1 INTRODUCTION AND LEGISLATIVE FRAMEWORK

1.1 Background

Killick Creek is located within the Kempsey Local Government Area (LGA). Its immediate catchment covers an area of 5 km^2, located to the north of the coastal township of Crescent Head. Killick Creek has two main tributaries referred to by the community as 'Muddy Arm' and 'The Flood Cutting'. The catchment also includes parts of Hat Head National Park. A locality map for Killick Creek is presented as Figure 1-1, and highlights some of the key locations around the vicinity.

In the late 1800s, farmers dug an informal drain between Belmore Swamp and Killick Creek, in order to improve the agricultural productivity of the low-lying lands surrounding the Belmore River. By January 1890 it is understood that a large flood had expanded the drain to 23 metres wide (70 foot) allowing broad large volumes of floodwater to discharge into Killick Creek. However, by the 1930s, this drain had become dysfunctional due to neglect and a lack of maintenance. In the 1950s, the original drain was improved and Killick Creek was formally connected to the Upper Belmore Swamp and the Macleay River system, via Killick Drain, and later, Scotts Drain (completed in 1974). Killick Creek is also connected to the Maria River (part of the Hastings River system) through Connection Creek (which flows from the south into Killick Drain – see Figure 1-1).

Large one-way floodgates are located between Killick Creek and the main agricultural drains in Belmore Swamp and Connection Creek. These floodgates aim to prevent saline estuary waters from entering the agricultural drains, but allow freshwaters to drain from the swamp into the estuary. The floodgates are not completely effective and some saltwater migrates into the agricultural drains (particularly during extended dry weather periods). Drop boards are also incorporated into the floodgate structure, and can be lowered into place to prevent outflow from the drains (as well as inflow from the estuary). The drop boards have been used periodically to protect the estuary from drainage waters (typically during summer holiday periods).

The drainage works associated with connection of Killick Creek with the Upper Belmore River was supplemented by dredging and training of the Killick Creek entrance (also constructed in the 1950s). The entrance works involved significant reclamation behind the rock training wall (most of the current Caravan Park site is reclaimed land, used to dispose of material dredged from the mouth of the creek). Prior to the 1950s, the entrance to Killick Creek was intermittently closed. An extended dry weather period in recent years has resulted in occasional entrance closure of Killick Creek, which has been very rare since training of the entrance.

The upper reaches of Killick Creek were also widened and deepened as part of flood works in the 1950s to increase the flood capacity of the creek.

Day to day tidal processes make Killick Creek a small but well flushed estuary, particularly in the lower reaches. The now almost permanently open entrance has increased the marine dominance of the estuary, increasing the extents of marine habitats, such as mangroves, and abundance and diversity of fish. Nonetheless, fish kills have still been recorded in Killick Creek, being attributable to a range of factors including anoxia (deficit of oxygen) and acid runoff. Anoxic conditions can occur in Killick Creek (particularly in the artificially deepened sections that sometimes stratify) due

to organic runoff from the agricultural drains, or sometimes ingress of marine algae and seaweed into the estuary (which becomes trapped and breaks down – consuming oxygen in the process).

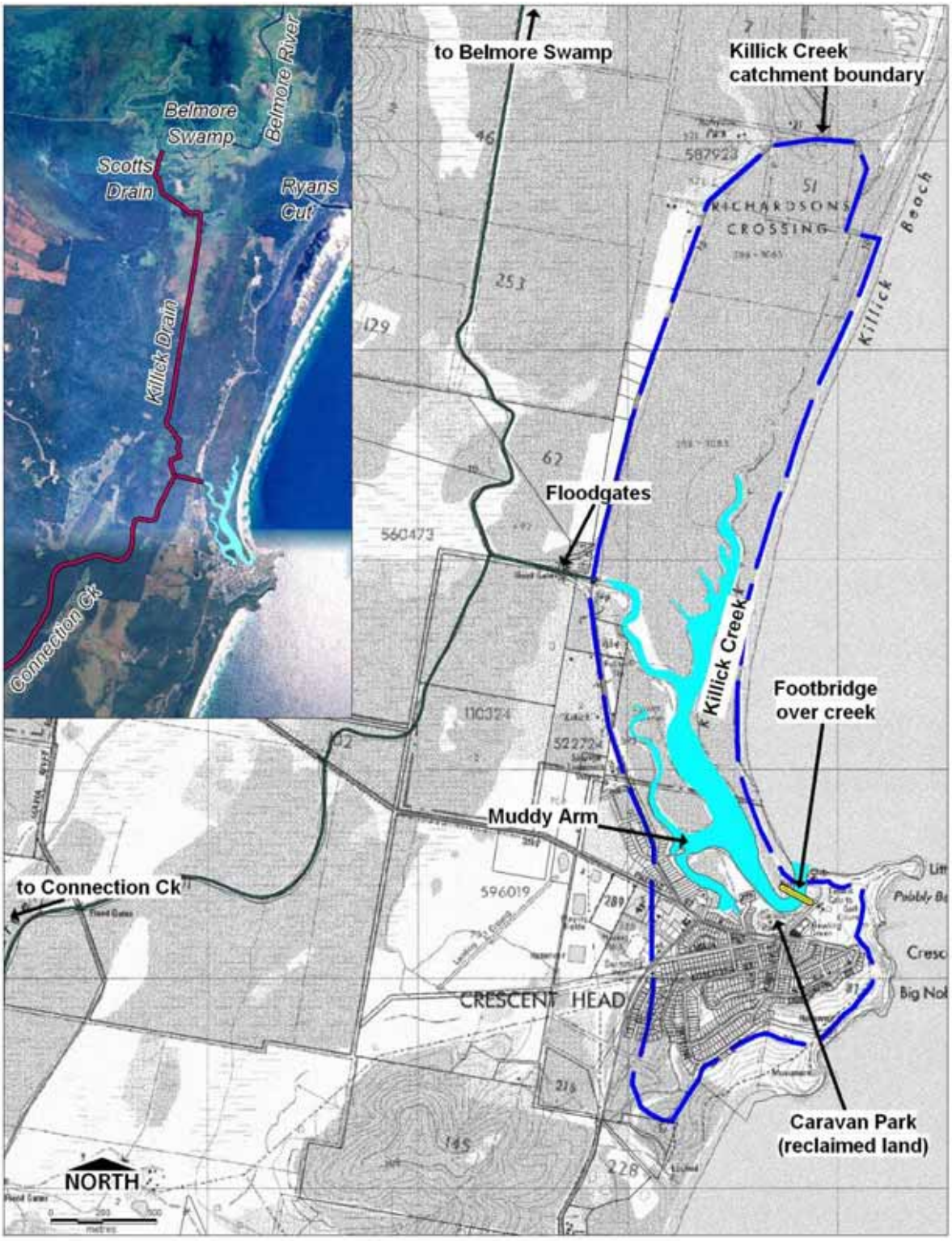

Figure 1-1 Killick Creek General Locality

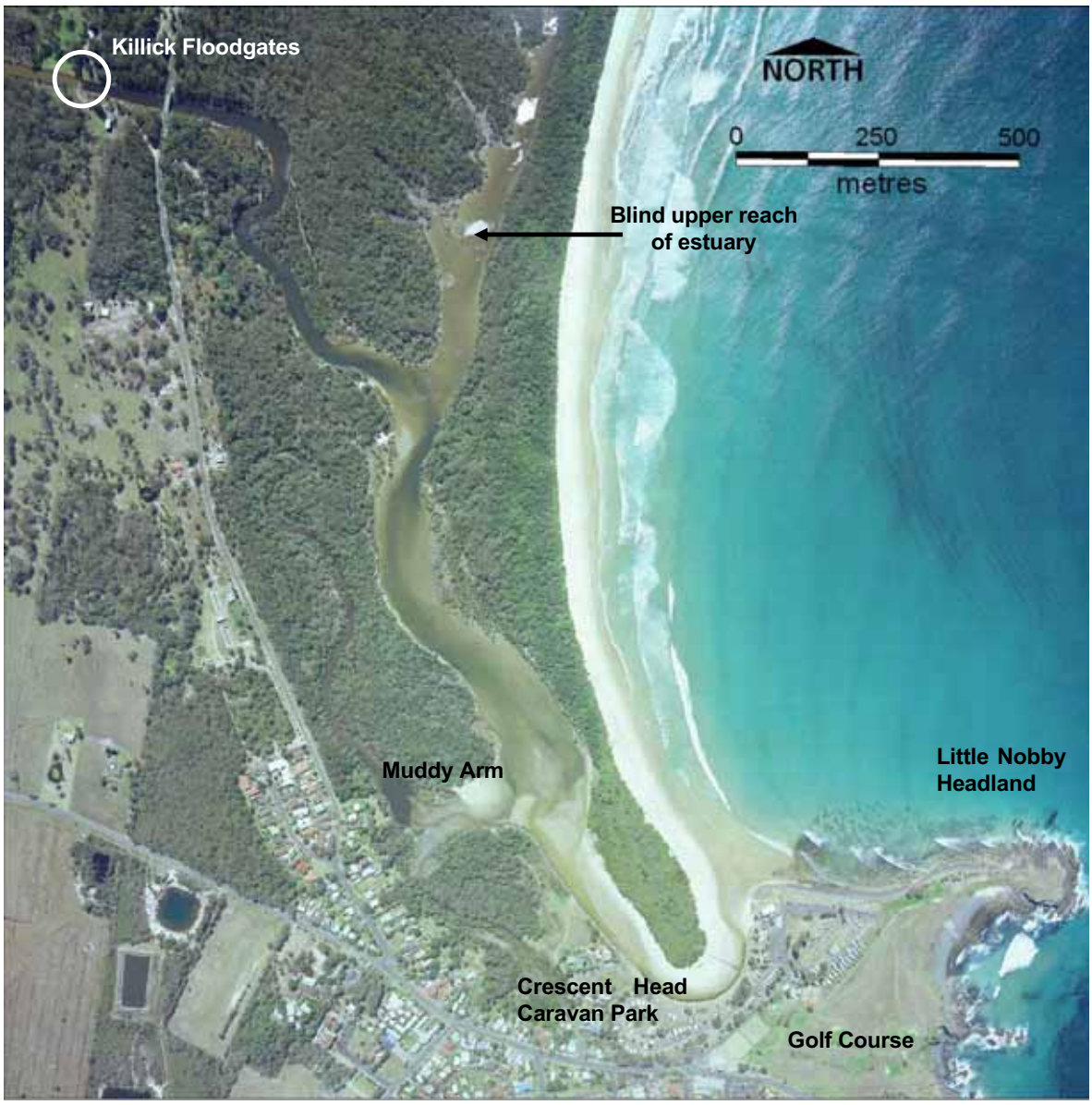

Figure 1-2 Killick Creek Estuary Details and Features

1.2 The Need for a Long Term Management Plan

The NSW coastline is experiencing unprecedented urban expansion. By the year 2031, it is projected that the non-metropolitan coastal zone of NSW will support an additional 430,000 people compared to the 2001 population (DIPNR, 2004). Attractive coastal settlements such as Crescent Head are expected to receive considerable pressure in the near future to accommodate the demand for coastal urban lands. The Crescent Head urban area is currently expanding to the south of the village – outside the Killick Creek catchment, however, this would still have indirect effects on the

environmental condition and amenity of Killick Creek through increased use of businesses and services located within the catchment.

The Crescent Head Caravan Park is the premier Council-operated park in the Kempsey shire (ISD, 2003), and is located on the banks of Killick Creek adjacent to the estuary entrance. Crescent Head is also a prime holiday destination, with an internationally recognised surf break.

Future management of Killick Creek will require consideration of the environmental and natural values of the system, as well as the usage of the system by resident and visiting community members (including commercial uses). Managing the 'summer impacts' of the holidaying public is particularly difficult, given the short-term peaks in recreational demand and external inputs (eg through litter, foreshore trampling etc).

For Killick Creek specifically, a balance in management is required between the residents and tourism-based interests of Crescent Head and the agricultural landholders who rely on Killick Creek to drain waters from farming lands after local rainfall and flooding within the Macleay River (and to a lesser extent, flooding from the Hastings catchment).

A long term management plan for Killick Creek will ensure that the various demands on the estuary, including ecological, economic and social demands, are managed in a balanced and sustainable manner. The Plan will also prioritise works and actions that are required to remediate existing problems with the system, and to prevent degradation of the system in the future.

1.3 Estuary Management Process

The Killick Creek Estuary Management Plan has been prepared under the NSW Government's Estuary Management Program. The Program is designed to fulfil the requirements of the NSW Estuary Management Policy (1992) and the NSW Coastal Policy (1997).

1.3.1 NSW Government's Estuary Management Program

In 1992, the NSW State Government introduced an *Estuary Management Policy*, aimed at managing the growing pressures on estuarine ecosystems. The policy is implemented through an Estuary Management Program, which is co-ordinated by the Department of Natural Resources (DNR), in co-operation with local government and the community.

The process of managing an estuary, in accordance with this Policy, is initiated by the establishment of an Estuary Management Committee. In compliance with the policy, Kempsey Shire has an active Coastal and Estuary Management Committee. This Committee is responsible for the development of an Estuary Processes Study, which outlines all the hydraulic, sedimentation, water quality and ecological processes within the estuary, and the impacts of human activities on these processes.

The Estuary Processes Study provides the necessary understanding of physical and biological processes for the development of an Estuary Management Study. The Management Study identifies the essential features and the current uses of the estuary, and determines the overall objectives required for management of the estuary. The Management Study also identifies options for meeting these objectives, and determines environmental impacts of the proposed options.

From the findings of the Management Study, an Estuary Management Plan is prepared. The Plan describes how the estuary will be managed, gives recommended solutions to management problems, and details a schedule of activities for the implementation of the recommendations. Once the Plan has been accepted by both the community and the relevant Government Authorities, the Plan can be implemented through planning controls, works programs, monitoring programs, and education services. The general estuary management process, as established by the NSW Government, is shown in Figure 1-3.

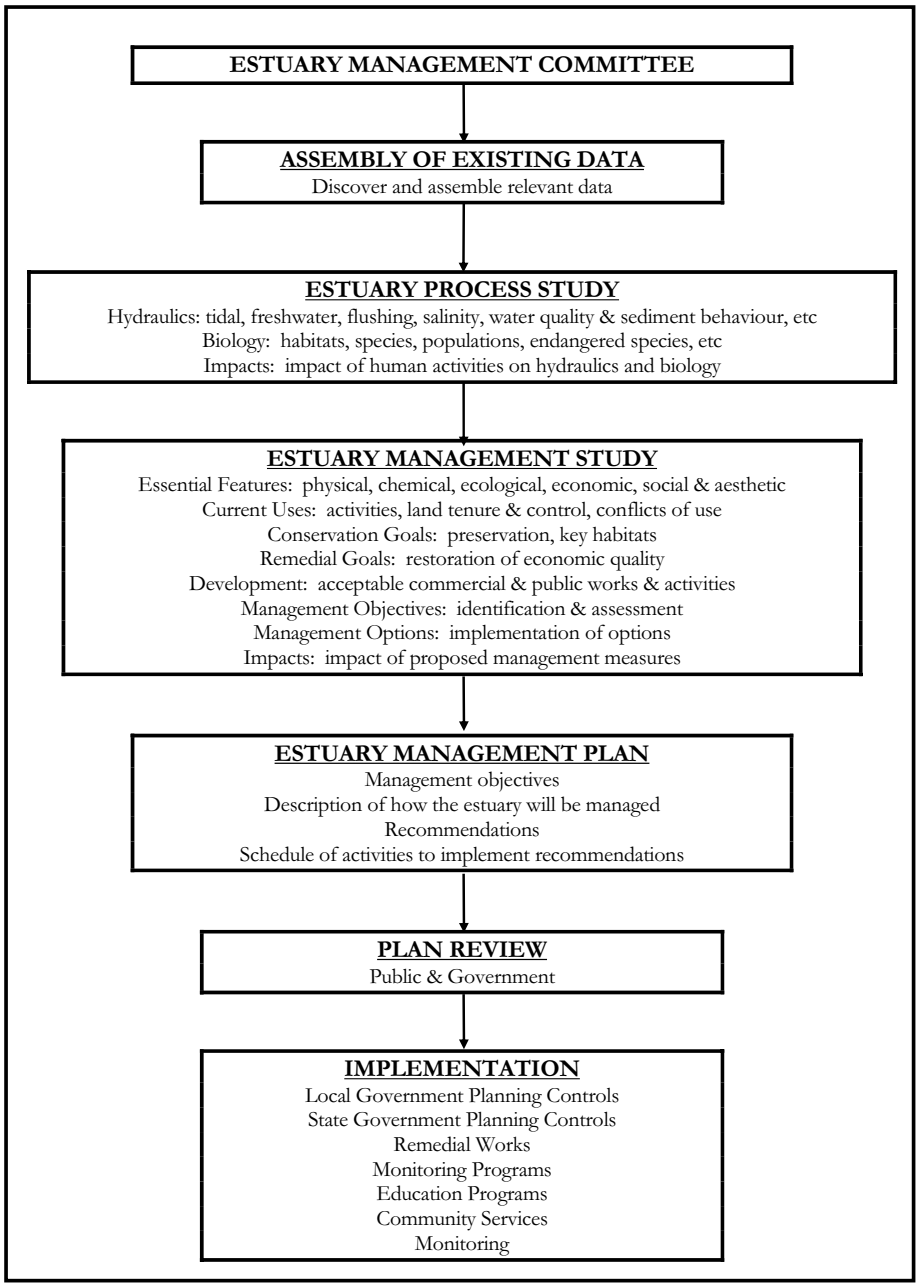

Figure 1-3 NSW Government's Estuary Management Process

The procedure of preparing an Estuary Management Plan is documented in the Estuary Management Manual (NSW Government, 1992). The manual broadly described a systems-based approach to estuary management that includes process and condition definition, management planning and implementation, monitoring of outcomes and plan review.

An Estuary Processes Study for Killick Creek was completed in November 2002 (MHL, 2002). A summary of the findings of the Processes Study is presented in Section 2. This document addresses the next two stages of the Estuary Management Process, being the development of an Estuary Management Study and an Estuary Management Plan.

1.3.2 Estuary Management Policy 1992

The NSW Estuary Management Policy is one of a suite of policies under the umbrella NSW State Rivers and Estuaries Policy. The Estuary Management Policy was developed as part of the State Government's recognition of the social and economic importance of estuaries. The specified general goal of the policy is "to achieve an integrated balance responsible and ecologically sustainable use of the State estuaries which form a key component of coastal catchments".

Specific objectives can be summarised as:

- Protection of estuarine habitats and eco-systems in the long term;
- Preparation and implementation of a balanced long term management plan for the sustainable use of each estuary and its catchment;
- Conservation of habitats;
- Conservation of aesthetic values;
- Prevention of further estuary degradation;
- Repair of damage to the estuarine environment; and
- Sustainable use of estuarine resources.

1.3.3 NSW Coastal Policy 1997

The NSW Coastal Policy is the State Government's response to the challenge of achieving a sustainable future for the NSW coastline while balancing environmental, economic, cultural and recreational needs. The policy is based on two fundamental principles: ecologically sustainable development (refer Section 1.3.3.1), and integrated coastal zone management (refer Section 1.3.3.2).

The NSW Coastal Policy 1997 applies to urban and non-urban areas along the NSW Coast, covering land:

- Three nautical miles seaward of the mainland and offshore islands;
- One kilometre landward of the open coast high water mark; and
- One kilometre around all bays and estuaries.

As such, Killick Creek and its foreshores fall within the jurisdiction of the Coastal Policy.

The Coastal Policy has nine goals, each underpinned by objectives that are to be achieved by strategic actions. Responsibilities for these actions have been assigned to appropriate agencies, councils and

other bodies. DNR is wholly or partly responsible for nearly half of the strategic actions in the Coastal Policy, with many of these involving a partnership with local councils.

The nine goals of the NSW Coastal Policy 1997 are:

1. To protect, rehabilitate and improve the natural environment;
2. To recognise and accommodate natural processes and climate change;
3. To protect and enhance the aesthetic qualities;
4. To protect and conserve cultural heritage;
5. To promote Ecologically Sustainable Development;
6. To provide for ecologically sustainable human settlement;
7. To provide for appropriate public access and use;
8. To provide information to enable effective management; and
9. To provide for integrated planning and management.

With regard to Killick Creek, the Policy specifically recommends that detailed management plans for estuaries be prepared and implemented in accordance with the NSW Government's Estuary Management Manual (Strategic Actions d f g h).

1.3.3.1 Ecologically Sustainable Development

The four principles of Ecologically Sustainable Development (ESD) are:

- *The precautionary principle*: The lack of full scientific evidence should not be used as a justification for the postponement of the introduction of measures to prevent or mitigate environmental degradation. This principle is fundamental to adaptive management. Monitoring and prevention are central to the precautionary principle – monitoring to measure progress, and prevention to minimise costs and risks. Decisions can and should be refined as ongoing monitoring and research provides better understanding.
- *Intergenerational equity*: Each generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for future generations. This principle points to institutional and community responsibilities for integrated management, to ensure quality of life is maintained and enhanced.
- *Conservation of biological diversity and ecological integrity*: Measures should be taken to prevent and protect against the extinction or loss of viability of plant and animal species due to human activities.
- *Improved valuation and pricing of environmental resources*: The quality and value of environmental resources should be maintained and enhanced through appropriate management and pricing, preventing degradation and damage.

As the NSW Coastal Policy 1997 applies to Killick Creek, Council is required to reflect the above principles of ecologically sustainable development in planning and management decisions. The Killick Creek Estuary Management Plan will outline a series of actions that are fundamentally

aligned with the ESD principles. Therefore, the Plan will provide a framework for implementing these principles as they apply to the Killick Creek, and its catchment.

1.3.3.2 Integrated Coastal Zone Management

NRMMC (2003) states that "the fundamental goal of Integrated Coastal Zone Management (ICZM) in Australia is to maintain, restore or improve the quality of coastal ecosystems and societies they support. A defining feature of ICZM is that it seeks to address both development and conservation needs within a geographically specific place – a single community, estuary or nation – and within a specified timeframe."

In essence, ICZM is a subset of ESD that relates specifically to the coastal zone. It seeks to protect essential ecological processes and biodiversity, accommodate orderly and balanced resource utilisation, and ensure greater harmony between physical processes and human activities (DNR, in prep.). Within Australia, Coastal Zone Management needs to consider key drivers influencing the sustainable use of the coastal zone, including population growth and demographic shifts; industry trends; protection of the coastal resource base; and climate change (NRMMC, 2003).

1.4 Other Government Initiatives for Natural Resource Management

In addition to the NSW Estuary Policy and the NSW Coastal Policy, the Estuary Management Plan for Killick Creek is to consider other Government Initiatives that have been developed with the aim of protection and sustainable management of the State's natural coastal resources. In this regard, the Estuary Management Plan is to be a **fully integrated document**, consistent with the goals of broader natural resource management plans.

Other Government initiatives and programs that have been considered and incorporated into the Killick Creek Estuary Management Plan are listed below and are described in the following sections of this report.

- Environmental Planning and Assessment Act, and associated State Environment Planning Policies (SEPPs);
- Rivers and Foreshores Improvements Act 1948
- Threatened Species Conservation Act 1995
- National Parks and Wildlife Act 1974
- Fisheries Management Act 1994
- Policy and Guidelines – Aquatic Habitat Management and Fish Conservation, 1999
- Protection of the Environment Operations Act 1997
- Catchment Management Authorities Act 2003
- Natural Resources Management Act 2003
- Coastal Protection Act 1979
- Local Government Act 1993

- Crown Lands Act 1989
- Environmental Protection and Biodiversity Conservation Act (Cth) 1999
- North Coast Regional Environmental Plan;
- EPA Stormwater Management Program
- Macleay River Floodplain Management
- Integrated Water Cycle Management;
- Healthy Rivers Commission Independent Inquiry into Coastal Lakes; and
- Catchment Management Blueprint / Catchment Action Plan.

1.4.1 Environmental Planning and Assessment Act 1979 (EP&A Act)

One of the key pieces of NSW legislation is the Environmental Planning and Assessment Act 1979. This Act provides a system of environmental planning and assessment for NSW. A number of objectives are specified under the act, as follows:

- Appropriate management, development and conservation of natural and artificial resources so as to promote the social and economic welfare of the community and a better environment.
- Facilitation of the orderly and economic use and development of land.
- Ensure appropriate provision and management of communication and utility services.
- Provide land for public purposes.
- Provide for and coordinate community services and facilities.
- Encourage the protection of the environment and facilitate ecologically sustainable development.
- Enable the provision and maintenance of affordable housing.
- Share the responsibility for environmental planning and management between the State and local government.
- Facilitate increased opportunity for public involvement and participation.

1.4.2 State Environmental Planning Policies (SEPPs)

These planning policies are instruments under the Environmental Planning and Assessment Act 1979. They deal with issues significant to the state and people of New South Wales.

1.4.2.1 SEPP 14 – Coastal Wetlands

Preservation and protection of coastal wetlands is the aim of this policy. It is recognised that coastal wetlands serve statewide environmental and economic interests. The policy applies to wetlands in the State identified as needing protection by Department of Natural Resources (DNR). Any development that would involve clearing, construction of levies, draining or filling of wetlands requires consent of the local council and the concurrence of the Director of DNR. Restoration works also require the consent of the local council and the concurrence of the Director. The Department of Environment and Conservation (DEC) must be notified of development proposals within SEPP 14 wetlands.

There are a number of SEPP 14 wetlands surrounding the Killick Creek estuary, as shown in Figure 1-4.

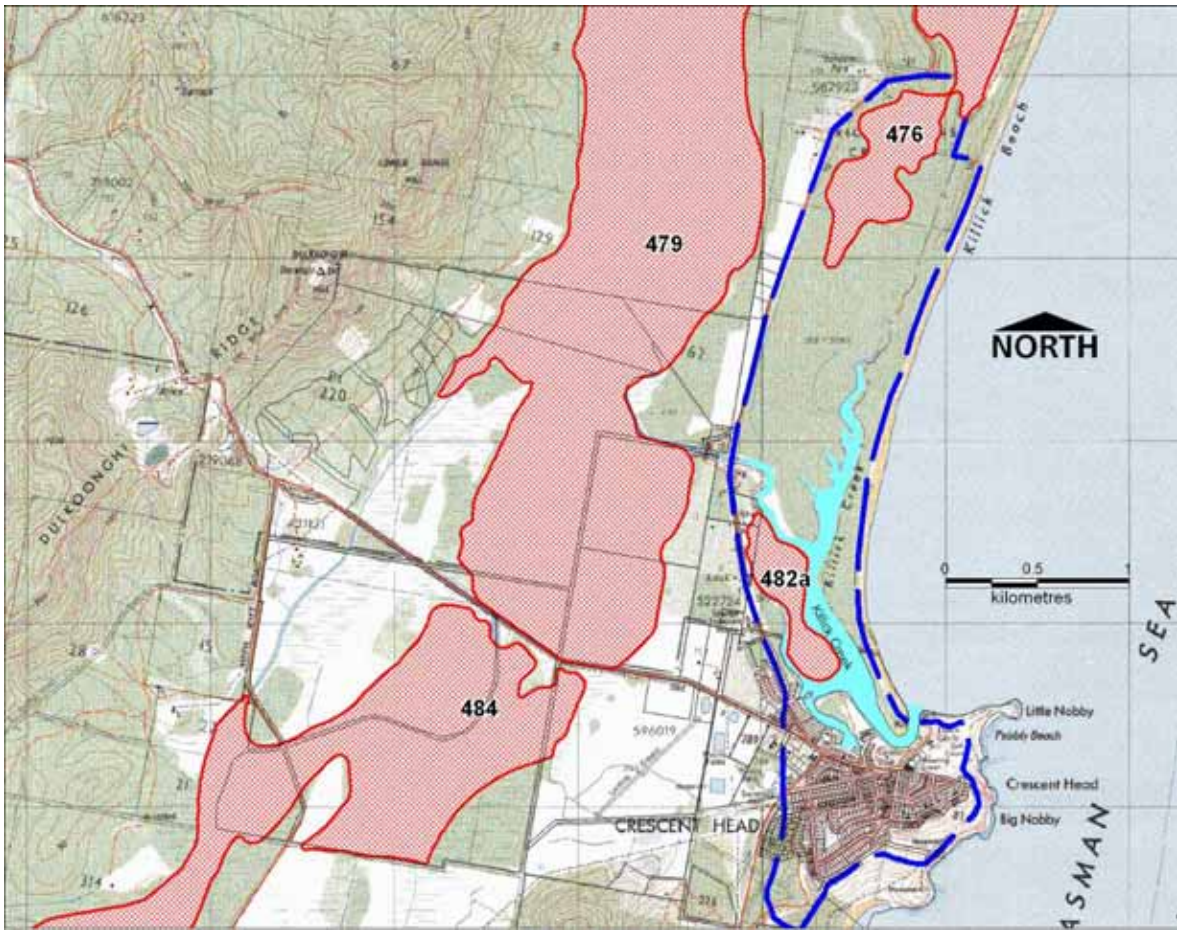

Figure 1-4 SEPP 14 Wetlands in the vicinity of Killick Creek

1.4.2.2 SEPP 35 – Maintenance Dredging of Tidal Waterways

This policy was developed to facilitate the maintenance dredging of tidal waterways by public authorities provided the works were carried out in a timely, cost effective and environmentally responsible way. The aim of the policy is stated as being to rationalise the planning controls applicable to the carrying out of maintenance dredging of tidal waterways. In this regard public authorities can undertake maintenance dredging without the need to obtain development consent.

Maintenance dredging should not be undertaken until all environmental impacts are identified and assessed. As part of the process the public authority needs to consult with effective bodies including councils and to take into account the views of those consulted.

SEPP-35 has historically been used as a mechanism for Councils to carry out dredging works of shoaled tidal entrances in order to improve tidal flushing and to restore or improve navigation.

1.4.2.3 SEPP 71 – Coastal Protection

SEPP-71 was first gazetted in November 2002, and applies to the coastal zone of NSW including most of the Killick Creek catchment. Recent changes to the Environmental Planning and Assessment Act 1979 and the introduction of a new State Significant SEPP have essentially replaced the provisions outlined in SEPP 71, and as such it is expected the SEPP 71 will be repealed in the near future.

Nonetheless, as originally outlined in SEPP 71, and now documented in the new State Significant SEPP and EP&A Act amendments, the NSW Minister for Planning becomes the consent authority for State significant coastal development. State significant coastal development includes mining, extractive industry, industry, landfill, recreational establishments, marinas, tourist facilities (except bed and breakfast establishments and farm stays) and buildings greater than 13 metres in height above the natural ground level.

It also includes development comprising subdivision of land:

- within a residential zone into more than 25 lots;
- within a rural residential zone into more than five lots; or
- within any zone into any number of lots if effluent is proposed to be disposed of by means of a non-reticulated system.

The policy also defines sensitive coastal locations and generally requires development applications proposed for these areas to be referred to the Director General of Planning for comment. Sensitive coastal locations are generally within 100 metres of tidal waterways, coastal lakes, SEPP-14 wetlands, National Parks and SEPP-26 littoral rainforest.

Master plans, or site-specific Development Control Plans (DCPs), are required to be approved by the Minister before some consents can be granted. Generally a master plan is a document consisting of written information, maps and diagrams that outline proposals for development of land.

1.4.2.4 Other SEPPs

There are a number of other State Environmental Planning Policies (SEPPs) that are applicable to developments within the Killick Creek catchment, but are considered not to be of significance regarding the long-term management of the estuarine receiving waters. These SEPPs include:

- SEPP-5: Housing for older people or people with a disability;
- SEPP-6: Number of storeys in a building;
- SEPP-9: Group homes;
- SEPP-11: Traffic generating developments;
- SEPP-55: Remediation of Land;
- SEPP-64: Advertising and signage;

- SEPP-65: Design quality for residential flat development; and
- State Significant SEPP (as discussed in Section 1.4.2.3 above).

Note there are no areas of littoral rainforest protected by SEPP-26 within the Killick Creek environs.

1.4.3 River and Foreshores Improvement Act, 1948

Part 3A of the Rivers and Foreshores Improvement (RFI) Act 1948 provides for the protection of rivers, lakes and other waterbodies within the State. A permit is required for excavation or removal of material within a waterway / watercourse or within 40 metres of a waterway (measured from the top of bank), unless the works are being carried out by a public or local authority.

Permits are issued by the Department of Natural Resources. Works assessed under the EP&A Act 1979 that require a permit under the RFI Act are deemed integrated development. The Department of Natural Resources can revoke or modify a permit, or can direct remediation works if it is considered that the conditions of the permit have been breached.

1.4.4 Threatened Species Conservation Act, 1995

The protection of species and ecological communities in New South Wales are administered by the Threatened Species Conservation Act 1995, the National Parks and Wildlife Act 1974 and the Fisheries Management Act 1994.

The Threatened Species Act is responsible for the protection of certain species, populations and ecological communities when they are a particular level of endangerment. These species are known as 'threatened species, populations and ecological communities' and include endangered, critically endangered, and vulnerable species, endangered population, endangered ecological communities and vulnerable ecological communities.

The Threatened Species Conservation Act has established a committee that is responsible for determining species, population, ecological community or threatened process that should be included in Schedules 1, 2 or 3. Consequently, species, populations or ecological communities can be listed by the committee or upon request by the Minister.

1.4.5 National Parks and Wildlife Act 1974

The National Parks and Wildlife Act 1974 was responsible for the establishment of the NSW National Parks and Wildlife Services (NPWS), which is now part of the Department of Environment and Conservation.

The NPWS is responsible for the administration of national parks and other lands under the National Parks and Wildlife Act and the Wilderness Act. The NPWS are also responsible for the threatened species under the Threatened Species Conservation Act 1995.

The objectives of the National Parks and Wildlife Act 1974 are the:

- Conservation of habitats and ecosystems, biological diversity in the community, landforms of significance, and landscapes and natural features of significance; and

- Conservation of the objects, places or features of cultural values within the landscape, which would include Aboriginal and European heritage and places of historic, architectural or scientific significances.

The objectives of this Act would be achieved by applying the principles of ecologically sustainable development (ESD).

Under the National Parks and Wildlife Act, a management plan needs to be prepared for each national park. The plan needs to address the following issues:

- The conservation of wildlife and its habitat;
- The preservation of the national park and its special features, including historic structures, objects, relics or Aboriginal places;
- The encouragement and regulation of the appropriated use, understanding and enjoyment of the national parks; and
- The preservation of the national park as a water catchment area, and protection against uncontrolled fires and soil erosion.

Within a national park, the Minister is allowed to grant leases to provide accommodation and facilities and licences to carry out trade or business activities, however, leases and licences cannot be granted over land that is within a declared wilderness area.

It is an offence to prospect or mine for mineral in a national park, unless the mining activity is authorised by an Act of Parliament.

1.4.6 Fisheries Management Act 1994

The Fisheries Management (FM) Act 1994 is one of the most important state laws in relation to protection of fish and marine vegetation. The Fisheries Management Act is responsible for the protection of freshwater and saltwater fish and invertebrates and marine plants. The Department of Primary Industries (DPI), which now incorporates the former NSW Fisheries department, is responsible for the administration of the FM Act.

The main aim of the Act is to conserve, develop and share the fishery resource of the State for the benefit of present and future generations. Conservation of fish species and habitats, threatened species, population and ecological communities, are dealt with under the Fisheries Management Act 1994. In addition, the Act is to promote ecologically sustainable development, including conservation of biological diversity.

Under the Fisheries Management Act it is considered an offence to harm any listed marine threatened species and damage a marine area declared to be critical habitat.

The Fisheries Management Act applies to all water is the State except for purposes relating to a fishery that is to be managed in accordance with the law of the Commonwealth pursuant to an arrangement under Division 3 of Part 5.

The main provisions of this legislation that relate to Estuary Management works are:

i) Habitat Protection Plans - which allow for the gazettal of management plans for the protection of specific aquatic habitats;

ii) Dredging and Reclamation Plans - which allows for the control and regulation of dredging and reclamation works, which may be harmful to fish and fish habitat. It establishes requirements to obtain a permit from or to consult with NSW Fisheries (now known as the Department of Primary Industries).

iii) Protection of mangroves and certain other marine vegetation, which requires permits to be obtained for the regulation of damage to or removal of certain marine vegetation including seagrass.

Of particular relevance to the Killick Creek Estuary Management Plan are provisions within the Act relating to the preparation of Habitat Protection Plans. Fish Habitat Protection Plans describe potential threats to fish habitat and recommend actions to mitigate the effects of potentially damaging activities. There are three habitat protection plans gazetted to date however only two of these plans are relevant to this study. These are outlined briefly below.

Habitat Protection Plan No 1 General

This is an advisory document summarising various protective measures in relation to dredging and reclamation activities, fish passage requirements, and the protection of mangroves, other marine vegetation and snags.

Habitat Protection Plan No. 2 Seagrasses

The Plan deals specifically with the protection of seagrasses across NSW, and discusses activities which impact on seagrasses, including the construction of jetties, wharves, and bridges, dredging and reclamation, and the collection of seagrasses.

1.4.7 Policy and Guidelines – Aquatic Habitat Management and Fish Conservation, 1999

This Policy and Guidelines document has been prepared by the then NSW Fisheries to improve the conservation and management of aquatic habitats in NSW. The document provides an overview of the different aquatic habitats found within marine, estuarine and freshwater environments. The document also discussed a range of activities that can potentially impact on these habitats (e.g. dredging, reclamation, waterfront development, flood mitigation works, water pollution), along with guidelines for minimising impacts on aquatic habitats.

A series of general policies for the conservation of fish, marine vegetation and aquatic habitats is provided, and are summarised below:

a. A precautionary approach is required in assessment of impacts on fish and aquatic habitats
b. Aquatic habitats must be protected when the habitat is important to maintain biodiversity or harvestable populations
c. Habitats of protected or threatened species must be afforded special protection
d. Protected Areas and critical fish habitats should be given priority consideration in development of plans in assessing the impacts of developments and in determining applications.

e. Terrestrial areas adjoining habitats should be carefully managed to minimise landuse impacts. Foreshore buffers at least 50m (or 100m adjacent to sensitive areas) should be established and managed for conservation.

f. Pollution of waterways should be avoided by (i) identifying sources, (ii) preventing or minimising discharges, (iii) treatment of discharges, and (iv) using alternative disposal.

g. Maintain free passage for migratory fish, with unlicenced barriers to be removed or fish passage facilities installed.

h. Alien, exotic or introduced species should not be released into any waterway without approval.

i. Where developments or activities are likely to affect fish or habitats, then NSW Fisheries (now, DPI-Fisheries) should be consulted and provided with all necessary information to assess impacts.

j. Environmental compensation needs to be integrated into the planning process, and needs to be provided where significant environmental impact is unavoidable (with new habitat created on a 2:1 basis).

k. Degraded aquatic habitats should be rehabilitated to repair past environmental damage.

l. Environmental monitoring is needed to determine if the assessment of the impacts of a development were accurate. Monitoring needs to be scientifically rigorous. As a general rule, a change of 20% in a biological indicator one year after the impact should be regarded as a major impact and require environmental compensation.

The Policy and Guidelines document provide specific guidance on management of intermittently opening coastal lagoons, which can be considered relevant to Killick Creek. The guidance with respect to coastal lagoons is focussed on entrance management. In essence, the Policy and Guidelines advocates minimum interference of entrances, and will not support artificial opening unless there is a threat to public health or safety. The document recommends using Estuary Management Plans to determine and define appropriate entrance manipulation guidelines. A number of specific guidelines are also provided, including:

- Guard against illegal entrance opening by erection and maintenance of appropriate signs
- Using factual data, not speculation or perception, as a basis for opening a lagoon entrance
- Interim entrance management strategies should be formulated for problematic lagoons
- Opening should be carried out during a falling tide to maximise potential for achieving maximum scouring and thus establishing a longer lasting entrance channel
- Artificial manipulations should be lessened in the future by adopting catchment management practices, transferring flood-prone land to public ownership, preventing development of flood-prone land, relocating susceptible infrastructure and increasing community awareness.

1.4.8 Protection of the Environment Operation Act 1997

The Protection of the Environment Operations Act regulates water pollution, air pollution and noise pollution in New South Wales. The Act enables the Environment Protection Authority, an agency within the DEC, to issue pollution license and notices, to take legal action to enforce the law and to create a range of pollution offences and penalties. The Act also enables members of the public to take legal action to enforce laws.

Under the PEO Act it is considered and offence to pollute water without an environmental protection licence. Water pollution is the placement of any matter in a position where pollution enters or is likely to enter the water. There are a number of activities that require licence, which are detailed in Schedule 1 of the Act, including dredging works and extractive industry, although these activities must remove more than 30,000 m^3 per year to trigger the Act.

Pollution of a waterway is allowed if an environmental protection license is held, however, there are conditions of a licence.

1.4.9 Catchment Management Authorities Act 2003

The purpose of the Catchment Management Authorities Act 2003 is to establish catchment management authorities that would carry out certain natural resource management functions in their regions. There are thirteen catchment management authorities in New South Wales. Killick Creek falls in the Northern Rivers catchment area. The Act repeals the Catchment Management Act 1989 and amends various other Acts.

The objectives of the Act are:

- To provide natural resource planning on a catchment level;
- To ensure that the decisions about natural resources take into account appropriate catchment issues;
- To ensure that catchment level decisions take into account state standards and involve the Natural Resource Commission in catchment planning;
- To make use of the communities' knowledge and expertise and to involved them in decision making;
- To ensure proper management of natural resources from the social, economic and environmental issues; and
- To provide financial assistance and incentives to landholders in connection with natural resource management.

Under the Act each catchment authority is required to prepare a draft Catchment Action Plan (CAP) as soon as possible after the commencement of this Act and submit it for approval by the Minister.

Details of the Catchment Action Plan, and the Catchment 'Blueprint' on which is has been based, are provided further in Sections 1.4.19 and 1.4.19.2.

1.4.10 Natural Resource Management Act 2003

The Natural Resource Management Act 2003 is responsible for the creation of the Natural Resources Commission. The objectives of the Act are:

- To establish a sound scientific basis for the informed management of natural resources in regards to the social, economic and environment interests of the State;
- To enable the adoption of State-wide standards and targets for natural resource management issues; and

- To advise in the circumstance where broad-scale clearing is regarded to be an improvement or maintenance of environmental outcomes for the purpose of the Native Vegetation Act 2003.

The Natural Resource Commission consists of a full time Commissioner and Assistant Commissioner. The role of the Commission is to provide the government with independent advice on natural resource management, in addition to recommending state-wide targets for natural resource management, approval of catchment action plans, and commenting on the effectiveness of these plans. The commission would also undertake natural resource management assessments, and would control investigations and inquires into natural resource management issues and research of the issues.

1.4.11 Coastal Protection Act 1979

The Coastal Protection Act 1979 was amended in 1998 and extended the coastal zone to include estuaries, coastal lakes and lagoons, islands and rivers in recognition of the strong connection between estuaries and the open coast. The coastal zone is delineated on maps approved by the Minister for Planning and Natural Resources.

The Coastal Protection Act 1979 provides general supervision of the use, occupation and development of the coastal zone. This includes a requirement for public authorities to gain agreement from the Minister for Infrastructure, Planning and Natural Resources before any development is carried out or consent is given for the use, occupation or development of the coastal zone. It also provides for general supervision of development within the coastal zone that is not otherwise subject to the provisions of an environmental planning instrument (other than a State Environmental Planning Policy).

The Act requires that the Minister promotes ecologically sustainable development. The Minister may reject development or use of occupation of the coastal zone, that is inconsistent with the principles of ecologically sustainable development, or that may adversely affect the behaviour or be adversely affected by the behaviour of the sea or an arm of the sea or any bay, inlet, lagoon, lake, body of water, river, stream or watercourse.

1.4.12 Local Government Act 1993

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

The Local Government (Ecologically Sustainable Development) Act 1997 amends this Act, so that the guiding operational principles are ecologically sustainable development and sustainable use of resources.

1.4.13 Crown Lands Act 1989

The Crown Lands Act 1989 provides for the administration and management of Crown land, which includes most beaches, coastal reserves, nearshore waters and estuaries, including Killick Creek.

The Crown Lands Act 1989 requires a land assessment to be undertaken prior to the reservation, dedication, exchange, vesting or sale of Crown land, or the granting of easements, leases or licences in respect of such land. The process for land assessment is specified by the Act and the *Crown Lands Regulation 2000*. It requires the physical characteristics of the land to be identified, the land's capabilities to be assessed and suitable uses identified. A draft land assessment is publicly exhibited for 28 days for comment. The exhibited draft may indicate a preferred use or uses.

1.4.14 Environment Protection and Biodiversity Conservation (Cth) Act 1999

The Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) is the main Commonwealth Law responsible for the protection of flora and fauna. The EPBC Act commenced on 16 July 2000 and replaced the Environmental Protection (Impact of Proposals) Act 1974 (Cth), the Act which formerly set out requirements for environmental assessment in Federal law.

This Act applies to:

- Flora and fauna within areas controlled or owner by the Commonwealth;
- Flora or fauna that may be harmed by the actions of the Commonwealth agency; and
- Actions that may have a significant effect on species on the national threatened species list.

The EPBC Act has increased the number of activities that will be subject to environmental assessment and approval by the Commonwealth government, and has given a more important role and broader powers to the Federal Minister for the Environment (the 'Minister'). Under the EPBC Act, it is necessary to obtain an approval from the Minister to carry out a 'controlled action', which is an activity that is likely to have a significant effect on the environment, or likely to have a significant effect on a "matter of national environmental significance".

The act provides protection to species and ecological communities by:

- Creating a process for the listing of protected species and ecological communities;
- Requiring the assessment and approval of proposals that are likely to have a significant impact upon threatened species, and ecological community or a migratory species; and
- Requiring permits for actions in a Commonwealth area that involve the killing, injury or taking of a listed threatened species or ecological community.

The EPBC Act provides protection for threatened species, migratory species that are listed under the JAMBA Convention, the CAMBA Convention or Bonn Convention, and listed marine species as detailed by the Department of Environment and Heritage.

The EPBC Act provides protection to Ramsar wetland from actions that would result in significant impact on the wetlands. However, an action that may have significant impact on the ecological character of a declared Ramsar wetland might take place outside the boundaries of the wetland. A

declared Ramsar wetland is an area that has been designated under Article 2 of the Ramsar Convention or declared by the Minister for the Environment to be a declared Ramsar wetland in accordance with section 16 the Act.

The EPBC Act was amended in 2003 to include protection of National Heritage. This amendment involved, including 'national heritage' as new matter of national environment significance, and the establishment of a national heritage list.

1.4.15 North Coast Regional Environmental Plan 1988

The North Coast Regional Environmental Plan 1988 (NCREP) is an overarching planning document that has been prepared by the now DNR. It details a range of matters that Council's, including Kempsey Shire Council, must consider when preparing draft Local Environmental Plans (LEPs) and when considering development applications (DAs). NCREP must be consistent with all relevant SEPPs, as discussed in Section 1.4.2.

Several Clauses within the NCREP address specific considerations relating to developments near waterways or environmental important or culturally significant areas, including for example Clauses 15, 29A, 32B, 33, 36A, 36B, 36C, 36D, 36E, 36F, 76 and 81.

1.4.16 Stormwater Management Planning

In April 1998 the NSW Environment Protection Authority (EPA) issued a direction under Section 12 of the Protection of the Environment Administration Act requiring councils to prepare stormwater management plans. The primary purpose of preparing urban stormwater management plans was to improve the health and quality of the State's urban waterways.

The stormwater management plans were to address environmental issues including stormwater quality, river flow, riparian vegetation and aquatic habitat management. A stormwater management plan was not intended to be a flood or drainage management plan. This program relates to the State Government's water reforms in that water quality and river flow objectives were to be established. These were expected to be the long term objectives of the stormwater management plans.

The Kempsey Shire Urban Stormwater Management Plan 2000 – 2005 was prepared by Council in response to the EPA requirements. The Plan identifies stormwater issues, values, objectives, pressures, and response strategies for the urban areas within Kempsey Shire.

In addition to the Shire-wide Plan, another site-specific Stormwater Management Plan was prepared for Crescent Head (GHD, 2003). The Plan covered the investigation, concept design, community consultation and community education relating to improving the quality of stormwater discharging into Killick Creek from the Crescent Head urban area. GHD (2003) recommended a number of structural and non-structural elements to the stormwater management strategy. These include:

- On-going water quality monitoring (both periodic and event-based);
- Installation of a number of treatment devices to remove litter (and one to remove oil and grease);
- Increase number of sullage disposal points in the Caravan Park; and
- Further community education, including drain stencilling, information on dog droppings, nutrients, reporting of sewer overflows, and using students to monitor stormwater quality.

1.4.17 Kempsey Integrated Water Cycle Management Study

The Kempsey Integrated Water Cycle Management (IWCM) Study has been prepared by Kempsey Shire Council, in conjunction with State Government, to aid in the identification and development of management strategies for urban water cycle planning. IWCM involves consideration of stormwater, sewage and water supply from a holistic and integrated perspective, incorporating whole-of-catchment processes and other planning and water management initiatives.

The Kempsey IWCM Study involved a detailed audit of the existing water systems in Kempsey to identify those areas where the system is not performing as well as it could in relation to water resources management. Specific issues were defined from the audit, which were then assessed in terms of driving causes and inter-relationships with other issues. A potential list of management tools and actions was prepared which were aimed at addressing these water management issues.

With regard to Crescent Head and the Killick Creek catchment, the IWCM study found that rainwater tanks should be considered to supplement potable water supply usage for garden watering and toilet flush, while effluent and stormwater reuse options should be considered to provide other water sources for town and other uses. Kempsey Shire Council has investigated the use of rainwater tanks in Crescent Head in the past, and found their application would be impractical. However, recent studies in Newcastle by Newcastle City Council have shown that rainwater tanks can be retrofitted to existing urban development with notable improvements to water cycle management.

1.4.18 Independent Inquiry into Coastal Lakes

In 2002, the NSW Healthy Rivers Commission (HRC) released an Independent Inquiry into NSW Coastal Lakes (HRC, 2002). While this Inquiry focussed on typically larger lakes and lagoons along the entire NSW coastline, the HRC advised that the approach adopted is applicable to all estuaries, including the smaller coastal creeks that have intermittently opening entrance. Killick Creek has been identified specifically by the HRC as an estuary that would be suitable for adoption of the HRC (2002) management approach.

According to the HRC, NSW coastal lakes provide valuable ecological, social and economic benefits to local and wider communities, yet pressures placed on them by increasing development within their catchments and around their foreshores, have resulted in their degradation. Unfortunately there is no agreed management system that pays sufficient regard to the inherent limitations of coastal lakes. Therefore, in order to achieve 'healthier lakes', a fundamental change in the way decisions are made is recommended by HRC.

A Coastal Lakes Assessment and Management Strategy has been presented by the HRC as an effective response to the challenges for managing coastal lakes. This Strategy comprises:

- A management framework for major classes of coastal lakes;
- Preparation of Sustainability Assessments to determine capabilities and limitations of each coastal lake;
- Arrangements to implement key elements of the strategy (eg implementation responsibilities); and
- A range of supporting initiatives.

The Management Framework is essentially a guide for making critical decisions for each major class of coastal lake. Each coastal lake is classified into one of four classes, and for each class, the framework provides guidance as to:

- The underlying intention of management decisions;
- The scope of the Sustainability Assessment;
- The intended outcomes;
- The types of actions possible; and
- A selection of management 'tools' for implementing actions.

HRC recommends Sustainability Assessments for each coastal lake to determine the capability and limitations of individual lakes and their catchments to support different types of human activities, and consider such assessments as pivotal to the overall management strategy. Sustainability Assessments would be carried out at three levels, viz: statewide, lake specific, and site specific. The statewide assessment is essentially covered by the HRC Independent Inquiry, which places all coastal lakes into one of four classes (Comprehensive Protection; Significant Protection; Healthy Modified Conditions; and Targeted Repair).

The lake-specific sustainability assessments would be based on more detailed information about individual coastal lakes, and would build on existing information, such as Estuary Processes Studies and soil maps, wherever possible. Lake-specific assessments would be based on:

- Key ecosystem processes and thresholds;
- Catchment processes;
- Environmental and ecosystem values;
- Indigenous values;
- Sustainable resource usage;
- Resident values;
- Public health implications; and
- Existing and possible future mechanisms for implementing strategies

The nature and scope of the sustainability assessments would be influenced by the management orientation (or class) of the lake. For example, assessments for Comprehensive Protection lakes would focus on identifying actions required for restoring and preserving natural processes, whereas assessments for Targeted Repair lakes may be focused on mitigating adverse effects, such as algal blooms.

Site specific sustainability assessments would be carried out by proponents of development proposals, and would confirm or fine-tune the assessments at the lake specific level.

1.4.18.1 Response to HRC Independent Inquiry by NSW Government

In response to the HRC Independent Inquiry, the NSW Government has prepared a Statement of Intent (NSW Government, 2003). The Statement suggested that relevant authorities are now

considered accountable for the environmental outcomes of natural resources in response to past and current management practices. This follows from previous recommendations of the Healthy Rivers Commission in respect to the Northern Rivers Inquiry (HRC, 2003), wherein rivers (and other natural waterways) need to be better valued and treated as assets, in order to afford them protection in planning and development processes.

The Coastal Lakes Statement of Intent also indicates that the government has committed resources and funds to carry out a series of pilot Sustainability Assessment and Management Plans for a small group of priority coastal lakes, comprising Cudgen, Myall, Wollumboola, Burrill, Narrawallee, Coila, Merimbula and Back Lakes. Also, the government has agreed to a number of supporting initiatives, including:

- Assessing risks associated with sea level rise and change in storm events;
- Reserve the beds of coastal lakes classified as Comprehensive Protection as part of nearby or adjacent national parks, or declaring the lakes as Marine Parks or Aquatic Reserves;
- Declaring adjacent Crown Land with outstanding conservation value as reserves;
- Revise estuary and coastal management manuals;
- Explore possibilities for nominating a group of South Coast lakes for World Heritage Listing;
- Reinforce efforts to contain the spread of the noxious aquatic weed *Caulerpa taxifolia*;
- Investigate possibilities for managing undeveloped private land with outstanding conservation value.

1.4.19 Northern Rivers Catchment Management Authority

1.4.19.1 Mid North Coast Catchment Blueprint

The Mid North Coast Catchment Blueprint was prepared by the former Mid North Coast Catchment Management Board (MNCCMB) in 2002. The Mid North Coast Catchment area encompasses the catchments of the Nambucca, Macleay, Hastings and Camden Haven Rivers within the Mid North Coast and Southern New England Tablelands regions of New South Wales. The blueprint provides a framework for natural resource management of the Mid North Coast Catchment Management Region, including targets and priorities for environmental action and investment over the next 10 years. The MNCCMB comprised representatives of primary producers, natural resource users, environmental groups, government and indigenous people. The Blueprint consists of:

- **First order objectives**: which provide a statement of the community's values about the desired state and functioning of the region's natural resources;
- **Catchment targets**: which indicate what needs to be achieved across the landscape to meet the first order objectives. They are specific, measurable, achievable, relevant and time-bound. These measurable targets provide a means of evaluating the effectiveness of the Blueprints and their management actions;
- **Management targets**: which state what has to be done to achieve the catchment targets. Again, they are specific, measurable, achievable, relevant and time-bound;

- **Management actions**: which specify who is responsible for what by when, in order to meet the catchment and management targets.

The Mid North Coast Catchment Blueprint focuses on Landuse and Planning, Stream Health, Acid Sulphate Soils, Vegetation and Biodiversity. Each of these broad issues contain specific catchment and management targets.

The first order objectives for the Mid North Coast Catchment Blueprint include:

> "Healthy aquatic systems, with water quality and quantity meeting the needs of the environment and the community".

The catchment target for Land Use and Planning is:

> "By 2012 mechanisms in place for effective land use planning and management addressing human settlement, sustainable development, heritage and rural production issues in a natural resource management context."

The specific management target for which Killick Creek is recognised as a priority catchment states that:

> "By 2012 plans in place for management of the coastal zone in each of the three main coastal government areas".

Action 1.2.3 from the blueprint states "Complete and implement Estuary Management Plans for the Nambucca River and for Deep Creek, Saltwater Creek, Korogoro Creek and Killick Creek". This document therefore fulfils Action 1.2.3 of the blueprint with respect to Killick Creek.

1.4.19.2 Northern Rivers Catchment Action Plan

In early 2004, the Catchment Management Boards of NSW were replaced with new Catchment Management Authorities, with delegation under the Catchment Management Authorities Act 2003. The former Mid North Coast Catchment Management Board was incorporated in the Northern Rivers Catchment Management Authority (NRCMA). The first task of the NRCMA is to prepare a Catchment Action Plan (CAP) to outline how catchment management will be carried out within the NRCMA jurisdictional boundaries. The NRCMA will be responsible for:

- Preparing a Catchment Action Plan (CAP) and associated investment strategies that integrate and enhance the Catchment Blueprints (see discussion above) and the regional vegetation management plans,
- Managing incentive programs to implement the CAP,
- Providing all landholders with access to data and relevant information to prepare Property Vegetation Plans (PVPS),
- Allocating funds to support the development of PVPs - including incentives,
- Providing advice, education and training on natural resource management, especially in vegetation management, and

- Developing transparent procedures for handling local disputes related to implementing the Catchment Action Plans.

A draft Catchment Action Plan for the Northern Rivers CMA was completed in December 2005. Management Target C2 relates to estuaries and coastal lakes, and states "By 2016, maintain and improve the condition of estuaries and coastal lakes through: completion of management plans (e.g. Estuary Management Plans, Coastal Zone Management Plans) for all estuaries (65% complete by 2009), and Sustainability Assessment and Management Plans for all coastal lakes (65% complete by 2009); and implementation of all priority NRM activities within those plans (65% complete by 2009)".

Killick Creek has been named within the CAP, and has been identified as having a 'low' risk to the natural ecosystem in the short to medium term by landuse pressures. The CAP calls for 65% completion of all NRM activities identified within the Estuary Management Plan by the year 2009, and 100% completion of NRM activities by 2016. Funding would be available through the NRCMA for implementation of the NRM activities outlined in the EMP in order to meet Management Target C2. NRM Activities associated with this Plan have been identified specifically in Section 7.7 for ease of CMA implementation.

1.5 Planning Reforms by State Government

In late 2004 the NSW Government announced a major review of current planning frameworks across the state. The goal of the planning reform by the government is to establish a new effective planning system that is more simplified and focuses on strategic planning for growth areas throughout the state.

The reform agenda by state government has four main areas of review:

- Strategically assess and plan for priority growth areas;
- Simplify plan making by reducing the layers of planning instruments and making the local environment plan the primary instrument;
- Improve development assessment; and
- More flexible use of developer financial contributions for local facilities and services.

From a local government perspective, the government plans to reduce the number of local environment plans within the state from 5,500 to 152 – just one for each local government area. A standardised local environment plan will further provide consistency across the state and remove conjecture regarding zoning categories and landuse definitions. State government also is removing itself from referral and concurrence roles for a large number of development types, placing responsibility for assessment and approval back onto local government.

New elements of the planning reform are continually being developed and implemented, such as the State Significant Development SEPP (May 2005), developer contributions changes (July 2005) and state government infrastructure assessment changes (July 2005).

1.6 Existing Council Planning Framework

1.6.1 Kempsey LEP 1987

In addition to the State Government Plans and Policies, the Killick Creek Estuary Management Plan needs to be consistent with, and fit into, the existing Kempsey Shire Council planning framework. The Council planning framework is based around a central Local Environment Plan (Kempsey LEP, 1987) and a number of supporting Development Control Plans (DCPs). The Kempsey LEP is consistent with the NCREP and defines landuse zones, which prescribes permissible developments throughout the LGA. The LEP also details a range of specific controls relating to development matters, such as subdivisions, height restrictions, clearing and offsets.

A new LEP for the Kempsey LGA is currently before Parliamentary Council, however, it is likely that modifications to this LEP will be required, in accordance with the standard LEP template developed by the NSW Government, before it can be gazetted.

The Killick Creek catchment incorporates part of the Crescent Head village, as well as small acreage rural-residential holdings and larger rural holdings. Landuse zonings applicable to the Killick Creek area are presented in Figure 1-5.

DCPs have been prepared by Council to guide specific types of development, or developments in specific areas within the Local Government Area (LGA). Generally, DCPs have been prepared to conserve particular values and attributes of the shire and its natural environment.

1.6.2 Development Control Plans

Development Control Plans (DCPs) are non-statutory policies that provide specific Council requirements regarding various aspects of development within the LGA.

Development Control Plans that are applicable to Killick Creek and its catchment include:

- DCP 11 - Aboriginal Heritage
- DCP 12 - Conflicting Land Use Buffers
- DCP 13 - Manufactured Home Estates and Caravan Parks
- DCP 21 - Dulconghi Heights, near Crescent Head
- DCP 22 - Local Housing Strategy (Urban Areas) 2001
- DCP 24 – Access and Mobility
- DCP 27 - Acid Sulfate Soils
- DCP 29 – Bed and Breakfast Accommodation
- DCP 30 - Exempt and Complying Development
- DCP 31 – Energy Smart Homes
- DCP 32 - Onsite Sewage Management Strategy
- DCP 36 – Engineering Guidelines for Subdivision and Development

1.6.3 Other Council Planning Policies and Instruments

There are also a number of other strategic planning documents relevant to Crescent Head and Killick Creek which Council must have regard to, including:

- Kempsey Residential Land Release Strategy: Includes supply and demand balance sheets for the Shire's towns and villages based on availability of infrastructure, population trends and broad development constraints. The strategy identifies future sequencing of urban release areas and is a requirement of the NCREP 1988. This strategy is currently being reviewed by Council.
- Kempsey Rural Land Release Strategy: Details Council's strategy for the release of land from rural residential subdivisions. This strategy is currently being reviewed by Council.
- Kempsey Shire Council Caravan Park Management Plans: recommending upgrades to the Crescent Head Caravan Park to the value of $690,000 over a 5 year period, comprising new cabins, office, facilities, signage, road improvements and landscaping.

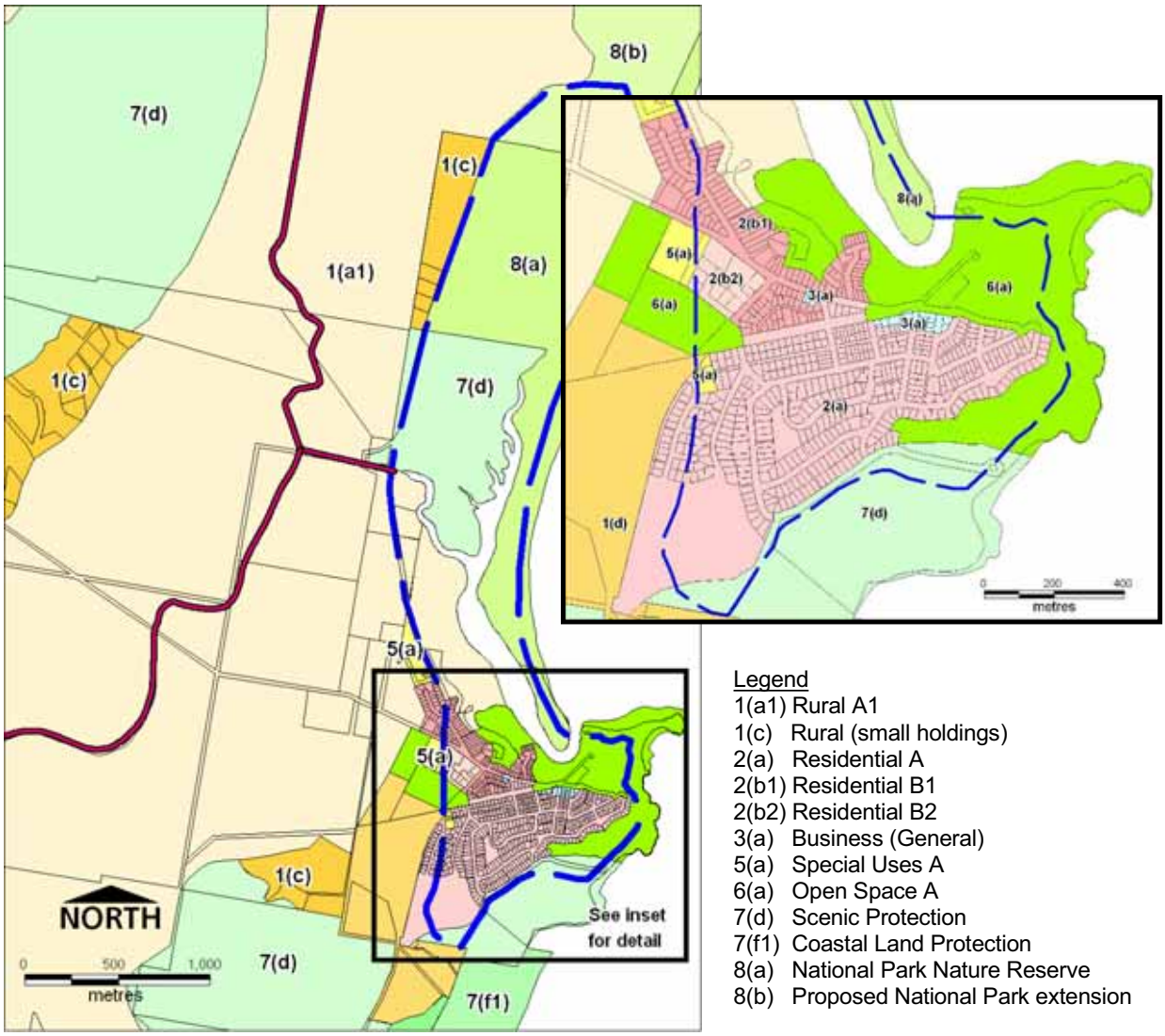

Figure 1-5 LEP Zonings for the Killick Creek Area

1.7 Lower Macleay River Flood Mitigation Scheme

The Macleay River catchment covers approximately 11,500km^2. The Lower Macleay River, downstream of Kempsey, meanders through extensive floodplain, which is subject to frequent and persistent flooding (Webb McKeown, 1999).

A Lower Macleay River flood mitigation scheme has been designed to achieve four (4) functions:

- Reduce the frequency of nuisance flooding to rural properties,
- Reduce the severity of flooding during major flood events,
- Improve post flood drainage, and
- Complement the pre-existing drainage of low lying pastures and the back swamps.

Killick Creek forms an integral component of the Lower Macleay River flood mitigation scheme (refer Figure 1-6). Along with Korogoro Creek and Ryans Cut, Killick Creek is used to mitigate major flooding by providing supplementary ocean discharges for floods within the Lower Macleay River, and the Upper Belmore River tributary in particular.

The Upper Belmore River area has been identified in the Lower Macleay River Floodplain Management Plan (Webb McKeown, 1999) as a drainage management area. For each drainage management area the Plan suggested development of a formal Management Strategy (Webb McKeown, 2000), which considers management of the floodplain during flood events as well as water quality and land management issues during non-flood times.

Under the Upper Belmore Floodplain Management Strategy (Webb McKeown, 2000), a Management Group was established for Scotts Drain. Killick Creek receives a large proportion of water from the southern sector of the Upper Belmore floodplain, and is critical to the post-flood drainage of the Upper Belmore Swamp area, enabling agricultural land to be drained within a few days, thereby reducing the likelihood of pasture loss and minimising non-production of the land. A variety of measures are identified in the Strategy relating to Killick Creek, such as installation of water gauges, keeping Killick dropboards in place during the dry season to maintain upstream drain levels, minimising exposure of Acid Sulphate Soils and providing landholders with means of monitoring water quality. Implementation of the Strategy is currently being carried out by Council, Stage Government and landholders (i.e. the Management Group) under the NSW Government's Floodplain Management Program.

1.8 Structure of this Report

The Estuary Management Plan, presented in this document, provides a series of strategic management actions that, if implemented, will result in the long-term sustainability of Killick Creek with regard to ecological, economic and social values. In addition to the management actions, the Plan describes the process that was adopted in developing and prioritising the various actions and strategies. This process is described in Figure 1-7. The various steps in this process are detailed in this Estuary Management Study and Plan document.

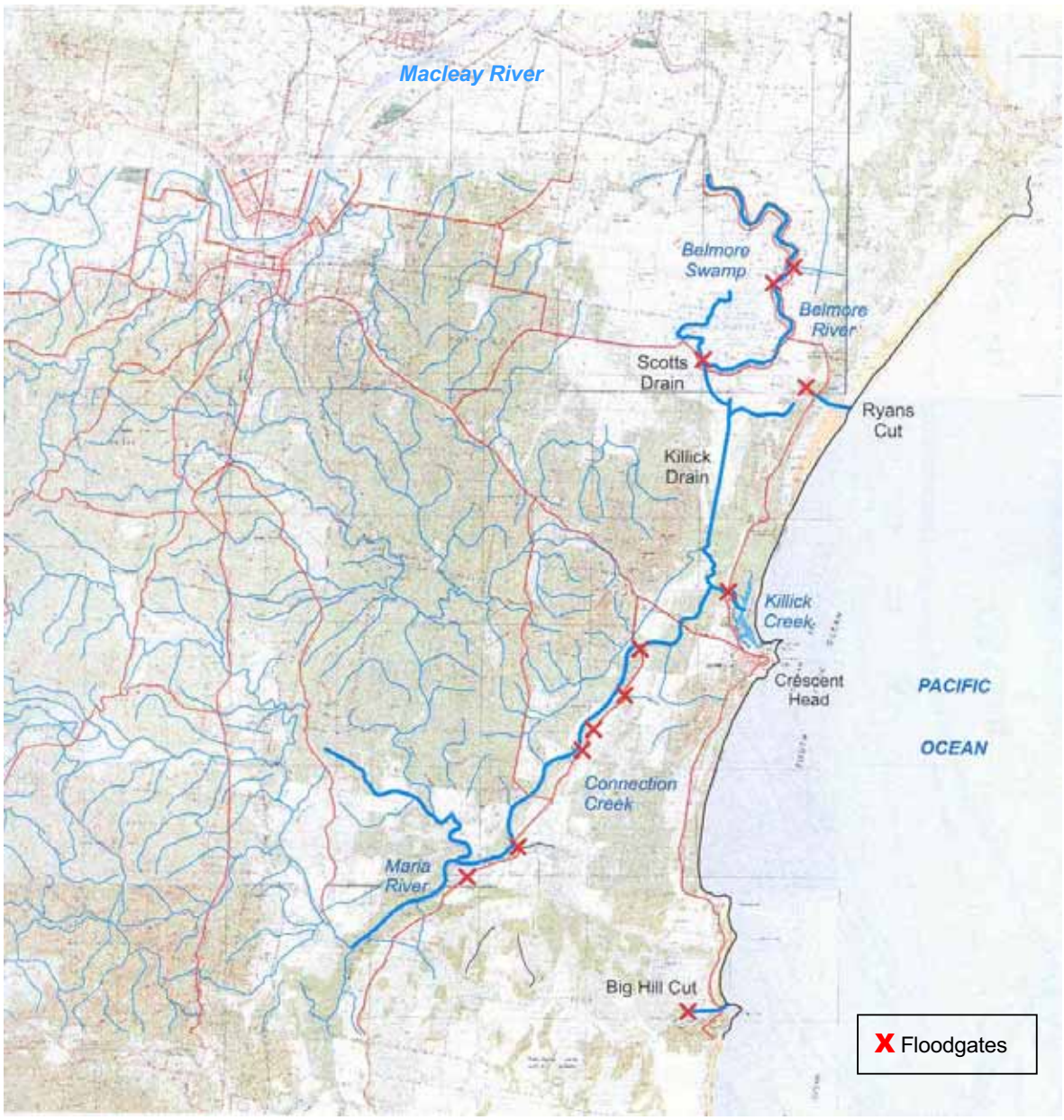

Figure 1-6 Connection between Killick Creek and the Lower Macleay River and Hastings-Maria Catchment Flood Mitigation Schemes (Source: MHL, 2002)

Presented below is a basic outline of the contents of each chapter of this document, as they relate to the process described in Figure 1-7.

Chapter 2 presents a **Summary of the Estuary Processes Study**. This outlines all of the fundamental physical, chemical and biological processes that currently occur within the estuaries, and how these processes need to be considered and managed in the future.

Chapter 3 summarises the **Values** of the estuaries, and also details the **Key Management Issues** that need to be addressed in order to maintain a healthy and sustainable estuarine environment in the future.

Chapter 5 defines **Management Objectives** that need to be addressed. The objectives are based on specific details relating to each of the Key Management Issues.

Chapter 6 provides a list of **Possible Management Options** that could be employed to address the management objectives. These options are then evaluated using a multi-criteria assessment, along with input from the Committee to give prioritisation of the management options.

Chapter 7 contains the **Estuary Management Plan**. This is a stand-alone section of the document that can be extracted and distributed to everyone involved in the implementation of the Plan. It provides details of prioritised management strategies for Killick Creek, who is responsible for implementation of the various strategies, and relevant timeframes for implementation.

Chapter 8 lists relevant **references** for the study.

Additional information is also provided in Appendices to this document, where necessary.

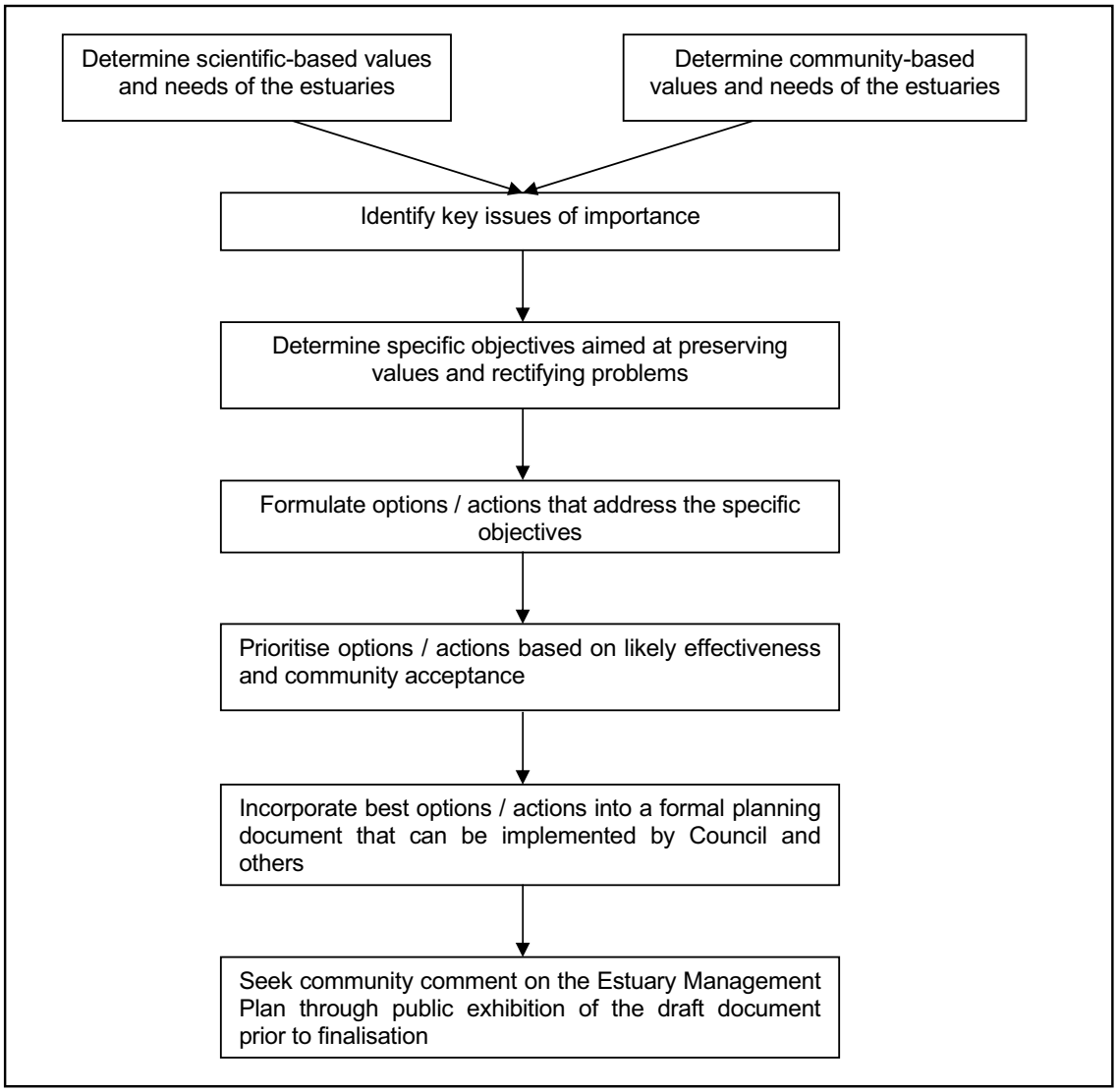

Figure 1-7 Process of developing Management Strategies for the EMP