6 Synthesis, conclusions and recommendations

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6.1 Background

Given the size and location of the Georges River, it might be expected that its aquatic ecosystems would have been better described. Most attention has been paid to Botany Bay—an historic icon, transport hub, and a sometime scene of environmental clashes—with the freshwater and other estuarine portions of the Georges River catchment being the forgotten parts of the aquatic ecosystem. Aside from the Environmental Control Study of Botany Bay done by the State Pollution Contol Commission in the late 1970s and early 1980s, there is a general lack of publicly available data about the river and its ecological features. There is virtually no information on its freshwater or estuarine fish communities, and prior to this investigation little was known about any of its aquatic plants.

Among other things, the lack of data makes it difficult to assess the need for and type of management intervention. For example, it is only in recent years that the popular press has reported disappearance of water from the headwaters of the Georges River catchment where mining has caused fractures in the stream beds. The effects of this dewatering on the freshwater flora and fauna communities are unknown, but are unlikely to be beneficial. Other little understood threats include those that arise from off-road vehicles, fire and weed infestation. Relatively few attempts have been made to comprehensively assess commonly recognised threats, with two notable exceptions. The first was Rish's (1992) analysis of water quality data over a 20 year period. The second was a community project in which a range of data was collated to assess the health of the estuarine portion of the river (Florence *et al.* 1999). Among other issues, Florence *et al.* (1999) expressed concern about levels of water pollution, but they suggested that water quality in the upper portion of the estuary had improved since the mid-1980s, when dry weather flow from the Liverpool and Glenfield sewage treatment works was connected to the Malabar ocean outfall.

The Healthy Rivers Commission recently completed an inquiry into the state of the Georges River–Botany Bay System (HRC 2000, HRC 2001). In his recommendations, the Commissioner drew attention to competing administrative jurisdictions and conflicting land uses, and stressed the need for coordinated management. The Commissioner also made a number of recommendations regarding the maintenance of river health, river flow, waste water, river corridors, and natural areas within the catchment and the management of Botany Bay. These recommendations are supported by actions detailed in the NSW Government Statement of Intent for the Georges River–Botany Bay System (NSW Government 2002). Summaries of the

relevant Healthy Rivers Commission recommendations and the NSW Government Statement of Intent are attached in Appendix L and Appendix M, respectively.

Bearing in mind the above, and in order to help develop an appropriate management framework for the aquatic ecology and biodiversity of the Georges River catchment, this Part provides a synthesis of the three major components of the study conducted by NSW Fisheries: (estuarine vegetation, estuarine fish and freshwater fish), and sets out in step-by-step fashion a conservation assessment built on the precedent set by DEC in *Biodiversity of the Georges River catchment:Terrestrial biodiversity*. The assessment ultimately leads to identification of portions of the shoreline needing special management measures, and a monitoring program for aquatic vegetation.

6.2 Framework

The steps by which the conservation assessment is built are laid out in Table 33. Before initiating the assessment, it is important to recognise features that provide the framework within which the assessment takes place:

- Most species of fish and crustaceans are generally prolific spawners, with large-scale and at least annual recruitment events.
- Fish and other aquatic species are categorised in three types:
    - **Residents**—species that spend their entire life cycle in estuaries. They are typified by the many species of gobies encountered in this study
    - **Migrants**—species that spawn at entrances to estuaries. Their eggs and larvae are subject to the vagaries of wind and tide and the juveniles of many species aggregate in seagrass. Fish in this group are commonly species of commercial and/or recreational value, such as bream
    - **Transients**—species whose larvae are brought to NSW waters from Queensland by the East Australian Current and usually do not survive the cooler temperatures of winter months.
- At the present time, none of the threatened species listed in Schedule 4 (endangered species, populations, ecological communities or species of fish or marine vegetation presumed extinct) or Schedule 5 (vulnerable species) of the FM Act are known to be in the Georges River catchment. Some years ago *Posidonia* was nominated for Schedule 4, Part 1 (Endangered species of marine vegetation), but the review committee considered that there were insufficient data available to proceed to a listing. The committee continues to monitor the status of *Posidonia*, as well monitor the occurrence of the black cod *Epinephelus daemelii* and green sawfish *Pristis zijsron*, two species of threatened fish that may have once occurred in the Georges River–Botany Bay system.
- Four activities identified in Schedule 6 (key threatening processes) of the FM Act pertain to the management of aquatic habitats in the Georges River catchment. Under the terms of the Act, each activity will engender a Threat Abatement Plan;

however in the meantime they trigger the requirement for a test of the significance of a proposed activity (see Section 5A of the EP&A Act). The four activities are:

- **Removal of large woody debris**—Introduced to the schedule to conserve habitat by managing the removal of snags, this provision is relevant to the freshwater reach of the river. Snag removal was at one time thought to enhance the dissipation of flood flow. Snags are now recognised as important enhancers of estuarine habitat.
- **Degradation of native riparian vegetation along NSW watercourses**—Introduced to the schedule to maintain bank vegetation and its attendant benefits (for example the prevention of erosion and elevation of water temperature) this provision is relevant to the freshwater and estuarine stretches of the river.
- **Introduction of fish to fresh water within a river catchment outside their natural range**—Introduced to the schedule to prevent the disruption of natural predator–prey relationships in circumstances where there is a desire to expand recreational fishing opportunities, this provision is unlikely to be much employed in the Sydney metropolitan area.
- **Modified flow**—Introduced to the schedule to ensure adequate amounts and seasonal pulses of water are available, primarily for freshwater fish, this provision may be employed in a number of ways in the catchment of the Georges River. It is relevant in terms of water release from Woronora Dam and in relation to loss of water through cracks in the stream bed of the upper Georges River by longwall coal mining. It is also relevant in terms of instream impoundments such as the Liverpool Weir, which now provides an artificial demarcation between fresh and salt water where once a gradual salinisation would have occurred.

- Provisions of the TSC Act also apply. Water is a key habitat feature for the majority of species, whether aquatic or terrestrial, and therefore any impact on water supply or quality has the potential to significantly impact on a broad range of species, principally those listed as threatened under the TSC Act. Schedule 3 of the Act sets out key threatening processes, being those activities that affect the survivorship of threatened species or the quality of habitat for such species. Two of these activities pertain to management of aquatic habitats in the Georges River catchment:
  - **Modified flow**—Analogous to the similar provision in the FM Act, this process relates to flow regime modifications that result from changes within the catchment. They include: loss of water through cracks caused in the upper catchment; impoundment of streams; changes in the permeability of surfaces (sealing); and the clearing of native vegetation (also a listed key threatening process) throughout the Georges River catchment. The Scientific Committee that provides advice under the terms of the TSC Act is currently considering a proposal to list water loss due to cracks in the catchment as a key threatening process.

- **Introduced species**—This was introduced to the schedule to prevent disruption of natural aquatic systems, including predation of native fauna by the introduced fish gambusia *Gambusia holbrooki* (Note: carp and goldfish are dealt with under the FM Act). A Threat Abatement Plan is being prepared for gambusia.

In combination, the above features provide a structure within which to undertake a conservation assessment of the aquatic habitats. Fundamentally, if the habitats are self-sustaining, so too should be the communities of fish and other aquatic fauna.

Given that the cover of aquatic vegetation is important to the condition of communities of aquatic animals, for the purpose of drawing some ecosystem-wide conclusions about change in cover over time, the table below is carried from *Biodiversity of the Georges River catchment: Terrestrial biodiversity*. Specifically, the data relate to change in cover from a pre-colonial condition to the present (Table 32). For some types of vegetation there has been a substantial loss of cover, particularly for Alluvial Woodland (90.9% lost), Riparian Forest (79.4% lost) and Freshwater Wetlands (82.9% lost). In contrast, much of the Riparian Scrub is still intact (28.8% lost) as it primarily lines steep creek banks throughout the freshwater portions of the river system and is in many cases inaccessible. Note that the cover of some vegetation communities in 1750 could not be modelled, and therefore losses in distribution were not estimated. While the impact of large losses of habitat on freshwater fauna is impossible to quantify, it is safe to say that the relative abundances of at least some native aquatic species have been modified over the past 200 years. Furthermore, and as is also noted in *Biodiversity of the Georges River catchment: Terrestrial biodiversity* in relation to terrestrial species, the degradation of habitat appears to create opportunities for increased invasion by alien species. This effect has been demonstrated in relation to the fish of Prospect and Cabramatta Creeks—in both cases foreshore areas have been extensively modified and the alien species gambusia, carp and goldfish were found to be most abundant at these locations. It should also be recalled that the alien algae *Caulerpa taxifolia* is now found in southern parts of Botany Bay and may have the potential to move to other locations of the estuary.

Table 32 Riparian vegetation of the Georges River catchment

Map Scale	Vegetation community	Map unit (NPWS)	Salinity regime	Area vegetated				
				Extant (ha)	Pre 1750 (ha)	% of pre 1750	1979 (West *et al.* 1985)	% of 1979
Broad-scale mapping (See *Biodiversity of the Georges River catchment: Terrestrial biodiversity)*	**Sedgeland Heath**	64	Freshwater	1612.5	NA	–	–	
	Riparian Scrub	35	Freshwater	1111.9	791.4	71.2	–	
	Alluvial Woodland	11	Freshwater	5080.0	461.0	9.1	–	
	Riparian Forest	12	Freshwater/ estuarine	453.1	93.5	20.6	–	
	Riparian Woodland	5	Freshwater	NA	NA	–	–	
	Castlereagh Swamp	4	Estuarine	32.7	NA	–	–	
	Freshwater Wetlands	36	Freshwater	106.4	18.2	17.1	–	
	Mangrove/Saltmarsh	34	Estuarine	322.5[1]	492.1	65.5	–	
Fine-scale mapping (this Volume)	**Paperbark**	NA	Freshwater/ estuarine	30.4	NA	–	NM	–
	Swamp She-oak	4 (part)	Freshwater/ estuarine	308.0	NA	–	NM	–
	Common Reed	NA	Estuarine	14.6	NA	–	NM	–
	Saltmarsh	34	Estuarine	153.7[1]	NA	–	184.8	83.2
	Mangrove	34	Estuarine	688.8[2]	NA	–	603.4	114.2
	All seagrass	NA	Estuarine	701.4[1]	NA	–	367.1[3, 4]	191.1
	Littoral Rainforest	NA	Estuarine	2.5	NA	–	NM	–

1. Area measured in this study over an equivalent study site was of the order of 400 ha.

2. *Zostera* spp.: 591.2 ha, *Posidonia*: 110.2 ha.

3. Includes all of Botany Bay

4. Seagrass in the upper portions of the Georges and Woronora rivers was not mapped by West *et al.* (1985).

NM—not mapped.

The data acquired in this study begin the better management of the aquatic resources in the catchment, but additional investigations are needed. For example, our study of the estuarine vegetation, via analysis of aerial photos in a geographic information system, did not, and could not, distinguish fine-scale spatial features such as the differential coverage of the co-occurring species of mangrove. There is a need for an understanding of temporal change of the distribution of estuarine vegetation, such as the rate at which cover of mangrove is increasing and the cover of saltmarsh is decreasing (Saintilan and Williams 1999, 2000). Ultimately, and particularly in regard to

the future rise of sea level which will modify the distribution of estuarine plants, fine-scale mapping will be needed to differentiate features such as these. Similar considerations apply to estuarine and freshwater fish, for which the main consideration should be the maintenance, and ideally the enhancement, of subaquatic vegetation. If water quality can be maintained at levels to support healthy vegetation, the fish communities should be self-sustaining.

The evidence from this study as well as others from around the globe suggests the situation for freshwater fish is slightly different to estuarine fish. The former are more dependent on the management of river flows and the maintenance of fish passage than are estuarine species, as well as being dependent on riparian vegetation. The latter provides shelter and prey for fish, and provides detritus, on which instream food chains are often based. In this context the word 'riparian' is used in its broadest sense and includes some of the vegetation types mapped by NPWS (Volume 2) as well as the types mapped in this study at a detailed scale. As human population pressure builds within the catchment, every measure should be taken to maintain or enhance water volume and quality in the freshwater reaches of the river and its tributaries. Conditions found at Prospect and Cabramatta creeks should not be allowed to persist or occur elsewhere.

In addition to gathering fine-scale detail about estuarine plants, a fuller assessment of the aquatic resources of the Georges River requires the mapping and monitoring of the distribution of freshwater vegetation. Freshwater Wetlands perform a series of hydrologic, habitat and food chain functions in much the same way as estuarine wetlands, and collectively these functions provide the human community with a series of valuable services. For example, Freshwater Wetlands absorb pulse flows of rainwater, providing a measure of protection to houses and infrastructure on otherwise flood-prone regions. Some freshwater plants, such as ribbon weed (*Vallisneria nana*) are analogous to seagrass in growth and function, playing an important role in the survival of species such as the Australian bass (*Macquaria novemaculeata*). The distribution of ribbon weed is amenable to mapping by GIS, but it was beyond the scope of this project to conduct an analysis of it or other freshwater vegetation equivalent to the analysis conducted for the estuarine vegetation.

With respect to flow, the impact of cracks in the substrata of some of the upper tributaries and loss of water to the aquatic communities needs to be quantified and receive remedial action as appropriate. The blockage caused by the Liverpool Weir was relieved (at least theoretically) by the fishway installed in 1997. Our survey suggests, however, that relatively few fish have used the fishway to date, and that any recovery of fish communities upstream of the weir may be a slow process. The Healthy Rivers Commission has recommended that the NSW Government assess the efficiency of this fishway as a priority action in the catchment.

It is also worth noting that the wetlands and other riparian communities of the Georges River catchment provide important habitat for populations of terrestrial fauna, including the Swamp Wallaby *(Wallabia bicolor),* Large-footed Myotis (*Myotis adversus*), Water-rat (*Hydromys chrysogaster*), Green and Golden Bell Frog (*Litoria aurea*) and a range of other vertebrate and invertebrate species. The bell frog is listed as Endangered on the NSW Threatened Species Act 1997 and as Vulnerable on the

Commonwealth Environmental Protection and Biodiversity Conservation Act 1999. The presence of these species in the Georges River catchment is unusual given the proximity to, and density of, suburban development in the metropolitan area. It is unlikely that many of them, notably the Swamp Wallaby, would persist in the catchment should the whole of the river's foreshores become urbanised in a manner akin to the Parramatta River. Detailed fauna surveys are needed to identify the geographic distributions of some of the terrestrial species living adjacent to the estuary before predicting the impacts of further development.

The primary objectives of a conservation assessment are to identify areas and features of the highest significance for biodiversity, as well as to highlight threats, and to provide advice on appropriate conservation measures. The conservation assessment used herein is generally consistent with the protocol set out by NPWS in *Biodiversity of the Georges River catchment: Terrestrial biodiversity* to deal with terrestrial communities. Table 33 sets out the stages by which the conservation assessment process was undertaken for aquatic resources.

Table 33 The conservation assessment process for aquatic habitats

Stage	Section	Source elements	Tables
1. Assess extant biodiversity values	7.2.1	This study	33
2. Integrate conservation goals and objectives	7.2.2	DUAP & M. Williams & Associates (2000)	34
3. Identify and describe habitat types that contribute to the conservation goals and objectives	7.2.3	This study	35
4. Develop a strategy for the management of biodiversity	7.2.4	Sharing the GRC framework	36, 37
5. Identify localities that contribute to the conservation goal and objectives	7.2.5	This study	38, 39, 40, 41

The protocol consists of five basic steps:

- **Assessment of extant biodiversity values**—The biodiversity values that require management depend on the features present within the Georges River catchment (e.g. the communities and habitat present) and the conservation status of those features. Consideration must be given to the degree of disturbance of the habitat, the diversity of features present, and known threats. These elements were generated within this study and are summarised in Table 34.
- **Integration of a conservation goal and objectives** for biodiversity protection and management. One overarching goal and seven subordinate objectives had previously been developed by DIPNR in consultation with the Georges River catchment Section 22 Committee. The goal was an expression of the broad intent for the management of biodiversity values within the study area. The aquatic study has identified a set of specific biodiversity features (e.g. features of high value or

that are in some way threatened) that directly or indirectly assist in defining the objectives of this goal. These elements are dealt with in Table 35.

- **Identification of areas** that contribute to the conservation goal and objectives. A systematic and transparent approach is applied to the analysis of biodiversity values present within any given area (e.g. patch, locality, catchment) and then the relative contribution each area might play in reaching the conservation goal is assessed. These elements were generated within this study and are dealt with in Table 36.

- **Development of a strategy** for the management of biodiversity. Once the specific and relative values of each area are determined, a strategy for the management of those areas must be prepared. In this case, a base framework has already been established for management of natural resources in the catchment—Shaping the Georges River Catchment (DUAP 1999). A hierarchy of three area management classes—Core Areas, Support Areas and Enhancement Areas—and a fourth that encompasses generic controls to ensure the proper management of habitats outside those area management classes, provides the framework for the management of biodiversity values at the regional scale. The conservation goal is re-assessed in the context of the management framework, and criteria for inclusion in each management class are determined. These criteria are then applied to the specific biodiversity values identified for the catchment and all vegetated areas in the catchment are assigned to one of the three area management classes, or relegated to the 'other habitats' class. These elements are dealt with in tables 36 and 37.

- **Identification of localities** that contribute to the conservation goal and objectives. Specific foreshore parcels are identified and the three management classes are assigned. These elements are dealt with in tables 38 through 41.

6.2.1 Assessment of extant biodiversity values

Fifteen categories of wetland-allied vegetation were identified in the recent biodiversity studies of the catchment of the Georges River: eight categories from Volume 2, and seven types from this study (Table 34).

Based on the fact that each of the 15 types of vegetation in Table 32 has special management requirements as well as extant biodiversity values, Table 34 was created. The table expands the vegetation categories by subdividing seagrass into *Posidonia*, *Zostera* and ribbon weed, and by dividing saltmarsh into 'sensitive' and 'less sensitive' categories. Conservation status of aquatic vegetation is provisionally assigned on the basis of the investigations conducted in this volume. The conservation status of other categories of vegetation was assigned in *Biodiversity of the Georges River catchment: Terrestrial biodiversity*. At least six categories are of the highest conservation value and have the most stringent requirements in order to maintain or enhance current distributions: Alluvial Woodland, Castlereagh Swamp, Littoral Rainforest, Paperbark, Riparian Forest and Sensitive Saltmarsh. Within the Sensitive Saltmarsh, three species are recognised: *Gahnia filum, Selliera radicans*, and *Wilsonia backhousei.* For the purpose of this assessment, ribbon weed falls into the same category as seagrass. Seagrass is considered vulnerable, whereas reed and mangrove are of lesser concern.

Explanatory notes on the relevant aquatic communities are provided below (The bulk of the terrestrial communities are dealt with in *Biodiversity of the Georges River catchment: Terrestrial biodiversity*).

- **Littoral Rainforest** is restricted to a small area (2.5 ha) in one part (Kurnell) of the catchment, and because it is listed as an Endangered Ecological Community under the TSC Act, its need for appropriate management is well understood.

- **Sensitive saltmarsh** includes three species (*Gahnia filum*, *Selliera radicans*, *Wilsonia backhousei*) that are of special conservation interest due to their limited occurrence. Sites at which these species are found are predominantly along the foreshore between Mill Creek and Williams Creek. These sites need special attention as they are subject to impact by off-road vehicles, rubbish dumping and other urban stresses.

- **Saltmarsh** as a general category is limited in its distribution, being mostly found at the Marine Tidal Delta (Towra Point) and along the Fluvial Delta. Much of the Towra Point saltmarsh is protected by the planning controls and management plans in the Nature Reserve and adjacent Towra Point Aquatic Reserve. Contrary to public perception, not all of Towra Point is in public ownership and saltmarsh in private hands may be at risk, particularly from disturbance by activities such as horse riding and the driving of off-road vehicles. Saltmarsh at other locations is protected in theory from human impact by land use controls within the Georges River National Park or by Bankstown Council's environmental protection zoning. Saltmarsh along the south shore of the river between Mill Creek and Williams Creek is currently protected by virtue of being Commonwealth land used for military purposes. The Department of Administrative and Financial Services is the owner of these lands and, while aware of the presence of saltmarsh, needs to be apprised of its ecological value well in advance of any proposed changes in land use or ownership. Prospective new owners need to be similarly advised.

- **Seagrass** and **ribbon weed** are also of high conservation value given their role in aquatic ecosystems. Three types of submerged vegetation are of primary concern—the estuarine species *Posidonia* and *Zostera*, and the one freshwater species, ribbon weed. *Posidonia* occurs generally in well-flushed, nutrient poor marine waters at the entrances to estuaries. Fifty years ago it extensively covered the northern and southern shores of Botany Bay (Larkum & West 1990), but now is found mostly on the south side of the Bay.

- *Posidonia* was found at the south-eastern foreshore of Kogarah Bay and its occurrence at this location is sparse, possibly due in part to the fact that the foreshore has been densely urbanised for many decades and is replete with multiple stormwater and sewer overflow points. *Posidonia* may once have been more abundant in Kogarah Bay. It is present in dense communities in analogous locations in Pittwater, Sydney Harbour and Port Hacking (West *et al.* 1985). The upper end of Kogarah Bay was a waste-disposal landfill site but is now a golf course. Discharges of sediments and nutrients from around the bay (and pollutants from the golf course) may alter water quality to the detriment of *Posidonia*. A

monitoring program to track the distribution and health of this species in the Georges River catchment is warranted.

- *Zostera* seagrass was identified by West *et al.* (1985) as present in the Marine Tidal Delta, Central Mud Basin and Fluvial Delta, but its existence in the Riverine Channel has gone unmapped until now. During the course of this project, fish were sampled from one bed in the latter zone. Fieldwork conducted as part of the vegetation survey revealed additional beds of *Zostera* along the Riverine Channel as well as in the Woronora River. Follow-up studies would reveal whether fish are present at these locations, and if they are, a good case exists to examine water quality, hydrodynamic conditions and human use patterns in these parts of the river with a view to conserving or enhancing the presence of *Zostera*. A monitoring program will indicate whether water quality is changing to the point where it adversely impacts on *Zostera*, and if special management considerations are required.

The presence of *Vallisneria* was not mapped in this study, but it likely occurs in all freshwater reaches and is thought to have special relevance to the survival of Australian bass and other species of native fish. Its distribution should be mapped and monitored.

- The **common reed** is abundant and its range may be increasing. It is not of the highest conservation status.
- **Mangrove** is abundant and its range is increasing. It is not of the highest conservation status.

6.2.2 Integration of a conservation goal for biodiversity protection and management

The next step of the conservation assessment was the integration of the biodiversity goal and objectives for the Georges River catchment with the extant biodiversity values. The goals and objectives were developed by DIPNR in consultation with the Georges River catchment Section 22 Committee (Table 35). This phase of the assessment develops the information necessary to implement the goal.

6.2.3 Identification of habitat types that contribute to the conservation goal

All vegetated aquatic habitats within the catchment were assessed for their potential to contribute to the achievement of the conservation goal set out in the previous section. Table 36 summarises these conclusions.

Table 34 Extant biodiversity values of wetland vegetation in the Georges River catchment. Vegetation types are presented starting from freshwater reaches moving downstream to the estuarine reaches.

Vegetation type	Conservation Status		Naturalness	Diversity	Threats
	In region[1]	TSC Act/FM Act*			
Alluvial Woodland[1] (MU11)	Critically Endangered	EEC[5]	Low–High[2]	Med–High[2]	High
Castlereagh Swamp[1] (MU4)		EEC[5]	Low–High[2]	Med–High[2]	High
Littoral Rainforest		P[7]	N/A	N/A	High
Paperbark	Endangered	–	N/A	Monospecific	High
Riparian Forest[1] (MU12)		EEC[5]	Low–High[2]	Med–High[2]	High
Sensitive saltmarsh		–	Low–High	Low	High
***Posidonia* seagrass**	Vulnerable	P	Low–High[2]	Monospecific	High
Ribbon weed		–	N/A	Monospecific	N/A
Saltmarsh (MU34)		–	Medium	Medium	Medium
Swamp She-oak		–	N/A	Monospecific	High
***Zostera* seagrass**		P	Low–High	Low	Medium
Freshwater Wetlands[1] (MU36)	Near threatened	EEC[6]	Low–High[2]	High[2]	High
Riparian Woodland[1] (MU5)	Least concern	EEC[5]	Low–High[2]	Med–High[2]	High
Common reed		–	High	Monospecific	Low
Mangrove (MU34)		–	N/A	Low	Low
Sedgeland Heath[1] (MU64)		–	Low–High[2]	Med–High[2]	Medium
Riparian Scrub[1] (MU35)		–	Low–High[2]	Med–High[2]	Medium

1. Classifications are indicative of relative conservation status only and have been determined by persons with scientific expertise. See Volume 2 for rationale by which classifications were assigned.

2. These categories can vary significantly from site to site.

3. Most patches are currently viable.

4. All viable except in Kogarah Bay.

5. See Sydney Coastal River Flat Forest (TSC Act).

6. EEC—some of these areas qualify as Endangered Ecological Communities under the TSC Act.

7. There is no Littoral Rainforest with the GRC, however there are patches adjacent on the Kurnell Peninsula.

P—Protected, EEC—Endangered Ecological Community (refers to listings on the TSC Act as at March 2002. There are no relevant EECs listed on the FM Act at the date of this report being finalised.)

Table 35 Goal and objectives for biodiversity management in the Georges River catchment (see also *Biodiversity of the Georges River catchment*).

Goal	To protect the biodiversity of the Georges River catchment and maintain ecological processes and systems.
Objectives	
1	With respect to Endangered (and regionally significant) Ecological Communities[1], to: • maintain high-quality remnants and essential ecological processes • improve the quality and integrity of protected remnants • restore areas of lower quality habitat wherever possible • reduce the impacts of processes known to threaten these communities.
2	With respect to Threatened Species and Threatened Populations (TSC Act 1995) and regionally significant species and populations, to: • maintain existing populations and known habitats • improve the quality of habitat for these species • restore areas of lower quality habitat so as to increase habitat opportunities for these species wherever possible • reduce the impacts of processes known to threaten these species.
3	Protect diverse areas—protect areas that have high species and/or habitat diversity.
4	Manage threatening processes—introduce management practices to effectively control the processes that threaten biodiversity in the catchment (e.g. pest species).
5	Maintain ecological functions and processes through protection of key habitat types or areas: • wetlands—including upland swamps, mangroves and saltmarsh • riparian lands—including floodplains • undisturbed catchments—for example, the relatively undisturbed catchments of the upper Woronora, O'Hares Creek and other subcatchments of the Holsworthy Military Area.
6	Maintain and enhance habitat linkages—to ensure the viability of significant habitats, and to maintain ecological processes throughout the catchment.
7	Maintain species and communities of least concern—with respect to currently common or widespread species and communities: • ensure that these species/communities remain common/widespread • maintain areas of high-quality habitat and habitat linkages for these species and communities • ensure that these species and communities are adequately represented in the reserve system (=15% of pre-1750 distributions).

1. Endangered communities were defined in this assessment as communities listed as Endangered Ecological Communities under the TSC Act, or communities classified as Critically Endangered or Endangered in Appendix E of Biodiversity of the Georges River catchment: Terrestrial Biodiversity. Regionally significant communities were defined as communities classed as Vulnerable in that Appendix.

Table 36 Summary of biodiversity conservation objectives and biodiversity features

Biodiversity objective	Biodiversity or landscape features relevant to objective	Relevant criteria (see Table 37)
1. Protect Endangered Ecological Communities	These communities include areas of sensitive saltmarsh and areas predominantly composed of submerged vegetation, including the seagrasses *Zostera* and *Posidonia*, and the ribbon weed *Vallisneria*; freshwater wetlands and upland swamps; and areas within undisturbed catchments.	C1, C2, C3, C4
2. Protect threatened species and populations	The current state of understanding indicates that species-specific management is unnecessary (i.e. that a broad habitat management approach is adequate). However, as species–habitat interactions become better defined, there may be a need for species-specific management approaches in the future (e.g. for seahorse species living in seagrass).	C1, C2, C3, C4, S1, E1
3. Protect diverse areas	In comparison to terrestrial counterparts, estuarine habitats are not so diverse. However, the foreshore of Mill Creek to Voyager Point has the greatest diversity of estuarine vegetation types encountered in this study.	C1
	All seagrass beds had higher numbers of species of fish than bare substrata in proximate locations.	C1
4. Manage threatening processes	The FM Act identifies four key threatening processes:	
	• Introduction of fish to freshwaters within a catchment outside a species' natural range, including alien species—there are alien species, including gambusia, carp and goldfish in the GRC	C1, C2, C3, C4, S1, E1
	• Removal of snags—primarily an issue in freshwater reaches	C1, C2, C3, C4
	• Degradation of native riparian vegetation along NSW watercourses	ALL
	• Modification of flow.	ALL
5. Maintain ecological functions and processes	Wetlands—including all area identified as Freshwater Wetland, Upland swamp (Sedgeland Heath Complex), Saltmarsh, Mangrove or Seagrass communities.	C1, C2, C3, C4
	Riparian lands—the assessment of riparian lands has been undertaken by DIPNR and has not been included in this assessment.	ALL
	Upland swamps—these wetlands provide a range of important ecological functions that contribute to overall catchment sustainability.	C3
	Undisturbed catchments—this objective was achieved by identifying all undisturbed catchments of minimal disturbance within the GRC.	C4
6. Maintain and enhance habitat linkages	Habitat linkages are inherently maintained in aquatic systems, except where interrupted by structures.	S1
7. Maintain species and communities of	With current understanding of freshwater and estuarine ecological processes, the broad habitat management approach taken for	E1

least concern	Objectives 1 and 2 is considered to enhance the protection available to these species/communities, however the goal of not endangering such species further must remain.	

6.2.4 Development of a strategy for the management of biodiversity

The DIPNR strategy for natural resource management in the Georges River catchment—*Shaping the Georges River Catchment* (DUAP 1999)—provides a basic management framework for the catchment. The strategy includes a Regional Environmental Plan, Action Plan, Foreshore Improvement Program, Guidelines and a program of catchment environmental studies. The primary component of the strategy—Greater Metropolitan Regional Environmental Plan No. 2—Georges River Catchment (GMREP 2)—established a framework for the management of catchment resources wherever development is proposed.

The purpose of this step is to assess and prioritise aquatic biodiversity values, and to use the management framework to achieve the conservation objectives for the Georges River catchment.

The broad habitat types represented in the Georges River catchment are initially prioritised in terms of their conservation significance and inherent biodiversity values, and in terms of the relative contribution they can make to achieving synergistic conservation outcomes. These broad priorities are then considered in terms of the management framework available, and finally each is funnelled into one of the area management classes available in the management framework. The first three columns of Table 37 set out the broad habitat types in order of relative priority.

Table 38 steps further forward by describing each of the four area management classes including a general description of the purpose and management objectives that will be applied to those areas included in each class. The first three classes are Biodiversity Core, Biodiversity Support, Biodiversity Enhancement. The table also identifies a fourth category, being those habitats that are not included in one of the area management classes. This four-tier management framework has been established to provide a relatively simple and robust framework for dealing with biodiversity management issues through the planning system. Those areas of highest priority are assigned the greatest levels of protection, whilst areas of least concern are provided with basic levels of protection to prevent them from also becoming areas of greater conservation concern. The areas in Core, Support and Enhancement classes will be mapped through GMREP 2 and directly associated with planning controls that fully recognise the relative significance of those areas and their biodiversity values.

Within the group requiring strategic protection, three levels have been introduced for the Georges River catchment: Biodiversity Core, Support and Enhancement Areas, with successively more modest levels of protection and development controls. Core Areas are those areas that contain habitats that are most sensitive to existing threats and have the greatest levels of inherent biodiversity value. Support Areas are those areas that have inherent biodiversity values in a somewhat degraded state, that have

some sensitivity to existing threats, or that may act as buffer zones for Core Areas. Finally, Enhancement Areas may have reduced inherent values due to prior degradation and/or minimal sensitivities to existing threats, but have been identified as potential areas for targeted rehabilitation works. It is not proposed that rehabilitation efforts be restricted to Enhancement Areas—in general the rehabilitation of degraded parts of Core and Support Areas would have greater priority. Enhancement Areas are identified to provide a regional guide to the greatest opportunities to restore linkages between Core and/or Support Areas.

Table 37 Inclusion criteria for each class of regional management area (RMA) for biodiversity

Criterion	Description	Areas included	RMA
C1 **Endangered & Vulnerable communities**	The conservation goal for the GRC refers to the maintenance of high-quality remnants of Endangered Communities and regionally significant communities. Endangered Communities are defined as communities listed as Endangered Ecological Communities under the TSC Act, or communities classified as Critically Endangered or Endangered in Appendix E, *Biodiversity of the Georges River catchment: Terrestrial biodiversity*. Regionally significant communities were defined as communities classed as Vulnerable in Appendix E, *Biodiversity of the Georges River catchment: Terrestrial biodiversity*.	Littoral Rainforest—Critically Endangered Sensitive saltmarsh—Endangered Saltmarsh—Vulnerable All submerged macrophytes (the seagrasses *Zostera* and *Posidonia*, and ribbon weed *Vallisneria*)—Vulnerable.	**Biodiversity Core Areas**
C2 **Freshwater Wetlands**	Some freshwater wetlands are listed as an Endangered Ecological Community under the TSC Act and provide a range of ecological functions in terms of habitat provision and water quality enhancement.	All areas mapped as Freshwater Wetlands (MU36) in *Biodiversity of the Georges River catchment: Terrestrial biodiversity*.	
C3 **Upland Swamps**	Upland Swamps (mapped in *Biodiversity of the Georges River catchment: Terrestrial biodiversity* as Sedgeland) are not listed as an Endangered Ecological Community under the TSC Act and are considered to be of Least Concern in terms of conservation status for regional biodiversity conservation purposes. However, these areas provide a range of ecological functions in terms of habitat provision and water quality enhancement that are critical to the condition of the catchment.	All areas mapped as Sedgeland (MU64) in *Biodiversity of the Georges River catchment: Terrestrial biodiversity*.	

C4 **Undisturbed Catchments**	The undisturbed catchments of the Upper Georges River catchment and Holsworthy Military Area provide a large area of natural habitat that is contiguous with the extensive areas contained in the Metropolitan Water Catchments and the NPWS reserves of Heathcote National Park and Dharawal SRA. Together these lands provide a conservation resource of high significance in southern Sydney, particularly given that the integrity of most other catchments in the Sydney Basin is compromised by development and pollution. The undisturbed catchments of the Upper Georges River catchment are very important for the conservation of flora and fauna (especially wide-ranging fauna) and the provision of clean water to the lower catchment. O'Hares and Stokes creeks in the upper catchment within Dharawal SRA are listed in the Directory of Important Wetlands in Australia and are presently being assessed for eligibility for Ramsar listing. The un-impounded streams within the Undisturbed Catchment Area are also important for many fish species, particularly those that migrate between freshwater and estuarine environments.	All undisturbed catchments of the Woronora Plateau—those catchments within which there has been minimal vegetation loss.	
S1 **Corridors and habitat for wide-ranging species and species vulnerable to habitat fragmentation**	Broad, contiguous or near-contiguous bands of vegetation that follow rivers, creeks and ridge tops provide important buffer habitat for Core Areas. As the landscape becomes more fragmented through urban and agricultural development the buffering function of the remaining corridors becomes increasingly more valuable.	All shorelines where land is zoned Environmental Protection, Open Space, Special Use or Rural.	**Biodiversity Support Areas**
E1 **Disturbed Habitat**	Rehabilitation of habitat that adjoins areas of seagrass provides a strategic opportunity to extend areas of greater biodiversity within the Georges River catchment.	Reed—lesser concern. Mangrove—lesser concern. A buffer area of 50 m around each patch of seagrass is included. Selected areas (see Tables 38–41).	**Biodiversity Enhancement Areas**

Table 38 Regional management area (RMA) classes

RMA	Description	Management objectives
Biodiversity Core Areas	These are areas of highest conservation value. They represent areas where species or communities are at imminent risk of extinction, or areas within the region that constitute the backbone of a viable conservation network across the landscape.	• To ensure that Core Areas are managed principally for the purpose of biodiversity protection—including secure protection provisions and active habitat management. • To ensure, as a first priority, that no development or activity, including public access, recreation and area management activities, results in adverse impacts or loss of habitat within the Core Area (i.e. a decline in the area, condition or conservation status of the habitat). Impacts or losses of habitat should only be permitted in exceptional circumstances and must be minimised, and appropriately offset, where they are unavoidable.
Biodiversity Support Areas	These are areas within the region that provide a range of support values to the existing reserve system, and critically endangered and core habitat, including increasing the size of and buffering these areas. The focus is to identify priority areas for restoration work in order to enhance the ecological functions and contribution of the areas to the conservation of regional biodiversity values.	• To ensure that Support Areas are managed principally for the purpose of biodiversity protection—including secure protection provisions and active management for biodiversity. • To ensure, as a first priority, that no development or activity results in an adverse impact or loss of habitat within the Support Area (i.e. a decline in the area, condition or conservation status of the habitat. Impacts or losses of habitat should only be permitted in exceptional circumstances and must be minimised, and appropriately offset, where they are unavoidable. • To rehabilitate Support Areas to a condition suitable for inclusion in a Core Area.
Biodiversity Enhancement Areas	These are areas within the region (including cleared areas) that have strategic values, particularly for the potential provision of intra- and interregion linkages. The focus is to identify priority areas for restoration work (outside Core and Support Areas) in order to enhance the ecological functions and contribution of the areas to a conservation network in the region.	• To rehabilitate Enhancement Areas in order to: > maintain and gradually increase the area and integrity of habitat > facilitate linkages between Core and Support Areas and provide ecological buffers to these areas. • To ensure that existing vegetation within the identified land is maintained and protected wherever possible. Impacts or losses of identified habitat should only be permitted after a full consideration of measures to avoid or minimise impacts.
Other habitats	Areas of native vegetation that do not fall within above areas. These areas have conservation significance due to the cumulative contributions of each area of habitat to the regional habitat context. These areas may be of significance for currently unidentified features (e.g. threatened species), may be of local significance, or may have other values (e.g. aesthetic, recreational).	• To rehabilitate areas outside the regional management area network in order to: > maintain and gradually increase the area and integrity of habitat > facilitate linkages between Core and Support Areas and provide ecological buffers to these areas. • To ensure that existing vegetation within the identified area is maintained and protected wherever possible. Impacts or losses of identified habitat should only be permitted after a full consideration of measures to avoid or minimise impacts.

As a result of the integration of Table 37 and Table 38:

- Four habitat types have been nominated for inclusion in the Biodiversity Core Area management class.
- One habitat type is nominated for inclusion in the Biodiversity Support Area management class.
- One habitat type is nominated for inclusion in the Biodiversity Enhancement Area management class.

6.2.5 Identification of localities that contribute to the conservation goal and objectives for flora

One of the most straightforward ways to conserve biodiversity is to identify sensitive areas and plan appropriately. As well as identifying aquatic habitats of the Georges River catchment requiring strategic protection, this study has also identified a need to provide more general protection so that impacts in all parts of the catchment can be managed through standard planning controls. Such an approach, while practical and readily implemented, does not account for the full range of ecological processes that are important in aquatic ecosystems. As the knowledge base grows, there will be future opportunities to reconsider the framework set out below.

The following tables identify specific localities within the Georges River catchment that are considered to meet the inclusion criteria for each of the area management classes, or that will be managed through standard planning controls:

1. Table 39 Estuary (northern shore)

2. Table 40 Estuary (southern shore)

3. Table 41 Freshwater reaches (east bank)

4. Table 42 Freshwater reaches (west bank)

Note that the regional management area network is mapped and specific management requirements set out in respect of each class. Everything outside these mapped areas will be managed through the process and activity-based controls of the planning system.

In spite of the fact that there have been significant losses of vegetation in some areas, our understanding of wetland values, for freshwater as well as marine systems, has been considerably broadened over the past 20 years. This provides an opportunity to apply long-term planning perspectives for conservation as well as rehabilitation purposes.

Table 39 Recommened planning response for the Georges River catchment estuary (northern shore)

Location*	LGA	Regional Management Area Network			Process and activity-based controls
		Biodiversity Core	Biodiversity Support	Biodiversity Enhancement	
Sans Souci	Rockdale		X		
Kogarah Bay	Kogarah			X	
Shipwrights Bay to Bald Face Point	Kogarah			X	
Bald Face Point to Connells Point	Kogarah				X
Connells Point to Oatley Point (Oatley Bay)	Hurstville			X	
Oatley Point to Jew Fish Point (Gungah Bay)	Hurstville				X
Jewfish Point to Gertrude Point (Jew Fish Bay and Lime Kiln Bay)	Hurstville			X	
Gertrude Point to Lugarno Pde.	Hurstville				X
Lugarno Pde. to lower Salt Pan Creek	Hurstville			X	
Lower Salt Pan Creek, except:	Bankstown			X	
GRNP*	Bankstown		X		
Upper Salt Pan Creek	Canterbury Bankstown				X
Beauty Point to Little Salt Pan Creek to Picnic Point to Lambeth St. Reserve (GRNP)	Bankstown		X		
Lambeth St. Reserve to Kelso Creek	Bankstown				X
Kelso Creek to Prospect Creek	Bankstown			X	
Prospect Creek	Bankstown Fairfield			X	
North riverbank at Chipping Norton	Fairfield			X	
Cabramatta Creek	Fairfield/ Liverpool			X	
Warwick Farm	Liverpool			X	

* GRNP—Georges River National Park

Table 40 Recommended planning response for the Georges River catchment estuary (southern shore)

Location*	LGA	Regional Management Area Network			Process and activity-based controls
		Biodiversity Core	Biodiversity Support	Biodiversity Enhancement	
Kurnell peninsula, except:	**Sutherland**				X
Littoral Rainforest	**Sutherland**	X			
Quibray and Weeney bays, Towra Point, Woolooware Bay	**Sutherland**	X			
Shell Point to east Taren Point	**Sutherland**		X		
West Taren Point to Sylvania Waters	**Sutherland**			X	
Sylvania	**Sutherland**			X	
Oyster Bay–Carina Bay	**Sutherland**		X		
Lower Woronora River	**Sutherland**		X		
Upper Woronora River	**Sutherland**	X			
Illawong (GRNP*)	**Sutherland**		X		
Alfords Point (GRNP*)	**Sutherland**		X		
Sandy Point/ Pleasure Point (HMA*)	**Sutherland / Liverpool**		X		
Voyager Point	**Liverpool**	X			
Hammondville/Chipping Norton/ Lake Moore	**Liverpool**			X	

* GRNP—Georges River National Park; HMA—Holsworthy Military Area

Table 41 Recommended planning response for the Georges River catchment freshwater reaches (east bank)

Location*	LGA	Regional Management Area Network			Process and activity-based controls
		Biodiversity Core	Biodiversity Support	Biodiversity Enhancement	
Moorebank to Cambridge Avenue Crossing	Liverpool			X	
Cambridge Avenue Crossing to Wedderburn (HMA*)	Liverpool	X			
Remainder	Various	X			

* HMA—Holsworthy Military Area

Table 42 Recommended planning response for the Georges River catchment freshwater reaches (west bank)

Location*	LGA	Regional Management Area Network			Process and activity-based controls
		Biodiversity Core	Biodiversity Support	Biodiversity Enhancement	
Macquarie Fields to the Basin, except:	Various				X
Simmos Beach, GRNR*	Various		X		
The Basin to O'Hares Creek, except the Reserves:	Various				X
GRNR*, Freres Crossing	Various		X		
Remainder		X			

* GRNR—Georges River Nature Reserve

6.3 Long-term management of vegetation

Evidence has been presented to suggest that the distribution of many of the wetland vegetation types of the Georges River catchment varies over time. The cover of some communities or species is so small as to require frequent monitoring (e.g. Littoral Rainforest or the saltmarsh species *Gahnia filum*, *Sellieria radicans, Wilsonia backhousei*). For some other plants, such as seagrass, distribution has been shown to be highly variable over time. The two species of mangrove (*Avicennia marina* and *Aegiceras corniculatum*) are increasing in cover and invading saltmarsh communities at some locations. At other locations mangrove is increasing in extent by seaward expansion. The status of common reed (*Phragmites australis*) is not well known as it was not mapped in earlier studies, but it too appears to be increasing in extent and invading saltmarsh. The sites and rate at which these incursions are taking place should be monitored. The frequency of monitoring for wetland vegetation is set out in Table 43. Monitoring frequency is based on the growth rate and sensitivity of the different vegetation types.

The financial arrangements by which any monitoring is to be conducted would need to be addressed within a long-term management plan for the river.

Table 43 Frequency of vegetation monitoring

Vegetation type	Monitoring frequency		
	Yearly	Every 2–3 years	Every 5 years
Littoral Rainforest			X
Paperbark			X
Reed		X	
Swamp She-oak			X
Sensitive saltmarsh species (e.g. *Gahnia filum*)	X		
Other saltmarsh		X	
Mangrove		X	
***Zostera* seagrass**		X	
***Posidonia* seagrass**		X	
***Vallisneria* ribbon weed**		X	

6.4 Recommendations

Recommendations stated in Section 2, 3, 4 and 5 of this report are consolidated below and are preceded by a series of general recommendations. All of the recommendations are consistent with the findings of the Independent Inquiry into the Georges River–Botany Bay System (HRC 2000, 2001) and the NSW Government Statement of Intent (NSW Government, 2002). An abridged schedule of the Commissioner's recommendations and the Statement of Intent is included in Appendix L and Appendix M of *Biodiversity of the Georges Catchment*.

A General

1. Areas of the catchment where increase in population may impact negatively on riparian and aquatic ecosystems need to be identified.

2. The potential impacts of increasing population pressure on riparian and aquatic ecosystems need to be assessed.

3. A data management and acquisition strategy needs to be developed for the aquatic resources of the Georges River.

B Study area

1. The four estuarine zones identified in Part B need to be recognised as planning units. Terms such as 'mid-river', 'upstream' or 'lower estuary' need to be carefully defined or they are meaningless in an ecological and planning sense.

2. Provision needs to be made to manage each of the four estuarine zones of the Georges River catchment in a distinct and separate way.

C Estuarine vegetation

1. Planning instruments must progressively integrate threatened species recovery plans for vegetation identified in a threatened condition.

2. To confirm changes in the cover of estuarine vegetation over the past 20 years, the aerial photos studied by West *et al.* (1985) should be analysed by the method described in this study or an analogous GIS method.

3. To put the dynamics of estuarine vegetation in context, a chronology of land use activities that have impacted on water flow, depth, nutrient input, sediment input and other relevant factors should be undertaken.

4. Biodiversity Core Areas on Towra Point should be added to by the acquisition of private lands.

5. The distribution of the common reed *Phragmites australis* should be monitored, especially as its occurrence along the river appears to be increasing.

6. As saltmarsh is limited in its distribution and, relative to other types of estuarine plants, appears to be decreasing in extent, its cover needs to be regularly monitored.

7. Special recognition and monitoring needs to be given to at least three sensitive species of saltmarsh: *Gahnia filum*, *Sellieria radicans* and *Wilsonia backhousei*. Conservation measures relevant to the long-term management of these species must be implemented.

8. An off-road vehicle management plan should be implemented to prevent further damage to saltmarsh communities.

9. A control program for terrestrial weeds, especially the spikey rush *Juncus acutus*, should be implemented, given the present limited distribution and ease of access to weeds in some locations.

10. The distribution of the mangrove species *Avicennia marina* and *Aegiceras corniculatum* should be monitored, especially as the general distribution of mangrove along the river appears to be increasing.

11. All beds of seagrasses in the Riverine Channel should be located and monitored.

12. The distribution and extent of seagrass in Kogarah Bay should be more fully assessed and a monitoring program established to identify water quality–seagrass interactions and whether special ongoing management is required.

13. Planning instruments must integrate pest species management plans for species such as *Caulerpa taxifolia*.

D Estuarine fish

1. Planning instruments must support recovery plans for currently listed threatened species of fish such as black cod *Epinephelus daemelii* and green sawfish *Pristis zijsron*. Planning instruments must be flexible and able to contend with species that might be listed at some future time.

2. Planning instruments must support pest species management plans for fish identified as pests at some future time.

3. Separate management strategies need to be devised for the fish communities of each of the four estuarine zones of the Georges River.

4. The fish communities of Kogarah Bay need to be defined better, particularly those species associated with seagrasses.

5. The fish communities of the Riverine Channel, particularly those species associated with seagrass need to be defined better.

6. The potential benefits of restrictive land management practices (e.g. foreshore building restrictions), for the better conservation of estuarine fish at Biodiversity Core, Support and Enhancement sites needs to be assessed.

7. Where there is potential to enhance fish habitat, particularly in the Riverine Channel, foreshore rehabilitation programs should be initiated.

E Freshwater fish

1. Additional investigation is needed to ascertain the merits of preventative management practices for the conservation of freshwater fish, such as the establishment of riparian buffer zones.

2. In the degraded portions of the Georges River catchment, where freshwater fish communities are substandard (e.g. more alien species), further investigation is needed to determine the relative merits of rehabilitation programs such as instream habitat restoration works and riparian habitat restoration works.

3. Further assessment of the instream freshwater vegetation in, and the freshwater wetlands adjacent to, the Georges River should be commissioned in order to determine the extent and sensitivity of these communities.

4. The adequacy of the Liverpool fishway should be investigated.

5. The impact of cracks in the stream bed on the fish communities of the upper catchment should be assessed.

F Synthesis

1. The planning responses set out in Tables 38, 39, 40 and 41 should be adopted in relation to Biodiversity Core, Support and Enhancement Areas.

2. The monitoring schedule for estuarine vegetation set out in Table 32 should be adopted.

For many of the above recommendations, well-established implementation mehanisms are in place. A challenge exists for the implementation of others.