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1 Introduction

This Resource Folder and its Appendices provide background information (and references to background information) to assist applicants, council staff and others to understand and meet the objectives of the Model DCP: *Protecting Sydney's Wetlands*. They are provided in loose leaf format to enable insertion of refinements and updates.

Sections 2 to 4 of the Resource Folder and the Appendices have most relevance to council staff, while Section 5 has most relevance to applicants. Notwithstanding, all stakeholders are encouraged to familiarise themselves with all the information provided.

The documents were prepared in 2000/2001 by the Sydney Coastal Council Group's Protecting Wetlands Steering Committee (PWSC) with financial assistance from Environment Australia.

PWSC includes representation from:

- Dept of Land and Water Conservation
- Department of Urban Affairs and Planning
- Environment Australia
- NSW Fisheries
- National Parks and Wildlife Service
- State Wetlands Advisory Committee
- Sydney Water Corporation
- Sydney Coastal Councils Group Technical Committee representatives
- Sydney Coastal Councils Group Secretariat
- University of NSW - Scientific Adviser

Consultancy services were provided by Sainty and Associates Pty Ltd and the Institute for Sustainable Futures, University of Technology, Sydney (UTS).

Comments and additions to the Model DCP, Resource Folder and Appendices are welcome. Please contact the Sydney Coastal Councils Group at PO Box 57 Chatswood NSW 2057, phone 9411 8215, fax 9411 8309 or e-mail sccg@region.net.au.

2 The Model DCP

2.1 Why produce a Model DCP?

The Model Development Control Plan (DCP) has its origins in SCCG's 1998 Sydney Regional Coastal Management Strategy. This strategy provides a management framework to guide coastal management and planning in the Sydney coastal region in the key areas of water cycle management, nature conservation, public access, role of government, climate change and cultural heritage.

One of the Strategy's principle strategic actions is "the development of a regional wetlands management plan that manages for the protection and enhancement of coastal wetlands". The Model DCP has been drafted in response to this strategic action.

The Model DCP is based on the Wyong Shire Wetland DCP No.30. The Wyong DCP 30 provides a suitable basis for the Model DCP and has been used and refined over a period of more than 10 years. Wyong Shire Council has sought community input at various stages of the development of DCP 30. Further information can be obtained from Wyong Council, phone (02) 4350 5555 or e-mail wsc@wyong.nsw.gov.au.

The underlying focus of SCCG's 1998 Strategy is progress towards and achievement of ESD in Sydney's coastal zone. The Strategy defines the goal of ESD as "development that improves the total quality of life both now and in the future, in a way that maintains the ecological processes on which life depends". It achieves this through objectives of individual and community well being, equity within and between generations and protection of biological diversity and maintenance of essential ecological processes and systems.

Protecting remaining wetland ecosystems in Sydney can contribute significantly to the ESD goal by maintaining valuable wetland ecological processes and furthering each of the abovementioned ESD goals.

Individual and community well being is enhanced by maintaining the many natural, cultural and economic benefits brought about by wetlands.

Equity within generations is promoted as all residents and visitors to Sydney benefit directly or indirectly from the presence of healthy wetlands. Equity between generations is promoted by preserving a valuable natural asset for the enjoyment of future generations.

Biodiversity and essential ecological systems are enhanced as wetlands areas are highly diverse biologically and provide a range of essential 'ecosystem services' to humans.

2.2 What is the status of the Model DCP?

The Model DCP is a template for councils to use developing their own wetlands protection DCPs. Although councils are not legally required to develop a wetlands DCP, they are strongly encouraged to do so.

Councils are encouraged to liaise with SCCG and neighbouring councils when preparing their wetlands DCPs to facilitate consistency in the plans between councils. The need for consistency must however be balanced against the need for councils to tailor the plan to meet the particular needs of their LGAs.

2.3 What material supports the Model DCP?

This document is one component of a set of documents that comprise the Model DCP.

The core components are:

- **a Model DCP instrument** - a template for councils to use in drafting their own wetlands protection DCPs
- **a set of draft wetland maps** - intended as draft information to be refined by councils over time
- **a resource folder** - includes background information to assist applicants to prepare DAs and councils to assess them

2.4 Why is zoning used?

The Model DCP provides for wetland areas to be rezoned from their current zoning to an environment protection zone called WETLAND ZONE. Zoning was chosen over alternative 'softer' options to ensure that councils are given sufficient legislative support achieve this aim - to refuse inappropriate developments and enforce rigorous conditions for developments that threaten to degrade wetlands.

WETLAND PROTECTION AREAS, defined as an area 100m around the WETLAND ZONE, are intended to protect wetlands from edge effects such as dumping, entry of sediment and weed invasion. They are also intended to provide for:

- **wetland boundary fluctuations** attributable to such factors as surface and ground water variations
- **'blurred' wetland boundaries**
- **mapping boundary inaccuracies**

Zoning is not used for WETLAND PROTECTION AREAS (buffers). Nor is it intended that the Model DCP significantly alter the objectives of the underlying zone in these areas. It applies additional information and assessment requirements to certain types of developments that have the

potential to impose significant indirect impacts on the adjacent wetland. A list of these developments is included in the Model DCP.

2.5 How does the DCP relate to the LEP?

In implementing the Model DCP, councils' LEPs would be amended by including:

- WETLAND ZONE objectives, listed in Section 1.2 of the Model DCP
- a list of permissible and prohibited uses within WETLAND ZONES
- the information requirements for developments within WETLAND ZONES, listed in Section 3.1 of the Model DCP
- amending the definitions of other zones in the LEP wherever appropriate to facilitate the operation of the Model DCP

The details of these amendments will vary from council to council according to the nature of the LEP and the method by which each council implements to the Model DCP. Councils are encouraged to refer to Amendment No.98 of the Wyong LEP 1991 as a guide (Wyong Council (1999)). This can be obtained from Wyong Council, phone (02) 4350 5555 or e-mail wsc@wyong.nsw.gov.au.

2.6 Does SEPP 60: Exempt & Complying Development apply?

State Environmental Planning Policy No.60: Exempt & Complying Development applies to few Sydney metropolitan councils. For most Sydney councils, provisions regarding exempt and complying development are included within their planning instruments (LEPs and DCPs). SEPP 60 states that land identified as environmentally sensitive (such as proposed WETLAND ZONES) are excluded from exempt and complying development provisions. Councils should check their planning instruments to ensure that this is the case.

For WETLAND PROTECTION AREAS, it is highly unlikely that any development captured by the Model DCP would be classified as exempt and complying.

2.7 How does the Model DCP apply across LGA boundaries?

To avoid cross-boundary difficulties, all councils are encouraged to adopt the Model DCP in a reasonably uniform manner so as to avoid major differences in the level and type of assessment undertaken. The need for consistency must however be balanced against the need for local relevance of the Model DCP. Neighbouring councils are also encouraged to refer cross-boundary DA information to each other and liaise throughout the assessment process.

Further suggestions for bringing about a consistent approach to assessment of cross-boundary DAs include:

- staff from both neighbouring councils to attend pre-DA meetings
- copies of the DA and accompanying information to be forwarded to the neighbouring council for comment soon after lodgement
- council staff responsible for processing the DA liaise regularly throughout the assessment process, including joint site inspections
- the 'strongest' assessment process be adopted as the common process - for example, the entire development would be assessed by the DCP if one council had adopted it, while the other had not
- a single common recommendation with common conditions of consent be drafted for consideration by each of the two councils

With respect to mapping, councils are encouraged to identify wetlands that cross LGA boundaries and bring this to the attention of neighbouring councils. Neighbouring councils should also liaise when refining mapping and where possible adopt a common approach.

2.8 To which developments does the Model DCP apply?

Within WETLAND ZONES, the Model DCP applies to all developments except for "minor developments" specified in the Model DCP. These minor developments are developments that would have a neutral or beneficial effect on wetlands. The exemption is intended to ensure that developments of this nature are not delayed by an unnecessarily onerous assessment process. Examples of "minor developments" are removal of sediment, weeds and litter and essential maintenance of existing structures such as boardwalks.

Applicants for proposed "minor developments" require written verification from council that the proposal does in fact fit this category. Council has the discretion to apply the DCP if warranted.

Within WETLAND PROTECTION AREAS, the Model DCP applies to, but is not limited to, developments that have the potential to fragment, pollute, disturb or diminish wetland values. These developments are listed in the Model DCP.

Within WETLAND PROTECTION AREAS, it is intended that the DCP only capture nearby developments that may have a significant indirect impact on the wetland itself. It is not intended that relatively minor and environmentally benign developments within WETLAND PROTECTION AREAS be captured by the DCP. Exclusion of benign developments is particularly important in well established urban areas where application of the DCP to all uses would create an unnecessary layer of planning assessment.

3 Sydney's wetlands

3.1 What is a wetland?

A wetland is exactly what the name suggests: wet land. Wetlands are areas that are wet for long enough that the plants and animals living in them are adapted to, and often dependant on, living in wet conditions for a least part of their life cycle. Wetlands typically contain shallow water, but they may not always be wet.

Inundation with water is one factor that determines that type and productivity of the soils and the plant and animal communities. The inundation with water may be temporary or permanent and the water fresh, brackish or saline, usually slow moving or stationary and shallow.

There is no single definition of wetlands that has been universally accepted. This is due to the diverse range of wetlands and the fact that most wetlands have been subject to some degree of modification. Nor has a single definition been used in preparing the Model DCP maps of Sydney's wetlands as the mapping is based on several different mapping studies.

The Model DCP includes a slightly amended version of the Environmental Planning and Assessment Regulation 1994 definition as follows:

Natural wetlands include marshes, saltmarshes, mangroves, seagrasses, backwaters, billabongs, swamps, sedgeland, wet meadows or wet heathlands that form a shallow water body when inundated cyclically, intermittently or permanently with fresh, brackish or salt water. The inundation determines the type and productivity of the soils and the plant and animal communities.

Non-natural wetlands include marshes, swamps, wet meadows, sedgeland or wet heathlands that form a shallow water body when inundated cyclically, intermittently or permanently with fresh, brackish or salt water. They differ from natural wetlands by being constructed or formed by non-natural processes and vegetated with wetland plant communities.

Another widely recognised definition is that of the Convention on Wetlands (Ramsar, Iran 1971). Wetlands are broadly defined as: "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water, the depth of which at low tide does not exceed six metres". In addition, the Convention provides that wetlands: "may incorporate riparian and coastal zones adjacent to the wetlands, and islands or bodies of marine water deeper than six metres at low tide lying within the wetlands".

Non-natural wetlands may be just as worthy of protection as their natural counterparts. They may be created intentionally or unintentionally. For the

purposes of the Model DCP, the same assessment criteria are applied to both types.

Examples of intentionally created wetlands include those built on golf courses and other open space areas, including many of Sydney's parks, and those built for the specific purpose of stormwater management, effluent treatment and habitat reinstatement.

Examples of unintentionally formed wetlands are areas where poor drainage has resulted in inundation and subsequent colonisation by wetland vegetation. They have also been created in areas where natural wetlands have been filled. Over time, these areas have sunk and become wet again. This frequently occurs along the periphery of coastal lagoons.

Most wetlands in Sydney have been modified to some extent, with some being highly modified. Modifications include changing the water regime by dredging, filling, and creation of bund walls. This generally occurred prior to wetlands being recognised as places of value.

These modifications have often resulted in the loss of the wetland altogether. In other instances, the vegetation community and/or the distribution of vegetation has been altered. Modifications can also have a positive impact on a wetland, such as restoration work, where a vegetation type is selected and planted to best cope with the current (albeit changed) wetland conditions.

3.2 Why are wetlands important?

The full range of wetland values are many and varied, from natural ecological values, such as biological diversity and role in the water cycle, to human-based values such as recreation, education and scientific significance. These values have only recently become widely appreciated.

Most wetlands have a number of values from the list below, and all function as active parts of the water cycle in any region. The uniqueness and productivity of wetlands is largely due to their occurrence at the margins between truly land-based ecosystems such as forests and grasslands, and truly aquatic ecosystems.

Ecological and functional values of wetlands include:

- plant & animal habitat
- biological diversity
- flood regulation & erosion control
- groundwater recharge
- water filtering and nutrient recycling
- breeding and nursery areas

Cultural values of wetlands include:

- nature conservation
- recreation
- landscape quality
- indigenous and non-indigenous cultural significance
- environmental research and education

Economic values of wetlands include:

- overall environmental quality
- foreshore protection
- tourism

Further discussion of these values is included in the Appendix.

3.3 Why do we need to protect Sydney's wetlands?

Many of the abovelisted wetland values have added significance in Sydney, where urban development has resulted in the loss of many of the region's wetlands. Whilst Sydney's remnant wetlands are already afforded some protection by local, State and Commonwealth legislation, plans and policies, this protection lacks certainty and consistency across the region. The Model DCP aims to provide this certainty and consistency. Note that State Environmental Planning Policy No.14: *Coastal Wetlands* does not apply to the Sydney region.

This move for greater protection is consistent with increased recognition of the importance of preserving these valuable remnant ecosystems and efforts to promote the principles of Ecologically Sustainable Development (ESD) within Sydney's coastal zone.

The Model DCP recognises that wetlands are affected by the cumulative impact of developments across the entire catchment, even though it is intended to apply only to wetland areas and their immediate surrounds. It is beyond the scope of the Model DCP to consider all catchment issues. The Model DCP is intended to provide 'last resort' protection to wetland areas and to become a component in a set of plans and policies that together act to protect and improve the health of the catchment.

3.4 What types of wetlands are found in Sydney?

Adam and Stricker (1993) have identified the following wetland types in Sydney:

- estuarine wetlands
- cliff-top marshes
- freshwater wetlands
- dune swale swamps
- floodplain wetlands

- upland swamps

Identification of wetland type is an important part of wetland management as different wetland types vary in their sensitivity to impacts from human activities. For example, saline wetlands are more susceptible to degradation from Nitrogen than Phosphorus, while freshwater wetlands are more susceptible to increased Phosphorus loads. Diversity of wetland types is mirrored by a diversity of management techniques needed to maintain ecological integrity.

A description of wetland types and summary of corresponding management techniques is included in the Appendix.

3.5 Where are Sydney's wetlands located?

The Model DCP includes a set of wetland maps for the Sydney region. These maps are based on a set of prior mapping studies. The most significant of these studies is Adam and Stricker (1993). This study includes an inventory which identifies over 300 wetlands in the Sydney region, with around 90 occurring within SCCG LGAs. Wetlands are described according to their type, size, viability and degree of impact.

A wetland inventory of SCCG member councils, based on Adam and Stricker (1993) and information collected by SCCG from member councils, is included in the Appendix and summarised below. Note that the Model DCP maps represent a significant expansion of this inventory, and should be consulted to identify all wetlands.

- **Botany** has four dune swale swamps, three estuarine and one non-natural
- **Manly** has one relatively undisturbed estuarine wetland
- **Randwick** has five dune swale swamps, one upland swamp and one non-natural wetland
- **Rockdale** has three dune swale swamps
- **Sutherland** has 23 estuarine wetlands, 16 dune swale swamps and eight upland swamps
- **Pittwater** has five estuarine wetlands, two upland swamps and one floodplain wetland
- **Warringah** has three estuarine wetlands, three floodplain wetlands and two upland swamps
- **Willoughby** has three estuarine wetlands and one saline wetland

These inventories indicate that wetlands located close to or within urban areas have the lowest viability and are subject to the most pollution pressure. Weed invasion of wetland areas appears to be the biggest wetland degradation issue. Although wetlands located away from urban areas are generally in better condition, nearly all wetlands are affected by weed invasion. Problems caused by urbanisation, such as increased sedimentation, nutrification and runoff are also widespread.

3.6 How have Sydney's wetlands been mapped?

The NSW Department of Urban Affairs and Planning (DUAP) has provided GIS services to SCCG to collate information from the following mapping projects to produce a single set of wetland maps for Sydney:

- **SREP 20:** *Hawkesbury-Nepean River*
- **Adam and Stricker:** *Wetlands of the Sydney Region*
- **Benson and Howell:** *Local Government Maps*
- **NSW Fisheries:** *An Estuarine Inventory for NSW*

A description of each of these projects is included in the Appendix.

The projects were carried out at different times using different scales, wetland definitions and mapping criteria. Note that currently NSW does not have a consistent wetland mapping methodology. All areas which were identified as being "wetlands" by the different maps were included on the Model DCP maps.

The output represents a 'standard' map format - 1:25,000 topographic sheets. The map data should not be used at scales below 1:25,000 as accuracy will be compromised.

It is likely that there will be boundary inaccuracies and omission of some wetlands, even though every effort has been made to include all significant wetlands in this first round of mapping. These omissions and inaccuracies may be the result of:

- **inaccuracies** in the Model DCP maps and the prior studies upon which they are based
- **inconsistencies** in the date, scale, wetland definitions, survey techniques etc. between the prior mapping studies
- **natural boundary fluctuations** over time

Councils are encouraged to carry out further round of mapping to ensure that all significant wetlands are mapped and thus covered by the Model DCP. Councils are also encouraged to update their mapping periodically to improve their accuracy and account for changes.

A further opportunity for improved wetland mapping is provided at the DA stage. The Model DCP requires applicants to supply an accurate 1:4,000 scale map to verify and add detail to the Model DCP maps.

4 DA information & assessment criteria

4.1 How does the Model DCP function?

A **flow chart** which summarises the DA preparation and assessment process is included in the Model DCP.

Councils are encouraged to bring local wetlands to the attention of the community through such measures as displaying wetlands maps, education forums and through the media. In this way, potential applicants are more likely to have an awareness of the presence of a wetland on or near their property and will be more likely to consider the DCP at an early stage.

Applicants for development approval are encouraged to seek advice from council as early as possible to determine whether planning instruments such as the Model DCP apply to the site. Public authorities are encouraged to undertake an assessment of their proposals against the Model DCP.

Captured development proposals within wetland areas would be assessed against the WETLAND ZONE assessment criteria listed in the Model DCP.

Captured developments within 100m of a WETLAND ZONE would be assessed against the WETLAND PROTECTION AREA assessment criteria if they fit into one of the land use categories listed in the Model DCP.

The applicant should arrange a pre-DA meeting with the council to:

- verify whether the DCP applies
- clarify the assessment information requirements to accompany the DA
- determine the requirements of other relevant legislation, plans and policies and referrals to other government agencies

Applicants are encouraged to engage professionals with relevant skills in addressing each of these requirements, and to discuss progress with relevant council staff. Completion of information required by the Model DCP is in addition to the information requirements of other relevant legislation, plans and policies.

Other steps to be undertaken by council shortly after receipt of the DA are:

- referral of copies of the DA and accompanying information to other relevant council staff members and State and Commonwealth agencies
- referral of copies of the DA and accompanying information to neighbouring councils for comments for developments on sites that cross LGA boundaries

- notification of proposal to adjoining and potentially affected landowners and occupiers, newspaper advertisements and site signage in accordance with the *EP&A Act* and council policy
- if required, requests to the applicant for additional information

An assessment by the council involves:

- **checking that all minimum information requirements** and submission details required by the DCP and other legislation, plans and policies are complete and correct
- **if necessary, requesting additional information** from the applicant - immediate refusal of the DA may be appropriate if the absence of information is such that the DA is considered incomplete
- **inspecting the site at least once** - if necessary, in the company of the applicant and others involved in the assessment
- **summarising and assimilating the assessments of other council staff** and other government agencies into the overall assessment
- **summarising and assimilating the issues raised in public submissions**
- **drafting conditions of development consent**
- **drafting a report that includes assessment details and a recommendation** for either approval with conditions or refusal, with reasons, and forwarding the report to council or a staff member for a decision
- **notifying all relevant parties of the decision**
- **ensuring responsibility is assigned to a council staff member for any subsequent information and management requirements**, such as preparation of management plans and monitoring reports

4.2 General DA information & assessment criteria

For general information on the development application process, refer to DUAP's *Guiding Development: Better Outcomes 1999* and the Australian Business Centre's *Making the NSW Planning System Work for You 1999*. This is available in folder format from the DUAP Information Centre for \$49.50.

The DUAP *Guiding Development* document includes information on a range of general DA assessment matters, including:

- different categories of development
- the development approval process in NSW
- complying development
- when a development application is required
- submission requirements for development applications
- assessment of development applications
- conditions of development consent

- integrated development applications
- procedures for Crown development applications
- pre-construction checklist

A full list of contents of both documents is included in the Appendix. Also included in the Appendix is a sample council development application lodgement checklist.

4.3 WETLAND ZONE assessment criteria

Applications for development within WETLAND ZONES must include the following information:

- **a description** of proposal
- **a map** showing location of proposal, WETLAND ZONE and WETLAND PROTECTION AREA
- **the aims** of proposal
- **compliance with DCP Wetland Management Objectives** (wetland ecology & habitat; hydrology; water quality; bushfire hazard; social & cultural values; and compensatory wetlands)
- **a description of wetland type**
- **a vegetation** survey
- **a fauna** survey
- **a water quality and hydrology** description
- **an acid sulfate soils** analysis
- **compensation** measures
- **cultural and social** values
- **a management plan**
- **a list of other relevant legislation, plans and policies**

Note that this is an abbreviated list. Further detail is included in the Model DCP itself.

4.4 WETLAND PROTECTION AREA assessment criteria

Applications for development within WETLAND PROTECTION AREAS must include information addressing the following assessment criteria:

- **a description** of the proposal
- **a description of the type of the nearby wetland**
- **compliance with DCP wetland management objectives:** wetland ecology & habitat; hydrology; water quality; bushfire hazard; social & cultural values; and compensatory wetlands
- **the social and cultural values** of nearby wetlands
- **the predicted impacts** and means of mitigating impacts

- a management plan
- a list of other relevant legislation, plans & policies

Note that this is an abbreviated list. Further detail is included in the Model DCP itself.

4.5 Wetlands management plans

Examples of management plans for Sydney wetlands are:

- **Warriewood** (Pittwater Council (1997))
- **Careel Bay** (Pittwater Council (1998a))
- **Bicentennial Park** (Bicentennial Park Trust (1998))
- **Eve Street, Arncliffe** (Field A et al (1993a&b))

The quality of a management plan can be gauged by its accuracy, how comprehensive it is and whether it is easy to use. Compilation of data contained in a wetland management plan can range from specific data on one wetland, e.g. Careel Bay Wetland, to an inventory of all wetlands, e.g. Brisbane Water Area.

All abovementioned wetland management plans followed the *Australian Natural Heritage Charter for the Conservation of Places of Natural Heritage Significance*. According to this charter, the following information is recorded for each wetland: wetland name, locality recorded (map co-ordinates), type, seasonality, access, flora, fauna, disturbance, ownership, zoning, protection, catchment status, issues and management considerations.

The *Local Government Act 1993* states that all councils should produce wetland management plans for all wetlands in their LGAs for which they have a responsibility. Such plans should at least cover the abovementioned criteria from the *Australian Natural Heritage Charter*.

Guidelines for wetland management plans are being prepared by the State Wetland Advisory Committee. These will refer to current policies and legislation and will cater for significant sites such as Ramsar wetlands. Input from councils, The Ramsar Convention Management Guidelines Team and NSW Health (for arbovirus issues) has been sought in preparing these guidelines.

The *NSW Wetlands Management Policy* (Department of Land & Water Conservation (1996)) states that the Department of Land & Water Conservation and Department of Urban Affairs & Planning are to encourage councils to incorporate wetland management provisions into their local planning instruments and management practices. These provisions are to include performance targets and are to list and discuss a range of management issues, with options to achieve the stated management aims.

The length and complexity of a wetlands management plan depends on a number of factors including the nature and size of the development and the wetland affected by the development. The most important feature of the plan is that it describes the actions required to conserve the values of the area and states how these tasks will be performed.

The following steps are generally involved in preparing a wetlands management plan (Hawkesbury Nepean Catchment Management Trust (1996b)):

- Step 1: Gather information
- Step 2: Identity the values and threats
- Step 3: Decide on actions
- Step 4: Monitor performance

A description of each of these steps, and suggested contents of a wetlands management plan, is included in the Appendix.

The **Commonwealth's EPBC Regulations 2000** establish the Australian Ramsar Management Principles which are designed to promote nationally consistent standards of management for all of Australia's Ramsar wetlands. These principles can also guide wetland management and the preparation of management plans for important wetlands that are not listed under the Ramsar Convention. Further information can be obtained from the Commonwealth references included in the Appendix.

4.6 Estuary management plans

Estuary management plans can provide guidance for the preparation of wetlands management plans. According to the NSW Estuary Management Policy 1996, councils are required to prepare estuary management plans. Examples are plans for Manly Lagoon, Berowra Estuary, Curl Curl Lagoon, Long Bay and Yowie Bay.

The NSW Estuary Management Policy is part of a suite of catchment management policies. It provides for the assessment of all estuarine uses, the resolution of conflicts and the production of a unified and sustainable management plan for each estuary. This includes remedial works and the redirection of activities, where appropriate.

An Estuary Processes Study defines baseline conditions including status and trends for the various physical, chemical and biological estuarine processes and interactions between them and between other land and water uses.

An Estuary Management Study defines management objectives, options and impacts on the estuary.

This leads to the development of an Estuary Management Plan, which consists of management strategies and a scheduled sequence of activities

that need to be undertaken to achieve the estuary management objectives. The estuary management process involves public participation at all stages.

4.7 Stormwater management plans

In NSW, councils have primary responsibility for the management of the stormwater system. They own the majority of the system and as such are responsible for its design, upkeep and the regulation of inputs and outputs.

The NSW Government's *Waterways Package* 1997 highlights the need for a whole-of-Government approach to stormwater management. The Package requires councils to prepare catchment-based stormwater management plans and to develop partnerships with the private sector to implement innovative, cost-effective stormwater management technologies. One of the most conspicuous of these technologies is adoption of artificially created wetlands to treat stormwater before it enters natural waterways.

The aim of the package is to identify major stormwater problems and formulate options to address the issues. Stormwater and point source pollution from sewage overflow points are identified as the main contributors to pollution of waterways and a major contributor to the decline of wetland health and long-term viability.

Further information on Stormwater Management Plans is included in the Wetlands Management Objectives guidelines below and in the Appendix.

5 Wetland management objectives

5.1 List of objectives

All developments captured by the Model DCP must provide information to show how they can comply with Wetland Management Objectives related to:

- hydrology
- water quality
- ecology & habitat
- social & cultural values
- compensatory wetlands
- bushfire hazard

These objectives are also listed in the Model DCP. References associated with each of these objectives are listed in the Appendix.

5.2 Purpose of objectives

The wetland management objectives are intended to provide a broad set of objectives-based assessment criteria in addition to the other assessment requirements of the Model DCP.

5.3 Objective 1: Hydrology

Objective: To improve, maintain or restore the physical, chemical and biological processes of the wetland by minimising negative impacts created by changes to wetland hydrology from adjoining landuses in the catchment.

Altering hydrology is the most fundamental and potentially damaging modification to wetlands as water quantity and flow is a primary determinant of the health of wetland ecosystems. Declining wetland health can lead to decreased plant and animal diversity and weed invasion .

Cumulative impacts from developments across the catchment can have significant detrimental short and long term hydrological impacts on the wetland. These impacts can be significant even though wetlands naturally experience fluctuations in the frequency, timing and depth of inundation.

Removing water from the land quickly has had, and continues to have, major effects on wetlands. Some of these effects are:

- **areas that were perennially wet are either dry or ephemerally wet** - many examples of this occur in Sydney, including playing fields

- **wetlands that were periodically dry or experienced gently fluctuating water levels may now be permanently wet** if they are used as stormwater detention area, or experience great fluctuations in water level if they are 'transport routes' for stormwater

The channelling of surface water flows and increase in area of impervious catchment surfaces has resulted in increased flood discharges and peaks, as well as greater movement of sediment and pollutants from catchment surfaces to receiving waters. This is vastly different to how the water moved over/through the landscape prior to urbanisation.

In the past, wetlands have been utilised as stormwater 'detention areas' with drainage pipes emptying directly into wetlands. Numerous examples of this still occur in Sydney. Emptying stormwater directly into a natural wetland changes its water regime and almost always leads to degradation.

Stormwater and sewage have been identified as the two main contributors to declining wetlands water quality in Sydney. See Northern Beaches Stormwater Management Committee (1998) and Field et al (1993a & b).

Hydrological changes are most pronounced when the catchment is moving from a 'green fields' situation toward urbanisation.

Too much water entering a wetland can result in damage or the death of the surrounding vegetation and salinisation of the soils. Increases in water may be caused by flooding or by building weirs or otherwise damming for water storage, or due to restriction of drainage channels by culverts, or by infilling of parts of the wetland.

Too little water can be equally or even more damaging as depriving a wetland of water is to deprive it of an essential element. Drainage of wetlands, the construction of levee banks or flood gates, the building of dams upstream and water extraction all reduce the amount of water available to a wetland.

Existing and appropriate water flow regimes should be maintained wherever possible. Proposed developments should not significantly alter existing local surface runoff, groundwater flows, wave patterns and tidal regimes.

A dispersed pattern of stormwater flow into the wetland preferable to a concentrated flow. This is mainly to avoid erosion and general wetland disturbance associated with a rapid flow of water entering the wetland. A dispersed flow also enables more consistent mixing of entering and receiving water than a concentrated flow.

The effects of uncontrolled stormwater discharges on wetland ecology are less destructive than controlled discharges. Discharge and nutrient characteristics of stormwater that travels through undeveloped areas is

usually mitigated by infiltration and sub-surface flow processes, which reduce flow velocities and volumes as well as nutrient loads.

Assessment of developments should consider the potential effects of stormwater on downstream environments, rather than just the development site. The location of culverts, drains and paved surfaces should be carefully considered to ensure the maintenance of appropriate water flow regimes to downstream wetlands.

Applications for developments which have the potential to significantly alter the hydrology of the catchment should include a wetlands management plan. The plan should establish the nature and extent of these hydrological impacts, which include an assessment of the current hydrological regime, prediction of future impacts and monitoring of actual impacts.

Development approvals should provide for monitoring of wetland hydrology and results should be used to guide council's other plans and policies related to upstream development. Should monitoring results show that wetland health is poor, council may need to restrict the extent and change the nature of upstream development.

5.4 Objective 2: Water quality

Objective: To improve, maintain and restore the quality of water within the wetland and entering the wetland to ensure that wetland values and natural ecological functions are not diminished.

Different types of wetlands have different water quality requirements as some are more sensitive to certain 'pollutants' than others. For example, saltwater systems, such as saltmarsh, are more susceptible to degradation as a result of elevated levels of Nitrogen, whereas freshwater systems are more susceptible to elevated levels of Phosphorus.

The best way to minimise water quality impacts on wetlands is to ensure that pollutants do not enter waterways in the first place through source controls and education.

Source controls devices could include:

- redesigning production processes to reduce liquid waste
- grease and oil traps
- well maintained sediment traps and fences
- bio-retention swales along car parks

Many councils have adopted a pro-active approach to source control through environmental education programs aimed at potential polluters in their LGA. This includes businesses and industry groups who are responsible for controlling the quality of their discharges to the stormwater system.

Source controls should be included in all new developments and retro-fitting of source control devices encouraged for existing developments. A number of Total Catchment Management policies, such as the *NSW Wetlands Management Plan* (Department of Land & Water Conservation (1996)), provide the framework for source control measures.

Eutrophication is the enrichment of wetlands with excessive nutrients. It is caused by run-off from agricultural and gardening activities, and from roads, sewerage and manure carrying excessive nutrients (usually Nitrogen and Phosphorous) into wetlands. Excessive nutrient concentrations favour the growth of algae and weeds which suffocate aquatic plants and animals.

Deciduous trees should not be planted near waterways as leaves from such trees contribute to decreased water quality and increased organic loads in water bodies.

Construction activities within a catchment can contribute to large sediment loads and associated nutrients flowing into wetlands. Under the *Protection of the Environment Operations Act 1997* it is an offence to allow soil, cement slurry or other building materials to be pumped, drained or allowed to enter the stormwater system.

All sediment and pollution control works need to be maintained and checked for effective operation on a regular basis, particularly after rainfall.

Bank stabilisation along waterways should be via grading where possible and be planted with riparian and aquatic vegetation.

Applications for developments within or adjacent to wetlands should be accompanied by a management plan detailing erosion and sediment control measures for any proposed construction or excavation activities.

Councils are obliged to follow ANZECC guidelines (e.g. ANZECC (1998 & 1999)) for water and sediment quality as minimum requirements for wetlands in their LGAs.

All developments within wetland zones should include the following features wherever possible:

- point source pollution controls
- on-site stormwater detention
- rainwater tanks
- connection to centralised sewerage system if not in a zone that is appropriate for on-site waste disposal

Stormwater Management Plans should address all aspects of pollution control including management of erosion and control of pollutants such as sediment, nutrients, litter, cement waste, paint, toxins and bacteria. They should also include details of permanent stormwater management measures at the site. These may include: on-site detention requirements; permanent

treatment ponds; landform landscape and urban design treatments; and stormwater reuse.

In-pipe controls play an important role in maintaining/improving water quality and wetland health. Structures such as gross pollutant traps and sediment detention basins are examples.

Correct selection and placement of in-pipe controls is essential if they are to have any effect on improving water quality downstream. Nutrient control devices and other pre-treatment measures should be constructed well away from wetland areas. Numerous examples of under-sized and inappropriately sited gross pollutant traps and associated sediment detention basins exist in Sydney. In-pipe controls are also expensive, so it is essential that they are appropriately designed and sited to maximise their value.

Choosing and installing in-pipe controls should always include site visits and detailed catchment studies and never rely solely on modelling. An understanding of the expected load entering the control device is essential in choosing the correct structure. Easy access for maintenance is mandatory because without regular maintenance, the efficiency of the structures is greatly reduced, which can result in a decrease in water quality.

Works likely to expose acid sulfate soils should be carried out with caution. Department of Land & Water Conservation and Department of Urban Affairs & Planning acid sulfate soil maps should be consulted to determine the likelihood of acid sulfate soils. If they are present then a detailed and site specific management plan should be prepared. See details in the *NSW Acid Sulfate Soil Manual* (Department of Urban Affairs & Planning (1998)).

Councils should be aware of potential acid sulfate soils in their areas, if not already. Model DCP maps should be overlaid onto acid sulfate soils maps in order to predict potential acid leachate problems.

A Section 117 Direction under the EP&A Act requires councils to consider acid sulfate soil risk when preparing planning instruments.

Sewerage systems play an important role in the overall management of wetland areas, particularly for wetlands located at the bottom of catchments, such as coastal wetlands. Sewerage treatment plants may directly discharge to wetland areas or rivers and creeks adjacent to wetlands. During heavy rain, sewerage systems often leak and overflow, with sewage entering wetlands via the stormwater system.

Responsibility for Sydney's sewerage system lies with Sydney Water, who also manages about 2% of the Sydney's stormwater infrastructure.

Most sewage in Sydney is discharged into the ocean after treatment at the three largest sewage treatment plants located at North Head, Bondi and Malabar. Sydney's smaller coastal treatment plants are Warriewood and

Cronulla. Approximately 0.5 per cent of Sydney's sewage is discharged untreated to the harbour at Vaucluse, Diamond Bay and Diamond Bay South.

Sydney's inland sewage treatment plants discharge into the Hawkesbury-Nepean, South Creek, Berowra Creek and Cattai Creek catchments. Effluent from two of the Georges River plants, Glenfield and Liverpool, is transported to Malabar STP for discharge into the ocean. However, during periods of wet weather, when the capacity of the system is exceeded, treated sewage from these plants may be discharged to the Georges River. The third Georges River plant (Fairfield) operates only in wet weather.

Sydney Water is bound by pollution guidelines and is licensed by the EPA to discharge effluent. It is also subject to the National Pollutant Inventory administered by Environment Australia, which documents the types and amounts of pollutants discharged by Sydney Water.

All councils in NSW are required to prepare an on-site sewage management strategy for their areas. These plans identify areas within the LGA that are or are not suitable for on-site disposal. Some residential areas in Sydney are not connected to the sewer and unregulated discharges from these systems have negative impacts on surrounding bushland, waterways and wetlands.

Options available for non-sewered properties include septic tanks, pump-outs, aerated treatment systems, and composting toilets, although there can be problems with all of these systems. For example, pump-out systems are generally not well maintained or regularly pumped out and can overflow during wet periods. Refer to Department of Local Government et al (1998).

Exfiltration of sewage into stormwater drains occurs through pipe leaks during both dry weather and under high flow events, resulting in the escape of untreated effluent to creeks and rivers. Although there is little data available on the impact of sewage on wetlands, it appears to be of less of a concern than other stormwater pollutants.

Stormwater runoff from road surfaces can carry significant quantities of pollutants including nutrients, particulate matter and heavy metals. Roads also form impervious surfaces that increase the volume and velocity runoff waters. Refer to Wong (2000).

The planning and design phase of a road project should include strategies for managing potential spills arising from accidents. Intercept traps, detention basins or similar works should be incorporated along major drainage lines and from bridges to direct polluted water away from watercourses.

Many councils are now using constructed wetlands to aid in stormwater quality management. Constructed wetlands could potentially bring benefits regarding water quality and discharge into receiving waters. However, if they

are to be effective in improving water quality, they need to be maintained and preferably used in conjunction with at-source controls.

Wetlands, natural or constructed, should not be used as the sole means of removing pollutants. Wetlands are 'end-of-pipe' nutrient removal measures and should be used in conjunction with source controls. The effectiveness of wetlands for this purpose can be limited if not properly maintained.

Wetland maintenance includes removal of accumulated sediment, maintenance of sheet water flow throughout the wetland, and regular inspection for management of noxious weeds and fauna.

5.5 Objective 3: Ecology & habitat

Objective: To protect and enhance the natural values and ecological functions of wetland habitat from potential impacts of adjoining or upstream/downstream land uses. This includes elevated nutrient and sediment loads, stormwater runoff, removal of vegetation and changes to landform.

Urban developments in Sydney have degraded or destroyed the habitat value of many wetlands. Development includes housing, playing fields, industrial estates, canal estates, foreshore structures and waste facilities. Development across a wetland's catchment can significantly increase the amount of sediment and nutrients entering a wetland. In-filling of floodplain wetlands and natural drainage depressions with subsequent urbanisation of the catchment can also exacerbate local flooding.

Flora and fauna assessments should be undertaken early in the DA process, so that if a threatened species is located or the habitat indicates a high likelihood of occurrence, there is ample opportunity to modify the design and control or mitigate the impacts.

Clearing of vegetation within wetlands and their surrounds is one of the most significant causes of wetland habitat degradation. Loss of native wetland vegetation reduces the amount of animal habitat, simplifies or reduces the biodiversity of the wetland ecology and can lead to changes in wetland hydrology as well as erosion, weed invasion, sedimentation and salinisation.

No clearing of vegetation within the wetland itself, or the surrounding buffer zone, should be carried out other than the minimum clearing necessary to accommodate the development. Apart from the direct impacts of clearing, the clearing of the buffer zone will push the extent of surrounding disturbed areas further into the undisturbed wetland area. This will downgrade the environment values of natural wetland areas.

The clearing of mangroves requires a permit from NSW Fisheries. These permits are subject to conditions including: the area or number of plants being cleared or damaged; the rehabilitation of the site, including the source of any seedlings required; and any subsequent monitoring.

Existing wildlife corridors should be maintained and habitat links provided between isolated units wherever possible. The breakup of the wetland into fragmented habitats should be avoided. Bands of natural vegetation should be kept between the development and the wetland to provide supplementary fauna habitat. The width of the buffer zone depends on such factors as vegetation type, surrounding land use, slope, potential for weed invasion, and potential for nutrient impacts on the wetland.

Where a DA may have a significant effect on a threatened species, population, ecological community or habitat listed under the *Threatened Species Conservation Act 1995* in a wetland area, the consent authority is required to undertake an eight-part test in order to determine if there is likely to be a significant effect on the aforementioned biota.

If the eight-part test identifies a likely significant effect, then, a species impact statement must be prepared according to the *EP&A Act*.

Concurrence of the Director-General of NPWS must be sought prior to granting of development consent. Further information on the *Threatened Species Conservation Act* is available at <http://www.npws.nsw.gov.au/wildlife/threaten.htm#1> Listing.

In December 2000, the Sydney Coastal Estuary Swamp Forest Complex was listed as an Endangered Ecological Community in Part 3 of Schedule 1 of the *Threatened Species Conservation Act 1995*. Further information on this listing is available at <http://www.npws.nsw.gov.au/news/tscdets/f001222a.htm>.

The existing condition of and the impact of development on riparian vegetation along watercourses which flow into the wetland should be considered even if such vegetation falls outside the ambit of the DCP. Such vegetation not only plays an important role in providing additional habitat in the vicinity of the wetland, but acts to moderate water quality and flow impacts that can further downgrade the habitat value of the wetland. Protection and improvement to riparian vegetation areas can be effected through such means as a requirement to carry out additional planting.

Buffer zones around wetlands are not only important areas in their own right, but provide a level of protection to the wetlands from surrounding influences that can downgrade their habitat values. It is thus important that any development within wetlands or surrounding buffer zones improve or at the very least minimise disturbance to these buffer zones. A key improvement initiative is the planting of locally occurring species to not only strengthen the protective role of the buffer zone, but to provide improved and additional habitat.

Edge effects such as weed and pest invasion diminishes the integrity of wetlands habitats in urban areas. Creating, maintaining and strengthening the buffer zones around the wetlands thus has added significance as these are generally the first and only line of defence against these incursions. As urban wetland habitats are often already degraded, the need for habitat restoration or improvement also has added significance.

Feral animals have a major impact on the habitat value of wetlands.

Cats and foxes eat ground-nesting water birds and introduced fish compete with native species. Many introduced aquatic plants and terrestrial weeds also invade wetlands, resulting in habitat loss and simplification of the wetland.

Weeds were cited as the most common form of impact on wetland habitats in all SCCG LGAs, although presence of weeds is an expression of a disturbed site or changed catchment activities (e.g. increased nutrients, clearing, changed water regimes). This is an important point to note as the task of removing or controlling weeds will never be completed. It is necessary to stop or reduce the activities that enable weed species to dominate.

Weeds affect wetlands by displacing native plant species and reducing biodiversity. This in turn can affect the availability of food sources, nesting and shelter sites for wetland fauna. Aquatic weeds can increase the biochemical oxygen demand within wetlands. Declared terrestrial and aquatic weeds are listed in Schedule 2 of the *Noxious Weeds Act 1993*.

Almost all noxious aquatic weeds that are known to occur in NSW occur within the Sydney region. A list of these species and information on how to control these plants is available in wetland management plans referenced in the Appendix.

Due to the impact of herbicides on hydrological ecosystems such as wetlands, the preferred method of weed control is manual removal. If herbicide use is unavoidable (e.g. for controlling *Ludwigia peruviana*) a licence from the NSW EPA is necessary and needs to be presented to council prior to undertaking control activities.

Mosquitoes are the most common pest animals in wetlands. Councils are responsible for mosquito control in constructed wetlands and are obliged to control mosquitoes in natural wetlands if nearby residents are adversely affected.

Mosquito control is an important consideration given global temperature change and the increased frequency of mosquito-borne disease in NSW.

NSW has issued a green paper on arboviral disease control in NSW. It was intended as a starting point for discussion on ways in which the public health burden of mosquito borne disease could be reduced in NSW. The paper outlines existing arrangements in NSW and other states for surveying for mosquito borne diseases and in some instances responding to them.

One method of controlling mosquitoes is source control, i.e. reducing mosquito numbers by eliminating breeding sites through water management. As methods include filling, clearing of edge vegetation, draining, flooding and ditching, this is not appropriate for achieving conservation objectives for wetlands

Another method is biological control. This method employs larvae, adult insects and fish that feed on mosquito larvae. Examples include beetles, bugs (Hemiptera), dragonfly nymphs (Odonata) and copepods. The plague minnow (*Gambusia affinis* or the mosquito fish) is an introduced species that has been declared a key threatening process for a number of threatened species. This fish must not be introduced into any waters in NSW - stocking of this species may result in penalties of up to \$22,000. Fungal pathogens and growth regulators can also be employed.

A third method is chemical control. Larvicides and insecticides provide immediate results but can lead to development of resistance in the community. They are often indiscriminate and will kill many non-target organisms including those that are natural predators of mosquitoes. Use of chemicals is subject to EPA licensing requirements.

Many of these techniques are harmful to wetlands and associated fauna. They are also harmful to surrounding land and waterways.

Recommended actions with respect to mosquito control include:

- **where possible, remove potential breeding areas** such as rubbish and depressions that do not contribute to the wetland ecology
- **consider introducing native fish**, endemic to the area, that prey on mosquito larvae - this requires careful research on potential impacts to the local ecology and also requires approval from NSW Fisheries in the form of a permit
- **ensure that all larger bodies of water in the wetland remain interconnected** to allow free passage of mosquito larvae predators by creating shallow interconnections where possible and, where necessary, maintaining appropriate-sized culverts - these works are considered to be dredging or reclamation and therefore require prior approval, in the form of a permit, from NSW Fisheries (Local councils are not exempt from requiring approval under the *Fisheries Management Act 1994*)
- **maintain conditions that support mosquito larvae predators**
- **include the local community in monitoring programs** so that an understanding of the requirements for integrated control is developed

Roads and watercourse crossings impact directly and indirectly on wetland habitats at both the construction and operational stages. Potential impacts from roads include barriers to fish passage, the loss, modification or disturbance riparian vegetation and water pollution.

Barriers to fish passage can reduce the diversity of fish species by limiting the reproductive capacity and movement of fish populations. At the planning stage of a road project refer to *Guidelines for Assessment of Aquatic Ecology in Environmental Impact Assessment* (Department of Urban Affairs & Planning (1998)) in order to identify the issues and potential impacts. For design considerations for roads and watercourse crossings in order to maintain fish passage refer to *Policy and Guidelines for Bridges, Roads, Causeways, Culverts and Similar Structures* (NSW Fisheries (1999)).

In order to minimise loss of fish habitat snags, boulders or rocks should not be removed from any waters unless for essential public purposes. Where their removal is essential for safety concerns, the options in order of preference include lopping, realignment (in line with the flow), relocation and then removal. Relocation or removal of a snag requires local councils to notify NSW Fisheries.

5.6 Objective 4: Social & cultural values

Objective: To conserve and enhance the indigenous and non-indigenous social and cultural values of wetland areas, including intrinsic, aesthetic, visual, scientific, cultural heritage, archaeological, educational and recreational values.

Developments should be designed to ensure that areas of high scenic value are to be preserved.

Development should be excluded from sites which are highly visible and areas of high scenic quality should be preserved.

Developments should include measures to minimise visual impacts on wetlands, such as use of natural and non-reflective materials and landscaped screens.

There may be opportunities to use barriers created by roads, cycleways or walkways as protective barriers to the wetland. This can create a physical and perceptual border that more clearly defines the wetland area and creates a barrier against the entry of weeds and fire, further protecting the wetland's habitat values.

Wherever possible, development surrounding wetlands should face the wetland so that local residents and visitors are aware of their presence and develop a sense of ownership of the wetlands. Experience with developments that 'turn their backs' natural areas is a lack of local ownership, a lack of casual surveillance to prevent damaging activities such as dumping and a tendency for residents to dump greenwaste over the back fence, exacerbating weed invasion problems.

Developments should enhance and maintain the social, education and recreational values of wetland areas. This is to be achieved through such

measures as appropriately sited boardwalks, information signs, background information and consideration of indigenous and non-indigenous heritage.

Wetland areas and their margins have a high potential to contain sites of cultural significance - in particular, indigenous archaeological sites.

Wetlands have historically been the source of Sydney's water supply (e.g. Botany Wetlands), the source products such as alkalis and are associated with food production.

Wetlands have played a significant role in the indigenous economy and may be linked with activities such as location of camp sites and water collection.

Councils should not grant consent to a DA which will affect an indigenous site or relic unless:

- a permit has been issued where required under the *National Parks and Wildlife Act* allowing for any damage, destruction or defacing of that site as part of the development
- it has considered the findings of an indigenous archaeological investigation where site or relics are likely or known to exist
- it has considered any representations made by the relevant Aboriginal Land Council on relation to the impact of the development on indigenous sites or relics

5.7 Objective 5: Compensatory wetlands

Objective: To provide for wetland restoration or construction of non-natural wetlands to compensate for unusual events where other imperatives require the harmful modification of natural wetland areas.

If a wetland is to be destroyed, development proposals will need to provide for the creation of compensatory wetlands. This will be a crucial component of any development that destroys or modifies wetland vegetation.

Compensatory wetlands should only be provided when:

- **a greater area of wetland will be established**, rehabilitated or enhanced to compensate for any wetland loss.
- **the wetland is not considered to be of high quality.**

Compensatory wetlands can be provided on degraded lands which are not required for the development proposal, or alternately areas can be provided off-site, subject to financial and legal arrangements being secured on the site which is proposed to be rehabilitated.

There are limits to the effectiveness of compensatory wetlands. Although once thought to be a great advance in conservation of wetlands,

compensatory wetlands are now widely considered to provide less environmental value than was originally thought.

Practice has shown that in many instances, the provision of compensatory wetlands has not achieved desired outcomes. Recovery of ecological functions can be so slow that there is no possibility of assessing their compensatory value.

Compensatory wetlands should be built and functioning before any natural wetlands are damaged wherever possible.

The criteria by which compensatory wetlands are evaluated for their ability to compensate are complex. There should be clear criteria by which success can be assessed. Management plans need to be adaptive to allow for feedback between monitoring management techniques. This is essential for compensatory wetlands as there are many unknowns surrounding their functioning.

Specialist knowledge is required to implement a compensatory wetlands program.

Often it is more effective to restore small, easily managed areas in a mosaic, rather than the entire system at once. The timing of operations is also critical and is mainly dependent on climatic and weather conditions.

Any approval for construction of an off-site compensatory wetland should be the subject of a detailed agreement between council, the applicant and other relevant parties.

See 'constructed wetlands' references in the Appendix in addition to:

- Water Resources Consulting Services (1997)
- Botany Wetlands Ministerial Task Force (1991)
- Department of Urban Affairs & Planning (1999)

5.8 Objective 6: Bushfire hazard

Objective: To conserve and enhance the indigenous and non-indigenous social and cultural values of wetland areas, including intrinsic, aesthetic, visual, scientific, cultural heritage, archaeological, educational and recreational values.

Permanent fuel hazard reduction measures are preferred over broad area controlled burning. Permanent measures include building setbacks and fire trails in areas adjacent to urban areas.

Owners and managers of land encompassing wetland areas not to be permitted to carry out burning without authorisation, and should consider the burning provisions of any management plans for wetland areas.

The burning of wetland areas should have regard to the sensitivity of wetland flora and fauna communities and the natural frequencies and intensities of fires in such areas at different times of the year.

6 Abbreviations & terms

ANZECC	Australia and New Zealand Environment & Conservation Council
CAMBA	China-Australia Migratory Birds Agreement
DA	Development Application
DCP	Development Control Plan
DLWC	Department of Land & Water Conservation
DUAP	Department of Urban Affairs & Planning
EP&A Act	Environmental Planning & Assessment Act 1979
EP&A Regulation	Environmental Planning & Assessment Regulation 1994
EPA	Environment Protection Authority
EPBC Act	Commonwealth Environment Protection & Biodiversity Conservation Act 1999
ESD	Ecologically Sustainable Development
GIS	Geographic Information System
JAMBA	The Japan-Australia Migratory Birds Agreement
LEP	Local Environmental Plan
LGA	Local Government Area
Minister	Minister for Urban Affairs & Planning
Model DCP	Model DCP: Protecting Sydney's Wetlands
NCC	Nature Conservation Council
NPWS	NSW National Parks & Wildlife Service
NSW	New South Wales
PWSC	Protecting Wetlands Steering Committee
REP	Regional Environmental Plan
RTA	NSW Roads & Traffic Authority
SCCG	Sydney Coastal Councils Group
SEPP	State Environmental Planning Policy
SREP	Sydney Regional Environmental Plan
SWAC	State Wetlands Advisory Committee

Buffer zone: A defined area of land around a wetland managed so as to protect the wetland from peripheral impacts such as weed invasion.

Catchment: The area draining surface and ground water to a particular location. It may include catchments of tributary streams as well as the main stream.

Clearing: Clearing of native vegetation and/or soil, i.e. removing vegetation/soil or injuring, killing, damaging or burning native vegetation.

Compensatory wetland: The restoration of an existing degraded wetland or creation of a new wetland at a nearby location to compensate for the loss of a

wetland. Such action is discouraged and is considered a 'last resort' measure.

Concurrence: Is the requirement for a government agency to consider development proposals in light of its specialised functions and policies, and to decide whether it agrees with the development

Development Control Plan: A plan made by councils under the *EP&A Act* to control development, generally adding detail to broader provisions contained in an LEP, and having less statutory force than an LEP.

Draining of land: The use of artificial depressions, ditches or channels to convey water from one area to another. This includes constructing, deepening or widening any drains or installing any pipes for the purposes of drainage.

Environmental planning instruments: Are SEPPs, REPs, LEPs and DCPs. They describe the current planning status and/or the future development of an area.

Filling: Changing the existing ground level by placement of soil or any other solid material on or under the ground.

Integrated development: Is development that requires a DA plus a specified permit/approval from a State agency, e.g. a NSW Fisheries or EPA licence

Listed migratory species: is a species listed under one or more of the following agreements: the Bonn Convention; Japan Australia Migratory Bird Agreement (JAMBA); or China Australia Migratory Bird Agreement (CAMBA).

Local Environmental Plan (LEP): A legally binding planning instrument made by councils and approved by the Minister for Urban Affairs & Planning under the *EP&A Act* which sets the broad framework for development across a broad area or a particular site.

Regional Environmental Plan (REP): A planning instrument proposed by the Minister or Director-General of Urban Affairs & Planning and approved by the Minister. They address matters of regional significance.

Ramsar wetlands: Wetlands that have been designated under the Convention on Wetlands of International Importance (Ramsar Convention) as being of international significance. Australia has 56 Ramsar wetlands including, for example, the Towra Point wetlands in Sutherland Shire.

State Environmental Planning Policy (SEPP): A planning instrument proposed by the Minister for Urban Affairs and Planning and approved by the Governor to address matters of State significance.

Wetland restoration: The re-establishment of wetland characteristics and functions at a site where they previously existed but are now degraded or absent.

Zoning: This is the system of categorising land uses as prohibited, requiring consent or not requiring consent within particular areas. Zones, such as Residential or Commercial) are shown in plan form and explained in environmental planning instruments.