

***A FRAMEWORK FOR REGIONAL
ESTUARINE MANAGEMENT:
A SOUTH AFRICAN CASE STUDY***

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(11052376)



***Thesis presented in partial fulfilment of the requirements for the degree of
Master of Natural Sciences at the University of Stellenbosch***

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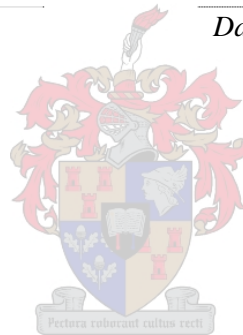
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Declaration

I, the undersigned, hereby declare that the work contained in this thesis is my own original work and that I have not previously in its entirety or in part submitted it at any university for a degree.

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Abstract

In South Africa, as a result of limited resources and capacity, the governance and management of estuaries occur on an ad hoc basis, with decisions about an estuary's freshwater-flow requirements, water quality, living-resources management, mouth management and protection status being made on a largely uncoordinated and non-strategic basis. This study is aimed at developing an understanding of the opportunities and constraints affecting estuarine management at a regional scale.

The objectives of this study were to:

- Review relevant policy and legislation governing estuarine management in South Africa;
- Discuss the current status of regional estuarine management in South Africa;
- Review international literature for potentially applicable management guidelines;
- Construct a management protocol for estuarine management in South Africa;
- Apply this protocol in a South African setting; and
- Recommend improved measures for regional estuarine management.

The main outcome of the study was the development of the proposed National Estuarine Management Protocol, which is currently in the process of being incorporated into the National Environmental Management: Coastal Zone Bill. The CAPE Estuaries Programme was developed to test the proposed Protocol in a regional setting.

The study concluded that there was an urgent need for a more holistic regional approach to estuarine management but that the proposed framework and protocol would be successful only if, in addition, they were supported by an understanding of the biophysical estuarine processes and management constraints operating at the local level.

Opsomming

In Suid-Afrika, as gevolg van 'n tekort aan hulpbronne en kapasiteit, geskied die beheer en bestuur van strandmere op 'n ad hoc basis. Besluite rakende die varswaterbehoefte, waterkwaliteit, lewende hulpbronne, mondbestuur en beskermingsvlak word op 'n ongekoördineerde en onstrategiese manier gemaak. Hierdie studie strewende daarna om 'n diepere begrip te ontwikkel oor die geleenthede en struikelblokke rakende strandmeer bestuur op 'n streekskaal.

Die studie het as hoof doelwitte om:

- 'n Oorsig van die relevante beleid en wetgewing wat die bestuur van standmere in Suid-Afrika reguleer te verskaf;
- Die huidige toestand van strandmeer bestuur in Suid-Afrika te bespreek;
- 'n Oorsig van internasionale literatuur rakende potensiële bestuursriglyne te bied;
- 'n Protokol vir die bestuur van strandmere in Suid-Afrika te ontwikkel;
- Die protokol in Suid-Afrikaanse toestande te toets; en
- Aanbevelings te maak om streeks bestuur van strandmere in Suid-Afrika te bevorder.

Die primêre uitkoms van die studie was die ontwikkeling van 'n voorgestelde Nasionale Strandmeer Bestuursprotokol, wat tans in die proses is om opgeneem te word in die Nasionale Ongewingsbestuur: Kussone Wetsontwerp. Die CAPE Estuaries Programme was ontwikkel om die voorgestelde Protokol op 'n streekskaal te toets.

Die studie bevind dat daar 'n ernstige behoefte is aan 'n meer holistiese streeksbenadering vir strandmeerbestuur. Die voorgestelde raamwerk en protokol sal egter alleenlik suksesvol wees as dit ondersteun word deur begrip van biofisiese prosesse in strandmere en struikelblokke vir bestuur op 'n plaaslike vlak.

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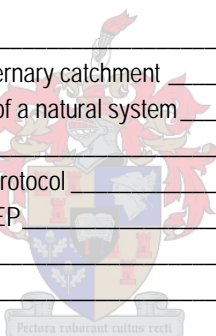
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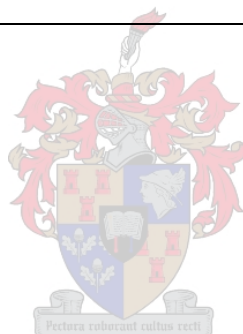
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Acronyms

<i>BIR</i>	Botanical Importance Rating
<i>CAF</i>	Consultative Advisory Forum
<i>CAPE</i>	Cape Action Plan for the People and the Environment
<i>CapeNature</i>	Western Cape Nature Conservation Board
<i>CEC</i>	Committee for Environmental Coordination
<i>CEP</i>	CAPE Estuaries Programme
<i>CERM</i>	Consortium for Estuarine Research and Management
<i>CFR</i>	Cape Floristic Region
<i>SALGA</i>	South African Local Government Association
<i>THETA</i>	Tourism and Hospitality Education and Training Authority
<i>PAETA</i>	Primary Agriculture Education and Training Authority
<i>CITES</i>	Convention on International Trade in Endangered Species of Flora and Fauna
<i>CMA</i>	Catchment Management Agency
<i>CMS</i>	Catchment Management Strategies
<i>CWAC</i>	Co-ordinated Waterbird Counts
<i>CBO</i>	Community-Based Organisation
<i>DEAT</i>	Department of Environmental Affairs and Tourism
<i>DWAF</i>	Department of Water Affairs and Forestry
<i>EAWG</i>	Estuarine Advisory Working Group
<i>ECA</i>	Estuarine Conservation Area
<i>EFR</i>	Ecological Flow Requirement
<i>EMP</i>	Estuarine Management Plan
<i>EPA</i>	Estuarine Protected Area
<i>FIR</i>	Fish Importance Rating
<i>GEF</i>	Global Environmental Facility
<i>ICARM</i>	Integrated Coastal Area and River Basin Management
<i>ICM</i>	Integrated Catchment Management
<i>ICZM</i>	Integrated Coastal Zone Management
<i>IDP</i>	Integrated Development Plan
<i>LAC</i>	Limits of Acceptable Change
<i>LMP</i>	Linefish Management Protocol
<i>LUM</i>	Land Use Management
<i>MCM</i>	Branch: Marine and Coastal Management, Department of Environmental Affairs and Tourism
<i>MAG</i>	Management Advisory Group
<i>MLRA</i>	Marine Living Resources Act (No. 18 of 1998)
<i>MoU</i>	Memorandum of Understanding
<i>MPA</i>	Marine Protected Area
<i>NEMA</i>	National Environmental Management Act (No. 107 of 1998)

<i>NEMP</i>	National Estuarine Management Protocol
<i>NGO</i>	Non-governmental Organisation
<i>NRF</i>	National Research Foundation
<i>NSBA</i>	National Spatial Biodiversity Assessment
<i>NWA</i>	National Water Act (No. 36 of 1998)
<i>NWRS</i>	National Water Resources Strategies
<i>NPA</i>	National Port Authority
<i>PSIR</i>	Pressure-State-Impact-Response
<i>RDM</i>	Resource Directed Measures
<i>RQO</i>	Resource Quality Objectives
<i>SANBI</i>	South African National Biodiversity Institute
<i>SANParks</i>	South African National Parks
<i>SDF</i>	Spatial Development Framework
<i>SEA</i>	Strategic Environmental Assessments
<i>SoE</i>	State of the Environment
<i>SWOT</i>	Strengths-Weaknesses-Opportunities-Threats
<i>WSDP</i>	Water Services Development Plan
<i>WUA</i>	Water User Associations



Chapter 1: Estuarine Management - The regional challenge in South Africa

In this introductory section a case is made for a regional approach to estuarine management to accommodate the ecological interdependency that links estuaries.

1.1 The need for a regional approach to estuarine management

In South Africa, as a result of limited resources and capacity, the governance and management of estuaries occur on an ad hoc basis, with decisions about an estuary's freshwater-flow requirements, water quality, management of living-resources, mouth management and protection status being made on a largely uncoordinated and non-strategic basis (Begg 1978, 1984; Whitfield 1998; Morant & Quinn 1999). In other words, very little proactive planning is done; problems are addressed as they occur, with little or no regard for holistic large-scale interactions between estuaries. This is true of most estuaries in South Africa but especially true of temporarily open systems, since in such systems, water levels, flow rates, residence times, waste assimilation capacity, exploitation levels and user conflicts vary considerably, depending on the status of the mouth and time of year.

Rapid industrialisation and a burgeoning population have caused a related increase in the demand for freshwater and a resultant alteration in the flow regime of many of South Africa's rivers. Estuaries are also at the receiving end of poor catchment practices, such as pollution, erosion, excessive water abstraction and impoundments. Furthermore, South Africa's coastline is very rugged, with few sheltered embayments and dominated by high-wave conditions and strong winds for most of the year. This has led to estuaries becoming the focus of coastal development (Morant & Quinn 1999). Poorly regulated activities have led to the destruction of many estuarine habitats by physical developments, such as mouth stabilisation, low-lying residential developments, canalisation, land reclamation, harbours, pollution and dredging.

Estuaries constitute one of the most heavily utilised and productive zones on our planet. Their integrative processes weave a web of complexity far out of proportion to their occupation of less than 1% of the planet's surface area (Welsh 1984). Estuarine management is a complex task, for it deals with the use and care of the interface between the land, rivers and the sea. It is a combination of terrestrial, freshwater and coastal management (UNEP/MAP/PAP 1999). It involves both catchment issues (e.g. water abstraction, erosion, water quality) and proximate issues in and around estuaries (e.g. marina and port development, bank stabilisation, fishing and bait collecting). In order to be effective, estuarine management should aim for best practice, which should be based on a sound understanding of estuarine functioning and guided by decision making protocols for the use and care of estuaries (Boyd, Barwell & Taljaard 2000). An accumulation of pressures presents a serious threat to the long-term well-being of South Africa's estuaries (Attwood, Harris & Williams 1997; Morant & Quinn 1999; Whitfield 1998; Van Niekerk & Taljaard 2003) and clearly highlights the need for a strategic approach at both a national and a regional level to cope with the various issues facing South African estuaries and the related goods and services that they provide society with.

Estuaries in South Africa include a wide variety of physical habitats, which in turn support a wide range of ecosystems and associated species. Estuarine habitats and related ecosystems form an interrelated web of life-support systems that

encompass both themselves and neighbouring terrestrial and marine habitats and ecosystems. Many estuarine species use a variety of habitats at different stages of their life cycles. Many species are explicitly dependent on different habitats in order to complete their life cycles (New South Wales Government 1992; Whitfield 1998).

Estuarine ecosystems in themselves are not independent and isolated from other external ecosystems. Rather, estuaries form part of regional, national and global ecosystems through either a direct connection via water flows (the transport of nutrients, detritus, larvae, plankton, etc.) or indirectly via the movement of estuarine fauna (e.g. Gillanders 2005; Ray 2005). The links between individual estuaries and other ecosystems may span a few hundred metres or thousands of kilometres. Hence, a disturbance to a specific estuarine ecosystem may be reflected in effects in ecosystems remote from that estuary. For example, prawns, fish and birds have been recorded as migrating over hundreds of kilometres (New South Wales Government 1992). Unfortunately, although there is ample evidence of the regional interaction and interdependence between estuaries, the management and governance of estuaries in South Africa do not reflect this critical aspect of their function.

A holistic approach for the management of estuarine-ecosystem health and productivity is required urgently. Mismanagement of river catchments or of areas adjacent to estuaries has led to a great number of impoverished systems. Almost 100 of the 250 estuaries along the South African coastline have been assessed as being in a "poor" to "fair" condition (Whitfield 1998). Similarly, the estuarine component of the National Strategic Biodiversity Assessment also states that about 25% of all estuaries are in fair condition and 15% are in poor condition (Turpie 2004c). There is thus an urgent need to ensure that the health of South Africa's estuaries does not decline further.

Until recently, there has been an almost complete failure of estuarine management authorities to consider estuaries as part of the wider catchment and adjacent coastal zone (Morant & Quinn 1999). Since 1998, estuarine management has become more integrated into catchment management as a result of the Resource Directed Measures (RDM) (i.e. Ecological Flow Requirements (EFR) or "Reserve") studies required under the National Water Act No. 36 (South Africa 1998c). However, integration into the coastal zone remains neglected. Little is known about the role that estuaries play in the functioning of immediately adjacent terrestrial environments (Morant & Quinn 1999).

1.2 Estuarine interdependence

Whereas the connectivity between the marine environment and estuaries is well documented, there is a paucity of published information on the relationship between individual estuaries in South Africa (e.g. Day 1981; Whitfield 1998; Wooldridge 1999). Intuitively, leading estuarine scientists in South Africa recognise the importance of biological interactions between estuaries in contributing to the health, productivity and overall biodiversity of these systems but the research needed to prove this is still in its infancy (Adams 2001 (pers. com.); Cyrus 2001 (pers. com.); Lamberth 2001 (pers. com.); Whitfield 2001 (pers. com.); Wooldridge 2001 (pers. com.)). The following sections highlight some of these interactions as they affect the major biological components of estuaries illustrated in Figure 1.1, such as vegetation, invertebrates, fish and birds.

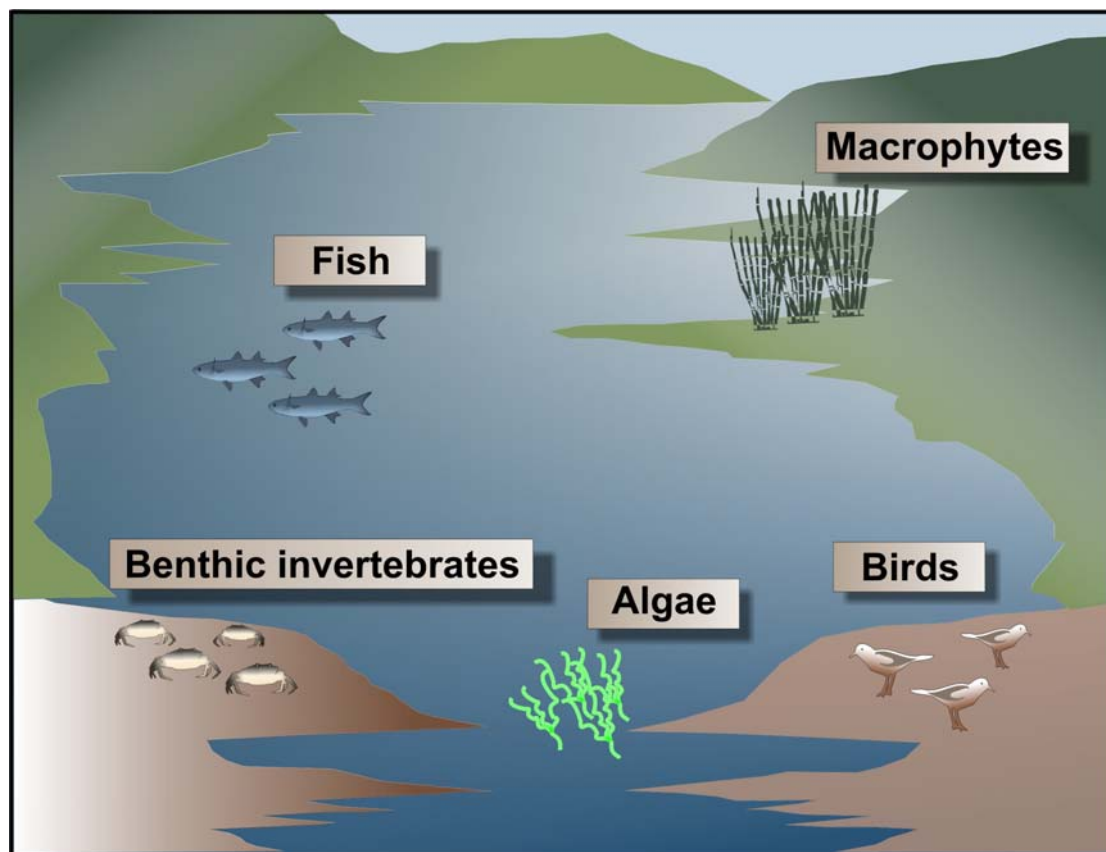


Figure 1.1 Various biotic components of estuaries

1.2.1 Vegetation

From a macrophyte perspective, the connectivity between estuaries occurs mainly in the form of mangrove-seed (propagules) dispersal via estuarine and marine currents (Steinke 1999). If submerged macrophytes (e.g. *Zostera capensis*) are removed completely from an estuary by scouring by a major flood, they can re-establish themselves either via the seeds or rhizome pieces transported by tidal currents into the estuary from an adjacent system (Adams 2001, pers. com.). This recruitment mechanism is very slow and is seldom observed, since estuarine vegetation normally sustains itself by means of large seedbanks. These lie dormant, waiting for optimum conditions before germination takes place in spring and summer (Adams, Bate & O'Callaghan 1999).

1.2.2 Invertebrates

The mudprawn *Upogebia africana* has an obligatory marine phase in its life cycle. Estuary-mouth closure, particularly for extended periods (e.g. >1 yr), disrupts this cycle and can result in the local extinction of the mudprawn (Wooldridge 1999). The recruitment of larvae does occur from the adjacent marine environment but larvae are predominantly recruited from the parent estuary, i.e. larvae from a particular estuary re-enter that system on completion of the marine phase of their life cycle (Wooldridge 1994). For example, mudprawn larvae are believed to stay in a 40 to 50 km radius of the parent estuary, depending on oceanographic conditions. This implies that, should a nearby estuary be open, cross-recruitment could occur. Wooldridge (1994; 1999; 2001, pers. com.) believes that recruitment is a localised process, with little cross-recruitment between estuaries, although this may occur if the population in a particular estuary

has been severely depleted or removed entirely. Cross-recruitment between estuaries is therefore a long and slow process. This form of recruitment is a function of the distance between individual estuaries and local wind and marine-current regimes (Wooldridge 1994, 1999). St Lucia is an example of an estuary that is so isolated that no mudprawns have been reported as occurring in the system. This is a consequence of the mouth being frequently closed and of its remoteness from other estuaries (Wooldridge 2001, pers. com.).

Small, temporarily open/closed systems are generally rich in numbers of individual species but have low species diversity. Such systems provide less access to predators and have more stable sediments, which allow populations to reach high numbers, e.g. the Mngazi Estuary. These estuaries therefore serve as important nursery areas. Marine-dominated estuaries normally have high species diversity and low species abundance, while freshwater-dominated estuaries have the lowest species diversity. This shows that the various estuaries in a region may have different functions and that the entire region should be managed with this in mind and not necessarily with the same strategy for all systems, i.e. a "one size fits all" approach is inappropriate (Wooldridge 2001, pers. com.).

1.2.3 Fish

Benefits provided by estuaries to fish include high productivity, low predation and refuge from adverse conditions in the marine environment, such as low temperature and oxygen concentrations. All these factors contribute to the more rapid growth and/or reduced mortality of estuarine fish populations (Lamberth 2004; Potter *et al.* 1990). As a result, many South African fish species are either partially or entirely dependent on estuaries to complete all or part of their life cycles (Whitfield 1998; Wallace *et al.* 1984). Many species of marine fish use estuaries as nurseries. Extended mouth closure limits access to estuaries by juvenile fish, which could have an adverse effect on the long-term viability of their populations. Similarly, fully grown fish that need to return to the sea to spawn will be prevented from doing so by protracted mouth closure. In severe cases, the numbers of fish will be greatly reduced by predation (by other fish, birds, mammals and anglers), such that, should the mouth open eventually, their numbers will be so low as to make an insignificant contribution to the adult population. Alternatively, the fish may simply die in the estuary without ever having had the opportunity to breed.

There is a high number of endemic fish species along South Africa's east coast, a high proportion of which is dependent on estuaries to complete their life cycles (Whitfield 1998). Priority should be given to the management of endemics specific to a small number of estuaries and cognisance taken of their specific biophysical requirements, e.g. the Knysna seahorse *Hippocampus capensis* (Klein Brak to Keurbooms), the Estuarine pipefish *Syngnathus watermeyeri* (East Kleinemonde, Bushmans, Kariega and Kasuka) and the Bot River klipvis *Clinus spatulatus* (Bot and Klein) (Harrison 2001, pers com.; Whitfield 1998).

Lamberth (2004) provides evidence for regional interactions between estuaries in terms of fish migration based on work done at the Breede Estuary. He states that the estuary cannot be considered separately from other estuaries in the region, as it constitutes only one component of the complex interactions between estuaries and the sea. Besides larval or juvenile recruitment, many fish species migrate into and out of the estuary as adults, while others move in and out of estuaries on a daily basis. Three species, the dusky kob *Argyrosomus japonicus*, spotted grunter *Pomadasys*

commersonii and leervis *Lichia amia*, have been tagged, released and recaptured in sufficient numbers to obtain a picture of their movement patterns. Tagging studies have provided evidence for a strong link between the Breede and adjacent estuaries and the surf zone and have highlighted the Breede's importance as habitat for both juveniles and adults on a regional and a national basis.

1.2.4 Birds

Birds, generally being near the top of the food-chain, are good indicators of the health state of an estuary. For example, mouth closure (as a result of a reduction in stream flow or poor mouth management practices) will lead to a loss of tidal action which, in turn, will adversely affect the quantity and availability of intertidal benthic organisms to waders (shorebirds), which characteristically feed on intertidal mudflats. Many of these waders are Palaearctic migrants and mouth closure can therefore have an international impact on the populations of such birds. The effects of reduced stream flow include the loss of shallow-water habitats favoured by herons, flamingos and other wading birds and the loss of islands, which provide roosts and breeding sites safe from terrestrial predators (Hockey & Turpie 1999).

Little is known about the regional movement of birds between estuaries and the carrying capacity of individual estuaries in terms of bird numbers (Turpie 1994; Turpie 2001, pers. com.). There is definitely some movement between estuaries at a seasonal scale and therefore a regional link. For example, at the Swartkops Estuary in late summer (March), there is an increase in numbers as migrant-bird species start forming large flocks by movement from smaller adjacent estuaries prior to migration. Similarly, in December at the Berg Estuary, the numbers of Palaearctic migrants change drastically as some birds move, most probably to the nearby Langebaan Lagoon. It is well known that changing water levels in the Bot Estuary result in a redistribution of birds to and from other estuaries in the surrounding region.

The Bot and Klein estuaries play an important role regionally and one of these systems should ideally be open when the Palaearctic migrants arrive in early summer to allow for exposed tidal mudflats. If the systems are closed, the birds would have to find refuge elsewhere (Turpie 1994; Turpie 2001, pers. com.).

1.3 Research aim and objectives

In South Africa, the governance and management of estuaries occur on an ad hoc basis, with decisions being made on a largely uncoordinated and non-strategic basis. While the importance of a more strategic approach is widely acknowledged, very little attention is given to regional estuarine management in South Africa. One of the reasons for the lack of a regional approach is that, to date, little compelling biophysical research emphasising the importance of a regional estuarine management approach has been undertaken. Research is required to determine the degree of interdependence or connectivity between estuaries and to inform management decision making at a regional scale. This general lack of information on estuarine interdependence requires the support of organisations such as the Consortium for Estuarine Research and Management (CERM) and National Research Foundation (NRF) to promote programmes and projects (e.g. genetic research and sonic tagging programmes) to assist in establishing the extent and scale at which these processes operate.

In view of the connectivity between estuaries in South Africa and the lack of a coordinated regional management approach, the aim of this study is: (i) to provide an overview of instruments that inform estuarine management in South Africa; (ii) to introduce the new protocol for this purpose; and (iii) demonstrate the application of the protocol.

This aim is focussed through the individual research objectives, which are to:

- Review relevant policy and legislation governing estuarine management in South Africa;
- Discuss the current status of regional estuarine management in South Africa;
- Review international literature for potentially applicable management guidelines;
- Construct a management protocol for estuarine management in South Africa;
- Apply this protocol in a South African setting; and
- Recommend improved measures for regional estuarine management.

1.4 Research methodology

The research results reported in this thesis were generated through my professional involvement with estuarine management in South Africa. As such a solid knowledge of, and access to, international and local literature sources have been maintained, from which conceptual, theoretical and policy guidance could be gleaned. Much of Chapters 2 to 4 were supported by this material. Scientific support has been obtained through personal interaction and experience with peers in the field of estuarine management – both locally and internationally and such insights are acknowledged throughout the thesis. The empirical information presented in Chapter 3 and 4 stems from direct involvement in the development and field application of the management protocol. The development work is firmly grounded in collaborative and participative work with a range of parties: scientific colleagues, academics and local and national officials involved in natural resource management and development. The results of these collaborative efforts are reported and acknowledged in this thesis.

1.5 Research design and report structure

An overview of regional estuarine management in South Africa, starting with relevant policy and legislation is presented in Chapter 2. An evaluation of the local management situation follows, before some international approaches are analysed for comparison. This background then supports the development of a protocol for national estuarine management in South Africa. Case studies at the regional (Cape Floral Region (CFR)) and local (Bot and Klein estuaries) scales are used to demonstrate the application of the protocol in Chapter 4. Summarised findings, conclusions and management recommendations arising from this study are presented in Chapter 5.

Chapter 2: South African Regional Estuarine Management

The planning framework within which an efficient protocol for sustainable natural resource management may be designed, needs to be informed by: the reigning political doctrine embedded in policy and legislative frameworks at various spatial levels of governance; the status of the management system currently in place; and international examples to provide comparative benchmarks. These three themes are explored in this chapter.

2.1 Estuarine policy and legislation

A major constraint to the effective management of South Africa's estuaries is the fragmentation of and overlap in legislation. To illustrate the fragmented nature of legislation, a list of international conventions, national policies and legislation relevant to estuarine management in South Africa is provided in Appendix A. The majority of environmental legislation is aimed at providing guidance for the management and control of specific types of activities and/or developments posing threats to the goods and services provided by the natural environment (including estuaries).

The statutory or legal framework for governance consist of several levels (Van Niekerk & Taljaard 2003):

- *Principles* which state society's values in relation to a specific issue, for example the Water Law Principles (DWA 1996);
- *Policy* as a statement of intent by the national government in which it indicates how compliance with principles will be ensured, for example the White Paper on the Water Policy (South Africa 1997);
- *Legislation* is the primary tool of Government for implementing policy. It provides details as to how policy objectives will be implemented and enforced, for example the National Water Act (NWA) No. 36 (South Africa 1998c); and
- *Regulations* which provide the quantitative details relating to specific legislation (e.g. Water use authorisation process for individual applications (DWA 2000)).

2.1.1 International conventions

A number of international conventions and treaties form the basis from which the principles and policies that govern estuarine management in South Africa are derived. The following are some of the international conventions and treaties pertinent to estuarine management in South Africa:

- Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (GPA) (1995);
- United Nations Convention on Biological Diversity (1992);
- Agenda 21 (1992);
- United Nations Framework Convention on Climate Change (1992);
- Convention on the Protection, Management and Development of the Marine and Coastal Environment of the East African Region (Nairobi Convention) (1985);
- United Nations Convention on the Law of the Sea (UNCLOS) (1982);
- Convention on the Protection, Management and Development of the Marine and Coastal Environment of the West and Central African Region (Abidjan Convention) (1981);
- Convention of Migratory Species of Wild Animals (Bonn Convention) (1979);

- International Convention for the Prevention of Pollution from Ships (MARPOL) (1973/1978);
- United Nations Environmental Programme (UNEP) (1972);
- Convention Concerning the Protection of the World Cultural and Natural Heritage (World Heritage Convention) (1972);
- London Convention for the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (1972, amended 1978, 1980, 1989); and
- Convention on Wetlands of International Importance especially Waterfowl Habitat (Ramsar) (1971);
- International Convention relating to Intervention on High Seas in cases of Oil Pollution (1969).

Some of the above-mentioned international conventions are directly applied to estuaries (e.g. Convention on Wetlands of International Importance especially as Waterfowl Habitat (the Ramsar Convention)), while the others form the basis for policy and legislation (e.g. United Nations Convention on Biological Diversity which provided the impetus for the White Paper on Sustainable Use of South Africa's Biological Diversity (1997) and the National Environmental Management: Biodiversity Act (South Africa 2004).

2.1.2 Policy

A significant number of policies, in the form of White Papers, may influence estuarine health or include estuaries in their potential sphere of application. The following are some of the policy instruments that should be considered in the management of estuaries:

- White Paper on Spatial Planning and Land-use Management (2001);
- White Paper on Integrated Pollution and Waste Management for South Africa (2000);
- White Paper for Sustainable Coastal Development in South Africa (2000);
- White Paper: A Minerals and Mining Policy for South Africa (1998);
- White Paper on Sustainable Use of South Africa's Biological Diversity (1997);
- White Paper on Water Policy in South Africa (1997);
- White Paper on a Marine Fisheries Policy for South Africa (1997);
- White Paper on Environmental Management Policy (1997); and
- White Paper on the Development and Promotion of Tourism in South Africa (1996).

The above mentioned policies have mostly been encapsulated, or are in the process of being drafted (e.g. White Paper for Sustainable Coastal Development in South Africa), in the legislation relevant to estuarine management listed in Section 2.1.4.

2.1.3 The South African Constitution

The Constitution (South Africa 1996a) is the supreme law of the land and provides the legal framework for legislation regulating environmental management in general. It emphasises cooperative governance and the need to devolve management functions to the lowest sphere of government able to undertake them. The Constitution is the statute against which all other South African laws (both statutory and common law) must be measured. To the extent that other laws are in conflict with it, they will be invalid (South Africa 1996a).

The most pertinent fundamental right pertaining to estuaries management is the environmental clause in the Bill of Rights (section 24), which provides that:

"Everyone has the right

- a) to an environment that is not harmful to their health or well-being; and*
- b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that –*
 - i) prevent pollution and ecological degradation;*
 - ii) promote conservation; and*
 - iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.."*

2.1.4 South African legislation pertaining to estuaries

The most pertinent legislation (i.e. that which regulate activities affecting estuaries) focuses on three key management areas:

- Land-use and infrastructure development;
- Water quality and quantity; and
- Exploitation of marine living resources.

The relevant aspects need to be teased out from the statutes to establish how various estuarine management measures are to be guided by this legislation.



2.1.4.1 Land-use and infrastructure development

Seven bills or acts are pertinent to land-use and infrastructure development and are dealt with here.

(i) National Environmental Management: Coastal Zone Bill

Policy dealing with the management and control of land use and infrastructure, as far as it pertains to estuaries, is dealt with primarily in the Policy for Sustainable Coastal Development in South Africa (South Africa 2000b). This will ultimately be given legal status through the National Environmental Management: Coastal Zone Bill (to be referred to as the Coastal Zone Bill) to become enacted in the near future. The lead agent is the Department of Environmental Affairs and Tourism (DEAT). The Bill sets out coastal management principles to guide public-sector decision making and ensure the conservation of the coastal zone, including estuaries. It promotes the equitable redistribution of the benefits flowing from the coastal zone. The Bill defines the legal status of coastal public property and sets out procedures for demarcating areas within coastal zones.

The Bill also promotes the integrated management and planning of coastal resources (including estuaries) to ensure that development is sustainable. It establishes a national monitoring and information system to facilitate the coordinated monitoring of the health and use of coastal ecosystems (although this is not as clear in the fourth draft of the Bill). The

Bill also controls the discharges of effluents, wastes and other pollutants into coastal public property and dumping at sea to improve ecosystems and human health and give effect to South Africa's international obligations.

The current version (11) of the Bill includes a reference to the fact that estuaries will be managed according to the National Estuarine Management Protocol (NEMP) to which Chapter 3 of this thesis is dedicated.

(ii) *National Environmental Management Act (NEMA)*

NEMA No. 107 (South Africa 1998b) aims to a) give effect to the section 24 right contained in the Constitution; b) create an enabling framework for governance in the environmental sector; and c) give effect to the environmental principles (e.g. "polluter pays" and "precautionary principle") in the White Paper on Environmental Management. The Act provides that "sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, (and) wetlands ... require specific attention in management and planning procedures, especially where they are subject to significant human resources usage and development pressure".

NEMA further requires that all national departments identified in the Act prepare either an environmental implementation plan (e.g. Department of Water Affairs and Tourism (DWA) and DEAT) or an environmental management plan (e.g. the Department of Land Affairs) or both. It requires DEAT to be the lead agent in ensuring the effective custodianship of the environment (Smith & Cullinan 2000).

The regulations for the control of vehicles in the coastal zone in terms of section 44 of NEMA aim to prohibit the off-road use of vehicles on the coast for recreational purposes. Vehicle use will be permitted only in approved, demarcated areas for boat launching and in recreational-use areas. The implementation and enforcement of the regulations will largely eliminate the damage to sensitive coastal ecosystems, such as estuaries, resulting from off-road vehicle use.

(iii) *Environment Conservation Act*

Although many of the provisions of the Environment Conservation Act No. 73 (South Africa 1989) have been repealed by NEMA, the *Environmental Impact Assessment (EIA) regulations* (implementing sections 21, 22 and 26 of the Act) remain in force until they are replaced with new regulations under NEMA. A guideline document on the EIA regulations was published in April 1998 by DEAT (South Africa 1998d). Activities in estuaries that would require an impact assessment include the construction or upgrade of marinas, harbours and all structures below the high-water mark of the sea, changes in land use from agriculture or undetermined to any other use and the reclamation of land below the high-water mark of the sea and inland waters, including wetlands. The EIA regulations have an important role to play in protecting ecologically sensitive areas such as estuaries. They are, however, administered by provincial authorities at present, which, in effect, excludes local authorities (with more direct knowledge) from the decision making process.

New Environmental Impact Assessment (EIA) regulations were published on 21st April 2006 under Chapter 5 of the National Environmental Management Act (NEMA, Act 107 of 1998). The regulations commenced on 3rd July 2006. Government Notice No. R. 385 defines the process to be followed and the delegation of authority under NEMA (South Africa 2006a). Activities and competent authorities identified in terms of section 24 of NEMA that require a Basic

Assessment as defined in regulations 22 to 26 (South Africa 2006b) are listed in Government Notice No. R.386. These include activities such as dredging, excavation, infilling and removal of soil from an estuary. Government Notice No. R.387 lists activities identified in terms of section 24 of NEMA that require scoping and environmental assessment (i.e. a "full EIA") in terms of regulation 27 to 36 (South Africa 2006c). These include, for example, development activities which exceed 20 hectares or more, and construction or earth moving activities in the sea or within 100m inland of the high water mark. The regulations are especially pertinent to estuaries as they are rapidly expanding development nodes along the South African coast and are under tremendous pressure from human activities.

(iv) National Environmental Management: Biodiversity Act

The objective of the National Environmental Management: Biodiversity Act No. 10 (South Africa 2004) is to provide for the conservation of biological diversity, the protection of species and ecosystems, the regulation of the sustainable use of biological resources and the assurance of a fair and equitable sharing of the benefits arising from the use of genetic resources. The Act also provides for cooperative governance in biodiversity management and conservation and the establishment of the South African National Biodiversity Institute (SANBI). The Act confirms the state as the custodian of South Africa's biological diversity, committed to respecting, protecting, promoting and fulfilling the constitutional rights of its citizens. The lead agent is the DEAT.

The Act recognises that South Africa is party to the Convention on Biological Diversity, the Convention on International Trade in Endangered Species of Flora and Fauna (CITES), the Convention on Wetlands of International Importance especially Waterfowl Habitat (the Ramsar Convention) and the Convention on Migratory Species. It requires the identification of landscapes and their natural processes, of ecosystems and ecological processes and of species important for the conservation of biological conservation. It also requires the establishment of monitoring procedures to determine the status and trends of such features. The Act provides for a national classification system for protected areas and for the proclamation and deproclamation of protected areas. The Act also calls for the management and control of alien, exotic and invasive species.

Section 43 calls for the establishment of biodiversity management plans. In terms of the provisions of the Act, any person, organisation or organ of state can submit a draft biodiversity management plan for an ecosystem of an individual species to the National Minister for approval. If the Minister approves the plan, the Minister must publish a notice in the Government Gazette that will indicate the manner of the implementation of the plan and assign responsibility of the implementation of the plan. Where a specific estuary of biodiversity significance or a specific estuarine species is under threat, a biodiversity management plan is a tool that can be used to outline a protection plan and assign responsibilities for implementing the plan. The biodiversity management plan entitles organs other than those of the state to be delegated protection responsibility.

(v) National Environmental Management: Protected Areas Act

The National Environmental Management: Protected Areas Act No. 57 (South Africa 2003) provides, within the framework of NEMA, for the declaration and management of a national system of protected areas in South Africa as part of a strategy to manage and conserve its biodiversity and provide for a representative network of protected areas on

state land, private land and communal land. In addition, the Act promotes the sustainable utilisation of protected areas for the benefit of people and participation of local communities in the management of protected areas. The Act also gives effect to international agreements on protected areas that are binding on South Africa and provides for cooperative governance in the declaration and management of protected areas. The lead agent is DEAT.

The Protected Areas Act allows for the declaration of Protected Areas by the National Minister or the relevant Provincial Minister. The Act applies to terrestrial and marine areas. Three main types of protected areas can be invoked:

- *Special nature reserves* intended for highly sensitive environments or areas important for scientific research;
- *Nature reserves* proposed for the protection of significant natural features, biodiversity, areas of specific interest, areas in need of long-term protection, areas to provide for a sustainable flow of natural goods and services, areas to enable the continuation of traditional consumptive uses and areas to provide for nature-based recreation and tourism opportunities; and
- *Protected environments* planned for buffer zones for the protection of a special nature reserve, world heritage site or nature reserve, collective action by landowners to conserve biodiversity, areas sensitive to development, a specific ecosystem outside a special nature reserve, world heritage site or nature reserve and ensuring the sustainable use of natural resources.

Where estuaries and their surrounding areas require protection one or the three forms of protected areas could be considered. Once an area has been proclaimed as a protected area, a management authority can be appointed. Management of that area must be in accordance with the purpose for which the protected area was declared.

(vi) *Local Government: Municipal Systems Act*

The legislative context for municipal planning is provided by the Local Government: Municipal Systems Act No. 32 (South Africa 2000a). Chapter 5 of this Act deals with Integrated Development Planning, which requires that each local authority adopt a single, inclusive plan for the development of that municipality. An Integrated Development Plan is intended to encompass and harmonise planning over a range of sectors, such as water, transport, land use and environmental management. The Development Facilitation Act No. 67 (South Africa 1995) requires the setting of Land Development Objectives. The principles of this Act have also been incorporated into Chapter 5 (s. 23 (l)) of the Municipal Systems Act. The Local Government Transition Second Amendment Act No. 97 (South Africa 1996b) also requires that all municipalities, both Transitional Local Councils (TLCs) and District Councils, draw up Integrated Development Plans (IDPs) for the integrated development and management of their areas of jurisdiction. The requirements of this Act have largely been incorporated in the Municipal Systems Act, which is currently driving the establishment and implementation of IDPs. The lead agent for the above-mentioned acts is the Department of Provincial and Local Government.

The management of activities that potentially could affect the health of South Africa's estuaries needs to be explicitly addressed in the IDPs of coastal municipalities.

(vii) *Sea-shore Act*

The *Sea-shore Act No. 21* (South Africa 1935) provides that ownership of the seashore and the sea (which includes some estuaries that fall within the definition of tidal lagoons or rivers) vest in the state insofar as it was not in private ownership before the commencement of the Act. All provisions of the Act have been assigned under section 235(8) of the Constitution to the four coastal provinces, except for the regulation of the seashore and the sea within ports and harbours. This Act is to be repealed in its entirety under the Coastal Zone Bill.

2.1.4.2 Activities affecting water quantity and quality

(i) *National Water Act (NWA)*

In estuaries, water quantity and quality related issues are dealt with mainly under the NWA No. 36 (South Africa 1998c). The Act's purpose is to ensure that South Africa's water resources are protected, used, developed, conserved, managed and controlled with due cognisance of factors such as basic human needs, the protection of aquatic and associated ecosystems and their biodiversity, the facilitation of social and economic development, the promotion of the efficient, sustainable and beneficial use of water, the reduction and prevention of pollution, the meeting of international obligations, the redress of past discriminations and the management of floods and droughts.

The Act has a wide definition of water use and covers abstraction, consumption and discharge but focuses primarily on the use of water resources. The Act requires anyone wishing to use water to apply for a licence to do so. The Act prescribes a two-tier approach to the development of water resource management strategies, namely the National Water Resources Strategies (NWRS) and the Catchment Management Strategies (CMS). The CMS allows for public participation by providing for the establishment of water-management institutions. The NWRS (DWA 2004a) provides for the integration of water resources management and cooperative governance. It requires the determination of the interrelationship among institutions involved in water resources management and promotes the management of catchments within a water management area in a holistic and integrated way.

Both the NWRS and CMS incorporate concepts such as ecological water requirements (the ecological "Reserve"), social and economic requirements (a Reserve for basic human needs), requirements for integrated resource management and the class of a water body being managed (i.e. an integrated measure of quantity). The Act provides detailed guidelines and protocols to derive Resource Quality Objectives (RQO) for the protection of aquatic ecosystems (i.e. guidelines for water quality, water quantity, habitat integrity and the biotic integrity for rivers, wetlands, estuaries and groundwater). The Act is currently by far the most important statute relating to the control of water resources in South Africa and therefore has a major impact on the effective management of estuaries.

The Act, by means of the RDM procedures, addresses regional management via catchment management. It sees estuaries as receiving bodies and strives through sound catchment management practices to allocate the necessary freshwater to an estuary to allow for ecosystem functioning to the level of its desired protection status. This could be between an A (pristine) and D (degraded) class (Weston 2001, *pers. com.*). Unfortunately, the majority of flow requirement assessments (under the auspices of the RDM procedures) are conducted on individual estuaries and do not

include an assessment of the health of the adjacent estuaries or the impact of the reduction of the health status of an individual system on the ability of a region to provide the goods and services that society depends upon.

(ii) Water Services Act

The key focus of the *Water Services Act 108 of 1997* (South Africa 1997) is to develop a regulatory framework within which water services can be provided and to establish water service institutions and define their roles and responsibilities. Water quality impacts on a water resource (e.g. estuaries), for example as a result of infrastructure deterioration, are to be linked to the NWA through the drafting of Water Services Developments Plans (WSDP) (Weston 2005, *pers. com.*).

(iii) Prevention and Combating Pollution of the Sea by Oil Act

DEAT also plays a significant role, as there are additional acts that relate to the protection of water quality, e.g. the *Prevention and Combating Pollution of the Sea by Oil Act No. 6* (South Africa 1981), which requires that contingency plans be in place to protect estuaries in the event of oil spills at sea.

2.1.4.3 Activities affecting exploitation of living resources

Marine Living Resources Act (MLRA)

The management and control of living resources in estuaries falls primarily under the MLRA No. 18 (South Africa 1998a). The lead agent in the management and control of living resources in estuaries is DEAT. The primary purpose of the MLRA is to protect marine living resources (including those of estuaries) through establishing sustainable limits for the exploitation of resources; declaring fisheries management areas for the management of species; approving plans for their conservation, management and development; prohibit and control destructive fishing methods and the declaration of Marine Protected Areas (MPAs).

The MLRA overrides all other conflicting legislation relating to marine living resources. This resulted in some provincial and local legislation providing for the effective protection of living resources being superseded before proper protection measures were put in place under the new Act. This situation resulted in some estuaries becoming vulnerable to overexploitation of, for example, bait species such as prawns.

Although DEAT is ultimately responsible for administering and enforcing the MLRA, the primary administrative role in enforcing the Act is undertaken by the Branch: Marine and Coastal Management (MCM). This has fragmented the enforcement capacity between national government (DEAT and the MCM) and local authorities or provincial governments that exercise jurisdiction over a particular estuary but not the marine living resources or shore (Smith & Cullinan 2000).

2.2 Defining management boundaries

To manage an estuary, it is necessary to define the spatial boundaries of the area that is to be managed. This can be done from a scientific, legal or administrative perspective as the subsections below explain. In deciding on a working definition for estuarine management, one should bear in mind that, although scientific opinion should inform legal and administrative decision making, its operational implementation is often technically too complicated to allow for clear, unambiguous management boundaries (Van Niekerk & Taljaard 2003).

2.2.1 Scientific definition of an estuary

In international literature, an estuary is defined as a semi-enclosed coastal body of water which has a free connection with the open sea and within which sea water is measurably diluted with freshwater derived from land (Cameron & Pritchard 1963; Pritchard 1967).

South Africa's estuaries are relatively small in comparison with those of the northern hemisphere and the mean annual runoff (MAR) of South African rivers is more variable, fluctuating between floods and extreme low to zero river inflow. This combination of small size and low runoff, coupled with extreme environmental conditions, such as droughts, has led to a number of different definitions for South African estuaries (Day 1980; Heydorn 1989). The most comprehensive definition for a South African estuary is outlined in the South African National Report (CSIR 1992:43) for the United Nations Conference on the Environment and Development held in Rio de Janeiro in June 1992 which reads: "That in South Africa an estuary is considered to be that portion of a river system which has, or can from time to time have, contact with the sea. Hence, during floods an estuary can become a river mouth with no seawater entering the formerly estuarine area. Conversely, when there is little or no fluvial input an estuary can be isolated from the sea by a sandbar and become a lagoon which may become fresh, or hypersaline, or even completely dry".

2.2.2 Legal definition of an estuary

According to the NWA (South Africa 1998c, Chapter 1), an estuary is defined as "a partially or fully enclosed water body that is open to the sea permanently or periodically, and within which the seawater can be diluted, to an extent that is measurable, with freshwater drained from land."

Chapter 1 of the Sea-shore Act No. 21 (South Africa 1935) refers to an estuary as a tidal river or lagoon and defines it as follows: "Tidal lagoon" means "any lagoon in which a rise and fall of the water level takes place as a result of the action of the tides" and "tidal river" means "that part of any river in which a rise and fall of the water level takes place as a result of the action of the tides."

Chapter 1 of the MLRA (South Africa 1998a) also refers to an estuary as a "tidal river" without explicitly stating the definition. The Regulations under the MLRA, however, refer to the definition as provided in the Sea-shore Act.

According to Smith & Cullinan (2000), the primary criticism of the definitions of tidal lagoon and tidal river is that neither of these takes into account the situation where the body of water, as defined, is closed or otherwise cut off from the sea.

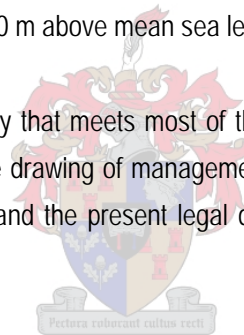
From the list of definitions provided above, that of the NWA provides the most appropriate legal definition of an estuary, as it makes provision for a number of South African estuarine conditions, e.g. temporarily closed estuaries or systems that are not tidal but do experience the mixing of saline and freshwater (Van Niekerk & Taljaard 2003).

2.2.3 Administrative boundary

Legislation, including the NWA, lacks formal criteria for delineating the administrative boundary of an estuary. This is a critical requirement in order to achieve cooperative management among the various national, regional and local authorities (Van Niekerk & Taljaard 2003). Although the RDM methods for estuaries issued under the NWA (DWA 2004e:pp 8) do provide such criteria, these are not legally binding and, in their present format, serve solely as guidelines. The criteria are:

- Seaward boundary is the estuary mouth (although there are systems where the biological functional estuary often extends to the nearshore marine environment, which means that this boundary definition may need to be reconsidered in future);
- Upper boundary is the extent of tidal influence, i.e. the point up to where tidal variation in water levels can still be detected or the extent of saline intrusion, whichever is furthest upstream; and
- Lateral boundaries along the banks at the 5.0 m above mean sea level (MSL) contour.

The most unambiguous administrative boundary that meets most of the criteria for effective management, even in the absence of detailed scientific information, is the drawing of management boundaries on the 5.0 m above MSL contour. This encompasses both the present scientific and the present legal definition and can be easily obtained from the 1:10 000 South African Orthophoto map series.



2.3 Status of regional estuarine management

In order to provide an overview of the current state of affairs which has resulted in the relatively poor management of South Africa's estuaries, this section highlights the reasons for the uncoordinated nature of estuarine management and then presents examples of current practices.

The majority of estuarine studies currently conducted for research or management purposes do not take cognisance of the regional interaction between estuaries. Reasons accounting for this state of affairs include the fact that:

- RDM methods (i.e. Reserve or EFR) focus on individual estuaries;
- Assessment of the interactions between estuaries and the marine environment is not required by legislation;
- Narrowly focused terms of reference for studies to address specific issues; and
- No methods for assessing cumulative effects have been developed for application to estuaries in South Africa.

To address the management challenge a limited number of national and regional-scale assessments that incorporate elements of a regional approach have been developed recently, of which the most pertinent are:

- Prioritisation of South African estuaries (Turpie 2002, 2004b);
- National Spatial Biodiversity Assessment: Estuaries Component (Turpie 2004c);

- Wild Coast Biodiversity Assessment (Turpie 2005b);
- Botanical Importance Rating (Coetzee, Adams & Bate 1997; Colloty 1999; Colloty, Adams & Bate 1998); and
- Fish Importance Rating (Maree, Whitfield & Quinn 2003).

2.3.1 Reasons for uncoordinated estuarine management

2.3.1.1 Narrow focus of Resource Directed Measures

EFR studies to define the freshwater "Reserve" for estuaries (conducted as part of the RDM procedures under the National Water Act No. 36 (NWA) (South Africa 1998c)) do not recognise explicitly the connectivity between estuaries in a region (DWAF 2004e). I have been involved (either as project manager or as hydrodynamics specialist) in all the "Reserve" studies conducted in South Africa since 1998, e.g. Breede, St Lucia, Orange, Tsitsikamma, Mdloti and Mhlanga, and none of them directly addressed the connectivity between adjacent estuaries and the regional ecological impacts of flow modifications (DWAF 2002, 2003a, 2003b, 2004b, 2004d). At most, this aspect might be addressed as a part of determining the "Functional importance" of an estuary, e.g. the Olifants Estuary is the only viable nursery area on a 400 km stretch of coastline and is therefore of "Very high importance" (DWAF 2006). The "Functional importance", an aspect of the overall ecological importance of the estuary, together with its current health status, is used to determine the "Recommended Ecological Category" or "Desired State" of an estuary. An estuary's importance status will influence the choice of management class and hence the freshwater allocation under the NWA. The RDM methods for estuaries do not have any explicit guidelines for dealing with the connectivity between estuaries in a region or assessing accumulative regional impacts.

2.3.1.2 Negation of marine environment interaction

The NWA (South Africa 1998c) does not recognise the marine environment as a receiving environment for freshwater flows and there is no recognition of the freshwater requirements of the marine environment and the link between the land and sea. Reducing freshwater flows to the marine environment impacts on the marine habitat directly (Gillanders & Kingsford 2002; Strydom, Whitfield & Wooldridge 2003; Van Ballegooyen *et al.* 2006), which in turn impacts on the health of estuarine-dependent and associated species that utilise the surf zone and nearshore marine environment. This reduction in the health of marine habitats contributes to the general decline in estuarine health status associated with freshwater modifications. The only example of a catchment-to-coast study in South Africa is the Thukela Reserve study (DWAF 2004c).

2.3.1.3 Narrowness in terms of reference

In general, most estuarine assessments and studies suffer from very narrow terms of reference. Research (especially field-data collection) is costly and clients require only explicit questions answered, e.g. the impact of a golf-estate development on an estuary or a dam development on a specific estuary. Holistic aspects, such as regional-scale interactions, are seen as being of secondary importance and are therefore not funded. For example, a strategic environmental assessment conducted on planned expansions at the port of Richards Bay did not include detailed evaluations of the impacts on the Mhlathuze Estuary, even though the Mhlathuze Sanctuary area is adjacent to the development and some of the future expansion plans will impact on the mangroves of the system (CSIR (in prep.)).

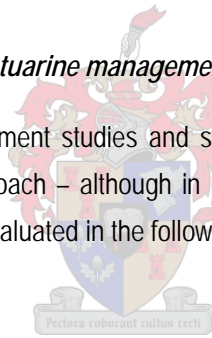
2.3.1.4 Lack of cumulative assessment accounting

No cumulative assessment is done on the impact of multiple activities on the same system or in a region. In most studies, it is implicitly assumed that all other anthropogenic variables (e.g. mouth management, local developments and recreational fishing pressures) will remain stable and that only the issues under investigation (e.g. flow modification) will change. An excellent example is the Orange River Reserve study that was conducted at the request of DWAF (South Africa) and the Department of Water Affairs (Namibia) (DWAF 2003c). During this same period, Namdeb (a Namibian diamond-mining company) evaluated the effect of expanding seawards the mining operation on the Namibian side of the estuary (CSIR 2003). In both cases, the consultant explicitly requested the clients to add to the study brief an assessment of the potential cumulative impact of these proposed developments on the Orange River Estuary and was repeatedly assured that “this was not a requirement at this stage of the investigations”.

The cumulative impacts of the planned mining activities, flow reductions and various mouth management practices at the Orange Estuary are interactive and the resulting synergy can have severe consequences on the future health of the estuary. As a single impact, none of these development scenarios was rated as a “severe risk” to the estuary’s future health but, collectively, these impacts may well represent the “No go” option for some of the future developments in the region.

2.3.2 South African examples of regional estuarine management approaches

Several examples of recent estuarine management studies and studies to develop estuarine indices have begun to incorporate the idea of a holistic regional approach – although in no instance is any one of these studies sufficiently comprehensive. Some of these examples are evaluated in the following subsections.



2.3.2.1 Prioritisation of South Africa’s estuaries

As part of an assessment of the conservation priority status of estuaries for use in management and water allocation South Africa's approximately 250 estuaries were ranked based on the collation of existing data for all South African estuaries (Turpie *et al.* 2002; Turpie 2002, 2004b). Estuaries were ranked in terms of their size, type, biogeographical zone, habitats and biota (plants, invertebrates, fish and birds). Thirty-three estuaries are currently under formal protection but they are not representative of all estuarine biodiversity. Turpie *et al.* (2002) performed a complementary analysis, incorporating data on abundance, where available, to determine the minimum set of estuaries that includes all known species of plants, invertebrates, fish and birds. In total, 32 estuaries were identified as “required protected areas”, including 10 that are already protected. This strategic approach to conservation planning incorporates some regional elements in its assessment, although it has some bias towards larger systems due to the incorporation of size (as proxy for lack of abundance data on most systems) as a variable.

2.3.2.2 Wild Coast Conservation Planning Project

As part of the Wild Coast Conservation Planning Project, the researcher conducted a desktop evaluation of the sensitivity of Wild Coast estuaries to river inflow. The study indicated that coastal processes (e.g. sediment availability at the mouth and wave energy) were fairly uniform and that systems grouped into large to medium-sized, permanently

open estuaries and medium to small, temporarily open/closed systems in two biogeographical regions (Van Niekerk 2005). Turpie (2005b) selected a total of 14 Estuarine Protected Areas (EPAs) and 20 Estuarine Conservation Areas (ECAs) on the basis of: 1) inclusion of nationally targeted EPAs; 2) biogeographical representivity and spatial relationships; 3) representation of estuary types; and 4) conservation importance status. There were two main clusters: Pondoland estuaries and southern Wild Coast estuaries, with a scattering of systems in between. EPAs comprise six temporarily open and seven permanently open estuaries and one river mouth and are concentrated along the northern part of the coast. ECAs comprise 12 temporarily open and eight permanently open estuaries.

The selected EPAs and ECAs became the nuclei around which most of the river and terrestrial conservation efforts were focused. This study represents a good example of estuarine and biodiversity management at a regional scale, as it included marine, freshwater and terrestrial components in its analyses (Reyers & Ginsburg 2005).

2.3.2.3 National Spatial Biodiversity Assessment: Estuaries Component

The Estuaries Component of the National Spatial Biodiversity Assessment (NSBA) had some regional focus. Most estuaries were evaluated against the occurrence or distribution of the three major biogeographical regions of South Africa (Turpie 2004c). Turpie (2004c) found that the overall health of South African estuaries was relatively good and estimated that a total of 28% of estuaries is considered in excellent, 31% in good, 25% in fair and 15% in poor condition (see Table 2.1).

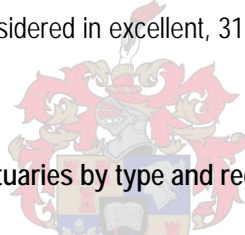


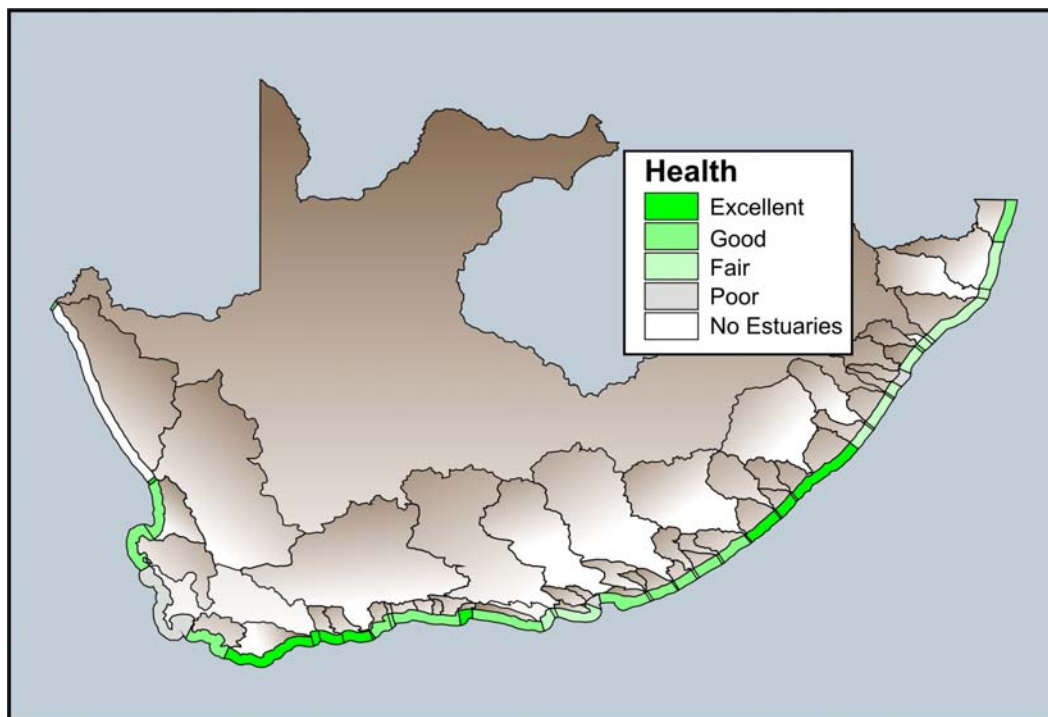
Table 2.1 Summary of the health status of estuaries by type and region

BIOGEOGRAPHICAL REGION	HEALTH CATEGORY				TOTAL
	EXCELLENT	GOOD	FAIR	POOR	
Cool Temperate	1	1	4	5	11
Warm Temperate	34	55	23	15	127
Subtropical	38	25	39	19	121

(Source: Turpie 2004c)

Turpie (2004c) indicated that the south and south-east coast estuaries tend to be the healthiest as Figure 2.1 indicates. The health status was also relatively good for the larger systems on the west coast and in northern KwaZulu-Natal. In contrast, estuaries tend to be in fair to poor health along the intensively developed areas of the Cape south-west coast, around Port Elizabeth and along almost all of the KwaZulu-Natal coast.

As a general trend, estuaries fed by larger catchments tend to be in poorer health than estuaries in adjacent smaller catchments (Turpie 2004c). This is largely due to the fact that estuaries in smaller catchments have generally been subjected to fewer human pressures than those in larger catchments. In the latter case, the estuaries themselves are usually larger, thus attracting more coastal development, and the catchments are more pressured in terms of water abstraction.



(Source: Turpie 2004c)

Figure 2.1 Average state of health of estuaries per quaternary catchment

Turpie (2004c) also found that the overall level of protection of South African estuaries is very low. Of the 41 estuaries that are included within protected areas, only 14 (5.4%) are considered to have a “high level of protection”. Moreover, the majority of these are very small estuaries. This contrasted sharply with the national target for the NSBA of 30% of estuaries protected at a high level. Indeed, as estuaries differ substantially in functionality, it was proposed that 30% of all estuarine types (e.g. a permanently open, estuarine lake) should be protected in each biogeographical zone. Against these criteria, all but two groups (i.e. warm, temperate river mouths and subtropical estuarine lakes) have no or low levels of protection. A shortcoming of this desktop analysis was that it was also done only on the number of estuaries included for each biogeographical zone and that no evaluation was done of the “total estuarine area protected” or of the viability of protecting a specific estuary.

2.3.2.4 Botanical Importance Rating

The Botanical Importance Rating (BIR) index for South Africa’s estuaries assigns values on the basis of percentage area cover, condition (degree of impact), functional importance and plant-community richness (Coetzee, Adams & Bate 1997; Colloty 1999; Colloty, Adams & Bate 1998). The BIR is calculated by the formula: *Botanical importance = Functional importance + Species richness + Community richness + Sum of habitat-rarity scores of each plant-community type present*, where functional importance is based on the area and number of different plant-community types and their contribution in the form of energy input (i.e. primary productivity). The functional importance formula includes all estuarine plant-community types, namely mangroves, salt marshes, submerged macrophytes, reeds and sedges, swamp forests, benthic microalgae and phytoplankton. Average primary productivity values were calculated from available South

African literature (Colloty, Adams & Bate 2000). Species richness is the number of plant species identified for a specific estuary and community richness is the number of plant-community types. For plant-community type rarity, a weight was assigned to the six least common community types found in South Africa. For example, if a community type occurs only once, it receives a score of one. If a community type is found in 20 estuaries, it receives a weight of 1/20. The weights of each community type found in each estuary are then summed to obtain a final score.

The functional importance rating of an estuary took cognisance of the proximity of an estuary to other estuaries in the region and allocated a higher score to estuaries further apart from each other, i.e. the assumption was made that estuaries may recruit from each other, although this has not been verified by empirical research (Adams 2001, pers. com.).

2.3.2.5 Fish Importance Rating

Maree, Whitfield and Quinn (2003) developed a Fish Importance Rating (FIR) for South African estuaries. This index is constructed from seven weighted measures that are considered to reflect the importance of estuaries to estuarine-associated fish (see Table 2.2). Scores are allocated to criteria, with positive factors being allocated higher scores than factors that influence fish communities negatively.

Table 2.2. Criteria used to evaluate importance of estuaries for fish

MEASURES OF SPECIES IMPORTANCE			MEASURES OF ESTUARINE IMPORTANCE			
Number of exploitable species	Number of estuarine-dependent species	Number of endemic species	Estuarine type: <ul style="list-style-type: none"> • Estuarine bay • Permanently open • Estuarine lake • Temporarily open • River mouth 	Estuarine area: <ul style="list-style-type: none"> • Large to • Small 	Estuarine condition: <ul style="list-style-type: none"> • Excellent • Good • Fair • Poor 	Estuarine isolation: <ul style="list-style-type: none"> • Isolated • Grouped

(Source: Maree, Whitfield & Quinn 2003)

Maree, Whitfield & Quinn (2003) compiled a presence-absence database of estuarine fish species for 251 estuaries, based on their distributions around the South African coast. The estuarine measures are included in the FIR, as the variables are assumed to affect fish abundance and are used as substitute for the lack of quantitative data. The degree of isolation or connectivity to adjacent estuaries in the region was seen as an important factor contributing to the overall importance of an estuary.

2.4 International estuarine management approaches

To ensure that the South African management approach is aligned with those being developed and implemented in the international arena, two other international estuarine management approaches suitable for local adaptation are compared. These are:

- An Australian approach (by the New South Wales Government); and
- Integrated Coastal Area and River Basin Management (proposed by the United Nations Environmental Programme).

A review of estuarine management in the United States of America, Britain and Canada showed a strong emphasis on the rehabilitation and management of severely degraded systems (e.g. pollution management, overexploitation and severe modification due to infrastructure development), with some attention also given to the establishment of protected areas (Adams & Asp 2000; Davidson 1990; Elder 1989; English Nature 1993; Hiller 1990; Hoare 2002; Imperial, Robadue & Hennessey 1992; NOAA 1996; Tuohy 1993). These approaches were not deemed appropriate for South Africa's relatively pristine estuaries and are therefore not discussed further in this thesis.

2.4.1 An Australian approach to estuarine management

The Australian approach is illustrated by the New South Wales Government policy and process.

2.4.1.1 New South Wales Estuary Management Policy

The New South Wales Government developed its Estuary Management Policy in 1992. This Policy forms part of a suite of catchment management policies. The general goal of the Policy is to achieve an integrated, balanced and ecologically sustainable use of the state's estuaries, which form a key component of the coastal catchments. Specific objectives of the Policy (New South Wales Government 1992) are:

- The protection and maintenance of estuarine habitats and ecosystems in the long-term, including the necessary hydraulic regime; and
- The preparation and implementation of a balanced long-term management plan for the sustainable use of each estuary and its catchment, in which all values and uses are considered and which defines management strategies for:
 - the conservation of aquatic and other wildlife habitats;
 - the conservation of the aesthetic values of estuaries and wetlands;
 - the prevention of further estuary degradation;
 - the repair of damage to the estuarine environment; and
 - the sustainable use of estuarine resources, including commercial uses and recreational uses, as appropriate.

In essence, the policy sets the scene for cooperation among all levels of government, catchment management committees and estuary users in the development and implementation of Estuarine Management Plans (EMPs) for each of the state's estuaries.

Leading from the policy, the New South Wales Government established an Estuary Management Program in 1992. The programme targets estuarine-related issues and engages local communities in the process. The programme focuses on maintaining (or improving) the overall health, functionality and integrity of an estuary, i.e. its chemical, physical and biological properties as well as its economic, recreational and aesthetic values.

The Estuary Management Program encourages local communities to take responsibility for managing their own estuaries. An Estuary Management Committee is established by the local authority and is made up of representatives from local government and state agencies responsible for managing the estuary's resources as well as from members of

the community (local residents, industry representatives and environmental interest groups) and researchers. These stakeholders work together to identify problems in the estuary, evaluate various management options, develop specific actions to address those problems, and create and implement a formal management plan to restore and protect the estuary.

While the state department administers the Estuary Management Program, programme decisions and activities are carried out by the Estuary Management Committees. The Committees oversee the development and implementation of an EMP, which addresses the whole range of environmental problems facing a specific estuary as well as the economic and social values of the estuary. By providing financial and technical assistance, the state department helps local councils to achieve these goals.

2.4.1.2 New South Wales estuarine management process

Estuary Management Committees follow a structured planning process to develop their EMPs. The process involves eight steps, starting with the formation of the committee (see Table 2.3). An EMP is not a static instrument. It needs to be reviewed on a regular basis and updated, where necessary, to cater for the changing needs and desires of society.

Table 2.3 The basic steps involved in the New South Wales estuarine management process

STEP	ACTIONS
1. Establish an Estuary Management Committee	Form an Estuary Management Committee comprising representatives of local community groups, relevant authorities, the local catchment management committee, council staff and councillors and users of the estuary.
2. Assemble existing data	Find and assemble relevant data, generally in the form of maps and reports that are available from various government agencies. This includes canvassing the community for input
3. Undertake an Estuary Process Study focusing on biophysical processes	Carry out an Estuary Process Study on: <ul style="list-style-type: none"> • Hydrodynamics: Tides, freshwater, flushing, salinity, water quality, sediment behaviour etc.; • Biology: Habitats, species, populations, endangered species etc.; and • Impacts: Impact of human activities on hydraulics and biology. (Note: An Estuary Process Study may be compiled from existing data and community knowledge.)
4. Carry out an Estuary Management Study, considering: <ul style="list-style-type: none"> • Current uses; • Conflicts of use; • Management options and objectives; and • Management strategies and potential impacts. 	Carry out an Estuary Management Study, including: <ul style="list-style-type: none"> • Community input on the recreational, social, economic and environmental components; • Essential features: Physical, chemical, ecological, economic, social and aesthetic; • Current uses: Activities, land tenure, and control and conflicts of use; • Conservation goals: Targets and key habitats; • Remedial goals: Restoration of environmental quality; • Development: Acceptable commercial and public works activities; • Management objectives: Identification and assessment; and • Impacts: Impact of proposed management measures.
5. Prepare a Draft EMP: <ul style="list-style-type: none"> • Develop goals and values; • Describe how the area is to be managed; 	Prepare a Draft EMP containing: <ul style="list-style-type: none"> • Management objectives; • Management strategies;

STEP	ACTIONS
<ul style="list-style-type: none"> • Recommend management options; • Provide a time frame; and • Calculate the cost of activities. 	<ul style="list-style-type: none"> • Recommendations; and • Time frame of activities to implement recommendations.
6. Review the Draft EMP	Have the Draft EMP reviewed by the public, stakeholder groups, council and government.
7. Adopt the EMP, which includes: <ul style="list-style-type: none"> • Interim management measures; • Planning actions; • Restoration works; • Monitoring; and • Education. 	Adopt and implement the EMP to guide: <ul style="list-style-type: none"> • Local-authority planning controls; • Government planning controls required; • Remedial works; • Monitoring programmes; • Education programmes; and • Community services.
8. Monitor and review process	Monitor and review the implementation of the EMP. Adapt plans or goals as required.

(Source: New South Wales Government 1992)

All eight steps of the estuarine management process up to and including implementation and monitoring are eligible for a 50% government subsidy under the estuarine management programme administered by the state department.

The Australian estuarine management process includes a number of important concepts applicable in South Africa. The approach emphasises the need to define the baseline conditions for the biophysical processes, including the status of, and trends in, the various physical, chemical and biological estuarine processes and interactions between them and between other land and water uses. In the Australian approach management objectives, options and impacts on an estuary are defined. After the objectives have been defined, an EMP is developed consisting of management strategies and a scheduled sequence of activities that necessary be undertaken to achieve the estuarine management objectives. The proposed estuarine management process involves public participation at all stages.

The Australian policy is executed through the preparation and implementation of EMPs. An Estuary Management Committee, chaired by a local council, supervise subsequent investigations and the ultimate formulation of an EMP.

2.4.2 Integrated Coastal Area and River Basin Management (ICARM)

2.4.2.1 The ICARM concept

Integrated Coastal Area and River Basin Management (ICARM) is a concept developed by the United Nations Environmental Programme (UNEP) to address the differences and overlaps between Integrated Catchment Management (ICM) and Integrated Coastal Zone Management (ICZM) (UNEP/MAP/PAP 1999). It recognises that the coastal zone is a component of the river catchment linked through a number of natural and socio-economic processes:

- The water cycle and its related freshwater quantity and quality affect the coastal ecosystem and human activities in the coastal zone (e.g. fishing, aquaculture, tourism and recreation);
- Sediment transport affects rivers, estuary channels and coastal dynamics and ultimately impacts on coastal ecosystems and human activities; and

- Human activities in a river catchment can affect the coastal ecosystem and human activities in the coastal zone in a positive way, such as in providing food, water and energy, or negatively through water retention for irrigation, soil erosion and sewage discharge.

Traditional approaches to catchment management seen in terms of water supply have been broadening in recent years to that of water resource management, which encompass water quality and quantity. To truly manage a catchment in an integrated manner, management must extend beyond the narrow conflicts between land use (e.g. farming, forestry and settlement) and water resources (amount and quality) and needs to recognise the many other functions of the catchment, including tourism, nature conservation and cultural heritage. ICZM is a combination of marine resource management and land-use planning. The coastal zone is an area of intense human activity and heavily used, with many conflicts arising from usage. Examples of incompatible usage are industry vs. tourism, private ownership vs. public access and environmental protection vs. economic development. ICZM has extended the coastal management boundaries in both a landward and a seaward direction and deems integrated coastal management essential for sustainable development.

Changing patterns of land and resource use in upstream areas will have an impact on downstream areas. Conflicting demands on natural resources and land use have led to the need for a more comprehensive approach, involving multiple objectives, and the need for a wider scale in both space and time. ICARM requires the adoption of goals, objectives and policies and the establishment of governance mechanisms that recognise the interrelationships between the two systems to ensure environmental protection and sustainable development (UNEP/MAP/PAP 1999).

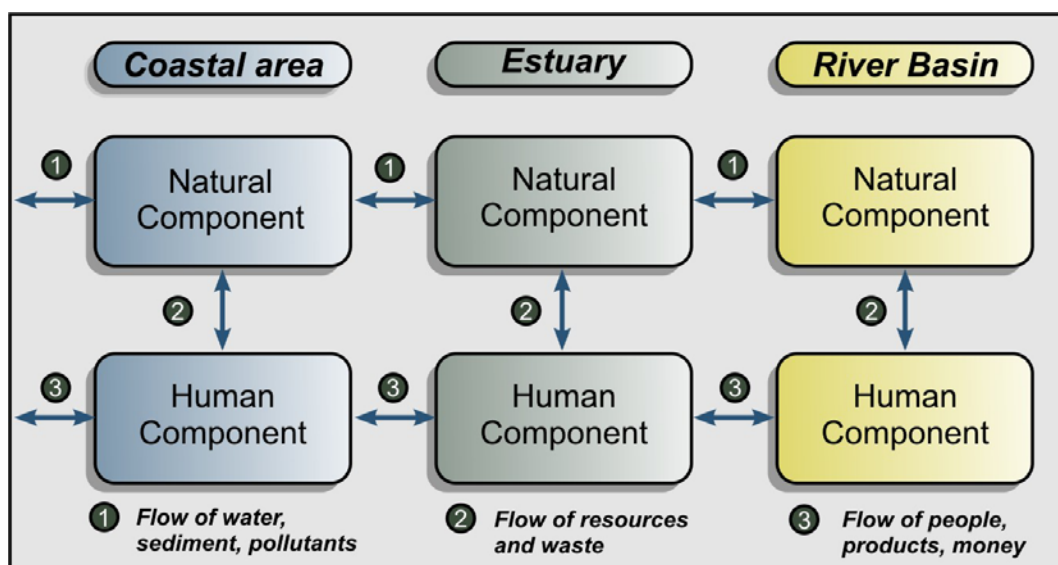
The basic principles of ICARM assume (UNEP/MAP/PAP 1999):

- Respect for the integrity of riverine, estuarine and coastal ecosystems and acceptance of these limits of the resources;
- Ensuring the strategic importance of renewable resources for socio-economic development;
- Allowing for the multiple use of resources by integrating complementary activities and regulating conflicting ones;
- Ensuring multi-sectoral and multi-level integration in decision making linking broad-scale management to local level intervention; and
- Allowing for the participation of all, particularly local, actors in the planning process to ensure effective management.

ICARM adopts a proactive approach. Planning acquires a central role in establishing a process of governance and management within a strategic framework of goals, policies and actions. It requires a high level of interaction between institutional structures, both at a horizontal level among sectors and at a vertical level in institutions.

As these are complex coastal and river ecosystems, it is necessary to develop a simple model that scientists and managers can use to describe the essential features of these ecosystems (natural systems) and their interactions with human usage (human systems) as illustrated in Figure 2.2. The systems approach recognises that all systems interact within and with other systems, e.g. nature provides resources for people and they discharge waste back into the system. ICARM sets issue-related boundaries, which means that relevant management issues determine the boundaries of the

system and what should be included in the systems analysis. Zones to be included are the coastal waters, the coastal strip (the transition zone between land and sea), the estuary and the coastal plain.



(Source: UNEP/MAP/PAP 1999)

Figure 2.2 Interaction process among the components of a natural system

Figure 2.2 illustrates that the system is defined in terms of the marine, estuarine and river systems and their interactions. The human system has the same geographical boundaries as the natural system, for it is indirectly coupled through the natural system. Resource use, waste disposal and engineering interventions in one component can have impacts on other parts of the natural system, which, in turn, would affect the function of the human system. For example, the deepening of an estuary causes a related increase in salinity penetration, which, in turn, affects irrigation and water supply further upstream.

2.4.2.2 The ICARM management process

The ICARM framework takes the form of a strategic management process and requires advance knowledge of changes in the medium to long-term. The emphasis is on the process of establishing priorities and actions for the integrated management of a coastal area and its river catchment. At a national level, policy needs to be defined with the necessary guidelines for provincial and local level initiatives. A lead agent responsible for the process at national level needs to be identified. Environmental and conservation-standard needs will be set at this level. A committee will work on sectoral concerns, allowing for the participation of all interested ministries. Subnational level (i.e. provincial), detailed plans based on national guidelines should be developed to ensure the integration of local level plans and to resolve conflict with national goals. Detailed plans would be developed at a local level.

The ICARM planning process is cyclic, allowing for the periodic review, assessment and revision of goals, objectives, priorities and measures. ICARM is a cyclic process with the basic steps listed in Table 2.4.

Table 2.4 The basic steps involved in the ICARM estuarine management process

STEP	ACTIONS
1. Initiation	<p>Organisation and mobilisation for planning. It includes the identification of key factors that lead to public awareness and will encourage the adoption of an action plan. Factors to be identified include:</p> <ul style="list-style-type: none"> • Urgent problems (e.g. the need for water or economic development); • Decisions (both past and present) that have resulted or could result in severe environmental degradation; • Conflicts over the use of resources; • Broader initiatives promoting integrated management (e.g. international agreements, national development plans, water management plans); and • Increased public awareness of growing environmental problems or demands for improved environmental quality. <p>It requires an understanding of contributing factors, such as political will, scientific knowledge, the existence of a national framework, the economic value of a river basin and coastal zone, general goals, boundaries, institutions and organisations expected to participate, available finances and a work plan and timetable.</p>
2. Analysis of existing situation	<p>A survey of the basic characteristics in terms of the structure and dynamics of the natural and human ecosystems. It deals with critical processes and factors and involves:</p> <ul style="list-style-type: none"> • A survey of the selected key issues (both socio-economic and ecological); • An analysis of the natural system highlighting the impact of human activities on natural resources; • An analysis of the socio-economic context and the related spatial implications, including information on demographics, the economy, the social structure, spatial patterns and institutional issues; and • The forecast of future developments (a projection of existing trends or expected future trends).
3. Identification of conflicts and opportunities	<p>The interaction between the natural and the human ecosystems both currently and in the future. It includes the analysis of needs and pressures on the stakeholders, which influences decision making in development and environmental management. Problems need to be defined in terms of urgency, irreversibility and impact on ecological values. Of equal importance during this phase is the identification of opportunities for development and intervention.</p>
4. Identification of goals and alternative courses of action	<p>An analysis of the critical factors and processes, conflicts and opportunities in order to identify management goals and objectives. These are formulated with a long-term perspective. Alternative courses of action reflecting the different priorities can then be identified and possibly incorporated with goals and objectives. Public participation is essential, as is the participation of the "larger" stakeholders in both the public and the private sector, e.g. large-scale business. Goals can be either general or area-specific or sectoral. Goals need to be translated into a set of objectives to be achieved, which leads to the formulation of possible strategies on how to link the goals and objectives. Once sectoral and cross-sectoral objectives are defined, they need to be integrated into sectoral plans.</p>
5. Development of a strategy	<p>Development of strategies in order to translate the goals and objectives into targets and policy measures, with the aim of developing a framework for environmental management. It requires detailed elaboration on the selected strategy of the previous phase. It should include the specification of policies, legislation, measures and an Action Plan to guide the implementation in the short and medium term. The first of these should be a strategic action plan highlighting key issues, such as:</p> <ul style="list-style-type: none"> • Population growth; • Socio-economic development targets; • Infrastructure development; • Basic land/sea/river use allocations; • The designation of environmentally sensitive areas for conservation; and • Legal, institutional and financial aspects. <p>The plan translates goals and objectives into measures (regulatory, physical or economic) and prioritises actions. It also needs to define the administrative context along with the regulatory framework required for its implementation, the existing legal framework or new legislation or institutions.</p>

STEP	ACTIONS
	This phase requires a high level of cooperation within and between institutional structures. Current institutions often do not recognise the internal linkage of ecological processes and this might require some specific emphasis in the action plan.
6. Implementation	<p>To work, the action plans need to have legal status and be realistic. The framework should therefore consider the:</p> <ul style="list-style-type: none"> • Scale of the problem; • Capacity of local government; • Human and financial resources required; • Necessary technological support; and • Coordination mechanism (a special agency, committee or body) assigned the leading role in plan implementation.
7. Monitoring and evaluation	<p>Monitoring and evaluation provide for administrative procurers and mechanisms to do a periodic review of progress towards the achievement of goals and objectives through an assessment of the state of the environment and policy implementation.</p> <p>For practical purposes, it is necessary to concentrate monitoring on a few key indicators, which relate to key factors and planning issues, e.g. the Pressure-State-Impact-Response Model. Monitoring is a continuous process starting from the inception of a project to reflect changes in the environment and is linked to management objectives. Evaluation is performed at selected times, such as near the middle and after completion of a programme. Key local and national stakeholders are involved in the monitoring and evaluation process.</p>

(Source: UNEP/MAP/PAP 1999)

An number of important estuarine management considerations relevant to the South African context are highlighted by the ICARM approach. The ICARM approach requires better coordination among the various sectors which leads to a more rational use of resources and more effective environmental protection. ICARM provides a way to link the various interactions between estuaries into some form of a strategic level management plan. The process allows for the multiple use of resources by integrating complementary activities and regulating conflicting ones. There is a strong drive for proactively planning intervention (in space and time) to reduce potential conflicts, bridge potential gaps and streamline potential overlaps among legislation through the setting of an overarching vision and objectives. ICARM strives for multi-sectoral and multi-level integration in decision making and the linking of broad-scale management to local level intervention.

The process places strong emphasis on the understanding of the natural and human environment before setting objectives and developing management strategies. It aims to uphold the integrity of river, estuarine and coastal ecosystems and promotes the acceptance of the limits of resources. It emphasises that there are substantial differences in terms of time frame and geographical scale among the various processes operating in the coastal areas and river basins and that this must be borne in mind in the decision making process.

The ICARM process is executed through the preparation and implementation of an Action Plan. The ICARM process also calls for the establishment of a governing body but is not too prescriptive regarding what form it should take. ICARM requires the participation of all actors, particularly local, in the planning process to ensure effective management. It

should be noted that the ICARM process puts a strong emphasis on the participation of the various authorities and the public.

2.4.3 Conclusion

DWAF is the lead agent responsible for the management of water quantity and quality in estuaries. At the same time, the national DEAT is tasked with the management and conservation of estuaries, i.e. land use and infrastructure. Within DEAT, the responsibilities for the management of marine living resources, including those in estuaries, is undertaken by MCM.

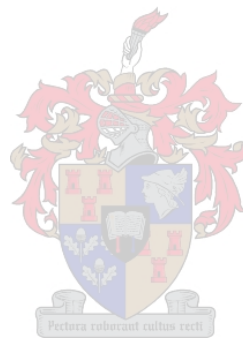
At present, estuarine management is carried out largely at a local level by other state bodies such as the South African National Parks Board (SANParks), provincial departments (responsible for nature conservation and environmental impact assessment) and local authorities. This approach has resulted in fragmented and inefficient estuarine management. At present, there are uncertainties as to which laws are applicable and to which areas they apply. In addition, there are uncertainties over which government departments or agencies are mandated to enforce the various laws and, finally, there is limited enforcement capacity to enforce these laws and regulations (Smith & Cullinan 2000).

The large number of overlapping laws (e.g. 16 international conventions, 9 white papers, 40 national acts (see Appendix A for details) that defines and regulates estuaries makes it difficult to conserve and manage estuaries effectively. The key to resolving the legal and administrative confusion lies in aligning the institutional arrangements so that their areas of jurisdiction correspond more closely with those of ecosystems. The White Paper on coastal zone management recognises that the interface between fresh and salt water should be at the centre of a management area rather than the boundary of that area (Smith & Cullinan 2000). This concept should be incorporated into the pending National Environmental Management: Coastal Zone Bill. South Africa is currently in the process of revisiting and redrafting its environmental legislation (South Africa 1998a, 1998b, 1998c, 2002a, 2002b). This presents an excellent opportunity to realign existing legislation and institutional arrangements and to influence pending legislation, such as the National Environmental Management: Coastal Zone Bill (Draft 11) to allow for this necessity. Guiding all future management recommendations should be the fact that estuarine ecosystems are not isolated and that they function in an integrated manner at a local, regional and global scale.

There are a limited number of examples in South Africa where estuaries have been assessed and management recommendations made for application at a regional scale. In most of these cases, the connectivity between systems has been addressed only as a function of the biogeographical representivity of a particular estuary type, i.e. acknowledging that different types of estuaries have different functions without explicitly addressing the interdependence of systems. The FIR for South African estuaries (Maree, Whitfield & Quinn 2003) is the only study that directly addresses aspects of connectivity between individual estuaries by evaluating the degree of isolation between estuaries. There is therefore a definite need for a more strategic regional approach to estuarine management in South Africa. To address this shortcoming, a number of current management practices and/or methods (e.g. RDM studies, EIA studies and cumulative assessment methods) need to be refined or developed.

Internationally estuarine policy and management approaches emphasise a number of key concepts, such as (New South Wales Government 1992, UNEP/MAP/PAP 1999):

- The importance of reviewing the current status (e.g. biophysical estuarine processes and socio-economic drivers);
- The recognition of the limits of the natural environment in planning, as this sets the boundaries;
- The need to include a broad range of stakeholders (from local to national) to be involved in the decision making process;
- The need to develop management strategies focused on overarching objectives (targets); and
- The importance of monitoring and evaluation after implementation.



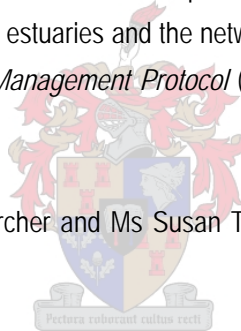
Chapter 3: The South African National Estuarine Management Protocol

Against the background of the legislation governing estuaries and the current state of the estuarine management the formulation of a South African estuarine management protocol could be initiated. The proposed protocol formalises the steps in the process; at national, provincial, regional or local level, necessary to implement an effective EMP.

3.1 The need for a national protocol

South Africa's 270 estuaries have a diversity of management requirements, often unique to an individual system, and are governed by a variety of authorities, from national to local level (e.g. the national DWAF and DEAT, Nature Conservation and local municipalities). Therefore an all encompassing estuarine management protocol would be too rigid and could not be developed for all systems. Consequently, there was a need to design a legally defensible estuarine management protocol to provide the guidelines to enable estuarine managers at all levels to develop sound management plans to suit individual systems. The management protocol was also necessary to coordinate management activities between, and to identify the responsibilities of, the various lead agencies. For example, management objectives need to be developed by both the national DWAF (EFR and RQOs as part of the Reserve process) and of DEAT (exploitation levels of estuarine living resources, development strategies around estuaries and the network of estuarine protected areas). In response to these expressed needs, a *National Estuarine Management Protocol* (NEMP) is proposed for inclusion in the National Environmental Management: Coastal Zone Bill.

This chapter abridges work done by the researcher and Ms Susan Taljaard of CSIR, and reported in Van Niekerk & Taljaard (2003), unless indicated otherwise.



3.2 Protocol development procedure

The research was commissioned, as part of the Eastern Cape Estuaries Management Programme (ECEMP), Institute of Natural Resources (funded by the Water Research Commission), to undertake a project on cooperative governance. The purpose of this project was to provide recommendations for a *Legal and institutional framework for the effective Cooperative Governance of estuaries*. One of the key outcomes of the framework was the proposed NEMP.

The development of the framework for the effective cooperative governance of estuaries, including the NEMP, comprised five research tasks (Van Niekerk & Taljaard 2003):

- Development of a broad vision and strategic objectives for the effective cooperative governance of estuaries were defined through an internal stakeholder workshop held with MCM. Eight people were present at the workshop, including the researcher;
- Van Niekerk and Taljaard collated and reviewed information on the current legislation and institutions governing the management of estuaries in South Africa was (as reported in Chapter 2);
- Based on the literature review, a situation assessment report was compiled to identify the opportunities and constraints to effective cooperative governance. The Situation Assessment Report was verified through e-mail

correspondence and telephonic consultation with key stakeholders. I sent (by "e-mail") the report to 117 individuals in 46 institutions and received 21 replies;

- A generic legal and institutional framework for the effective cooperative governance of estuaries was drafted based on the information compiled in the situation assessment report, the identified legal requirements and the authors' own experience in estuarine management. The draft framework included recommendations on achieving the strategic objectives, based on the opportunities and constraints in the current situation. The findings of this document are summarised in this chapter; and
- To review the draft framework for the effective cooperative governance of estuaries, including the proposed NEMP, the researcher held a capacity building workshop with key stakeholders in the Eastern Cape to communicate and review the recommended framework and desired outcome of the project. Thirty-two individuals from 12 institutions, including all levels of government, attended the workshop. Following the feedback from the workshop, the documentation was finalised.

3.3 The proposed National Estuarine Management Protocol

The "Framework for the Effective Cooperative Governance of Estuaries" comprises the proposed NEMP and the institutional arrangement required to facilitate effective management of estuaries in South Africa. The proposed NEMP views estuarine governance as an adaptive management process following a sequence of generic steps (see Figure 3.1), comprising:

- Setting the strategic vision and objectives;
- Devising management strategies to achieve the vision and objectives;
- Implementing the objectives and strategies in the planning and operations of activities/development;
- Monitoring the effectiveness of strategies; and
- Assessing and evaluating monitoring results in terms of objectives, strategies and implementation.

These generic management steps are discussed in more detail next and are expanded on at national, provincial and local level in the rest of the chapter.

3.3.1 Strategic vision and objectives

The setting of the strategic vision and objectives requires an analysis of the critical factors and processes, conflicts and opportunities that affect estuarine management in order to identify a vision and objectives. These should be formulated from a long-term perspective in the context of sustainable development principles. Public participation is essential, including that of the "larger" stakeholders in both the public and the private sector. The vision can be global (general) or area-specific and needs to be translated into a set of achievable objectives. Once the overarching, cross-sectoral vision and objectives have been defined, they need to be developed and integrated into the various sector-specific objectives. The multidimensional character of the problem often generates a range of objectives with related sectoral strategies.



Figure 3.1 The generic adaptive management process

In order to manage estuaries at a strategic level, a vision and objectives need to be set for both the biophysical and the socio-economic environments. This needs to be done at two levels, namely a strategic national and/or regional (e.g. provincial) level and a local vision and objectives that are site-specific and need to be set for individual estuaries.

3.3.2 Management strategies

Once ecological and socio-economic objectives have been set, either nationally, regionally or for a particular estuary; the responsible authorities need to develop their specific management strategies that give effect to these objectives. This requires detailed elaboration on the overarching management vision and objectives and should include specification on policies, measures and a management plan to guide the implementation in the short, medium and long-term (UNEP/MAP/PAP 1999).

Estuarine management includes strategies to (Van Niekerk & Taljaard 2003):

- Achieve national and regional strategic objectives;
- Coordinate and control development and activities;
- Ensure the sustainable use of the environment;
- Maximise opportunities for coastal communities; and
- Restore or rehabilitate degraded areas.

Management strategies to meet ecological and socio-economic objectives may be either proactive or reactive. Proactive options include initiatives for the controlled, sustainable development of estuaries, aiming at anticipating future development and providing guidance mechanisms for future action. Reactive approaches, on the other hand, refer to problems, usually created by existing developments or activities, requiring corrective measures to align with local objectives.

3.3.3 Planning and implementation

This step relates primarily to the actions that need to be taken in the implementation of: the NEMP, nationally defined guidelines for estuarine management and local EMPs. Implementation focuses on managing the activities and developments in and around estuaries. Implementation issues within an estuarine context can logically be grouped into the key management areas mentioned earlier, namely:

- Land-use and infrastructure planning;
- Water quantity and quality; and
- Exploitation of living resources.

3.3.4 Monitoring

Monitoring can be divided into:

- Strategic monitoring (to establish natural variability and change over time); and
- Compliance monitoring (associated with specific activities or developments).

Monitoring and evaluation provide for administrative procurers and mechanisms to do periodic reviews of progress towards the achievement of goals and objectives through the assessment of the state of the environment and policy implementation.

A wide range of natural forces and processes and of anthropogenic activities operates in and around an estuary (including the river catchment and coastal zone), with a multitude of factors and variables that should be monitored to examine the state of the system. For practical purposes, it is often necessary to concentrate monitoring on a few key indicators relating to key factors and planning issues. Indicators may be organised in the form of the Pressure-State-Impact-Response Model, which is widely used in environmental management, e.g. as is currently being used for national State of the Environment (SoE) reporting (DEAT 2002). Changes in natural systems are monitored by *in situ* measurements or remote sensing. Slowly varying processes (e.g. sediment processes) can be monitored at discrete time intervals, while rapidly varying processes (e.g. water level recordings) require continuous observation. Socio-economic changes are monitored by assessing demographic, social and economic parameters (e.g. population density, land use, and Gross National Product).

3.3.5 Assessment and evaluation

The ultimate success of any management process relies on the effectiveness of the feedback loop via the assessment and evaluation component (UNEP/MAP/PAP 1999). Assessment and evaluation are characterised by objectivity, credibility and representation, ensuring that key local and national stakeholders are involved in the evaluation process. While monitoring is a continuous process, starting from the inception of a project, to reflect changes in environment and linkage to management objectives, evaluation is performed at selected times, such as near the middle or after completion of a project or at regular predefined time intervals.

Assessments and evaluations are done at a strategic level but also on specific activities or developments. Strategic assessment and evaluation are required to establish long-term natural variability as well as potential trajectory of change

associated with human interference. Assessment and evaluation of specific activities or developments, on the other hand, entail compliance testing with critical limits set for processes and actions associated with the activity or development as well as with measurable ecological and socio-economic objectives set for a particular estuary.

Assessment and evaluation can also occur at different time intervals, for example:

- *High frequency intervals*, which refers to the assessment and evaluation of monitoring data collected on the processes and actions of a particular development or activity against the critical limits. The frequency of such assessment can range from hourly to monthly, for example monitoring the flow and water quality of waste discharge into an estuary to assess against critical limits set for the discharge.
- *Medium frequency intervals*, which refers to the assessment and evaluation of monitoring data collected in the estuarine environment, with the local vision and management objectives set out for a particular estuary. The frequency of such assessments would typically be on a seasonal to five-yearly basis, for example biannual or annual ecological impact monitoring exercises to assess compliance with local management objectives.
- *Low frequency intervals*, which refers to the assessment and evaluation of monitoring data collected on both the processes and actions of a particular development or activity and of the estuary to establish long-term trends and compliance with strategic objectives set for estuaries. Such assessments are typically included in the national or provincial SoE reporting and the revision of RDM for a particular catchment. The frequency of such assessments is usually five years or longer.

3.4 National and provincial estuarine management

Estuarine management in South Africa is undertaken by all three tiers of government from the national, provincial and regional levels down to the local level¹. The roles of national and provincial (regional) government are discussed separately from those of local government. The same generic framework outline in Section 3.3 structures the discussion in this section.

3.4.1 National and provincial vision and objectives

As stated before, estuaries do not operate in isolation but are connected to other estuarine systems in a region and even globally (e.g. through fish and bird migrations). As a result, certain decisions need to be made at a higher level to ensure overall sustainability (taking into account social equity, economic growth and ecological integrity). In setting the national vision and objectives for the environment, it is important that South Africa's international obligations pertaining to estuaries be taken into account. In this context, it is necessary to: 1) formulate a national and provincial or regional vision for estuaries; and 2) define broad, strategic objectives to achieve this vision.

The proposed strategic vision for estuaries in South Africa is that (Van Niekerk & Taljaard 2003: 14):

¹ In this thesis, both the terms "provincial" and "regional" are used to refer to the second tier of government. The sectors dealing with the management of marine living resources and land use and infrastructure operate on a provincial level, while the water sector operates on a regional or catchment level. The term "provincial" in this section must read as "provincial/regional" depending on the context.

"The biodiversity and functionality of South African estuaries are conserved, protected and optimally managed such that sustainability, in terms of ecological integrity², social equity and economic growth, is promoted in a regional, national and global context."

Even though legislation pertaining to the management and control of estuaries is fragmented, involving various government departments and authorities, it is crucial that the authorities subscribe to a common vision, common objectives and common management strategies for estuaries to minimise conflicts among the requirements of the various statutes and to achieve effective cooperative governance. National strategic objectives for estuaries need to be defined. These objectives must be aligned with national principles and policy pertaining to environmental management. Strategic objectives need to be set for both the biophysical environment and the socio-economic context (developmental objectives) in and around estuaries. An excellent example of strategic objectives is the goals for the protection of estuarine biodiversity proposed by Turpie (2004a: D37):

1. *"Maintain/restore the ecological integrity of estuaries, by ensuring that the ecological interactions among estuaries and those between estuaries, their catchments and other ecosystems are maintained.*
2. *Maintain/restore the health of estuaries in/to a good to excellent condition, assuring that a representative set of estuaries is maintained in as close to their pristine state as possible. This includes (for all estuaries) maintenance of the natural:*
 - *magnitude, variability and frequency of natural physical processes within estuaries;*
 - *characteristics and variability of estuarine populations and communities in terms of size, structure and functioning, through sustainable utilisation; and*
 - *taxonomic diversity of all estuaries, without loss of indigenous taxa from any estuary other than by natural processes, and without the introduction of alien species."*

For estuaries, the strategic vision and objectives need to be defined not only on a national but also at a provincial or regional level to facilitate appropriate sectoral responses and make the middle tier of government aware of the national estuarine objectives. Such a holistic vision and associated objectives will need to be formulated and supported by role players at all levels. Ideally, the national and provincial or regional strategic vision and objectives for estuaries should be established before the local vision and objectives are set for a particular estuary to guide to the local process.

² The terms "integrity" and "health" have been widely used to designate desired states of an ecosystem. Without further refinement, neither health nor integrity is a useful or measurable descriptor of an ecosystem. Karr, Yant & Fausch (1987) define biological integrity as the ability to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of the natural habitat. The Chesapeake Bay Programme (CBP 1987) defines integrity in such a way that the entire system must be balanced, healthy and productive. In turn, "balanced" is defined as having sufficient population of prey species to support the species at the top of the food chain, and to limit overabundance at the bottom of the food chain; no major function of the ecosystem dominates the other. "Health" is defined as having diverse populations that fluctuate within acceptable bounds, that are free from serious impacts of toxic contaminants, parasites and pathogens and that have sufficient habitat to support a diversity of species. Lastly, productivity is seen as providing the sufficient production of harvestable products to serve human needs without depleting predator and grazer populations to the point where internal, functional balance is disrupted. In setting the vision and objectives for estuaries, it is important to understand what these definitions are.

3.4.2 National and provincial management strategies

To ensure the effective implementation of the strategic vision and objectives set at national and provincial or regional levels for estuaries, it is crucial that these be translated into sound management strategies, also referred to as strategy guidelines. This will provide local authorities with clear guidelines on setting and aligning local objectives and management strategies, ensuring that national and regional strategies are implemented through to local level.

At a national and provincial or regional level, management strategies translate the strategic vision and objectives into policy measures (regulatory, physical or economic) and prioritise actions. They also define the administrative context along with the regulatory framework required for implementation. This could happen through the existing legal framework or new legislation or institutions. National and regional level management strategies must include all necessary details, for example instruments to be used (e.g. building permits and written regulations). They also need to address financial and technical feasibility aspects to ensure effective implementation (UNEP/MAP/PAP 1999).

Defining national and provincial or regional level management strategies requires a high level of cooperation within and between institutional structures, specifically at a horizontal level among sectoral institutions in the development of the management-strategies phase (during the implementation phase, this becomes more vertical within institutions). Current practices often do not recognise the connectivity of the ecological processes and this often requires some specific emphasis in management strategies (UNEP/MAP/PAP 1999).

An agency responsible for processes at national level needs to be identified, since environmental and conservation standards are set at this level. A committee needs to be formed to work on sectoral concerns and to allow for participation of all interested ministries. At a regional level, detailed plans may be developed, based on national guidelines. This level sets out to integrate local level plans and to resolve conflicts with national goals. Detailed plans are developed at a local level (UNEP/MAP/PAP 1999).

Examples of strategies that should be developed at national and provincial or regional levels are to (Van Niekerk & Taljaard 2003):

- Maintain or restore the quality and extent of estuarine habitat required to support living resources at a local and, ultimately, national scale that includes both estuarine and marine species;
- Prioritise all South African estuaries at a national and regional scale in terms of their biodiversity, i.e. ecological importance;
- Allocate protection levels to each South African estuary, taking into account its ecological importance, but in the context of its present ecological state, reversibility of existing impacts and achievability of protected status. This would include the establishment of a network of EPAs that will conserve 100% of estuarine biodiversity in South Africa;
- Establish a national guideline for the maximum allowed loss of biodiversity from an individual estuary (e.g. it may not lose more than 10%) due to approved development;

- Determine the national stock assessment of important estuarine living resources and exploitation levels allocated to key stressed resources. Stock assessments and exploitation levels must be reassessed periodically, depending on the life cycle of the resource; and
- Identify and prioritise estuarine systems in need of rehabilitation, e.g. the Orange Estuary.

3.4.3 National and provincial implementation of strategies

Implementation at a national and provincial or regional level comprises providing the legislative framework for estuarine management in South Africa. It requires the development of the necessary legislation, regulations and guidelines to support the local decision making framework. Implementation also includes enforcement through technical, administrative, legal and financial instruments. Management and control interventions are required to correct unwanted short-term developments.

Implementation requires engaging the lower tiers of government in implementing strategic objectives and management strategies regarding biodiversity conservation at a national and provincial scale. Specifically, the living resources of estuaries are managed and enforced at a national level in South Africa as required by the MLRA No. 18 (South Africa 1998a). The Act governs the conservation of marine ecosystems, the long-term sustainable utilisation of marine living resources and the orderly access to the exploitation, utilisation and protection of marine living resources. Decisions regarding exploitation are normally taken at a national level. Compliance under the Act can be delegated to a provincial or a local level, e.g. CapeNature in the Western Cape and KZNWildlife in KwaZulu-Natal.

Operational Management Plans are required for every fishery, the assumption being that each fishery comprises a single or a few species or stocks, e.g. rock lobster and hake. However, in the case of multi-species, multi-user fisheries targeting a variety of species with vastly different behavioural and biological characteristics, a Management Protocol was deemed more practical (e.g. South African linefishery, which includes estuaries). The Linefish Management Protocol (LMP) sets the guidelines for monitoring, stock assessment procedures and the development of species-specific management plans (Griffiths, Attwood & Thomson 1999; Griffiths & Lamberth 2002). A similar approach is envisaged for estuaries where each is almost unique in terms of physical and biological characteristics, management issues and the impact of anthropogenic influences.

To achieve the national objective for a particular species, a management plan has to be developed according to the LMP. The protocol and, ultimately, the management plan would take into consideration a prioritisation of species in terms of conservation requirements and the importance of the fishery, which includes total catch, the number of participants and the economic value or contribution of the fishery to the national or local economy. The management plan for a particular species would then set guidelines for effort levels, bag limits, size limits and the establishment of MPAs, if deemed necessary (Griffiths, Attwood & Thomson 1999).

For example, in order to reduce the fishing pressures on dusky cob, the following restrictions have been instituted on the coastal region east of Agulhas:

- *Estuarine and shore-based fishery*: Bag limits have been reduced from five to one fish per person and the size limits increased from 40 to 60 cm; and
- *Marine boat fishery (recreational and commercial)*: The recreational bag limit stayed at five fish per person but only one fish larger than 15 kg per person is allowed. In the case of marine recreational and commercial boat fishing, a minimum size of 50 cm is set, as it is difficult to distinguish between dusky and silver cob and most offshore catches in the region are silver cob.

3.4.4 National and provincial strategic monitoring programmes

The purpose of strategic monitoring programmes is to collect long-term data and information necessary to characterise and understand natural variability and trends pertaining to estuarine systems. This enables strategic objectives to be set at a national or provincial scale. SoE Reporting, for example, requires monitoring programmes to establish long-term changes and trends. Strategic monitoring initiatives should be coordinated to ensure the efficient use of resources, both human and financial, and prevent duplication. Different departmental responsibilities must also be clearly indicated and aligned with the necessary funds and human resources. Therefore, for strategic monitoring programmes:

- Monitoring initiatives should be coordinated and specific responsibilities be allocated to specific authorities or institutions; and
- The appointed authority or institution should have sufficient resources, both human and financial, to execute such monitoring or provide a strategy to obtain such resources.

Management goals for ecosystem health and integrity are based on the realisation that society's concerns for selected functions or resources, e.g. water quality, endangered species or recreational values, are best addressed within a holistic perspective (Toth 2005). However, the successful achievement of these broad goals must be viewed in an operational context whereby endpoints or outcomes are identified and used to select the most appropriate indicators for monitoring progress.

Hammond *et al.* (1995: 43) describe an indicator as a measure that provides a clue to a matter of large significance or makes noticeable a trend or phenomenon that is not immediately discernable. The terms "environmental indicator" and "environmental index" are often used synonymously in scientific literature. However, an environmental indicator generally refers to some environmental attribute (e.g. the average number of anglers on an estuary per day), while an environmental index is often used to represent a single number derived from two or more indicators and is viewed as a composite measure of an overall ecological condition or environmental quality.

Environmental indicators are normally formulated along two lines: 1) based on environmental legalisation and society values; or 2) based on perceived ecosystem properties that would respond to stress (Jordan & Smith 2005). The term "health" features in both these approaches. One advantage in focusing on health-related terms is that they provide a focus for maintaining (or restoring) the beneficial uses of estuarine ecosystems. Health also attracts public attention. Health elicits little disagreement (value conflict) about whether environmental health or ecosystem health is a good idea. Impaired ecosystem health can also be interpreted to mean declining ecosystem properties and services that have human health implications. Costanza (1992) and Costanza & Mageau (1999) define an ecosystem health index

comprising three parameters: system organisation (ecosystem structure), vigour (productivity) and resilience to stress. Sherman (2000) describes ecosystem health on the basis of diversity, productivity, biomass yield, resilience and stability. Due to the abstract nature of these constituent terms, indicators or indexes are often hard to find to quantify ecosystem health and communicate findings to management.

The pressure-state-impact-response (PSIR) framework is suitable for establishing environmental monitoring programmes linked to coastal resource management goals and objectives (Hammeedi 2005). The resulting data from such an approach are pertinent to developing diagnostic parameters, analytical models and risk assessment procedures for decision making. At present, the PSIR framework has not been applied successfully due to diverging agency mandates and fragmented sectorial management. Integration among agencies, collaboration between public and private sectors in making resource decisions and a multidisciplinary approach are needed to facilitate this (Hammeedi 2005). The PSIR framework is based on the premise that socio-economic activities and related land use in an area translate into demands (drivers) for a variety of goods and services within and from outside the defined area. As a consequence: 1) environmental pressures build up via the socio-economic *driving forces*, causing changes in the state of the environment; 2) changes in the environmental *state* affect human and non-human receptors in a number of perceived ways (benefits and cost); and 3) such effects or *impacts*, in turn, provide a stimulus for management *response* (Robinson 1993).

Hammeedi (2005) summarises by stating that selected indicators should at least be SMART: specific (clearly stating the objective), measurable (both in time and in quantity), achievable (within available resources and intellectual capital), relevant (to elucidate the issue at hand) and trackable (amenable to evaluation and the determination of progress). These are critical attributes of indicators that serve to communicate environmental information to broad and varied audiences.



Conceptual models are fundamental to the development of a monitoring programme (Barnes & Mazzotti 2005; Boyle, Kay & Pond 2001). These range from detailed flow diagrams based on energy flow in the ecosystem to qualitative descriptions of expected values or outcomes. Conceptual models can be used to identify biological attributes or indicators that should be monitored to interpret ecosystem conditions, changes and trends. They are a means to: 1) simplify complex ecological relationships; 2) integrate data into more comprehensively implicit ecosystem dynamics; 3) identify which species will show ecosystem response; 4) interpret and track changes in targets; and 5) communicate with environmental managers and improve interdisciplinary science through the use of conceptual models as a communication tool.

A conceptual model should be presented in both graphic and narrative form. Each model and narrative should include (Ogden & Davis 1999):

- A brief description of the dynamics and problems in the landscape;
- A description of the specific ecological stressors and drivers as well as the ecological attributes (indicators or endpoints);
- Ecological effects, including descriptions of major ecological linkages affected by stressors and a level of certainty of the links (a working hypothesis);

- Research questions developed by a working hypothesis; and
- Recommended performance measures and restoration targets for attributes.

These concepts lead naturally to indicators based on a suite of interactions or relationships between inputs and outputs. Such indicators can be single species, community indicators or ecosystems indicators.

3.4.5 National and provincial assessment and evaluation

Strategic assessments and evaluation are required to establish long-term natural variability as well as the potential trajectory of change associated with anthropogenic interventions. In South Africa, the two examples of strategic assessment and evaluation pertaining to estuaries are SoE reporting and the revision of RDM (i.e. Reserve determinations) for a particular catchment.

These assessments are typically conducted at low to medium frequency intervals. Low frequency assessments refer to the assessment and evaluation of data collected on the estuary to establish long-term trends and compliance with the strategic objectives set out for estuaries. Such assessments are typically included in the national or provincial State of the Environment (or State of Coast) Reporting and the revision of RDM (i.e. Reserve determinations) for a particular catchment. The frequency of such assessments is usually five years or longer.

3.4.6 National and provincial key role players and institutional structures

The following key role players need to be involved in national and provincial or regional estuarine management:

National lead agents: DEAT and DWAF are tasked with national management.

Provincial lead agents: The Provincial Departments of Environmental Affairs and of Planning, and Catchment Management Agencies (CMAs) (DWAF, through regional offices, will undertake the responsibilities of CMAs until such time as these are established).

Important stakeholders: The Department of Energy and Mineral Affairs, the Department of Agriculture, the Department of Provincial and Local Government (IDP guidelines), national and international conservation organisations, local stakeholders and estuarine specialists (ecological, social and resource economics).

National institutional structures: A Subcommittee of the Committee for Environmental Coordination (CEC) should be established to set a national strategic vision and objectives. An Estuarine Advisory Working Group(s) (EAWG), consisting of provincial government institutions, non-government organisations as well as estuarine ecological, social and resource economic specialists, should also be established. Decisions of the Subcommittee and EAWG need to be formalised in a Memorandum of Understanding between DEAT and DWAF (and any other organ of state that may be considered appropriate) to ensure effective cooperation.

Provincial institutional structures: Provincial coastal committees (proposed under the Coastal Zone Bill) should include representatives from the regional offices of DWAF (for water quality and quantity), catchment management agencies included in a province (for water quality and quantity), MCM (for the exploitation of marine living resources), the Provincial Department of Planning (for land use and infrastructure), provincial conservation authorities and estuarine specialists (for ecological, social and resource economics).

3.5 Local estuarine management

The discussion of local estuarine management follows the same sequence as used in Section 3.4, but with the focus on the local level.

3.5.1 Local vision and objectives

The responsibilities for the protection, management and control of a particular estuary are distributed among various national, provincial and local authorities, each setting its own ecological and socio-economic objectives, usually independently from one another. Frequently these objectives are biased towards departmental briefs leading to non-alignment and even conflict in the ecological and socio-economic objectives for a particular estuary. To ensure long-term sustainability of estuaries it is critical to have a common local vision and objectives for a particular estuary. The local vision and objectives must be aligned with the more strategic vision and objectives for estuaries set at national, provincial or regional levels. However, this does not mean that local authorities and communities cannot take the initiative, thereby encouraging national and provincial authorities to implement estuarine management within a "bottom-up" approach.

Factors that must be taken into account when local ecological and socio-economic objectives are set include:

- Limits of acceptable change and carrying capacity;
- Current or potential natural goods and services provided by estuaries;
- Current or potential activities posing threats to the health of an estuary; and
- Opportunities and constraints.
-

These factors are discussed in more detail below to guide local implementation.

(i) *Limits of acceptable change and carrying capacity*

Both living and non-living resources of estuaries are finite. This dictum needs to be communicated and articulated to all stakeholders. The concept of ecological sustainability needs to be understood and accepted in order to develop realistic and sustainable operational strategies that are recognised and honoured by all stakeholders. The fragmentation of legislation has also resulted in impact assessments being done singularly within a particular key management area, like development and infrastructure, rather than addressing cumulative impacts occurring across key management areas.

Although sustainable development is promoted by most of South Africa's new environmental policies and legislation, its implementation is often skewed in terms of ecological integrity, social equity and economic growth. As a result of past

inequities, participation and the immediate demands of social equity often override limits set by the natural environment in importance. For example, during the implementation of the MLRA, stakeholders demanded a greater share from the ecological resource, which could be supplied in the short-term but not in the longer term, resulting in major conflicts between DEAT and local stakeholders (Lamberth 2001, *pers. com.*). For this reason, it is necessary to state explicitly that the limiting factor to resource allocation is the *carrying capacity of the ecological resource*. These limits, for both living and non-living ecological resources, must be defined before the local vision or management objectives are set. The effect of cumulative impacts must also be addressed through, for example, strategic environmental assessment.

Unfortunately, from a management perspective, humans are not constrained by ecological rules to the same extent as other animals are. Therefore the concept of carrying capacity, as it applies to people using estuaries, requires a somewhat different approach. The "Limits of Acceptable Change" (LAC) method has been developed for assessing carrying capacity in terms of protected areas and other sensitive sites. LAC involves a process whereby stakeholders identify the impacts that they are willing to accept and then develop "on the ground" standards for maximum acceptable impact. This implies a set of conditions that may not be exceeded and needs to be tested within the context of South African estuaries at both the public and the statutory levels (Boyd, Barwell & Taljaard 2000).

(ii) *Current and potential goods and services provided by estuaries*

Estuaries are focal points for community and business activities along the coast, as they provide a wide range of opportunities and benefits, such as a source of food, jobs and income generation, recreation, cultural activities and spiritual values. Local governments benefit by generating substantial revenue from higher rates that result from elevated property values along estuary shores. More rates mean that more services can be provided to coastal communities (Mander 2001). Indirect benefits are the ability of estuaries to control or reduce floods or improve water quality. Economic activities, such as estuary tourism, are maintained at minimum cost to the local council. As a consequence of these benefits, coastal communities, tourists and local governments along the coast depend on estuaries as an important source of revenue. Because estuaries are natural features, the opportunities that they provide are free. Free goods and services³ are seldom accorded their proper value and are thus commonly abused. Estuary goods and services are just like any other goods and services that may be bought, except that these are generated through the functioning of the estuary ecosystem. These goods and services can be used directly or indirectly, or they can be left as an option for future use. Few of these services are purchased, even though people regularly use them (Mander 2001).

Goods and services provided by South African estuaries are listed in Table 3.1 (Costanza *et al.* 1997; Mander, Turpie & Lamberth 2001; Mander 2001; South Africa 2000b).

³ The terms "goods" and "services" originate in the field of Ecological Economics. Daily (1997: pp 3) defines an ecosystem service as the conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfil human life. Ecosystem goods, on the other hand, represent the material products that are obtained from natural systems for human use (DeGroot *et al.* 2002: pp395). Ecosystem goods and services occur at multiple scales, from climate regulation at the global scale, to water supply at the local and regional scales (DeGroot *et al.* 2002). They also contribute direct or indirectly to human welfare, with those listed above being less directly connected, while food, raw materials, recreational opportunities, and aesthetic and cultural values are more directly connected.

Table 3.1 Goods and services provided by South African estuaries

CATEGORY	GOODS AND SERVICES	EXAMPLES OF OPPORTUNITIES & ACTIVITIES
Ecological	Biological control	Maintaining the balance/diversity of plants and animals
	Refugia/migratory corridors	Fish and crustacean nurseries and roost for migratory birds
	Sediment supply	Creation and maintenance of beaches, sand bars and sand banks
	Erosion control	Prevention of soil loss by estuary vegetation and by soil being captured in reed beds and mangroves
	Soil formation	Accumulation of sediment and organic material on floodplains and in mangroves; beach replenishment
	Nutrient supply and cycling	Nutrient supply, nitrogen fixation and nutrient cycling through food chains
	Genetic resources	Genes for mariculture, ornamental species and fibre
	Disturbance regulation	Flood control, drought recovery and refuge from natural and human-induced catastrophic events (e.g. oil spills)
Subsistence	Living resources for food (or resale)	Linefishing; intertidal collecting; beach and seine-netting
	Raw material for subsistence use (e.g. building material)	Harvesting of craftwork and house building materials
Recreational & Tourism	Nature appreciation	Provision of access to estuaries and associated wildlife for viewing and walking
	Scenic views	Resorts, residential houses, housing complexes and offices with scenic views; increasing turnover of properties with sea view
	Culture	Aesthetic, educational, research, spiritual, intrinsic and scientific values of estuary ecosystems
	Sports fishing	Estuary fly fishing; estuary and inshore conventional fishing
	Water sports	Water sports: Swimming, sailing, canoeing, skiing and kayaking
Commercial and Industrial	Waste treatment	Breaking down of waste and detoxification of pollution
	Water supply and regulation	Freshwater supply to marine environment and water for mariculture
	Mariculture (e.g. oysters and bait)	Production (natural and cultivated) of fish, crustaceans and worms
	Commercial food production	Fishing (not allowed in South African estuaries)
	Raw material for commercial use	Diamond and titanium mining, sand winning and salt production
	Transport services	Ports, harbours, marinas and ski-boat launching sites

(Source: Van Niekerk & Taljaard 2003)

Estuaries are economic assets just like any other service infrastructure. Local governments have asset registers listing all manner of built infrastructure and their related maintenance programmes. However, estuaries are seldom considered a local government asset, even though they generate considerable rates and other revenue for local government. Because of the failure to appreciate their value, little is spent on management. Estuaries should be regarded as an asset and managed to maintain their value. Failure to do so can have major cost implications for local governments (Mander 2001; Mander, Lamberth & Turpie 2001).

The use of estuaries should be balanced with the ability of estuaries to deliver goods and services. There is a need to manage the demands placed on estuaries to ensure that they do not exceed the natural ability of the ecosystem. If demand exceeds supply future well-being is reduced. If demand equals or is less than supply, the estuary will continue to supply goods and services sustainably. This should not be seen as a constraint to economic development but should rather be seen as an opportunity to diversify the local economy. By focusing on a wide range of complementary and

sustainable uses, the greatest benefits can be generated for the greatest number of people by an estuary at minimised cost to society (Mander 2001; Mander, Turpie & Lamberth 2001).

A number of trade-offs can be made regarding estuary use and management, such as investing management resources between different estuaries (e.g. identifying conservation priorities), deciding on benefits to be utilised and deciding on the extent to which resources are invested in estuarine management or in other local-government expenditure. Trade-offs need to be from a biological as well as an economic perspective. To do this requires a framework for economic decision making (e.g. the RDM process, a local user or management forum and local-government budget allocations), a decision making process (e.g. multiple-criteria decision making, cost-benefit analysis and cost-effectiveness analysis) and available economic information (e.g. the type of users and the value of benefits) (Mander, Turpie & Lamberth 2001).

Mander, Turpie & Lamberth (2001) believe that resource economics provide managers with a more proactive means for focusing on both the intended and the unintended results of using estuary resources, a technique to maximise benefits and minimise cost and to facilitate informed decision making. Lamberth & Turpie (2003) found that the management of estuaries in South Africa has not been well organised in the past but that, with the increasing realisation of their value, efforts are being made to redress the situation and to set in place sound decision making processes regarding the management and conservation of estuaries. This is both in terms of the management of catchments and freshwater requirements, and in terms of the direct management of estuaries and activities within them.

(iii) *Activities posing threats*

Many human activities carried out in and around estuaries impact directly on estuarine biodiversity and resource stocks. Different activities often conflict with one another through such impacts. If estuaries are to be managed in an optimal, sustainable way, it is necessary to understand the full impact of activities on the value of the goods and services that estuaries provide (Mander, Turpie & Lamberth 2001). Activities that could pose threats to the provision of goods and services by estuaries are listed in Table 3.2 The reason for explicitly listing activities and their associated impacts is to be able to identify clearly the direct and indirect impacts on other goods and services.

Table 3.2 Activities posing threats to South African estuaries

CATEGORY	RELATED ACTIVITIES
Land use and Infrastructure	Construction and upgrading of: <ul style="list-style-type: none"> • Electricity generation; • Nuclear reactors; • Transport routes, structures and facilities involving hazardous substances; • Bridges, roads, railways and airfields; • Marinas, harbours and all structures below the high-water mark (e.g. bank stabilisation, jetties and slipways); • Cableways; • Communication network structures and access roads; • Racing tracks; • Canals, channels and water-transfer schemes; • Dams, levees or weirs; • Reservoirs;

CATEGORY	RELATED ACTIVITIES
	<ul style="list-style-type: none"> • Bulk water-supply schemes (ground and surface water); • Public and private resorts; • Sewage treatment plants; and • Industrial and military facilities associated with explosives or ammunition.
	<p>Change of land use from:</p> <ul style="list-style-type: none"> • Residential use to industrial or commercial use; • Light industrial use to heavy-industrial use; • Agriculture or undetermined use to any other use; • Grazing to any other form of agricultural use; and • Nature conservation or zoned open space to any other land use (e.g. salt-works and mining). <p>Livestock in confined structures for the purpose of commercial use</p> <p>Husbandry involving invasive alien species (plants or animals)</p> <p>Reclamation of land below the high-water mark of the sea and in inland waters</p> <p>Solid-waste dump sites</p> <p>Use of water for recreational purposes (carrying capacity, e.g. boating, swimming, footpaths and vehicles in sensitive areas)</p> <p>Mining (sand winning, diamonds and titanium)</p>
Activities affecting water quantity and quality	<p>Taking water from a water resource (ground or surface water)</p> <p>Storing water</p> <p>Impeding or diverting the flow of water in a watercourse</p> <p>Activities resulting in stream-flow reduction, e.g.:</p> <ul style="list-style-type: none"> • Afforestation; and • Cultivation of crops. <p>Irrigating land with waste water generated through an industrial activity or a water treatment works</p> <p>Modifying atmospheric precipitation</p> <p>Power generation activity altering the flow regime of a water resource</p> <p>Discharging waste or water containing waste (e.g. sewage, industrial effluents and storm water)</p> <p>Disposing of waste in a manner that may detrimentally impact on a water resource (e.g. littering, solid-waste dumping, and septic and conservancy-tank seepage)</p> <p>Disposing in any manner water that contains waste from, or that has been heated in, any industrial or power-generation process</p> <p>Altering the bed, banks, course or characteristics of a watercourse (e.g. mouth breaching, dredging, dredge-spoil dumping and sedimentation or erosion issues)</p> <p>Using water for recreational purposes (e.g. water quality issues)</p> <p>Mariculture</p> <p>Oil spills occurring at sea</p> <p>Ballast water</p>
Exploitation of living Resources	<p>Commercial:</p> <ul style="list-style-type: none"> • Net fishing (e.g. gill nets, beach seine-nets and fyke nets); • Linefishing; • Collection of shellfish, red bait and other invertebrate species (e.g. bait); <p>Mariculture (including the use of genetically modified organisms);</p> <p>Fishing harbours; and</p> <p>Commercial-fishing activities (e.g. landing, transportation, delivery and processing, the aquarium trade, the curio trade, traditional medicine and medical research).</p>

CATEGORY	RELATED ACTIVITIES
	Subsistence: <ul style="list-style-type: none"> • Net fishing (e.g. beach seine-nets, gill nets, set nets, drift nets and stake nets); • Traditional fish traps; • Linefishing; • Collection of shellfish, red bait and other invertebrate species (e.g. bait); and • Aquatic plants (e.g. mangroves for building material)
	Recreational: <ul style="list-style-type: none"> • Cast-net fishing (fish and invertebrate species); • Linefishing; • Collection of shellfish, red bait and other invertebrate species (e.g. bait); and • Hobby-aquarium collection (e.g. exploitation of seahorses and pipe-fish).
	Biological pest control
	Ballast water

(Source: Van Niekerk & Taljaard 2003)

Underpinning the above-mentioned threats to estuaries are constraints to the effective cooperative governance of estuaries. In fact, ineffective governance leads to or exacerbates activities that pose threats to estuaries.

(iv) Opportunities and constraints

The present and future interactions between natural and human systems need to be considered. It includes the analysis of human needs and pressures that influence decision making in development and environmental management around estuaries. Problems need to be defined in terms of urgency, irreversibility and impact on ecological values. Of equal importance for this aspect is the identification of opportunities for development and for intervention (UNEP/MAP/PAP 1999).

The natural resources of estuaries provide a wide range of options for use, i.e. goods and services. Estuary management is more about the management of people's use of estuarine goods and services and less about the management of the natural environment. Conflicting uses, where one use reduces the scope and opportunities for other uses, should be limited, while complementary uses should be encouraged (Breen & McKenzie 2001). Conflicts, in particular, manifest themselves:

- Among users. For example powerboating and bird-watching are mutually exclusive;
- Between users and the natural environment where user activity impacts on the environment. For example where waste discharges exceed the assimilative capacity of an estuary; and
- Between the natural environment and users, where environmental events and processes such as floods and beach erosion create risks or hazards to human life and property.

Interactions between the various users and functions of the estuary can be quantified by sequential cause-and-effect analyses using the Driver-Pressure-State-Impact-Response (DPSIR) approach (UNEP/MAP/PAP 1999). Analysis of the existing situation and forecasts can be made by means of the Strengths-Weaknesses-Opportunities-Threats (SWOT) technique, taking into account the (UNEP/MAP/PAP 1999):

- Limits of change and carrying capacity of the natural system (i.e. understanding of the natural environment);
- Goods and services provided by the natural system (i.e. the socio-economic context);

- Human activities posing threats (i.e. activities affecting on the ability of the natural system to provide goods and services); and
- Forecasting of future developments (either the projection of existing trends or expected future trends).

To decide on the optimum combination of good and services, within the limits or carrying capacity of the natural environment, multi-criteria techniques can be used to discriminate between various options (UNEP/MAP/PAP 1999). It is strongly recommended that one of the criteria included in such analyses be the economic value of the resource and the goods and services provided.

(v) Setting local vision and objectives

Ultimately, a vision for a particular estuary with site-specific ecological and socio-economic objectives needs to be defined. For these objectives to be implemented effectively, they must be presented in a measurable format for both the biophysical and the socio-economic environments, e.g. indicators with specific target values or ranges must be defined.

3.5.2 Local management strategies

There are two prerequisites for the successful implementation of management strategies. To work, EMPs need to: 1) have legal status; and 2) be realistic (UNEP/MAP/PAP 1999). Management strategies should therefore consider the scale of the problem, the capacity of local government, human and financial resources required and the necessary technological support available. As soon as an appropriate level of governance for the plan has been defined, a coordination mechanism has to be set in place in the form of a special agency, committee or body that is assigned a leading role in plan implementation.

Effective implementation of local ecological and socio-economic objectives, requires their translation into sound management strategies. It is important that local management strategies be aligned with national and provincial or regional strategies. For effective implementation, local management strategies need to be encapsulated in local management plans.

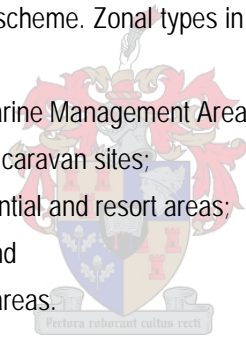
In view of the complexities surrounding estuarine management (e.g. overlapping legislation, conflicting goods and services and complex ecological processes), EMPs need to be developed specifically for the individual estuaries concerned, which would integrate all the different requirements, both ecological and socio-economic. In order to deal decisively and in a proactive manner with activities or developments in and around estuaries, EMPs should be formally gazetted. Furthermore, before an EMP can be gazetted, it should be properly reviewed and approved by appropriate national and/or provincial authorities to ensure alignment with national or regional objectives and strategies. Such a review is also important to resolve potential conflict between and within sectors of society (e.g. between government institutions). Both estuarine specialists providing the ecological context and the social and resource economic specialists providing socio-economic context must participate in the review process. This will ensure that local strategies, as detailed in the EMP, can achieve the overall objectives.

An EMP should include (Van Niekerk & Taljaard 2003):

- A description of the area, with spatial references (for management purposes boundaries of the system may extend beyond the estuary itself);
- Local vision and management objectives;
- Details on how national or regional objectives are to be achieved;
- Description of the status and location of existing and proposed infrastructure;
- The goods and services provided by the estuary;
- The type and intensity of use in areas zoned for specific purposes;
- The demarcation of dynamic or hazardous areas not to be developed;
- Details on the Reserve and RQOs, if determined for an area (NWA requirement);
- A detailed compliance plan and the monitoring thereof;
- A detailed, integrated monitoring plan (both compliance and baseline), including the allocation of responsibilities and an indication of monitoring frequency;
- An awareness and education programmes to be introduced;
- Details of the resource (both human and financial) implications of the plan; and
- A record of the management process followed, including the public participation process.

Part of the EMP should be an estuarine zoning scheme. Zonal types in estuaries may, for example, include one or more of the following:

- Protected areas, e.g. EPAs, ECAs and Estuarine Management Areas (Turpie 2004a);
- Limited development zones, e.g. camping or caravan sites;
- High-density development zones, e.g. residential and resort areas;
- Recreational zones, e.g. swimming areas; and
- Boating zones, e.g. sailing or powerboating areas.



At present, zonation in and around estuaries occurs on a fragmented or *ad hoc* basis, depending on provincial ordinances and local by-laws. However, it is likely that future zonation plans for estuaries will become a legal requirement and form part of more comprehensive EMPs.

To ensure effective governance, EMPs must be incorporated into broader coastal management plans, such as the Municipal Coastal Management Programmes (CMP) (as proposed under the Coastal and Estuarine Bill), or as a part of Integrated Development Plans (IDPs), as required by the Local Government: Municipal Systems Act. As an incentive to encourage local authorities to develop EMPs in their area, national government could offer financial assistance. This could be in the form of either a one-off contribution for developing such a plan and/or a co-funding option where both the national and the relevant local authority contribute towards this effort. The Marine and Coastal Fund, proposed under the Coastal and Estuarine Bill could, for example, be utilised in this manner. Revenue generated from permits, fines and the sales of confiscated goods, like nets and boats in a particular estuary, could also be utilised to develop and even implement the EMP of that system.

3.5.3 Local implementation of objectives and management strategies

This step entails the actions that need to be taken in the implementation of the EMP. Implementation focuses on managing the activities and developments in and around estuaries dealing with: 1) land use and infrastructure planning; 2) water quantity and quality; and 3) exploitation of living resources. Implementation at a local level typically includes the following five steps:

- Step 1: Submission of application;
- Step 2: Assessment of impacts against EMP guidelines;
- Step 3: Setting of critical limits for activity or development;
- Step 4: Operational management plans for activity or development; and
- Step 5: Implementation of operational management plans.

The steps are similar to that required in the EIA process to ensure alignment with current practises in land use and infrastructure planning. In the case of new developments, the above process should logically start at Step 1, allowing for a proactive approach. However, in the case of existing activities already in their operational phase (Step 5), a reactive approach may be required. Where operations of an existing development or activity result in non-compliance with ecological or socio-economic objectives, the causes of impacts need to be established (i.e. Step 2) and mitigating actions need to be taken in terms of either the setting of critical limits or the revision of the management plans and operations associated with the development or activity (i.e. Steps 3 to 5). The individual steps are discussed in greater detail below.

Step 1: Submission of application

Before embarking on any activity or development that could impact directly or indirectly on an estuary, the applicant should have a pre-application consultation with the relevant departments and authorities, either telephonically, by letter, by facsimile, by e-mail or, preferably, by personal meeting. Consultation at such an early stage will avoid delays caused by requests for additional information and provide an opportunity for an exchange of views at a flexible stage. It will also clearly indicate to the applicant whether the proposed activity can be accommodated in the overall vision and management objectives set for the estuary. Following a pre-consultation process, the applicant will then be required to submit a formal application of which the required content is usually specified in relevant legislation.

Step 2: Assessment of impacts against EMP guidelines

Depending at the scale of the activity or development and its related impacts (nature, extent, duration, intensity and probability), the responsible authorities may require a detailed impact assessment. It is recommended that, at all times, such assessment be done by acknowledged experts in estuarine processes (both physical and biological), so that not only are direct impacts identified and evaluated but also possible indirect impacts are highlighted and assessed. Cumulative impacts also need to be evaluated, as estuaries become degraded due to "the death by a thousand cuts principle", according to which no single development is responsible for a deterioration in health but in which collective impacts reduce the productivity and functionality of an individual or regional estuary ecosystem(s).

Step 3: Setting of critical limits for activity or development

Approval for a proposed development or activity may be granted under specific conditions. These conditions usually include the setting of critical limits, which the activity may not exceed. Critical limits are typically laid down in the individual permit or licence conditions of an approved development or activity and should be measurable. Examples of critical limits appear in Table 3.3.

Table 3.3 Examples of critical limits for activities or developments

LAND USE AND INFRASTRUCTURE	WATER QUANTITY AND QUALITY	MARINE LIVING RESOURCES
Extent of a building line or garden into a flood plain	Volume and flow rate of an effluent	Closed period for an estuary to protect specific species during vulnerable periods in their life cycle, e.g. spawning migration.
Quantification of recreation carrying capacity (e.g. number and type of boats).	Restriction on direct abstraction during low flow periods	Demarcated areas for fishing (protected areas within an estuary)
Number and type of jetties allowed per development	Nutrient concentration limits of an effluent being discharged into an estuary	Limit on the number of boats on an estuary or limiting activities in prime habitat in order to lower the disturbance factor.

Step 4: Operational management plans for activity or development

The main purpose of operational management plans is to ensure compliance with the set critical limits. Management plans should be detailed, clearly showing how the activity or development intends to minimise or mitigate impacts. These operational management plans should be assessed in terms of their alignment with ecological and socio-economic objectives and take into account the management strategies for particular systems. A key component of an operational management plan is a monitoring programme that focuses on the potential impacts of a particular activity or development.

Step 5: Implementation of operational management plans

Operational management plans are implemented after an activity or development has been commissioned or where the construction of a development has been completed. Non-compliance with these plans during the implementation can still result in detrimental impacts on the environment. Therefore the effectiveness of the operational procedures also needs to be considered in evaluating the impact of an activity or development.

3.5.4 Local compliance monitoring

The purpose of compliance monitoring programmes is to assess (or audit) the performance of specific activities or developments against predetermined critical limits and the ecological and socio-economic objectives of the estuarine environment on which they may have an impact. Such monitoring programmes are therefore usually linked to specific activities or developments in and around estuaries and that are also required to finance such programmes.

Compliance monitoring programmes for specific activities or developments are often developed independently, as these arise from different departmental and legal requirements. It is therefore necessary that local estuarine management

authorities coordinate compliance monitoring programmes to ensure the efficient use of resources and to prevent duplication. Aspects such as monitoring sites, monitoring frequency and monitoring parameters should be taken into account. Guidelines for the local monitoring of estuarine-specific activities or developments have been developed in detail by McGwynne and Adams (2004). Taljaard *et al.* (2003) developed guidelines for the detailed scientific monitoring of estuarine ecosystems in order to establish change over time.

3.5.5 Local assessment and evaluation of specific activities or developments

The assessment and evaluation of specific activities or developments entail compliance testing against critical limits set for processes and actions associated with the activity or development as well as with measurable ecological and socio-economic objectives set for a particular estuary. Assessment against measurable ecological and socio-economic objectives, in the case of specific activities or developments, focus on the potential zone of impact. As a result of the complexity of estuarine dynamics, the temporal and spatial scales (footprint) associated with a specific activity or development may extend well beyond the anticipated zone of impact. The extend of the footprint therefore also needs to be taken into account in both the design of monitoring programmes and assessment. The frequency of such assessments range from high (daily, seasonally) to medium (biannually, annually), depending on the environmental component.

The assessment and evaluation of specific activities or developments are typically conducted at medium to high frequency intervals. High frequency intervals refer to the assessment and evaluation of data collected on the processes and actions of a particular development or activity against the critical limits. The frequency of such assessment can range from hourly to monthly, for example the monitoring of the flow and water quality of waste discharge into an estuary to assess against critical limits set for the discharge. Frequent assessment and evaluation of operations against predetermined critical limits provide for early-warning systems in terms of potentially detrimental impacts on the receiving estuarine environment and its goods and services and should therefore form part of permit and licence conditions.

3.5.6 Local role players and institutional structures

A range of key role players and stakeholders need to be involved in local estuarine management, among which:

Local lead agent: The local municipal authority or conservation agency (in consultation with national DEAT, which deals with aspects related to marine living resources).

Important stakeholders: The Provincial Departments of Environmental Affairs and of Planning, CMA or the national DWAF, Nature Conservation, the National Parks Board (for an estuary in a National Park), the Department of Provincial and Local Government and the National Port Authority (NPA) (for a port within an estuary). Other important local stakeholders include: Tourism boards, heritage associations, WUAs, ratepayers associations, local developers and industries, local angling or fishing groups, Non-Governmental Organisations (NGOs), Community-Based Organisations (CBOs), estuarine specialists (ecological, social and resource economic) and the general public.

Institutional Structures: Estuarine forums comprising some of the above-mentioned stakeholders should be established to act in an advisory role to the estuarine management authority. WAU (under the NWA) are formal institutional structures through which forums can gain legal recognition. To bestow legal status on a forum or WAU, it is important that a local municipality or nature conservation authority forms part of the forum or association.

A smaller working group, consisting of the different estuarine management authorities, needs to be established for each estuary to deal with the day-to-day implementation of the EMP in order to ensure rapid responses to, for example, monitoring results. The initiative to establish such a working group needs to come from the estuarine management authority already involved in a compliance monitoring programme in the system.

The Consultative Advisory Forum (CAF) was established with the aim of advising the Minister of Environmental Affairs and Tourism on scientific matters related to the planning and operations of the exploitation of living resources, including those in estuaries. Coupled to this is the establishment of Management Advisory Groups (MAGs), which debate and provide input on a specific fishery or resource, e.g. the Tuna Management Advisory Group. The establishment of an estuarine MAG would provide an ideal forum to debate and finalise EMPs and to provide recommendations on estuarine issues directly to CAF and/or the Minister. Representation on these forums includes scientific institutes, industry, recreational sectors (e.g. recreational angling), provincial government and nature conservation authorities.

Although the planning associated with the exploitation of marine living resources is done by the national DEAT, institutional arrangements to assist the Department with operational aspects at a local level include role players such as:

- MCM compliance officers;
- Delegated or appointed local authorities;
- Honorary officers (appointed by MCM or local authorities);
- Harbour masters (where fishing harbours are situated within an estuary, e.g. the Berg River Estuary);
- Conservancies;
- South African Police Services; and
- South African National Defence Force.

3.6 The NEMP summary

The proposed NEMP (illustrated in Figure 3.2) provides a framework for considering explicitly aspects previously outside the scope of planning. The integrated approach leads to better coordination of policy making and management across sectors (water, forestry, agriculture, urban development, marine living resources, environmental protection, etc.) and geographically, leading to a more rational use of resources and more effective environmental protection.

The proposed NEMP allows for proactive planning in space and time to reduce potential conflicts, bridge potential gaps and streamline potential overlaps among legislation. This can be done through recognising key linkages between coastal areas and river systems (both natural processes and human activities) and identifying key areas (both geographical and sectoral) where policy intervention is required. The substantial differences in terms of time frame and geographical scale among the various processes operating in coastal areas and river basins must be borne in mind in the decision making

process. Above all, the proposed NEMP provides a way to manage the estuaries of South Africa, with their related interdependence and interactions, at a regional level.

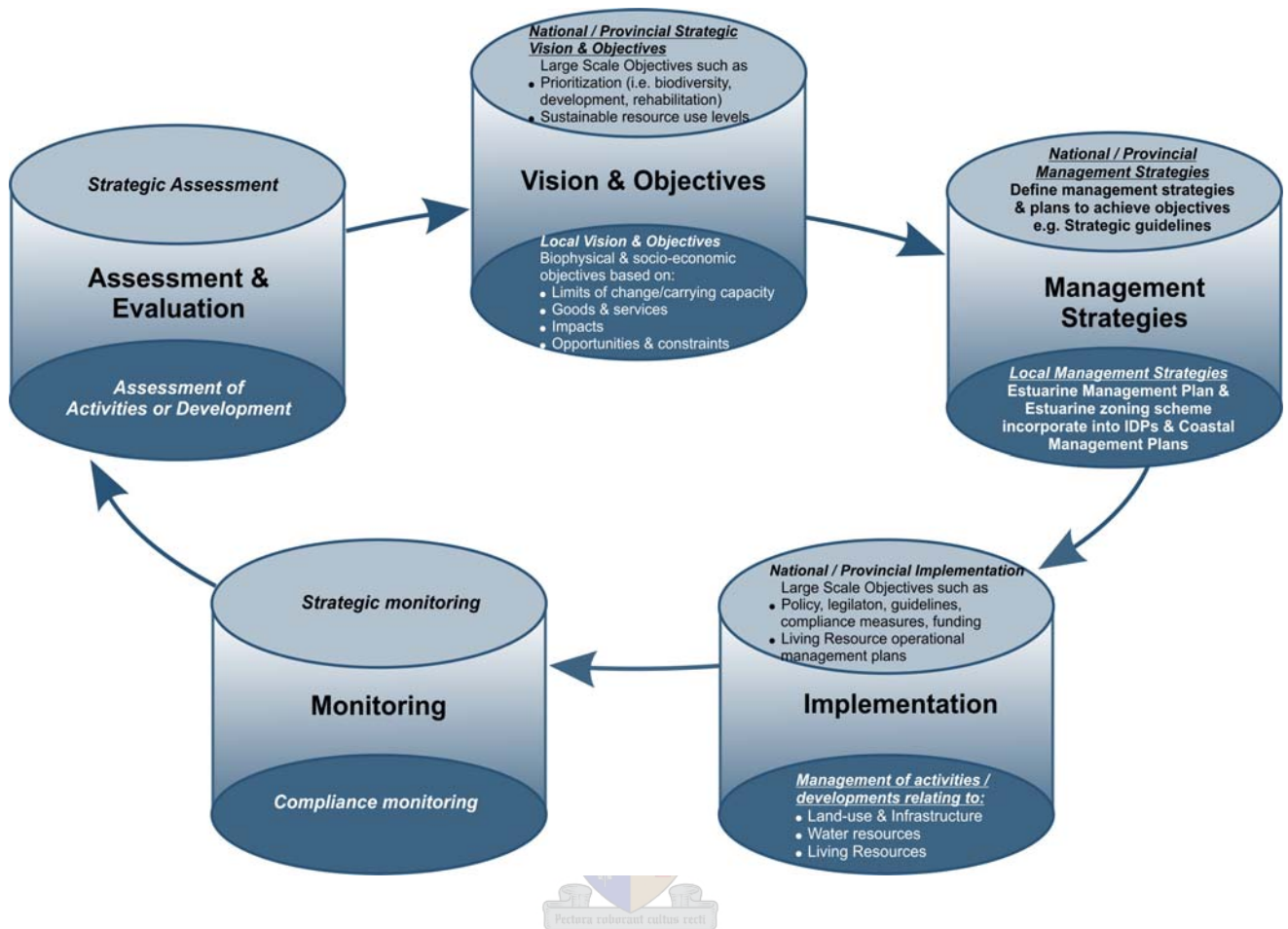


Figure 3.2 Proposed National Estuarine Management Protocol

Chapter 4: Towards application of the protocol in the Cape Floristic Region

A protocol for estuarine management in South Africa was presented and discussed in the previous chapter. Examples of the application of the protocol (or elements thereof) in South Africa follows. The first application discussed is at the regional level in the Cape Floristic Region (CFR) followed by two local examples. It has to be borne in mind that the protocol only has been proposed in draft legislation and, as yet, has no official recognition or legal status. The discussions, therefore, will focus on those issues where research and practice have gone some way towards the ideal implementation.

4.1 Regional application in the CFR

Since the CFR is unique in its international status as a biodiversity hotspot, its estuaries are of particular importance. It is, therefore, reasonable to use the CFR to test and refine the implementation of the protocol. This section commences with an overview of the CAPE Estuaries Programme (CEP), detailing its strategic vision, objectives, strategies and management structures. An overview of estuaries in the region is given before justifying the selection of specific estuaries for pilot testing the regional management approach. An outline of the future work plan provides detail on the regional implementation of the programme.

4.1.1 The CAPE Estuaries Programme

The comprehensive CEP will be the first of its kind in South Africa, perhaps even internationally, and will be a test case for the incorporation of strategic decision making into estuarine management. The programme forms part of the larger Cape Action Plan for People and the Environment (CAPE). The programme was developed through the drafting of a discussion document by the researcher and CSIR colleagues (Van Niekerk, Morant & Taljaard 2002), which was then workshopped with the relevant stakeholders (e.g. MCM and DEAT). The proposed project work plan was then reviewed by the funding agency, the Global Environmental Facility (GEF), at a proposal conference and approved for implementation. Funding from the GEF, MCM (DEAT) and DWAF was provided to implement the programme in 2005.

The aim of the CEP is to ensure the conservation and sustainable utilisation of the estuarine biodiversity in the Cape Floristic Region (CFR). The programme follows a strategic, integrated approach to estuarine management. Cooperative governance is seen as a key requirement for the success of the programme. The proposed NEMP is the recommended approach for establishing broad alignment at a regional scale. To pilot test the strategic concept, the CEP was designed in accordance with the guidelines of the proposed Protocol (as stipulated in the new National Environmental Management: Coastal Zone Bill, Draft 11). The CEP will follow a phased approach, in which Phase I (2005 to 2009) will focus on the design and testing of the process delineated by the proposed NEMP in a number of pilot estuaries in the CFR. Phase II (2009 to 2014) will extend the Programme to more complex estuaries (from a management perspective) in the region. Phase III (2015 to 2020) will expand the Programme to all the remaining estuaries within the CFR.

The first task of the CEP was to hold a workshop with 61 scientists and managers from 29 organisations (Van Niekerk & Taljaard 2005). The purpose of the workshop was to:

- Develop the overarching vision for the CFR;
- Prioritise the threats of the CFR estuaries;
- Develop strategic objectives and management strategies to counter the major threats;
- Identify the tools, methods, guidelines and targets needed to implement these strategies;
- Nominate the members of a working group to assist in the technical guidance and development of the programme; and
- Select the four to six pilot estuaries in the CFR to be used as case studies.

These task elements provide the structure for the following subsections.

4.1.2 Vision for the CEP

The overarching vision, objectives and management strategies for the CEP was developed at the workshop (Van Niekerk & Taljaard 2005). The regional vision and objectives for the estuaries of the CFR recognise both South Africa's national and international obligations pertaining to estuaries as well as local socio-economic requirements (e.g. livelihoods and tourism) for growth in the region. The vision describes an ideal state and focuses on the core issues decided upon by consensus among the participants of the workshop. The vision also serves to motivate role players in estuarine management in the region regarding future actions.

The strategic vision for the estuaries in the Cape Floral Region is (Van Niekerk & Taljaard 2005):

Our estuaries are beautiful, rich in plants and animals, they attract visitors, sustain our livelihoods and uplift our spirits.

This vision translates into a formal statement that reads:

The estuaries of the CFR sustain our spiritual and economic wellbeing through their biophysical attributes and production of goods and services, which are made possible by the maintenance of their biodiversity and ecosystem functions (integrity).

The formal vision highlights the different aspects of the CFR estuaries that are valued and that need to be enhanced and managed, namely:

- Their contribution to society's spiritual well-being;
- Their role in the region's economic welfare;
- Human dependency on the goods and services that the CFR estuaries provide;
- The importance of their biophysical attributes; and
- The value of maintaining the biodiversity and ecosystem function so that society can derive these benefits from these systems.

The formal vision was developed to impress upon scientists and managers the technical aspects that are of value to the region and to communicate these to the larger scientific community and funding bodies.

4.1.3 Constraints to the CEP vision

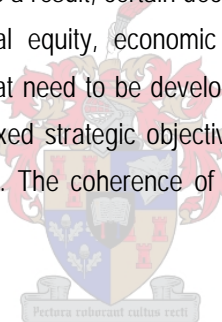
Taking into account the regional and local understanding of operational constraints, guiding policies, legislation and institutional structures in South Africa, activities and management actions posing threats to the estuaries of the CFR can be subdivided into a number of broad categories (Van Niekerk & Taljaard 2005; Van Niekerk & Taljaard 2003; Turpie 2002; Breen & McKenzie 2001; Boyd, Barwell, & Taljaard 2000; Morant & Quinn 1999; Smith & Cullinan 2000; Glazewski 2000; Prochazka & Griffiths 2000):

- The unsustainable use of living resources;
- Water quantity and quality (i.e. the modification of river flows or pollution);
- Land use and infrastructure planning (i.e. the modification and destruction of habitat);
- Institutional and management structures;
- Climate change; and
- Education and awareness.

4.1.4 Strategic objectives for the CEP

Estuaries do not operate in isolation but are connected ecologically to other estuarine systems in the CFR and even globally (e.g. through fish and bird migrations). As a result, certain decisions need to be made at a higher level to ensure overall sustainability (taking into account social equity, economic growth and ecological integrity). The strategic objectives for the CEP set out: 1) the targets that need to be developed to achieve the vision; and 2) the key actions required to address the priority threats. The boxed strategic objectives below were developed to achieve the CAPE Estuaries vision (Van Niekerk & Taljaard 2005). The coherence of the approach achieved through these functional groupings is demonstrated graphically in

Figure 4.1.



Living resources:

Achieve targets for ecosystem biodiversity and health in terms of the long-term habitat persistence of habitats, species, community structure, biomass and functioning by 2015.

Water quantity and quality:

Determine, implement, monitor and review resource-quality objectives (taking into account public health) in order to maintain or restore estuarine structure and function in the best attainable state for five priority estuaries within the CFR by 2010.

Land-use and infrastructure planning:

Define estuarine areas, assess their current status and values and formulate appropriate, integrated management plans to regulate development and other activities impacting upon them, with particular reference to cumulative impacts by 2008.

Institutional and management structures:

Relevant management institutions comprising appropriate spheres of government and civil society cooperatively manage estuaries according to appropriate management plans by 2010.

Climate change:

Minimise the detrimental impacts of predicted climate change by 2010 through:

- 1) *Long-term precautionary approaches to infrastructure development and water resources planning;*
- 2) *Influencing land management in upper and middle catchments to reduce impacts on estuaries; and*

3) Long-term sustainable livelihoods promoted through estuarine management that minimises risks.

Education and awareness:

Generate education and awareness regarding the CFR estuaries by 2010, having:

- 1) Contributed to integrated, collaborative and informed action and decision making regarding estuaries;
- 2) Contributed to a sustainable quality of life;
- 3) Promoted good management practices that will sustain healthy estuarine functioning;
- 4) Raised awareness of the intrinsic value of estuaries and developed a sense of ownership of estuaries among not only the local communities but the whole of South Africa; and
- 5) Raised awareness of and insight into the legal context and obligations of all levels of government (national, provincial, local and community).

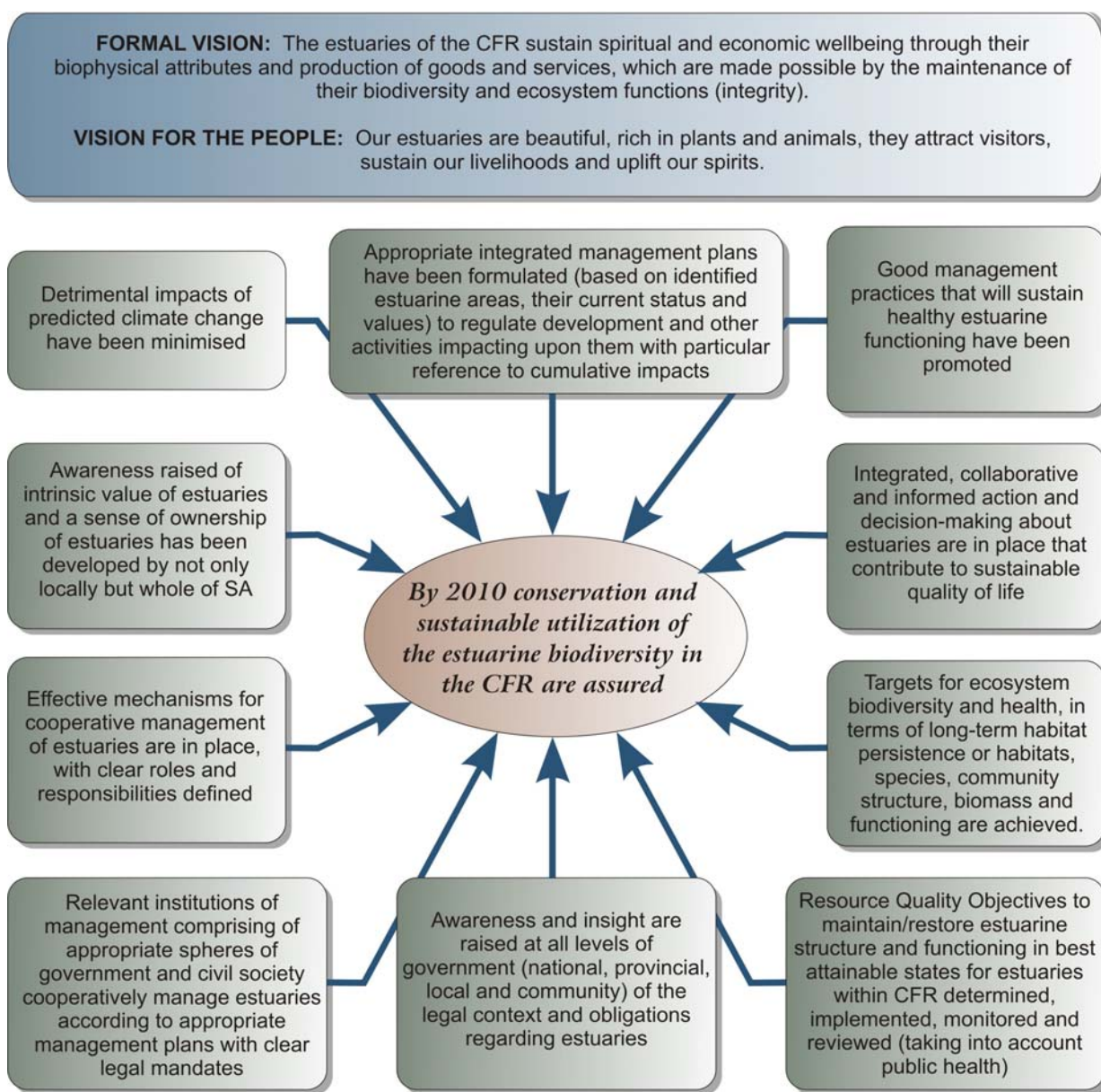


Figure 4.1 The vision and strategic objectives for the CEP

4.1.5 Management strategies for CEP

In order to achieve the strategic objectives, management strategies were developed to deal with the key threats that prevent the achievement of the overarching vision. These can be divided into the overarching strategy to protect biodiversity and the individual management strategies necessary to deal with specific strategic objectives. Appendix B provides more details for the interested reader.

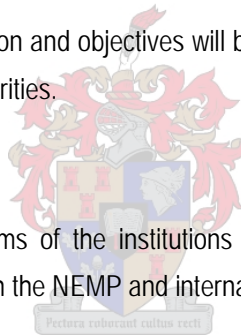
The workshop participants were tasked with developing an action plan for each strategy, taking cognisance of (Van Niekerk & Taljaard 2005):

- The identified key threat(s);
- The action needed to mitigate/address the key threat(s);
- The level/sphere of governance responsible for managing the action;
- The institution/organisation responsible for executing the action;
- The tools and/or methods required to perform the action;
- The completion date for the action; and
- The expected outcome of the action.

Some of the actions required to achieve the vision and objectives will be executed by the CEP itself, while others will be executed in collaboration with the relevant authorities.

4.1.6 Management Structure of the CEP

The management structure is analyzed in terms of the institutions represented in the various structures and their delegated responsibilities to show alignment with the NEMP and international approaches.



4.1.6.1 CAPE estuarine task team

The CEP will be guided by an estuarine task team comprised of the key funding bodies and major role players in the region (e.g. CapeNature, DWAF, MCM and DEAT). The estuarine task team consists of five members under the chairmanship of Dr K Hamman from CapeNature.

The role of the estuarine task team is to:

- Report to CAPE on the progress of the CEP;
- Secure the provision of the identified national or regional funding for the programme;
- Communicate outcomes of the programme to the various government departments at the appropriate level; and
- Ensure alignment of the CEP with departmental mandates.

4.1.6.2 Estuarine working group

A working group was nominated at the workshop to assist the estuarine task team in fulfilling its obligations regarding the CEP. The Working Group comprises 10 members (50% managers and 50% scientist) from eight organisations under the chairmanship of the researcher.

The objectives of the estuarine working group are to:

- Attend scheduled bi-annual meetings to consider CEP related issues;
- Report to the CEP estuarine task team;
- Provide technical guidance to the CEP;
- Review products and documentation produced by the programme, including individual EMPs for the pilot estuaries;
- Review the overall direction of the programme and assist in the future planning of the programme (e.g. Phase II and Phase III); and
- Where funding allows, assist government departments (national to local) with the management of the estuaries in the CFR⁴.

4.1.6.3 Technical advisors to the working group

In addition to the working group, 12 people from 10 organisations with line functions at specific estuaries or with specialists in certain areas were listed and can be consulted on specific estuarine-related issues if and when their inputs are required.

4.1.7 Pilot estuaries for the CEP

This section finally turns the attention to an overview of CAPE estuaries and justifies the selection of the pilot estuaries.

4.1.7.1 Overview of the CAPE estuaries

Sixty-two estuaries are recognised in the CFR. These range in size from major systems (Olifants, Great Berg, Breede) to small estuaries such as the Lourens, Buffels, Klipdrift, Maitland. Important attributes (such as size of an estuary and the number of fish or plant species occurring within it), are known, enabling the ranking of the CFR estuaries according to a range of criteria. These attributes are listed in Table 4.1 comparatively allowing the reader to develop a sense of the range and diversity within the CFR.



⁴ It is envisaged that the CEP working group will be similar to the Management Advisory Groups (MAGs) that support the Consultative Advisory Forum (CAF). The Consultative Advisory Forum is an institutional structure under the Marine Living Resources Act with the particular aim of advising the Minister of Environmental Affairs and Tourism on scientific matters related to the planning and operations of the exploitation of living resources, including those in estuaries. The establishment of a regional estuarine working group could also be considered a "pilot process" (like the pilot EMPs). In future, a national estuarine working group could include other provinces and could provide an ideal forum to debate and finalise estuarine management planning and provide recommendations on estuarine issues directly to the responsible Departments, the coastal working groups and/or the relevant Ministers.

Table 4.1 Ranking of the Cape Floral Region estuaries⁵

NO.	ESTUARY	TYPE	SIZE (ha)	BIODIVERSITY IMPORTANCE SCORE	SA RANK	ATTRIBUTES
1	Olifants	O	701.69	98.5	2	<ul style="list-style-type: none"> • Comprehensive water Reserve (DWAF) • CAPE Cederberg Initiative • Very high biodiversity importance • Very high demand for water abstraction • High nutrient load from agricultural return flow • Gillnet fishery in estuary causing severe degradation • Local fishing management structure (including alternative and sustainable livelihood projects)
2	Verlorenvlei	L		71.5	57	<ul style="list-style-type: none"> • Sandveld Groundwater Project
3	Berg (Groot)	O	3615	98.4	3	<ul style="list-style-type: none"> • Skuifraam Berg Estuary Monitoring Project (DWAF) • Planned comprehensive Reserve • Planned Ramsar site • High biodiversity importance • High user conflict • Local forum (Laer Groot Berg Bewarings Assosiasie)
4	Rietvlei/Diep	C	515	69.9	65	<ul style="list-style-type: none"> • Municipal reserve • Highly modified • High user conflict • Local forum (Friends of Rietvlei)
5	Disa (Hout Bay)	R		36.1	177	<ul style="list-style-type: none"> • Local forum (Friends of Hout Bay)
6	Wildevoëllei	C	75.79	77.9	39	<ul style="list-style-type: none"> • Table Mountain National Park • Local forum (Friends of Wildevoëllei/Kommetjie Environmental Action Group)
7	Bokramspruit	C		15.0	244	<ul style="list-style-type: none"> • Table Mountain National Park • Local forum (Kommetjie Environmental Action Group)
8	Schuster	C		15.0	245	<ul style="list-style-type: none"> • Municipal reserve
9	Krom	C		29.6	202	
10	Silvermine	C	6.52	41.8	160	<ul style="list-style-type: none"> • Local forum (Friends of Silvermine) • CMC rehabilitation project
11	Sand	C	155.48	76.3	44	<ul style="list-style-type: none"> • Medium/high biodiversity importance • Planned municipal reserve • Local forum (Sandvlei Trust)
12	Eerste	C	10.2	38.3	171	<ul style="list-style-type: none"> • New MPA
13	Lourens	C	7.09	38.3	172	<ul style="list-style-type: none"> • New MPA • Local forum (Friends of Lourens River)
14	Sir Lowry's Pass	C	2.95	29.5	204	
15	Steenbras	O	1.88	18.5	236	
16	Rooiels	C	10.84	43.3	156	
17	Buffels (East)	C	17.28	46.5	138	
18	Palmiet	O	33	63.9	78	<ul style="list-style-type: none"> • Kogelberg Biome • EFR
19	Bot/ Kleinmond	L	1 698.4	96.3	8	<ul style="list-style-type: none"> • Kogelberg Biome • High biodiversity importance

⁵ The CFR estuaries are ordered from west to east in terms of their type, size (ha) and updated conservation importance score. Estuary types are classified as river mouths (R), permanently open (O), temporarily open/closed (C), estuarine bay (B) and estuarine lakes (L).

NO.	ESTUARY	TYPE	SIZE (ha)	BIODIVERSITY IMPORTANCE SCORE	SA RANK	ATTRIBUTES
						<ul style="list-style-type: none"> • Local forum (Friends of Botvlei)
20	Onrus	C	41.13	57.4	95	<ul style="list-style-type: none"> • Local forum (Friends of Onrus)
21	Klein	L	2 958.9	95.9	9	<ul style="list-style-type: none"> • Link to terrestrial nature reserve • Link to Marine Protected Area • Very high biodiversity importance • High water demand • Artificial breaching • Low-lying developments • Local forum (Klein River Advisory Committee) - Inactive at present
22	Uilkraals	C	104.7	75.3	49	
23	Ratel	C	10	30.9	196	
24	Heuningnes	O	172.51	83.5	24	<ul style="list-style-type: none"> • Ramsar site • Link to terrestrial nature reserve • Link to Marine Protected Area • CAPE Agulhas Plain Initiative • High biodiversity importance • Need to link to Soetendalsvlei in management plan • Used to close, managed as permanently open • Sedimentation • Potential backflooding of agricultural land
25	Klipdrifsfontein	C		13.5	251	
26	Breede ⁶	O	455.28	86.8	19	<ul style="list-style-type: none"> • Intermediate water Reserve (DWAF) • High water demand • High biodiversity importance • High user conflict on estuary • MCM/CapeNature/River Rangers compliance initiative • Active local forum (Breede River Rangers) • High conflict with boating activities
27	Duiwenhoks	O	203.07	83.6	23	<ul style="list-style-type: none"> • High importance • Wetlands rehabilitation project (Department of Agriculture) • Next to potential MPA • Local forum (Vermaaklikheid)
28	Goukou ⁷	O	154.76	79.9	34	<ul style="list-style-type: none"> • Part of new Marine Protected Area • CAPE Gouritz Initiative • Hessequa Municipality busy with EMP • Medium/high biodiversity importance • High conflict w.r.t. boating activities
29	Gouritz ⁸	O	112.58	75.5	46	<ul style="list-style-type: none"> • Gouritz Initiative • Medium/high biodiversity importance • Local forum (Gouritz Trust)
30	Blinde	C		25.8	215	
31	Hartenbos	C	40.59	64.5	77	<ul style="list-style-type: none"> • Highly modified
32	Klein Brak	C	96	58.0	93	<ul style="list-style-type: none"> • Planned Reserve

⁶ The Breede River Rangers and CapeNature are in the process of developing an EMP based on available data, but require guidance on the carrying capacity of the estuary.

⁷ The Goukou Estuary provides a working model of the process to be followed in developing an EMP. An "Action Plan for the Goukou catchment and estuary" has been consolidated through public participation and only requires funding to draft the EMP. This funding can be provided either through CAPE or the Gouritz Initiative.

⁸ The Gouritz Trust has set aside R40 000 for the drafting of an EMP and would look favourably on a co-funding model.

NO.	ESTUARY	TYPE	SIZE (ha)	BIODIVERSITY IMPORTANCE SCORE	SA RANK	ATTRIBUTES
33	Groot Brak	C	113.92	75.4	47	<ul style="list-style-type: none"> • Planned comprehensive/intermediate Reserve • Local forum (Great Brak Environmental Committee)
34	Maalgate	C	13.5	31.5	191	
35	Gwaing	C		13.6	250	
36	Kaaimans	O	8	27.5	209	
37	Wilderness	L		82.5	27	<ul style="list-style-type: none"> • Ramsar • Wilderness Lakes National Park
38	Swartvlei	L	1 076.6	96.5	7	<ul style="list-style-type: none"> • Ramsar • Wilderness Lakes National Park • High biodiversity importance • Rapid Reserve
39	Goukamma	C	270	67.8	69	<ul style="list-style-type: none"> • Nature reserve • MPA • Rapid Reserve
40	Knysna	B	3 594	100	1	<ul style="list-style-type: none"> • Part of SANParks • High user conflict in and around estuary • Very high biodiversity importance • Subsistence Fishery Forum • Landscape Initiative • Planned Intermediate Water Reserve (DWAF)
41	Noetzie	C	8	20.1	231	<ul style="list-style-type: none"> • Rapid Reserve
42	Piesang	C	92.24	70.8	62	
43	Keurbooms	O	295.17	88.3	18	<ul style="list-style-type: none"> • Nature reserve • Planned Reserve • High biodiversity importance
44	Matjies/Bitou	C		23.4	220	
45	Sout (East)	O	52.22	57.9	94	<ul style="list-style-type: none"> • Tsitsikamma National Park
46	Groot (West)	C	39.28	62.4	82	<ul style="list-style-type: none"> • Tsitsikamma National Park
47	Bloukrans	R		52.1	113	<ul style="list-style-type: none"> • Tsitsikamma National Park
48	Lottering	R	17	30.6	198	<ul style="list-style-type: none"> • Tsitsikamma National Park
49	Elandsbos	R	6	24.1	219	<ul style="list-style-type: none"> • Tsitsikamma National Park
50	Storms	R		37.6	174	<ul style="list-style-type: none"> • Tsitsikamma National Park
51	Elands	R		16.0	242	<ul style="list-style-type: none"> • Tsitsikamma National Park
52	Groot (East)	R		19.3	234	<ul style="list-style-type: none"> • Tsitsikamma National Park
53	Tsitsikamma	C		21.8	229	<ul style="list-style-type: none"> • Huisclip reserve • Rapid Reserve
54	Klipdrif	C		18.5	237	
55	Slang	C		7.9	256	
56	Kromme	O	240.34	86.4	20	<ul style="list-style-type: none"> • Intermediate Reserve • Highly modified (100% MAR dam above estuary, little potential for rehabilitation) • Local forum
57	Seekoei	C	132.22	75.4	48	<ul style="list-style-type: none"> • Rapid Reserve • Highly modified (can potentially be rehabilitated) • Nature reserve
58	Kabeljous	C	117.94	75.8	45	
59	Gamtoos	O	467.03	90.9	16	<ul style="list-style-type: none"> • High biodiversity importance • CAPE Baviaanskloof Initiative • WRC Estuarine Biophysical Study (2000) • Agricultural return flow (nutrient load) • Bank erosion • Extensive development pressures expected • Important for Dusky Kob, but heavy angling pressure • Significant freshwater abstraction

NO.	ESTUARY	TYPE	SIZE (ha)	BIODIVERSITY IMPORTANCE SCORE	SA RANK	ATTRIBUTES
						<ul style="list-style-type: none"> • Municipality has some management capacity. • Spatial Development Framework acknowledges the need for appropriate management of the system • Relatively pristine: little morphological manipulation, little channel infrastructure, steady baseflow
60	Van Stadens	C	28	46.3	139	
61	Maitland	C	0.2	34.8	181	
62	Swartkops	O	499	92.0	12	<ul style="list-style-type: none"> • High biodiversity importance • Environmental flow requirement • High user conflict • Local forum (Swartkops Trust)

(Modified from Turpie 2004b)

4.1.7.2 Selection criteria for pilot estuaries

The process that was developed to determine the "Reserve" for water resources (including estuaries) under the NWA includes methods for the determination of:

- An ecological health assessment;
- The "desired state" for the estuary (i.e. the recommended ecological category);
- Management objectives (e.g. ecological specifications and ROO); and
- Long-term resource monitoring programmes.

As the above-mentioned are vital aspects required for the successful development of detailed management plans compatible with long-term conservation in the region, it is strongly recommended that estuaries for which Reserve determination studies have already been completed or are in progress be selected.

Other criteria that were considered in the selection of the pilot estuaries include:

- High biodiversity importance;
- Linkage to other initiatives of the CAPE project;
- Linkage to a terrestrial or marine protected area;
- Limited user conflict in and around the estuary to accommodate the short first phase of the programme (Phase II targets high user conflict systems once the process is developed);
- Political will in the form of interested municipalities or active forums and conservancies; and
- Data availability.

The emphasis on limited user conflict in and around the pilot estuaries relates to the short time frame in which Phase I of the CEP needs to generate results. Phase II intends to target high user conflict systems once the overall process has been developed. Workshop participants recommended that one pilot estuary with high user conflict be included to develop some understanding of the key issues and process required to handle such condition. Furthermore, the workshop was convinced that, if an active local forum and a strong management authority exist at the pilot site to initiate the process, this would expedite the conflict resolution process regarding the development of the vision and strategic

objectives for the pilot site. Knysna was earmarked as the ideal estuary for such a test case. In addition, it was also felt that at least one system for which little data are available (e.g. no Reserve has been calculated) should be selected, as this situation prevails in a large number of CFR estuaries. This would require significant methodology development, especially with reference to water quantity and quality requirements. The CAPE programme also strongly emphasises the need to link with related CAPE initiatives (e.g. the Cederberg, Agulhas Plain and Gourits Initiatives) to strengthen the planning integration processes. It was decided that at least one pilot site should be from the Eastern Cape to represent the management issues from that part of the CFR.

Selecting a range of different estuarine types (e.g. permanently open estuaries, temporarily open estuaries, estuarine bays and estuarine lakes) would also be beneficial to the development of the guidelines for estuarine management in the region, as they can have different management requirements.

4.1.7.3 The selected pilot estuaries

Based on the foregoing rankings and criteria, a short-list of estuaries was compiled and presented and expanded at the workshop. The final short-list comprises nineteen estuaries:

- Olifants
- Berg
- Diep
- Lourens
- Bot
- Klein
- Heuningnes
- Breede
- Duiwenhoks
- Goukou
- Gourits
- Goukamma
- Swartvlei
- Knysna
- Keurbooms
- Kromme
- Seekoei
- Gamtoos
- Swartkops



The working group, in consultation with the Eastern Cape Provincial Coastal Committee, selected the following pilot estuaries: the Olifants, Klein, Heuningnes, Breede, Knysna and Gamtoos.

4.1.8 Development of CEP management instruments

The CEP does not intend to redevelop existing methods or tools. Instead, it intends to incorporate or extend current approaches to strengthen its goals. It recognises the importance of a number of other initiatives in the country and, through the involvement of its various team members and sub-projects, intends to collaborate or dovetail:

- The Eastern Cape Estuaries Programme, Phase I and Phase II;
- Provincial coastal management plans or programmes;
- Local estuarine management initiatives (e.g. the Goukou, Gourits, Breede and Groot Brak); and
- The St Lucia Monitoring Programme.

In terms of developing technologies for management, the programme intends rather to focus on the most critical areas lacking management tools, such as the State of Estuary Reporting and a Rapid Health Assessment and Recreational Carrying Capacity Analysis. A selection of existing instruments, techniques and methodologies appear in Table 4.2. The subset tabled separately was identified during the workshop and will receive attention.

Table 4.2 Management Instruments for CEP application

EXISTING INSTRUMENTS	
Task	Instruments
Objective setting and development of management strategies	RDM (include methods for determining Reserves and RQOs)
	Strategic Environmental Assessment (SEA)
	Resource Economics
	Eastern Cape Estuaries Management Programme: Sustainable Use Protocol
	Eastern Cape Estuaries Management Programme: Biodiversity Protocol
	Eastern Cape Estuaries Management Programme: Co-management Protocol (setting local vision)
	Eastern Cape Estuaries Management Programme: Rehabilitation Protocol
	Multi-criteria analysis
	Driver-Pressure-State-Impact-Response Approach
	Environmental Impact Assessment (EIA)
	Operational Management Plan
	Environmental Management Plan
Management plan formulation	EMP
	Estuarine Zoning Scheme
	Integrated Development Plan (IDP)
	Spatial Development Framework (SDF) and Land Use Management System (LUM)
	Catchment Management Plan
Monitoring and assessment	Resource monitoring procedures for estuaries (RDM)
	Eastern Cape Estuaries Management Programme: Monitoring Protocol
	Co-ordinated Water Bird Count (CWAC)
	National Linefish Survey
	State of the Environment Reporting
INSTRUMENTS SUGGESTED AT THE CEP WORKSHOP	
Source	Instruments
CEP	Estuarine Health Monitoring Programme (similar to the River Health Programme)
	Refinement of the prioritisation of estuaries
MCM DWA Municipalities	Cumulative Assessment Methodology for Estuaries
	Recreational carrying capacity
	Spatial extent of estuarine area for CFR
MCM	Newsletter to communicate the programme progress
	Review and update estuarine-related legislation
	Review and develop guidelines for the NEMP after the CEP implementation
DWA	Resource guidelines at all levels of governance (best-practice guidelines)
	Procedure to incorporate RQO into local management plans
	Management strategy provides for estuarine freshwater requirements in the absence of a Reserve Study
	Guidelines or tools for estuarine management of water quality or quantity issues at a local level

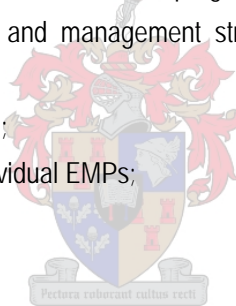
EXISTING INSTRUMENTS	
Task	Instruments
DWAF, MCM	Predictive tools for climate change
CAPE, DWAF, MCM, WRC, Eastern Cape Estuaries Programme	Multi-level educational materials
Provincial authorities, Larger municipalities	SEA as comprehensive tool to guide development
DEAT, DWAF, Provincial authorities	Legal status to spatial planning tools

The CEP will support the development of a number of the above-mentioned methodologies or tools for estuarine management. Where this might not be possible due to budgetary constraints, the relevant government departments will be approached for assistance regarding method development.

4.1.9 Structure and status of CEP implementation

Overall, the programme consists of an initial design phase, followed by an implementation phase (not relevant yet). The design phase entails the six tasks (graphically displayed in Figure 4.2) discussed in the subsequent subsections of this section. An indication is given to what extent implementation has progressed on these tasks. The tasks are, in sequence:

- Develop the overarching vision, objectives and management strategies for the estuaries of the CFR (*partially completed*);
- Design the individual EMPs for pilot estuaries;
- Review the implementation design of the individual EMPs;
- Review the CEP;
- Implement the EMPs; and
- Finalise the CEP.



4.1.9.1 Task 1: Development of the overarching vision, objectives and management strategies for the estuaries of the CFR

- *Conduct the CEP Workshop to determine the Vision, Objectives and Management Strategies.* This task has already been partially completed as the workshop was held in September 2005.
- *Classify and prioritise the estuaries of the CFR on the basis of health, conservation and economic importance* (e.g. tourism). The classification and prioritisation will incorporate the findings of existing and future national and regional evaluations done for DWAF and/or DEAT. The classification and prioritisation of South African estuaries on the basis of health and conservation priority status for the determination of the estuarine water Reserve has been completed (Turpie 2002, 2004b).

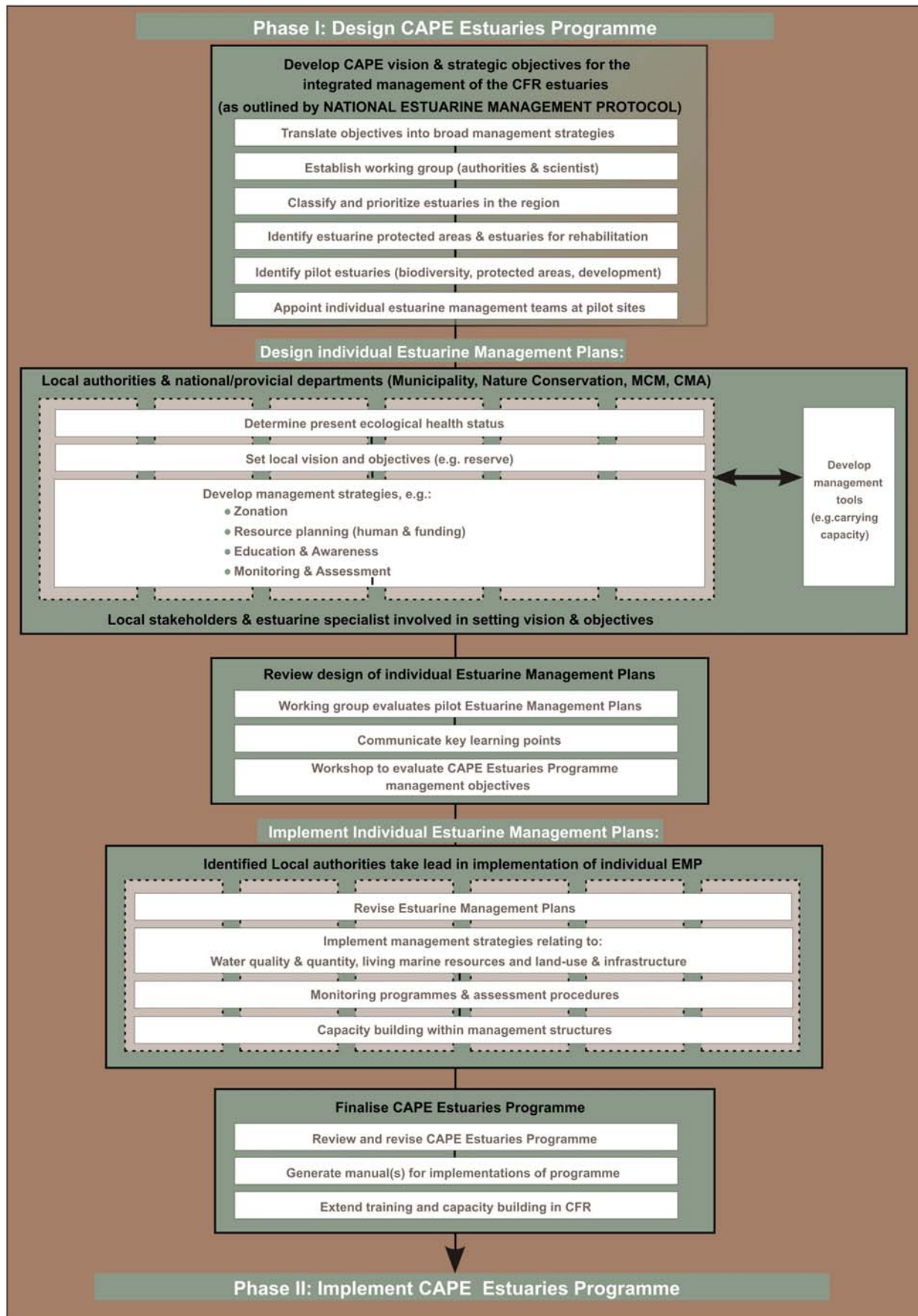


Figure 4.2 Implementation tasks of the CEP

This sub-task will also identify estuaries to be included in a network of EPAs in the CFR that will provide for conservation, environmental education and research and contribute to sustainable fishing activities. It is crucial that staff from management authorities (e.g. MCM, the CapeNature and local municipalities) be included in this task. As part of the prioritisation study, estuaries in need of rehabilitation in the CFR will be identified and ranked. This sub-project was initiated in November 2005 under the leadership of Dr JK Turpie of Anchor Environmental Consultants.

4.1.9.2 Task 2: Design of individual EMPs for pilot estuaries

This second task entails the completion of four subtasks:

- *Draft generic guidelines for the design of EMPs.* Develop or adapt methods to determine physical carrying capacity (e.g. for boating, recreation and tourism), ecological carrying capacity (e.g. sustainable exploitation levels or livelihoods), the economic value of the goods and services provided by estuaries and techniques to resolve multi-user conflicts in a South African estuarine management context (e.g. limited data, comprehension and resources).
- *Evaluate the present ecological health of the pilot estuaries,* taking into account impacts related to water quantity and quality, land use and infrastructure and the exploitation of living resources. DWAF has developed an estuarine health index to assist in this regard (based on specific requirements under the NWA). The existing DWAF method will therefore be applied to assess present health, with adaptations, as required. In the interim, where detailed information on present health is not available for any of the pilot estuaries, it is proposed that DWAF fund desktop or rapid assessments.
- *Determine Local Vision and Objectives.* DWAF has developed a method to determine Future Ecological Health Status (i.e. Ecological Category) and Ecological Quality Objectives for estuaries (based on specific requirements under the NWA). The existing DWAF method for setting the ecological vision and objectives will therefore be applied with adaptations, as required, by a specialist team. This information will be provided to the individual task teams to take into account in setting individual local vision and objectives. The vision and objectives need to incorporate aspects such as physical and ecological carrying capacity, current or potential goods and services provided, current or potential activities posing threats, and national and regional (CFR) objectives. This will be done in consultation with stakeholders during a workshop.
- *Draft individual Management Strategies for the pilot estuaries* for inclusion in individual EMPs (as defined by the proposed NEMP). The management strategies would require details about the:
 - Type and intensity of use in areas zoned for specific purposes;
 - Demarcation of dynamic or hazardous areas not to be developed;
 - Detailed compliance plan and its monitoring;
 - Detailed integrated monitoring plan and assessment procedures;
 - Awareness and education programmes to be introduced in order to gather public support and understanding of the biodiversity and economic importance that estuaries provide to a region; and
 - Human and financial resource allocations for the plan. This might require an altered or expanded legal mandate of some of the local authorities and reallocating financial resources from different spheres of government.

4.1.9.3 Task 3: Review of the implementation design of the individual EMPs

This task reviews the completed plans and entails:

- The Working Group, with input from stakeholders, *evaluate the individual EMPs* by extracting their key learning points. This will be done after the completion of the individual EMP designs.
- *Key learning points* will be communicated to local authorities and stakeholders of the pilot study areas and improvements to individual plans will be recommended.

4.1.9.4 Task 4: Review of the Regional Estuarine Management Programme

- *Convene a broad stakeholder workshop* to communicate and review progress on the CEP to date to ensure continuous alignment with any new developments in policy and legislation (e.g. National Environmental Management: Coastal Zone Bill).

4.1.9.5 Task 5: Implementation of the EMPs

The task requires the implementing agency to:

- *Revise the individual EMPs* by the local estuarine management teams based on the outcomes of Tasks 3 and 4 (where required) in order to provide a systematic and effective integrated management approach for the region.
- *Implement the management strategies*, as defined in the revised individual EMPs. These will typically be separated into Water Quantity and Quality, Exploitation of Marine Living Resources, and Land Use and Infrastructure categories. The adoption of the pilot EMPs would require the substantial capacity building and training of local authorities. All efforts should be made to provide the required human and financial resources.
- *Establish monitoring and assessment programmes* in order to measure the effectiveness of the individual EMPs and the progress towards achieving the overarching objectives and strategies of the CEP. It is envisaged that this programme will form the basis for the establishment of a national estuarine monitoring and assessment programme, which falls within the mandates of both DEAT and DWAF. It is envisaged that this task would be initiated in a stakeholder workshop (consisting of the lead authorities and estuarine scientists) to determine the scope of the Estuarine Monitoring and Assessment programme. The workshop will assist in determining:
 - An approach for the design of the estuarine monitoring and assessment programme;
 - A work plan for monitoring;
 - An assessment of human and financial resource requirements;
 - A schedule for the project; and
 - Deliverables expected from the process.

This task needs to align its outcomes with the requirements of the national Recreational Linefish Monitoring Programme (MCM), RDM - Reserve (DWAF) and the River Health Programme (DEAT and DWAF).

4.1.9.6 Task 6: Finalisation of the CAPE Regional Management Programme

This final task requires three subtasks to be carried out:

- *Finalise a review and revision of the pilot EMPs*, including an evaluation of the overall effectiveness of the CEP. This process should be guided by the working group but will need input from various local stakeholders and authorities on its overall success and effectiveness.

- *Develop training modules and manuals for the implementation of CEP* in the C.A.P.E region, capturing the knowledge and insights gathered during this phase. These can be aimed at, for example, on-the-ground managers as well as for training purposes in schools and universities. Products need to be developed by scientists and managers currently working in the field of estuarine research and management in order to be of value and to provide in-depth, up-to-date guidance.
- *Implementation of Training and Capacity Building* with regard to the management of estuaries in CFR regions. This subtask requires the training and/or development of staff within relevant management authorities to conduct effective estuarine management and decision making under the auspices of the proposed NEMP currently being developed by DEAT.

4.2 Local application at the Bot and Klein River estuaries

Having considered the issues involved in estuarine management and planning at the national and regional levels, the necessity of a local focus is demonstrated in this section. Two of the most important estuaries in the CFR, and nationally, the Bot and the Klein, are compared in terms of their characteristics to illustrate how two estuaries which appear very similar at a regional scale require local knowledge to be managed effectively. In order to illustrate the relevant concepts, the discussion is focussed mainly on one aspect of estuarine management, namely conservation planning.

The Bot and Klein are two large estuaries located on the south-western coast of South Africa approximately 110 km south-east of Cape Town as can be seen in Figure 4.3 (Koop, 1982).

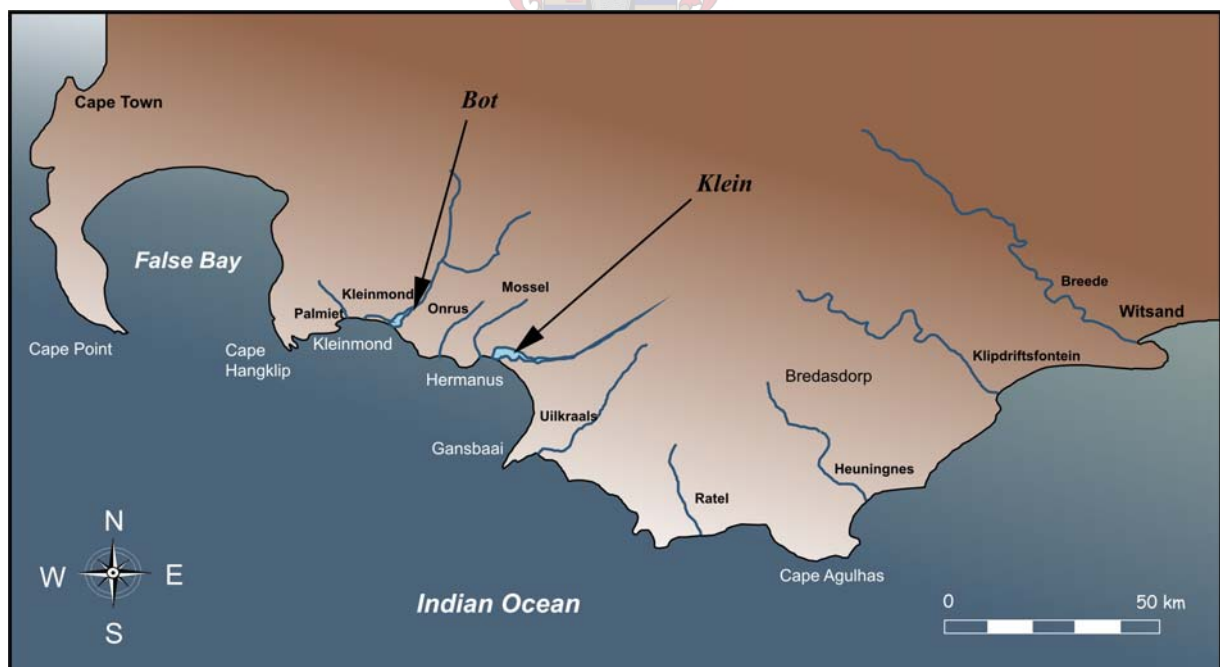


Figure 4.3 Location of the Bot and Klein estuaries

The Bot lies to the west of Fisherhaven and Hawston between 34°18'30" to 34°22'30"S and 19°04' to 19°09'E. The Klein Estuary is situated between Hermanus and Stanford at 34°24'S and 19°18' E (De Decker 1989). Both estuaries discharge into the Atlantic Ocean. For purpose of comparison, some of the main biophysical and socio-economic features of the Bot and Klein estuaries are summarised in Table 4.3 below.

Table 4.3 Summary of the characteristics of the Bot and Klein estuaries

FEATURE	BOT ESTUARY	KLEIN ESTUARY
Biogeographic region	Cool, temperate	Cool, temperate
Catchment size	813 km ² (Heydorn & Tinley 1980) 1 000 km ² (Caledon Divisional Council 1975) 900 km ² (Van Niekerk, Van der Merwe & Huizinga 2005)	750 km ² (Heydorn & Tinley 1980) 741 km ² (Noble & Hemens 1978) 906 km ² (Crowther 1987)
MAR	47 x 10 ⁶ m ³ (Jezewski & Roberts 1986) 116 x 10 ⁶ m ³ (Noble & Hemens 1978) 86 x 10 ⁶ m ³ (V3 Consulting Engineers 2000) Virgin MAR: 88.54 x 10 ⁶ m ³ , Present MAR: 65.9 x 10 ⁶ m ³ (Schultz & Watson 2002)	40 x 10 ⁶ m ³ (Crowther 1987) 96 x 10 ⁶ m ³ (Noble & Hemens 1978) 40.0 x 10 ⁶ m ³ (De Decker 1989)
Geology of catchment	The catchment is dominated by the Bokkeveld Group, with some Table Mountain Sandstone present (Koop 1982). These geological features produce water unstained by humic acids, i.e. white water (Heydorn & Tinley 1980).	Table Mountain Sandstone and Bokkeveld Groups, interspersed with Cape Granite (De Decker 1989) Drains acidic, low-nutrient duplex loams that produce highly acidic black-water rivers (Schloms, Ellis, & Lambrechts 1983; Heydorn & Tinley 1980)
Catchment activities	Agriculture Alien forestation and vegetation Diffused irrigation practices Small farm dams	Agriculture Alien forestation and vegetation Diffused irrigation practices Small farm dams
Dimension of estuary	~7 km long and ~2 km across (Koop 1982) Total area varies between 9 km ² and 23 km ² , depending on the water level (Branch <i>et al.</i> 1985)	~10 km long and 2 km across (De Decker 1989) Total area varies between 5.6 and 11.28 km ² , depending on the water level ⁹ (De Decker 1989)
Type of estuary	Estuarine lake (Whitfield 1992)	Estuarine lake (Whitfield 1992)
Depth	Relatively shallow with an average depth of -1.5 m MSL, deeper than 2.0 m MSL in the limited central area (Koop 1982)	Average depth of 2.0 m MSL, with deeper areas near the northern shores of ~5.0 MSL (De Decker 1989)
National rank in conservation importance	8 (Turpie 2004b)	9 (Turpie 2004b)
Activities/Developments	Bird watching Yacht club Canoeing Limited swimming near Meerensee Fishing	Bird watching Yacht club Canoeing Swimming at the mouth and beach Fishing
Threats	Serious illegal harvesting of living resources (gill-net poaching) Large resort development with golf course in floodplain Significant new large developments planned (e.g. Arabella Phase II, Benguala Cove)	Limited illegal harvesting of living resources (gill-net poaching) Significant residential development along northern banks Approved low-lying development, necessitating artificial breaching

⁹ This is a significant underestimation, as De Decker (1989) did not include the area between Stanford (which is also tidal and of variable salinities) and the Klein "vlei".

FEATURE	BOT ESTUARY	KLEIN ESTUARY
	Approved low-lying development, necessitating artificial breaching	Sewage entering system from Stanford waste-water treatment works Sewage seepage from Scout camp near mouth Municipal refuse dump next to estuary
Governing authority	CapeNature	CapeNature
Estuarine forum	Friends of Botvlei	Klein River Advisory Committee (not active at present)
Breaching frequency	Every 2 to 4 years	Annually
Breaching mechanism	The system is connected to the Kleinmond estuary via an overflow channel at 1.7 m MSL. The natural breaching level of the Kleinmond estuary mouth is ~2.5 m MSL. The natural breaching level of the Bot is 2.7 m to 3.0 m MSL (Koop 1982; Van Niekerk, Van der Merwe & Huizinga 2005). The two systems are connected at a water level of about 1.7 m MSL. If the Kleinmond estuary is open, water flows from the Bot to the Kleinmond and out to sea. The Bot breaches naturally only when river inflow exceeds outflow through the Kleinmond mouth. The total inflow volume required to breach the Bot is dependent on the amount lost via the Kleinmond. The more water lost through the Kleinmond mouth, the less water is retained in the Bot and the more freshwater inflow is required for the natural breaching of the Bot.	The Klein breaches when the large water body behind the sand berm fills and overtops the bar at the mouth (Huizinga, Van Niekerk & Withers 1997; Huizinga & Van Niekerk 1998, 1999). Artificial breaching is implemented at levels varying between 1.8 and 1.65 m MSL.
Salinity ranges	35-6 ppt, with long period (1 to 2 years at < 10 ppt) (sea water 35 ppt, freshwater 0 ppt)	35 -12 ppt in main water body and 34-4 ppt in upper reaches (Significant salinity values have also been recorded by myself and MCM at Stanford, e.g. 24 ppt under the Stanford bridge (Van Niekerk, personal observation).)
Duration of open-mouth period	2 to 4 months (Van Niekerk, Van der Merwe & Huizinga 2005)	4 to 6 months (Huizinga & Van Niekerk 1999)
Hyper-salinity	Prone to hyper-salinity (40 ppt) if breached during early summer and closed during late summer	Hyper-salinity (36-37 ppt) was observed in the upper reaches during the period the estuary remained open for more than a year. This was unusual under the present management plan.
Rare and/or endemic species	Fish: Endemic Bot River klipvis (<i>Clinus spatulatus</i>) (occurs in only 3 estuaries globally) Birds: 5 Red Data species (endemic Victorin's scrub warbler (<i>Bradypterus victorini</i>), white pelican (<i>Pelicanus onocrotalus</i>), greater and lesser flamingos (<i>Phoenicopterus ruber</i> and <i>P. Minor</i>), Caspian tern (<i>Hydroprogne caspia</i>), fish eagle (<i>Haliaeetus vocifer</i>) (Koop 1982)	Fish: Endemic Bot River klipvis (<i>Clinus spatulatus</i>) (occurs in only 3 estuaries globally) Birds: 10 Red Data species (martial eagle, Stanley's bustard, Caspian tern, white pelican, greater and lesser flamingos, black stork, white stock, Arctic tern, house martin) (De Decker 1989)
Biota	Vegetation: algae and submerged macrophytes (8 species), reeds and marshes (17 species), Invertebrates: 23 species Fish: 25 species Birds: 118 species (Koop 1982)	Vegetation: algae and submerged macrophytes (14 species), reeds and marshes (24 species) Invertebrates: 128 species Fish: 33 species (2 aliens) Birds: 217 species (De Decker 1989)

FEATURE	BOT ESTUARY	KLEIN ESTUARY
Level of compliance in local community	Proximity to Hawston creates low compliance among estuarine users	More affluent community of Hermanus and Stanford values biodiversity/estuary health more

At a national and regional scale, these two estuaries are remarkably similar in terms of their biogeographical distribution, estuarine type, size, habitat and national importance to conservation planning. They rank nine and eight out of ~250, (Turpie 2004b) but, when compared on a finer scale, they differ significantly in the persistence of important habitats and the ability to preserve estuarine biota. The Klein Estuary supports a significantly higher number of estuarine species. To a large extent, the difference in estuarine species supported is related to the fact that the Klein Estuary breaches nearly annually while the Bot Estuary opens to the marine environment only every two to four years. The Bot Estuary represents a more stable, fresher environment, with salinities below 15 ppt at least 50% of the time (Van Niekerk, Van der Merwe & Huizinga 2005). In comparison, the Klein Estuary represents a more dynamic, estuarine environment, with the normal estuarine stressors of large annual fluctuations in water levels and significant changes in salinity regime (Koop 1989). It should also be noted that the Klein Estuary salinity is above 15 ppt for most of its breaching cycle (Koop 1982).

As a result of its complex breaching mechanism and large size, the Bot Estuary requires significantly more runoff to breach than the Klein Estuary. This breaching mechanism also makes the Bot Estuary more vulnerable to anthropogenic influences, such as artificial mouth manipulation (at the Bot and Kleinmond outlets) and reduction in runoff from the catchments. The Klein system is somewhat buffered from these influences, as it does not have this secondary outflow channel and a large part of its catchment falls within protected areas. One can therefore conclude that the Klein Estuary is more likely to maintain its present connectivity with the marine environment while the Bot is gradually changing into a freshwater lake due to anthropogenic interventions (Van Niekerk, Van der Merwe & Huizinga 2005).

Turpie (2005a) states that conservation planning has evolved from *ad hoc* selection of conservation areas in the past to systematic conservation planning, where ecological goals are developed by integrating conservation and development needs in a region. Contrary to the previous focus on the representation of species, conservation planning has evolved to incorporate ecosystem processes and now gives greater emphasis to biodiversity persistence (Turpie 2005a; Cabeza & Moilanen 2001). A major challenge is setting targets for the maintenance of ecological and evolutionary processes, which requires the identification of processes and finding spatial surrogates for them (Pressey *et al.* 2003). Another key challenge is delivery of a plan that not only achieves representativeness but also ensures the persistence of targeted populations and the maintenance of biodiversity (Reyers *et al.* 2002). In addition, it is becoming increasingly recognised that conservation planning cannot take place in isolation, without an understanding of socio-economic pressures and values. Socio-economic factors are important in identifying the most appropriate types of conservation intervention, and resource economics play an increasing role in conservation planning (Abbitt, Scott, & Wilcove 2000; Balmford 2003; Balmford *et al.* 2000; Frazee *et al.* 2003; Moore *et al.* 2004; Faith & Walker 2002).

Based on the strategy proposed by Turpie (2004a) for the conservation of estuarine biodiversity in South Africa, it becomes clear that the Klein Estuary, rather than the Bot Estuary, should become one of the designated EPAs, as is currently required by the national estuarine prioritisation exercise (Turpie *et al.* 2002). If the persistence of habitat (i.e.

the trajectory of change) and socio-economic and managerial issues are taken into consideration, the Klein Estuary meets the criteria for being proclaimed an EPA far better than the Bot for the following reasons:

- There is less development pressure on the Klein Estuary because the inclusion of a terrestrial reserve on the southern banks prevents significant development from occurring in that region;
- It hosts more estuarine-associated and dependent species;
- Annual breaching allows for better connectivity with the marine environment and therefore better annual recruitment and migration of estuarine-associated and dependent species;
- It guarantees greater persistence of estuarine habitat, especially in terms of the high-salinity requirements of endemic fish species, such as the Bot River klipvis, which prefers a salinity of 15 ppt (the highest abundance was recorded at 15 to 20 ppt (Lamberth, unpublished data));
- There is less illegal harvesting (poaching) of living resources in the system; and
- There is greater compliance among the local community and more compliance monitoring because of the proximity of the Hermanus CapeNature Office.

4.3 Refinement of protocol application

The comprehensive CEP will be the first of its kind in South Africa and perhaps internationally. It will be a test case for the incorporation of strategic decision making into estuarine management. The aim of the programme is to ensure the conservation and sustainable utilisation of estuarine biodiversity in the Cape Floristic Region (CFR). The programme follows a strategic, integrated approach to estuarine management. Cooperative governance is seen as a key requirement for the success of the programme. The proposed NEMP is the recommended approach for establishing broad alignment at a regional scale. The ultimate goal is to bring estuarine decision makers (e.g. DWAF, DEAT, and provincial and local authorities) together and generate awareness of the impacts of various sectorial developments (e.g. water abstraction and living resources utilisation) on individual estuaries. The project also strives to establish the concept of the interdependency of estuarine systems on each other and the need for South Africa's estuaries to be managed for the highest possible health status in order to ensure the viability of shared resources, such as estuarine-dependent fish.

An analysis of local conditions indicates that, although regional estuarine management is essential for the large-scale holistic planning process, it should be followed by a more detailed analysis at the local scale to ensure the success of broad-scale conservation planning objectives. Regional planning objectives can be achieved only if they are supported by a detailed understanding of the estuarine biophysical processes and socio-economic interactions at a more local scale.

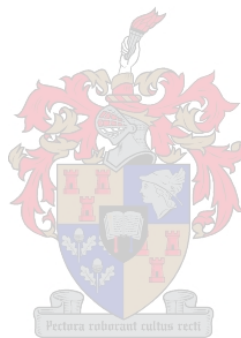
In the absence of detailed information on individual estuaries, especially for the smaller estuaries in rural areas, it is strongly recommended that a comprehensive estuarine monitoring programme be developed that can generate such information. At the very least, such a programme should monitor the estuarine components listed below. Innovative, cost-effective methods should be sought to achieve estuarine monitoring of:

- River runoff into the estuary;
- Water level recordings/observations on the state of the mouth;
- Salinity-distribution patterns;

- Water quality parameters in river inflow to the estuary;
- Condition of macrophytes;
- Status of fish stocks; and
- Status of birdlife.

Current long-term monitoring or measurement programmes that are already in place for estuaries and that could be extended or incorporated into a national monitoring programme include:

- National network of river-flow gauging at sites near estuaries (DWAF);
- National network of water level recordings (DWAF);
- National water quality monitoring network at sites near estuaries (DWAF);
- National network of estuarine bathymetric monitoring surveys collected from 1985 to 2000 (DEAT);
- Aerial photography of estuaries (DEAT/DWAF);
- National Recreational Linefish Monitoring Programme to be initiated in 2007 (MCM, DEAT); and
- Coordinated Waterbird Count in South Africa (CWAC) (Avian Demographic Unit, University of Cape Town).



Chapter 5: Estuarine management: Closure on results and recommendations

The research objectives are revisited in this chapter in order to evaluate the findings and results of the study. Some recommendations for estuarine management in South Africa and future research requirements are also provided.

5.1 The research objectives revisited

5.1.1 Current status of regional estuarine management in South Africa

At present the governance and management of South Africa's estuaries is undertaken on an *ad hoc* basis (Chapter 2). For the most part decisions pertaining to estuaries are made in a largely uncoordinated and non-strategic fashion with limited resources (financial and capacity) allocated to the management of these important natural systems.

While the importance of a more strategic approach to estuarine management is widely acknowledged, very little attention is given to regional estuarine management in South Africa. Reasons for this include: the very limited biophysical research emphasising regional connectivity; the *ad hoc* nature of the application of the DWAF's RDM procedures for determining a Reserve (the freshwater allocation for estuary ecosystem function); and the lack of methods for assessing the cumulative effects of development on estuaries. There are few examples where estuaries in South Africa have been assessed, and management decisions made, at a regional scale. In most of these cases, the connectivity between systems has been addressed only as a function of the biogeographical representivity of the particular estuary type, i.e. acknowledging that different types of estuaries have different functions without explicitly addressing the interdependence of adjacent estuaries. To address this shortcoming, a number of management practices and/or methods (e.g. RDM studies, Environmental Impact Assessment studies and cumulative assessment technologies) currently in use need to be refined or developed further.

5.1.2 Relevant legislation

An added complication with respect to the management of estuaries in South Africa is the numerous overlapping (and often conflicting) laws that define and regulate estuaries making it difficult to conserve and manage them effectively (Chapter 2). For example, 16 international conventions, 10 white papers, ~40 national acts, provincial legislation and local by-laws govern estuarine management. The key to resolving the legal and administrative confusion lies in aligning the institutional arrangements so that their areas of jurisdiction correspond more closely with the boundaries of the ecosystems that they are intended to manage and control.

At a national level, through the application of the National Water Act No 36 of 1998, the Department of Water Affairs and Forestry (DWAF) is the lead agent responsible for the management of water quantity and quality in estuaries. At the same time, the national Department of Environmental Affairs and Tourism (DEAT) is tasked with the management and conservation of estuaries, i.e. land use and infrastructure. Within DEAT, the responsibilities for managing living marine resources, including those in estuaries, are undertaken by the Branch: Marine and Coastal Management. From the provincial level downwards, there is further fragmentation of responsibility for the management and control of estuaries

which has led to poor implementation of legislation. At the local level estuarine management is carried out by conservation agencies (e.g. CapeNature and KZNWildlife), by provincial departments (responsible for nature conservation and environmental impact assessment, e.g. Department of Economic Affairs, Environment and Tourism (Eastern Cape)) and by local authorities. The multiplicity of responsible agencies and authorities has resulted in ineffective management of estuaries. At present, there is widespread uncertainty as to which laws are applicable and to which areas they apply. In addition, there is uncertainty over which government departments or agencies hold the mandate to enforce the various laws and, finally, there is very limited capacity to enforce these laws and regulations. The key to resolving the legal and administrative confusion lies in aligning the institutional arrangements so that their areas of jurisdiction correspond more closely with those of the ecosystems.

5.1.3 International concepts applicable to estuarine management in South Africa

The NEMP aligns very well with international estuarine policy and management approaches, such as the New South Wales Government Estuary Management Policy and the proposed Integrated Coastal Area and River Basin Management (Chapter 2) (New South Wales Government 1992, UNEP/MAP/PAP 1999). These approaches emphasise a number of key concepts, such as the importance of reviewing the current status (e.g. biophysical estuarine processes and socio-economic drivers); planning within the limits of the natural environment; broad stakeholder participation in the decision making process; developing overarching objectives to inform management strategies; and emphasising the importance of monitoring and evaluation as part of the management cycle.

5.1.4 South African Estuarine Management Protocol

The proposed NEMP was developed to provide a framework for explicitly considering aspects that have previously been seen to be beyond the scope of the various planning sectors (Chapter 3). The integrated approach proposed in the Protocol is expected to lead to better coordination of policy-making and management across sectors (water, forestry, agriculture, urban development, marine living resources, environmental protection, etc.). It also aims to facilitate a more rational use of resources and more effective environmental protection. The proposed Protocol allows for proactive planning in space and time to reduce potential conflicts, bridge potential gaps and reduce the effects of overlaps in the legislation. The key linkages between the marine environment and river systems (both natural processes and human activities) are recognised and key areas where policy intervention is required identified. The Protocol provides a means to manage the estuaries of South Africa, with their related interdependences and interactions, at a strategic level.

5.1.5 South African application

The Cape Estuaries programme (CEP) was developed to apply, and further refine, the proposed NEMP (Chapter 4). The comprehensive CEP will be a test case for the incorporation of strategic decision making into estuarine management. The aim of the programme is to ensure the conservation and sustainable utilisation of estuarine biodiversity in the Cape Floristic Region (CFR). Cooperative governance is seen as a key requirement for the success of the programme. The ultimate objective of the programme is to bring the various estuarine decision makers (e.g. DWAF, DEAT and local authorities) together and to generate awareness of the impacts that various sectorial developments (e.g. water provision and exploitation of living resources) have on individual estuaries. The programme also strives to establish the concept of

the interdependency of estuarine systems and the need to manage South Africa's estuaries so that the highest possible health status is achieved in order to ensure the viability of shared resources such as estuarine-dependent fish.

The case study focusing on the Bot and Klein estuaries indicates that, although regional estuarine management is essential for the large-scale holistic planning process, this should be followed by more detailed analysis at the local scale to ensure the successful implementation of broad-scale conservation planning objectives (Chapter 4). Regional planning objectives can be achieved only if they are supported by an understanding of estuarine biophysical processes and socio-economic interactions at a more local scale. As this information is often lacking, especially for the smaller estuaries in rural areas, it is strongly recommended that a comprehensive estuarine monitoring programme that can generate such information be developed and implemented by the responsible authorities and agencies.

5.2 Recommendations for estuarine management in South Africa

Recommendations to enable the achievement of effective regional estuarine management in South Africa are presented in this section. A number of management interventions necessary for the NEMP to succeed in its objective of establishing a more holistic or strategic approach to estuarine management in South Africa are listed. Recommendations include:

- *Incorporation of the proposed NEMP in the appropriate legislation.* South Africa is currently in the process of revisiting and redrafting its environmental legislation which presents an excellent opportunity to realign existing legislation and institutional arrangements and to influence legislation presently being drawn up. The proposed NEMP should be incorporated into this proposed legislation. DWAF and DEAT will have to co-operate to determine what aspects of the Protocol should be incorporated into legislation administered by their respective Departments. The most direct avenue for formalising the Protocol would be to include it in the new National Environmental Management: Coastal Zone Bill (The Protocol is currently incorporated in Chapter 4 of draft 10.7 of the Bill). The details of the Protocol could then be specified in the regulations promulgated under the proposed Act and explained in guideline documentation and/or a manual, i.e. similar to the guideline documentation provided for the drafting of an Integrated Development Plan.
- *Establishment of an interdepartmental task group.* Agreement will have to be reached on joint management objectives and shared responsibilities if true cooperative governance is to be achieved. This contrasts with the "turf protection" and limited communication that characterise the current situation. The best way to reach consensus on joint strategic management objectives would be via the interdepartmental task group proposed at a recent meeting between DEAT and DWAF. Such a task group should include representation from national and provincial governments as well as from the scientific and legal communities.
- *Drafting of estuary specific EMPs.* At the local level, issues regarding shared responsibilities, limited resources and accountability would be identified and dealt with during the drafting of formal estuary-specific EMPs.
- *Integration of individual EMPs into coastal IDPs.* In the long-term, the individual EMPs need to be included in or integrated with the various Integrated Development Plans of the coastal cities and municipalities in order to be truly effective and to highlight the need for estuarine management at a local scale.

- *Clarification and formalisation of the definition of an estuary.* An issue that needs urgent clarification and agreement is the scientific, legal and operational definition of an estuary. The ambiguity around the definition of an estuary creates overlaps in jurisdiction and allows for loopholes in the management of estuaries.
- *Establishment of a national estuarine monitoring programme.* Data necessary to understand and manage South Africa's estuaries effectively are completely inadequate. Monitoring, therefore, is a priority for effective management programmes to be established and sustained. It is strongly recommended that a National Estuarine Health Programme be developed to gather data and inform estuarine management at all levels of the decision making process.
- *Quantification of the environmental goods and services provided by estuaries.* Estuaries provide a host of goods and services to their surrounding areas (such as water purification, a reduction in flood impacts and nursery areas for fish). The full cost of reducing or destroying an estuary's ability to deliver any of these goods or services is not included in the cost-benefit appraisal for new developments, even if the potential damage and destruction are obvious. In order for development to be sustainable, the environmental costs and benefits cannot be ignored.

Essentially, there are three approaches for entrenching a new management practice effectively. These are drafting sound legislation, creating financial incentives and/or penalties and establishing a firm support base (e.g. communication with stakeholders). For the NEMP to be effective and enduring, it would have to be supported by a framework that encompasses all three approaches.

5.3 Recommendations for future research

Research is urgently required on the interdependence or connectivity between estuaries to inform management decision making at a regional scale. Projects to determine the degree of interdependence between estuaries on a regional scale need to be formulated and undertaken. These regional scale projects should include both the physical aspects (such as estuarine mouth regimes and duration and extent of the river inflow signals in the marine environment) and biological aspects (such as migration between estuaries). Three-dimensional numerical modelling of the estuarine and nearshore marine environment on a regional scale would assist ecologists in developing a greater understanding of the transport mechanisms facilitating connectivity between estuaries. Techniques such as genetic analysis and sonic tagging programmes should be used to address uncertainties in regional distribution and migration patterns of estuarine biota.

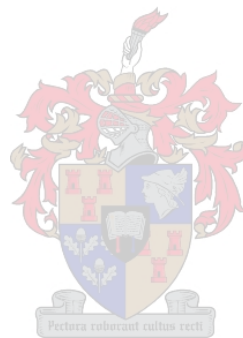
The general lack of information on, and understanding of, processes governing the relationship between estuaries requires organisations such as the Consortium for Estuarine Research and Management (CERM) and the National Research Foundation (NRF) to promote projects that will assist in establishing the extent and scale at which processes governing interdependence operate.

5.4 Closure

Estuarine management should be undertaken within a framework that emphasises the principles of sustainable development, biodiversity conservation, the precautionary principle, integrated management, self-regulation and sensitivity to local circumstances. Particular emphasis should be placed on the need for the various actors, agencies and

levels of government to work together and seek consensus aimed at the continued sustainability of South Africa's estuaries.

Successful estuarine management requires the political will, cooperation among government departments at all levels, and a regional approach to management that should be supported by a sound understanding of the various physical, chemical and ecological interactions at a regional and local scale. If this cannot be achieved, the prospects for either long-term biodiversity protection or sustained estuarine functioning are poor. Management of South Africa's estuaries can be achieved only through integrating the scientific, management and legal initiatives currently taking place in this country. The National Estuarine Management Protocol provides the tool to achieve this objective.



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Cyrus D 2001. Telephonic interview on 9 May 2001 with Prof. D Cyrus, Zoology and Coastal Research, University of Zululand, in connection with regional interaction between estuarine invertebrates.

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Lamberth SJ 2001. Telephonic interview on 8 and 25 May 2001 with Mr SJ Lamberth, researcher at Branch: Marine and Coastal Management, Department of Environmental Affairs and Tourism, in connection with regional estuarine management, Estuarine Protected Areas and estuarine-dependent fish migration behaviour.

Turpie JK 2001. Telephonic interview on 9 May 2001 with Dr JK Turpie, Percy Fitzpatrick Institute, University of Cape Town, Zoology, in connection with regional interaction between estuarine birds.

Weston B 2001. Telephonic interview on 15 May 2001 with Ms B Weston, Acting Deputy Director, Directorate of Social and Environmental Services, DWAF, in connection with regional management of estuaries as it relates to the National Water Act (No. 36 of 1998).

Weston B 2005. Water Research Commission Steering Committee meeting on 21 November 2005, where Ms B Weston, Deputy Director, Directorate of Resource Directed Measures, DWAF, clarified the relationship between the National Water Act No. 36 (1998b) and the Water Services Act No. 108 (South Africa 1997).

Whitfield AK 2001. Telephonic interview on 1 June 2001 with Dr AK Whitfield, JLB Smith Institute of Ichthyology, Rhodes University, in connection with regional interaction between estuarine fish.

Wooldridge TH 2001. Telephonic interview on 15 May 2001 with Prof. TH Wooldridge, Institute for Coastal Resources, Nelson Mandela Metropolitan University, in connection with regional interaction between estuarine invertebrates.

Appendix A:

Summary of existing legislation

Extracted from Van Niekerk & Taljaard (2003)

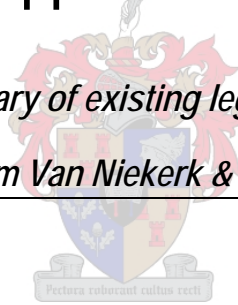


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This Appendix provides an overview of the international conventions, legislation and policies relevant to estuaries. The majority of environmental legislation is aimed at providing guidance in the management and control of specific types of activities and developments posing threats to the goods and services provided by the natural environment (including estuaries). With regard to estuaries, statutes can be sub-divided in terms of the activities/developments they regulate:

- Land-use and infrastructure planning;
- Water quantity and quality; and
- Living resources.

This is also indicated in the Tables below.

Table A.1 International conventions

INTERNATIONAL CONVENTION	DESCRIPTION	REGULATED ACTIVITIES/DEVELOPMENT
Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (GPA) (1995)	South Africa upholds the principles of GPA. The GPA is designed to assist states in taking action individually or jointly within their respective policies, priorities and resources, that will lead to the prevention, reduction, control or elimination of the degradation of the marine environment, as well as to its recovery from the impacts of land-based activities. The GPA builds on the principles of Agenda 21. Adopted in November 1995.	<ul style="list-style-type: none"> ▪ Land-use/Infrastructure ▪ Water quantity and quality
United Nations Convention on Biological Diversity (1992)	<p>The United Nations Convention on Biological Diversity came into force in December 1993. The Convention on Biological Diversity has three objectives: the conservation of biological diversity; the sustainable use of biological resources; and the fair and equitable sharing of benefits arising from the use of genetic resources.</p> <p>As a party to the Convention, South Africa is required to develop national strategies, plans or programmes, or adapt existing ones, to address the provisions of the Convention, and to integrate the conservation and sustainable use of biodiversity into sectoral and cross-sectoral plans, programmes and policies. South Africa's response to this requirement is contained in the White Paper on the Conservation and Sustainable Use of South Africa's Biological Diversity, published in the Government Gazette on 28 July 1998. This in turn was incorporated into the National Environmental Management: Biodiversity Protection Bill, which is to give statutory effect to the White Paper.</p>	<ul style="list-style-type: none"> ▪ Land-use/Infrastructure ▪ Water quantity and quality ▪ Living resources
Agenda 21 (1992)	Internationally accepted strategy for sustainable development, decided upon at the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro in 1992. Agenda 21 is, however, not legally binding on states, and merely acts as a guideline for implementation. At the national level, the Department of Environmental Affairs and Tourism is responsible for the preparation of a National State of the Environment Report. Local authorities (including the City of Cape Town) produce State of the City Environment reports under the Cities Environment Reports on the Internet (CEROI) initiative.	<ul style="list-style-type: none"> ▪ Land-use/Infrastructure ▪ Water quantity and quality ▪ Living resources
United Nations Framework Convention on Climate Change (1992)	The United Nations Framework Convention on Climate Change took effect in March 1994. It sets an "ultimate objective" of stabilizing greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Countries ratifying the Convention agree to take climate change into account in such matters as agriculture, energy, natural resources, and	<ul style="list-style-type: none"> ▪ Land-use/Infrastructure ▪ Water quantity and quality ▪ Living resources

INTERNATIONAL CONVENTION	DESCRIPTION	REGULATED ACTIVITIES/DEVELOPMENT
	<p>activities involving sea coasts. They agree to develop national programmes to slow climate change. The Convention encourages parties to cooperate to reduce greenhouse gas emissions, share technology and carry out scientific research.</p> <p>South Africa's ratification of the Convention was published in the Government Gazette on 19 December 1997. The Department of Environmental Affairs and Tourism published a Climate Change Policy Discussion Document in August 1998 to begin the process of formulating policies to respond to climate change both locally and internationally (www.environment.gov.za).</p>	
<p>Convention on the Protection, Management and Development of the Marine and Coastal Environment of the East African Region (Nairobi Convention) (1985)</p>	<p>The convention focuses on standardization of coastal management in the East African region. The broad objectives of the convention are the development, protection and management of the coastal and marine environment. It requires that environmental management issues are identified for which co-operative efforts are to be made, which include specially protected areas, co-operation in case of emergency, mitigation of environmental damage from engineering activities, undertaking of EIAs and promoting scientific and technical co-operation. The Convention lists sources of pollution that require control such as pollution from ships, dumping, land-based sources and seabed activities together with airborne pollution. Enforced in 1996, SA is in the process of accession.</p>	<ul style="list-style-type: none"> ▪ Land-use/Infrastructure ▪ Water quantity and quality ▪ Living resources
<p>United Nations Convention on the Law of the Sea (UNCLOS) (1982)</p>	<p>UNCLOS does not establish any international programmes and, essentially, it represents a codification of international law rules for states to observe in marine-related operations. However, it does institutionalise an International Sea Bed Authority to oversee exploration/exploitation of deep seabed minerals and a Commission on the Limits of the Continental Shelf. Important provisions likely to be addressed by MCM will ensure proper conservation of, and management measures for, living resources in the South African Exclusive Economic Zone (EEZ).</p> <p>South Africa is signatory to this convention, but the principles of the treaty have not been ratified by Parliament. Pollution of the marine environment from land-based sources is specifically dealt with in Articles 207, 212 (1) and 213.</p>	<ul style="list-style-type: none"> ▪ Water quantity and quality ▪ Living resources
<p>Convention on the Protection, Management and Development of the Marine and Coastal Environment of the West and Central African Region (Abidjan Convention) (1981)</p>	<p>The Convention focuses on the standardization of coastal management in the West and Central African regions. The broad objectives of the Convention are the development, protection and management of the coastal and marine environment. It requires that environmental management issues are identified for which co-operative efforts are to be made, which include specially protected areas, co-operation in case of emergency, mitigation of environmental damage from engineering activities, undertaking of EIAs and promoting scientific and technical co-operation. The convention lists sources of pollution which require control such as pollution from ships, dumping, land-based sources and seabed activities together with airborne pollution. Enforced in 1984, SA is in the process of accession.</p>	<ul style="list-style-type: none"> ▪ Land-use/Infrastructure ▪ Water quantity and quality ▪ Living resources
<p>Convention of Migratory Species of Wild Animals (Bonn Convention) (1979)</p>	<p>South Africa acceded to the Convention in December 1991. The convention was a response to the need for nations to cooperate in the conservation of animals that migrate across borders, including terrestrial animals, reptiles, marine species and birds. Special attention is paid to endangered species.</p>	<ul style="list-style-type: none"> ▪ Land-use/Infrastructure ▪ Water quantity and quality
<p>International Convention for the Prevention of Pollution from Ships</p>	<p>Annex I (regulations on oil) and Annex II (regulations on noxious liquid substances in bulk). As regards to the disposal of garbage from ships, Annex V of the International Convention for the prevention of pollution from ships 1973/78 (MARPOL) headed 'Regulations for the Prevention</p>	<ul style="list-style-type: none"> ▪ Water quantity and quality

INTERNATIONAL CONVENTION	DESCRIPTION	REGULATED ACTIVITIES/DEVELOPMENT
(MARPOL) (1973/1978)	<p>of Pollution by Garbage from Ships' applies. Annex V prohibits any form of disposal of garbage which it defines as 'All kinds of victual, domestic and operational waste, excluding fresh fish and parts thereof, generated during a normal operation of the ship and liable to be disposed of continuously or periodically except those substances which are defined or listed in other annexes to this present Convention.'</p> <p>In 1991, the Marine Environment Protection Committee (MEPC) of the International Maritime Organisation adopted recommendations on International Guidelines for Preventing the Introduction of Aquatic Organisms and Pathogens from Ship's Ballast Water and Sediment Discharges, as resolution MEPC 50(31). It is the intention that these guidelines form the basis for a new technical annex to the MARPOL Convention. The above guidelines acknowledge that '... port states and administrations have a responsibility to ensure that ballast water, loaded in their ports and harbours, does not contain plants, animals or pathogens that pose a threat to the waters of other states'.</p>	
United Nations Environmental Programme (UNEP) (1972)	The United Nations Environmental Programme (UNEP) was initiated in 1972. Several programmes set up under UNEP consider marine pollution, e.g. the Ocean and Coastal Areas Programmes was set up under UNEP's Water Programme, because of the inseparable link between marine and freshwater systems. There are Regional Seas Programmes introduced by UNEP. Two are of relevance for Africa, namely the 1981 Abidjan Convention (for West Africa), and the 1985 Nairobi Convention which SA is considering joining (Taljaard <i>et al.</i> 2000). Interesting to note is that South Africa is the only country that will probably be involved in both.	<ul style="list-style-type: none"> ▪ Water quantity and quality
Convention Concerning the Protection of the World Cultural and Natural Heritage (World Heritage Convention) (1972)	<p>The Convention states that each state party recognizes the duty of ensuring the identification, protection, conservation, presentation and transmission to future generations of the cultural and natural heritage situated in its territory.</p> <p>Natural heritage is defined as: "natural features consisting of physical and biological formations or groups of such formations, which are of outstanding universal value from the aesthetic or scientific point of view, geological and physiographical formations and precisely delineated areas which constitute the habitat of threatened species of animals and plants of outstanding universal value from the point of view of science or conservation, natural sites or precisely delineated natural areas of outstanding universal value from the point of view of science, conservation or natural beauty".</p>	<ul style="list-style-type: none"> ▪ Land-use/Infrastructure
London Convention for the Prevention of Marine Pollution by Dumping of Wastes and other Matter (1972, amended 1978, 1980, 1989)	"Dump", in relation to any substance, means deliberately to dispose of at sea from any vessel, aircraft, platform or other man-made structure, by incinerating or depositing in the sea. It does not, however, include the disposal at sea of any substance incidental to, or derived from, normal operations of a vessel. Nor does it include legally depositing at sea any substance for a purpose other than its mere disposal. In November 1996 the contracting parties to the London Convention of 1972 adopted the 1996 Protocol to the London Convention. South Africa was also a signatory to the 1996 Protocol that will eventually replace the current Convention. South Africa acceded to the 1996 Protocol in December 1998.	<ul style="list-style-type: none"> ▪ Water quantity and quality
Convention on Wetlands of International Importance especially as Waterfowl Habitat	The broad aims of this Convention are to stem the loss and to promote wise use of all wetlands. The Convention includes estuaries in its definition of wetlands. The Convention defines wetlands 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	<ul style="list-style-type: none"> ▪ Land-use/Infrastructure ▪ Water quantity and quality ▪ Living resources

INTERNATIONAL CONVENTION	DESCRIPTION	REGULATED ACTIVITIES/DEVELOPMENT
(Ramsar) (1971)	<p>exceed six metres.'</p> <p>The Convention addresses one of the most important issues in South Africa, namely the conservation of the country's water supplies, for both the use of the natural and the human environments. South Africa has designated 15 sites to the List of Wetlands of International Importance. A number of others are under consideration.</p>	
International Convention relating to Intervention on High Seas in cases of Oil Pollution (1969)	<p>South Africa upholds the principles of UNEP. Several programmes set up under UNEP consider marine pollution, e.g. the Ocean and Coastal Areas Programmes was set up under UNEP's Water Programme, because of the inseparable link between marine and freshwater systems.</p>	<ul style="list-style-type: none"> ▪ Water quantity and quality

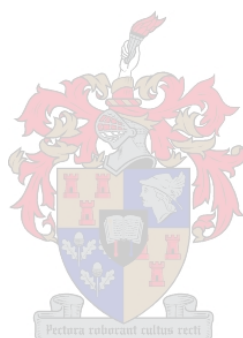


Table A.2 White Papers (policies)

WHITE PAPER	DESCRIPTION	REGULATED ACTIVITY/DEVELOPMENT
White Paper on Spatial Planning and Land-use Management (2001)	<p>This White Paper intends to satisfy the following specific needs:</p> <ul style="list-style-type: none"> • The development of policies, which will result in the best use and sustainable management of land; • Improvement and strengthening planning, management, monitoring and evaluation; • Strengthening institutions and coordinating mechanisms; and • Creation of mechanisms to facilitate satisfaction of the needs and objectives of communities and people at local level. <p>Integrated planning for sustainable management of land resources should thus ensure that:</p> <ul style="list-style-type: none"> • development and developmental programmes are holistic and comprehensive so that all factors in relation to land resources and environmental conservation are addressed and included; • all activities and inputs are integrated and coordinated; • all actions are based on a clear understanding of the natural and legitimate objectives and needs of individual land users to obtain maximum consensus; and • institutional structures are put in place to develop, debate and carry out proposals. 	<ul style="list-style-type: none"> ▪ Land-use/Infrastructure
White Paper on Integrated Pollution and Waste Management for SA (2000)	<p>This white paper outlines the government's new thinking in relation to pollution and waste management. This management approach envisages:</p> <ul style="list-style-type: none"> • Pollution prevention; • Waste minimization; • Managing the environmental impacts associated with waste and pollution; • Remediating damaged environments; and • Integrating the management of various sources of waste. <p>This Integrated Pollution and Waste Management policy is a subsidiary policy of the overarching environmental management policy, as set out in the White Paper on Environmental Policy for South Africa, and further supported by NEMA.</p> <p>The White Paper proposes a number of tools to implement the objectives of the policy it sets out. The most significant of these is a legislative programme that will culminate in new pollution and waste legislation. One of the identified administrative actions is initiating the process of integrating pollution and waste management functions within all spheres of government, including functions relating to water and marine pollution. A remediation fund for marine pollution will also be investigated. A National Waste Management Strategy, which will form the basis for translating the goals and objectives of this policy into practice, has also been developed.</p>	<ul style="list-style-type: none"> ▪ Water quantity and quality
White Paper for Sustainable Coastal Development for SA (2000)	<p>The white paper sets out a policy which aims to achieve sustainable coastal development in South Africa through integrated coastal management. The white paper sets out a vision, a number of principles and goals for coastal management.</p> <p>The key messages of the White Paper are: 1) the value of the coast must be recognised, 2) sustainable coastal management must be facilitated; 3) Coastal management must be co-ordinated and integrated; 4) Government must adopt a co-operative style of management</p> <p>The key action points that the White Paper lays out are:</p>	<ul style="list-style-type: none"> ▪ Land-use/Infrastructure ▪ Water quantity and quality ▪ Living resources

WHITE PAPER	DESCRIPTION	REGULATED ACTIVITY/DEVELOPMENT
	<ul style="list-style-type: none"> • Institutional and Legal Development: At a national level, the Department of Environmental Affairs and Tourism (DEAT) will act as national lead agent for coastal management and a new Coastal Management Act will be drafted. In the provinces lead agents for coastal management will be defined and Coastal Working Groups will be established. At local level, local authorities will still have day-to-day coastal management responsibilities and it is proposed that some areas establish local coastal forums. • Awareness, Education and Training: A coastal public awareness programme will be carried out in conjunction with the education and training of coastal stakeholders and role players. • Information: A programme will be designed to monitor the state of the coast and regular state of the coast reports will be published. An information and decision-support system to assist coastal managers will be established. • Projects: A shortlist of national and provincial priority issues will be identified and programmes developed to address these issues (INR 2000). 	
White Paper: A Minerals and Mining Policy for SA (1998)	<p>The White Paper is organised into six main themes:</p> <ul style="list-style-type: none"> • Business Climate and Mineral Development, which looks at the continuation of policy conducive to investment and includes a section on Mineral Rights and Prospecting Information which presents changes to the system of access to, and mobility of, mineral rights; • Participation in Ownership and Management, which examines racial and other imbalances in the industry; • People Issues, which looks at health and safety, housing needs, migrant labour, industrial relations and downscaling; • Environmental Management; • Regional co-operation; and • Governance. <p>The policy states that government will ensure that the following principles are adhered to:</p> <ul style="list-style-type: none"> • In order to achieve integrated and holistic environmental management, Government requires compliance with a single national environmental policy and governance within a framework of co-operative governance. The DME will, in support of the lead agent (DEAT), develop and apply the necessary to ensure the mining industry's compliance with national policy on environmental management; • During decision making, a risk-averse and cautious approach will be adopted; • The polluter-pays principle will be applied; • A consistent standard of environmental impact management will be applied; • Equitable and effective consultation with interested and affected parties; • Mining companies will be required to comply with the local Development Objectives, spatial development framework and Integrated Development Planning of the municipalities within which they operate; • Clear guidelines for implementation of environmental management procedures and decision making will be provided; and • The principles of Integrated Environmental Management (IEM) will be applied in the mining industry, including cradle-to-grave management of environmental impacts. 	<ul style="list-style-type: none"> ▪ Land-use/Infrastructure

WHITE PAPER	DESCRIPTION	REGULATED ACTIVITY/DEVELOPMENT
White Paper on the Conservation and Sustainable Use of South Africa's Biological Diversity (1997)	<p>The United Nations Convention on Biological Diversity came into force in December 1993. As a party to the Convention, South Africa is required to develop national strategies, plans or programmes, or adapt existing ones, to address the provisions of the Convention, and to integrate the conservation and sustainable use of biodiversity into sectoral and cross-sectoral plans, programmes and policies. South Africa's initial response to this requirement is contained in this White Paper.</p> <p>The White Paper specifically recognises the importance of estuaries and commits the government to a number of strategies to protect wetland areas (including estuaries). The strategies suggested cut across a number of legislative sectors such as water law, resource conservation and planning. Some of the key strategies are to:</p> <ul style="list-style-type: none"> • Facilitate the development of appropriate legislation to secure the conservation of South Africa's wetlands, and to maintain their ecological and socio-economic function; • Promote the establishment of a National System of Protected Wetlands as part of the protected area system; • Prevent inappropriate activities and development around wetlands, and that of linear development in particular. Ensure that adequate buffer strips are retained around wetlands, taking due cognisance of the 1:50 year flood line; • Through establishing appropriate mechanisms and procedures, recognise the functions and values of wetlands in resource planning, management and decision making; and • Determine the impact of commercial, recreational and subsistence fishery practices on fisheries, fish, and their habitats, and develop guidelines for managing such fisheries on an ecologically sustainable basis (INR 2000). 	<ul style="list-style-type: none"> • Land-use/Infrastructure • Water quantity and quality • Living resources
White Paper on National Water Policy for SA (1997)	<p>The objective of the White Paper is to set out the policy for the management of both quality and quantity of our scarce water resources. The White Paper reflects the urgent need for change in this field, and the high priority given to appropriate water management by the national Government.</p> <p>The purpose of this White Paper is to:</p> <ul style="list-style-type: none"> • provide some historical background regarding access to and the management of water in South Africa; • explain the current development context in which South Africa finds itself; • explain the environmental and climatic conditions which affect the availability of water in South Africa; • put forward certain policy positions, based on the Fundamental Principles (see Appendix 1) adopted by the Cabinet in November 1996; • outline the proposed institutional framework for water management functions; • outline the steps which will follow the publication of this White Paper in order to translate the policy into law and action. <p>Some of the key proposals which will guide water management in South Africa in the future are that:</p> <ul style="list-style-type: none"> • The status of the nation's water resources as an indivisible national asset will be confirmed and formalised. • National Government will act as the custodian of the nation's water resources. • All water in the water cycle, whether on land, underground or in 	<ul style="list-style-type: none"> • Water quantity and quality

WHITE PAPER	DESCRIPTION	REGULATED ACTIVITY/DEVELOPMENT
	<p>surface channels, falling on, flowing through or infiltrating between such systems, will be treated as part of the common resource.</p> <ul style="list-style-type: none"> • Only water required to meet basic human needs and maintain environmental sustainability will be guaranteed as a right. This will be known as the Reserve. • All other water uses will be recognised only if they are beneficial in the public interest. • These other water uses will be subject to a system of allocation that promotes use which is optimal for the achievement of equitable and sustainable economic and social development. • Water use allocations will no longer be permanent, but will be given for a reasonable period. 	
White Paper on Marine Fisheries Policy for SA (1997)	<ul style="list-style-type: none"> • The document sets out the main policy principles that the DEAT will endeavour to implement through its marine fisheries management institutions in order to achieve this overall policy objective. • It is the objective of the policy to improve the overall contribution of the fishing industry to the SA economy. • Expansion of the sector's total activity is limited by the natural productive capacity of the living marine resources from which the activities derive, and the necessity to limit and control the total harvesting pressure according to what the resources can sustain on a long-term basis. • In spite of these constraints, the fisheries sector is of great importance to the economy in several coastal regions, and for the livelihood of many communities. • The fisheries policy is founded on the belief that all natural marine living resources of South Africa, as well as the environment in which they exist and in which mariculture activities may occur, are a national asset and the heritage of all its people, and should be managed and developed for the benefit of present and future generations in the country as a whole. 	<ul style="list-style-type: none"> • Living resources
White Paper on Environmental Management Policy for SA (1997)	<p>The White Paper contains the government's environmental management policy and describes the context in which it has been developed. The White Paper has the following sections:</p> <ul style="list-style-type: none"> • an introduction that sets out the concept of environment used in the policy, the scope and purpose of the policy; • a new vision for environmental policy and the mission of the DEAT with respect to the new policy; • the policy principles that must be applied in developing and testing policy; • government's strategic goals and supporting objectives to begin addressing major issues facing environmental management and the sustainable use of resources; and • government's approach to governance, setting out the powers and responsibilities of the different spheres and agencies of government and the regulatory approach to environmental management. <p>The purpose of policy is twofold:</p> <ul style="list-style-type: none"> • to inform the public what government's objectives are and how it intends to achieve its objectives; and • to inform government agencies and state organs what their objectives are and what they must do to achieve those objectives. 	<ul style="list-style-type: none"> • Land-use/Infrastructure • Water quantity and quality • Living resources
White Paper on Tourism Policy for SA (1996)	<p>The White Paper provides the government's stance on Tourism and describes the following:</p> <ul style="list-style-type: none"> • the role of tourism in South Africa, • the problematique around tourism, • the way towards a new tourism, 	<ul style="list-style-type: none"> • Land-use/Infrastructure • Water quantity and quality • Living resources

WHITE PAPER	DESCRIPTION	REGULATED ACTIVITY/DEVELOPMENT
	<ul style="list-style-type: none">• the vision, objectives and principles,• how to ignite tourism growth,• the roles of the key players,• the organisational structure,• and the way forward. <p>Based on an assessment of the problems, constraints and opportunities facing the South African tourism industry, the concept of "Responsible Tourism" emerged as the most appropriate concept for the development of tourism in South Africa.</p>	

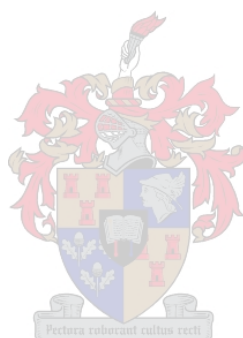


Table A.3 National legislation

KEY LEGISLATION	DESCRIPTION	REGULATED ACTIVITY/DEVELOPMENT
National Environmental Management: Coastal Zone Bill (Draft 10.7, 2006)	<p>The Bill:</p> <ul style="list-style-type: none"> • Sets out coastal management principles to guide public sector decision making and ensure conservation of the coastal zone. It promotes equitable re-distribution of the benefits flowing from the coastal zone; • Defines the legal status of coastal public property and sets out procedures for demarcating areas within the coastal zone; • Promotes the integrated management and planning of coastal resources to ensure development is sustainable; • Establishes a national monitoring and information system to facilitate co-ordinated monitoring of the health and use of coastal ecosystems (not as clear in the 11th Draft of the Bill); • Controls the discharges of effluents, wastes and other pollutants into coastal public property and dumping at sea to improve ecosystems and human health and give effect to South Africa international obligations. 	<ul style="list-style-type: none"> • Land-use/Infrastructure • Water quantity and quality • Living resources
National Environmental Management: Biodiversity Act 10 of 2004	<ul style="list-style-type: none"> • Provides for the conservation of biological diversity; • Protection of species and ecosystems; • Regulates the sustainable use of biological resources; and • Ensures a fair and equitable sharing of the benefits arising from the use of genetic resources. • Provides for co-operative governance in biodiversity management and conservation and the establishment of the South African National Biodiversity Institute (SANBI). • The Act states that the state is the custodian of SA's biological diversity and is committed to respect, protect, promote and fulfil the constitutional rights of its citizens. The lead agent is the Department of Environmental Affairs and Tourism. 	<ul style="list-style-type: none"> • Land-use/Infrastructure • Water quantity and quality • Living resources
National Environmental Management: Protected Areas Act 57 of 2003	<p>Provides, within the framework of the NEMA, for:</p> <ul style="list-style-type: none"> • The declaration and management of a national system of protected areas in South Africa as part of a strategy to manage and conserve its biodiversity; • A representative network of protected areas on state land, private land and communal land; • Promotes sustainable utilisation of protected areas for the benefit of people and participation of local communities in the management of protected areas; • Gives effect to international agreements on protected areas which are binding on the Republic; • Provides for co-operative governance in the declaration and management of protected area; and • The lead agent is the DEAT. 	<ul style="list-style-type: none"> • Land-use/Infrastructure

<p>Mineral and Petroleum Resources Development Act 28 of 2002</p>	<ul style="list-style-type: none"> • The Act contains the statutory requirements regarding the enforcing of environmental protection and management of mining impacts, including sand and coastal mining. • It requires environmental management plans that identified mine's impact on environment and provides clear programme on how these will be managed, based on an Environmental Impact Assessment (EIA). • To ensure compliance with environment issues the act requires consultation with each Department charged with administration of any law that relates to any matter affecting environment before an environmental management plans may be approved. • The act is administered by Department of Minerals and Energy. 	<ul style="list-style-type: none"> • Land-use/Infrastructure • Water quantity and quality
<p>Disaster Management Act 57 of 2002</p>	<p>Provides for:</p> <ul style="list-style-type: none"> • An integrated, co-ordinated and common approach to disaster management by all spheres of government; • A disaster management policy that focuses on preventing or reducing the risk of disaster and mitigation of severe disasters. 	<ul style="list-style-type: none"> • Land-use/Infrastructure
<p>Local Government Municipal Systems Act 32 of 2000.</p>	<p>Chapter 5 of this Act deals with Integrated Development Planning. It requires each local authority to adopt a single, inclusive plan for the development of the municipality (Section 25 (1)) which:</p> <ul style="list-style-type: none"> • "Links, integrates and coordinates plans and take into account proposals for the development of the municipality; • Aligns the resources and capacity of the municipality with the implementation of the plan; • Forms the policy framework and general basis on which annual budgets must be based; and • Is compatible with national and provincial development plans and planning requirements that are binding on the municipality in terms of legislation." <p>The Municipal Planning and Performance Management Regulations (2001) promulgated in terms of the Act, describe the content requirements of IDPs. The regulations (Section 2(4)(f)) state that the spatial development framework reflected in the municipality's IDP must "contain a strategic assessment of the environmental impact of the spatial development framework".</p>	<ul style="list-style-type: none"> • Land-use/Infrastructure • Water quantity and quality • Living resources
<p>National Heritage Resources Act 25 of 1999</p>	<ul style="list-style-type: none"> • Introduces an integrated and interactive system for the management of national heritage resources (which include landscapes and natural features of cultural significance); • Promotes good governance at all levels; • Empowers civil society to nurture and conserve its heritage resources in order to bequeath them to future generations; • Introduces an integrated system for the identification, assessment and management of heritage resources; • Establishes the South African Heritage Resources Agency together with a Council to co-ordinate and promote the management of heritage resources; and • Enables the provinces to establish heritage authorities, which must adopt powers to protect and manage certain categories of heritage resources. <p>Under this Act the Regulations in connection with the Greater St. Lucia Wetland Park, No. R.1193, 24 November 2000, were promulgated to create the framework to ensure that the Greater St. Lucia Wetland Park be managed, protected and developed in a manner consistent with South Africa's obligations under the World Heritage Convention, international best practice and the principles of co-operative governance set forth in Chapter 3 of the Constitution.</p>	<ul style="list-style-type: none"> • Land-use/Infrastructure • Water quantity and quality • Living resources

World Heritage Convention Act 49 of 1999	<p>Provides for:</p> <ul style="list-style-type: none"> • The incorporation of the World Heritage Convention into SA law; • Implementation and enforcement of the World Heritage Convention in SA; • Recognition and establishment of World Heritage Sites; and • the related establishment of authorities and the granting of additional powers to existing organs of state. 	<ul style="list-style-type: none"> • Land-use/Infrastructure • Water quantity and quality • Living resources
Marine Living Resources Act 18 of 1998	<p>The objectives and principles of this Act deal with the:</p> <ul style="list-style-type: none"> • Utilization, conservation and management of marine living resources; • Need to protect whole ecosystems; • Preservation of marine biodiversity; • Minimization of marine pollution; • Compliance with international law and agreements; and • Restructuring of the fishing industry. <p>Almost all the Act's provisions deal with fishing and fisheries. Chapter 4 of the Act empowers the Minister to declare an area to be a Marine Protected Area where various activities are prohibited.</p> <p>The Act defines South African waters to mean the sea-shore, internal waters and such waters include tidal rivers in which a rise and fall of water level takes place as a result of the tides. Fish is defined to mean the marine living resources of the sea and the seashore, including any aquatic plant or animal, whether piscine or not, and any mollusc, crustacean, coral, sponge, holothurian or other echinoderm, reptile and marine mammals and includes their eggs, larvae and all juvenile stages, but exclude sea birds and seals (Smith & Cullinan 2000).</p>	<ul style="list-style-type: none"> • Living resources • Water quantity and quality
National Water Act 36 of 1998	<ul style="list-style-type: none"> • One of the most important aims of this Act is water resource management to ensure protection of the aquatic ecosystems. To be able to do this effectively, it is important to have legislation and policies in place that provide guidance in developing RQOs for aquatic ecosystems, i.e. specifying aspects such as habitat integrity, biotic composition and functioning, water quality and, in some instances, water quantity requirements. • The Water Resource Protection Policy under the National Water Act (No 36 of 1998) provides detailed guidelines and procedures to develop RQOs for the protection of aquatic ecosystems (i.e. for water quality, water quantity, habitat integrity and biotic integrity) for rivers, wetlands, estuaries and groundwater. 	<ul style="list-style-type: none"> • Water quantity and quality
National Veld and Forest Fire Act 101 of 1998	<ul style="list-style-type: none"> • Sets out to reform the law on veld and forest . • Repeals certain provisions of the Forest Act of 1984. • Provides for matters relating to fire protection, and fighting, offences and penalties and enforcement. 	<ul style="list-style-type: none"> • Water quantity and quality

National Environmental Management Act 107 of 1998	<ul style="list-style-type: none"> • Provides for co-operative environmental governance through the establishment of national environmental management principles, and procedures for their incorporation into decisions affecting the environment; • Emphasizes co-operative governance and assists in ensuring that the environmental right and related rights in the Constitution are protected; • Requires the DEAT to be the lead agent in ensuring the effective custodianship of the environment; • Articulates principles such as 'the polluter pays' and the precautionary principle; and • Provides that sensitive, vulnerable, highly dynamic or stressed ecosystems, such as estuaries, require specific attention in management and planning procedures, especially where subjected to significant human resource usage and development pressure (Smith and Cullinan 2000). 	<ul style="list-style-type: none"> • Land-use/Infrastructure • Water quantity and quality • Living resources
Local Government Municipal Structures Act 117 of 1998	<p>The Constitution establishes three categories of municipalities. This Act:</p> <ul style="list-style-type: none"> • Elaborates on the categorisation of municipalities as defined by the Constitution; • Provides for "the establishment of municipalities in accordance with the requirements relating to categories and types of municipality; • Establish criteria for determining the category of municipality in an area" and other related matters; • Includes chapters on the categories and types of municipalities; and • the establishment of municipalities and the functions and powers of municipalities (Glazewski 2000). 	<ul style="list-style-type: none"> • Land-use/Infrastructure • Water quantity and quality • Living resources
Environmental Laws Rationalization Act 51 of 1997	<p>Makes provision for the rationalisation of certain Acts of Parliament which are administered by the DEAT (e.g. Sea-Shore Act and Dumping at Sea Control Act), by amending those acts and by extending their application to certain areas which at present form part of the national territory of the Republic, but where other laws applied, such as Transkei, Bophuthatswana, Venda, Ciskei and other previously self-governing territories such as Kwa-Zulu.</p>	<ul style="list-style-type: none"> • Land-use/Infrastructure • Water quantity and quality
Wreck Salvage Act 94 of 1996	<p>The Act provides for:</p> <ul style="list-style-type: none"> • the salvage of certain vessels; • the application of the International Convention on Salvage, 1989, to SA waters; and • the repeal or amendment of certain sections of the Merchant Shipping Act (1951). 	<ul style="list-style-type: none"> • Water quantity and quality

<p>The Constitution of the Republic of South Africa Act 108 of 1996</p>	<p>The Constitution, which is the supreme law of the land, provides the legal framework for legislation regulating estuarine management in general. It emphasises co-operative governance and provides the legal basis for allocating powers to different spheres of government.</p> <p>The most pertinent fundamental right in the context of estuarine management is the Environmental Right (Section 24) which provides that:</p> <p>"Everyone has the right:</p> <ul style="list-style-type: none"> • to an environment that is not harmful to their health or well-being; and • to have the environment protected for the benefit of present and future generations through reasonable legislative and other measures that – • prevent pollution and ecological degradation; • promote conservation; and • secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development. <p>Section 24 of the Bill of Rights guarantees the people of South Africa the right to an environment not detrimental to human health or well-being, and specifically imposes a duty on the State to promulgate legislation and take other steps to ensure that the right is upheld and that, among other things, ecological degradation and pollution is prevented.</p>	<ul style="list-style-type: none"> • Land-use/Infrastructure • Water quantity and quality • Living resources
<p>Local Government Transition Act 209 of 1993</p> <p>and</p> <p>Local Government Transition Act Second Amendment Act 97 of 1996</p>	<ul style="list-style-type: none"> • In terms of the Act all municipalities, both Transitional Local Councils (TLCs) and District Councils, are required to draw up Integrated Development Plans (IDPs) for the integrated development and management of their areas of jurisdiction. • An Integrated Development Plan is intended to encompass and harmonise planning for a range of sectors such as water, transport, land use and environmental planning. • A key component of a municipality's Integrated Development Plan is the land-use management component (this could be in the form of a town planning scheme or a zoning scheme). In many cases the land-use management component would provide an overall spatial framework that indicates the areas where categories of development can take place (INR 2000). 	<ul style="list-style-type: none"> • Land-use/Infrastructure

<p>Development Facilitation Act 67 of 1995</p>	<p>The Development Facilitation Act establishes the overall framework and administrative structures for planning throughout the country. It is intended to be a framework law which allows provinces to pass provincial planning laws and regulations which are appropriate for specific circumstances.</p> <p>The overall objective of the Act is to introduce extraordinary measures to facilitate and speed up the implementation of reconstruction and development programmes and projects in relation to land; and in so doing to lay down general principles governing land development throughout the Republic.</p> <p>The Act contains general principles for land development and conflict resolution, such as:</p> <ul style="list-style-type: none"> • Policy, administrative practice and laws should promote efficient and integrated land development in that they: <ul style="list-style-type: none"> – promote the integration of the social, economic, institutional and physical aspects of land development; – promote integrated land development in rural and urban areas in support of each other; and – encourage environmentally sustainable land development practices and processes. <p>Furthermore, the Act requires that policy, administrative practice and laws should promote sustainable land development at the required scale in that they should-</p> <ul style="list-style-type: none"> • promote land development which is within the fiscal, institutional and administrative means of the Republic; • promote the establishment of viable communities; • promote sustained protection of the environment; and • meet the basic needs of all citizens in an affordable way. <p>Each proposed land development area should be judged on its own merits and no particular use of land, such as residential, commercial, conservational, industrial, community facility, mining, agricultural or public use, should in advance or in general be regarded as being less important or desirable than any other use of land.</p> <p>The Constitution determines that planning is a provincial responsibility, and most coastal provinces are currently preparing new development planning legislation in terms of the principles of the Development Facilitation Act.</p>	<ul style="list-style-type: none"> • Land-use/Infrastructure
<p>Maritime Zone Act 15 of 1994</p>	<p>The Act provides for:</p> <ul style="list-style-type: none"> • The demarcation of the maritime zones of the Republic (e.g. internal waters, territorial waters, contiguous zone, maritime cultural zone, exclusive economic zone, continental shelf); and • matters relating to installations, maritime casualties and self-defence. 	<ul style="list-style-type: none"> • Water quantity and quality
<p>National Forest Act 122 of 1994</p>	<ul style="list-style-type: none"> • The purpose of this Act is to reform forestry-related legislation. • It recognises that natural forests and woodlands form an important part of the environment, and need to be conserved and developed according to the principles of sustainable management. • While plantation forests play an important role in the economy, they have an impact on the environment and need to be managed appropriately. 	<ul style="list-style-type: none"> • Water quantity and quality

<p>Environmental Conservation Act 73 of 1989</p>	<ul style="list-style-type: none"> • The provisions of this Act have been repealed by the NEMA. New Environmental Impact Assessment (EIA) regulations were published on 21st April 2006 under Chapter 5 of the NEMA. • The regulations commenced on 3rd July 2006. Government Notice No. R 385 defines the process to be followed and the delegation of authority under NEMA (South Africa 2006a). • Government Notice No R 386 lists activities and competent authorities identified in terms of section 24 of NEMA that require a Basic Assessment as defined in regulations 22 to 26 (South Africa 2006b). These include, for example, activities such as dredging, excavation, infilling and removal of soil from an estuary. Government Notice No. R 387 lists activities identified in terms of section 24 of NEMA that require scoping and environmental assessment (i.e. a "full EIA") under Regulation 27 to 36 (South Africa 2006c). These include, for example, development activities which exceed 20 hectares or more, and construction or earth moving activities in the sea or within 100m inland of the high water mark. The regulations are especially pertinent to estuaries as they are rapidly expanding development nodes along the South African coast and under tremendous pressures from human activities. <p>A guideline document on the EIA regulations was published in April 1998 by the DEAT. Currently there are two useful management tools relating to legislation in Sensitive Coastal Areas (SCAs). They are a series of published <i>Guidelines for the Control and Management of Activities in Sensitive Coastal Areas</i>, and a computer-based <i>Decision Support System</i> (DSS).</p>	<ul style="list-style-type: none"> • Land-use/Infrastructure • Water quantity and quality • Living resources
<p>Sea Fisheries Act 12 of 1988</p>	<ul style="list-style-type: none"> • Defines "sea" to mean "the water and the bed of the sea ... including the sea-shore and the water and the bed of a tidal river, tidal lagoon " and includes the internal waters referred to in section 3 of the Maritime Zones Act: Provided that in the case of rivers and lagoons, internal waters shall only include tidal rivers and tidal lagoons". The Sea Fisheries Act uses the same definitions for "tidal lagoon" and "tidal river" as those used in the Sea-shore Act. • Along certain sections of our coast, marine reserves have been proclaimed under this Act. Marine reserves may include inter-tidal and sub-tidal areas. While some marine reserves were proclaimed to protect commercially important species such as rock lobster or abalone, others prohibited certain activities, such as boat angling or spear fishing. In a few, all marine life is protected. • Part IX of this Act was replaced by the Marine Living Resources Act, with the exception of some provisions regulating control over the collection and removal of aquatic plants and shells. 	<ul style="list-style-type: none"> • Living resources

<p>Marine Pollution Intervention Act 64 of 1987</p>	<ul style="list-style-type: none"> • Provide for the protection of the marine environment from pollution by oil and other harmful substances, the prevention and combating of such pollution, and the determination of liability in certain respects for loss or damage caused by the discharge of oil from ships, tankers and offshore installations. The Minister of Transport may make regulations in order to achieve the Act's objectives. • The Act prohibits the discharge of oil from ships, tankers and offshore installations, but provides exemptions in the case of, for example, the oil being released as a result of damage and steps being taken as soon as practicable to stop or reduce the escape of oil. The Act provides reporting procedures for discharges of any harmful substance. • The Act establishes the powers of the South African Maritime Safety Authority to take steps to prevent pollution of the sea where a harmful substance is being or is likely to be discharged. The Authority, for example, may require the master of a ship to unload a harmful substance from a ship or tanker, or to transfer the substance to another ship or tanker. • In terms of the Act, the owner of a ship, tanker or offshore installation is liable for any loss or damage caused by pollution resulting from the discharge of oil. The owner is also liable for the costs of any measures taken by the Authority to reduce damage resulting from such discharge. Tankers carrying more than 2 000 tons of oil are subject to compulsory insurance. The Authority may detain a ship if its owner fails to pay the costs in terms of this Act. 	<ul style="list-style-type: none"> • Water quantity and quality
<p>Conservation of Agricultural Resources Act 43 of 1983</p>	<ul style="list-style-type: none"> • Provides for control measures to be made in order to protect water resources against pollution from farming. • However, appropriate regulations have not been promulgated. 	<ul style="list-style-type: none"> • Water quantity and quality
<p>Legal Succession to the South African Transport Services Act 9 of 1989 (Harbour Regulations GN 5621, 26 March 1982)</p>	<ul style="list-style-type: none"> • Commercial harbours fall under the Legal Succession to the South African Transport Services Act (No. 9 of 1989) that repealed the South African Transport Services Act (No. 65 of 1981). However, important regulations passed under this Act, e.g. the 'Harbour Regulations' (GN 5621, 26 March 1982) are specifically preserved by the 1989 Succession Act. These regulations set out to manage and control pollution in harbour areas. Administered by Department of Transport and National Ports Authority (NPA). 	<ul style="list-style-type: none"> • Land-use/Infrastructure • Water quantity and quality •
<p>Marine Traffic Act 2 of 1981</p>	<p>The Act sets out to regulate traffic in South Africa and provides for:</p> <ul style="list-style-type: none"> • Matters such as regulating ship traffic ; • Stopping or anchoring of ships outside fishing harbours; and • The sinking and abandoning of ships. <p>Administered by the Department of Transport.</p>	<ul style="list-style-type: none"> • Water quantity and quality
<p>The Prevention and Combating Pollution of the Sea by Oil Act 6 of 1981</p>	<p>The Act provides for:</p> <ul style="list-style-type: none"> • the prevention and combating of pollution of the sea by oil; • determining liability in certain respects for loss or damage caused by the discharge of oil from ships, tankers or offshore installations; and • matters relating to insurance, cost for which owner is liable and jurisdiction of courts. <p>Local Coastal Plans detail the actions to be taken when there is a threat of oil impacting the shore line or an impact has occurred, i.e. the Coastal Oil Spill Contingency Plans. Local authorities in the various coastal zones play an important role in the execution of such plans and their tasks are detailed in the documents. These coastal plans, are, however, in the process of being re-drafted and it is important that local authorities clarify their responsibilities in this regard (Dr L Jackson, DEAT, pers. comm.)</p>	<ul style="list-style-type: none"> • Water quantity and quality

Dumping at Sea Control Act 73 of 1980	<ul style="list-style-type: none"> • The Dumping at Sea Control Act (No. 73 of 1980) provides for the control of dumping of substances in the sea. • This Act gives legal effect in South Africa to the London Convention for the Prevention of Marine Pollution by Dumping of Wastes and other Matter, 1972. "Dump", in relation to any substance, means deliberately to dispose of at sea from any vessel, aircraft, platform or other man-made structure, by incinerating or depositing in the sea. 	<ul style="list-style-type: none"> • Water quantity and quality
Health Act 63 of 1977	<ul style="list-style-type: none"> • Provides measures for the promotion of a safe and healthy environment. It defines the duties and responsibilities of several authorities which render health services and provides measures for the co-ordination of such health services. • The Act deals with the control and management of waste mainly in respect of the protection of human health. • Although the Act falls under the jurisdiction of the Department of Health, most of the related functions have been delegated to provincial and local authorities. 	<ul style="list-style-type: none"> • Water quantity and quality
National Buildings Regulations and Building Standards Act 103 of 1977	<ul style="list-style-type: none"> • Sets requirements for the approval and installation of storm water drains. • These regulations must be read together with the South African Bureau of Standards' code of practice, which also lays down detailed requirements for the design of storm water drainage systems. 	<ul style="list-style-type: none"> • Land-use/Infrastructure
National Parks Act 57 of 1976	<ul style="list-style-type: none"> • Provides for the establishment of National Parks. • National Park status establishes the strongest claim to permanent protection that is possible. • Areas above and below the intertidal zone may be included in a National Park. 	<ul style="list-style-type: none"> • Land-use/Infrastructure • Water quality and quantity • Living Resources
Lake Areas Development Act 39 of 1975	<ul style="list-style-type: none"> • This law (rarely used since enactment) provides for the establishment of Lake Areas (which include tidal lagoons or tidal rivers) and the opening and closing of the mouth of a tidal lagoon or a tidal river in a declared lake area. • The relevant provision requires consultation on breaching or closure of a river mouth within a designated Lake Area and further prescribes that these activities can only be done subject to DWAF's directions. • The effectiveness of this law is questionable, as only two such areas have been proclaimed under it. Those Lake Areas are managed by SANParks by virtue of provisions in the National Parks Act (as well as other public authorities) (Smith & Cullinan 2000). 	<ul style="list-style-type: none"> • Land-use/Infrastructure • Water quality and quantity • Living Resources
International Health Regulations Act 28 of 1974	<ul style="list-style-type: none"> • Requires that every seaport must be provided with a system for the removal and disposal of excrement, refuse, wastewater, condemned food and other matter dangerous to health. • Responsible authority in SA is National Ports Authority (NPA). 	<ul style="list-style-type: none"> • Water quantity and quality
Hazardous Substances Act 15 of 1973	<ul style="list-style-type: none"> • Provides for the control of substances which may cause injury or ill health to, or death, of human beings by reason of their toxic, corrosive, irritant, strongly sensitizing or flammable nature. • Provides for the prohibition and control of the importation, manufacture, sale, use, operation, application, modification, disposal or dumping of such substances and products. • The Act is administrated by the Department of Health and Welfare. 	<ul style="list-style-type: none"> • Water quantity and quality

Foodstuffs, Cosmetics and Disinfectant Act 54 of 1972	<p>In South Africa standards (i.e. concentration limits of constituents required by law) specifying the limits of chemical and microbiological constituents in the flesh of different marine organisms used for human consumption are covered under the Foodstuffs, Cosmetics and Disinfectants Act (No. 54 of 1972) and are listed in two regulations, i.e.:</p> <ul style="list-style-type: none"> • Regulation - Marine food, 2 November 1973 (re Bacteriological contamination). • Regulations related to metals and foodstuffs, 9 September 1994. • Responsible authority: Department of Health and Welfare 	<ul style="list-style-type: none"> • Water quantity and quality
Physical Planning Act 88 of 1967	<ul style="list-style-type: none"> • The Act provides for Guide Plans that could influence the planning and location of storm water drains. 	<ul style="list-style-type: none"> • Land-use/Infrastructure
Merchant Shipping Act 57 of 1951	<ul style="list-style-type: none"> • Towards preventing oil pollution at sea. Responsible authority: Department of Transport 	<ul style="list-style-type: none"> • Water quantity and quality
Sea-shore Act 21 of 1935	<ul style="list-style-type: none"> • The Act states that the State President is the owner of the sea and seashore in South Africa, but in a custodianship role. • Accordingly the control of development, pollution and waste management becomes the responsibility of the State and, because the Department of Environmental Affairs and Tourism administers the Seashore Act, it is, therefore, responsible to fulfil this state function. 	<ul style="list-style-type: none"> • Land-use/Infrastructure • Water quantity and quality

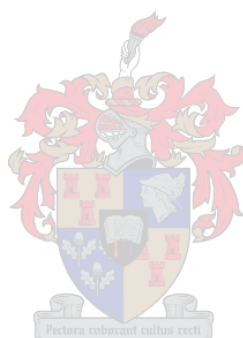
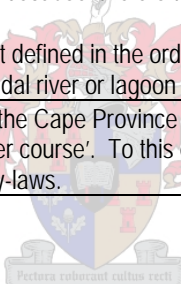


Table A.4 Provincial legislation

Coastal development has historically been controlled in terms of land use planning legislation, administered by the provincial and local authorities. The new political dispensation after 1994 created four coastal provinces (Kwazulu-Natal, Eastern, Western and Northern Cape), all of which are introducing new land-use planning legislation that will replace their existing ordinances. For example, Land Use Planning Ordinance 15 of 1985, which regulates land-use planning in the Western Cape Province, will be repealed by the Western Cape Planning and Development Act.

PROVINCIAL LEGISLATION	DESCRIPTION	RELATED ACTIVITY/ DEVELOPMENT
Western Cape Planning and Development Act 7 of 1999	<ul style="list-style-type: none"> Replaced the Land Use Planning Ordinance, 1985 (Ordinance No. 15 of 1985) of the Cape Province. Lays down guidelines for the future spatial development of the area to which it relates in such a way as will most effectively promote the order of the area as well as the general welfare of the community concerned. 	<ul style="list-style-type: none"> Land-use/Infrastructure
KwaZulu-Natal Planning and Development Act (No. 5 of 1998)	<p>The KwaZulu-Natal Planning and Development Act (No. 5 of 1998) replaces the Town Planning Ordinance in that province.</p> <p>It aims to rationalise and consolidate all planning and development laws applicable in the province and to facilitate and give effect to the provisions of the Development Facilitation Act.</p> <p>This Act is premised on certain principles. These include:</p> <ul style="list-style-type: none"> using legislation and policies and procedures stipulated in it in an enabling and development-orientated rather than a prescriptive or control-orientated manner; ensuring that planning in all areas is largely directed at the strategic management of development. This objective can be achieved by regulating changes in land use; regarding planning as an interactive process, conducted by and between communities to identify needs and goals and to develop strategies to achieve those; and promoting an environmental ethic of sustainable use through policy measures, in financial provisions, guidelines and policy plans. <p>The principles apply throughout the province and bind the State. They must be applied in the preparation and administration of any physical plan, guide plan, structure plan, scheme, development plan, land-use plan, development code or any other plan or scheme administered by any responsible authority in terms of any applicable provincial law.</p> <p>The Act also provides for all matters relating to development plans in the province and, in addition, for ministerial determination of special case areas. It empowers the Minister of Local Government and Housing to prescribe areas where development restrictions can be applied so as to prevent the destruction of those features which make a region unique or generally worthy in any event of increased protection.</p>	<ul style="list-style-type: none"> Land-use/Infrastructure
Kwazulu-Natal Conservation Management Act 9 of 1977	<p>This Act provides for institutional structures for nature conservation in the province and generally regulates nature conservation. It provides that the provincial Minister responsible for environmental protection and nature conservation is responsible for overseeing the implementation of the Act. Among the other powers that the Minister has in terms of the Act, is to prescribe categories of protected areas.</p>	<ul style="list-style-type: none"> Land-use/Infrastructure Living resources

PROVINCIAL LEGISLATION	DESCRIPTION	RELATED ACTIVITY/ DEVELOPMENT
	<p>Regarding institutional structures under the Act, it establishes the KwaZulu-Natal Nature Conservation Board and prescribes its powers, duties and functions. The Board's primary functions are to direct nature conservation management, protected area management and the development and promotion of eco-tourism facilities within protected areas.</p> <p>There is an obligation on the Board to determine conditions and set norms and standards for the following:</p> <ul style="list-style-type: none"> • nature conservation activities and protected areas management; • the sustainable use of all indigenous plants and animals in KwaZulu-Natal; and • the regulation of the import, export and use of indigenous and non-indigenous wild plants and animals throughout the province. <p>The Board must in addition ensure the protection and management of heritage resources within protected areas and in accordance with the principles stipulated in the KwaZulu-Natal Heritage Act.</p> <p>The Nature Conservation Service, established under the Act, is accountable to the Board for the exercise of its functions, powers and duties. The Service's primary function is nature conservation inside and outside protected areas.</p>	
Cape Nature Conservation Ordinance 19 of 1974	<ul style="list-style-type: none"> • Although this ordinance applies to the land, by analogy it can be extended to the marine environment because it refers to inland waters (which in turn includes tidal rivers). • The term 'tidal rivers' is not defined in the ordinance, but in terms of the Sea-Shore Act of 1935 a tidal river or lagoon forms part of the sea. 	<ul style="list-style-type: none"> • Land-use/Infrastructure • Living resources
Municipal Ordinance 20 of 1974 of the Cape	<ul style="list-style-type: none"> • Grants local authorities in the Cape Province the power 'to drain storm water into any natural water course'. To this end, a number of local authorities have passed by-laws. 	<ul style="list-style-type: none"> • Land-use/Infrastructure



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APPENDIX B:

CAPE Estuaries Workshop Management Strategies

Table B.1 Overarching targets for ecosystem biodiversity and health	114
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The following section summarises the management strategies developed for the CEP, based on the proceedings from the CAPE Estuaries workshop held in September 2005 (Van Niekerk & Taljaard 2005). The strategies are grouped into the development of management strategies to address :

- Overarching targets for ecosystem biodiversity and health;
- The unsustainable use of living resources;
- Water quantity and quality (i.e. the modification of river flows or pollution);
- Land use and infrastructure planning (i.e. the modification and destruction of habitat);
- Institutional and management structures;
- Climate change; and
- Education and awareness.

Table B.1 Overarching targets for ecosystem biodiversity and health

Developing the overarching targets for ecosystem biodiversity and health in terms of long-term habitats, persistence of habitats, species, community structure, biomass and functioning (Source: Turpie 2005b)



MANAGEMENT TASK	ACTIONS
1. The filling of biodiversity data gaps	Address important deficiencies in the estuarine biological data set: <ul style="list-style-type: none"> • Vegetation: Update spatial data for CFR estuaries, involving the detailed mapping of at least 12 systems. • Fish: Validate Harrison data and use the analysis to devise a sampling plan to augment existing data. • Birds: Undertake bird counts in estuaries not covered by existing monitoring programmes or recent studies (about 30 systems).
2. Health assessment	Evaluate the health state of the CFR estuaries by: <ul style="list-style-type: none"> • Analysing the data for estuaries for which RDM health studies have been carried out in order to test the reliability of simple predictors of health (e.g. % MAR and estuary size); • Updating data on the required predictors for CFR estuaries, as far as possible; and • The rapid-level classification of CFR estuaries in terms of health.
3. Assessment of conservation importance	Determine the conservation importance of estuaries in terms of the abundance of habitats and species and ecological functions, including in a broader coastal context: <ul style="list-style-type: none"> • Update the data sets described in Turpie et al. (2004). • Check and refine the scoring index, if necessary, and apply this to the updated data to reclassify estuaries in terms of conservation importance.
4. Determining of the	Estuaries provide goods and services that generate a range of economic values and contribute to national income. This task will describe the economic value

MANAGEMENT TASK	ACTIONS
economic value of CFR estuaries	<p>of CFR estuaries through:</p> <ul style="list-style-type: none"> • Gathering economic data for CFR estuaries on subsistence use (from key informants); • Gathering economic data on tourism and property values (key informants); • Analysing existing data to assess the indirect (e.g. nursery) value of fisheries; • Augmenting existing data on non-use value (survey Western Cape residents); • Classifying and prioritising estuaries in terms of current economic importance; and • Identifying and evaluating economic trade-offs that need to be considered in conservation planning.
5. Conservation planning	<p>The identification of a network of protected estuaries will require the consideration of the representation of different types of estuaries and estuarine biodiversity, and the long-term maintenance of species, communities and ecological processes. The conservation plan will also take into account the sensitivity of systems to perturbation, irreplaceability, the vulnerability of particular species, existing threats and socio-economic trade-offs. The relationships between ecosystem health and socio-economic value will be identified and taken into consideration as far as possible. The task will involve the following:</p> <ul style="list-style-type: none"> • Identify conservation goals for the CFR and set quantitative conservation targets for species, vegetation communities and estuary types, and quantitative targets for minimum size, connectivity or other design criteria. • Review existing conservation areas (do a gap analysis), assessing the extent to which quantitative targets have already been achieved. • Review best practice and develop new algorithms for integrating ecological and socio-economic data in the selection process. • Select additional estuaries to identify preliminary sets of new conservation areas for consideration by managers as additions to established areas. • Make recommendations as to the level or type of conservation for different systems. • Identify and prioritise systems in need of rehabilitation.
6. Workshop to verify and finalise results	<p>Hold a key-stakeholder workshop (with the estuarine research and management community) to communicate methods and results. The workshop will involve the following:</p> <ul style="list-style-type: none"> • Detailed report-back on all of the above; • Test results of the rapid health assessment against expert opinion; • Finalisation of the importance scores for estuaries; and • Finalisation of protection categories and priorities for rehabilitation.

Table B.2 Living Marine Resources

Strategic Objective: Achieve targets for ecosystem biodiversity and health in terms of the long-term habitat persistence of habitats, species, community structure, biomass and functioning by 2015.						
RELATED THREAT	ACTION	SPHERE OF GOV.	ORGAN OF STATE	TOOLS	DATE	DELIVERABLE
Exploitation of living resources	Do stock assessments of the coast and estuaries on a regular basis. This should include an evaluation/review of the priority species' life histories.	National	MCM	Standard methods	2010 for priority species	Data on stock status
	Review management approach (carrot-and-stick) and upgrade linefish and bait-collection regulation.	National	MCM	Review	2010	Linefish and bait-collection regulation that improves the stock status of collapsed species and maintains the status of others
	Establish Marine Protected Areas, Marine Conservation Areas, Marine Management Areas, Estuarine Protected Areas and Estuarine Zonation Areas to protect species from overexploitation and allow stock to recover.	National Provincial Local	MCM (national/regional) Conservation agencies Municipalities (need to consult)	Conservation planning tools EMPs	2015	A network of MPAs, MMAs, MCAs and EPAs Implemented EMPs, including zonation schemes
	Increase compliance enforcement.	National Provincial Local Community	MCM (national/regional) Conservation agencies Municipalities Conservancies	Legislation Memoranda of Understanding (MoU) between different spheres of government	2010	Effective compliance and an increase in the successful prosecution of environmental crimes
Climate change	Evaluate the effect of climate change on species distribution and persistence of habitats. (Changes in water quantity and sea-level rise are dealt with above.)	National Provincial	MCM(national/regional) DWAF(national/regional) SANBI Estuarine scientists	Numerical modelling Conceptual modelling (e.g. mouth status) Modelling of stock status and distribution Determination of buffer zones	2010	Scenarios highlighting the impact of climate change on estuarine biodiversity, especially in the CFR

Strategic Objective: Achieve targets for ecosystem biodiversity and health in terms of the long-term habitat persistence of habitats, species, community structure, biomass and functioning by 2015.						
RELATED THREAT	ACTION	SPHERE OF GOV.	ORGAN OF STATE	TOOLS	DATE	DELIVERABLE
	Adapt MPAs and EPAs to mitigate for the effects of climate change.	National Provincial	MCM	Conservation planning tools, e.g. fine-scale conservation planning	2015	An adapted network of protected areas
Invasive aliens and mariculture	Assess the invasive aliens in estuaries (terrestrial, freshwater and marine: vegetation, invertebrates, fish and birds).	National Provincial	MCM Global ballast water management programme Conservation agencies	GIS Monitoring	2010	A map with the spatial distribution of invasive aliens
	Asses the impact of alien invasives on estuarine biodiversity.	National Provincial	MCM	Conservation tools	2010	An outline of potential threat to estuarine biodiversity
	Establish an estuarine alien eradication programme (if feasible).	National Provincial Local	MCM (national/regional) Conservation agencies Municipalities Conservancies	Legislation Funding	2015	The systematic eradication of invasive species (freshwater, terrestrial and marine)
	Investigate stringent regulations on mariculture and the feasibility of mariculture in estuaries.	National Provincial	MCM	Legislation	2010	Strong legal instruments Guidelines for mariculture in estuaries



Table B.3 Water Quantity and Quality

Strategic Objective: Determine, implement, monitor and review RQOs (taking into account public health) in order to maintain or restore estuarine structure and function in the best attainable state for five priority estuaries within the CFR by 2010.						
RELATED THREAT	ACTION	SPHERE	ORGAN OF STATE	TOOLS	DATE	DELIVERABLE
Water quantity and quality	Identify priority estuaries.	National or Regional	DWAF (national/regional) MCM (national/regional) Conservation agencies	Prioritisation using multi-criteria decision making analysis	2006	A national consensus on the list of priority estuaries
	Asses freshwater requirements for priority estuaries (i.e. Reserve determined and RQOs) are set, where necessary).	National Regional	DWAF	RDM protocol for estuaries	2015	RQOs (quantity, quality and biophysical) Desired state (recommended class)
	Implement and monitor priority estuaries.	National Regional	DWAF	RDM protocol for estuaries	2010	Implemented Reserve at priority estuaries
	Develop an Estuarine Health Programme (i.e. Regional Monitoring Programme).	Regional	DWAF (national/regional) MCM (national/regional) CapeNature	Development of an Estuarine Health Programme	2006	Operational Estuarine Health Programme
	Link RQOs with national, provincial and local development plans.	National Regional Local	DWAF (national/regional) MCM (national/regional) Provincial authorities Municipalities Communities	Development of a procedure to incorporate RQOs into local management plans	2010	IDPs that include EMPs, based on the class and RQOs for that estuary
	Develop guidelines/tools for estuarine management at local level for dealing with water quality/quantity issues and determining "no-go" development boundaries (riparian buffer zones).	National Regional	DWAF	Development of guidelines/tools for estuarine management at local level for dealing with water quality/quantity issues	2007	Effective guidelines/tools for estuarine management at local level for dealing with water quality/quantity issues
Management	Set up Water User Associations (WUAs) or make use of other localised bodies (with relevant legal mandates) to manage estuaries, depending on what is practical – DWAF (2007 for priority estuaries).	National	DWAF	Following of existing procedures	2007	Operational Estuarine Form/Advisory Committee/WUA that assists in the management of the estuary

Strategic Objective: Determine, implement, monitor and review RQOs (taking into account public health) in order to maintain or restore estuarine structure and function in the best attainable state for five priority estuaries within the CFR by 2010.						
RELATED THREAT	ACTION	SPHERE	ORGAN OF STATE	TOOLS	DATE	DELIVERABLE
	Draw up interim management action plans to deal with water quality and quantity issues.	National	DWAF (overall management plan driven by DEAT)	Development of a new strategy	2007	Effective Water Management Strategy to deal with water demand until the Reserve is set
	Draw up MoU for priority estuaries that will define roles and responsibilities regarding the management of those estuaries.	National Regional Provincial Local	DEAT DWAF	Delineation/delegation of responsibilities	2007	Clearly defined roles and responsibilities among lead agents
	Identify a champion(s) for estuaries to drive activities, such as the Estuarine Health Programme (i.e. regional monitoring).	Regional	DWAF MCM	Recruitment of a champion to implement the programme	2006	An active champion for estuaries in the CFR
Climate change	Actively fund studies to investigate the impact of climate change on the estuaries of the CFR (e.g. runoff, temperature, evaporation and changes in agriculture).	National Regional	DWAF	Modelling (numerical and conceptual) Expert opinion	2010	Scenarios highlighting the impact of climate change on the estuaries of the CFR
	Develop plans to mitigate the impact of climate change on the estuaries of the CFR.	National Regional	DWAF	Strategic planning	2010	An effective strategy in place to mitigate the long-term impact of climate change on the estuaries of the CFR
Lack of awareness and capacity, communication (between scientists and managers), and knowledge and expertise	Involve local stakeholders more when the Reserve/RQOs are determined.	National Regional Local	DWAF	Stakeholder workshops	2005	Capacitated estuarine managers
Lack of technical expertise	Employ graduates with estuarine training in government posts where estuaries are managed. Alternatively, fund consultants with estuarine training.	National Regional Local	DWAF (national/provincial) MCM (national/provincial) Provincial authorities Municipalities	Recruitment Job creation	2005	Capacitated government staff

Table B.4 Infrastructure and development

Strategic Objective: Define estuarine areas, assess their current status and values and formulate appropriate integrated management plans to regulate development and other activities impacting upon them, with particular reference to cumulative impacts, by 2008 (with particular reference to mechanisms).						
RELATED THREAT	ACTION	SPHERE	ORGAN OF STATE	TOOLS	DATE	DELIVERABLE
Strategic biodiversity planning	Assess (audit), map and identify problems at a fine scale.	At a local or provincial level (funded by national/provincial/regional government)	Funded by: MCM (national) SANBI Provincial authorities Implemented by: CapeNature SANParks Municipalities (i.e. SDFs) MCM (provincial)	GIS Aerial photography Estuarine Health Monitoring Programme Estuarine Health Index	2006	Maps Assessment of health
	Strategically plan according to targets set for the CFR region (consider the trajectory of change for estuaries, e.g. abstraction and climate change).	National/ Provincial government	MCM SANBI	Conservation planning tools	2006	Conservation targets Strategic plan
	Establish Protected Areas/Zonation.	National Provincial Local Community Scientists	MCM (national/provincial) CapeNature, SANParks, Municipalities (i.e. SDFs) MCM	Conservation planning tools EMPs	2006/7	Network of EPAs Local zonation schemes
	Manage and monitor (biophysical and compliance).	Provincial Local	Municipalities, Conservation agencies, Conservancies	EMPs MoUs	2009	Implemented EMPs
Uncontrolled/inappropriate development	For each estuary: Define what constitutes the "estuary space" and what the appropriate development (if any) within it is. Ways to achieve this include: Persuading and capacitating provincial and local land-use	Provincial Local	Conservation agencies Municipalities (local and district) Provincial land-use planning agency	SEA Spatial Development Frameworks (SDFs) NEMA (EIA regulations) Coastal Management Act	2007	Spatial plan delineating estuarine space Determined levels of appropriate development for individual systems

Strategic Objective: Define estuarine areas, assess their current status and values and formulate appropriate integrated management plans to regulate development and other activities impacting upon them, with particular reference to cumulative impacts, by 2008 (with particular reference to mechanisms).						
RELATED THREAT	ACTION	SPHERE	ORGAN OF STATE	TOOLS	DATE	DELIVERABLE
	decision makers to abide by outcomes; and Obtaining legal status for SDFs. Provincial Coastal Management Plans NEMA Policy Guidelines Geographical area provisions Bioregional Plan Proclamation			Provincial coastal management plans Biodiversity Management Act Cumulative assessment methodology		Local/Provincial authorities abiding by plan Obtained legal status for plan
Physical manipulation	Asses the extent to which physical manipulations are occurring along the CFR coastline. Review the acceptability/motivation for manipulations. Mitigate, where possible. Incorporate into EMPs.	Local Provincial	Municipalities Provincial Coastal Committees	Provincial Coastal Management Plans IDP EMPs	2006	Revaluated artificial manipulation Mitigated for certain aspects Increased control on procedures leading to manipulation
Carrying capacity exceedance	Determine the individual carrying capacity of estuaries in the CFR. Incorporate into EMPs/IDPs.	Local Provincial	As above	Recreational carrying capacity guidelines	2010	Carrying capacity being part of individual EMPs

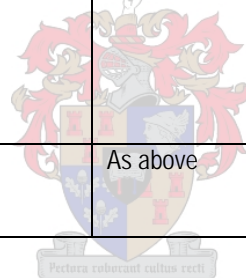


Table B.5 Climate Change

Strategic Objective: Minimise the detrimental impacts of predicted climate change by 2010 through: 1) Taking a long-term precautionary approach to infrastructure development and water resources planning; 2) Influencing land management in upper and middle catchments to reduce impacts on estuaries; and 3) Promoting long-term sustainable livelihoods through estuarine management that minimises risks.						
RELATED THREAT	ACTION	SPHERE	ORGAN OF STATE	TOOLS	DATE	DELIVERABLE
Developmental pressures (e.g. in terms of space for the environment to respond/evolve), protection of inappropriately sited infrastructure etc.	Map appropriate development setback lines also accounting for predicted impacts of climate change.	National	MCM	Predictive analyses etc.	2007	Setback lines on GIS of responsible bodies
Lack of long-term sustainability considerations, impacts on fisheries potential etc.	Do capacity building in terms of environmental importance to socio-economic and political issues. Ensure the consideration of estuarine management in the Provincial Spatial Development Framework, EIP, municipal Integrated Development Plans, Spatial Planning Frameworks and management plans.	Provincial/ Municipal	Provincial Municipal	Statutory planning instruments	2007	Establishment of a clear link between livelihoods, economics and climate-change impacts. Revision of relevant documentation (see action column).
Changes in freshwater inflows, reduced goods and services, amenity value etc.	Fully implement CMAs and Ecological Reserves.	National	DWAF	Reserve and CMA plans	2010	Reserve and CMA plans done.
Impacts on mouth dynamics, sediment regime, estuary type, biota etc.	Obtain a better understanding of impacts as well as links to livelihoods, management actions etc.	Parastatals, NGOs, consultants, organs of state etc.	National Provincial	Research, studies, broad-scale and fine-scale numerical modelling, monitoring etc.	2005 - 2010	Practical guidelines drawn up
Global warming, climate change, sea-level rise, increased storminess etc.	SA helps to drive the global acceptance and implementation of protocols etc.	National	Top national level	Global politics, statesmanship, pressure etc.	2010	Ratification and implementation of international treaties etc.

Table B.6 Institutional and Management Structures

Strategic Objective: Relevant institutions of management comprising appropriate spheres of government and civil society cooperatively manage estuaries according to appropriate management plans by 2010.						
RELATED THREAT	ACTION	SPHERE	ORGAN OF STATE	TOOLS	DATE	DELIVERABLE
Fragmented legislation	Support the development of the NEMP in terms of policy development and legislation.	National	MCM DWAF	Updated review and constructive comments	2006	Detailed document on the NEMP
	Get an updated list of estuarine-related legislation (e.g. listed activities under various acts).	National	MCM	Review	2005	Updated Guide to Estuarine Legislation
Lack of expertise and capacity	Structure a process through which we can learn from each other.	National Regional	CEP MCM	Protocol newsletter	2007	Progress report on the CEP
	Look critically at the education section of the CEP.	National Regional	CEP MCM	Review	2006	Developed educational material for management
Lack of relationships and trust	Show benefits of working together.	National Provincial Local Community	All	Cooperative governance	2006	Improved cooperation between levels of government
	Help, train and capacitate managers to improve trust.	National Provincial Local	MCM (National/provincial) DWAf (National/provincial) Provincial authorities Local	Multi-level training material	2008	Developed multi-level training material
	Implement pilot estuaries EMPs.	Regional	CEP Municipality	Workshops with target municipalities	2005/6	Active involvement by local municipalities
Estuarine priorities not being recognised by local decision makers (e.g. housing projects being considered more important)	Incorporate EMPs into IDPs	National Provincial Local Community	All	IDP guidelines Protocol in Coastal Act Requirement from Provisional Coastal Management Plans	2010	IDPs that include details on estuary issues (via the incorporation of EMPs)
Lack of funding	Create synergy through co-funding (e.g. GEF,	National	MCM (National/provincial)	Cooperative	2005	Better return on

Strategic Objective: Relevant institutions of management comprising appropriate spheres of government and civil society cooperatively manage estuaries according to appropriate management plans by 2010.						
RELATED THREAT	ACTION	SPHERE	ORGAN OF STATE	TOOLS	DATE	DELIVERABLE
	CAPE, MCM and DWAF)	Provincial Local Community	DWAF (National/ provincial) Provincial authorities Local	governance		investment
Lack of a legally mandated lead agent prepared to take control for certain key aspect	Draft legislation and develop the NEMP	National	MCM DWAF	Reviewed original document, disaggregated line functions and added guidelines	2005/6	Detailed guidelines on the NEMP
Lack of political will	Organise a big political launch of the CEP	Regional	CEP	E-mail Local media Television Cape Media Team	2005	Increased awareness of the CEP
Very low profile that estuaries currently have on national, provincial and local levels	Bring out a newsletter	Regional	CEP	E-mail Local media Television Cape Media Team	2005	Increased awareness of the CEP

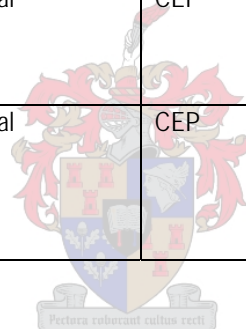
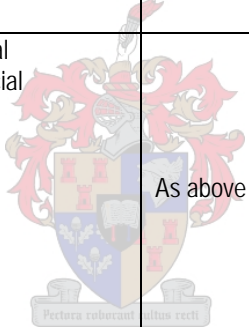


Table B.7 Education and Awareness

Strategic Objective: Generate education and awareness regarding the CFR estuaries by 2010, having: 1) Contributed to integrated, collaborative and informed action and decision making regarding estuaries; 2) Contributed to sustainable quality of life; 3) Promoted good management practices that will sustain healthy estuarine functioning; 4) Raised awareness of the intrinsic value of estuaries and developed a sense of ownership of estuaries not only among local communities but also throughout South Africa; and 5) Raised awareness of and insight into the legal context and obligations of all levels of government.						
RELATED THREAT	ACTION	SPHERE	ORGAN OF STATE	TOOLS	DATE	DELIVERABLE
Key objectives	Audit and collate current information and resource material for estuary function, value and management. Identify gaps.	National Provincial Local Community	DEAT DWAF Provincial Departments of Environmental Affairs Eastern Cape District and Local municipalities SANParks National Port Authority	Provincial coordinating committees CMAs CAPE Task Teams Communications specialist Estuarine Management Committees Media	2006	Checklist of all resources (an audit report) with references to sources; - Web-based resources - Information requirements - Popular articles
	Develop resource guidelines for various levels of governance (tailored as appropriate). Ensure capacity building, packing of resource material and communication programmes for WUA and Forums.	National Provincial Local	As above	As above	2006	Suite of appropriate resource materials (biophysical/ecological good-practice guidelines)
	Draw up estuary legalisation guidelines.	National Provincial Local	As above	As above	2006	Good distribution
	Develop appropriate training for all levels of estuarine governance.	National Provincial Local	As above	Training budgets Capacity-building strategies Appropriate training institutions	2006/7	Suite of training courses Road show aimed at various levels Career books
Lack of strategy, profile, awareness and education in political strategies Organisational structure and budget	Strategic interventions: Formulate policy on education and awareness in all spheres of government. Intervene/influence budget cycles. The IDP process includes budget posts.	National Provincial Local Community	As above, including South African Local Government Association (SALGA)	Strategic planning (all levels) Human Resources Departments IDP frameworks consultant Briefs	2006 - 2008	Strategies reflect appropriate education and awareness of importance and interventions, with explicit targets in all CAPE signatory organisations

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RELATED THREAT	ACTION	SPHERE	ORGAN OF STATE	TOOLS	DATE	DELIVERABLE
	Ensure that the job descriptions for staff/consultants include estuarine responsibilities.					IDPs and government strategy documentation, with clear education and awareness responsibilities and targets (% of budget) Focused and strategic training, with a multiplayer effort
Lack of capacitated educators/awareness champions	Expose educators to accredited training by appropriate institutions (e.g. Goldfields and tertiary institutions). Create in-field formal and informal training programmes and mentorship/coaching programmes to ensure a crop of emerging, capacitated trainers (internships).	National Provincial Local	 As above	Training institutions, e.g. Goldfields, universities, learnerships; Tourism and Hospitality Education and Training Authority (THETA); Primary Agriculture Education and Training Authority (PAETA), etc.	2007 - 2010	Estuary resource material teaching programmes Staff with appropriate and accredited training Active mentorship/coaching relationships at all levels of governance