



Healthy and valued coast and waterways

LSPS Priority 1

2.0 Healthy and valued coast and waterways

The coast and waterways are iconic and an intrinsic part of the Northern Beaches' lifestyle for their scenic views and for the vast array of passive and active recreational opportunities they support. Water is transported from every part of the area to a coastal lagoon; directly onto the beaches; into Sydney Harbour, the Hawkesbury River or Pittwater. The creeks and lagoons are part of an overall natural system and contribute to the green infrastructure that cools and greens the area.

The LSPS principles for Priority 1 will guide future planning decisions to protect and enhance the Northern Beaches highly valued coast and waterways. These principles are:

- Promote development that maintains or restores the community's uses and values of waterways. Where these values are achieved in a waterway, they should be protected; and where they are not being achieved, all activities should work towards their achievement over time.
- Protect and enhance ecological condition of the coastal areas, catchments, waterways and their riparian areas.
- Improve the quality of water discharged to beaches, waterways, riparian areas and bushland.
- Promote integrated water cycle management and integrate water sensitive urban design measures into the built form.
- Conserve watercourses or restore them where possible.
- Encourage water efficiency, water re-use or alternative water sources to reduce potable water use.
- Protect and enhance sustainable recreation at beaches, lagoons, watercourses, wetlands and surrounding riparian or natural areas without compromising the integrity of environmentally sensitive aquatic and riparian habitats.

The coast, creeks and lagoons shape the landscape and character of the Northern Beaches. The natural features including the major catchments and waterways are shown in Figure 1 and with more detailed maps shown in Appendix 1.

The network of waterways, coastline, beaches, aquatic reserves, lagoons and creeks provide habitat for the regions' biodiversity, support threatened ecological communities and support coastal, marine and groundwater-dependent ecosystems. They also receive discharged stormwater and wastewater.

Our waterways perform essential environmental services, distributing and filtering nutrients, enabling groundwater dependent ecosystems to thrive, providing habitat for aquatic and riparian species, supporting the conveyance of rainfall, cooling urban areas and providing recreational and scenic enjoyment. Waterways provide essential habitat for both aquatic animals and terrestrial fauna including threatened and endangered species such as the Hairy pipefish and the Bush stone curlew, as well as a number of migratory birds protected by international agreements, including native species such as the Eastern osprey and Glossy black cockatoo.

Climate change is expected to impact the coastline with more damaging coastal storms and a higher sea level. The natural flow patterns of the LGA's waterways are expected to change due to extreme flooding and prolonged periods of drought (Towards 2040).

The coastline extends 40 kilometres from North Head at Manly to Barrenjoey at Palm Beach, and for 80 kilometres when including Pittwater estuary and Sydney Harbour. Arguably some of the most iconic open coastline in the country, it is interspersed with 25 ocean beaches that are important locally, nationally and internationally.

The coast supports a rich biodiversity of plants and animals, including those within five aquatic reserves and four intertidal protected areas.

The area includes a World Surfing Reserve at Manly, National Surfing Reserves at Manly-Freshwater and North Narrabeen and 27 coastal and public rockpools.



25

Ocean Beaches

Avalon, Bilgola, Bungan, Collaroy, Dee Why, Fishermans, Freshwater, Long Reef, Manly, Mona Vale, Narrabeen, Newport, North Avalon, North Curl Curl, North Narrabeen, North Palm, North Steyne, Palm, Queenscliff, Shelley, South Curl Curl, South Narrabeen, Turimetta, Warriewood, Whale.



15

Estuary Beaches

Clareville, Clontarf, Fairlight, Forty Baskets, Great Mackerel, Paradise, Sandy, Snapperman, Station, Little Manly Manly Cove, Dalwood, Sandy Bay, Currawong, Bayview.



8

Major Catchments

Hawkesbury River (Cowan Creek), Pittwater, Coastal Catchments, Narrabeen, Dee Why, Curl Curl, Manly, Sydney Harbour.



4

Intertidal Protected Areas

Bungan Head, Mona Vale Head, Dee Why Head, Shelly Beach Headland.



3

Major Estuaries

Hawkesbury River, Pittwater, Sydney Harbour.



5

Coastal Lagoons

Manly, Curl Curl, Dee Why, Narrabeen, Great Mackerel.

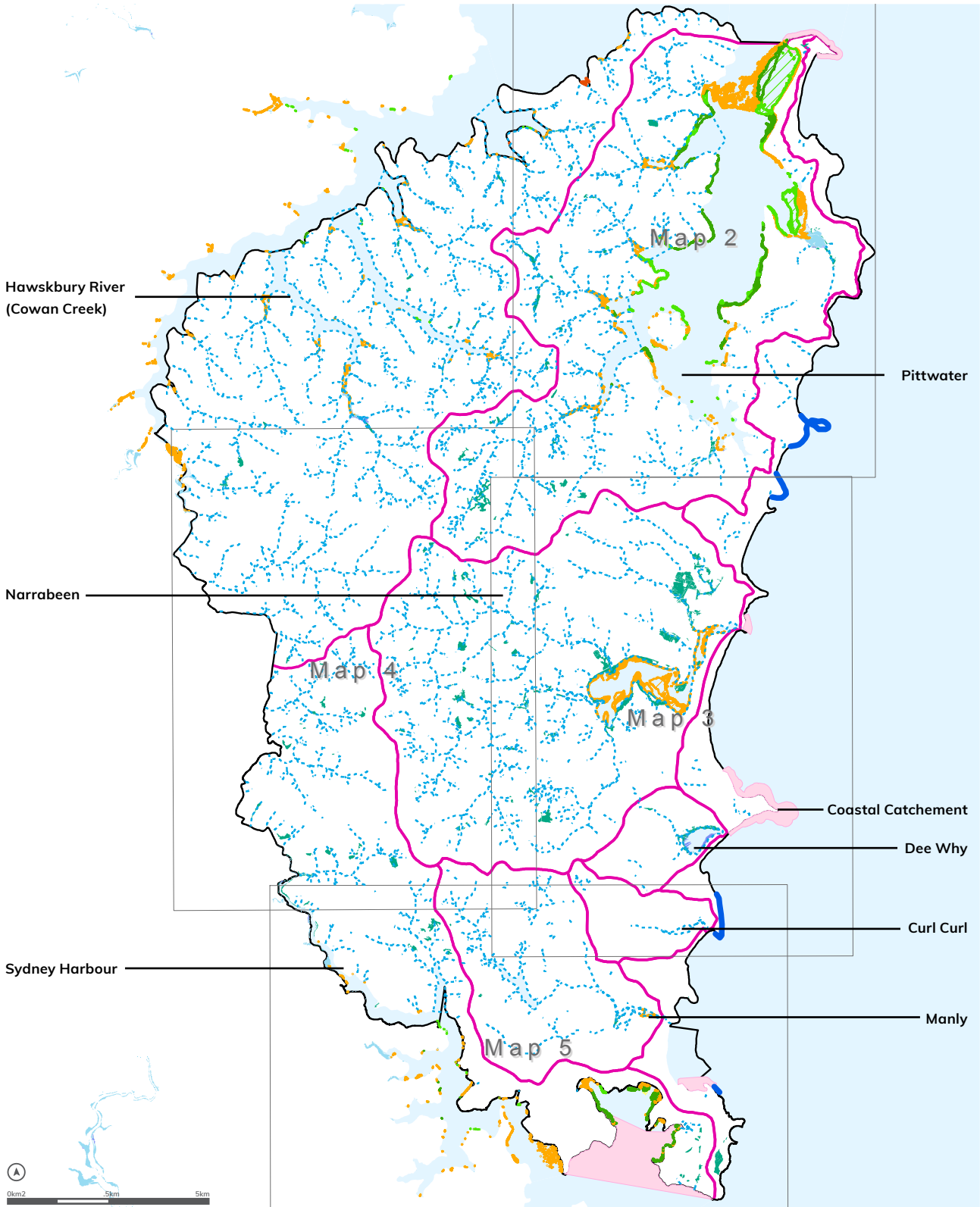


5

Aquatic Reserves

Barrenjoey Head, Narrabeen Head, Long Reef, Cabbage Tree Bay, North Harbour.

Figure 1: Major catchments, waterway features and estuarine macrophytes



Legend

- Watercourse
- Catchment Boundary
- Intertidal Protected Zone
- Wetlands
- Aquatic Reserves
- Posidonia
- Posidonia - Sparse
- Posidonia/Zostera
- Zostera
- Zostera/Halophila
- Mangrove
- Mangrove/Saltmarsh
- Saltmarsh
- Halophila
- Ruppia

2.1.1 Coastal Headlands

Coastal headlands at Barrenjoey, Avalon, Bangalley, Bilgola, Bungan, Mona Vale, Warriewood, Long Reef, Dee Why/Curl Curl, Queenscliff and North Head form a stunning natural feature and clear distinction between the sandy beaches. These headlands were formed during the Triassic Age (199 to 251 million years ago), from a sequence of sedimentary rocks including interbedded sandstones, siltstones and claystone formations.

2.1.2 Coastal Dunes

Coastal dunes form a large part of the coastal environment within the LGA and are one of the key natural assets (Cardno, 2018). Of the 25 beaches, 17 have coastal dune systems covering an area of more than 61 hectares. These dunes are located at Palm, Whale, Avalon, Bilgola, Newport, Bungan, Mona Vale Basin, Mona Vale, Warriewood, Turimetta, North Narrabeen, South Narrabeen, Fishermans, Long Reef, Dee Why, Curl Curl and Freshwater Beaches. In 2018, an assessment found that the condition of these dunes ranges from poor to good. The dune condition assessment considered geomorphology (formations), flora species, weed cover and proportion of blowout areas. The dunes are managed through a series of bush regeneration contracts to maintain and improve the condition.

2.1.3 Estuaries

The Northern Beaches region is rich in estuarine environments containing diverse ecosystems that form the foundation of the coastal food chain. Fifteen beaches within Pittwater and Sydney Harbour are key recreational areas for the community. Key features of the coast that sets the Northern Beaches apart from many other coastal landscapes are the coastal lagoons, estuaries that are known as 'Intermittently Open and Closed Lake or Lagoons' (ICOLLs) and the drowned river valley estuaries of the Hawkesbury River and Sydney Harbour Catchments and Pittwater. Both support extensive aquatic and riparian habitats and species and are highly utilised for recreation and valued by the community.

The incised nature of Pittwater, the Hawkesbury River and Sydney Harbour mean that wetlands can only form on low lying fluvial deltas. These wetlands support mangroves, seagrasses, saltmarsh and sandflats across the area and provide essential source of food and habitat for both aquatic fauna and migratory birds. These habitats are sensitive to disturbance and are extremely important for the survival of many aquatic and terrestrial species.

Nine threatened species listed under the Fisheries Management Act (FMA), 1994 have been identified to have or potentially have occurred in the LGA (Table 1, Appendix 2). These include the Whites Seahorse, the Greynurse Shark and the seagrass *Posidonia australis*. In addition, the FMA identifies a number of listed protected species that occur or are likely to occur in the LGA or adjacent waters (Table 2, Appendix 2). Marine vegetation, including seagrass beds are listed as Key Fish Habitat.

2.1.4 Estuarine Macrophytes

The Northern Beaches is rich in a range of estuarine macrophytes including seagrasses, mangroves and coastal saltmarsh. They play a vital role in the nutrient cycling from sediments to the food chain and provide habitat for aquatic macroinvertebrates, fish and birds of the estuaries.

2.1.4.1 Seagrasses

Seagrass beds are found in Pittwater, Sydney Harbour, Cabbage Tree Bay and Narrabeen Lagoon (see Figure 1). While the area of seagrass can vary, recent mapping estimates an area of 285ha in the LGA. Three species of seagrass occur in the area including *Posidonia australis*, *Zostera Capricornia* and *Halophila ovalis*. The sensitive *P.australis* (strapweed) is often found growing in association with *Z.capricorni* (eelgrass), but at slightly greater water depths. *H.ovalis* (paddleweed) is commonly found in mixed beds with both *Z.capricorni* and *P.australis*.

2.1.4.2 Mangroves

Mangroves, an important estuarine macrophyte, are present throughout the LGA and cover an area of 27 ha. Mangroves provide habitat and food and act as a buffer; reducing erosion and maintaining water quality.

The two species of mangroves present in the area are the Grey Mangrove *Avicennia marina* and the River Mangrove *Aegiceras corniculatum*. The largest area of mangroves in the LGA is in the Careel Bay area, which has increased three-fold over the past 50 years coinciding with a substantial decline in coastal saltmarsh. Diversity of macrofauna in mangrove forests adjacent to saltmarsh has been found to be greater than in mangroves that do not border saltmarsh (Yerman *et al*, 2004).

2.1.4.3 Saltmarsh

Coastal saltmarsh is recognised as a threatened ecological community under the NSW *Biodiversity Conservation Act, 2016* and is listed as vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999*. Approximately, 11ha of coastal saltmarsh was identified in the LGA through recent mapping by DPI (2020). This community is found at Dee Why Lagoon Wildlife Refuge, Winnererremy Bay, Careel Bay, Refuge Cove, Saltpan Cove and Winji Jimmi Bay (Figure 1). Coastal Saltmarsh occurs in the intertidal zone on the shores of estuaries and lagoons that are permanently and intermittently open to the sea. Saltmarsh occupies the high tide zone on sheltered foreshores and species composition will vary depending on the elevation and frequency of inundation. As with mangroves, coastal saltmarsh has historically been undervalued and considered by many to be boggy swamps and wastelands and as a result many have been drained, reclaimed, become degraded or completely lost.

Coastal Saltmarsh provides four very important and basic roles; provides habitat, provides food, acts as a buffer and filter of nutrients and is a carbon sink. Saltmarsh provides habitat and shelter for fish, juveniles and smaller fish species, especially when inundated. These areas also provide habitat for many other fauna species including, birds, bats and aquatic and terrestrial insects and invertebrates. They can also provide an important summer feeding and roosting area for migratory wader birds.

Some of the plant species found in Coastal saltmarsh include; *Baumea juncea* (bare twig-rush), *Juncus kraussii* (sea rush), *Sporobolus virginicus* (marine couch), *Ficinia nodosa* (knobby club-rush), *Samolus repens* (creeping brookweed), *Suaeda australis* (austral seablite) and *Zoysia macrantha* (prickly couch).

2.1.5 Habitats of local conservation significance for waterbirds

Careel Bay provides habitat of high local conservation significance for a variety of waterbirds. These include migratory waders from the Northern Hemisphere such as the Eastern Curlew, Whimbrel and Bar-tailed Godwit. Australia has an international obligation to protect these species and their habitat under several international agreements including the Japan-Australia and China-Australia Migratory Birds Agreements and the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention). The apparent decline since 1972 in the numbers and variety of migratory waders using Careel Bay must be viewed with some concern. "The most significant of the migratory waders recorded at Careel Bay is the Eastern Curlew. The majority of the world population comes to Australia. It is not rare but it is generally considered a species of special concern, with declining numbers being recorded at several sites in Australia" (Smith and Smith 1997 in Careel Bay Plan of Management).

Another important habitat for migratory waterbird species occurs at Dee Why and Long Reef. This is complimented by the Long Reef Aquatic Reserve that covers approximately 60 hectares offshore, providing important foraging and roosting habitat. The significance of this area is recognised at a national level by its listing on the Register of the National Estate. Dee Why Wildlife Refuge is surrounded by native vegetation including a variety of wetland and other plant communities which provide better, more secluded and more varied habitat for waterbirds than the nearby Curl Curl and Manly Lagoons. Approximately 86 native waterbird species have been recorded at Dee Why Lagoon. This includes ten waterbirds which are threatened species in NSW. A number of waterbirds use the lagoon as a temporary stopover location during migratory

or nomadic movements, including in times of drought, which establishes its conservation significance at both the state and national levels.

2.1.6 Aquatic Reserves

The primary objective of aquatic reserves is to conserve biodiversity, or particular components of biodiversity (such as specific ecosystems, communities or species), in a specified area of the marine estate. Intertidal protected areas (IPAs) have been established to protect selected rocky habitats and intertidal species.

The Narrabeen Head Aquatic Reserve encompasses the foreshore from the southern end of Turimetta Beach to the ocean baths at Narrabeen Head, and extends offshore. The proximity of Narrabeen Lagoon gives rise to a combination of estuarine and oceanic influences which supports a wide variety of marine life, including threatened species.

The Cabbage Tree Bay Aquatic Reserve covers approximate 20 hectares including the entire bay, the rocky shores and beaches from the southern end of Manly Beach to the northern end of the Shelly Beach Headland. This highly protected reserve makes this a popular dive and snorkelling spot with a huge variety of marine species and seven types of habitat.

The Barrenjoey Head aquatic reserve covers approximately 30 hectares including the rocky shore around Barrenjoey Head, extending from the northern end of Palm Beach around Barrenjoey Head to the northern end of Station Beach, and out to 100m offshore. The reserve is focused on conserving marine biodiversity of the rocky shore fringing Barrenjoey Headland. The rocky shore has a diversity of habitats and associated marine life, including four of the five types of habitats described for NSW rocky shores (platform, crevice, rock-pool and boulder habitats).

North Harbour (Sydney) Aquatic Reserve is located between North Head and Dobroyd Head in the northern part of Sydney Harbour, covering an area of approximately 260 hectares. Historically, the reserve was the site of some of the first marine specimen collecting conducted in the 1830s by the superintendent of the Quarantine Station. The aquatic reserve includes a variety of habitats, including rocky shores, sandy beaches, nearshore reefs, sandy seabed and harbour waters up to around 20 m deep.

2.1.7 Coastal Lagoons

The coastal lagoons include Narrabeen, Manly, Dee Why, Curl Curl and Great Mackerel (Figure 1). The largest of these is Narrabeen Lagoon with a surface area of 2km² and catchment area of 55km². The lagoons support a variety of species and are a highly valued recreational assets, especially for Narrabeen Lagoon.

To understand ecological condition, water quality has been monitored in four of the coastal lagoons since 2012 and commenced in Pittwater in 2017 in accordance with NSW State Government Monitoring, Evaluating and Reporting (MER) Program. The MER Program uses measurements of chlorophyll-a and turbidity to form the basis of water quality grades as they provide an effective measure of the short-term response of estuary ecosystem health in response to a range of likely pressures and their management. The estuarine water quality grades are shown in Table 1. A grade of A represents very good condition scaling to F representing very poor condition. Water quality varies according to changes in climatic conditions as well as changes in land-use and catchment practices and as such long-term monitoring is essential.

Table 1: Estuarine Water Quality

Location	Overall water quality grade							
	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20
Curl Curl Lagoon	F	C	D	D	C	C	F	C
Dee Why Lagoon	B	B	C	B	B	C	B	B
Manly Lagoon	D	C	C	D	D	C	C	D
Narrabeen Lagoon	B	B	C	B	B	C	B	B
Pittwater	na	na	na	na	na	A	A	A

Source: NSW DPIE in partnership with NBC.

Table 2: Northern Beaches Catchment Characteristics

Catchment	Catchment size (km ²)	Major tributaries	Key natural features	Key land uses
Hawkesbury River (Cowan Creek)	72	Kierans, Duffys, Smiths, Cowan, and Coal and Candle Creeks	Kuring-gai Chase NP; Dundundra Falls Reserve; Dardabong Reserve	National park, peri-urban and rural settlements. Associated activities in this area include equine activities, nurseries, larger rural land holdings
Pittwater	51	Pittwater estuary, McCarrs, Wirreanda, Cicada Glen and Careel Creeks	Kuring-gai Chase NP incl. Barrenjoey Headland, Katandra Bushland Sanctuary, Stapleton Reserve, Angophora Reserve, McKay Reserve	Residential, marinas including >3,600 moorings, small commercial centres, light industrial, national parks, bushland
Coastal catchments	13	Minor creeks flowing directly to the coast	Coastal beaches, headlands, aquatic reserves and wildlife refuges, rockpools, Sydney Harbour National Park	Residential, commercial centres of Manly, Mona Vale, Newport, Freshwater
Narrabeen	55	Narrabeen, Five Mile, Deep, Middle, South, Oxford, Wheeler, Snake, Mullet Creeks, Narrabeen Lagoon	Narrabeen Lagoon, Garigal National Park, Warriewood Wetlands, Ingleside Chase Reserve, Irrawong Bushland Reserve, Irrawong Waterfall, Heydon Reserve	Residential, open space, rural, landfill, national parks
Dee Why	5.7	Dee Why Creek, Dee Why Lagoon	Dee Why Lagoon Wildlife Refuge, Dee Why Park, Stony Range Regional Botanic Garden, Wingala Reserve	Residential, commercial, industrial
Curl Curl	4.4	Curl Curl Lagoon, Greendale Creek	Curl Curl Lagoon, John Fisher Park, Flora and Ritchie Roberts Reserve	Open space (former landfill sites), residential, industrial
Manly	18	Curl Curl (Manly), Brookvale, Burnt Bridge Creeks, Manly Dam, Manly Lagoon	Manly Dam Reservoir and parklands, Allenby Park, Mermaid Pool, Reserves	Open space (some former landfill sites), residential, commercial (Warringah Mall), industrial, bushland
Sydney Harbour	35	Middle Harbour, Bare, Carrolls, Frenchs, Bate, Bantry Bay Creeks	Garigal and Sydney Harbour National Parks, The Cascades, Dobroyd Head, North Harbour Reserve, North Head	Business Park, waste management and former landfill site, recreational mountain bike park, residential, bushland

2.2 Catchments and Creeks

Catchments are areas of land bounded by hills where water flows over the landscape, into creeks and down into the soil, eventually finding its way to a waterbody.

Catchments are physical systems which draw together both terrestrial (land-based) and aquatic (water-based) features. These important systems are mutually reliant. An impact or change in one part of the system has flow-on effects to the rest of the system, either positively or negatively. The Northern Beaches is naturally defined by seven major catchments and the coastal catchments (Figure 1).

The characteristics of the eight catchments of the Northern Beaches are the shown in Table 2.



Curl Curl Lagoon

2.2.1 Creeks

Creek systems are the critical component of our natural environment – the natural 'blue grid'. Creeks and the associated riparian zones support a high diversity of plants and animals, provide wildlife corridors between larger bushland reserves, reduce impacts from stormwater runoff and pollution, provide a cooling effect in urban areas and provide recreational opportunities for the community.

Creeks provide habitat and channel water to the highly valued receiving waters. More than half of the creeks are within National Parks. Around 100 kilometre of creeks are on private land and the remaining 150 kilometre are under Council management. Incorporated into this network are freshwater wetlands and coastal upland swamps that provide valuable habitat and are important in regulating water flow within the catchment.

Coastal Upland Swamp in the Sydney Bioregion and Freshwater Wetlands on Coastal Floodplains are listed as threatened ecological communities under the NSW *Biodiversity Conservation Act, 2016*. Within the LGA there are many relatively small coastal upland swamps covering an area of approximately 19ha, with most of these occurring along Middle and Deep Creeks and at Warriewood Wetlands.

Across the Northern Beaches, some creeks are in near pristine condition including Deep, McCarrs and Smiths Creeks and the upper reaches of Wheeler Creek. However, in most catchments, development has resulted in:

- changes to creek flows, including increased stormwater, flood frequencies and artificial barriers to flow such as weirs/culverts;
- increased sediment loads and bank erosion;
- a decline in water quality including increased nutrient, toxicant, sediment and litter; and
- clearing of vegetation and invasion by weeds in and around the creeks.

Virtually all creeks within the area are at risk of further degradation. The level of risk varies widely, as does the sensitivity of creeks to further change. One feature is common to all creeks – they flow into receiving waters that are highly valued – the coastal lagoons, beaches and the estuaries of Sydney Harbour and the Hawkesbury River. Each of these is under stress from pollutants conveyed by the creeks.

Several creeks (such as Snake Creek) have development in the upper reaches and also flow into national parks or reserves and finally into sensitive estuarine waters. Most of these are highly modified in the urban and rural areas but are in good condition in the national parks or reserves. There is a risk that this group of creeks is at the point where any increase in flows or pollutants from the catchment could result in significant deterioration in the national park sections.

Many creeks in the urban areas have been degraded in significant – and possibly irreversible ways – due to historical catchment development leading to the alteration of creek floodplains and creek flows. However, while they have been degraded ecologically some of these areas can provide highly valued recreational opportunities such as walking or riding trails.

The Green Grid is a network that seeks to combine hydrological, ecological and urban resilience through a network of green Infrastructure. The Blue Grid comprises the hydrological elements of the Green Grid, including the region's waterways and water-dependent ecosystems with high ecological value.

2.2.2 Groundwater

Groundwater in the broad sense is all water that occurs below the land surface. It is an integral part of the “water cycle” (or “hydrologic cycle”) and interacts directly with the water present on the earth’s surface. Groundwater provides significant contributions to creeks, wetlands and swamps, being an ongoing source of water during seasonally dry periods. It also maintains the dynamics of estuarine and near-shore marine water bodies, contributing inflows of fresh water to otherwise saline environments. As such, protection of groundwater and groundwater dependent ecosystems is essential.

2.2.3 High quality catchments

Creeks, and their catchments were assessed under a range of criteria to determine their overall condition as either Group A, B or C catchments. Group A catchments are ‘high quality catchments’ having high landscape and ecological value and will degrade quickly if even minor changes occur (such as weed growth, vegetation clearing or urban development). The following catchments have been defined as high quality catchments in the Northern Beaches Water Management for Development Policy (2021): Oxford, Bare, Deep, Kierans, Duffys, Smiths, Cottage Point, Wirreanda, Cicada Glen, Deep, Wheeler and Curl Curl Creeks.

These high quality catchments typically have low imperviousness (hard surfaces) and are commonly less developed. When urban development occurs, the increase in hard surfaces including buildings, roads driveways and the like increases the catchment imperviousness. When impervious surfaces make up more than 10% of a catchment, waterway health is impacted (MWH, 2004). Urban development, that

increases hard surfaces, impacts both the quantity and quality of stormwater runoff.

Impervious surfaces contribute to poor waterway health in the following ways:

- They can disrupt the natural water cycle, preventing water from infiltrating into the ground and replenishing groundwater:
 - In coastal groundwater aquifers, this increases saltwater intrusion and impacts vegetation health.
 - Lower groundwater contributions to base flows in creeks means they are more likely to cease flow in dry periods.
- They can change the flow regime, increasing flows during low rainfall events and increasing peak flows in high rainfall events. This can have a number of impacts on:
 - flooding
 - the fauna community present (some require permanent water and others are naturally adapted to periods without flow, and it can impact lifecycle activities such as spawning)
 - aquatic and riparian vegetation
 - water quality
 - erosion/sedimentation
 - supporting the invasions and success of exotic and introduced species.
- They can increase heat, which directly impacts flora and fauna health and increases the heat of our waterways, which then increases algal growth and changes the species diversity. Directly associated to this is the relationship between increase in impervious surfaces and loss of vegetation that provides shade to waterways.

2.3 Challenges and Opportunities

2.3.1 Asset management

There is an opportunity to consider waterways, or the natural blue grid, as an infrastructure asset – a 'blue asset' to be integrated into decision making to protect environmentally sensitive waterways and address the cumulative impact of land management decisions.

2.3.2 Vegetation management

Maintaining coastal vegetation on dunes and coastal headlands through planned bush regeneration activities provides habitat for flora and fauna as well as building the resilience of these systems to coastal processes

2.3.3 Water quality

Protecting the natural blue grid across the Northern Beaches will support and enhance water quality and aquatic and terrestrial ecosystems, as well as address the cumulative impact of land management decisions, especially in more natural catchments such as Narrabeen, and the Hawkesbury River. These catchments are particularly vulnerable to increased urban development not only because of the sensitive nature of receiving waters and environments but also the relatively natural state of their catchment headwaters.

One of the biggest challenges facing waterways is the impact of poor water quality and sedimentation as a direct result of increased urbanisation.

The impact of changing land uses, increasing connected impervious surfaces and land clearing, especially in riparian zones, continues to place pressure on water quality and the health of important ecosystems and aquatic habitats including mangroves, saltmarshes and seagrasses, which support aquatic and terrestrial flora and fauna. It can also impact on the ability for waterways and lagoons to be utilised for valued recreational purposes.



Coastal boardwalk view to Long Reef Beach and Dee Why

2.3.4 Stormwater and overland flow

Waterway systems, including creeks, have historically been seen as merely a way to transport away nuisance water. This has led to extensive constructed stormwater networks which saw a preference for straightening creek lines and lining some channels with concrete. Northern Beaches Council has a stormwater network that incorporates over 600 kilometre of stormwater pipes. The network of waterways, drainage paths and the coast should be viewed as a connected and dependent network which contributes to community liveability.

The changes to the waterway system through piping has increased the velocity of flows, which itself impacts the aquatic ecology and streambank stabilisation. These increased velocities carry pollutants, elevated nutrient levels, sediment, litter and plastics into and along creeks and waterways and to lagoons and the ocean.

Catchment and waterway rehabilitation and restoration is important for improving the overall health of waterways, protecting and enhancing their intrinsic natural values, and slowing down the flow of water thus improving overall water quality before it enters receiving waters. Rehabilitation and restoration activities include bank stabilisation, erosion control, riparian habitat restoration and stormwater quality improvement devices. Another key mechanism to protect waterways from urban impacts is to 'disconnect' the stormwater drainage infrastructure from the receiving waterway.

Within urbanised catchments such as Dee Why and Curl Curl, stormwater run-off can be controlled and treated before entering local waterways, protecting them from increased flow and excess nutrient and sediment loads. Improving water quality and flow characteristics along the system can enhance overall waterway health. This can be achieved through introducing stormwater controls which are tailored to the receiving waters. This is particularly important for sensitive receiving waters.

2.3.5 Recreational use

Sustainable recreational use of water-based environments of the Northern Beaches is an essential component of waterway management and ensures the longevity of valued environments over generations. It is essential in maintaining cultural identity, lifestyle values, and it is also key to supporting a healthy, robust and diverse local economy.

With an increasing population and associated growth in the LGA, there is potential for negative impacts on waterways and the coast. To ensure protection of the environment is balanced with recreation, sensitive areas where recreation is not sustainable needs to be identified.

It may also be appropriate for degraded natural areas to be reconfigured as passive or active recreational areas, as has occurred around Curl Curl Lagoon. Further, management of natural areas, such as dunes and riparian lands management provides an opportunity to increase the resilience of these areas.

Environmental Planning Actions

LSPS Priority 1

Healthy and valued coast and waterways

The following environmental planning actions have been developed to deliver the LSPS planning priorities. These will also help to achieve the outcomes of the ECC Strategy.

LSPS Action	ECC Strategy	Environmental Planning Actions	Timeframe
Implement Environment and Climate Strategy Protect.Create.Live and develop associated action plans for coastal areas and waterways.	Protect our waterways with strategic land-use planning and development controls including water sensitive urban design.	1.1 Assess and map freshwater habitats - Finalise the assessment of watercourses, wetlands and riparian lands. Use these assessments to incorporate the outcomes of this review into a new, comprehensive map that consistently categorises watercourses, wetlands and riparian lands (including corridors and buffers) for inclusion in the new planning framework.	Short Term
Prepare a stormwater quality management plan to guide implementation of the risk-based framework, identify stormwater quality targets, and prioritise public and private stormwater infrastructure needs.	Reduce pollution entering our coastal environment using best practice source controls, treatment measures and best practice detection systems.	1.2 Develop planning controls for freshwater habitats - Protect and maintain watercourses, wetlands and riparian areas at current or improved condition from development impacts by reviewing current controls and where necessary developing and implementing new planning controls using appropriate setbacks and corridors based on environmental value and stream order. Examples may include different controls depending on categories, buffers and higher environmental value areas. Consider innovative approaches or alternative solutions to enhancement of riparian areas, such as rehabilitation of offset areas.	Short Term
Develop LEP and DCP controls that incorporate the findings of the above studies, including stormwater quality targets; integrated water cycle management (including water sensitive urban design); coastal management programs; protection of riparian areas; coastal hazard management and criteria for environmentally friendly sea walls.	Work to allow coastal processes to naturally shape the coastal environment, whilst preserving the natural character through policies, strategic land use planning and development controls.	1.3 Manage the threat to water quality and aquatic ecology - Complete a water cycle strategy that identifies catchments according to risk, value and condition. Develop stormwater quality and quantity targets to protect water quality and aquatic ecology.	Short Term
Investigate the feasibility of local green grid projects:		1.4 Develop planning controls to protect water quality and aquatic ecology - Develop and implement planning controls that integrate water sensitive urban design and stormwater controls to ensure development achieves the identified stormwater quality and quantity targets for each catchment and protects downstream water quality and aquatic ecology. Examples may include landscape and rainwater reuse controls for all catchments with the objective of increasing infiltration and stormwater quantity reduction, which has multiple water cycle and waterway benefits.	Short Term
<ul style="list-style-type: none"> a continuous foreshore path around the Pittwater waterway a new boat ramp on Pittwater to cater for medium to larger boats naturalisation of creeks at Dee Why, Mona Vale and Avalon new aquatic reserves for areas of high biodiversity value, in addition to better management of existing aquatic reserves and marine estates opportunities for non-motorised water sports launching, storage and utilisation 		1.5 Ensure watercourses, wetlands and major stormwater, flood mitigation works, infrastructure are incorporated into public land in precincts to facilitate ease of maintenance, multifunctionality and optimal waterway health and amenity outcomes.	Ongoing
		1.6 Protect natural assets including watercourses, wetlands and riparian lands, water quality and aquatic ecology by considering them early in the strategic planning process, such as during precinct planning.	Ongoing
Prepare an open space and recreation strategy and map a local green grid that supports environmentally sustainable access to the coast and waterways where appropriate.	Improve and manage sustainable recreational access whilst protecting environmentally sensitive lands.	1.7 Identify and protect coast and waterway areas of high environmental value within the local green grid.	Ongoing
		1.8 Ensure that Councils recreation planning considers protection of high environmental value coast and waterway assets and ensures recreational activities and infrastructure within these areas are low impact.	Ongoing