory requirement 6 for the area the subject of the proposed CMP (or parts of that area) if those tasks have already been undertaken for the coastal management of that area, provided that council first considers:<br>i) whether the existing assessment of coastal risks, vulnerabilities and opportunities, or the existing evaluation of coastal management options, that council proposes to rely on enables council to prepare the CMP in accordance with mandatory requirement 8 below and sections 14 and 15 of the *CM Act*;<br>ii) the effectiveness of the existing coastal management of that area; and<br>iii) whether any circumstances concerning the coastal management of that area have changed. | N/A |
| *Matters to be dealt with in a coastal management program* | | |
| 8. | A CMP must:<br>i) provide a description of how the objects of the *CM Act* have been considered and promoted in preparing the CMP; | The objects of the *CM Act* are reflected in the specific local objectives developed for this CMP (Section 1.3). The alignment of the objects of the *CM Act* and the *MEM Act* with the specific local objectives of the CMP is shown in Appendix 1. |
| | ii) provide a description of how the objectives of the coastal management areas covered by the CMP have been given effect to in preparing the CMP; | The management objectives for each coastal management areas have been used to guide the development of specific local objectives developed for this CMP (Section 1.3). |
| | iii) identify the key coastal management issues affecting the areas to which the CMP is to apply and how these have been considered; | The range of coastal management issues are summarised in Section 2 and discussed in detail in *Stage 1 Scoping Study* (Hydrosphere Consulting 2018) and *Stage 2 Vulnerabilities and Opportunities Study* (Hydrosphere Consulting, 2019a). |
| | iv) identify any coastal management actions required to address those key coastal management issues in an integrated and strategic manner; | Management actions are provided in Section 6. |
| | v) identify how the coastal management actions in (iv) have been considered and evaluated (including, without limitation, how council has evaluated the coastal management actions in light of the functions and responsibilities council has under legislation other than the *CM Act*); | A description of how management options were evaluated and selected is provided in *Stage 3 Management Options Study* (Hydrosphere Consulting, 2019b). |
| | vi) identify any environmental protection works, on land identified as 'coastal wetlands' or 'littoral rainforests' on the Coastal Wetlands and Littoral Rainforests Area Map under the *CM SEPP*, that are proposed to be carried out by or on behalf of a public authority; | N/A |
| | vii) identify any coastal protection works that are proposed to be carried out by or on behalf of a public authority; | Refer to Appendix 1 for discussion of coastal hazards to be addressed as part of the Ballina Coastline CMP. |

| Mandatory Requirements | | How this has been addressed in this CMP |
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| | viii) set out the recommended timing for the proposed coastal management actions; | The proposed timing (i.e. in which Delivery Program(s) of Council's IP&R Framework) of action is specified in the Business Plan (Section 6.3). |
| | ix) identify a proposed monitoring, evaluation and reporting program in relation to the CMP, including by identifying key indicators, trigger points and thresholds relevant to the CMP; and | A monitoring program is provided in Section 6.1.9. |
| | x) include a business plan. | A Business Plan is provided in Section 6.3. |
| 9. | The business plan included in the CMP must identify:<br>i) all proposed coastal management actions identified elsewhere in the CMP;<br>ii) the full proposed capital, operational and maintenance costs, and recommended timing, of proposed coastal management actions;<br>iii) any proposed cost-sharing arrangements and any other viable funding mechanisms for the proposed coastal management actions to ensure delivery of those actions is consistent with the timing for their implementation under the CMP; and<br>iv) the distribution of costs and benefits of all proposed coastal management actions. | A Business Plan is provided in Section 6.3. |
| 10. | Where coastal hazards have been identified in a coastal management area, a CMP must identify proposed coastal management actions for those hazards. | Refer to Appendix 1 for discussion of coastal hazards to be addressed as part of the Ballina Coastline CMP. |
| 11. | If the *CM Act* requires that a coastal zone emergency action subplan be prepared, it must identify any requirements for how emergency coastal protection works, within the meaning of the *CM SEPP*, are to be carried out. | N/A - Refer to Appendix 1 |
| 12. | A CMP must demonstrate how a council has considered:<br>i) projected population growth and demographic changes; and<br>ii) projected use of coastal land for infrastructure, housing, commercial, recreational and conservation purposes | Projected growth and land use changes are considered in detail in *Stage 1 Scoping Study* (Hydrosphere Consulting 2018). |
| 13. | A CMP must demonstrate how a council has considered:<br>i) current and future risks, at timeframes of immediate, 20 years, 50 years, 100 years and (if council considers it relevant based on expert advice) beyond;<br>ii) (if council considers it relevant) current and future risks of potentially high consequence, low probability events that may affect the relevant area;<br>iii) the effects of projected climate change and how it may affect the relevant area;<br>iv) the local and regional scale effects of coastal processes; and<br>v) the ambulatory and dynamic nature of the shoreline and how it may affect the relevant area. | The timeframe of risks assessed are discussed in *Stage 1 Scoping Study* (Hydrosphere Consulting 2018) and *Stage 2 Vulnerabilities and Opportunities Study* (Hydrosphere Consulting, 2019a). |

| **Mandatory Requirements** | | **How this has been addressed in this CMP** |
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| 14. | A CMP is to include the following sections:<br>i) Executive summary<br>ii) Introduction<br>iii) A snapshot of issues<br>iv) Actions to be implemented by the council<br>v) Actions to be implemented by public authorities<br>vi) A business plan<br>vii) Coastal zone emergency action subplan (where relevant)<br>ix) Maps<br>x) Reference list | The CMP has been formatted according to Mandatory Requirement 14. |
| *Consultation on the coastal management program* | | |
| 15. | A draft CMP must be exhibited for public inspection at the main offices of the councils of all local government areas within the area to which the CMP applies, during the ordinary hours of those offices, for a period of not less than 28 calendar days before it is adopted. This mandatory requirement does not prevent community consultation, or other consultation, in other ways. | Public exhibition of the CMP will be undertaken in accordance with Mandatory Requirement 15. |
| *Review, amendment and replacement of a coastal management program* | | |
| 16. | When implementing a CMP, a council must:<br>i) carry out the monitoring, evaluation and reporting program in the CMP (MER); and<br>ii) monitor key indicators, trigger points and thresholds identified in the MER. | A monitoring program is provided in Sections 6.1.9 and **Error! Reference source not found.** with indicators provided in action descriptions Section 6. |
| 17. | Councils must report on the implementation of a CMP through the IP&R framework on an annual, four yearly and ten-yearly basis. | Alignment of the CMP with Council's IP&R Framework is discussed in Section 6. |
| *Implementation of a coastal management program* | | |
| 18. | When an adjoining council or a public authority is affected, or is likely to be affected, by implementation of some aspect of a CMP, a council must liaise with that authority when implementing that aspect of the CMP. | Section 6.2 discusses actions to be undertaken by Public Authorities |
| 19. | Councils must maintain sufficient information and records about its management of the relevant parts of the coastal zone that will enable it to demonstrate:<br>i) how the CMP has been implemented<br>ii) what has been achieved in connection with the CMP, including whether coastal management actions have been carried out within the timeframes identified in the CMP. | Monitoring, evaluation and reporting of implementation is discussed in Section 6.1.10. |