C. A. P. E.
ESTUARIES
PROGRAMME

OVERSTRAND
MUNICIPALITY

ESTUARY MANAGEMENT PLAN

for the

BOT / KLEINMOND ESTUARINE SYSTEM

OVERBERG REGION, WESTERN CAPE

PART 1 : SITUATION ASSESSMENT REPORT

FINAL

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FOR

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WESTERN CAPE NATURE CONSERVATION BOARD

SITUATION ASSESSMENT REPORT

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Preface to the Final draft (February 2009)

The Draft *Part 1: Situation Assessment Report* was made available for public scrutiny in September 2008, and followed by a public meeting held on 16 October 2008 in the Thusong Hall at Hawston, affording stakeholders and interested and affected parties the opportunity to comment and provide further input into the process of drafting the Estuarine Management Plan for the Bot and Kleinmond estuaries. The Consultant, on behalf of the C.A.P.E. Estuaries Programme, received numerous submissions from the public in the weeks following the meeting, all of which are recorded in the Annexure to this, the updated and final situation assessment report.

During the course of consultations and in the written comments, many people expressed concern about the emphasis, in the Situation Assessment Report, on development and socio-economic issues, which they considered to be counter to the primary objective of the estuarine management plan. They suggested that the EMP should be focused on the management of the "environment".

The province-wide assessment of development potential and subsequent identification of Hermanus as a leader town for development in the Western Cape (WCPSDF, 2005), brings huge pressure to bear on the Bot's estuarine catchment, which demands very careful assessment and a proactive approach in order to manage this pressure through forward planning, rather than reactive adaptation, as is the case when communities rely on developer- and municipality driven EIA processes to inform decisions on the form that development should take. The Consultant viewed the preparation of an Estuary Management Plan to be the appropriate opportunity for a proactive approach to development planning that would take into account the needs of all of the people who have an interest in the Vlei, as well as the inevitable future demands for land for all types of development in the Hermanus – Kleinmond area, all from a point of view which has the Vlei as its central point of concern; that is, what is proposed is an integrated approach to planning the use of the land around the Vlei and to managing activities that relate to the estuary itself.

The cue for adopting this integrated approach to the management of human activities within the estuaries' catchments, which includes urban development and socio-economic development, comes from South Africa's policy for sustainable coastal development (DEAT, 2000). Further cues for an integrated approach are provided by the national policy framework for sustainable development which depicts a 'nested' view on development, where development of the economy is dependent on the health of socio-political systems, both of which cannot exist without the ecosystem services, or "environment", which support them. Internationally, the approach to ecosystem management planning (such as an EMP) relies on identifying and addressing the causal factors of impacts (i.e. human actions and behaviour) because, by changing those, long-lasting sustainable solutions to environmental problems become possible. Hence the importance, for example, of considering why facilities in the past have been vandalised, and aiming to create a future situation where people behave differently.

The differences between this, final version of the Situation Assessment Report, and the September draft are broadly as follows:

Corrections and additional information provided by the resident community and key roleplayers, as recorded in the Annexure, have been incorporated into this report. This was facilitated by the responses that the Consultant provided in the comment report (iRAP actions).

The addition of Section 5.7.5 is a summary of items raised by the resident community and key roleplayers which will need attention during the implementation phase of the EMP.

The Ecological Assessment, which was prepared by Lara van Niekerk of the CSIR, has been updated by herself through the addition of a list of 41 species of fish that have been recorded in the Bot, and a proposal for revised breaching criteria. The latter represents a useful and well-informed guideline for consideration at the forthcoming Indaba scheduled for April 2009, and should be further interrogated following the Estuarine Ecological Reserve Determination study which, it is hoped, will commence later in the year as a result of the C.A.P.E. Estuaries Programme.

The valuable contributions of all of the people who took the time to attend meetings and respond to the invitation to comment on the draft situation assessment report are gratefully acknowledged, as are the original and additional contributions from stakeholders and members of the project team.

Summary

The development of management plans for estuaries in the Cape Floristic Region is a recent initiative co-ordinated by the C.A.P.E. Estuaries Programme, hosted by CapeNature and supported by a number of government line departments, including Water Affairs (DWAF) and Marine and Coastal Management (DEAT-MCM). The preparation of an Estuary Management Plan (EMP) for the Bot is co-funded by the Overstrand Municipality. The Situation Assessment report presents the findings of the first phase of the project.

The estuary of the Bot River, known also as *die Vlei*, *Hawstonvlei* or *Botriviersvlei*, is the third largest in the Cape Floristic bioregion. The Situation Assessment is premised on the view that the Bot and Kleinmond estuaries, and intermediate wetlands of Rooisand and Lamloch Swamp, must be managed as an inter-related system on the basis that, at the current time, water flows between them. The diversity of habitat types within the system, and the expanse of the water body, make it unique in South Africa.

The health of an estuary is affected by activities on the land that surrounds it and in the upper catchments of the rivers that feed into it. The assessment must therefore include all of these areas and activities. Its aim is to provide a foundation for an integrated management plan that addresses not only the biophysical aspects of estuarine management but also the drivers of the threats to estuarine health, which include social and economic issues.

Mouth management

Mouth management dominates the discourse on estuary management at the Bot. It is a bone of contention between parties who hold different views on whether or not, and how, the Bot estuary should be artificially breached. The mouth is mostly closed. At present it is breached artificially approximately once every three years. In the last 60 years the system has breached naturally three times.

The expertise and data to formulate a breaching policy is available but what is absent is a clear and consensual decision on what the breaching policy should aim to achieve. A review of the policy will be undertaken early in 2009. This will have to take into account the findings and objectives of the EMP, *inter alia*, and the increasing importance of the nursery value of the Bot estuary. In the context of a global decline in fish stocks, the irreplaceability of the Bot estuary's nursery function adds weight to the business case for managing the estuary as a resource-orientated service area in the interests of the national economy and global food security.

The scientific view that the system is naturally transforming to a freshwater lake has been countered by a body of research that indicates that the rareness of natural breaching occurrences is the result of human interventions – reduced flow of water from the catchments, artificial breaching of the Kleinmond estuary and, in earlier times, the stabilisation of the Middelvlei dune field to the east of the mouth. More frequent opening would support a greater stability of the ecosystem than infrequent opening and would reduce the impact of gill-netting on stocks of marine fish.

Views on mouth management are influenced by economic interests. Considerable investment has been made in property development in the upper reaches of the lagoon, and high water levels are favoured for recreational purposes and scenic value. More frequent opening of the mouth increases biodiversity and optimises the nursery function of the estuary, thereby serving regional commercial fisheries' interests. More frequent opening is also supported by local residents from Hawston, the community that formerly managed the estuarine fishery, because it results in replenishment of marine fish stocks in the estuary.

Issues of global, national and regional significance

Some aspects of the Bot / Kleinmond estuarine system are of interest only to local residents, investors, managers and recreators, whilst others have a regional, national and even worldwide significance.

- The Bot and Klein estuaries together represent 40-50% of the estuarine nursery habitats required to support marine fish stocks in the area between Cape Point and Breede River. The value of the Bot's nursery function to the fisheries industry – estimated at R22- to R55 million – is significantly higher than the economic value of the estuarine-based exploitation of marine living resources . Fisheries around the

world are collapsing because stocks have been exploited beyond sustainable levels. The nursery environment provided by the extensive sheltered waters of the Bot estuary is an irreplaceable regional asset. Its value will continue to grow in potential as the economics of scarcity respond to the global collapse of fisheries and species extinctions.

- Loss of biodiversity is a global concern resulting from the dramatic increase in population over the last few decades. All over the world, coastal marshes such as the Bot / Kleinmond system are being transformed by development so that they no longer support the range of plants and animals that would normally be found there. Many species are under threat of extinction. The Bot / Kleinmond system supports a large population of water birds – 108 species have been recorded – and there are a number of endangered species present, including white pelican, Caspian Tern, arum frog, micro-frog, and the endemic klipvis. The reasons for the decline in biodiversity at the Bot / Kleinmond are that natural habitats have been transformed into residential and cultivated lands, salinity levels of the estuary fluctuate between fresh- and salt-water extremes, silt builds up and alters the normal workings of the system, the introduction of alien invasive vegetation and fish species such as carp, kurper and largemouth bass causes a depletion of indigenous species, and a lack of public awareness and resources makes it difficult to eradicate them. Given the extent of scientific and traditional knowledge of the Bot / Kleinmond system, it is considered possible that management interventions can reverse the decline and thus contribute to the global effort of conserving biodiversity.
- South African policy on coastal development (DEAT, 2000) establishes the principle that coastal waters, which by definition includes coastal wetlands such as the Bot-Kleinmond system, belong to all the people of South Africa and that their right to access and benefit from the resource takes precedence over private interests.
- Hermanus has been identified in the Western Cape Province's Spatial Development Framework (WCP SDF), with good reason, as a town that should grow. Due to topographic constraints and transportation links, arguably the most suitable direction for it to grow in is the Fisherhaven / Hawston area. Provincial spatial planning policy also provides guidelines for avoiding urban sprawl by containing development within a defined urban edge. The application of this, and policies regarding the development of residential estates and resorts, must be rigorously applied in the estuarine catchment in order to safeguard the value of the natural heritage which is the foundation of the local economy. The undeveloped land between Hawston and Fisherhaven represents an opportunity for higher density development that would serve to defuse the pressure for urban sprawl and optimise the Municipality's investment in infrastructural improvements. The timeous nature of the EMP intervention presents an opportunity for review of the Overstrand Municipality's SDF (2006) proposals for this area, particularly in respect of urban edges and expansion areas proposed within the estuarine catchment.
- There is a duty of care to conserve not only the natural heritage but, also, sites of cultural heritage significance and cultural landscapes, cultural diversity and living heritage. The coastal zone is rich in remnants from pre-colonial times, including shell middens. The residents of Hawston have strong links to the Vlei and have depended on its resources for 150 years. Fishers consider themselves the custodians of traditional knowledge on the management of the mouth and the fishery resource. The SDF identifies the significance of the Blue Flag beach and estuary at Kleinmond as a cultural landscape based on its historical / recreational role. These are examples of heritage elements that need to be conserved so that they can be accessible to residents, non-residents and future generations.

At the local level, mouth management has tended to overshadow other issues requiring attention. The EMP needs to provide an integrated and balanced plan for addressing these. Amongst other things, it is important to address the high rate of unemployment and the need for skills development in the Greater Hermanus and Kleinmond areas.

Livelihoods, compliance

Fishing is an activity that represents a valuable source of food protein to the estimated 78% of Hawston household who earn less than the subsistence income of R1,600 per month. As is happening all over the world, restrictions on individual rights of access to marine resources have been introduced in order to give fish stocks the opportunity to recover from over-exploitation. In the Bot estuary, declining fish stocks have resulted not only from overfishing but also the impact of an increasingly freshwater dominated ecosystem. The number of licenses issued for commercial fishing in the estuary have reduced steadily over the years and currently there are none. Communities who were previously dependent on these resources are severely affected, economically and socially. Non-compliance with regulations aimed at protecting the resource is widespread: subsistence fishers admit to fishing illegally for commercial purposes, and operate an unlicensed gill-net fishery in the estuary.

There is an urgent need for alternative livelihood options. Urban development will generate economic development opportunities in construction and business sectors. However, many of the affected people are descendents of families of fishers that go back generations to when the town was founded in 1859. Being employed as a gardener or builder is not consistent with their cultural heritage. Sustainable estuarine-based livelihood alternatives are required.

Urban development

Urban development has to be contained within an urban core in terms of provincial spatial planning policy. The findings of this assessment indicate that the Fisherhaven / Hawston area is suitable for urban expansion *provided that* disturbance of sensitive coastal areas is avoided, an open-space system / ecological corridor approach is adopted for the purpose of protecting critically endangered vegetation and areas of hydrological sensitivity, and solid and liquid wastes are scrupulously managed to prevent contamination of the estuary, associated wetlands and natural drainage systems. The current contribution of the estuary to the real estate sector is estimated to be between R25- and R40 million. In order to maintain this value, it is important to maintain a balance between natural and built areas around the estuary. The Regional Estuaries Conservation Plan proposes a target of 50% of the margin be protected from development and excessive use.

The coast is particularly vulnerable to climate change. Greater intensity and frequency of storms, resulting in high seas and flooding, is anticipated. Development frameworks have to respond by directing new investment away from high risk areas. The presence of pre-colonial heritage sites and cultural landscapes must also be taken into account in the selection of land for development.

Westward expansion of the urban edge of Greater Hermanus over the Middelvlei dune field appears ill-advised. The impact of the proposed stormwater drainage project at Paddavlei on the localised catchment hydrology and hence the vegetation, including the protected Milkwood trees in this area, requires careful examination.

Water quality and flow

Water quality is relatively good in the Bot estuary at the current time, a situation ascribed to the vigilance of the Bot River Estuary Advisory Committee (BREAC) but, in order to maintain the situation and achieve a Class A or B water requirement, as proposed in the regional Estuaries Conservation Plan, the Municipality needs to address shortfalls in sewerage reticulation and treatment infrastructure, and remain vigilant on the disposal of solid waste. This is particularly relevant to the Kleinmond estuary where, up until recently, the estuary was sometimes artificially breached in order to maintain water quality to acceptable standards for recreational use. The Overstrand SDF specifies that extension of the piped sewer system is a pre-requisite to any new development. This needs to be rigorously observed in order to maintain estuarine health. Besides the water quality aspect, Resource Directed Measures (RDM), particularly the determination of an ecological reserve for the estuary, which balances water use needs against the water needed to support a healthy estuary, must be prioritised in order to guarantee an adequate flow during high rainfall periods. This is important for, amongst other things, giving the cue that is needed in the marine environment for recruitment of fish into the estuary.

Catchment management

Extensive tracts of land within the estuarine margins are overrun by alien invasive vegetation. This situation extends into the upper catchments. Approximately 40% of the Bot's 907km^2 catchment is used for agricultural cultivation. 56% of the catchment area represents historic vegetation habitats that are classified as critically endangered. 16% is under formal protection. Maintenance of a riparian reserve, and the establishment of a network of ecological corridors to connect the river corridor and areas of endangered vegetation, is required in order to achieve national biodiversity conservation targets and secure the health of the rivers and estuaries. Vigilance regarding upstream leachate and discharges into the river, from industry and from solid and liquid waste collection sites requires inter-municipality co-operation.

Tourism development, exploitation of natural heritage value, recreation

Impacts of recreational activities in the margins, relating to horse-riding trails, camping, off-road driving, dumping and vandalism, are driven by inadequate investment in infrastructure, poor surveillance and monitoring, and unco-ordinated management. The Bot estuary, with its 13.6km^2 expanse of water (when full), is a popular destination for bird-watchers and a wide range of water sport enthusiasts. Activities include

skiing, sailing, paddling and also recreational angling. Evidence of social conflict or severe negative environmental impacts relating to recreational use of the water body was not encountered. A proposed amendment to the statutory recreational use zones falls far short of achieving the Regional Estuaries Conservation Plan's target of a 50% Estuarine Protected Area encompassing at least 33% of each of the estuarine habitat types.

The tourism value of the estuary is currently valued at R40-60 million per year. The potential is under-exploited due to a lack of facilities and year-round attractions. There are only three public points of access to the Bot estuary and only one of these offers facilities of any kind. The lagoon at Kleinmond is popular for swimming and small water-craft; the beach has Blue Flag status and is identified in the Overstrand SDF as a cultural landscape. The proposed development of facilities at this site requires a design approach that is mindful of these considerations and considers environmental, social, visual and heritage impacts.

Social sustainability

The huge diversity in the wealth of residents and property owners in the Bot / Kleinmond area is indicated by the disparity between the estimated R25-40 million annual contribution of properties in the area to the real estate sector, and the monthly earnings of the large majority of residents, which is less than R1,600 per month. This diversity brings with it all of the associated social ills: an 'us and them' polarity, mistrust, defensiveness, diverse and sometimes conflicting values, and a perceived lack of equality, amongst others. Attitudes to conservation tend to follow income profile, with cash-poor people placing a higher emphasis on use of the estuary's resources and amenities than those who are financially self-reliant and tend to prioritise conservation over access and use or who enjoy a higher level of access by virtue of their riparian property location.

The traditional fishers in the area have been denied access to a formerly common resource - fish. The longest-standing residents of the area, from Hawston, are being successively excluded, through privatisation, from amenities that were previously public recreation areas in the estuarine margins, like Sonesta and potentially the Rooisand Nature Reserve through the introduction of an entry fee. Developments like these are perceived by Hawston residents as being socially unjust. Property developers and other residents in the estuarine catchment perceive the non-compliant behaviour of the traditional users of the estuary and its resources as a threat not only to their own welfare but, also, to the health of the estuary. They have adopted the role of custodians and protectors of the natural heritage in which they have made a considerable investment.

Cultural and natural heritage conservation presents opportunities for integrating social sustainability into ecosystem management. This can be achieved by recognising and accommodating the diversity of cultural heritage sites, traditions and environmental interests in the area and considering, in context, the worldwide social and economic crises of fishing communities that have lost their identities as a result of the global crisis of declining fish stocks. The traditional fishers have an untapped wealth of knowledge of the biophysical environment and fish resource management. Environmentalists have knowledge of what is happening at a global scale. Knowledge sharing can potentially provide a vehicle for building relationships that cross cultural and class divides.

Local environmentalists, fishers and other interested and affected parties represent a huge resource of human energy that has been and can be directed towards managing the estuary's natural assets and the protection thereof. Their common ground is their passion for the estuary / *die Vlei* . The key to the success of the estuary management plan is the identification and adoption of a set of objectives that provides a channel for all parties to exercise their particular interest. Thereafter, during the implementation phase of the EMP, it will be achieved through the ongoing maintenance of stakeholder support and the involvement of a facilitative agency.

Monitoring and evaluation

Implementation of the EMP needs to include an ongoing and expanded programme of monitoring and evaluation. The existing institutional structure for estuary management, known as BREAC, has the advantage of being an existing constituted body with significant buy-in and commitment from a range of IAPs but it also has 'baggage'. The pros and cons of maintaining this structure, or making a fresh start, need to be carefully weighed.

Framework

Implementation strategies must support the integration of the EMP within the broader institutional management framework, *inter alia*:

- The C.A.P.E. Estuaries Programme proposes that 50% of the extent of the estuarine water body is managed as a protected area, and 50% of the margin should be protected from development and excessive use.
- A Marine Protected Area is under consideration in the marine component of the Kogelberg Biosphere Reserve, extending to the mouth of the Bot. One of the overarching programme's targets is to restore at least half of the over-exploited and depleted fish stocks to sustainably managed levels by 2020 and maintain the status of all sustainably exploited stocks. The area between the Bot and Palmiet estuaries is proposed as a managed but unrestricted area – fishing and other forms of harvesting will be permitted. The proposal represents an opportunity to create a marine-estuarine link between the MPA and the estuary.
- The Integrated Coastal Management Bill (2007) provides the legal basis for adoption of the EMP and for introduction of Coastal Public Property and Coastal Protection Zones which, by definition, include the estuary and a margin of at least one kilometre in non-urban areas.
- The Bot River is identified in the Overstrand SDF as a coast-to-mountain ecological corridor, and the shoreline and dune environment between Kleinmond and Hawston as a coastal corridor.
- The C.A.P.E. Stewardship program has identified the Lamloch swamps between Kleinmond and Arabella as a priority biodiversity corridor within the Kogelberg Biosphere Reserve and is currently in the process of investigating this initiative.
- The WCP SDF identifies Greater Hermanus as a town with high growth potential and proposes Fisherhaven / Hawston as the most suitable location for development to support the growth.

Recommended management tools

The full range of framework alignments, issues and opportunities present in the Bot / Kleinmond estuarine environment can be managed through adoption of a selection of management tools, namely:

» A co-operative management structure
» A compliance strategy
» Resource directed measures (RDM)
» A catchment-wide riparian reserve
» A spatial conservation and development framework and associated land use guidelines
» A conservation plan
» A mouth management policy
» A community based resource management programme focused around the fish resource, and
» a monitoring, evaluation and reporting programme.

The EMP will provide action plans for the development of these tools in order to give effect to the strategic objectives and vision that are still to be adopted in consultation with stakeholders.

The Situation Assessment Report is the output of the first phase of the EMP development project. Formulation of the draft Management Plan has been based on the findings and recommendations of the Situation Assessment, as recorded in the report and amended by comments received from readers, and will be guided by a vision and strategic objectives to be agreed in consultation with IAPs during the next phase of the project.

The best laid plans will fail unless a culture of co-operative engagement is embraced by all interested and affected parties, and then maintained through their ongoing constructive participation as custodians of the estuarine system and its catchments.

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ACRONYMS

ABI	Agulhas Biodiversity Initiative
BREAC	Bot River Estuary Advisory Committee
C.A.P.E.	Cape Action for People and the Environment
CMS	Catchment Management Strategies
CSIR	Council for Scientific and Industrial Research (South Africa)
DEA&DP	Department of Environmental Affairs and Development Planning (Western Cape)
DEAT	Department of Environmental Affairs and Tourism (national)
DM	District Municipality
DPLG	Department of Provincial and Local Government (national)
DWAF	Department of Water Affairs and Forestry
ECA	Environment Conservation Act, Act No.73 of 1989
EIA	Environmental Impact Assessment
EMP	Estuary Management Plan
IDP	Integrated Development Plan
IAP	Interested and Affected Party
IEM	Integrated Environmental Management
ISP	Internal Strategic Perspective
MCM	Marine and Coastal Management
MLRA	Marine Living Resources Act, Act No.18 of 1998
MPA	Marine Protected Area
NBSAP	National Biodiversity Strategy and Action Plan (2005)
NEM	National Environmental Management
NEMA	National Environmental Management Act (1998)
NFSD	National Framework for Sustainable Development (2006)
NWA	National Water Act No.36 of 1998
NWRS	National Water Resources Strategy
NEMA	National Environmental Management Act, Act No.107 of 1998
ODM	Overberg District Municipality
RDA	Rural Development Area
RQO	Resource Quality Objectives
SAEON	South African Environmental Observatory Network
SCP	Systematic Conservation Planning
SDF	Spatial Development Framework
SPC	Spatial Planning Category
WCPSDF	Western Cape Province Spatial Development Strategy (CNdV Africa, 2005)
WMA	Water Management Area
ABI	Agulhas Biodiversity Initiative
GIS	Geographic Information Systems
ICM	Integrated Coastal Management
IDP	Integrated Development Plan
IEM	Integrated Environmental Management
LUM	Land Use Management
MLRA	Marine Living Resources Act, Act No.18 of 1998
NBSAP	National Biodiversity Strategy and Action Plan (2005)
NEM	National Environmental Management
NEMA	National Environmental Management Act (1998)
NFSD	National Framework for Sustainable Development (2006)
NWA	National Water Act, Act No.36 of 1998
NWRS	National Water Resources Strategy
ODM	Overberg District Municipality
RDA	Rural Development Area
RDF	Rural Development Framework
SA	South Africa
SANBI	South African National Biodiversity Institute

1. Introduction

The estuary of the Bot River is the third largest estuarine system in the Cape Floristic Region. The lagoon is roughly 2km at its widest point, near the coast, and stretches back 7km, where it is bridged by the main Hermanus access road. When full, the lagoon covers an expanse of approximately 13.6km^2 (Fromme, 1985).

The Bot estuary, known also as *die Vlei*, *Hawstonvlei* or *Botriviersvlei*, is connected to the adjoining Kleinmond estuary via a young wetland known as Rooisand, so that they form a combined estuarine system, with water flowing in either direction between them (Bally and Branch, 1986). The implications demand that the two are managed as a linked system and, consequently, the subject of this assessment is the Bot / Kleinmond estuarine system, rather than the estuary of the Bot River alone as implied in the study's terms of reference. The diversity of habitat types within the system, and the expanse of the water body, make it unique in South Africa.

The expanse of the water body and the low-lying areas that make up the Vlei, offset by the layered mountain backdrop, provide a particularly strong sense of place at the water level. The Rooisand area, Lamloch Swamps, and dune areas on the seaward side, represent a relatively untrammelled environment, as they are distant from any road access.

It is an environment which, a few decades ago, would have been regarded by many as a 'wasteland'. Had the pressure for growth in the area been greater at the time, it would have been transformed, like many other coastal marshes, to the point where its characterising features were no longer discernable. Fortunately, the dynamic conditions in the lower reaches of the system have kept large-scale development at bay. In recent years, however, developer interest in the waterfront property on the upper reaches of the Bot lagoon has thusfar given rise to two high-income gated residential estates.

Pressure for development and economic opportunities is also driven by high levels of poverty among residents of Greater Hermanus and Kleinmond, exacerbated by the introduction over the past decade of restrictions on individual rights of access to marine living resources. Communities who were previously dependent on these resources are severely affected, economically and socially, and this is the driver of a range of impacts and implications for estuary management.

The relative health and the diversity of habitat types within the system have immense social and biophysical value. The combined expanse of the Bot and Klein River estuaries is estimated to contribute 40-50% of the estuarine nursery habitats required for marine fish species along the coast between Cape Point and Breede River (Lamberth and Turpie, 2003). The Bot River lagoon is an important habitat for water birds and attracts considerable numbers of bird-watching tourists. The tourism value of the estuary is considered to be underexploited due to the limited amount of facilities and access for visitors, and the seasonal nature of current visitor use.

The full social and economic potential of the of the system can only be realised if management interventions steer development on a course that enhances the value of the natural heritage and resource base. Timeous management attention to the cause of impacts, rather than the reactive remediation of the impacts themselves, is needed in order to deliver sustainable solutions.

The development of an Estuary Management Plan for the Bot / Kleinmond system is a component of the Cape Action for People and the Environment (C.A.P.E.) Estuaries Programme which was established to co-ordinate preparation of a strategic conservation plan for estuaries in the Cape Floristic Region, followed by the roll-out of management plans for individual estuaries. The latter process commenced in 2007 with six pilot projects, one of which was for the Klein River estuary to the east of Hermanus. This project, the preparation of an Estuary Management plan for the Bot River estuary (and Kleinmond, by extension), is one of a second set that are jointly funded by CapeNature and the respective local municipalities. The Estuaries Programme is hosted by CapeNature and supported by DWAF, MCM, Eastern Cape Parks Board and CSIR. iRAP Consulting is the service provider contracted to CapeNature to develop the EMPs for the Bot / Kleinmond and Klein River estuaries.

Figure 1 Overberg District, showing the estuary and quaternary catchments of the Bot River

1.1 Project terms of reference

The objective of the EMP project is to develop a plan for managing the estuary in a way that takes into account the interests of present and future generations of stakeholders.

This is to be achieved through a process of identifying issues, preparing an assessment of the situation, formulating a vision and strategic objective, identifying strategies and drafting proposals for management action.

The output will be a draft Estuary Management Plan (EMP) which, once adopted, heralds the first generation of a series of 5-year planning and implementation cycles. The EMP will describe the actions that need to be undertaken over a 5-year period and, towards the end of that period, the overall results will be reviewed and evaluated, and a new plan for the following 5 years period will be drafted.

This report has been prepared in response to the Objective 1 of the Client's Terms of Reference – a Situation Assessment:

> *"The consultant is expected to review all existing local information in the form of local research reports and management processes. This information can be obtained from Local Authorities and forums. A map of the estuary should be developed identifying different habitats and potential and existing management zones. The map should identify and record all developments in at least a 500m zone surrounding the estuary. The possible direct impacts of these and other local developments should be noted."*

The consultants undertook to achieve the following deliverables during this first phase of the project:

- Inception meeting with the Client Reference Group. Held at the offices of Overstrand Municipality on 24 April 2008.
- One public meeting with IAPs. Held at the Fisherhaven Yacht and Boat Club on 7 August 2008.
- Submission of a draft *Situation Assessment Report* in electronic form to the Client Reference Group. The draft report was distributed to the Client Reference Group on 19 September 2008.

Due to under-representation of residents and resource users from the Hawston area at the public meeting, a follow up meeting was held in Hawston on 25 August 2008. Records of the public meetings are included in the document that forms the Appendix to this report.

1.2 The study area

The Bot / Kleinmond River estuarine system is located in the Overberg District (Figure 1) of the Western Cape Province of South Africa. The upper catchments – G40E and G40F – of the Bot River and its tributaries extend into the Theewaterskloof Municipality while the estuary and coastal quaternary catchment – G40G – is almost entirely contained within the Overstrand Municipality. The estuaries are on the coast of the Atlantic Ocean, to the west of the coastal town of Hermanus. The estuary and coastal quaternary sub-catchment G40L is situated entirely within Overstrand Municipality.

The study area was intentionally not restricted by a definition of its extent. It is considered appropriate that the Management Plan's sphere of influence should be determined by the spatial extent of the key drivers that need to be addressed. Various windows were used for the assessment, ranging from the estuarine system to the entire catchment.

The Bot estuary is fed by two rivers, the Bot and the Afdaks. The Lamloch River feeds into the Kleinmond Estuary. The catchment is characterised by a mix of formal conservation areas and farmland, and includes the towns of Caledon and Botrivier. Much of the catchment is located within the Kogelberg Biosphere Reserve. There is a small area that is formally protected for conservation purposes on the western bank of the Bot estuary.

An estuary is defined in the ICM Bill (2007) as "a body of surface water that (a) is part of a water course that is permanently or periodically open to the sea; *and* (b) in which a rise and fall of the water level as a result of the tides is measurable at spring tides when the water course is open to the sea; *or* (c) the salinity is measurably higher as a result of the influence of the sea." (Emphasis added).

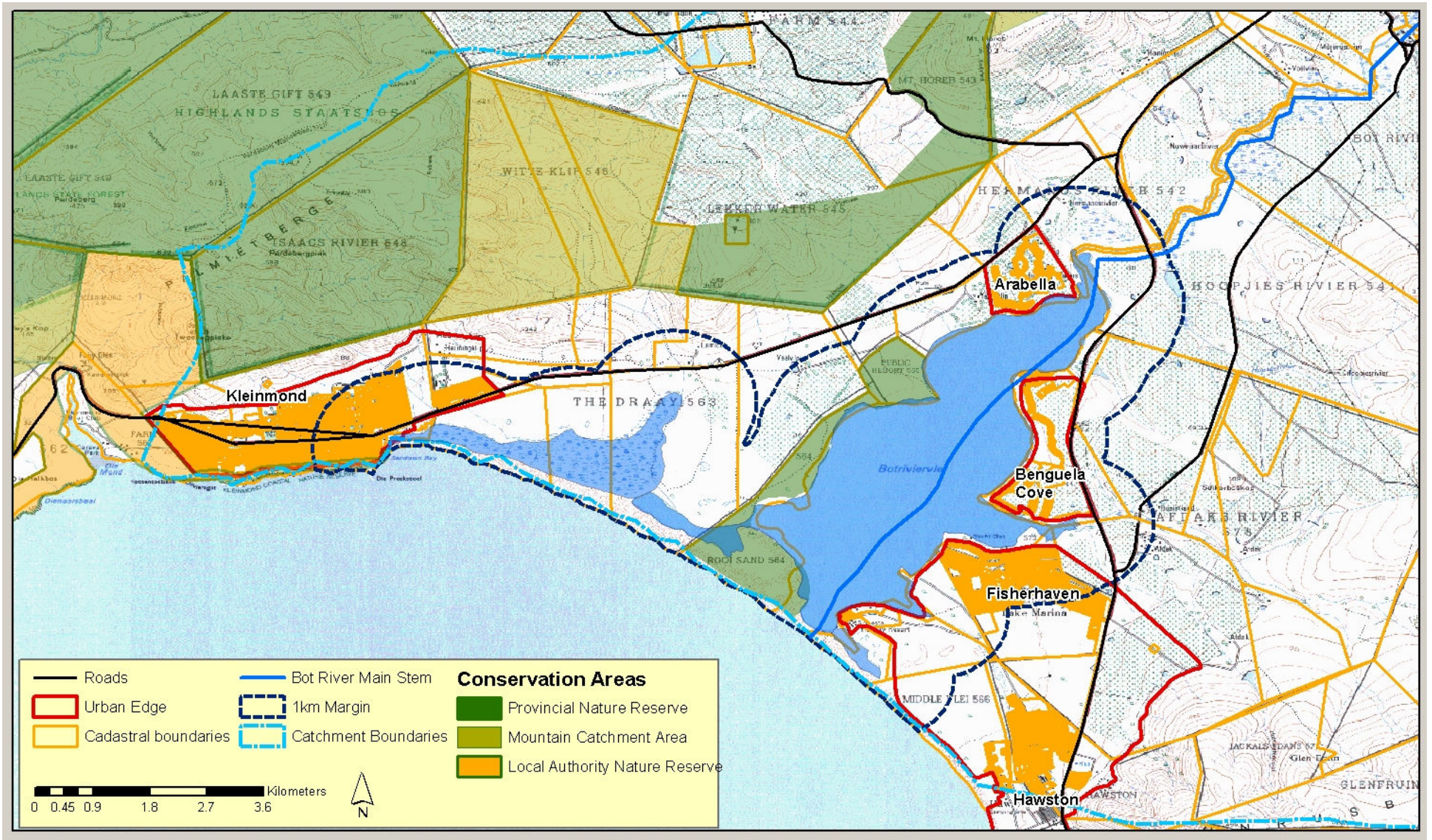

Figure 2 Topo-cadastral and urban-conservation management mechanisms in the estuarine environment

In legal terms, therefore, the estuary extends beyond the head of the lagoon, to a point where salinity is no longer detectable. However, management action is more often linked to the characteristics of 'lagoon' and 'river' biogeographies and it is likely that this will be reflected in the management plan.Figure 2 provides a close-up view of the estuarine environment. The 1km margin is projected from the outer extent of the estuary as defined by the Special Habitats GIS layer from SANBI's *Putting Plans to Work* project, and using the head of the lagoon as an upstream delimiter. It provides an indication of the properties that may be affected by the delineation of the Coastal Protection Zone in terms of the ICM Bill, 2007 (Data Sheet No.1).

Urban development areas are located on the coastal frontage of Kleinmond, and on the east bank of the Bot River estuary at Fisherhaven and Hawston – the western part of Greater Hermanus. Land use transformation on both sides of the estuarine system demonstrates a trend from agriculture and low-key resorts towards residential 'lifestyle' estates and tourism facilities, the most visible of which is Arabella. The proposed urban edge for Greater Hermanus, as shown on the Municipality's SDF (Final Draft, 2006), extends to the eastern edge of the Bot estuary. Besides extractive uses, the system is used for recreational purposes including sailing, windsurfing and birdwatching.

1.3 Approach to the assessment

This report provides a snapshot assessment of the situation at the Bot / Kleinmond estuarine system at the present time. The assessment was conducted over a period of 9 weeks. Where data has not been encountered, or has not been forthcoming during the period of assessment, this has been made explicit. The scope of the project does not extend to primary research or sampling.

Issues were identified through consultation with stakeholders, in correspondence, telephonically and in meetings. Desktop-based sectoral assessments were conducted by members of the team, which included specialists in environmental management, coastal area planning, resource economics, estuarine hydrodynamics, sustainable development, biodiversity conservation planning and geographic information systems. Due to the strategic nature of the project, assessments were outcomes driven, aiming to identify implications of the situation for management, as opposed to a comprehensive account or baseline study.

The findings and recommendations of the sectoral assessments were then synthesised into a summary of threats and their causal factors, or drivers. Opportunities and potential solutions were also described in this way, and finally, both impact and opportunity drivers were linked to a set of management tools. The method is an effective integrator, demonstrating that diverse issues result from a common set of causal factors, or root causes. It also enabled the identification of those factors that fall outside of the influence of an estuary management plan, providing a useful delimiter for objective setting.

1.4 Structure of the document

We have endeavoured to make the material informative and accessible to the stakeholder community. It has resulted in added bulk and some of the material may be superfluous for reviewers who are versed in the subject material. We hope that this will not deter readers.

The main document is in three parts (Table 1).

Part A addresses the Project's external environment – the relevant aspects of policy and legislation, and the instruments through which they are brought to bear on the project environment. It includes an inventory of data.

Part B contains six sectoral assessments relating to the social, economic and biophysical environment. Each of these provides a snapshot view of relevant aspects of the sector, and highlights those items that are priorities for management attention.

Part C provides a synthesis of the sectoral assessments through analysis of the issues – threats, opportunities and their drivers – and includes a basis for the selection of appropriate management tools. The conclusion provides recommendations for the range of strategies to be developed in the EMP.

Table 1 Easy reference document summary

Part		Chapter number, title
		1. Introduction
A	PROJECT FRAMEWORK ASSESSMENT	2. Policy and planning environment 3. Planning and management instruments 4. Availability and location of data
B	SECTORAL ASSESSMENTS	5. Socio-economic environment and stakeholder assessment 6. Landscape and heritage 7. Land use, recreational use and infrastructure 8. Ecosystem services 9. Ecological assessment 10. Initial terrestrial biodiversity conservation assessment
C	SYNTHESIS	11 Threats, opportunities and recommended management tools 12. Conclusion
	APPENDIX	Data sheets (background research) Records of public meetings Project information sheet

Part A : PROJECT FRAMEWORK ASSESSMENT

2. Policy and planning environment

This section identifies the vehicles through which the principles of conservation and sustainable development are applied in the study area. It includes a review of the most important informants for, and tools that can be employed in, estuarine management in the CFR generally, as provided by policy, legislation and planning frameworks and strategies, and identifies their relevance for the Bot / Kleinmond Estuary Management Plan. Aspects to be taken forward into the EMP development process are highlighted.

Further information is available in a suite of guidelines prepared for the C.A.P.E. Estuaries Programme, listed in Data Sheet No.2.

2.1 Integrated environmental management

The framework for integrated environmental management (IEM) is established in the National Environmental Management Act (NEMA, 1998). The implementation of IEM is regulated primarily through the Environmental Impact Assessment regulations of 2006 (amendments to which are currently at draft stage). These set out a process to be followed where an activity is proposed that may have an impact on the environment. The regulations include a list of activities requiring either a Basic Assessment process or Scoping and Environmental Impact Assessment. An abridged list of the activities that are most likely to arise in the study area is provided in Data Sheet No.3.

In Western Cape, the Department of Environmental Affairs and Development Planning (DEA&DP) is the competent authority to whom applications for environmental authorisation must be submitted. Municipalities wishing to undertake any of the listed activities must comply with the regulations in their capacity as project developer. They are also required to assist in the enforcement of the EIA regulations by reporting incidents of non-compliance to DEA&DP. Building plan approval for a listed activity cannot be issued by the Municipality without environmental authorisation from DEA&DP.

There is no stipulation in the legislation that Municipalities must employ environmental officers or managers. The portfolio frequently becomes an ‘add-on’ to, for example, the LED Manager’s job description. More commonly it becomes the responsibility of an Environmental Health Officer who is seldom trained or skilled in managing the environmental component of integrated development planning. The Municipal Systems Act (2000) does not include an Integrated Environmental Management Plan as one of the minimum requirements of an IDP. Through review processes ongoing since 2002, the DEAT has identified that the majority of IDPs have not adequately considered environmental issues in their planning processes.

The IDP Guide Pack (DPLG, 2001) recommends the inclusion of an Integrated Environmental Programme as a mechanism for ensuring that environmental issues are addressed in municipal planning processes. This programme should describe the manner in which the Municipality will ensure environmental compliance with the principles of sustainable development. It should also identify those projects and activities proposed through the IDP process that have the potential to significantly affect the environment and those that require an EIA. On the whole, however, the Guide Pack makes scant reference to the need for environmental management within municipal institutions. The DEAT has introduced a programme that aims to support local government in addressing this weakness. One of the interventions has been the development of IDP Environmental Toolkits for each province, including Western Cape (EEU, 2004).

The Overstrand Municipality has, in the past year, increased capacity within its Environmental Services unit through the recruitment of two new officers active in the project area – in the Hermanus and Kleinmond offices. The unit is located within the Engineering Services department of the municipality.

The Bot River EMP can draw from and contribute to IEM by

» Identifying any proposed activities in the study area that may require a Basic Assessment or Scoping and EIA, and any specialist studies that may be indicated.
» Aiming to strengthen and support the Municipality's environmental management capacity.
» Consider the case for recommending preparation of an Environmental Management Framework.

2.2 Coastal area planning and management

The White Paper for Sustainable Coastal Development (2000) is the policy that gave rise to the recently promulgated National Environmental Management: Integrated Coastal Management Bill (ICM Bill, 2007). The Bill is the direct legal frame of reference for the EMP: Chapter 4, which is devoted to estuaries, describes the process for establishing a National Estuarine Management Protocol and Estuarine Management Plans. The detailed requirements for EMPs are not spelled out; this is one of the items identified for attention in the Estuarine Management Protocol. Guidelines have not yet been officially adopted but the development of the Protocol is well underway.

- The Eastern Cape Estuaries Programme has been operational for some time and, with support from the Water Research Commission, has produced a number of Estuarine Management guideline documents targeting co-management forums and IDP practitioners.
- The C.A.P.E. Estuaries Programme commissioned a series of guideline documents on a range of themes relating to estuaries management and also the development of a generic EMP (van Niekerk and Taljaard, 2007) as a guideline for the pilot phase of Estuary Management Plan preparation.

The EMP for the Bot River estuary, as one of the pioneer projects of the C.A.P.E. Estuaries Programme , has the potential to contribute to the development and ongoing improvement of the Estuaries Management Protocol.

» A 'lessons learnt' evaluation process should be included as an explicit component of the development of this, and any other, EMP.

The ICM Bill contains other provisions that have a bearing on the EMP:

- The preparation of provincial and municipal coastal management programmes. The latter must, inter alia, be consistent with national estuarine management protocol and may include EMPs.
- The area below the high water mark is defined as coastal public property which must be accessible to the public. The municipality is required to introduce a by-law that designates coastal access land for this purpose and must ensure that it is signposted, maintained and equipped with public facilities where appropriate. This applies to estuaries as well as the seashore.
- An area referred to as the coastal protection zone is defined as including, inter alia, coastal protected areas, privately owned portions of the admiralty reserve and seashore, and the entire extent of any land parcels that are wholly or partially located within 1km of the high water mark of the sea or an estuary and that are not within an urban edge or human settlement area, i.e. that are zoned for agricultural or indeterminate use, or are not zoned. In other zones, it is 100m (not 1km).

The purpose of the coastal protection zone is to enable the use of this land to be "managed, regulated or restricted" for various objectives. Further information is provided in Data Sheet No.1. This aspect of the ICM Bill could potentially have significant implications for the Bot River EMP.

» The EMP is a vehicle for application of the Coastal Protection Zone in the Bot River estuary management area.
» The EMP is a vehicle for spatially defining Coastal Public Property and the Coastal Protection Zone.

The Draft Coastal Zone Policy for the Western Cape (2004) aims to provide an integrated policy framework for planning, management and development in the coastal areas, including the Province's Coastal Management Programme. This is potentially a useful resource for the EMP but the document could not be sourced from DEA&DP and its status is undetermined.

Coastal management is defined in the ICM Bill as a District Municipality competency unless otherwise agreed between the District and Local Municipalities. Many of the suggested components of the

municipal coastal management programmes are Local Municipality competencies, e.g. zoning schemes and by-laws relating to access lands.

» The EMP must clarify the issue of the mandate for coastal management in the Overberg / Overstrand.

The ICM Bill also provides for the establishment of institutional structures to facilitate co-operative governance in the coastal zone, in the form of a provincial Environmental Affairs Coastal Management sub-directorate and a Provincial Coastal Committee as a forum for co-operative decision-making. Coastal management capacity in the offices of DEA&DP and the metropolitan municipalities is intended to facilitate a co-ordinated programme of activities, the components of which are generally hosted by other agencies such as the District (or Local, if delegated) Municipalities, DWAF, CapeNature, etc.

Marine pollution is another aspect of coastal management that is regulated in terms of the ICM Bill and a number of other instruments referred to in the C.A.P.E. Estuaries Guideline 1 (Taljaard, 2007).

Regulations relating to the control of the use of vehicles in the coastal zone (which definition includes estuaries) were promulgated in terms of NEMA in 2001 and amended in 2004. The introduction of these regulations created the need for the licensing of boat launch sites in order to permit the use of vehicles at designated sites.

The mandates for managing compliance and enforcement associated with pollution, the use of vehicles and launch sites are generally the source of confusion particularly for municipalities. The EMP should seek to clarify the issue of mandates for compliance and enforcement.

The EMP can draw from and support coastal area planning and management by:

» Its contribution to mobilising a coastal management programme for the Overstrand and Overberg.
» Contributing to the development of the national estuarine management protocol.
» Providing an institutional entity for representation on the Provincial Coastal Committee.
» Supporting the Overstrand and Overberg Municipalities towards achieving compliance with the ICM Bill.

2.3 Marine resources management

The Marine and Coastal Management (MCM) directorate of DEAT is also a stakeholder in the EMP process on the basis of their role in the management of marine living resources which aims to protect the habitats of marine organisms in order to secure the sustainability of the fisheries along our coast. This is relevant to estuary management planning because many marine species need to spend a part of their life cycle in an estuary, hence the reference to estuaries as nursery areas for marine fish. This has gained much greater significance in recent years as new scientific evidence has been gathered of the importance of this function, particularly in the light of global collapse of fisheries due to unsustainable levels of harvesting and increasing pressure on habitats.

Much of MCM's activities, including permitting and enforcement, is regulated in terms of the Marine Living Resources Act (1998). Data Sheet No.4 provides a summary of relevant information and regulations. Data Sheet No.5 provides information on an approach to promoting compliance.

The mandates for managing compliance and enforcement associated with marine resources and fisheries are generally a source of confusion particularly for municipalities.

The EMP can draw from and support marine resources management by:

» Servicing the objectives of the Marine Living Resources Act (1998).
» Clarifying mandates and the supporting the process of building capacity for marine resources management.
» Identifying the implications of the MLRA for local stakeholders and developing strategies to address these.

2.4 Estuaries classification and prioritising for conservation

Broadly defined, estuaries are those portions of rivers that interact, to varying degrees, with the sea and the marine environment (Breen and McKenzie, 2001). South African estuaries, unlike those in other parts of the world, are more frequently closed to the sea than open. Classification systems identify five types of estuaries occurring in South Africa. According to Reddering and Rust (1990), few southern African systems are true estuaries with only 37 (12.8%) of the 289 river mouths maintaining permanent tidal inlets with the sea. Whitfield (1992) suggested the following classification:

- Estuarine bays – large tidal prism, tidal mixing process, average salinity 20-35 ppt). *Examples*: Durban Bay (KwaZulu-Natal), Knysna (Western Cape);
- Permanently open estuaries – moderate tidal prism, tidal/ riverine mixing process, average salinity 10- >35 ppt. *Examples*: Mlalazi (KwaZulu-Natal), Mzimkhulu, Mngazana, Keiskamma (Eastern Cape), Berg (Western Cape);
- River mouths – small tidal prism, riverine mixing process, average salinity < 10 ppt. *Examples*: Mfolozi (KwaZulu-Natal), Orange;
- Estuarine lakes – negligible tidal prism, mixing process - wind, average salinity 1- >35 ppt. *Examples*: St Lucia (KwaZulu-Natal), Swartvlei (Western Cape);
- Temporarily closed estuaries – tidal prism absent, mixing process - wind, salinity 1- >35 ppt. *Examples*: Mtata, Kasuka (Eastern Cape).

The Bot/Kleinmond system is classified by both Whitfield (1992) and Turpie (2004) as an estuarine lake system. The estuaries in the CFR are referred to as 'temperate' in contrast to the 'sub-tropical' estuaries on the east coast.

Turpie and Clark (2007) have presented a conservation plan for temperate South African Estuaries on the basis of biodiversity importance, ecosystem health and economic costs and benefits. The process for selecting estuarine areas to meet the set biodiversity targets at the lowest net cost or highest net benefit involved the division of each large estuary into two conservation units theoretically available to conservation on the basis that it was not practical to assume that 100% of most estuaries were available for conservation.

In their rating of biodiversity importance temperate estuaries, the Bot/Kleinmond estuarine system is ranked seventh after Knysna, Orange, Berg, Olifants, Klein and Swartvlei, and eighth in biodiversity importance out of all SA estuaries (Kosi being the sixth). Health of the temperate estuaries was assessed based on Whitfield's previous assessment (2000). Bot/Kleinmond estuarine system is rated as good. However, it is ranked as one of 39 temperate estuaries in SA considered to be high priority for rehabilitation, citing Whitfield's (2000) assessment of estuarine health as "Fair" (Table 6.12, p88). The type of rehabilitation required extends to water quality (pollution), water quantity, alien clearing, inappropriate bank stabilisation and mouth management. The pedestrian bridge and ablution block are highlighted as aspects requiring attention. Estimates of economic value are revisited in this report (Chapter 8) but in Turpie and Clark's (2007) ranking, they placed the Bot/Kleinmond system second highest of the 149 temperate estuaries in South Africa for annual subsistence harvest (just over R787,500). The system was ranked fourth highest in terms of nursery value – R46.7 million per year – and eighth highest (R452 million) in an evaluation of the impact of the estuary on property value. It was awarded a lower rating for tourism value – R5 million per annum, ranked 18th amongst temperate estuaries.

The outcome of Turpie and Clark's (2007) investigation is a recommendation that the Bot/Kleinmond system is included in a set of estuaries identified to fulfil biodiversity conservation targets. The target is for half of the area of the system to effectively function as a sanctuary area.

The EMP can support conservation of temperate South African estuaries by:

» Ensuring that a sufficient target is set and planned for the conservation of represented estuarine habitats and the terrestrial margin in fine scale planning.
» Recommending appropriate zoning and associated legal protection measures for the estuarine habitats and terrestrial margin.
» Supporting the improvement of biodiversity value and estuarine ecosystem and economic health levels through the introduction of strategies for rehabilitation.

2.5 Response to climate change

Policy for the response to climate change in the Western Cape Province is established in the Provincial Spatial Development Framework (2005) as, "No further urban development shall be permitted on open coast lines that are vulnerable to erosion, inlets that are susceptible to increased storm activity, river banks that are liable to flooding, coastal buffer zones and ecological setback lines in estuaries and below the 1:50 year floodlines (erven) and the 1:100 year floodline (building platforms)."

'A climate change response strategy and action plan' has recently been developed by the Provincial Government of the Western Cape.(OneWorld, 2007). It's purpose is to identify risk areas, to aim to strengthen the province's resilience to climate change and its adaptive capacity, particularly in vulnerable economic sectors and communities.

Water resources emerge as the top priority, and estuaries feature extensively in the study's identification of vulnerable systems, due to:

- » increased saltwater intrusion, coastal erosion and raised groundwater tables resulting from an increase in extreme events
- » impacts of sea level rise
- » increased flooding (frequency and extent)
- » reduced flow in rivers due to increasing water scarcity
- » possible effect of increased storminess on open/closed mouth status.

Areas sensitive to flooding or inundation are identified as low-lying areas adjacent to some estuaries, tidal inlets, coastal wetlands and marinas, and sea walls, road and rail embankments built too close to the sea. Sandy coastlines are expected to recede by 20-80 metres as a result of erosion, depending on slope. Sediment transportation and sand budgets are expected to be affected. This will have an impact on estuarine mouth closure and opening.

According to the specialist review on coastal adaptive capacity, "Halting coastal impact is both virtually impossible and may lead to other detrimental effects." Planning and research, the identification of thresholds of dangerous change, a provincial vulnerability atlas, development setback lines, shoreline management plans and protective are proposed as the tools for managing impacts (Theron, 2007).

Prioritised mitigation measures particularly relevant to estuarine environments are those relating to the establishing of clear links between resource stewardship, livelihoods and the economy, under the umbrella of a Land Stewardship and Livelihoods Programme. This is to be achieved by, inter alia,

- » protecting, maintaining and enhancing natural resources
- » maintaining economic diversity
- » strengthening vulnerable communities
- » taking risks into account in coastal development planning and disaster management planning
- » mapping the 1:50 year floodline (DWAF) and applying this in the development application process
- » implementing a wetland conservation and fragile environment protection programme
- » implementing an integrated invasive alien species programme (CapeNature)
- » researching the socio-economic impacts of reduced [or migrating] fisheries (MCM, DEA&DP).

The action plan identifies Working for Wetlands as the possible custodian of a wetlands conservation programme, with the determination of an ecological reserve being a priority action for key wetlands.

- » The EMP can contribute to the achievement of the objectives of the climate change strategy as listed above.

2.6 Catchment management

The White Paper on a National Water Policy for South Africa (DWAF, 1997) and the National Water Act (NWA, 1998) have established the key principles in the management of water resources in South Africa: equity, sustainability and optimal use (efficiency). They establish the catchment as the "unit of management" for water resources and further provide for the establishment of water resource

management institutions. The NWA requires that water resource protection (including conservation and demand management) should be balanced with water resource development to achieve sustainable utilisation of the resource.

"Catchment management is the integrated management of all water resources in an area, with input from local stakeholders. It is simultaneously a philosophy, process and strategy to achieve sustainable balance between utilisation and protection of water resources in a particular catchment area, taking account of inter-dependencies with other catchments. Catchment management recognises the need for mutual dependence of water resource and land use management, and is based in consensual participation by relevant stakeholders, communities and organs of state." (DWAF, 2001).

The National Water Resources Strategy (NWRS, 2004) provides the overarching strategy context for catchment management. The NWRS, together with water resources classification and Reserve determination (resource directed measures), provide the framework for catchment management within a Water Management Area. The Reserve provides for the water quantity and quality for basic human needs and the quantity and quality to protect aquatic ecosystems in a sustainable manner. The attainment of resource quality objectives are given effect through catchment management strategies (CMS), also required by the Act.

The National Water Act views estuaries as water resources thereby enabling the full range of protection and management mechanisms to these systems (classification of water resources, determination of the Reserve and setting resource quality objectives).

A Breede River Catchment Management Agency has been established. Prioritisation of the Bot in the planned Reserve determination studies has not been established.

An estuarine Reserve determination is needed in order to:

- » enable definition and targets for the resource directed measures that are required to improve the status of the river and the estuary.
- » ensure that water quality management issues are addressed in line with national guidelines
- » inform requirements for improved environmental performance of land-based activities in the catchment that impact on water quality and flows in the estuary, (depending on the relative contribution of flows of the Bot River sub catchments and tributaries to the ecological reserve requirements for the Bot river Estuary).
- » The EMP can draw from and support catchment management by being a key platform for the development of an estuarine reserve determination process.

2.7 Biodiversity conservation

Overall, the policy, legal and strategy mechanisms for biodiversity conservation (refer Data Sheet 6) can provide for the proactive planning and conservation as well as avoidance of loss and degradation of natural habitat in critical biodiversity areas which include: Critically endangered ecosystems; endangered ecosystems; ecological corridors; river corridors; wetlands and estuaries; and special habitats. Bioregional plans published in terms of the Biodiversity Act will identify critical biodiversity areas on a map, and will provide guidelines for land-use planning and decision-making in these critical biodiversity areas.

The challenge for the Bot River EMP and its effective implementation is to enlist supporting policy and law for the effective integration of biodiversity conservation planning at different scales and within the interdependent terrestrial, freshwater, estuarine and marine ecosystems.

The EMP can draw from and support biodiversity conservation by:

- » ensuring that a sufficient target is set and planned for the conservation of represented estuarine habitats
- » providing a platform for a Reserve determination process and hence ensuring the persistence of the estuarine biodiversity in the long-term.
- » recommending appropriate protection status and further measures that enable an appropriate level of integration and connectivity between the marine and coastal and terrestrial, freshwater ecosystems in recommendations n conservation and land use planning.

- » recommending appropriate zoning and associated legal protection measures for the estuarine habitats as well as their integration with the IDP, SDF and municipal Land Use Management Systems.
- » ensuring that the implications of climate change are taken into account.
- » informing the conservation of terrestrial habitat and the attainment of resource quality objectives for the river.
- » providing a tangible link between the health of the estuarine and related systems to the direct and indirect socio-economic value of the estuary.
- » consolidating an important coastal conservation node for the Overberg District and Overstrand Municipality with significant (and well subscribed) tourism and recreational value.

2.8 Municipality-wide spatial planning and land use management

The introduction of integrated development planning and the demarcation of area-wide local municipalities meant that, for the first time in 2000, local municipalities were responsible for planning and land use management in rural and agricultural areas as well as urban. This introduced the requirement that land use zoning schemes should be developed for rural areas in order to integrate urban and rural within the municipal land use management system. It also introduced the need for an 'urban edge' as a mechanism for containing the spread of urban development into rural and agricultural areas.

Spatial planning is conducted at the strategic level through the IDP process and represented in the Spatial Development Framework (SDF) whereas zoning schemes (discussed in Section 4.8) are the instruments for managing land use. The SDF is a tool that aims to redress past spatial imbalances, indicate directions for growth and major movement routes. At provincial level it is used inter alia to identify towns with potential for growth and, at national level to identify catalytic growth and development initiatives.

The use of GIS by municipalities has made it possible to improve the level of integration between SDFs and conservation planning and stewardship initiatives, amongst other things. In Western Cape, the Bioregional Planning approach has been used for some time as a decision-support tool in strategic planning and land use management. As the various biodiversity conservation Bioregional Programmes complete their fine-scale planning and associated guidelines, so will it become easier for planning practitioners to take this into account in the preparation of SDFs and the decisions associated with land use management.

Another aspect of conservation that is receiving increased attention in land use management since the administrative integration of urban and rural/agricultural areas is the conservation of high potential and unique agricultural land. This reflects an international trend that has emerged from concerns about the increasing encroachment of urban development into agricultural areas, generating a transformation process involving subdivision of farm lands, the introduction of non-agricultural uses into agricultural areas, be they on-farm or off-farm, and the change of use from agricultural to other, including residential estates, golf estates, resorts, agricultural industries and intensive feed farming.

This trend impacts on agricultural productivity and causes the transformation of pastoral landscapes into urban sprawl. It also has benefits: diversification of farming activities may be essential for the continued viability of a farm; agri-tourism is one of the activities that is increasing in agricultural areas and may include the sale of produce produced on the farm, horse stabling and riding, wine tasting, bed-and-breakfasts etc. The challenge in land use management is to ensure that the non-farm uses do not undermine the agricultural value and integrity of the area and detract from the agri-tourism experience.

Both the Overberg and Overstrand SDFs stress the importance of maintaining the rural character of the area and provide comprehensive guidelines for land use management in agricultural areas. The subdivision of agricultural land is subject to a range of authorisations, including the Department of Agriculture, in terms of the Subdivision of Agricultural Land Act (1970), as well as the EIA Regulations (refer Data Sheet No.3) and the Land Use Planning Ordinance. DEA&DP has produced a range of guideline documents to support the decision-making process, and provide a greater degree of certainty for prospective developers, including Guidelines for the Development of Golf and Polo Estates, also for Resorts. The latter is currently being reviewed. Guidelines for the management of land use in agricultural areas in the Western Cape are currently being developed.

The development of the EMP can

» draw from and inform spatial planning and land use management in the study area, particularly in respect of provisions for the integration of conservation planning and environmental management, land use in the rural and agricultural areas around the estuary, management of the urban edge, open space systems and ecological corridors within and outside the urban edge, and the identification of opportunities for tourism and recreation development.

2.9 Governance systems, institutional capacities and mandates

A critical component to the preparation of the Management Action Plans associated with the EMP is an understanding of:

- who makes policy and plans for management in the study area
- who issues licenses, permits and authorisations
- who monitors compliance and is responsible for their enforcement, and
- in respect of all of the above, what capacity is available to them to support the implementation of these mandates.

This analysis aims to establish a baseline that reflects the normative position, i.e. who should be doing it, in terms of mandates conferred by the policy and legislation framework. This will provide a matrix which, during the development of the EMP, can be expanded to reflect unfunded mandates, delegated responsibilities, gaps and inadequately resourced offices. The foundation for the matrix is represented in Table Table 2.

Table 2 Mandates applicable to the study area

Functional area	Who makes policy/plans	Who issues licenses / permits / authorisations	Who monitors compliance / enforces
Estuary management	DEAT (ICM Bill, 2007)	Activity dependent	Activity dependent
Water use / abstraction	Breede Catchment Management Agency (National Water Act, 1998)	DWAF (Water) – WARMS	Breede Catchment Management Agency (National Water Act, 1998)
Water flow / dam management	Breede Catchment Management Agency (National Water Act, 1998)	Breede Catchment Management Agency (National Water Act, 1998)	Breede Catchment Management Agency (National Water Act, 1998)
Estuarine pollution resulting from human waste (sewage, urban surface water, solid waste)	DEAT (ICM Bill, 2007)	DEAT (ICM Bill, 2007)	DEAT (ICM Bill, 2007)
Marine pollution	DEAT (MCM) (ICM Bill, 2007)	DEAT (MCM) (ICM Bill, 2007)	DEAT (MCM) (ICM Bill, 2007)
Estuarine pollution and siltation resulting from run-off in agricultural areas	DWAF (Water) (National Water Act, 1998) Dept of Agriculture (CARA, 1983)	DWAF (Water) (National Water Act, 1998)	Breede Catchment Management Agency (National Water Act, 1998)
Protection of milkwoods	DWAF (Forestry) (National Forests Act, 1998)	DWAF (Forestry) (National Forests Act, 1998)	DWAF (Forestry) (National Forests Act, 1998)
Alien vegetation clearing	Dept of Agriculture (CARA, 1983)		
Flooding	Overberg District Municipality (Disaster Management) (MSA, 2000) Breede WMA (flood lines) (National Water Act, 1998)	Overstrand Municipality (Development applications - flood lines)	Overstrand Municipality (Development applications - flood lines)

Functional area	Who makes policy/plans	Who issues licenses / permits / authorisations	Who monitors compliance / enforces
Land use of coastal public property (below the high-water mark)	DEAT (ICM Bill, 2007)	DEAT (ICM Bill, 2007)	DEAT (ICM Bill, 2007)
Operation and maintenance of recreation facilities on coastal public property	Province (Constitution, 1996) (Data Sheet No.7)	DEAT (ICM Bill, 2007)	DEAT (ICM Bill, 2007)
Operation and maintenance of recreation facilities on municipal land that is not coastal public property	Overstrand Municipality	DEA&DP if subject to EIA authorisation, e.g. within 100m of high-water mark (NEMA, 1998)	DEA&DP if subject to EIA authorisation, e.g. within 100m of high-water mark (NEMA, 1998)
Land use management outside of coastal public property	Overstrand Local Municipality (MSA, 2000)	Overstrand Local Municipality (MSA, 2000)	Overstrand Local Municipality (MSA, 2000)
Applications for new development involving change of use / rezoning	PGWC DEA&DP and DEAT (LUPO, 1985; NEMA, 1998)	PGWC DEA&DP (LUPO, 1985 and EIA Regs, 2006)	PGWC DEA&DP (IEM) and Overstrand Local Municipality (MSA, 2000)
Applications for new development involving subdivision of agricultural land	PGWC DEA&DP and DoA (LUPO, 1985; Subdivision of Agricultural Land Act, 1970)	PGWC DEA&DP and DoA (LUPO, 1985; Subdivision of Agricultural Land Act, 1970)	PGWC DEA&DP and Overstrand Local Municipality (MSA, 2000)
Calculation of flood lines	Breede Catchment Management Agency (National Water Act, 1998)	Development - Overstrand Local Municipality (MSA, 2000)	Development - Overstrand Local Municipality (MSA, 2000)
Activities in the coastal protection zone	Activity dependent	Activity dependent	Activity dependent
Recreational use of the water body surface	Cape Nature Conservation Board and Overstrand Municipality (Proclamation 357, 1972; Municipal By-law, 2004)	Overstrand Municipality (Municipal By-law, 2004)	Overstrand Municipality (Municipal By-law, 2004)
Use of ORVs in the coastal zone	DEAT (MCM) (ORV Regulations 2001)	DEAT (MCM) (ORV Regulations 2001)	DEAT (MCM) (ORV Regulations 2001)
Harvesting of marine living resources (e.g. shellfish, bait, fish)	DEAT – MCM (Marine Living Resources Act, 1998)	DEAT – MCM (Marine Living Resources Act, 1998)	DEAT – MCM (Marine Living Resources Act, 1998)
Harvesting of other resources on coastal public property	DEAT (ICM Bill, 2007; Marine Living Resources Act, 1998)	DEAT (ICM Bill, 2007; Marine Living Resources Act, 1998)	DEAT (ICM Bill, 2007; Marine Living Resources Act, 1998)
Marine Protected Areas	DEAT – MCM (Marine Living Resources Act, 1998)	DEAT – MCM (Marine Living Resources Act, 1998)	DEAT – MCM (Marine Living Resources Act, 1998)

2.10 Concluding notes

The Bot / Kleinmond EMP will be informed by and aligned with the national and regional policies and strategies that have been described in this chapter. The specific instruments associated with these frameworks are discussed in the following chapter.

3. Planning and management instruments

This section discusses the specific regional and sub-regional planning instruments that have a bearing on, and can be informed by, the EMP and identifies the specific elements that are relevant to the EMP development process and the mechanisms though which the EMP can engage with them.

3.1 Western Cape Provincial Spatial Development Framework (WCPSDF)

The WCPSDF provides the spatial component of the Province's Growth and Development Strategy and is a guiding framework to assist decision-makers. It informs municipal-level IDPs and SDFs, government and private investment in infrastructure, development direction and location, and actions to redress the spatial legacies of apartheid. Some of its policies are mandatory, others are guiding principles. In the context of integrated development planning, the provincial framework facilitates the optimisation of relative advantages at the local level.

Hermanus is identified as one of the Province's "leader towns" with high growth potential.

Issues identified in the WCSDF of particular relevance for the Bot River EMP are the need to mediate potential conflict between tourism / resort development and protection of coastal ecology, the water shortages in coastal settlements over Christmas period, and urban sprawl and traffic congestion on the Hermanus – Kleinmond route.

Strategies to address these of relevance to the Bot EMP are as follows:

- » Secure access to fishing rights
- » Investigate Hermanus - Fisherhaven / Benguela Cove with respect to a new transport and urban development corridor
- » Manage pressure on coastal resources in the Overberg coast by intensifying existing urban settlements and strictly controlling development outside of the Urban Edge.

3.2 Western Cape State of Environment Report (SoER)

State of Environment Reporting provides a co-ordinated framework for monitoring changes in the environment. Through the use of an agreed set of indicators, comparative monitoring and reporting is possible on a national scale. Findings i.r.o. the coastal zone of the Western Cape are shown in Figure 3. The following are suggested indicators for future monitoring:

- » Land cover changes, as an indicator of transformation of land, based on DEAT's South African Estuaries Landcover Programme, 2005.
- » Recorded landed catches and official estimates of illegal catches of abalone, rock lobster and line fish. For the latter, data should be sourced from the National Linefish Survey, an initiative of MCM.

The report notes that the health of estuaries in the Western Cape is below the national average.

Coastal Zone Indicators	How we are doing?	Comments
Estuarine Health Status	☹	The state of the Western Cape's estuaries are worse than in the rest of SA, especially near the CMA.
Percentage of land based effluent being discharged into the marine environment	?	A fairly large 32% of South Africa's effluent is discharged in the province's marine environment – no trend data available.
Number and location of marine discharges	N/A	Baseline information.
Concentrations of cadmium in filter feeders	☹	Levels are increasing
Concentrations of lead in filter feeders	☺	Levels are decreasing.
Total Allowable Catch (TAC) of South African West Coast Rock Lobster	☹	There has been a significant decline in numbers.

Figure 3 Scorecard of State of Environment analysis for the coastal zone in Western Province (source: DEA&DP, 2005, p58)

3.3 Overberg District Municipality IDP and SDF

Summaries of relevant information extracted from the IDP and SDF are provided in Data Sheet No's. 8 and 9 respectively. The documents were reviewed in order to identify potential areas for alignment and integration. Of particular relevance for the EMP are:

- The identification of bioregional planning objectives as the basis for sustainable environmental management. This aspect has been developed in "rough grain mapping" in the SDF and presented with guidelines and a list of strategies and projects.
- Many of the projects listed in the SDF have stated objectives that may align with EMP objectives and therefore present potential opportunities to be invoked in support of the EMP.
- One example of the strategies and projects included in the SDF is to protect estuaries and river mouths from developmental impact by regulating all development in accordance with Plan 2 of the SDF (land use classification on the basis of Spatial Planning Categories) and strictly applying the value system (Chapter 8 of the SDF) in decision-making. The Overberg District Municipality (ODM) is identified as the responsible party.
- The proposal for Project no. SW1116: Storm water system: Paddavlei, Hawston is assessed in Chapter 7 (Land use) of this report.
- Some of the other projects that potentially have relevance as integrators between the EMP and ODM IDP/SDF:
    - » Scoping for upgrading of boat slipways
    - » Upgrading of Hawston harbour
    - » Strategic planning relating to water resources
    - » Managing and monitoring solid waste disposal and chemical pollution
    - » Development of more biospheres and/or Green Corridors
    - » Rehabilitation pilot projects
    - » Establishment of a network of protected areas and conservancies.

The list of projects identified in the ODM SDF is extensive and includes not only those that would be implemented by ODM but also those that fall within the mandated area of, for example, SANParks, CapeNature, DWAF and Department of Agriculture.

3.4 Overberg fine-scale biodiversity planning

A study is being commissioned by SANParks to undertake a fine-scale biodiversity plan for the Overberg District Municipality. This work will be undertaken in 2008 and will integrate the fine-scale conservation planning that has already been undertaken for the Agulhas Biodiversity Initiative (Cole et al, 2000) as well as the Cape Lowlands Renosterveld Project (von Hase, 2003). This is likely to inform the publication of a Bioregional Plan or Biodiversity Plan in terms of the Biodiversity Act (2004).

Further work on the land cover spatial layers by CapeNature (Don Kirkwood) has enabled a re-analysis of current ecosystem status of key vegetation types in the catchment (Chapter 10).

The Overstrand Municipality has committed to including all public owned land that is of high conservation importance within a formal municipal reserve network (see Section 3.10).

The EMP can contribute to the fine-scale biodiversity planning process by:

- » Identifying key linkages between intact or good state terrestrial, freshwater and estuarine habitats. The river corridor and surrounding conservation areas and critically endangered habitats provide the potential for biological corridor linkages between the inland Overberg mountains and the coast which are also identified as being an essential approach in planning for the impacts of climate change and long term persistence of ecosystems and processes that support them.
- » Identifying conservation priorities and providing protection and management recommendations.

3.5 C.A.P.E. Bioregional Programme

Bioregional programmes are multi-sectoral partnership programmes that aim to link biodiversity conservation with socio-economic development. The C.A.P.E. Programme is described as “a partnership for sustaining life in the fynbos and adjacent shores”. The C.A.P.E. Programme was initiated under the C.A.P.E Strategy in 2000 and includes both the GEF-supported Biodiversity Conservation and Sustainable Development and the Agulhas Biodiversity Initiative.

The goal of C.A.P.E. is that "By the year 2020, the natural environment of the Cape Floristic Region will be effectively conserved and restored wherever appropriate, and will deliver significant benefits to the people of the region in a way that is embraced by local communities, endorsed by government and recognised internationally".

The components of the C.A.P.E.’s 20-year strategy are: conserving biodiversity in priority areas; using resources sustainably; and strengthening institutions and governance. Table 2 outlines the overall design of the initial five year implementation programme.

Table 3 The C.A.P.E. Programme components

DEVELOPMENT OBJECTIVE 1: A foundation is established for mainstreaming biodiversity in the CFR into economic activities	**DEVELOPMENT OBJECTIVE 2:** Conservation of the CFR is enhanced through piloting and adapting site-based models for sustainable, effective management
1. Institutional strengthening	4. Protected areas
2. Conservation education	5. Biodiversity economy and conservation stewardship
3. Program co-ordination, management and monitoring	6. Watershed management

The C.A.P.E’s Estuarine Management programme falls within the watershed management component of the conservation objective. It is through this regional Programme that the Bot River Estuary has been identified as a priority for management intervention.

The Bot River Estuary EMP and its implementation could draw from and inform C.A.P.E’s programme through:

- Its potential as one of the pioneer co-funded projects in C.A.P.E.’s Watershed Management Programme to provide opportunities for learning;
- Supporting the optimisation of the value of estuaries as an anchor in local government’s “biodiversity economy”;
- Creating linkages with C.A.P.E.’s Conservation Stewardship programme

3.6 Breede River Water Management Strategy

The Breede River Water Management Area (WMA) is the southernmost of the 19 WMAs within South Africa. Most of the area is drained by the Breede River and its main tributary, the Riviersonderend River. A proposal for the establishment of the Breede Water Catchment Management Agency (CMA) was compiled in 2004 and resulted in it being the second to be established in South Africa. The CMA has appointed a Board and is in the process of establishing management capacity for proposed delegated integrated water resource management functions.

A Catchment Management Strategy will be developed by the CMA. Until such time as this strategy is put in place, the Internal Strategic Perspective (ISP) for the Breede WMA, published by DWAF (2004) presents existing water resource information and provides an interim set of management strategies.

The Bot River Estuary is among three priority estuaries (with Heuningnes and Onrus) identified in the ISP’s high priority Estuaries and Wetlands Strategy for ecological reserve determination. The time frame could not be ascertained at the time of reporting.

The WMA conducts baseline monitoring of river health in the Bot River estuary. There is no Water User Association established for the Bot River and its tributaries. The decommissioning of existing

commercial forestry operations in the Western Overberg has resulted in a reserve of previously allocated water becoming available.

The EMP can draw from and support the Breede Water Management Strategy in the following ways:

» Prioritise aspects of monitoring that can contribute to the reserve determination process.
» Ensure that further water abstraction or use applications are considered within the framework of a precautionary approach, taking into account the conservation importance and the economic value of the Bot River Estuary.
» Provide a platform for prioritisation of Resource Directed Measures and determination of the estuarine ecological reserve.

3.7 Protected Area network

The catchment hosts a range of protected areas, all in the western portion of the catchment (Figure 2). The extent of land under protection is assessed in Chapter 10. The institutional instruments are:

- Provincial Nature Reserve, including *Rooisand Nature Reserve* on the western edge of the estuary, administered by CapeNature
- Private Nature Reserves and Conservancies, administered by the land owners with support from conservation agencies such as the CapeNature Stewardship Programme and Kogelberg Biosphere Reserve.
- Mountain Catchment Areas, established in terms of the Mountain Catchment Act, 1970. These are management zones which may be declared over privately owned land. They enable the implementation of fire management plans.

There are no National Parks, Municipal Nature Reserves or Marine Protected Areas in the study area. CapeNature has a strong presence in the area through its involvement with the Bot River Estuary Advisory Committee (section 3.12).

3.8 Kogelberg Biosphere Reserve

Registered as the first of its kind in South Africa in 1998, the Kogelberg Biosphere Reserve comprises the Kogelberg Nature Reserve as its core and a surrounding Buffer Zone and Transition Zone (refer also to Figure 25). The latter includes a number of coastal villages, including Kleinmond, and extends along the western edge of the Bot River estuary, north of the Rooisand Nature Reserve. The Buffer Zone extends 3.5 nautical miles into the ocean on the Reserve's coastal perimeters, terminating in the east at a line centred on the Bot River estuary.

The three management zones, relative to the Bot / Kleinmond catchments and estuarine system, are as follows:

Table 4 Management zones of the Kogelberg Biosphere Reserve

Zone description	Areas within Bot / Kleinmond catchments
Core Zone – sensitive, mostly state-owned zone where conservation of biodiversity is the primary function	Rooisand Nature Reserve Portions of the eastern section of the Kogelberg Nature Reserve Hottentots Holland Nature Reserve
Buffer Zone – private and municipal land containing mostly indigenous vegetation and zoned for active outdoor recreation	Lamloch Swamps, De Draay and Witteklip Farms A 3.5 nautical mile marine zone to the west of a line extended from the centre of the Bot River estuary. Houhoek mountains north of the N2.
Transition – fruit orchards, timber plantations and urban areas.	All other areas west of the R43 (including Arabella Estate and Kleinmond)

The Kogelberg Biosphere Reserve Company (KBRC), a Section 21 company set up to co-ordinate management, aims to promote socio-economic development based on the sustainable use of the Reserve's natural resources and ecosystem services. It receives funding from local government and international donors.

The KBRC is about to embark on preparation of a Spatial Development Plan and a set of sustainability criteria with associated monitoring.

The EMP can draw from and support the KBRC by:

» Further exploring the potential for identification, development and implementation of projects that serve the objectives of the Bot EMP and the KBR.
» Contributing to the development of the proposed KBRC Spatial Development Plan through formulation of a spatial framework for the Bot River RDA that supports the aims and intent of the KBR management zones.

3.9 WWF Marine Programme

The WWF Sanlam Marine Programme was established with three aims (Petersen, 2007):

- set up a network of effectively managed and ecologically representative Marine Protected Areas by 2020
- restore at least half the over-exploited and depleted fish stocks to sustainably managed levels by 2020 and maintain the status of all sustainably exploited fish stocks
- apply an Ecosystem Approach to Fisheries in South Africa and reduce associated negative environmental impacts of fishing practices to acceptable levels by 2012.

Current projects include inter alia (WWF-SA, 2008) –

- Supporting the development of offshore MPAs in South Africa, including compilation of an offshore GIS data inventory.
- MPA Management Forum administered by WWF, DEAT, SAEON and MPA managers, including development of management plans for MPAs.
- Conducting Ecological Risk Assessments for fisheries, which identify and prioritise the issues faced by a fishery from ecological, social and governance perspectives. These have been adopted as the basic workplan for fisheries specific Resource Management Working Groups.
- Responsible Fisheries Forum comprising fishing companies that work with WWF towards reducing their impacts on the marine ecosystem.
- Agulhas Bioregional spatial plan. This has specific relevance for the Bot/Kleinmond EMP. Inshore habitats of the entire Agulhas Bioregion have been classified and mapped and a set of new MPAs, including Kogelberg, have been proposed in order to increase existing coverage and diversity towards achieving the target of 20-30% of all major habitat types. The eastern extremity of the proposed Kogelberg MPA is shown as a line projected from the mouth of the Bot River estuary (34°22.02'S; 019°05. 80'). The section between the Palmiet and Bot River estuaries is proposed as a managed but unrestricted area where line fishing, shore angling and harvesting of abalone, rock lobster and invertebrates will be permitted (Clark et al, nd).

The EMP can draw from and support the WWF Marine Programme by:

» Considering the potential linkages between EMP strategies and Marine Programme projects, such as the proposed Kogelberg MPA.

3.10 Overstrand Local Municipality IDP and SDF

Summaries of relevant information contained in the IDP and SDF are provided in Data Sheet No's. 10 and 11-15 respectively. As per the District plans, the documents were reviewed in order to identify potential areas for alignment and integration. Aspects that hold potential impacts or opportunities for the preparation of the EMP are:

- The growth and development strategies of the SDF, proposed development projects and infrastructure challenges are assessed in Chapter 7 in order to identify the threats and opportunities in respect of land use and infrastructure that could be addressed through the EMP.
- The IDP highlights the need for addressing the shortage of affordable housing and other infrastructure backlogs.
- Aquaculture is identified in the IDP as a potential opportunity for local economic development.

- The development of bicycle paths is proposed as a strategy to attract tourists, encourage non-motorised transport and create job opportunities.
- The IDP identifies the need to broaden the ownership base of the economy through the release of municipal land to HDI partners.
- The SDF includes a range of environmental protection principles, amongst which is the restriction of development within the carrying capacity limitations of the natural resource base.
- It includes goal statements, with associated objectives, for
    - » the protection of biodiversity
    - » conservation and sustainable use of natural resources
    - » a strong local economic base in rural areas through non-consumptive tourism and agriculture
    - » the management of development pressure and its spatial implications.
- Amongst the strategies for land use management are the delineation of a proposed Rural Development Area (RDA) which includes the Bot River estuary (refer Figure 4), and the application of urban edges at Hawston, Fisherhaven, Benguela Cove, Arabella and Kleinmond (Figure 2 in the introduction).

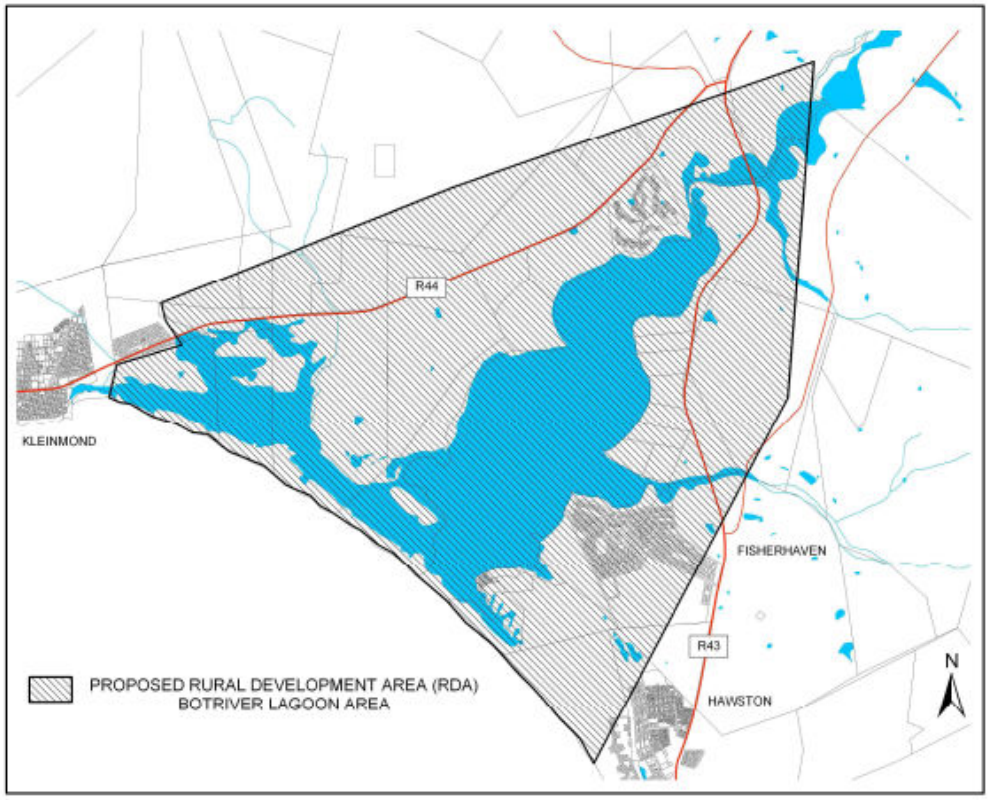

Figure 4 Proposed Rural Development Area, Bot River Lagoon area (Overstrand SDF Figure 22, 195)

- The Fisherhaven / Hawston area is identified as having potential to become a significant growth area within Greater Hermanus and the sub-region.
- The use of bioregional planning is promoted as a means of supporting decision-making relating to change of use and/or subdivision applications. The SDF includes spatial definition and guidelines for Spatial Planning Categories (SPCs) (refer Figure 5).

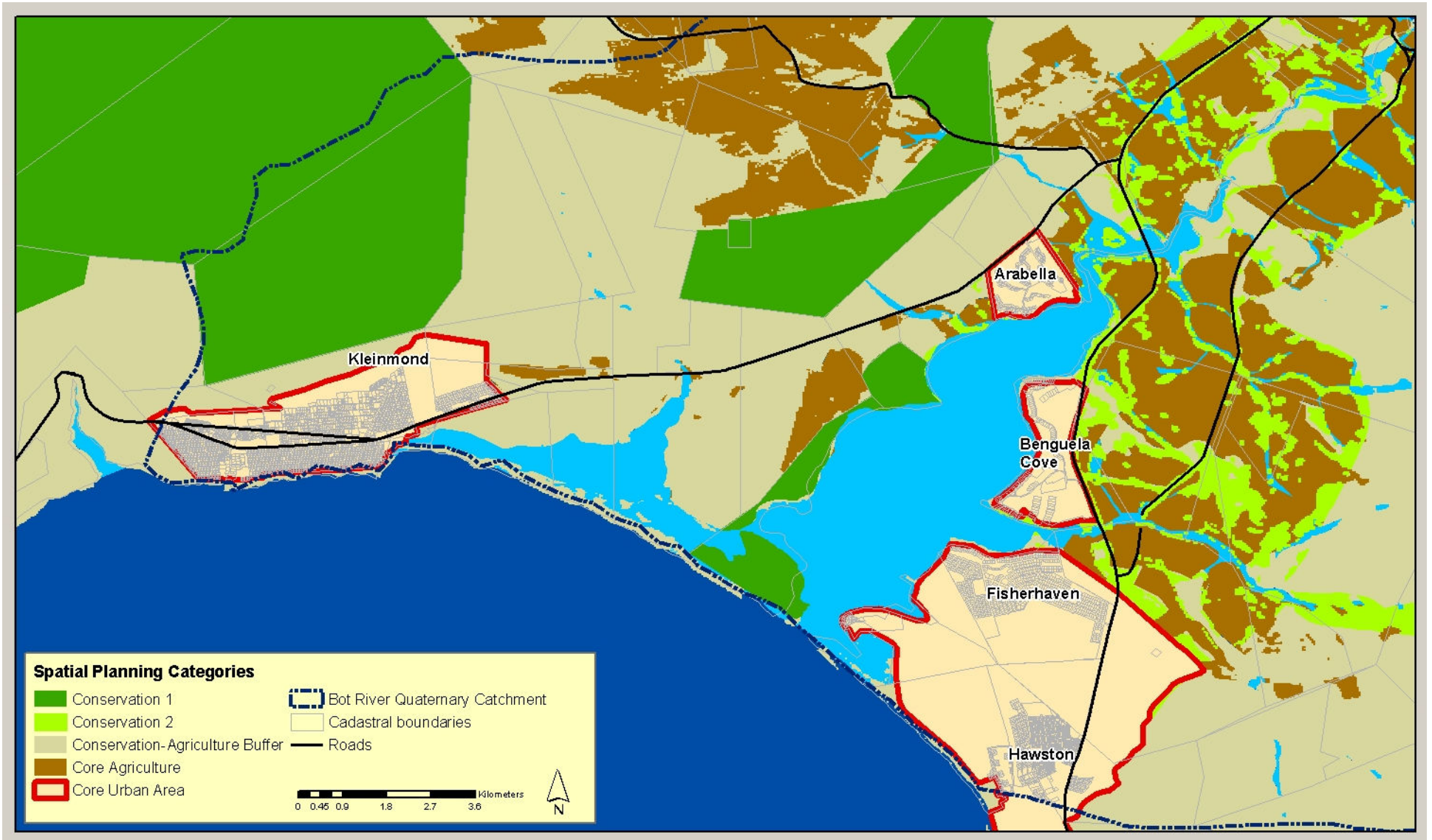

Figure 5 Overstrand Municipality Spatial Development Framework – application of Spatial Planning Categories in the study area

- The SDF provides for all state-owned conservation-worthy land to be established as contract nature reserves through its inclusion in CapeNature's Conservation Stewardship programme.
- An intensive agricultural resource area is identified in the eastern and upstream parts of the estuarine quaternary catchment (refer Figure 6).

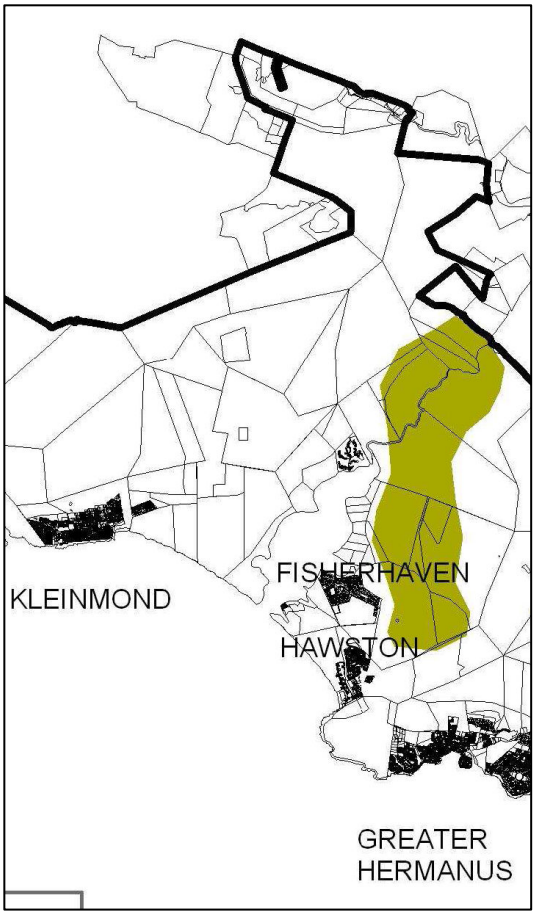

Figure 6 Intensive agricultural resource areas in the area (Source: Overstrand SDF p115)

The IDP 2008/09 Revision includes a summary list of funded projects for the current financial year (2008/09) and an estimate of capital budgets required for various infrastructural projects over the IDP planning period.

Provincial approval of the SDF is not yet secured (pers.comm. Senior Planner: Overstrand Municipality, 20-11-2007, confirmed by DEA&DP, 12-09-2008). The version that is referred to in this assessment is the Final Draft – October 2006.

The EMP can draw from and support the Overstrand IDP and SDF by:

» Elaborating on the potential linkages that have been identified here – e.g. IDP and SDF projects that have common objectives or spatial overlap – and including actions for activating these links.
» Commenting on and contributing to the SDF proposals and strategies that relate to the estuarine management area.
» This would include the adoption by the Municipality of the EMP as a foundation for the Bot River Rural Development Framework.

3.11 Town Planning Zoning Scheme

Whereas Spatial Development Frameworks (SDF) are instruments that guide the growth and future development of an area (at any scale), Town Planning Schemes are instruments employed in the day-to-day management of land use by a Local Municipality. The planning scheme provides detailed specifications for each land parcel regarding use, density of development and the placement of buildings upon the site.

Prior to the year 2000, planning schemes were required only in urban areas. Following the consolidation of urban and rural administrative areas, local municipalities are required to extend the existing planning schemes across the expanded extent of the municipality. Very few municipalities have made significant advances in this regard, and there have been delays in the promulgation of

enabling legislation. Many municipalities, including Overstrand, have yet to complete their schemes and develop the capacity required to manage agricultural and rural areas.

In the preparation of an SDF, planners calculate the extent of land required to accommodate the Municipality's agreed expansion needs (e.g. housing backlog) over the SDF planning time frame, and establish the delineation of the urban edge accordingly. In the Overstrand Municipality SDF, this land is described as "Urban Extension" and is intended to support growth over the next 5-10 year period. For the most part, it is represented by the land that occupies the space between the Town Planning Zoning Scheme and the urban edge. Development is preceded by the extension of the planning scheme, and the infrastructure for basic services, into those areas.

Town planning schemes are not fixed – they are commonly referred to as schemes "in the course of preparation" – but are required to be available for public scrutiny at all times. The Overstrand municipality town planning schemes could not be located or accessed during the assessment period.

3.12 Bot River Estuary Advisory Committee (BREAC)

The institutional vehicle established in 1993 to co-ordinate management decisions is the formally constituted Bot River Estuary Advisory Committee (BREAC). Its mission is "The co-operative management of the Bot River Estuary, associated wetlands and coastal strip as an ecological unit and on a scientific and sustainable basis." Objectives include the drafting of a management plan, promotion of sustainable land-use practices, protection through education, policing and enforcement, monitoring, the consolidation of land for conservation purposes and the commissioning of research.

BREAC is managed and chaired by CapeNature. Overstrand Municipality acts in a supporting role in administering bylaws and law enforcement. Membership is restricted to representatives of organisations and community sectors. This extends to compulsory membership for relevant government organisations, and voluntary membership for NGOs, affected local communities or community sectors, and affected landowners. Each organisation may send a maximum of two representatives to meetings – one participating representative, and one who is afforded limited speaking rights. The membership list for 2005 shows a total of seven compulsory member organisations, with potentially 13 representatives, and voluntary membership comprising riparian landowners (potentially 8 representatives) and environmental interest groups (potentially 14 representatives). Riparian landowners are listed as: Farm Rooistrand, Arabella Country Estate, Benguela Cove, Meerensee. Environmental interest group organisations are listed as: Friends of the Bot River Estuary and Environs (Botfriends), Lake Marina Yacht and Boat Club, KOBIO (Kogelberg biosphere), Fisherhaven Ratepayers Association, Hawston Fishing Community, Kleinmond Nature Conservation Society and De Draay Conservancy.

Minutes from a meeting in November 2005 record a rift between the Hawston fishing community representative and other members of BREAC, the resignation of the representative and the intention to find a replacement. The issue of representation of Hawston residents and fishers in management of the estuary is further addressed in the Social Assessment.

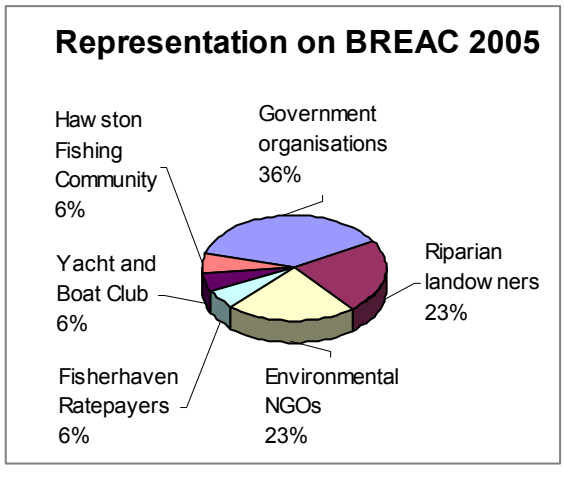

Figure 7 Representation on BREAC (2005)

BREAC's activities include mouth management, a significant aspect of the Bot system, reported in the Ecological Assessment. Strategies adopted by BREAC have been developed collaboratively by scientists over the years, with key events being:

- A symposium held at UCT in 1983, resulting in a published collection of papers on the Bot/Kleinmond system (Branch et al, 1985)
- A workshop held at Jonkershoek on 26 October 2000
- A Breaching Criteria Indaba held at Arabella on 5 February 2003.

The impacts of mouth closure and breaching events have been systematically monitored since 2003 and a review is planned for early in 2009. BREAC's current policy for mouth management, which supports periodic managed breaching, is summarised in Data Sheet 16. When out-of-season high rainfall in September 2008 caused water levels in the Bot estuary to rise, and salinity levels to drop, the Hawston fishing community lobbied for the artificial opening of the mouth and BREAC took a controversial decision to do this, despite it being outside of the provisions of the policy. The record of decision, as per the minutes of an emergency meeting held on 26-09-2008, reads as follows:

> "the overall verdict from specialists and authorities was one which supported breaching. Although the breaching criteria specified that the season ended on 30th August the new information regarding the low oxygen levels, combined with the extremely low average salinity (4.8 parts per thousand) and the highest recorded levels in the last 8 years (2.76 m) reinforced the decision to breach."

Local environmental NGOs note that BREAC has been effective under very difficult circumstances, in which very little informed local government activity has been applied to the management of the Bot estuary and its natural surroundings. The relatively good condition of the Bot Vlei is largely ascribed to the activities of BREAC and Botfriends, without whose involvement and lobbying of various authorities over a long period of time, it is felt that the Botvlei would in all probability be a very much less healthy body of water than it is at present.

3.13 Estuary Zoning schemes and municipal bylaws

Regulations made in terms of the Nature Conservation Ordinance to regulate the use of inland waters (including estuaries) make specific reference to the Bot River estuary and, by reference to survey beacons on the banks, establish three zones for the use of the water body. The emphasis of Proclamation 357 is on establishing low-disturbance zones for angling (separation of conflicting activities), and regulating the use of nets. (Refer Data Sheet 17).

The recreational use zones are supported by a local by-law introduced in 2004 (PG 6147, 9 July 2004) to regulate boat use. The by-law requires, amongst other things, that any craft that is not a canoe, paddleski, sailing board or rowing boat with a length of under 3 metres may only be launched from a designated launch site or slipway and that only boats (including canoes and paddleskis) that have a license issued by the Overstrand Municipality may use the estuary. The licensing system makes it possible for the Municipality to monitor, regulate and restrict boat use.

According to reports from stakeholders, beacons demarcating the zones are not visible to users, and compliance is neither policed nor enforced.

An development on Proclamation 357 regulations has been drafted by BREAC and is proposed for adoption in the Municipal by-laws. A number of sub-zones are proposed, indicated in Figure 12, making provision for further restriction on activities (Refer Data Sheet 18). In summary, these are:

- Introduction of sanctuary zones for birds where no water-based activity is permitted
- Restriction on high speed activities in the margins of the water sports area
- General clauses which regulate human behaviour for environmental protection purposes, such as littering and artificial breaching of the mouth.

The General clauses are largely aligned with national legislation for environmental protection and management. In respect of living resources, the document makes reference to the need for compliance with the Marine Living Resources Act and notes that all fishing nets, with the exception of landing nets, are illegal. No reference is made to bait collection.

Overall, the proposed amendments to the regulations represent a shift in emphasis from resource use to conservation.

The EMP needs to consider this existing initiative by reviewing the proposed amendments in terms of conservation targets and other EMP objectives.

3.14 Concluding notes

The Bot / Kleinmond EMP will engage with the identified planning instruments through its attention to the actions highlighted in this assessment.

4. Availability and location of data

An assessment of this nature provides little scope for primary research and is heavily dependent on the existence and availability of secondary sources. The Bot is one of the most researched estuaries in the country, in terms of the natural sciences, and the challenge has more to do with the co-ordination of the database so that material is accessible to those who need it. A DWAF initiative, with support from CSIR, (http://www.ewisa.co.za/misc/Estuaries/, accessed on 22/08/2008) houses some material but it is not comprehensive.

The nature of an integrated management plan requires a broader base than the natural sciences and besides the framework of policy and legislation relating to estuaries generally, there is a lot of data to be collected and reviewed for the assessment that are specific to the local context.

It is also inevitable that there will be data that is known to exist but cannot be sourced, and that there will be data that is not revealed in any form. The situation is exacerbated by the constraint of time frames and the need, at a certain point, to cease pursuing data, 'bank' what is available and proceed with the assessment. The following are the most significant gaps:

- Prioritisation status of the Bot River for Resource Directed Measures in the Breede River Water Management Area, and time frame for estuarine ecological reserve determination.
- Identification of pre-colonial heritage sites in the estuarine environment.
- Documentation of traditional knowledge of the biophysical environment, fisheries resource management and the spiritual / religious links of local residents to the estuarine environment.
- GIS datasets for Overstrand Municipality SDF proposals relating to land use within the urban edge, heritage overlays and sites, and the extent of the existing urban footprint (town planning scheme) and bulk infrastructure reticulation will enhance planning for conservation and development within the terrestrial margin.
- Clarification on precedence of Spatial Planning Categories established in the Provincial, District and Local Spatial Development Frameworks.
- GIS-based mapping of estuarine habitats in the Bot / Kleinmond system is currently being done under the auspices of the C.A.P.E. Estuaries Programme Conservation Plan but was not completed in time for use in this assessment. This is expected to become available during the course of preparation of the EMP to enhance conservation planning.
- Species and spatial data on fish in the Bot River estuary, which will enhance conservation planning.

The inventories provided in the following pages contain references to data that pertains specifically to the Bot and Kleinmond River estuaries and their catchments. It does not extend to material relating to estuaries in general. Table 5 is followed by a record of the GIS datasets that were used in the course of this assessment, and those still awaited.

The inclusion of this database in the Draft Report presents the opportunity for reviewers to contribute to its expansion.

Table 5 Inventory of data relating to the Bot and Kleinmond estuaries

Short name / description	Theme	Reference if available	Availability	(? Possible) Source	Comments
Scientific article	Mouth management	Avian Demography Unit, Tygerberg Bird Club. 2000. Waterbird responses to management decisions at Botriviervlei, Western Cape	Unknown	? UCT library	Listed in the SANBI WC Wetlands Directory
Database	Data	Avian Demography Unit. CWAC Waterbird counts from 2000. Contact Marius Wheeler	Unknown	http://cwac.adu.org.za/cwac_map.php?Pv=WC	Listed in the SANBI WC Wetlands Directory
Scientific article	Ecosystem	Bally, R. & McQuaid, C.D. 1985. The physical and chemical characteristics of the waters of the Bot River estuary, South Africa.	Unknown	? UCT library	Listed in the SANBI WC Wetlands Directory
Scientific article	Data	Bally, R. 1985. Historical records of the Bot River estuarine system	Unknown	? UCT library	Listed in the SANBI WC Wetlands Directory
Scientific article	Mouth management	Bally, R. 1987. Conservation problems and management options in estuaries: the Bot River Estuary, South Africa, as a case-history for management of closed estuaries.	Unknown	? UCT library	Listed in the SANBI WC Wetlands Directory
Published literature	Mouth management	Bally, R., Branch, G.M. 1986. The Bot River Estuary - should we interfere? African Wildlife Volume 40 No.6.	Unknown	? UCT library	Listed in the SANBI WC Wetlands Directory
Scientific article	Ecosystem	Bally, R., McQuaid, C.D. & Pierce, S.M. 1985. Primary productivity of the Bot River Estuary, South Africa	Unknown	? UCT library	Listed in the SANBI WC Wetlands Directory
Report	Resource value	Barnes, Keith N. 1998. The Important Bird Areas of southern Africa	Unknown	? UCT library	Listed in the SANBI WC Wetlands Directory
Scientific article	Mouth management	Bennet, B.A. 1985. A mass mortality of fish associated with low salinity conditions in the Bot River Estuary.	Unknown	? UCT library	Listed in the SANBI WC Wetlands Directory
Scientific article	Mouth management	Bennet, B.A., Hamman, K.C.D., Branch, G.M., Thorne, S.C. 1985. Changes in the fish fauna of the Bot River estuary in relation to opening and closure of the estuary mouth.	Unknown	? UCT library	Listed in the SANBI WC Wetlands Directory
Scientific article	Ecosystem	Bennett, B.A. 1989. The diets of fish in three south-western Cape estuarine systems	Unknown	? UCT library	Listed in the SANBI WC Wetlands Directory

Short name / description	Theme	Reference if available	Availability	(? Possible) Source	Comments
Breaching impacts – Bot River	Mouth management	Branch, G. M., R. Bally, B. A. Bennett, H. P. de Decker, G. A. W. Fromme, C. W. Heyle, and J. P. Willis. 1985. Synopsis of the impact of artificially opening the mouth of the Bot River Estuary: implications for management. Transactions of the Royal Society of South Africa 45:465–483.	Unknown	? UCT library Bot Friends chairperson	
Scientific article	Mouth management	Branch, G.M., Bally, R., Bennet, H.P., Fromme, G. 1985. Synopsis of the impact of artificially opening the mouth of the Bot River estuary: implications for management	Unknown	? UCT library	Listed in the SANBI WC Wetlands Directory
Thesis	Integrated	Cilliers, C and J de Jager. 1997. *Management Plan for the Bot River and Kleinmond Estuaries, Associated Wetlands and Surrounding Land.* Stellenbosch University and Cape Department of Nature and Environmental Conservation	Available (hard copy)	CAPE Estuaries Programme	
Scientific article	Ecosystem	Coetzee, D.J. 1985. Zooplankton and some environmental conditions in the Bot River Estuary.	Unknown	? UCT library	Listed in the SANBI WC Wetlands Directory
Scientific article	Conservation	Cooper, J., Summers, R.W., Pringle, J.S. 1976. Conservation of coastal habitat of waders in the south-western Cape, South Africa	Unknown	? UCT library	Listed in the SANBI WC Wetlands Directory
Scientific article	Ecosystem	De Decker, H.P. & Bally, R. 1985. The benthic macrofauna of the Bot River Estuary, South Africa, with a note on its meiofauna.	Unknown	? UCT library	Listed in the SANBI WC Wetlands Directory
Scientific article	Ecosystem	De Decker, H.P., Bennett, B.A. 1985. A comparison of the physiological condition of the southern mullet Liza richardsoni (Smith), in a closed estuary and the sea.	Unknown	? UCT library	Listed in the SANBI WC Wetlands Directory
Breede WMA ISP	Water Quality and Quantity	Department of Water Affairs and Forestry. 2004. *Breede River Water Management Area (WMA18). Internal Strategic Perspective Version 1.* October 2004	Available	Breede WMA	
Thesis	Mouth management	Fah, D. 2004. The effects of salinity and catchment management in the dominant macro-algae in the Bot River estuary. Unpublished honours thesis.	Available (electronic)	Breede WMA – J Roberts	

Short name / description	Theme	Reference if available	Availability	(? Possible) Source	Comments
Scientific article	Hydro-dynamics	Fromme, G.A.W. 1985. The hydrology of the Bot River Estuary	Unknown	? UCT library	Listed in the SANBI WC Wetlands Directory
Scientific article	Ecosystem	Heyl, C.W. & Currie, M.H. 1985. Variations in the use of the Bot River Estuary by water-birds	Unknown	? UCT library	Listed in the SANBI WC Wetlands Directory
Green Report	Integrated	Koop, K. 1982. Estuaries of the Cape. Part ii: Synopsis of available information on individual systems. Report No.18. Bot/Kleinmond system (CSW 13). Heydorn, A.E.F. and Grindley, J.R. (eds). Stellenbosch C.S.I.R. Research Report 417.	Limited	CSIR	Listed in the SANBI WC Wetlands Directory
Scientific article	Ecosystem	Koop, K., Bally, R., McQuaid, C.D. 1983. The ecology of South African estuaries. Part XII. The Bot River, a closed estuary in the south-western Cape. South African Journal of Zoology 18(1).	Unknown	? UCT library	Listed in the SANBI WC Wetlands Directory
Published article	Resource value	Lamberth, S.J. & Turpie, J.K. 2003. The role of estuaries in South African fisheries: economic importance and economic implications. African Journal of Marine Science 25: 131-157	Available	UCT Library	
Report	Resource value	Maree, R.C, Whitfield, A.K. & Quinn, N.W. 2003. Prioritization of South African estuaries based on their potential importance to estuarine-associated fish species.	Unknown	? UCT library	Listed in the SANBI WC Wetlands Directory
Zoning	Land use and Infrastructure	N/A	Available		Required for properties outside of the urban edge, not available in Overstrand's planning scheme mapping
Overberg DM SDF	Integrated	Overberg District Municipality. 2004. Spatial Development Framework, March 2004. Prepared by Dennis Moss Partnership.	Available	www.overberg.gov.za	
Overberg DM IDP	Integrated	Overberg District Municipality. 2006a. *Revised Integrated Development Plan 2006/2007.* Revised by Dr Joan Prins: Manager, Overberg PIMS Centre.	Available	www.overberg.gov.za	

Short name / description	Theme	Reference if available	Availability	(? Possible) Source	Comments
Overberg DM IDP - Projects	Integrated	Overberg District Municipality. 2006b. *IDP Projects Approved*: 2006/2007	Available	www.overberg.gov.za	
Overstrand LM SDF	Integrated	Overstrand Municipality. 2006. *Overstrand Municipal Wide Spatial Development Framework. Volume II: Development Strategy. October 2006* – Final Draft.	Available	Overstrand Municipality	
Overstrand LM IDP	Integrated	Overstrand Municipality. 2007. *Integrated Development Plan 2007/8 – 2011/12*	Available	www.overstrand.gov.za	
Situation Assessment	Integrated	Proceedings of the Bot River Estuary Workshop held at Jonkershoek Conference Room on 26 October 2000	Available (electronic)	CAPE Estuaries Programme	
Scientific article	Ecosystem	Roberts, C.H., Branch, G.M. & Robb, F.T. 1985. The annual cycle of free-floating bacteria in the Bot River Estuary.	Unknown	? UCT library	Listed in the SANBI WC Wetlands Directory
Scientific article	Mouth management	Rogers, J. 1985. Geomorphology, offshore bathymetry and quaternary lithostratigraphy around the Bot River estuary	Unknown	? UCT library	Listed in the SANBI WC Wetlands Directory
Wetlands database	Data	SANBI website. Western Cape Wetlands Directory. Accessed on 08/08/2008	Available	http://bgis.sanbi.org/wcwd/project.asp	
Institutional Report	Stakeholder data	Setplan, DJ Environmental and Envirocentric. 2006. Preparation of a Strategic Management Framework for the Kogelberg Biosphere Reserve. Initial Stakeholder Consultation. Kogelberg Biosphere Reserve Company.	Available (electronic)	Kogelberg BR	
Scientific article	Ecosystem	Stewart, B.A. & Bally, R. 1985. The ecological role of the red-knobbed coot Fulica cristata Gmelin at the Bot River Estuary, South Africa: a preliminary investigation	Unknown	? UCT library	Listed in the SANBI WC Wetlands Directory
Thesis	Catchment management	Stipinovich, A. 2005. Change in land cover and water abstraction: modelling runoff effects in the Bot River catchment. Unpublished M.Arts thesis, University of Stellenbosch.	Available (electronic)	Breede WMA – John Roberts	Original Word file was corrupted – repairable by opening in WordPad, saving as .doc and rejecting deletions
Scientific article	Data	Summers, R.W., Cooper, J. Pringle, J.S. 1977. Distribution and numbers of coastal waders (Charadrii) in the	Unknown	? UCT library	Listed in the SANBI WC Wetlands Directory

Short name / description	Theme	Reference if available	Availability	(? Possible) Source	Comments
		southwestern Cape, South Africa, summer 1975-1976			
Institutional report	Data	Taylor, P.B. 1997. South African palustrine wetlands: the results of a survey in summer 1995/96	Unknown	? UCT library	Listed in the SANBI WC Wetlands Directory
Institutional report	Data	Taylor, P.B., Navarro, R.A., Wren-Sargent, M., Harrison, J.A., Kieswetter, S.L. 1999. Total CWAC Report Coordinated Waterbird Counts in South Africa, 1992-1997	Unknown	? UCT library	Listed in the SANBI WC Wetlands Directory
Estuaries Conservation Plan	Conservation	Turpie, J. and Clark, B. 2007. *Development of a conservation plan for temperate South African estuaries on the basis of biodiversity importance, ecosystem health and economic costs and benefits.* Final report. C.A.P.E. Regional Estuarine Management Programme	Available	C.A.P.E. Estuaries Programme	
Scientific article	Conservation	Turpie, Jane K. 1995. Prioritizing South African estuaries for conservation: a practical example using waterbirds.	Unknown	? UCT library	Listed in the SANBI WC Wetlands Directory
Report	Ecosystem	Turpie, J. 2000. *Birds of The Bot River Estuary*. Bot River Estuary Workshop 26 October 2000	Author		
Recreational facilities performance study / audit	Land use & Infrastructure	Unknown	Unknown	Unknown. Overstrand Municipality?	Possible that a study like this may have been conducted, e.g. by the Municipality
Flood lines	Land use and Infrastructure	Calculated for Sandown Bay and Benguela Cove development applications	Unknown	Overstrand Municipality?	1:100, 1:50 and 1:10 year floodlines referenced in various development control mechanisms
Fish population data	Data	Unpublished	Unknown	S. Lamberth, Marine and Coastal Management	
Salinity level data	Data	Unpublished data on salinity levels	Unknown	? Cape Nature – Steve Gildenhuys	
Water quality	Data	Unpublished data on sampling carried out by Arabella Estate	Unknown	Arabella Estate,	

Short name / description	Theme	Reference if available	Availability	(? Possible) Source	Comments
data		(E.Coli. and nutrients along their estuarine frontage) and also by Overberg District Municipality (E.coli. levels at Fisherhaven slipway and Meerensee, possibly also at Kleinmond estuary).		ODM	
Water level data	Data	Unpublished data on water levels monitored by DWAF at Ysterklip and Kleinmond Mouth Unpublished data monitored by Cape Nature	Unknown	? Breede WMA CapeNature – Steve Gildenhuys	
Scientific article	Data	van Foreest, D. 1985. A numerical model for the wind-driven circulation in the Bot River estuary.	Unknown	? UCT library	Listed in the SANBI WC Wetlands Directory
Scientific article	Mouth management	van Heerden, I. 1985. Barrier/estuarine processes - an interpretation of aerial photographs.	Unknown	? UCT library	Listed in the SANBI WC Wetlands Directory
Scientific article	Hydro-dynamics	van Niekerk, L., van der Merwe, J.H. & Huizinga, P. 2005. The hydrodynamics of the Bot River Estuary revisited. Water SA Vol. 31 No. 1	Available	http://www.wrc.org.za	
Scientific article	Resource value	Wallace, J.H., Kok, H.M., Beckley, L.E., Bennet, B.A., Blaber, S.J.M., Whitfield, A.K. 1984. South African estuaries and their importance to fishes	Unknown	? UCT library	Listed in the SANBI WC Wetlands Directory
Report	Data	Whitfield, A.K. 2000. Available scientific information on individual South African estuarine systems	Unknown	? UCT library	Listed in the SANBI WC Wetlands Directory
Scientific article	Mouth management	Willis, J.P. 1985. Bathymetry, environmental parameters and sediments of the Bot River Estuary.	Unknown	? UCT library	Listed in the SANBI WC Wetlands Directory

Table 6 GIS data relating to the Bot / Kleinmond system

Data category	Dataset description
Study area	Three quaternary catchments of the Klein River
	1km buffer area around estuary, developed by buffering outer extent of estuary as defined by the Special Habitats layer from SANBI's Putting Plans to Work Project.
Biodiversity (pattern and process)	SANBI Vegetation Map
	Vegetation ecosystem status (critically endangered, endangered etc) based on SANBI vegetation map and integrated land-cover layer from D Kirkwood and using latest SANBI guidelines for determining ecosystem status.
	Agulhas plain original (historic) vegetation layer. Only extends over part of the immediate estuarine catchment area.
	River conservation status, source NSBA. All major rivers within the study area catchments are critically endangered.
	Overstrand special habitats from SANBI Putting Plans to Work project. Mapped features within the study area include wetlands and milkwood patches.
	Theewaterskloof priority clusters from SANBI Putting Plans to Work project. Essentially shows critical Renosterveld patches with a 500m buffer.
	Theewaterskloof special habitats from SANBI Putting Plans to Work project. Features in the study area are all wetlands.
	Red Data and Orange list plants (point locations from CREW) with locational precision of 2km or better. Official clearance to use the data requested and awaited.
	Biodiversity and sensitivity value surfaces derived using sensitivity-value analysis procedure.
Conservation	Protected area boundaries, including provincial reserves, local authority reserves, private nature reserves, national heritage sites, mountain catchment areas.
	Conservancy boundaries
Hydrology	1:50 000 rivers
	1:500 000 rivers
	Quaternary catchment boundaries
	River geomorphic provinces
	Breede Water Management Area Boundary
Topography	Digital elevation model
	Slope
Land-cover	Integrated broad land-cover developed by D. Kirkwood (e.g., natural, near-natural, degraded, transformed etc). Following land-cover datasets integrated:
	National Land-Cover 2000
	Agulhas Plain land-cover
	Lowlands land-cover
	Cultivated field mapping

Data category	Dataset description
	National land-cover 2000 dataset
	Proposed development and developments under way (developed from various informants)
Agriculture	Soil potential from Mike Wallace (Elsenburg)
	Land capability (ARC)
	Mapped cultivated fields from Mike Wallace (Elsenburg)
Infrastructure	All roads in area from SA Explorer Dataset (doesn't include minor roads within settlements)
	Railway lines (one line runs through the north of our 3 quaternary catchments)
	Waste facilities (gives type of facility and whether open or closed)
	Recreational sites (includes camping sites, jetties and launch sites). Developed from various informants)
	Estuarine use zone beacons and lines
Population	2001 census dataset
Context	Place names
	Municipal boundaries
	1:50 000 topographic maps
	Cadastral boundaries (farms and erven) from Surveyor General.
Imagery	Spot 5 colour imagery for all three quaternary catchments
Outstanding	Overstrand SDF Heritage Overlay Zones
	Overstrand SDF Local Heritage Sites
	Estuarine Habitat map (Tommy Bornman)

Part B: SECTORAL ASSESSMENTS

5. Socio-economic environment and stakeholder assessment

Sustainability is often represented by the "triple bottom line" which reflects the economic, social and environmental components of an activity, be it related to resource use, infrastructure development, carrying capacity or agriculture, etcetera. Social sustainability addresses the human aspects of the activity and relates to the well-being or quality of life of people. Social sustainability includes social capital and human capital and therefore encompasses improvements to the human development index or provision of basic services, job creation, skills development, access to resources, recreation and the preservation of sense of place. It also concerns civil society and its cohesion, such as relationships, community based organisations and action groups, amongst others (DEAT, 2005; Director of Social Planning, 2005).

In trying to balance the economic, environmental and social arms of sustainability, the Overberg District IDP recognizes that there is overexploitation of the natural environment, with the following aspects tipping the balance away from environmental sustainability:

- Urban sprawl along the Overberg coastline
- Negative impact on under-ground water resources, especially along the coastal plains
- A growing demand for water from Cape Town Metro
- A growing demand, in the face of poverty and deprivation, to have access to natural resources, e.g. fynbos, wildlife, etc
- Development of high potential agricultural land, and
- Over-exploitation of the marine resources.

At the same time, the in-migration of unskilled persons from outlying areas or other provinces is placing pressure on resources and thereby compromising social sustainability. In Hermanus, in particular, human needs are considered to be high (van der Merwe, 2005, WCPSDF, 2005).

The pressure for socio-economic development in the municipality has significant implications for the management of the estuary: management objectives cannot address themselves only to the bio-physical environment. An integrated management plan that addresses social and economic needs within an ecosystem-based management approach is indicated, and is consistent with 'best practice' cases relating to the management of estuaries across the globe.

This snapshot assessment of the socio-economic aspects of the Bot / Kleinmond estuarine environment was developed through literature review and the collection of information through discussion with stakeholders and interested and affected parties (IAPs). The initial scoping of the stakeholder base was informed by documentation from previous stakeholder consultation processes in the area, and through networking. It was expanded during the EMP planning process through public meetings, consultations and communications between the consultant and stakeholder organisations, groups and individuals.

Much of the material presented here was provided by the people who live in the estuarine environment and/or who are involved in its management. It is therefore not a technical report but a presentation of the profile of the most immediate stakeholders, representing their priorities, interests and concerns. It is further noted that what is presented is a 'snapshot' of the situation at the current time: people's priorities, interests and concerns may change with time.

5.1 Demographics

Information about the demography of the Overstrand area was obtained from the Overberg District Municipality Annual Report (2007-08), the Overstrand IDP (2007-08) and the Theewaterskloof IDP (2008-09).

All documents refer to the in-migration of "low skilled" Black Africans from the Eastern Cape as the reason for the rapid growth in the population of the district over the past few years (Table 7). This increase is likely to slow down and population projections have been tempered in the Overstrand's 2007-08 IDP reports compared 2006-07 reports. Overstrand supports over 30% of the population and

in spite of a significant reduction in the projected growth rates the Overstrand rate is almost double the district average.

All identify the out-migration of skilled workers and the in-migration of unskilled persons as a threat to their economies.

Table 7 Summary of population figures for ODM, Overstrand and Theewaterskloof Municipalities

Municipality	Census 1996	Census 2001	Est. 2007	Projection 2015
Overberg District	159,033	205,945	237,555	270,202
Overstrand	37,315	58,332	73,031	91,356
Theewaterskloof	74,272	92,777	103,281	111,218

The Overstrand Municipality IDP provides population figures per population group, per ward for the Bot River catchment (Table 8). Figures for Ward 8 show combined population for Hawston and Fisherhaven.

Table 8 Population figures for relevant towns in the Bot River estuary catchment area, by racial group (source: OSM IDP)

Ward/Area	Population Group	Total
Ward 8: Hawston, Fisherhaven	Black Indian Coloured White	90 5 7,023 449
Ward 9: Kleinmond, Proteadorp, Honingklip, Overhills	Black Indian Coloured White	2,001 7 2,582 2,306
Botriver (TWK municipality)	Total (TWK IDP 2006-07)	4,785

The data do not provide detail on the split of the population in Ward 8 between Hawston and Fisherhaven. It is an important missing piece of information because the people in these two settlements conveyed diverging priorities and concerns during the EMP consultation process and, without the data, the magnitude of those needs could not be assessed. The consultant therefore made an estimate, based on available information:

- The OSM IDP provides a breakdown by "population group". This was used as baseline data for the estimate.
- Prior to democracy, South African law prescribed that settlements be racially segregated. Based on this, the consultant estimated that, prior to 1990, all legal residents of Hawston were Coloured and all legal residents of Fisherhaven were White.
- Residents of Fisherhaven advised that there are "several Hawston families" now living in Fisherhaven. It is assumed that this situation extends to some White families living in Hawston. A figure of 50 people was assigned in each case by the consultant for the purpose of the estimate.
- Since no information was received on where the Black and Indian people live, the numbers were divided equally between Hawston and Fisherhaven for the purpose of the estimate.
- Based on the above, the Consultant estimates that the population of Hawston is approximately 7,070 and that of Fisherhaven is 497 (93% and 7% of Ward 8 respectively).

5.2 Local Economic Development

From a socio-economic perspective it is interesting to note that almost half of the jobs created in the Overberg District, between 2001 and 2006, were in the Overstrand municipal area. However, in 2001, unemployment in Hermanus was considered to be 25% and that of Zwelihle 40%. A larger

percentage of households in the Overstrand Municipality (almost 11%) earn no income. There has been a 160% increase in drug-related crime in the area. Overstrand reports unemployment at 27%, and illiteracy (over 14 years) to be 19%. The need for skills training and job creation is acknowledged in the IDP, and programmes are underway and being developed to halve official unemployment by 2014.

The local authority has also received funding from the IDC to set up a Local Economic Development Agency that will be tasked with fast tracking development projects and marketing these to investors. In the Hawston area three projects have been identified for implementation:

- Hawston Abalone Village (HAV)
- Abalone Farm, adjacent to HAV
- Shopping Centre at the entrance to town.

At Kleinmond there are plans for the development of visitor facilities at the Blue Flag beach.

The TWK IDP review (2008-09) identifies the town of Botrivier, up-river from the estuary, as being "ideally located to become the industrial hub of the Overberg". No further detail is provided as to the type of industry. It is likely to be linked to agriculture.

The town of Hermanus is considered to have high development potential and high human need (van der Merwe, 2004; CNdV Africa, 2005) due mainly to economic change, commercial services and regional vitality. Tourism and recreation make up the economic base of the town. Van der Merwe (2004) notes that, besides the limiting availability of fresh water, growth is constrained by inadequate access roads and limited scope for the lateral expansion of the town. The WCP SDF (CNdV Africa, 2005), provides the framework to guide focused infrastructure and social investment to towns such as this.

Hawston (partnered with Fisherhaven in Ward 8), on the other hand, is identified in van der Merwe's (2004) study as having low human need yet medium to high development potential focusing on fishing and residential. "Town investment" is supported. The WCP SDF (CNdV Africa, 2005) shows that towns with such a combination of needs and potential will attract infrastructure investment and some social investment.

Kleinmond is identified as low need with low to medium development potential. The economic base focuses on retirement and recreation, with minimal investment supported. Although potential and need are low, investment will still take place, particularly focusing on social investment (CNdV Africa, 2005).

Both the Overstrand SDF and the WCP SDF view the Hawston / Fisherhaven Corridor as a strong focal area within the Overstrand municipal development planning arena for infrastructure investment. Two of the issues recorded for attention in the Overberg district are the need to mediate between tourism /resort development and protection of coastal ecology, and urban sprawl between Hermanus and Kleinmond, much of which is adjacent to or near the Bot / Kleinmond system. Strategies proposed by the WCP SDF for dealing with these issues include the investigation of a new transport and urban development corridor for Hermanus – Fisherhaven / Benguela Cove, and densification of existing urban settlements and strictly controlling development outside of the Urban Edge as a means to managing pressure on coastal resources.

With the declining fish stocks in the estuary resulting from an increasingly freshwater based ecology as well as overfishing, the need for alternative livelihood development has been identified, particularly for subsistence fishers[1]. Limited economic opportunities exist at present, and creative thinking is required to expand opportunities at the estuary for generating incomes, in particular for the residents of Hawston and Kleinmond. It is anticipated that the Hawston Abalone Farm could create as many as 100 jobs (Edwin Arrison, pers comm.). The same number of jobs could be created through identified opportunities related to the estuary, for example, field guides (horse trails, canoeing, birding, hiking, boating), ferry staff (Benguela to Arabella), alien clearing, general maintenance of facilities and security personnel, amongst others.

[1] The term 'subsistence' is used loosely to include traditional, artisanal and/or subsistence fishers

The envisaged focused investment by the public and private sectors in the Hermanus / Fisherhaven corridor will also create many temporary and permanent jobs for skilled and unskilled workers. However, many of the people living in Hawston are descendents of families of fishers that go back generations, to when the town was founded in 1859. Some fishers assert that making a living out of 'Die Vlei' is in their blood. The idea of being employed as a gardener or builder is not consistent with their cultural heritage. The EMP needs to identify strategies for development of estuarine-based sustainable livelihoods that represent viable alternatives for the fishers.

5.3 Balancing socio-economic development and natural heritage

The Overstrand IDP (2007-08) presents the economic situation in the area as follows:

"There are two dominant features of the local economy that merit high level attention. First, the future of the Overstrand economy cannot be separated from the region's natural heritage. The physical beauty of the area is its single biggest asset, but the natural resource base may also limit growth if resources are not effectively managed. In Overstrand the economy and its ecology are inseparable. The municipality has a fairly diversified economy and a great potential for tourism.

"The second is the highly racialised and geographically concentrated poverty of the area. Economic forces (e.g. the decline in fishing and the seasonality of tourism and agriculture) impact negatively on the semi-skilled and unskilled workforce of Overstrand, while the growth sectors have benefited mainly the wealthy. In-migration of poor and unskilled people to the area is associated with rising rates of poverty and inequality. Other than the formal safety nets of grants, the poor depend on informal work (construction) or on the third economy of illegal livelihoods (e.g. abalone poaching). Eighty-nine percent of Africans and 78% of Coloureds live below the household subsistence level of R1,600 per month, compared to just 10% of Whites. One third of whites earned in excess of R6,400 per month, 1% of Coloureds and just 14 Africans."

Through the application of the Consultant's population estimates for Hawston and Fisherhaven (Section 5.1) and the above percentages, there is an estimated 5,484 people in Hawston (78% of the estimated population of Hawston) who are sustained on a household income of less than less than R1,600 per month, and a further 80 people in Fisherhaven (16% of the local population).

The situation is confirmed through observation in the field; Fisherhaven (mostly White) is a middle/upper income area, and is joined politically through the Ward 8 demarcation to Hawston, a mostly Coloured area supporting a predominantly poverty-stricken community. The needs of residents of the two areas are widely divergent. The residents of Hawston feel very strongly that their traditional (cultural) use of the Bot River estuary has been eroded through increased conservation pressure and exclusive 'White' developments along the water frontages of the Vlei.

The link between the local economy and the natural resources is one that needs to be carefully balanced. The protection of natural resources is seen by many as elitist and exclusionary, yet without their protection the local economy will suffer in the long term.

5.4 Interested and Affected Parties, Stakeholders and Users

5.4.1 Non-government and Community Based Organisations:

There is a very wide range of community groups whose interests include, or are solely related to, the Bot River estuary and environs. At the local level these groups include:

- Arabella Country Estate Home Owners Association
- Biosphere Reserve Action Group
- Birdlife Overberg
- Birdlife Walker Bay
- Bot River Aesthetics Committee
- Botanical Society (Kogelberg Branch)
- Botanical Society of South Africa
- Botfriends
- Botrivier advies en Ontwikkelings sentrum
- Botrivier Grondeienaars
- Fisherhaven Ratepayers Association
- Greater Hermanus Association for Commerce and Tourism

» Greater Hermanus Environmental Action Group (GHEAG)
» Hangklip Environmental Action Group
» Hangklip Heritage Trust
» Hangklip/Kleinmond RPAs
» Hawston Combined Abalone
» Hawston Community Development Trust
» Hermanus Bird Club
» Hermanus Botanical Society
» Hermanus Ratepayers' Association
» Kleinmond Nature Conservation Society
» Kleinmond Ratepayer's Association
» KOBIO
» Kogelberg Biosphere Reserve Co
» Middelvlei Homeowners Assoc
» Overberg Conservation Foundation
» Overstrand Heritage and Aesthetics Committee
» Stony Point Nature Reserve Society
» Suid Afrikaanse Vissers Front
» Suidelike Bootassistent Vereniging

5.4.2 Other interest groups

» Arabella Western Cape Hotel & Spa
» Arabella Equestrian Centre
» Beaumont Wines
» Botrivier Hotel
» Caledon Tourism
» Hangklip - Kleinmond Tourism
» Hawston Abalone Village
» Hermanus Tourism
» Kleinmond Harbour Development
» Lake Marina Yacht and Boat Club
» Local residents and property owners
» New Property Ventures (Benguela Cove)
» Overberg Tourism
» Overstrand Marketing (DMO)
» SATSA (Southern Africa Tourism Services Association) Western Cape Committee (Training & Tourism in Schools)
» Wine & Biodiversity Initiative

5.4.3 Private Nature Reserves and Conservancies

» Benguela Cove Private Nature Reserve
» De Draay Conservancy

A reference on 1:50,000 survey maps to “Middelvlei Nature Reserve” is assumed to be a reference to the former administration of this land by the Department of Forestry, as state owned coastal land. It was during this period of administration that the dunefield was stabilised through the introduction of alien vegetation, thus establishing it as a state forestry area, which was not uncommon in the coastal areas during the 1960s to 1970s. No record could be found that awards either public or private nature reserve status to this part of the Middelvlei dune field.

5.4.4 Government Organisations

A wide range of government departments at all three levels of government is responsible for various aspects of estuarine management. At local level the catchment falls within two local municipalities' and one district municipality's jurisdiction. Within the Western Cape provincial government, two departments and one parastatal are involved, and at National level four departments are directly involved in the management of the estuary and its catchment.

Local:

» Overberg District Municipality (ODM) Environmental Management

» Overstrand Municipality (OM) Communication, Environmental and Conservation Services, Economic Development and Planning (incl. Infrastructure Planning), Ward 3 committee, Ward 8 Committee
» Theewaterskloof Municipality: Environmental Management, Health & Development

Provincial:

» Department of Local Government, Environmental Affairs and Development Planning (DEA&DP) Coastal Management Unit, Integrated Environmental Management incl. Overberg Region, Biodiversity, Provincial and Regional Planning Policy
» CapeNature (C.A.P.E. Estuaries Programme, Incentives Programme, Kogelberg Biosphere Reserve, Land Use Advisory Unit, Overberg BU, Regional Ecologists, River Conservation Unit, Stewardship Programme
» Department of Agriculture (WC) including LandCare

National:

» Department of Environmental Affairs and Tourism (DEAT) Directorate: MPAs and Estuarine Management of Marine and Coastal Management, and Directorate Tourism
» Department of Water Affairs including Breede River Water Management Area (WMA), Sub directorate: Resource Protection, Water quality / permitting, Working for Water, Working for Wetlands
» Department Agriculture (DoA) Business Plan Committee: KBR, LandCare Overberg Region
» Department of Minerals and Energy.

5.4.5 Regional, national and global interests

The Bot estuary's ranking as one of the top 10 most important estuaries in the country, and its contribution, with the Klein River estuary, to 60% of the surface area of estuarine systems in the Western Cape province, places it at a level of global significance in terms of its ecotourism value and bird habitats. An application to Ramsar to have the area declared a Ramsar site (a wetland of international significance) is being prepared.

The establishment of estuary management plans for 12 estuaries in the in the Cape Floristic Region is being funded by the World Bank. This in itself reflects the global significance of the Bot - Kleinmond estuarine system.

Accolades of international significance include:

- The International Association of Golf Tour Operators (IAGTO) voted Arabella Western Cape Hotel & Spa located on the shores of the estuary as the Golf Resort of the Year for 2008 in the Rest of the World category (outside Europe and North America).
- In December 2006 the Bot River district, where there are 12 wine farms, was awarded the status of Biodiversity Wine Route (a world first).
- Hawston Beach and Kleinmond Beach have Blue Flag status which is an internationally recognized standard in beach experience and facilities.

The real estate profile of Arabella Country Estate and Benguela Cove brings national and international economic interests and tourism into the area. Use of the Bot and Kleinmond estuaries for recreation purposes attracts visitors from the region, and domestic tourists, besides local residents. The estuary's importance as a nursery for near-shore fisheries renders it classifiable as a regional resource of importance for livelihoods and recreational fishing.

South African policy on coastal development (DEAT, 2000) establishes the principle that coastal waters, which by definition includes coastal wetlands such as the Bot-Kleinmond system, belong to all the people of South Africa and that their right to access and benefit from the resource takes precedence over private interests.

5.4.6 Subsistence[2] Users

Turpie and Clark (2007) list the Bot River estuary as having the 6th highest subsistence value of the country's estuaries. Subsistence users are predominantly from the nearby towns of

[2] The term 'subsistence' is used loosely to include traditional, artisanal and/or subsistence fishers

Kleinmond and Hawston. Fishers from these towns are active in the estuarine area as shore anglers and bait collectors, and Hawston residents admit to regular illegal netting. The exact number of fishers or households that rely on the estuary as a livelihood or for subsistence use is unknown but is suspected to be significant in the Hawston area. Subsistence fishers admit to fishing for commercial purposes "when times are tough" particularly when sea conditions are too rough for taking fishing boats out to sea.

The Hawston community has strong feelings about their 'historical rights' to fish in 'die Vlei'. They are resentful of the fact that they have had gill netting applications refused by MCM and perceive conservationists to be marginalising them from conducting traditional practices in the Vlei. An attitude of "if they don't give us permits to fish legally, then they are forcing us to fish illegally" prevails.

5.4.7 Recreational Users

As with most of the province's estuaries, the Bot River is used extensively for recreational purposes, and has huge local and regional value in this regard.

Activities in and around the estuary include:

» Hiking	Canoeing	Kite surfing
» Horse riding	Boating (motor and oars)	Sailing
» Birding	Waterskiing	Windsurfing
» Swimming	Powerboating	Surfing
» Fishing	Wakeboarding	

5.4.8 Commercial Activities

In the surrounding area commercial enterprises include mainly those based on tourism, property development and sport (golf and horse trails). Agricultural and agri-business activities take place upstream of the R43 road bridge where there is also the Bot River Brick Works and associated quarry. Sand mining activities take place close to the brick works on the R43 as well as on the western bank near the Rooisand Nature Reserve. Major property developments include the golf estate of Arabella, and the wine estate of Benguela Cove. Limited overnight accommodation (lodges, B&Bs and self-catering facilities) is available at Middelvlei and Fisherhaven with some located closer to the R43/R44 intersection.

The Theewaterskloof Municipality has identified the town of Botrivier as "ideally located to become the industrial hub of the Overberg".

No commercial activities take place in or on the water body of the estuary, although the developments of Arabella Country Estate and Benguela Cove have plans to set up a ferry to transport residents and guests between these estates.

5.5 Unauthorised and illegal activities

In 2004 the media drew attention to widespread poaching of marine organisms in the Overstrand area, in particular the use of illegal gill nets to trap fish in the Klein and Bot River Estuaries. Although the Overstrand IDP refers to the establishment of a law enforcement unit, and reports that this has improved the Municipality's ability to enforce the relevant legislation, anecdotal evidence points to ongoing illegal exploitation of marine living resources, general lack of compliance and an almost complete lack of law enforcement. One of the contributing factors is cited as the lack of clarity on who is responsible for enforcement of restrictions on the harvesting of fish and other marine living resources. The hand over of certain responsibilities from the former District Council to the Overstrand local municipality in 2002 further complicated the situation.

Non-compliant activities reported to the Consultant during the course of the assessment include:

» Illegal netting of fish, particularly at night, and fishing and bait collecting without permits.
» Motorboat users not adhering to promulgated use zones, speed regulations and regulated times of use.
» Dumping of solid waste, leaching of sewage from Hawston Waste Water Treatment Works (accidentally, due to power failures, or through negligence), littering, pollution through run-off (fertilisers, pesticides).

» Illegal camping by Hawston residents between Fisherhaven and Middelvlei. Permission is sought from the Overstrand Municipality and is usually granted with conditions. According to reports, these conditions are not complied with.
» Illegal driving on sand dunes and the beach (quad bikes and 4x4 vehicles).
» Blocking of public access.
» Illegal fires on beach and in dune areas.
» Unsanctioned breaching of the estuary.
» Vandalism of public toilet facilities.

In 2003 the Overstrand MARINES (Management Action for Resources of the Inshore and Nearshore Environments) was established by the Overstrand Municipality, DEAT and WWF-SA. Although their target was to prevent abalone and rock lobster poaching they were also involved in "enforcement of conservation regulations, data gathering, animal rescue service, education and awareness raising". In addition, a second project, PALMIET (Poverty Alleviation through Long-term Management of Inshore Environments for Tourism) involved the appointment of contractors to "manage and maintain access control points along the coast including slipways, picnic sites, Blue Flag beaches and tourist sites." 75% of fees from these amenities are used to fund the staff of PALMIET. An update on these programmes was not available at the time of the assessment but it appeared that these projects were no longer effective.

5.6 Riparian access rights, land claims and other prescriptive claims

At this stage no land claims have been identified in the study area. In 1992 the 'Coloured' recreational resort of Sonesta (developed in the mid 1970s) was sold by the State to private landowner/s and is now a controlled access resort and residential estates referred to as Meerenbos, Meerensee and Sandown. Sonesta was a highly valued weekend and holiday destination for the people of Hawston who are resentful about its sale and current exclusive use. It is understood that there is no land claim in this regard (the land belonged to the State). However, Hawston residents wanted to know why it was sold, at least for purposes of closure.

Prescriptive claims have also not been identified but these may yet emerge. The designation of public access areas by the Overstrand Municipality, required in terms of the ICM Bill, will need to consider existing corridors of access either based on prescriptive use or on current patterns of access. The Hawston community claim to have "traditional rights" to the resources and recreational (camping) amenity of the Vlei. Public access around the estuary is limited, with only three sites being available currently. There appears to be dissatisfaction with the way that access is sometimes restricted at these sites due to ongoing user conflict.

The details of riparian rights, regarding access to and use of the water body, have not been investigated within the scope of this assessment. In terms of national policy, supported by provisions in the ICM Bill, exclusive property rights do not extend beyond the high water mark.

5.7 Articulation of issues to be addressed in the EMP

A public meeting was held in Fisherhaven on 7 August 2008 and was well attended by interested groups and government officials. The meeting focused on issues gathering, and the outcome was satisfactory to the attendees and the consultant team who believe they had a diverse and accurate collection of well-articulated issues concerning the estuary. However, only two Hawston residents were present, and this was viewed as a significant gap in the process. The team undertook to make contact with IAPs from Hawston.

A second meeting was held in Hawston on 25 August 2008 and was attended by about 20 stakeholders. The meeting was invaluable in terms of issues gathering, and provided a more 'two-sided' set of issues revealing significant areas of conflict. A number of IAPs subsequently alleged that this meeting represented preferential treatment of one group over others. However, there were no reports tabled, in the public meeting of 7 August, of under-representation of any other group, and the Consultant therefore made a strategic decision to request an unscheduled meeting with Hawston IAPs in the interests of ensuring that all parties had the opportunity to be heard.

Records of both meetings are included in the Appendix to the Situation Assessment report. They provide a detailed record of the insights into the issues raised by IAPs, which have been assimilated into the sectoral assessments in this report.

The following are priority issues, identified in this assessment of the socio-economic environment, to be addressed in the EMP.

5.7.1 Conflict and relationship building

Sensitive ways need to be identified for dealing with the deep-rooted conflict, mistrust and suspicion between user groups (Hawston residents, members of the 'White' public and upmarket real estate and golf developments). Conflict centres around, amongst others:

» illegal camping
» illegal and irresponsible resource use
» unfair distribution of resources
» limited recreational facilities
» historical alienation and marginalisation
» breaching policy
» antisocial behaviour
» limited access to the water body
» reneging on conditions of development approval
» exclusive use of resources
» alternative livelihood opportunities
» 'deals' between conservation bodies and estate developments
» exclusive committees
» change from resource use to conservation approach to management
» pollution from runoff.
» poaching.

It was unfortunate that Hawston residents did not feel welcome to attend the public meeting held in Fisherhaven, yet at the same time it was probably a blessing. The two stakeholder groups have so many conflicting issues relating to the Bot estuary that, had they all attended the first meeting, the conflicts would have overshadowed the meeting purpose and would not have allowed for constructive issues gathering. The issues of this conflict will need to be addressed in the EMP planning process in order to broker a way forward for the management of the Bot River estuary or Die Vlei, as the residents of Hawston prefer to call the area.

The challenge now is the same as it was when Branch and Bally wrote, in 1985, "there are so many different parties interested in the estuary, with so many conflicting interests, that it is impossible to design a management policy that will satisfy everyone. But whatever policy is adopted, it should take into account both the needs of the people using the estuary and the importance of conserving the estuary in an ecologically healthy state."

5.7.2 Breaching Policy

The current policy is deemed by some to be outdated and has led to confusion regarding the 'purpose' of the estuary. At the time of preparing the assessment, there were calls from members of Hawston's fishing community for the estuary to be breached. The policy (Data Sheet 16) stipulates that breaching should not be artificially induced after August in the second year and this date had passed.

Managers recommended that the review considers a 'policy and guidelines' approach which admits a greater degree of informed discretion in the decision-making process. This would enable the consideration, amongst other things, of changing weather patterns due to climate change.

5.7.3 Alternative livelihood strategies

The majority of residents of the estuarine catchment are extremely poor and desperate for economic opportunity and skills development. Creative ways of developing livelihoods through activities at the estuary need to be investigated urgently. Opportunities for community based resource management should be investigated.

5.7.4 Education and Awareness (Environmental and Social)

Some of the conflict could be reduced through education and awareness for all at various levels and themes, through existing programmes already underway.

5.7.5 Further stakeholder priorities and concerns raised after the Draft Situation Assessment Report was made available to the public in September 2008

A full record of all written comments received from stakeholders is provided in an Annexure that accompanies this Final draft of the Situation Assessment. Corrections to be made to the Situation Assessment, including those raised at a public meeting on 16 October 2008, are recorded in the Annexure and have been incorporated into this Final draft.

There were a number of items requiring the attention of the parties who will be responsible for implementation of the EMP, and these are summarised here for the record.

- Threat to Milkwoods on the Meerenbosch side of the Middelvlei dune area, as a result of bank erosion when water levels in the Bot estuary are high. This condition was observed during late September 2008, after a high rainfall period, prior to opening of the mouth. The Milkwoods are identified as a natural heritage asset in the Landscape and Heritage Assessment (Section 6.3.6).
- Conditions that require monitoring and, where indicated, adaptive management action (i.e. to be included in the Estuary Monitoring and Evaluation Programme:
    - Horse trails in the Rooisand area, possibly being monitored in terms of the Rooisand Management Plan – impacts on dunes and bird habitats
    - Water quality monitoring is currently carried out by Overstrand Municipality (*E.coli* levels at Fisherhaven slipway and Meerensee, possibly at Kleinmond estuary) and Arabella (*E.coli* and nutrients along their frontage). Additional point was suggested as Afdaks. Samples taken from saline environments need to be sent to a marine laboratory for testing.
    - Leachate collected from the Karwyderskraal solid waste landfill site is deposited into the sewerage treatment facilities at Hawston. Discharges need to be closely monitored and tested for the presence of toxic substances.
- Spatial data on the Spatial Planning Categories indicated for the Overstrand area in the WCP SDF (2005) could not be sourced by the Consultant during the preparation of the EMP. Further effort is needed to source these and check alignment of EMP SCDF proposals and address any inconsistencies, in the course of developing the SCDF (an action to be noted for inclusion in the relevant management strategy).
- Proclamation 410 of 1969, which makes provision for the protection of flora and fauna around the Botvlei, was brought to the attention of the Consultant by one of the residents. A request was forwarded to CapeNature for clarification on its status. This issue remains unresolved, with no official clarification received to date from CapeNature.
- CapeNature reported that there is an area (“triangle”) of critically endangered vegetation types in the vacant land between Hawston and Fisherhaven. The data was not available to the Consultant and has not been taken into account in the initial terrestrial biodiversity assessment. Further effort is needed to source the data and check alignment of EMP SCDF proposals and address any inconsistencies, in the course of developing the Terrestrial Conservation Plan and SCDF (an action to be noted for inclusion in the relevant management strategies).

6. Landscape and heritage

This assessment is based on material presented in the Overstrand SDF (Data Sheet 15), literature review, GIS analysis, anecdotal information gathered through discussions, and observation during site visits conducted in April and August of 2008.

The Overstrand SDF (Final Draft, October 2006) identifies heritage management as an integral component of municipal management and highlights the need for a strategic approach in the light of limited resources and for balancing conservation against a developmental approach. The SDF acknowledges the multiplicity of heritage elements, namely individual sites, cultural landscapes, cultural diversity and living heritage (traditions, ceremonies, indigenous knowledge systems).

As an integrated management plan which aims for adoption as a component of the SDF, the EMP must consider both social and spatial aspects of heritage conservation. The strong relationship between the historical settlement of Hawston and the 'Botvlei' is an example of the social aspects. This section also addresses the spatial implications of those social aspects, as well as the cultural values associated with the landscape and sense of place.

6.1 Cultural diversity and living heritage

Evidence of the presence of Khoisan strandlopers in the coastal area between Kleinmond and Hawston is provided by fish traps and kitchen middens. Middens and semi-fossilised bones of hippopotami[3] are reported to have been found within the Rooisand Nature Reserve. The first Khoisan apparently settled in Middelvlei (now Hawston) and the indigenous Griqua people "maintained their identity in the area".

The area "Botterivier over de Hottentots Holland Kloof" was given to Daniel Malan for grazing in 1731. The name Bot originated through the trading of fat (butter) that took place with Khoi about 50 years before this. In 1818 it was granted as a farm to Daniel de Kock. The farm "Compagnes Drift" was founded in 1806 and consisted of much of the current Botrivier town area. There are reports of old wagon trails still visible above the railway line in Botrivier town.

By the mid-1800s, a small fishing community was established at Jongensklip, now known as Kleinmond, and the area fast became popular as a holiday locale for the surrounding farmers. The settlement gradually developed into a town and the first Village Management Board was established in 1948.

The town of Hawston was founded by Samson Gabriel Dyers in 1859 and named after Charles Haw. The town is proud of its rich history. Maree, Gillion and P February recently collected historical material to produce a booklet about Hawston titled, "Hawston: Tussen Berg en See. Die Geskiedenis". Strong family ties bind the current generations to their forefathers and well known surnames link individuals and their families to stories that go back many years and provide status within the community.

The Bot River estuary was used by pilots during the Second World War as a landing site for military planes adapted to landing on the water. The area's recent history is reflected in the assessments of the socio-economic environment and stakeholders, land use and recreation, and ecosystem goods and services.

6.1.1 Traditional resource management practices

The residents of Hawston have strong links to the 'Vlei' and have depended on its resources since before the town was formally proclaimed 150 years ago. Apart from harvesting, people used the lagoon's protected waters to teach younger members about fishing and prepare them for going to sea. Fishers consider themselves the custodians of traditional knowledge on the management of the mouth and the fishery resource.

[3] www.ioltravel.co.za/article/view/3695773; www.overberginfo.com; www.abalonevillage.za.net;

International literature on coastal ecosystem management emphasises the value of traditional or customary knowledge systems and provides guidelines for its integration with western-developed planning and management systems. Kay and Alder (2005) stress the importance of enlisting the assistance of relevant experts, such as sociologists and anthropologists, in this process, in order to obtain an understanding, and record, traditional knowledge on biophysical characteristics, customary rules and decision-making hierarchies for exploitation of resources, and the role of religious and spiritual beliefs.

6.1.2 Cultural traditions

For over 100 years the residents of Hawston have enjoyed family outings and camping holidays at 'die Vlei', particularly over the festive season. An annual tradition for many people associated with Hawston was displaced when the formerly extensive public facilities for camping, established in 1975, at Sonesta were privatised in January 1992.

The activity was displaced to the under-serviced area referred to as 'Middelvlei State Ground'. This has been a source of contention and even litigation between campers and residents of nearby Fisherhaven who have called upon the Municipality to enforce a by-law that prohibits camping in the estuarine margin without a permit. The area has no infrastructure to support camping or even day visits and, as a result, the impacts on the environment are significant. The situation is exacerbated by the use of off-road vehicles in the dunes and illegal dumping of building rubble and waste along the access road.

Camping at the Vlei is considered by its protagonists as an activity that qualifies for 'living heritage' status, and by others as the stuff of nostalgic memories, something that is no longer possible in modern day conditions. It is a situation that begs a solution achieved through a participatory planning process and which may involve identifying alternative locations and/or developing facilities.

The Vlei was also used by local churches in Hawston for baptisms. Since the destruction of ablution facilities at Seaway Corner, these practices have relocated to the public slipway at Fisherhaven, to other locations, or have ceased.

6.2 Cultural landscapes and heritage sites

6.2.1 Pre-colonial sites

The coastal zone is a significant archaeological resource because remnants from pre-colonial times are well preserved in this environment, and shell middens provide valuable information on coastal resources used by strandlopers during those times. Sites have generally been revealed accidentally as a result of anthropogenic disturbance rather than by intent, and there is an absence of comprehensive, reliable and consistent data on the location of palaeontological and archaeological sites. "Unchecked property development", and the use of off-road vehicles, informal footpaths, braai and picnic sites, in coastal dunes and strandveld areas are listed in the SDF as threats to heritage sites in the coastal zone. The inclusion of Heritage Impact Assessments in EIAs is identified as the primary mechanism for addressing this.

This has particular relevance for the SDF proposal for urban extension into the Middelvlei dunefield area, the use of the Middelvlei 'State Ground' for public recreation purposes, the impact of horse trails in the Rooisand Nature Reserve and the proposed development of a visitor and environmental centre in the Reserve.

6.2.2 Colonial sites

There are many colonial era structures and buildings of heritage importance in the coastal zone in and around Hermanus and Kleinmond, particularly relating to early harbour sites. None of these are located within the study area.

The only shipwreck catalogued in the Sandown Bay is the Pisa, an Italian wooden sailing vessel (barque) which sunk on 18 August 1879.

6.2.3 Sandown Bay, Kleinmond

The interface between Kleinmond town and Sandown Bay obtains its sense of place from its informality. It is a popular destination for surfers, despite the rip current in the deep channel alongside the rocky shoreline, which is popular with fishermen (www.wavescape.co.za). The combination of these attractions with the safe swimming and boating environment of the lagoon make it a good all-round destination for families.

The SDF identifies the significance of this area as a cultural environment based on its historical / recreational role. The unique village character of Kleinmond and the sense of place conferred by the combination of riverine / estuarine conditions and sandy beach are also highlighted.

These considerations provide strong design informants for the proposed tourism / commercial leisure facilities identified in the draft IDP (2008-09) (Figure 8) as a project for development by the municipal development agency.

Figure 8 Site map for proposed development at Sandown Bay (extract from Draft IDP 2008-09 Revision)

6.2.4 Free-roaming horses

There is a small herd of about 20 free-roaming horses that live at Rooisand and Lamloch. They were originally farm horses that were set free in the area about 40 years ago and have adapted to living in marshy conditions (Figure 9). An assessment of their condition and habits (van der Merwe, 2006) concludes that they are healthy, although in-bred and pose no threat to the environment as long as their numbers do not increase beyond 30 odd.

The horses have become a tourist drawcard and one of the attractions for users of the commercial horse trail through this area. The degree of disturbance to vegetation in the path of the trail used for the outrides is significant, a threat in terms of potential blowouts in the dune environment. A programme for monitoring and managing use of the trail within limits of acceptable change should be considered. The development of a visitor and environmental centre at Rooisand with increased pedestrian and vehicular traffic may intrude on the tranquil existence of the free-roaming herd. Site planning for such a development requires consideration of alternatives and their impact on the horses, and ongoing monitoring if development proceeds.

Figure 9 Free-roaming horses in the Rooisand area

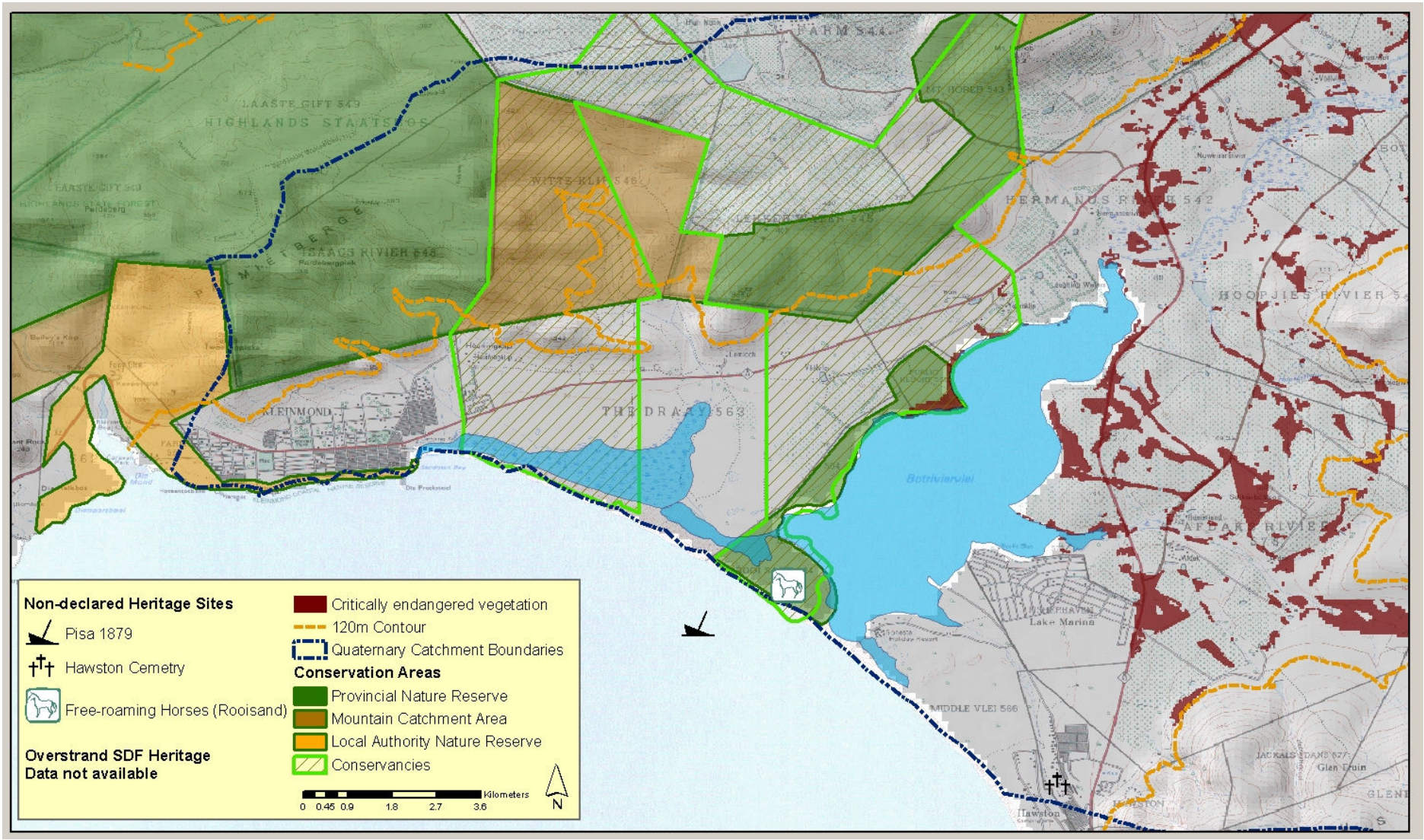

Figure 10 Spatial aspects of heritage conservation

6.3 Natural heritage

6.3.1 Bird habitats and breeding areas

The Bot River estuary is an important habitat for water birds and attracts considerable numbers of bird-watching tourists. Application has been made for Ramsar status but has not been successful to date due to the lack of formal protection of avian habitats. Provision for bird sanctuary areas has been made in the proposed amendments to the municipal by-laws relating to recreational use of the estuarine environment.

6.3.2 Nursery area for marine fish

The combined expanse of the Bot and Klein River estuaries is estimated to contribute 40-50% of the estuarine nursery habitats required for marine fish species along the coast between Cape Point and Breede River (van Niekerk et al, 2005, citing Lamberth and Turpie, 2003). The zoning regulations for the Bot River estuary provide for certain zones where high-speed sporting activities are prohibited but there are no spatial provisions relating to harvesting of marine living resources. Enforcement of regulations relating to estuary zoning and harvesting of marine living resources is inadequate, and gill-netting is practiced in contravention of regulations. Possibly of greater significance to the nursery are the long periods of closed mouth conditions and the reduced flow of freshwater into the estuary, which have impacted on the migration of fish between the sea and the estuary. The heritage value of the nursery area is severely threatened.

6.3.3 Rooisand and Lamloch Swamp

A large portion of the Rooisand wetland, and the entire extent of Lamloch Swamp, are on privately owned land, much of which is not managed as a conservancy (Figure 10**).** The Millenium Ecosystem Assessment (2005) established that, on a global scale, freshwater wetlands are being drained to give way to agriculture and coastal marshes are disappearing as a result of increasing population pressure. Their depletion would mean the extinction of a range of species that are dependent on these very special and irreplaceable habitats and a huge loss to the biodiversity of the planet. The imperative of securing conservation of the world's remaining coastal marshes is indubitable.

6.3.4 Critically endangered terrestrial habitats

As a signatory to the international agreement on the Conservation of Biological Diversity, South Africa has embarked on a process of assessing and mapping areas in terms of their contribution to national targets for the conservation of habitats. Good progress has been made on the terrestrial habitats, defined in terms of vegetation types, making it possible to identify those terrestrial areas within the study area that should be conserved because they represent critically endangered vegetation types. The loss of habitats is the main contributor to species extinction and loss of biodiversity.

6.3.5 Dynamic process areas

The sandy beaches on the shoreline of the sea, the bare dunes and successionally vegetated dunes, as well as the bare margins of the estuary, the water body and the near-shore environment in the sea, are all components of a system that constantly removes and replenishes sand within the littoral active zone. Interruptions to the flow, as when dunes are artificially stabilised, causes impoverishment of the sand supply to another location along the coast. Similarly, disturbance of vegetated dunes can cause them to become unstable and behave as active components of the sand movement system. These areas are classified as 'sensitive coastal areas' and are important and often overlooked elements of our natural heritage.

River corridors have been identified as important coast-to-mountain corridors in the Western Cape. Besides the transportation of sediments, nutrients and organisms in the water, riverine corridors provide opportunities for linkages between biological communities, and migration of macrofauna and, on a more subtle and evolutionary scale, for the 'migration' of plant species. These are particularly important features in response to climate change. Riparian corridors are thus an important mechanism for supporting the sustainability of the natural heritage.

6.3.6 Milkwood trees

Protected milkwood trees are found at various localities around the estuary. Permits are required in terms of the National Forests Act (1998) for trimming or removal of these trees.

Groves of milkwoods in the Paddavlei extension of the Botvlei are identified in the SDF's heritage assessment. Their protection needs to be supported in the EMP. Current plans to install a piped stormwater system in this area are of concern as this would have significant impacts on localised catchment hydrology, and hence the vegetation – including the milkwoods.

On the east bank of Meerenbosch – south of Fisherhaven – bank erosion is undermining stands of milkwoods at the water's edge, and residents of Meerenbosch are seeking advice on how best to protect the trees.

6.3.7 Protected areas

Declared natural heritage sites are shown in Figure 10 and further described in assessments of land use and terrestrial biodiversity. Conservancies established on privately owned land are also depicted. CapeNature's Stewardship Programme provides incentives and technical support to land owners. Land to the west of the Bot River also falls within the transition and buffer zones of the Kogelberg Biosphere Reserve (Figure 25) but does not, as yet, enjoy formal protected status.

6.4 Sense of place – Botvlei, including Lamloch Swamp and Rooisand

The expanse of the water body – one of the largest estuaries in the Western Cape – combined with the low-lying areas that make up the Vlei, offset by the layered mountain backdrop, are particularly strong contributors to the sense of place of the estuarine environment. The lagoon is roughly 2km at its widest point (near the coast), stretches 7km back from the coast and, when full (MSL +2m), the main lagoon covers approximately 13.6km^2 (Fromme, 1985). In Turpie & Clark (2007), the Bot/Kleinmond system was awarded a "high" score for scenic and existence value.

For the most part, due to the flatness of the valley terrain, the inaccessibility of the water's edge and the dense alien growth in some areas, the water body is not visible from the main road (R43 and R44). Its value is most apparent from the edge of the Vlei, hence the high value awarded to waterfront properties, and also from the vantage point of people recreating on or alongside the water body. The Rooisand area, Lamloch Swamps, and dune areas on the seaward side, represent a relatively untrammelled environment, due to the distances involved in accessing them by the only legal means – by horse or on foot. The experience is heightened by the visual screening effect of the low dunes. Indigenous vegetation in the estuarine margin is short and scrubby and does not present a significant visual obstruction (Figure 11). Views from higher elevations around the estuary offer a high value sense of place experience.

Figure 11 View across *Die Vlei* from Rooisand, looking east towards the Onrustberge and Babilonstoring peak on the left

As a consequence of this particular combination of factors –

- There is a high demand for waterfront property which would, however, be undermined if views are further visually impacted by development. The draft Coastal Zone Policy for the Western Cape promotes an approach of allowing development on one side only of a river or lagoon. This is

supported by the target of a 50% undeveloped margin proposed for the Bot/Kleinmond system in the Estuaries Conservation Plan (Turpie & Clark, 2007).

- The main roads have not attracted 'Scenic Route' status in the SDF. In parts they are proposed as 'Scenic Link Routes' (passing through the town of Kleinmond and the proposed urban extension area of Fisherhaven / Hawston). Visual assessments must be carried out as part of the EIA for development proposals in the vicinity of scenic routes.
- From the low elevation vantage point of users on and at the edge of the water body, sense of place can be protected by maintaining a margin of untransformed vegetation on all riparian frontages. This also serves to filter contaminants from surface water runoff.
- The maintenance of a riparian reserve of untransformed or rehabilitated vegetation between mudflat and development areas can also serve to mitigate the perceived negative impact of exposed mudflats during low water level periods. Mudflats are considered by residents to be unsightly but they are an integral element of the Vlei ecosystem. Stabilisation of the edges of the Vlei should be avoided, for ecological reasons and the consequential impacts of disturbance on visual quality.
- Consideration should be given to limiting development on the mountain slopes that flank the valley, in order to mitigate impact on the sense of place, as well as the impact of 'light pollution' on the nocturnal landscape. The 120m contour line is highlighted in Figure 10.

The Municipality is planning to develop a series of overlay zones as a means of integrating heritage proposals into its planning scheme and land use management system (Data Sheet No.15). A similar approach could be adopted for the estuarine environment.

6.5 Concluding notes

The consideration of heritage issues in the EMP provides a mechanism for the integration of social sustainability into ecosystem management. Through the consideration of cultural and natural heritage practices and sites, it becomes possible to view the estuarine environment as the 'home' to a rich diversity of interests which, through visionary management hold the potential to be realised as complimentary, rather than exclusionary or conflictual, relationships.

The Bot / Kleinmond estuarine system, also known as *Die Vlei*, extends across a large area. The challenge in formulating a management plan is to find space within that to accommodate the interests of all IAPs. Heritage considerations are an important driver in this regard.

7. Land use, recreational use and infrastructure

Chapters 9 and 10 of the assessment report address issues emanating from catchment-wide land use and its implications for estuary management. This chapter focuses on current and emerging land use in the immediate environment and its implications for management and spatial planning at the local level. It also addresses the recreational use of the estuarine water body and management thereof.

The assessment contributes to the formulation of an EMP Spatial Framework for conservation and development within the estuarine management area which aims, ultimately, for integration into the Overstrand Municipality's Spatial Development Framework. The Overstrand SDF (2006) makes reference to preparation of a Rural Development Framework as a prerequisite for establishment of the proposed Bot River Rural Development Area. The EMP is also referred to by the Municipality as a Sectoral Plan.

The first part of the assessment broadly addresses current investment, land use and management practices in the study area, followed by future plans including the proposals contained in the Overstrand IDP (Draft, 2008) and SDF (2006). Finally, the report summarises key issues and makes recommendations for their implications in the management of the estuary. The assessment was constrained by the unavailability of spatial zoning information on both urban and rural components of the study area and certain datasets for Overstrand SDF proposals (specified in Chapter 4).

7.1 The current situation

A qualitative description of land use in the estuarine margin, starting in the west at Kleinmond and ending at Hawston in the east, is followed here by a quantitative analysis of land use by category. Uses have been spatially located in Figure 12.

- The Kleinmond estuary provides the "edge" that gave rise to Kleinmond as a settlement that subsequently grew into a coastal town. The interface is informal and low-impact, providing a popular attraction as an uncommercialised urban beach frontage.

- The pedestrian bridge across the estuary reportedly limits flow during flood conditions due to the stacking up of debris against the bridge supports. This would have an impact on the estuary's capacity to open naturally and would result in raised water levels in the area behind the obstruction.

- Only 20% of Kleinmond is served by a waterborne sewerage system, the remainder being septic tanks and conservancy tanks (IDP, 2008-9). The water treatment works requires upgrading to service additional demands. Location of sewerage treatment works was not established during the course of the assessment.

- An extensive area on the seaward side of the R44, between Kleinmond and the Bot River estuary, is undeveloped privately owned land (Farm De Draay 563) referred to as the Lamloch swamp and Rooisand.

- The Rooisand Nature Reserve which occupies ±60% of the western frontage on to the lagoon is a designated Provincial Nature Reserve administered by CapeNature. Public access to the public recreation area within the reserve is not monitored and, at the time of the Consultant's first field trip, had been blocked by a physical barrier, reportedly a temporary measure until such time as a management mechanism is established.

- Behind the Reserve, an extent of privately owned land (Farm De Draay 563) shown on the Surveyor-General maps as being under commercial forestry is now infested with invasive alien vegetation.

- Land to the north of the Reserve is managed in favour of a controlled access residential and golf course estate – Arabella – which is also the site of a resort hotel. The Estate installed and manages a private sewerage treatment plant on the northern corner of the property, reportedly well maintained, as well as an golf course designed to meet international championship standards.

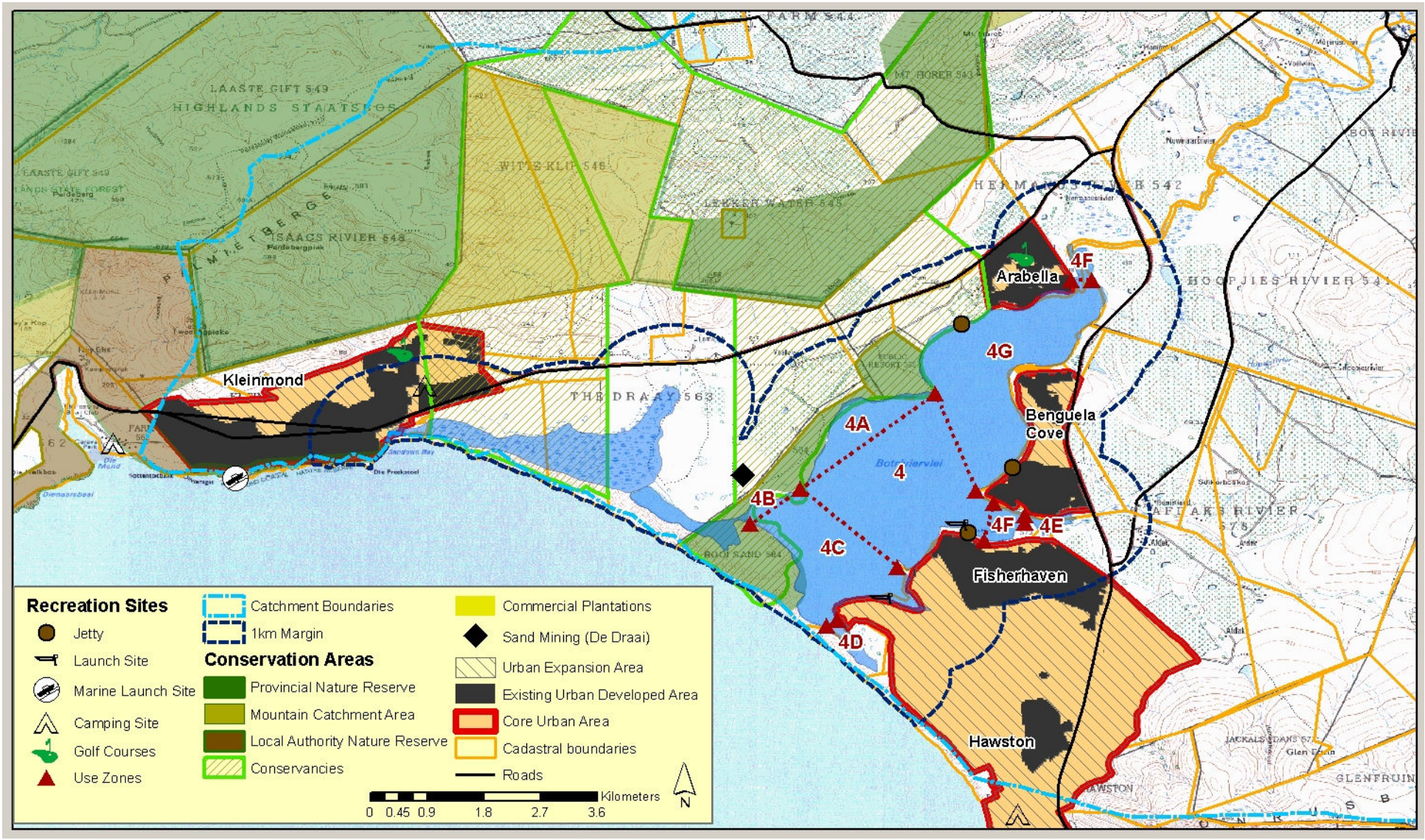

Figure 12 Land use in the estuarine environment

- At the head of the estuary, inland from the lagoon, the river is flanked by agricultural lands. Up river, within Overstrand Municipality, land use classification specified in the Spatial Planning Categories section of the Overstrand SDF is predominantly Core Agriculture, with Conservation 2 applied to hydrological process areas. The maintenance of a riparian reserve requires attention in the EMP. The R43 road bridge crossing just over 1km above the head of the lagoon cause disruption to water flow when a temporary gravel wall was built during its construction phase and never fully removed (Willis, 1985). The bridge was identified by IAPs as a source of risk relating to spillage. District level disaster management planning needs to take this into account.

- The eastern frontage of the estuary is mostly developed for residential purposes, with the exception of some agricultural land at the head of the lagoon, and the Middelvlei State Ground south of the Fisherhaven urban area.

- The northernmost, and largest frontage, of these is Benguela Cove, a low-density controlled access themed estate with an associated vineyard. Environmental management is reported to be good. The estate is linked to the water-borne sewage network serviced by the Hawston treatment works. A floating dock has recently been constructed.

- The waste water treatment works at Hawston is operating at maximum capacity. Upgrading is required, and leachate from the Karwyderskraal landfill site is disposed of here. Its location relative to surface flows, and possibly groundwater, gives rise for concern (Figure 13).

- South of the Afdaks River is Fisherhaven, formerly referred to as Lake Marina, an established township of privately owned erven ranging between 900 to 1500 m^2 in extent. The area is serviced by piped municipal water which is in poor condition. There is no sewer main. Disposal is by conservancy tanks serviced by tankers. The north-facing frontage of Fisherhaven, on to the entrance of the Afdaks River into the estuary, is the site of the only public boat launching site on the estuary, at the Lake Marine Boat and Yacht Club. The Club is reportedly the only structure on the estuary that is vulnerable to 50-year flooding.

- Undeveloped land to the south of Fisherhaven is referred to as Middelvlei State Ground. It is one of the few remaining areas of unrestricted public access to the lagoon edge. In the past 5 years this area has been the site of confrontation between festive season campers, environmentalists and the municipality. Vehicular access to the estuary has been blocked at times by temporary barricades. The unmonitored access road is used for illegal dumping of solid waste.

- The stabilised dune field south of Fisherhaven, west of Hawston, referred to as Middelvlei, is largely undeveloped with the exception of an area at the furthest north-westerly extent, which previously was a camping site referred to as Sonesta. The facility was subsequently sold and developed as a controlled access resort and residential estates referred to as Meerenbos, Meerensee and Sandown. There is an informal slipway in this area.

- The Middelvlei dune field is bordered on the north by a minor water course / dune slack, and on the furthest seaward edge by the remnant of the former mouth of the estuary, now a bird sanctuary. There is a pedestrian bridge linking the dune field with the beach, for the convenience of beachgoers and surf anglers.

- Access for legitimate public recreation on the Bot River estuary is limited and facilities are near to non-existent. It is a subject of conflict within the resident community and a challenge for the Municipality.

- There is an area-wide shortage of treated water supply capacity, which imposes constraints on use during peak season and for future development in all areas.

An analysis of land use in broad categories within the estuarine margin is provided in Table 9. A margin of 1km from the provisional high water mark was applied for the purpose of the analysis.

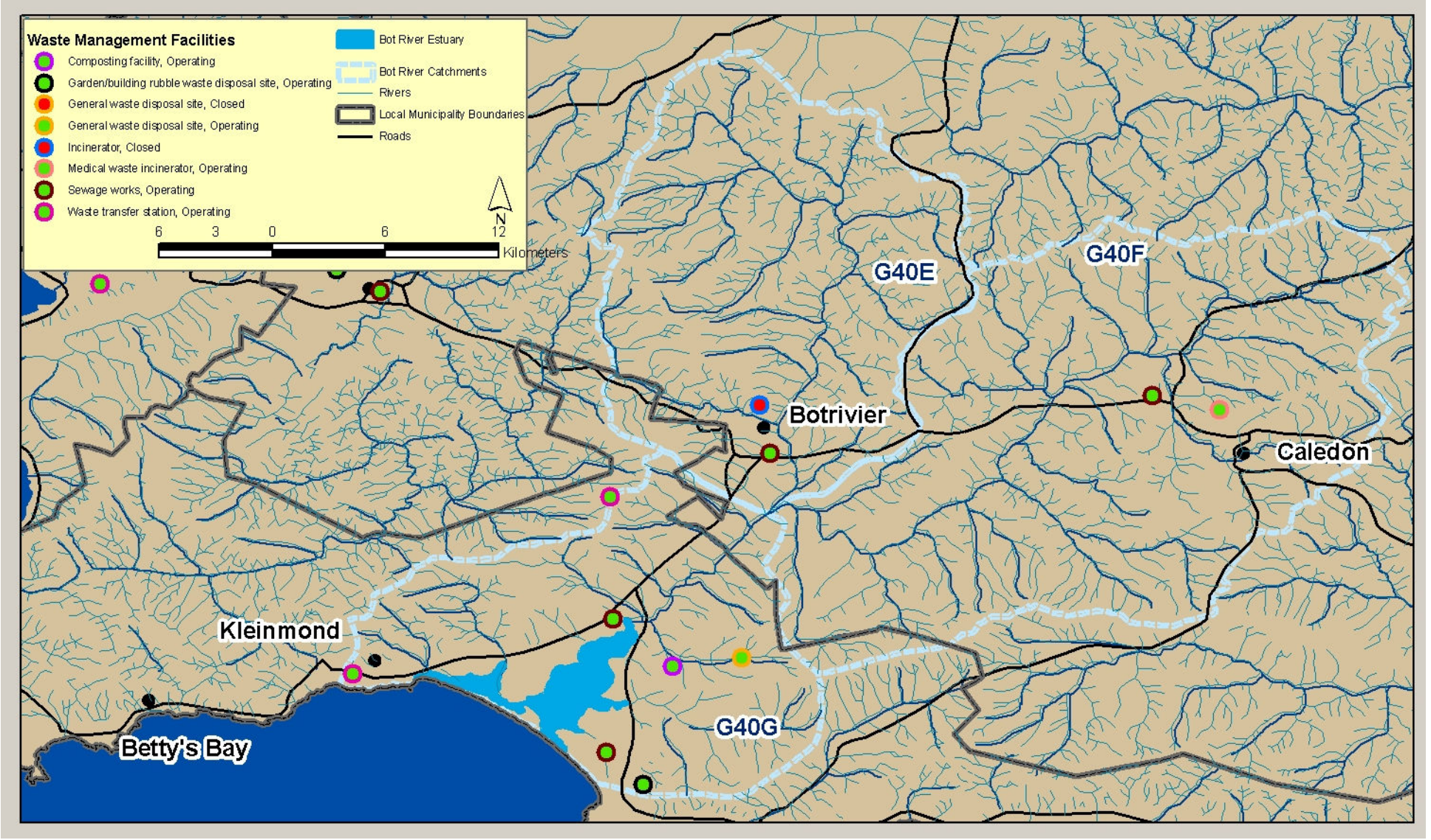

Figure 13 Catchment-wide disposal sites [Note: Kleinmond sewage works, west of the Palmiet estuary, is not shown]

Table 9 Land use within the estuarine margin – current

Use category	ha	100%	Category definition
Existing developed areas	502	± 16%	Areas within the urban edge, excluding areas proposed for urban extension and related open space areas (Overstrand SDF, Final Draft, 2006)
Estuary zone	178	± 6%	The estuarine water body and swamp areas up to a provisional high water mark generated from the 'special habitats' dataset
Plantations	0	± 0%	Commercial forestry land (pine)
Cultivation / transformed	429	± 14%	Transformed portions of remaining lands
Protected area	246	± 8%	Remaining lands situated within declared protected areas (Rooisand Provincial Nature Reserve)
Untransformed, unprotected	1,766	± 56%	Remaining untransformed lands

The descriptive report on recreational and commercial use of the estuary and its resources presented here is drawn from a range of secondary sources and information provided by stakeholders.

- The water surface area of the Kleinmond estuary is small, and use is limited to rubber dinghies and canoes in holiday season, linked to the attraction of the popular Blue Flag beach nearby.
- Bird watching is a popular activity at the Bot River estuary, supporting the use of hiking trails on the western shore. A herd of free-roaming horses are an added attraction in the Rooisand area, and an equestrian centre based south of Arabella offers outrides that view the herd and access the beach in this area, causing noticeable disturbance of the vegetation along their route.
- Limited public access and, until recently, limited development providing private access, to the Bot River estuary has meant limited recreational use of the water body for recreational angling and boating (sailing dinghies and power boats, including water skiing). There is one public launch site, at Fisherhaven. Kayaking and canoeing is popular. In terms of the Municipal by-laws, craft that are less than 3m in length do not require a permit for use and can be launched anywhere.
- For the most part, the edge condition of the estuary does not support shore angling apart from Seaway Corner in Fisherhaven. There used to be a commercial estuarine fishery that made use of gill nets. Over the years the number of commercial licenses issued has reduced, with only two commercial permits issued in 1971, and none at the current time.

The estuarine-based fishery is further discussed in Chapter 8, and in Chapter 5 where there is also an inventory of the groups who use the estuary for recreational purposes.

7.2 The emerging situation

The sources for this report included the Overstrand Municipality SDF (2006) and information supplied by municipal officials regarding developments under consideration. These are depicted in Figure 14. GIS datasets for proposed SDF 'Urban Extension' areas within the urban edge were not available. For the purpose of analysis, a spatial category referred to as 'Urban Expansion' was generated, occupying the gaps between the existing urban footprint, based on landcover data, and the Urban Edge as shown in the Overstrand SDF (2006).

- At Kleinmond, a 'Community Facility' site (SDF, 2006) on the town centre's prime frontage to the estuary and Sandown Bay is proposed as a tourism/commercial leisure facilities project to be developed by the Overstrand Development Agency.
- An approximately 60 ha extension of the urban area to the east of Kleinmond Golf Course is proposed in the SDF, assumed to be for 'other' housing . Extension of the sewerage system is specified as a pre-requisite to any new development (SDF, 2006). Budget has been allocated for treatment works in 2010-11. An application for development of Kleinmond Estate (residential) has been lodged with the municipality.

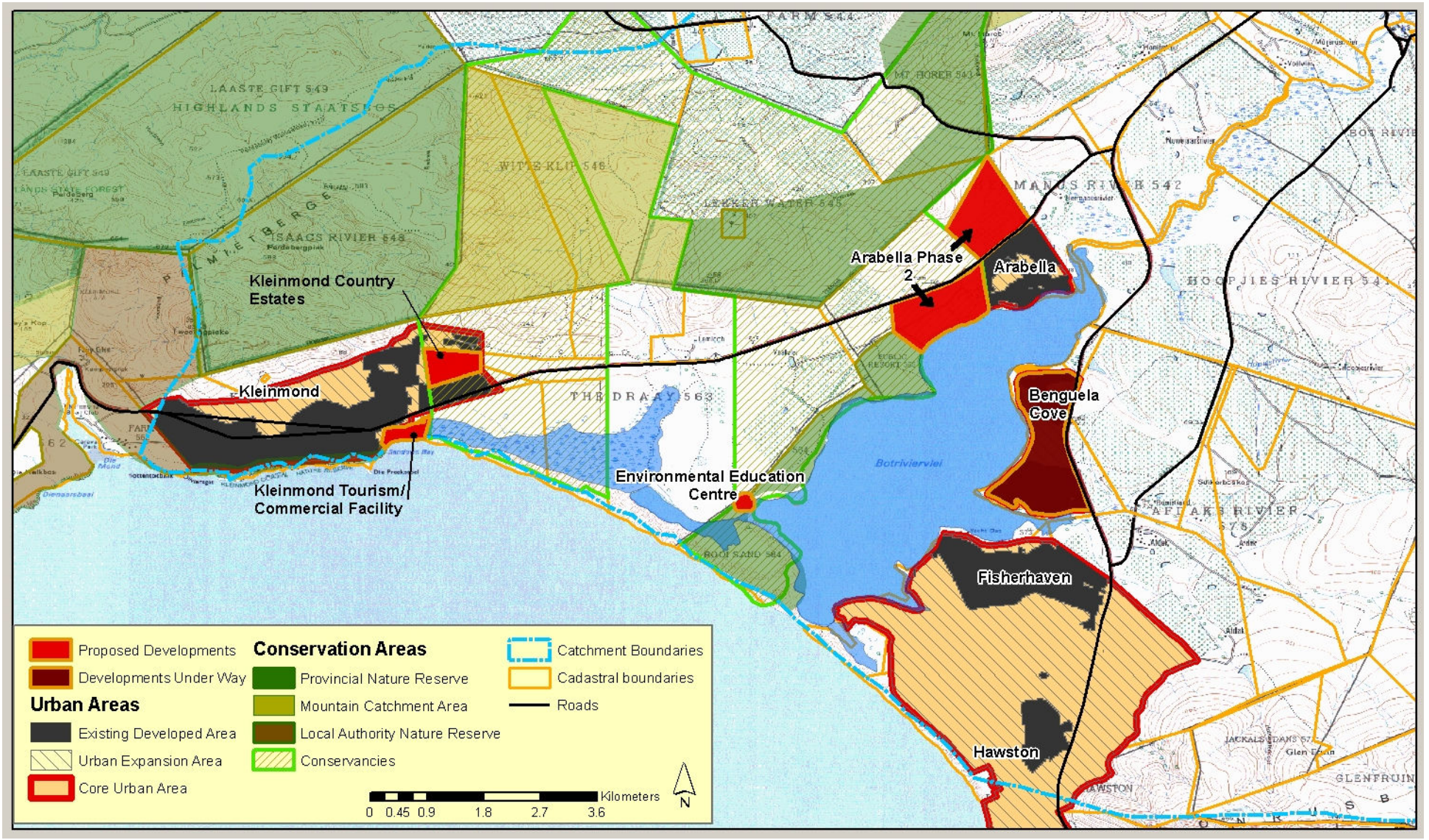

Figure 14 Emerging developments in the estuarine environment

- The phasing out of conservancy- and septic tanks is proposed in the IDP, due to concerns about groundwater pollution, but it is considered unfeasible to implement conventional solutions everywhere. "Alternative and innovative methods must be found" (IDP, 2008-9).

- Arabella Estate is reportedly negotiating with CapeNature regarding the management of the Rooisand Nature Reserve. The privatisation of the management function would result in an entry fee being charged for access to the Nature Reserve.

- An application has been lodged for development of Phase 2 of Arabella Estate on Portion 1 and Rem of Portion 3 of Farm Hermanus River No. 542.

- Construction of private homes is ongoing at Benguela Cove.

- There is no reference in the SDF to the conditions for development and environmental management, including municipal service provision, within the controlled access estates, which represent extensive land holdings within the estuarine margins.

- There is a budget allocation of R100,000 reflected in the IDP for the upgrading of the slipway at Fisherhaven in the current year 2008-9.

- Budget of R4.5 million is allocated in the current year 2008-9 for stormwater management at Paddavlei in Hawston, which links to the estuary via Skilpadvlei. A Basic Assessment is being undertaken and a tender for supply of the pipes has been advertised.

- The SDF identifies the Hawston / Fisherhaven area as having potential to become a significant growth area within Greater Hermanus and the sub-region. This is in line with the Provincial SDF's identification of Hermanus as one of the Province's leading towns in terms of its potential for growth. The SDF proposes that this is a principle to be promoted, with due regard to the conservation of the natural and cultural environments, promoting Fisherhaven / Hawston as a tourist destination and maintaining the natural corridors of the drainage and wetland system

- The area proposed for urban extension in the SDF (2006) would include accommodation of the backlog of subsidised housing for Hermanus – 15 hectares is required for 750 units – and the associated social facilities and an internally accessible CBD, to be provided as an integrated development project. The total urban extension area in the Hawston / Fisherhaven part of the Bot River estuarine catchment is estimated to be in the order of 850 hectares, as follows (refer Figure 16):
    - » Approximately 100 ha infill development – located to the north of Fisherhaven and in the area between Fisherhaven and Hawston. A natural open space area of ±10 ha divides the proposed urban extension areas.
    - » Approximately 400 ha in the Middelvlei area, between Hawston and the estuary.
    - » Approximately 350 ha on the landward side of the R43.

- An unconfirmed report of a proposed aircraft landing strip was received, apparently rejected because of adverse prevailing winds and proximity to the mountain.

- The Estuaries Conservation Plan (Turpie and Clark, 2007) proposes that 50% of the margin of the estuary should be retained as untransformed land.

With regards recreational activity and use of the water body, it can reasonably be projected that intensity of use of boats and other water-based craft, and hiking, will increase proportionately to the growth of residential estates having frontage on to the estuary, described above. Improved access to the estuary, the development or upgrading of recreational facilities, and marketing of the area as a tourist destination, would further increase intensity of use. The application of recreational zoning, restriction on the numbers of users, and enforcement, will require management attention.

The Estuaries Conservation Plan (Turpie and Clark, 2007) proposes that 33% of each estuarine habitat type be captured within an Estuarine Protected Area extending over 50% of the water body. Current proposals for the amendment to estuary zoning regulations make provision for 'no-go' bird sanctuary areas but their extent falls well short of 50% of the lagoon area (Figure 12).

The extent and implications of the proposed urban extension in the Bot River Estuary environs is significant. Table 10 provides an analysis of proposed land use in the estuarine margin, and Figure 15 shows the comparison between the current and emerging situations, as presented in Table 9 and Table 10. The expansion of urban development areas into currently untransformed, unprotected areas will result in an 88% marginal increase on the current footprint.

Table 10 Land use within the estuarine margin – emerging

Use category	ha	100%	Category definition
Urban development areas (Core Urban Areas)	940	± 30%	Areas within the urban edge, including areas proposed for urban extension and related open space areas (Overstrand SDF, 2006)
Estuary zone	178	± 6%	The estuarine water body and wetlands up to a provisional high water mark generated from the 'special habitats' dataset
Plantations	0	± 0%	Commercial forestry (pine)
Cultivation / transformed	396	± 13%	Transformed portions of remaining lands
Protected area	246	± 8%	Remaining land situated within declared protected areas (in this case, the Rooisand Provincial Nature Reserve)
Untransformed, unprotected	1,361	± 43%	Remaining untransformed lands

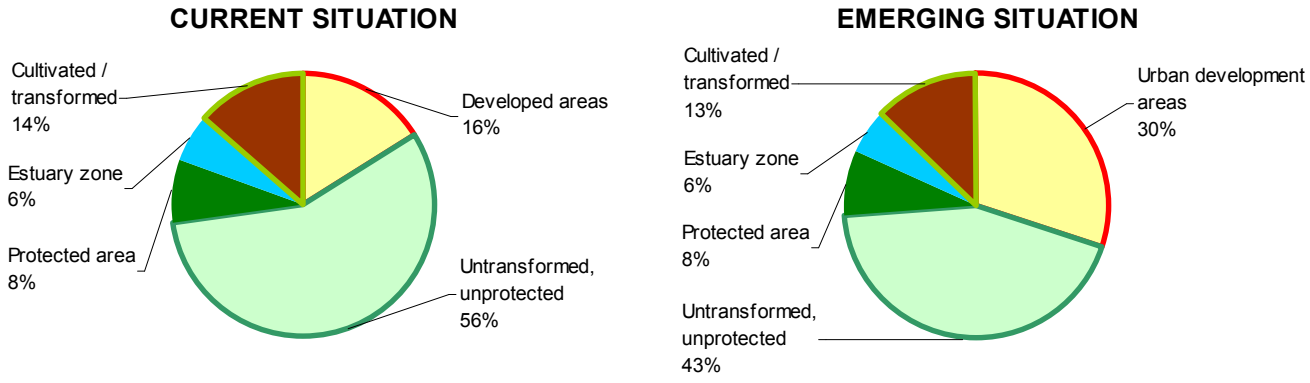

Figure 15 Comparison of current and emerging land use within a 1km estuarine margin

7.3 Key issues for preparation of an estuary management plan

The following emerge from the assessment as priority issues requiring attention during the course of preparation of the EMP, subject to confirmation of the accuracy of information used in the assessment.

7.3.1 Proposed urban extension into Middelvlei dune field

The area under consideration is the diagonally cross-hatched ovoid shape on the left, on the coastal frontage, in Figure 16.

The Middelvlei area is, in geological terms a relatively young dune barrier which, prior to the 1930s, was mobile and migrating along the coast in an easterly direction. Aerial photographs show the area gradually being covered with vegetation after the Department of Forestry embarked on policy of stabilising dune fields in the early part of the twentieth century. The

back barrier dunes are sparsely vegetated, hummocky dunes up to 10m high, orientated perpendicular to the coast and subject to alongshore and/or offshore prevailing winds. (Van Heerden, 1985). Stabilisation was achieved through planting "introduced" species such as *Acacia cyclops* (Rooikrans) and *Ammophila arenaria* (Marram grass) (Bally, 1985).

Disturbance involving removal of the vegetation from the Middelvlei dune field – e.g. construction – will create the conditions for the dunes to once again become mobile. Further, should development go ahead in parts, including drainage of areas such as Paddavlei as proposed in the current financial year, the impact on the water table could result in changes in the vegetation and destabilisation of remaining undisturbed areas. Paddavlei and the associated drainage system between Hoek van den Berg and Bot river estuary is identified in the SDF as an ecological corridor. The current stormwater management project should be carefully assessed.

Destabilisation of the dune field will have significant, potentially long-term, and costly, impacts, including the ongoing encroachment of sand, into the established neighbouring areas of Hawston, into stormwater drains – leading to constant blockages – and an increased rate of migration of the dune barrier into the estuary with consequent impacts for mouth opening and other aspects of the estuarine system.

The EMP needs to highlight the magnitude of the implications of developing or otherwise disturbing Middelvlei dune field. A precautionary conservation-orientated approach to the management of this area is recommended. If IAPs require further evidence, a full EIA must be undertaken, which includes specialist studies of the geohydrological and barrier/estuarine processes, and case studies of developments undertaken in similar environments (e.g. housing development at Vale Farm near Gonubie in the Buffalo City Municipality, Eastern Cape).

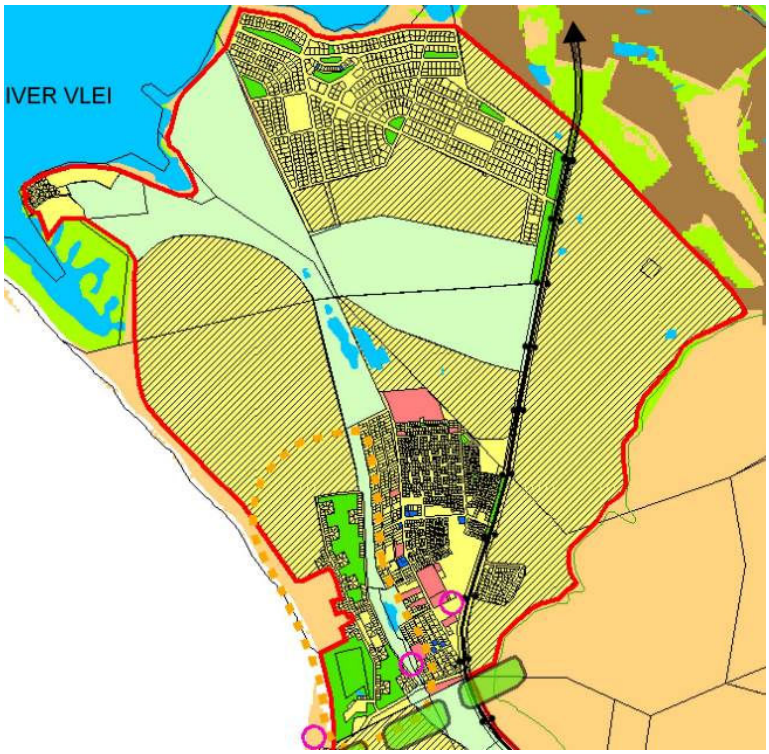

Figure 16 Extract from Plan 13 of Overstrand SDF (2006): Spatial proposals for Fisherhaven / Hawston

The diagonally hatched areas are the category referred to as Urban Extension. The solid red line is the proposed urban edge.

7.3.2 Planning for socio-economic gradients

The SDF calls for the vacant land between Hawston and Fisherhaven to be developed to its full potential, with varying densities and a balanced land use mix, including land uses that ensure that it is not a dormitory area to Hermanus. Reference is made to a CBD that can be accessed internally without recourse to the R43. Spatial proposals for infill development show the retention of a Natural Open Space 'buffer' between Fisherhaven and Hawston (Figure 16).

Guidance is provided in the Provincial Spatial Development Framework (2005) regarding application of the socio-economic gradient principle, which provides an approach to integrating communities of different socio-economic status via a high-density commercial industrial core

supported by diminishing densities of residential development (Chapter 8 p37). This approach could potentially offset the loss of urban extension land proposed on the Middelvlei dune field and provide a more effective integrating mechanism than is currently proposed for Hawston / Fisherhaven, giving effect to the SDF principle of "efficient and integrated planning".

By thinking of the open space as an opportunity for development of a shared commercial precinct, real possibilities for integration become possible.

7.3.3 Private ownership of land that qualifies as coastal public property

The Lamloch swamp and Rooisand areas are integral components of the Bot River / Kleinmond estuarine system and qualify, by definition in the ICM Bill, as coastal public property subject to the provisions relating to same. They are almost wholly contained within the original cadastre described as De Draay Farm, which is privately owned. There may be other areas within the system that demonstrate the same conditions. Public coastal property must be "used, managed, protected, conserved and enhanced in the interests of the whole community" (ICM Bill, 12a), present and future generations included.

The Bill provides for the procurement of such land by the State in consideration of the "importance of ensuring the natural functioning of dynamic coastal processes and of extending the coastal boundaries of coastal public property to include the littoral active zone and sensitive coastal ecosystems, including coastal wetlands" (ICM Bill, 27c).

The EMP, in accordance with the objectives of Spatial Development Framework planning, must provide clarity on the implications of the ICM Bill with regard to coastal public property.

7.3.4 Use of coastal frontage sites

Development of a "tourism/commercial" leisure facility at the beach/lagoon frontage at Kleinmond is identified in the current IDP (Draft – 2008-09) as a project to be undertaken by the Overstrand Development Agency. Kleinmond's beach enjoys Blue Flag status. Efficient maintenance and the unstructured town–beach–lagoon interface all contribute to its popularity. South Africa's coast is littered with evidence of inappropriate design responses to environments such as this. The project represents an opportunity to ensure that intervention delivers improvements on the current condition, that are sustainable in the long-term, with due regard to the recommendations and strategies of the Provincial Climate change response strategy and action plan. The EMP must provide mechanisms for guiding an appropriate response for developments such as this.

7.3.5 Authorisation of structures and launch sites

In terms of the ICM Bill (2007), a lease must be applied for in respect of any structure located on coastal public property. This will apply to the slipway and jetty at Lake Marine Yacht and Boat Club in Fisherhaven, the slipway at Sandown Bay, the floating dock at Benguela Cove and the jetty at Ysterklip, as well as any new structures under consideration.

7.3.6 Use of public lands, access and public facilities

Public access to the estuary is limited and likely to become further restricted by the privatisation of management at the Rooisand Nature Reserve, if this goes ahead. The ICM Bill (2007) requires that access strips are provided and properly signposted, maintained, and equipped with facilities to enable public access to public coastal property. The spatial definition of coastal public property, and recommendations for access and the management thereof, need to be addressed in the EMP with due regard to security of property, persons and resources, financial sustainability, and the interests of all communities associated with the estuary.

7.3.7 Discharges from in situ treatment of sewerage

The Overstrand Municipality has acknowledged the problems associated with in situ treatment of water-borne wastes, and has recorded its intention of addressing this over the current IDP implementation period. Upgrading is identified as a prerequisite for new development in certain areas.

- Kleinmond: expansion of the sewer system and upgrading of the waste water treatment works is a prerequisite for new development. Budget is allocated in 2008-09 for sewerage reticulation. Funds for upgrading the treatment works are built into estimates for 2010-11.

- Fisherhaven / Hawston: Expanding the sewer system "in the next couple of years" (SDF, 2006) and upgrading the waste water treatment works is a prerequisite for new development. A small sum for sludge ponds is allocated in the 2008-09 budget. Large sums are built into estimates for Greater Hermanus for 2008-09 and the following 3 years.

It is essential that the stated intention, of limiting new development until such time as efficient disposal systems are in place, is upheld, in order to avoid contamination of the water body.

The IDP notes that it is not feasible to extend the sewer network to all areas and that innovative and alternative solutions need to be found. The Arabella Estate is serviced by a local treatment plant located approximately 1km from the edge of the lagoon. Its proximity to the water body represents a risk. Ongoing monitoring and evaluation must be maintained at all times.

The policy of compact urban development restricted within an agreed urban edge has many merits, amongst them the efficiencies associated with engineering infrastructure. 'Leap-frogging' of development beyond the edges of core urban areas creates an unsustainable management situation because of the need, inter alia, to consider cumulative impacts. The situation calls for a precautionary approach and upholding the principles of urban edge planning as described in the WCPSDF.

7.3.8 Development within limits of services infrastructure

This issue is linked to the previous one, that of waste water treatment, but extends also to water services. The Overstrand SDF identifies limitations in this respect as follows:

- Kleinmond: Upgrading of the water purification works is advised, and a successful application for an increase in abstraction of water from the Palmiet River is a pre-requisite for new development. The Isaacs River is reportedly the source being investigated for supply to the new development proposed above the Kleinmond Estuary, causing some concern regarding the impact on freshwater flow into the estuary.
- Fisherhaven / Hawston: Construction of a new reservoir and investigation of new water sources is a pre-requisite for new development.

The availability and sustainability of waste water treatment systems and water supply needs to be an unwaivable condition of approval for new development. Proposals for development of any new infrastructure must include comprehensive studies of the impact that these will have on the estuarine system.

7.3.9 Run-off and groundwater impacts of greens, grounds and cultivar maintenance

The presence within the catchment of extensive agricultural lands and, in the estuarine catchment of highly managed landscapes such as Arabella and Kleinmond Golf Courses, as well as the vineyards at Benguela Cove, create the conditions for potential negative impacts on the estuary relating to water use, nutrient run-off from fertilisers, infiltration of pesticides, and a raised water table due to irrigation. Risks need to be managed. This could be achieved through the adoption of a policy and implementation of management guidelines by all riparian owners, accompanied by independent monitoring and regular evaluation in order to identify point sources as and when they arise.

Maintenance of a riparian reserve, wherein natural ecosystem functioning is supported, is a cost-effective and efficient mechanism for filtering out some of the impacts that would otherwise negatively affect estuarine functioning. Guidelines and incentives must be introduced for private landowners to implement such measures, and the support of Department of Agriculture must be mobilised around this issue.

7.3.10 Invasive alien vegetation

The need for a well-managed and co-ordinated programme aimed at eradication of invasive alien vegetation, most notably *Rooikrans* and Port Jackson, is well known and requires no elaboration here. It is particularly relevant in the area west of the Rooisand Nature Reserve, on Farm De Draay, and in the Middelvlei area where it was introduced specifically to stabilise the dune field. The programme must take into account the potential de-stabilisating result of removal, implications of non-removal of debris regarding fire and flood conditions, and opportunities for income generation and employment.

7.3.11 Clarification of the relationship between government organisations and privately managed estates

National legislation establishes the principle that local municipalities are responsible for delivery of basic services, such as water supply, waste water and solid waste disposal, other government agencies provide a range of services, including management of protected areas and public resources, and in return, property owners, individuals and companies pay a tax based on the extent and value of their land holdings, and their incomes, respectively. The introduction of trade offs and agreements – exceptional deals for exceptional areas – leads to complexities and an 'us and them' perception between those 'inside' and 'outside' such establishments and deals.

This issue arises out of the absence of any detail in the Overstrand Municipality SDF regarding conditions of approval for the establishment of privatised housing estates in the area, and strategies for managing future growth of these areas, as well as reports on negotiations relating to the privatisation of the management of the Rooisand Nature Reserve.

If and where such deals are contemplated, in order to uphold the principle of social equity they need to be considered in an exceptionally transparent manner, and in the determination of whether or not such trade off is in the interests of the public, the public must be consulted.

7.3.12 'Carrying capacity' of the Bot River estuary and its catchment area

A brief literature review on Carrying Capacity is provided in Data Sheet 19. The reviewer's conclusion is to accord with the observation of McArthur (nd.) that, "Carrying capacity is the lazy man's answer to visitor management, just like fences and regulations! Sophisticated models that incorporate feedback (monitoring) and adaptive management are more accountable and socially just … The challenge is to acknowledge that the complexity of visitor management requires an integrated and long term approach."

A calculation of the physical carrying capacity of the Bot Vlei does little to advance the cause of management: the size of the water body is not constant, the calculation of physical carrying capacity is dependent on a coarse division of water surface area divided by the surface area required for the activity under consideration. There is no magical formula that delivers a satisfactory answer for carrying capacity, even in purely physical terms. Add to that the complexity of user perceptions (when does 'crowded' become 'too crowded'?) and ecological carrying capacity (how many boats can spill oil before the lagoon becomes too polluted?) and it requires no further convincing that 'carrying capacity' is a contrived science.

Whilst an exact calculation is not possible, the *concept* of carrying capacity nevertheless holds validity. The challenge for management is how to apply the concept in practical terms. The concept of carrying capacity is multi-faceted; it has to do with the balance of developed and open space areas, discharges and run-off, recreational activities on the water body, increased levels of boat ownership, etcetera. In future there will be pressure for more boats, more hikers, more horse and hiking trails, and the challenge lies in establishing a basis for building consensus on measuring when 'enough' becomes 'too much'.

Practical measures for doing this could include monitoring 'levels of acceptable change'. For example, disturbance to vegetation in dune field areas needs to be monitored and managed to pre-empt destabilisation and avert blowouts, water quality needs to be monitored in order to identify pollutants, etcetera. A well designed programme of monitoring the receiving environment, with an associated response strategy, is the recommended approach.

8. Ecosystem Services

8.1 Introduction

In recent years the important role that the natural environment plays in providing valuable goods and services to society has been more fully appreciated. Techniques have been developed to estimate the economic value of these environmental goods and services so that economic and environmental factors can be integrated into both policy making and the management of the resources.

Estuaries are recognised as being among the most productive ecosystems on earth. In their study, Costanza *et al* (1997) estimated the average annual global value in $US per hectare for a range of ecosystems by ascribing values to 17 types of ecosystem services and functions. They attributed the highest value per hectare of the ecosystems they measured to estuaries at $US22 832/ha per annum, and the next highest value to swamps and flood plains at $US19 580/ha per annum (amounts stated in 1997 terms). Nutrient cycling was the ecosystem service provided by estuaries that were highly valued in the study.

In South Africa, in the last five years research has taken place into the economic value of estuaries (see, for example, Cooper *et al* 2003; Lamberth & Turpie 2003; Turpie *et al* 2003; Turpie & Hosking 2005; Turpie & Clark 2007; Anchor Environmental Consultants 2008). These studies have identified estuaries as important systems that contribute to the local and national economy through various types of value – directly contributing to the subsistence of communities and providing the opportunity for recreational activities; indirectly contributing through the ecological services they provide and having existence values.

This chapter provides some background on the concepts of ecosystem services and Total Economic Value, describes the ecosystem services of the Bot/Kleinmond estuaries and provides preliminary estimates of their value, based on available information. Finally, some observations are made regarding the potential implications of management of the estuary mouth on the value of the estuary.

8.2 Ecosystem Services

Ecosystems are the natural capital that contribute to economic production and human welfare, while ecosystem services are the benefits that people receive from ecosystems (Millennium Ecosystem Assessment 2005). There are different ways of describing and classifying ecosystem services. Barbier (1994) classified the benefits from ecosystems as goods, services and attributes as follows:

- Goods are harvested resources, such as fish.
- Services are processes that contribute to economic production or save costs, such as water purification.
- Attributes relate to the structure and organisation of biodiversity, such as beauty, rarity or diversity, and generate less tangible values such as spiritual, educational, cultural and recreational value.

The Millennium Ecosystem Assessment (2005) classified the ecosystem benefits slightly differently by identifying provisioning, regulating, cultural and supporting services as follows:

- Provisioning services such as food and water;
- Regulating services such as climate, flood and disease regulation and water purification;
- Cultural services such as aesthetic, spiritual, recreational, and cultural benefits; and
- Supporting services, such as nutrient cycling and soil formation, that maintain the conditions for life on Earth.

There is good alignment between the above classifications i.e. goods / provisioning; services / regulation and attributes / cultural classifications are fairly similar. The supporting services identified by the Millennium Ecosystems Assessment (2005) underlie the other services and accordingly will be affected by the values of the other characteristics.

The types of ecosystem goods, services and attributes associated with temperate South African estuaries are provided in Table 11.

Table 11 Ecosystem goods, services and attributes based on definitions by Costanza et al (1997) that are likely to be provided by temperate South African estuaries (Turpie, 2007)

	Ecosystem Goods, Services & Attributes	Description	Importance in estuaries
Goods	**Food, medicines**	Production of bait, fish and food plants; medicinal plants	High
	Raw materials	Production of craftwork materials, construction materials and fodder	Medium
Services	**Gas regulation**	Carbon sequestration, oxygen and ozone production,	Low
	Waste treatment	Breaking down of waste, detoxifying pollution; dilution and transport of pollutants	Medium
	Refugia and nursery areas	Critical habitat for migratory fish and birds, important habitats for species, including critical breeding habitat, nurseries for marine fish	High
	Export of materials and nutrients	Export of nutrients and sediments to marine ecosystems	High
Attributes	**Genetic resources**	Medicine, products for materials science, genes for resistance to plant pathogens and crop pests, ornamental species	Low
	Structure and composition	Species diversity and habitats providing opportunities for recreational and cultural activities	High

8.3 Total Economic Value

The concept of Total Economic Value provides a framework for environmental valuation. This concept involves identifying the following components of economic value of environmental assets:

- Direct use values which arise from direct human utilisation of the resource, such as harvesting or consumption of the resource for subsistence, commercial or non-commercial purposes. Direct use values can further be broken down:
  - » consumptive uses such as harvesting, and
  - » non-consumptive uses such as recreational uses.
- Indirect use values. These are associated with the ecological functions of the environmental resources i.e. the regulatory services identified in the Millennium Ecosystem Assessment (2005) summarised above. These services derive their values from supporting or protecting economic activities that have directly measurable values (Barbier et al 1996). These indirect use values are often difficult to quantify.
- Non-use values. Environmental resources have non-use values, being those benefits that do not arise from contact between the consumer and the environmental asset, and are:
  - » option value, being the potential future-use benefit
  - » existence value, or the wellbeing that comes from the knowledge that an environmental resource exists, without the intention, necessarily, of using it, and
  - » bequest value, or the willingness to retain the asset for the benefit of future generations.

The Total Economic Value is the sum of the above values. In performing this calculation, care needs to be taken that there is no double counting, i.e. a single benefit must not be included in more than one type of use.

In common with determining the economic value of ecosystems, it is difficult to provide a precise estimate of the economic value, and the preferred approach is to provide a range of values based on a best estimate of the likely values. Indeed, Turpie and Clark (2007) acknowledge that the objective of their study was to produce a rough estimate of the value of each of South Africa's temperate estuaries. In this study, all values are expressed in 2008 Rands.

8.4 Subsistence fisheries

The main use of resources is the gillnet fishery, though bait worms and sandprawns are also harvested (Turpie & Clark, 2007). The bait fishery has become less important since the frequency of mouth openings has decreased, as this has affected the abundance of sandprawns which do not tolerate long periods of low salinity.

The gillnet fishery is an illegal fishery which targets a range of species including harders and linefish species, using a range of mesh sizes and nets of up to 700m long. Gillnets are set most nights, and are typically weighted so that they are not visible at the surface. The fishery is affected by the management of the estuary mouth. When the system is closed for long periods and allowed to become fresh, the growth of *Potamageton* becomes a hazard for the fishery, leading to net entanglement, and has even resulted in drowning of fishers. Fishing effort tends to become more concentrated in the lower reaches, compared with at other times when it is spread throughout the estuary.

It is estimated that there are about 20 groups of fishers active on the estuary. The fishers are likely to come from Hawston, whose residents have had a close association with the fishing industry for many years. These community members have been involved in fishing off the coast as commercial divers and boat assistants, as well as being employed in the processing factories in Hermanus. The employment is often on a seasonal basis with linefishing taking place to supply food for their own consumption or for sale to make a living between seasons. Currently, there are fishing rights awarded for linefish, west coast rock lobster and abalone in the Hawston / Hermanus area, some of these rights being held by community members (Joubert Undated). The gillnet fishery in the estuary is entirely illegal, however. The gillnet fishery is thought to be linked to the coastal abalone fishery, in that gillnetting activity in the estuary peaks when conditions for diving are bad. Because of the illegal nature of the fishery, it is not well managed, with the result that catches are not sustainable and are often wasted when nets are abandoned or stranded. There have been problems of hostility by fishers towards other users of the estuary.

There are concerns that the gillnet fishery has a marked impact on the fish stocks in the estuary and hence on the nursery function of the estuary (see below). When the estuary is opened, both small and large fish recruit into the system as part of their life cycle. Research has shown that the large recruits are mined out within a relatively short space of time, and that the smaller recruits are taken out as they grow (S. Lamberth, MCM, pers. comm.).

Turpie & Clark 2007 estimated the value of the subsistence fisheries using survey data collected as part of the Subsistence Fisheries Task Group assessment (Clark *et al,* 2002). These data were re-analysed to isolate the number of fishers, catches and values of individual estuaries in the study area. Where data were not available, estimates were interpolated based on expert knowledge of the systems. Based on the estimated catches, the Bot estuary fishery is estimated to be worth in the region of R110,000 to R550,000 per annum (2008 Rands; Turpie & Clark, 2007).

8.5 Raw materials

There is no information available regarding the use of reeds or sand by communities around the Bot River Estuary. These materials are typically used by local communities in building traditional dwellings. Hawston is the main community with access to the estuary, and although there may be small scale use of materials for building purposes, the dwellings in Hawston are typically built using modern materials.

There is a sand mining operation on Farm De Draai but it appears to be some way removed from the estuary itself (based on aerial photo observation).

It is thus assumed that there is no significant value attributed to the use of raw materials from the estuary.

8.6 Carbon sequestration

Carbon sequestration is measured in terms of the net storage or loss of carbon that takes place as a result of a long-term increase or decrease in biomass. The contribution made by estuaries to carbon sequestration is unknown but is unlikely to be significant in temperate estuaries.

8.7 Waste treatment

The value of this function is usually estimated by the cost savings of treating water before it is released. While waste treatment is possibly an important ecological service provided by the Bot River system, the quantity of pollutants released into the system is unknown and it is not possible to estimate a value for this function.

8.8 Nursery Value

Estuaries are productive systems due to high nutritional inputs and providing sheltered habitat and nursery grounds for many organisms, which can either be utilised in the estuary itself or later in their lives, in the coastal area. Factors that make estuaries suitable nursery habitats are increased food, higher temperature, turbid waters and lower salinities, while possibly also providing protection from predators.

Nursery value is the value contributed by estuaries to marine fishery production as a result of providing nursery areas for commercial or recreationally valuable species. This value was estimated on a regional level by Lamberth & Turpie (2003). This study considered the estuaries' role as nursery areas for species of fish exploited by recreational and commercial harvesting in the inshore marine environment. The study identified 80 fish species utilised in fisheries that make use of estuaries, and categorised the species according to their degree of association with the estuary. According to available information and by extrapolating from various relationships, total catches were estimated for the fish species. In this manner, a value for estuaries was obtained on a regional basis and was disaggregated to individual systems on the basis of the area of the estuary. The values were estimated based on the contribution to Gross Domestic Product, including value added by subsidiary industries in the case of commercial fisheries.

The value estimates were provided for five different coastal sections, including the south coast from Cape Point to Port Elizabeth, in which the Bot River Estuary is located. The values per coastal section were disaggregated to individual estuaries on the basis of the size of the estuary. For the south coast estuaries, the value (in 1997 Rands) was estimated to be R26,392 per hectare.

Based on the above study, it is estimated that the nursery value for Bot estuary could be in the order of R50 million. However, it is argued that the illegal exploitation of fish resources in the estuary may have seriously impacted on this value.

8.9 Export of materials and nutrients

The export of sediments and nutrients to the marine zone is an important function of some river systems, particularly up the east coast. While there is some knowledge of the biophysical aspects of this function (Branch *et al,* 1985), no research has been carried out on the economic implications of this function.

8.10 Property and tourism value

Amenity value of an estuary is reflected in the premium paid for property with access to, or views of, estuaries, as well as the expenditure incurred by visitors to the estuary. Much of the Bot estuary margin is undeveloped, apart from Fisherhaven, an urban settlement of some 350 houses on the south-eastern bank, Middelvlei Estate near the mouth, and the Arabella Country Estate located on the northern shore at the head of the estuary. The latter estate comprises a five star hotel (the Arabella Western Cape Hotel & Spa), a wellness centre, a championship golf course and an exclusive residential area where private owners have built houses on plots that vary in size from 550 to 1,050m^2. The estate advertises that it is located "alongside Southern Africa's largest and most beautiful natural lagoon", providing an indication of the benefit that the property developers see in the estuary. The

private properties are owned by a combination of permanent residents and others who use it as a holiday home and over weekends.

In addition, a new development is under way on the north eastern banks of the estuary. The Benguela Cove Coastal Wine Estate will provide 124 residential opportunities on 210 ha, with the 80 ha Renosterveld Nature Reserve part of the estate. About half of the sales already concluded have been to overseas buyers with vacant plots being sold at prices ranging roughly from R2- to R5- million. A productive wine farm and cellar will also be developed. The estate has 5km of estuary frontage and will offer two jetties for water sports, water skiing and sailing as well as fishing and hiking trails. It is understood that a boutique hotel is also planned for the estate. The marketing material notes that the estate offers "majestic views over the lagoon to the Palmiet mountains".

The property value of an environmental asset is generally estimated using the Hedonic Pricing approach – a form of multiple regression – or through expert estate agent estimates. Property value has been estimated for some South African estuaries (see, for example, Cooper et al. 2003 and Turpie et al. 2003). Building on a study undertaken by Masiwime (2006), Turpie & Clark (2008) concluded that it was difficult to predict property value on the basis of easily obtainable estuary characteristics. The approach was therefore to collate property value data and interview estate agents throughout the temperate region, thereby providing a rapid assessment of the property value of the estuary systems.

On this basis, Turpie and Clark (2007) estimated the estuary premium on capital property value attributed to the Bot / Kleinmond estuaries to be R500 million in 2008 Rands. Expressed in terms of estimated annual contribution to the real estate sector, the annual property value attributed to the Bot/Kleinmond estuaries would be approximately R15 million.

However, the above property value may understate the value attributed to the exclusive private property residences at Arabella Estates and the private plots that are currently being sold and developed at Benguela Cove. Discussions with estate agents confirmed the importance of the estuary to property owners, with the premium attributed to the estuary being estimated at somewhere between R1 million for an undeveloped plot to R5 million for a house, or between 25% and 50% of the value of the property. Assuming an average premium of R2 million per property, for the 474 properties (350 at Arabella and 124 at Benguela Cove) suggests an estuary premium for the properties of about R950 million. Applying the same basis as Turpie (2006) to translate the capital premium to an annual contribution to the real estate sector, implies an annual property value attributed to the estuary for Arabella and Benguela Cove of about R30 million. A rough estimate of the annual property value attributed to the Bot River Estuary is therefore R25 to R40 million.

Tourism value is reflected in visitor's expenditure on travel and accommodation. However, only portion of the recreational experience, and thus the expenditure, can be attributed to the estuary itself. Studies of tourism value were only available for a few estuaries, and as tourism value is not correlated with property value, it was estimated by interpolation between estuaries of known value, based on expert understanding of these systems.

Visitors to the estuary include guests of the Arabella Western Cape Hotel & Spa facilities, B&Bs, guest houses and rented accommodation in the area, as well as day visitors to the estuary. The importance of the Bot River Estuary to the Arabella Western Cape Hotel & Spa is clearly reflected by its use in the marketing material on the web sites for the luxury hotel, wellness centre and golf course. Many of the activities offered by the hotel are directly or indirectly (where the experience is enhanced by for example, the views of the estuary) associated with the estuary – these activities include golf, bird watching, nature trails, mountain biking, kayaking and canoeing. Other visitors to the estuary also enjoy bird-watching, sailing, boating and fishing. However, visitor numbers are not as high as for many other estuaries in the region, possibly because of the distance from major centres and the relatively limited amount of visitor facilities. Visitation is seasonal, and numbers can become fairly high over the peak summer holiday period.

Visitors to estuaries generate expenditure on accommodation, food, beverages and in the retail sector. This expenditure by tourists is a partial measure of the Willingness to Pay for the estuary as a recreational amenity, although not all the value is directly attributable to the estuary. For example, Turpie *et al* (2003) in their study to establish an economic value of the Knysna Estuary conclude that the estuary contributes 60% of the enjoyment of tourists to Knysna, while Turpie's (2006) study

concludes that the Kromme and Seekoei estuaries account for 17% and 10% respectively of the attraction of the areas. Similar data are not available for the Bot River Estuary.

Based on Turpie & Clark (2007), the tourism value attributed to the Bot River Estuary would be roughly estimated to be in the order of R4 -10 million per annum (2008 Rands). However, this value may be understated as a rough calculation for the Arabella Western Cape Hotel & Spa suggests, at a room occupancy of 50% per annum, and assuming that 30% of the enjoyment of visitors is attributed to the estuary, an expenditure by hotel guests on accommodation alone of some R50 million. This excludes expenditure on food (dinner and lunch are excluded from the hotel rates), beverages, golf, spa treatments and other entertainment. On this basis, the tourism value for the Bot River Estuary is estimated to be in the range R40 to R60 million.

8.11 Existence Value

The existence value of an estuary is the wellbeing that comes from the knowledge that an environmental resource exists, with or without the intention of using the estuary. People are willing to pay to maintain this feeling of well being and the Willingness to Pay (WTP) is used to reflect the existence value in monetary terms. Turpie and Clark (2007) referred to previous studies on the existence of estuaries and also carried out a Contingent Valuation Survey of 605 people in the Western Cape. This survey ascertained people's willingness to pay for the conservation of estuaries, and respondents were required to rate a range of different estuaries for which photos and information were provided. These same estuaries were scored for their scenic beauty in a separate survey of 125 people. WTP was related to income and extrapolated by income group. It was found that scores were well correlated with scenic beauty and this allowed extrapolation of scores to all estuaries based on an independent rating of their scenic beauty. The scores were used to disaggregate the total WTP for all South African estuaries – which had been estimated at R90 million based on this and previous studies – for all estuaries in South Africa.

The value per individual estuary was found to be in the range R50,000 to R500,000. Values were not attributed to individual estuaries in the study but were instead ranked in terms of existence value. Bot River / Kleinmond estuaries were ranked 19th.

8.12 Summary

The estimated values for the ecosystem goods, services and attributes valued above are summarized in Table 12. The table further briefly highlights the importance of the benefit and the key stakeholders who have an interest therein. Based on these rough estimates, it is estimated that the Bot River Estuary generates an annual value of between R87 and R155 million for subsistence, property and tourism uses as well as for the nursery function, although the value may be closer to the lower bound due to the overexploitation of fish resources. In addition, there are a number of potential ecosystem services that the estuary may provide but for which there is no information – these services have been excluded from the valuation, as have all the non-use values.

Table 12 Summary of estimated annual value for Bot / Kleinmond Estuary in 2008 money terms (all amounts in R'000)

	Range of Estimates		Importance	Stakeholders
	Low	High		
Subsistence use value	110	550	Contributes to livelihoods	Hawston community
Property value	25,000	40,000	Increases value of property	Residents
Tourism value	40,000	60,000	Provides and enhances recreational opportunities	Tourists Local tourism sector Local businesses
Nursery value	22,000	55,000	Contributes to inshore marine stocks	Commercial fishing sector Recreational fishers Subsistence fishers

8.13 Implications for estuary management

There are a wide range of beneficiaries from the goods, services and attributes provided by the estuary. These range from the Hawston community and other residents, to the local tourism and fishing sectors to regional, national and international tourists. The estuary therefore makes an important contribution to the local economy. This suggests that the loss or degradation of the estuary system will have material negative economic impacts over and above the environmental impacts. It is therefore important that the threats that the system faces be identified and appropriate management measures be implemented.

Management decisions will impact on the relative value of different services as well as the overall value of the estuary. The relative importance of these values may be weighted depending on the objectives of decision-makers, for example the importance of meeting biodiversity conservation criteria (unvalued), social goals such as food security and employment, or economic goals such as contribution to national income.

One of the most immediate threats to the value of the estuary is the unsustainable exploitation of fish resources in the illegal gillnet fishery. These activities affect the nursery value of the estuary, which is a highly valuable service provided by the estuary, and which itself benefits a wide range of stakeholders along the coast that are linked to recreational, subsistence and commercial fisheries. Management action that addresses this issue will provide significant benefits to the region.

Factors that threaten the ecological health of the estuary, including reductions in water inflows due to upstream abstraction and alien vegetation, and inappropriate management of the mouth will also affect the value of the estuary as a nursery area, and indeed it's potential to support a viable subsistence fishery.

Mouth management has important impacts on the fisheries of the estuary. Current management is aimed at preventing very low salinity conditions, since this results in fish kills. Flooding of properties is not a major concern, affecting mainly the Yacht and Boat Club at Fisherhaven, and possibly the old Sonesta resort at Middelvlei. In order to benefit fisheries, its breaching should occur during high flow events in which the estuary breaches after reaching high water levels and thus produces a large enough freshwater cue in the marine environment to encourage recruitment. Breaching at high water levels also creates sufficient scour to keep the mouth open for longer.

Mouth management also affects the recreational value of the estuary. Users associated with the developments at the head of the estuary prefer full conditions, as this is good for boating and swimming. Thus the mouth tends to be kept closed for longer than is ideal to maximize the value of the fishery. From a fishery management perspective, it should open at least every 1-2 years, but it sometimes remains closed for as long as 3 years.

The recreation and tourism value of the estuary will be affected by the type of development that is allowed around the estuary in future. Although there is scope for more development at this estuary, it is important that some of the natural character is maintained, particularly on the western shoreline, which is important for connectivity with the wetland and Kleinmond estuary.

9. Ecological Assessment

The first part of this assessment summarises the biodiversity importance of the Bot / Kleinmond estuarine system and provides some of the background for the current mouth management practices. The assessment then highlights some of the key physical features that drive decision-making around the estuary, before highlighting the biological response to changes in the physical processes. It concludes with recommendations for strategies to be addressed in the drafting of the estuary management plan.

9.1 Biodiversity importance

In two recent surveys of estuaries of South Africa, the Bot/Kleinmond Estuary scored very highly in ecological importance. In a prioritisation of estuaries on the basis of health and conservation status the Bot/Kleinmond system was ranked eighth overall (Turpie, 2004; Turpie et al, 2002). A similar study on the prioritising of estuaries based on their importance for fish, ranked the system 24th in the country (Maree, Whitfield & Quinn in press). In the Cape Action Plan for the Environment (CAPE) project, the Bot/Kleinmond system was estimated to be among the top ten most important estuaries in the Western Cape Province in terms of biodiversity, and in dire need of protection (Prochazka & Griffiths, 2000).

As part of the development of a regional conservation plan for the cool and warm temperate estuaries, Turpie and Clark (2007) recommended that the Bot/Kleinmond Estuary be included in the core set of estuaries that needs to be protected to meet biodiversity targets in South Africa. The conservation plan stipulates that 50% of the terrestrial marginal area be protected from development and excessive use and that the Recommended Ecological Water Requirement Category be an A or B.

The above mentioned studies emphasise the high conservation importance of the Bot/Kleinmond estuarine system.

Table 13 Summary of the recommended extent of protection required and the priority for rehabilitation for the Bot/Kleinmond Estuary (Source: Turpie and Clark, 2007)

Core bio-diversity set	Extent of sanctuary protection	Extent of undeveloped margin	Minimum water requirement (management class)[4]	Priority for rehabilitation
Core	Half	50%	A or B	High

9.2 Managed actions

In the late 1970s there was considerable debate about whether or not the Bot River Estuary (also known as the Botvlei) is naturally turning into a fresh water coastal lake and whether or not the Bot should be artificially opened to the sea (Bally & Branch, 1986; Bally, 1987). This led to a six-year research programme, covering a range of disciplines and culminated in a symposium held in Cape Town, 16 November 1983 (Sloan, Branch & Bally, 1985) and the drafting of the current management plan for the estuary. Very little research has been done on the system since then.

Bot River Estuary lies between 34°18'30"-34°22'30"S and 19°04'-19°09'E on the south-western coast of South Africa about 110 kilometres from Cape Town (Koop, 1982). The Bot River Estuary is a relatively shallow triangular coastal lake, 7km long and about 2km wide (Koop, 1982). The mean depth is about MSL -1.5m (below mean sea level) (Willis, 1985). The Bot Estuary mouth, shown in Figure 1, is mostly closed and at present is breached artificially approximately once every three years. In the last 60 years the system had only breached naturally three times (Bally & Branch, 1986).

[4] Management class denotes the future state of health of the estuary, from A (near natural) to D (functional), and with A-category systems having greater water requirements than D-class systems.

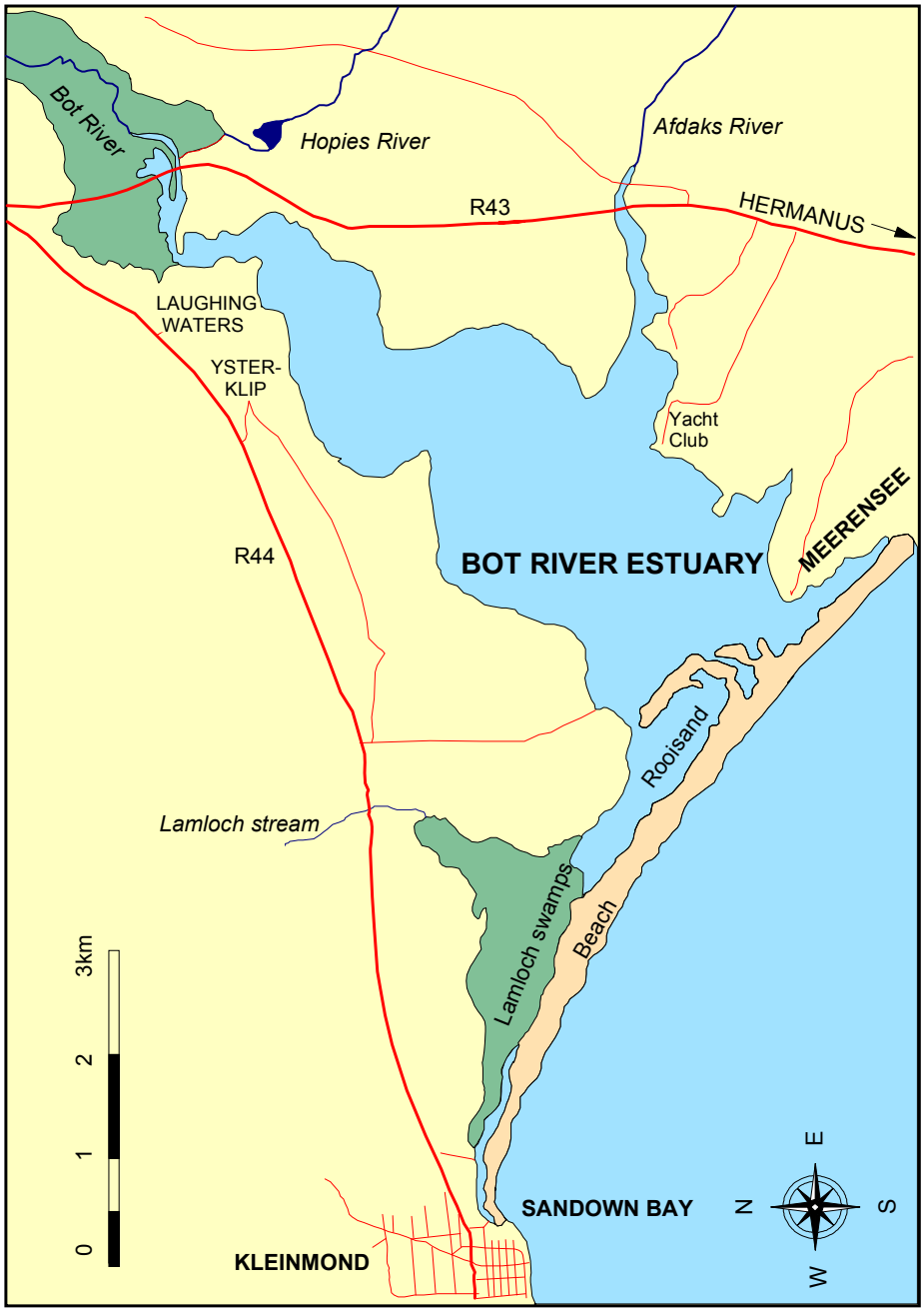

Figure 17 Bot/Kleinmond System. Drawn from 1:50 000 Topographical Sheet 3419 AC

The Bot is normally breached at Meerensee (previously Sonesta), creating a deep tidal mouth, between 80 and 110m wide and MSL -2.0 to -2.5m deep. The mouth stays open for two to four months after a breaching. Outflow during a breaching varies between 254m³/s and 409m³/s (Fromme, 1985b). The water level in the estuary varies from about MSL +2.7m shortly before a breaching to about MSL 0.0m after a breaching (Koop, 1982). This drastic change in water levels and exposure of the marginal areas, resulting from an artificial breaching, is seen by some as a huge shock to the system and therefore to be avoided (Branch et al, 1985; Morant & Quinn, 1999). After a breaching event, sea-water intrusion increases salinities to 35ppt throughout the estuary (Bally & McQuaid, 1985; Willis, 1985).

The Bot and Kleinmond estuaries are connected via a natural overflow channel through the Lamloch swamps, as can be seen in Figure 17, at a water level of MSL +1.7 m. When the joint system is breached at the Kleinmond Estuary mouth, the Bot Estuary loses water at about 310,000m³ a day or approximately 11cm a week (Willis, 1985).

Breaching of the Kleinmond Estuary – whether naturally or artificially induced - can drain up to one metre of water from the Bot, which is a critical loss in terms of future potential breachings. If frequent breaching does not occur at Kleinmond, the Bot would possibly breach near annually.

The constant loss of water has led to longer periods between breachings and to the present day ecology reflecting a more freshwater defined system. This led scientists in the past to assume that Bot is naturally developing into a fresh water coastal lake. A review of the abovementioned assumptions and facts led to the current research hypothesis: that the Bot River Estuary is turning into a fresh water lake due to anthropogenic intervention at the Kleinmond Estuary and a reduction in the run-off from the catchments.

The more recent approach to estuarine research (e.g. DWAF estuarine RDM studies) emphasises that systems should be evaluated in terms of changes from the reference condition to their present state, with the natural condition taken as the ideal state (Huizinga & Van Niekerk, 1997, 1998a, 1998c, 1998d, 1998e). This approach has clearly not been the case for the Bot/Kleinmond system.

The first, and most essential, step in the above mentioned approach is an analysis of the hydrology and hydrodynamics of the estuarine system.

9.3 Physical processes

9.3.1 Bathymetry and Volumetric Analysis

A bathymetric survey of the Bot Estuary mouth was done in 1999 (Figure 19) by the CSIR using standard surveying techniques (Van Niekerk et al, 2004). The bathymetry data in turn were used to do a volumetric analysis is of the volume of water that flows out to the sea during a breaching and to estimate the volume of water necessary to fill the estuary before breaching. The volume estimates were conservative as they are only accurate up to 2.0m MSL, beyond this there is no increase in surface area as the water level increases. The result is displayed in frequency to which the estuarine system can connect with the marine environment.

During a breaching the water level in the Bot drops from MSL +2.75 to 0.0m in a few hours. This is equal to about 31,289,800m³ of water discharged from the system during a breaching.

Stipinovich (2005) indicated that there has been a 26% reduction in inflow to the estuary, which equates to about 24 $X10^6m^3$ of freshwater from the Bot River Catchments. To put this in perspective, the reduction in freshwater inflow to the system is equivalent to more than 50% of the total volume of the estuary and represents the volume of water required to increase the water levels in the system from MSL +1 to +2.7m, i.e. breaching level. Therefore current levels of development in the catchment are impacting on the frequency to which the estuarine system can connect with the marine environment.

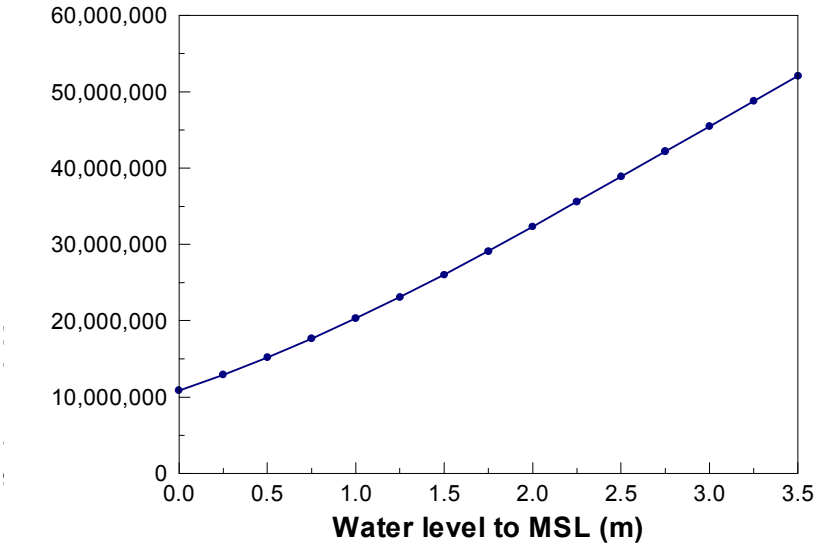

Figure 18 Volume estimates for the Bot River Estuary for different water levels of the Botvlei

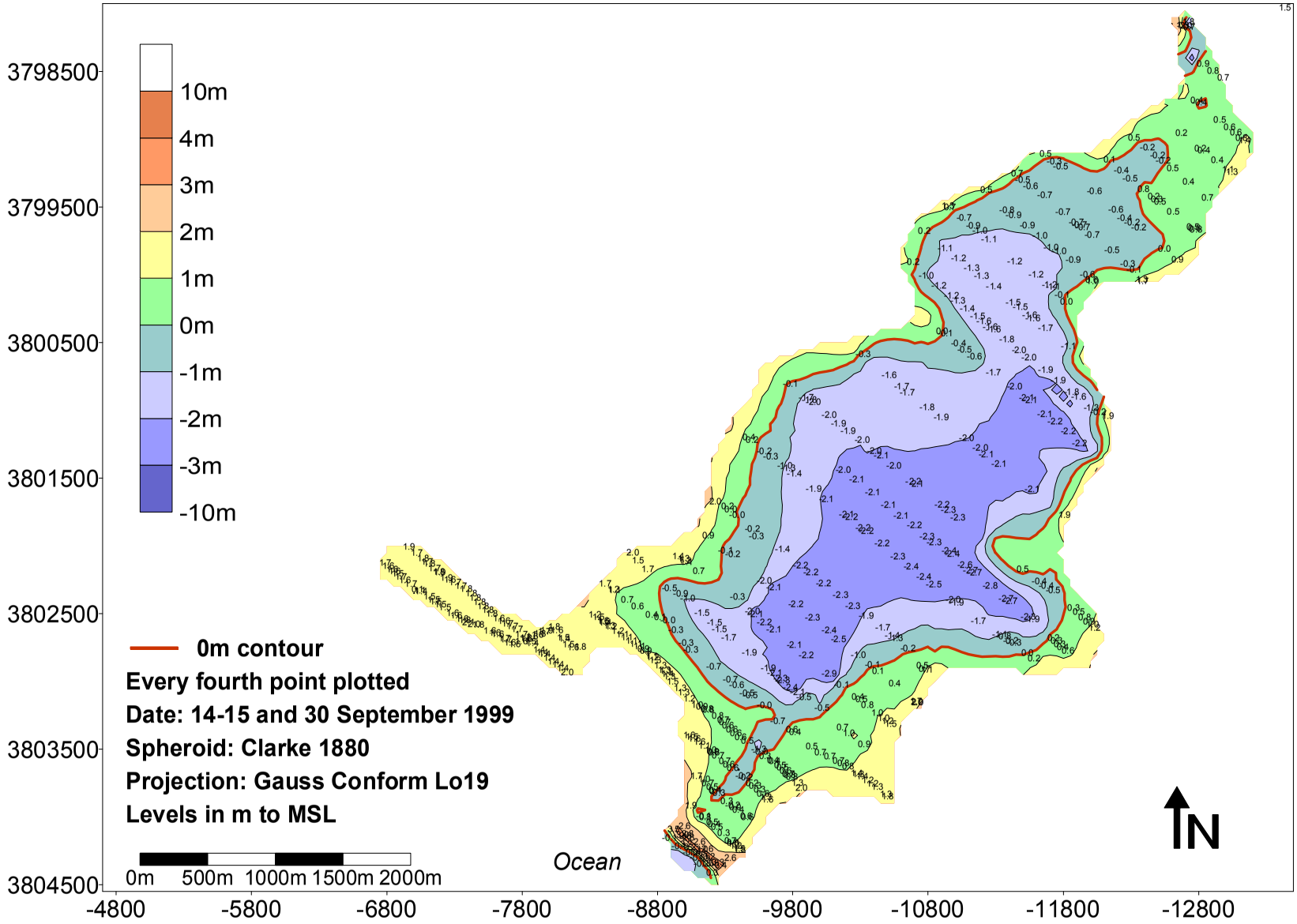

Figure 19 A bathymetric map of the Bot River Estuary

9.3.2 The interplay between salinity and water levels

Salinity in the Bot can vary from nearly fresh (<1ppt) to hypersaline (>35ppt) depending where it is in its cycle as depicted in Figure 20. After the mouth closes (State 1) and the water level is still low, the salinity in the system in summer can increase too levels higher than that of sea water due to evaporation.

When the winter rains start to fall (State 2a), the water level rises and the salinity start to drop due to dilution. As more rain continuous to fall (State 2b) the water level increases in the estuary and at levels of about MSL +1.7m water overflows via the channel and the salinity continues to drop further in the Bot. This is a cyclic process and is strongly influenced by the state of the Kleinmond mouth.

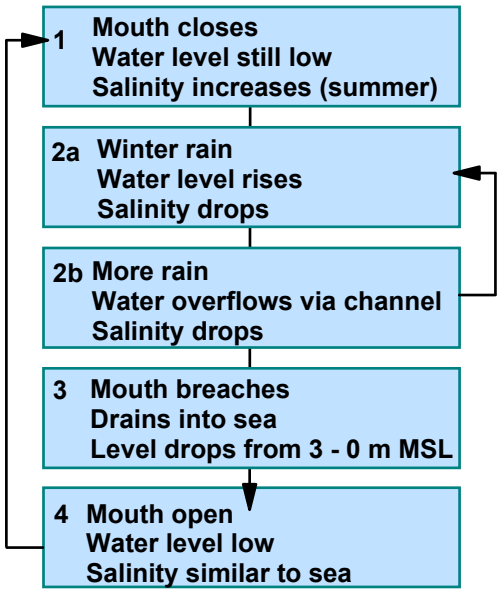

Figure 20 Mechanism effecting salinity variation in the Bot River Estuary

If more run-off enters the system (State 3), the Bot mouth can breach (artificially or naturally) and water in the estuary drains to the sea. The water level then drops from MSL +3.0 to 0.0m in a few hours, after which the mouth stays open (State 4) for about four months on average and the salinities in the system are similar to that of seawater.

A more regulated breaching pattern at the Bot would stop State 2 from occurring for an extended period and inhibit the system from becoming too fresh. This would also prevent extreme changes in salinity occurring, as is sometimes the case under the current breaching policy. More regular breaching would lead to less widely fluctuating salinity as is illustrated in Figure 21.

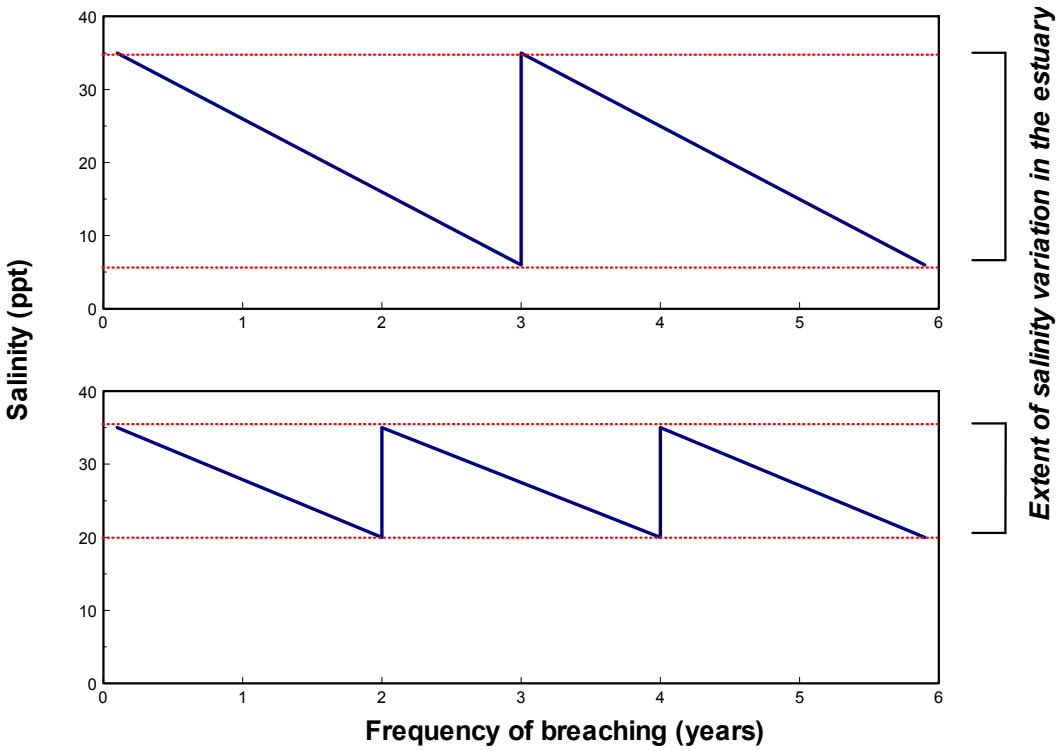

Figure 21 Illustrating that higher frequency in breaching reduces the salinity range

DWAF maintains an uncorrected water level recorder in the Botvlei (G4R003), which collects continuous data on tidal variation and mouth closure in the estuary continuously. The data from the water level recorder can be corrected to MSL by subtracting 0.6m taken from gauge plate near the mouth. Table 14 summarises the occurrence of mouth breaching for the period and lists the duration the mouth was open and the reasons for breaching. On average the mouth was open for about four months at a time after a breaching.

Table 14 Summary of mouth breachings during the period 1979 to 1995

No.	Date	Months open	Trigger Event
1	Aug 1981	2	Low salinities
2	Oct 1981	2	Low salinities
3	Jul 1983	4	Flood
4	Jul 1985	2.5	Flood
5	Aug 1986	5	Flood
6	Jun 1989	5.5	Flood
7	July 1990	5	High water levels
8	Apr 1993	5.5	Flood
9	Aug 1995	8	High water levels
	Average	**4**	

The water level in the estuary depends the balance of the inflow (+) and the outflow (-). The inflow is dependant on the run-off from the catchment and the outflow on what flows through the Kleinmond mouth, seepage and evaporation.

- At levels of ~MSL +1.7m, the Bot and Kleinmond estuaries are connected (Koop, 1982).
- The natural breaching level of Kleinmond estuary is ~MSL +2.5m. This is based on the level that the berm of the Kleinmond breached at naturally in the year 2000 after there had been no intervention in its natural mouth dynamics (Martens, pers comm.).
- The natural breaching level of Botvlei is estimated to be about ~MSL +3.0m (Van Niekerk et al, 2000).

The interaction between the two systems occurs in the following manner (Figure 22. At about MSL +1.7m the two system become connected via the outflow channel and water can freely exchange between them (CapeNature unpublished data). If the Kleinmond estuary is then open, water flows from Bot to Kleinmond and out to sea. The Bot can only open if the river inflow is greater than the outflow through the Kleinmond mouth. The total amount of water required to breach the Botvlei is thus strongly dependant on the amount lost to the Kleinmond. The more water is lost through the Kleinmond mouth, the more water is needed for the Bot to breach. Therefore artificial changes in the berm heights and premature openings at Kleinmond reduce the possibility of breachings at Botvlei considerably and are one of the critical factors for the Bot not breaching as often as it should.

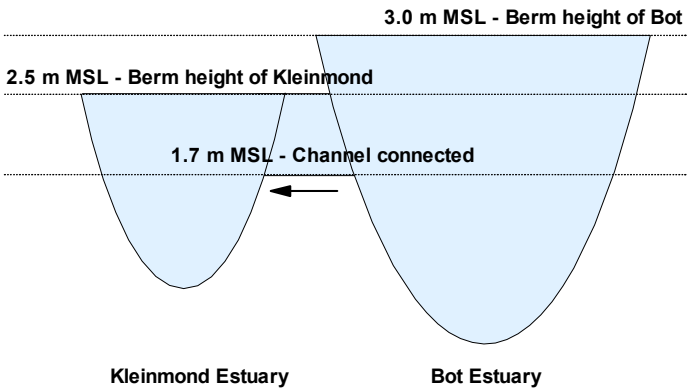

Figure 22 Illustration of the interplay of water levels in the Bot and Kleinmond Estuaries

If the extent to which run-off from the catchment has been reduced is considered together with the loss to Kleinmond due to premature breachings, it is quite clear that the Bot would have breached more regularly than it had done in the last 20 years.

It is only possible to state that the Bot River Estuary is naturally becoming fresher if there has been no reduction in run-off from the catchment and no change in the Kleinmond breaching patterns. This has clearly not been the case for the Bot River Estuary. In fact the system would be more estuarine if not for human intervention at the Kleinmond mouth and changes in the catchment.

9.3.3 Nutrients

Cillier and de Jager (1997) state that nutrient values were generally in the range of what one would expect for such an system. This observation is not supported by the prolific growth of reeds adjacent to the Arabella Golf Estates during periods were dieback is quite apparent in the rest of the estuary. Some concern therefore exists that nutrients may be entering the system and, as the current management plan allows for extended periods of mouth closure, this aspect needs to be investigated[5]. The Kleinmond Estuary is often breached for water quality reasons, e.g. sewerage overflow and leaking septic tanks. This needs to be investigated and addressed.

9.3.4 Sediment processes

The Botvlei is bordered on the western and north western banks by drift sand and alluvium. The southern side is bordered by aeolian sand while the eastern side comprise soils and rocks of the Bokkeveld group (Cillier and de Jager, 1997).

The Botvlei is effectively dammed by a 100 to 200m wide coastal dune belt consisting of a steep, narrow, dune barrier ridge 3 to 6m high and a hinterland of low hummock dunes. The dune ridge is interrupted by a number of natural gaps trough which overwash from the sea occurs occasionally during equinox tides and storm events.

In 1938 a sand veneer was present at Rooisand, while well formed dune ridges occurred both east and west of the Bot mouth. Between 1938 and 1961 the Middlevlei area became densely vegetated through a stabilisation intervention. The planting of *Accacia Cyclops* and *Ammophila arenaria* interfered with aeolian transport processes resulting in sediment that was being transported along the beach by wind, being dropped in the mouth area. Before the stabilisation of the dune fields it was possible for breaching to occur any where between Kleinmond and Bot, where a low-lying depression would form in the dune field. It is also deemed very likely that the interruption of the sediment transport process has resulted in higher berm levels than under natural conditions, necessitating even more freshwater inflow before a natural breaching can occur (Cillier and de Jager, 1997).

While sediment did enter the Bot Estuary naturally under high flow conditions, at present increased siltation is a problem as a result of agricultural and forestry activities causing soil erosion in the catchment. A fine layer of silt often deposits in the upper estuary (near Laughing Waters) under high flow conditions where the strong flowing river water enters the lager estuarine area (personal observation). During windy conditions some of the fine sediments may be brought into re-suspension, increasing the turbidity well beyond its natural limits. It is only during the open phases that some of the accumulated sediment can be removed from the system.

9.3.5 Floods

Floods and high flow events are very important in the system as floods often trigger breachings. An added advantage of the sudden increase in water levels and the subsequent breaching shortly thereafter is that the short duration of high water levels cause no flood damage to properties and do not allow the ecology to stabilise at higher water levels. Therefore, the ecology is not so vulnerable to the extreme change in water levels during a breaching as was the case in 1981 when the mouth had been closed for four years, when most of the historical data was gathered. This also skewed the findings of the symposium held at Cape Town in 1983 to some extent and led to a negative impression of the effect of breaching on the ecology.

[5] Water Quality analyses needs to be conducted by a marine laboratory as seawater acts as buffer.

As there are no large dams (but a significant number of smaller farm dams) in the catchment, is estimated that floods would not be as severely reduced as base flows to the estuary, but this should be verified through an Intermediate or Comprehensive Estuarine RDM study.

9.4 Biological processes

9.4.1 Plants

Koop (1982) indicate that the Pytoplankton biomass was low and mainly consist of flagellates in the Bot. Diatoms were also in low concentrations in the sediment, being evident in lonely the surface layer (5 cm) and predominantly occurring in the fine sediment.

Large amounts of algae are washed into the estuary during the open mouth conditions (and over wash) such as the giant kelps *Ecklonia maxima* and *Laminara pallida* as well as smaller amounts of *Macrocystis angustifolia*. *Chara* occurs through out the estuary, being denser near the head and in the Lamloch swamps. The epiphytic algae *Cladophora* sp. also grows prolifically on the submerge macrophytes occurring in the system. No definitely growth cycle are reported for the algae, it seems to grow rapidly for several months followed by a rapid decline.

The aquatic weed, *Ruppia maritima*, is the most important macrophyte in terms of biomass. It is only found in shallow water less than 2.9m. It has a salinity tolerance range of 2-18 ppt (Allanson and Baird, 1999). *Potamogeton pectinatus* (5-15 ppt tolerance range) only occurs in the upper reaches. Plant production was estimated by Bally (1985) to be about 13,000 tonnes (dry weight) per year. The aquatic weed *Ruppia maritima* together with *Potamogeton pectinatus*, *Chara* sp. and *Cladophora* sp. contributes 72% of the total production. *Ruppia* dominates most of the estuary (Bally, Mcquaid & Pierce, 1985). Roberts, Branch & Robb (1985a, 1985b) discuss the annual growth cycle of the weed beds and the role that bacteria play in their decomposition and the drastic reduction in the numbers of bacteria after a mouth breaching. Noteworthy is the tolerance range of the free-floating bacteria, which grow best in 50% seawater, moderately in 100-200% seawater and poorly in 10% seawater.

Sporobulu virginicus grows mainly in areas of periodic inundation, but can withstand long periods of being submerge such as along the southern reaches of the Lamloch swamps. *Phragmites australis* and *Scirpus littoralis* form dense patches of reed swamps in the submerge areas near the bridge, in the Lamloch swamps and where the Afdaks river enter the estuary. There is some concern that nutrient enrichment is causing excessive reed and aquatic weed growth. This in turn can influence sediment and hydrodynamic processes in the estuary. This should to be verified through a RDM study.

Developers in the past have lobbied strongly that the bare unvegetated banks of the Bot Estuary be “rehabilitated” to something that is more aesthetically pleasing, little realising that this bare strip of ground surround the system is the result of natural processes relating to the infrequent breaching of the estuary. Infrequent breaching results in unstable water levels, under which conditions neither the terrestrial vegetation and saltmarsh, nor the submerged macrophytes and algae ever gets an opportunity to develop a good seedbank for regrowth during the next cycle. At the Klein Estuary, where breaching occurs annually, a well established plant community is evident along the banks.

9.4.2 Invertebrates

De Decker (1987) and De Decker & Bally (1985) recorded extremely low densities of benthic invertebrates (only 25 species). The most abundant was the sand prawn *Callianassa kraussi* in the shallow sandy areas and the small mussel *Arcuatula capensis* among the weed beds. Many of the species typically occur in low-salinity habitats. It should be noted though that *Callianassa kraussi* cannot breed in salinities below 12 ppt (Bally & Branch, 1986).

The zooplankton (Coetzee, 1985) and meiofauna (De Decker & Bally, 1985) are also depauperate. The zooplankton is dominated by a single species *Pseudodiaptomus hessei*, which contributes about 80% of the numbers. The zooplankton numbers and biomass seems to be adversely affected by low salinities, declining when the estuary is diluted.

It seems the Bot can be divided into three zones: a littoral zone (shoreline), a *Ruppia* zone (including the macrophyte beds) and a Deep zone (central and deeper areas without macrophytes). One of the characteristic species of the *Ruppia* zone is *Arcuatula capensis* which form the largest part of the biomass in the system. *Callianassa kraussi* is associated

with the more sandy littoral zone. After extended periods of closure the species composition represents that of a coastal lake while during the open phase it is that of an estuary.

9.4.3 Fish

Large numbers of fish of 41 species occur in the estuary, of which white steenbras, leervis and elf are the most important to anglers (Lamberth, unpublished data; Bennett et al, 1985) (see Table 15 and Table 16). Virtually all the fish are estuarine or marine dependent, or use the estuary as a nursery. During periods of low salinities (associated with extended period of mouth closure) alien fish species such as carp, kurper and largemouth bass enter the estuary (Bally & Branch, 1985). Noteworthy is the klipvis, *Clinus spatulatus*, which is endemic to the Bot and Klein estuaries (Whitfield, 1998). Almost all the marine fish depend on a deep, tidal mouth for recruitment; only the southern mullet Liza richardsoni are able to recruit via the overflow channel (Bennett, 1985; Bennett et al, 1985).

With the exception of the freshwater fish (all alien species) the estuarine dependent and marine fish are severely stressed if the salinities drop too low (< 5 ppt) (Bennett et al, 1985). Mass fish mortalities have occurred during periods of prolonged closure when salinities drop below 3 ppt.

There are a number of very important considerations to managing the Bot / Kleinmond system beneficially for fish (Bennett et al, 1985; Lamberth, pers. comm.):

- Most of the important fish species targeted in the recreational fishery are marine migrants. Their abundance and size structure are clearly linked to open mouth conditions.
- Good quality fishing in the estuary owes much to the estuary remaining closed for extended periods, allowing fish to become bigger, than in estuaries where there is a more frequent link with the marine environment.
- Estuarine dependant fish species such as *Lithognathus lithognathus, Lichia amia, Mugil cephalus* and *Rhabdosargus holubi* are entirely dependant on estuaries as juveniles. Since the Bot Estuary is the third largest estuarine system in the Cape Floristic Region, it has an important nursery function, especially with regards species where the stock has collapsed.
- Open mouth conditions every 2 years are about the only way of ensuring that important estuarine species complete their lifecycle before they are targeted by illegal gillnetting. After 1-2 years of age, most of the fish species are large enough to be caught in the gillnets.
- Fish abundance is significantly lower in the Botvlei versus the Klein Estuary, though the systems are similar in terms of biogeographical region, size, type and habitat. Of special concern is the decrease in the endeminc *Clinus spatulatus* which has decreased significantly in abundance over the last five years, indicating that the low salinity observed over the last few years (e.g. < 6ppt August 2006 and December 2007) are stressing the fish and reducing their reproductive capacity (Lamberth, unpublished data).

Table 15 List of all fish species recorded in the Bot River Estuary according to (a) Bennett 1985, 1989, Bennett et al. 1985, Branch et al. 1985 and (b) Lamberth unpublished data. Estuarine dependence categories adapted from Whitfield 1994 (see Table 16)

Family name	Specific name	Common name	Dependence category	Recorded by
Anguillidae	*Anguilla bengalensis*	African mottled eel	Va	b
	Anguilla marmorata	Madagascar mottled eel	Va	b
	Anguilla mossambica	Longfin eel	Va	b
Ariidae	*Galeichthys feliceps*	Barbel/white seacatfish	IIb	a,b
Atherinidae	*Atherina breviceps*	Cape silverside	Ib	a,b
Carangidae	*Lichia amia*	Leervis/garrick	IIa	a,b

Family name	Specific name	Common name	Dependence category	Recorded by
	Trachurus trachurus	Horse mackerel	III	a
Centrarchidae	*Micropterus salmoides*	Largemouth bass	IVc	a,b
Cichlidae	*Oreochromis mossambicus*	Mozambique tilapia	IVb	a,b
Clinidae	*Clinus spatulatus*	Botriver klipvis	Ia	a,b
Clupeidae	*Gilchristella aestuaria*	Estuarine roundherring	Ia	a,b
Cyprinidae	*Cyprinus carpio*	Carp	IVc	a,b
Engraulidae	*Engraulis capensis*	Anchovy	III	a
Galaxiidae	*Galaxias* sp.	Cape galaxias	IVa	b
Gobiidae	*Caffrogobius gilchristi*	Prison goby	Ib	a,b
	Caffrogobius nudiceps	Barehead goby	Ib	b
	Caffrogobius saldanha	Commafin goby	Ib	b
	Psammogobius knysnaensis	Knysna sand-goby	Ib	a,b
Haemulidae	*Pomadasys olivaceum*	Piggy	III	a,b
Hemiramphidae	*Hyporhamphus capensis*	Cape halfbeak	Ib	a,b
Monodactylidae	*Monodactylus falciformis*	Cape moony	IIa	a,b
Mugilidae	*Liza dumerili*	Groovy mullet	IIb	a,b
	Liza richardsonii	Harder/ southern mullet	IIc	a,b
	Liza tricuspidens	Striped mullet	IIb	a,b
	Mugil cephalus	Flathead mullet	IIa/Vb	a,b
	Myxus capensis	Freshwater mullet	IIa/Vb	b
Ophichthidae	*Ophisurus serpens*	Sand snake-eel	III	a
Pomatomidae	*Pomatomus saltatrix*	Elf	IIc	a,b
Rhinobatidae	*Rhinobatos annulatus*	Lesser guitarfish	III	a,b
Sciaenidae	*Argyrosomus japonicus*	Dusky kob	IIa	a,b
Soleidae	*Heteromycteris capensis*	Cape sole	IIb	b
	Solea bleekeri	Blackhand sole	IIb	a,b
Sparidae	*Diplodus cervinus*	Zebra/wildeperd	III	a,b
	Diplodus sargus	Dassie/blacktail	IIc	a,b
	Lithognathus lithognathus	White steenbras	IIa	a,b
	Lithognathus mormyrus	Sand steenbras	III	b
	Rhabdosargus globiceps	White stumpnose	IIc	a,b
	Rhabdosargus holubi	Cape stumpnose	IIa	a,b
	Sarpa salpa	Strepie	IIc	a,b

Family name	Specific name	Common name	Dependence category	Recorded by
Syngnathidae	*Syngnathus temminckii*	Longsnout pipefish	Ib	a,b
Triglidae	*Chelidonichthys capensis*	Cape gurnard	III	a,b
Total			**41 species**	

Table 16 The five major categories of fishes that utilise South African estuaries occurring in the Bot/Kleinmond estuarine system (Adapted from Whitfield, 1994)

Category	Description of categories	Number of species
I	Estuarine species that breed in southern African estuaries:	
	Ia. Resident species breed only in estuaries	2
	Ib. Resident species that also have marine or freshwater breeding populations.	5
II	Euryhaline marine species that usually breed at sea with the juveniles showing varying degrees of dependence on southern African estuaries:	
	IIa. Juveniles dependent on estuaries as nursery areas.	8
	IIb. Juveniles occur mainly in estuaries but are also found at sea.	5
	IIc. Juveniles occur in estuaries but are usually more abundant at sea	3
III	Marine species that occur in estuaries in small numbers but are not dependent	3
IV	Euryhaline freshwater species, whose penetration into estuaries is determined by salinity tolerance. Includes some species that may breed in both freshwater and estuarine systems:	
	IVa. Indigenous	3
	IVb. Translocated from within southern Africa	2
	IVc. Alien	1
V	Catadromous species that use estuaries as transit routes between the marine and freshwater environments:	
	Va. Obligate catadromous species that require a freshwater phase in their development	1(3)
	Vb. Facultative catadromous species that do not require a freshwater phase in their development	2

9.4.4 Birds

The estuary is an important habitat for water birds with more than 118 species recorded. Notable is the large number of red-knobbed coot *Fulicia cristata*, as many as 36,000 at times (Heyl & Currie, 1985). The large number of bird species reflects the habitat diversity of the system. Summer et al (1979) states that the area supports about 8% of the resident wader population between the Olifants and Cape Aghulhas, and 2.4 % of the resident- plus migrant waders.

During periods of low salinity (associated with high water levels and prolonged closure) the productivity of the aquatic vegetation increases, supporting in excess of 30,000 red-knobbed coot *Fulica cristata* at one time. Stewart & Bally (1985) estimated that red-knobbed coot

consume up to 759 tonnes (dry weight) of *Ruppia* and return about 470 tonnes of faeces to the system a year.

Five bird species recorded in the Bot/Kleinmond coastal area are listed in the South African Red Data Book. White pelican *Penecalus onocrotalus* and the Caspian Tern *Hydroprogne caspia,* listed as rare, use the system for foraging. Greater *(Phoenicopterus rubber)* and lesser flamingos *(P. minor)* are listed as intermediate and both have been seen to breed on the estuary. The Fish eagle is listed as vulnerable.

9.4.5 Amphibians

Three rare frog species listed in the South African Red data book occur in the Northern Lamloch swamp area: Microfrog *Microbatrachella capensis* , Cape Platanna *Xenopus gilli* and Western Leopard toad *Bufo* pantherinus (de Villiers, unpublished data). These frogs breed between June and September. The wetlands between Kleinmond and Arabella contain more than 50 % of the remaining viable Microfrog *Microbatrachella capensis* habitat. This area also contains very large populations of about a third of the frog species in the Western Cape. This high diversity of species is related to the abundance of freshwater pans in the area. This is one of the supporting reasons for proposing the Bot/Kleinmond as a Ramsar site.

Major threats to the frog populations include sandmining, alteration and loss of habitat due to development and uncontrolled spread of alien vegetation.

9.4.6 Mammals

A herd of free-roaming horses can be found around the Vlei. They feed on the surrounding grasses and weeds and are known to have adapted somewhat to their surroundings. Adaptations include broader and flatter hooves for greater surface area and a resistance to foot rot normally associated with wet surroundings.

Other interesting mammals recoded in the area include Chacma baboon *Papio ursinus*, Caracal *Felis caracal,* Small-spotted genet *Genetta genetta,* Egyptian mongoose *Herpestes ichneumon,* Southern elephant seal *Mirounga leonine,* Cape Fox *Vulpes chamas,* Cape grey mongoose *Herpestes pulverulentus,* and Water mongoose *Atilax paludinosus*

Red data species include: Leopard *Panthera pardus,* Aardwolf *Proteles cristatus,* Honey badger *Mellivora capensi*, *Cape clawless otter Aonyx capensis* and Cape greater gerbil *Tatera afra.*

9.5 Conclusions

The current Revised Criteria for artificial breaching of the Bot River Estuary, agreed on 5 February 2003 by Bot River Estuary Advisory Committee (BREAC, Breaching Criteria Indaba held 5 February 2003), stipulate that artificial breaching of the sand bar situated between Meerensee Resort and Rooisand Nature Reserve (regarded as the mouth of the Bot) may only be done during the period 01 May to 31 August, during daylight hours, preferably at spring high tide (Data sheet 16). Breaching may only take place in the:

- **First Year after a previous breach**: If water height is at or over 2.5 metres above mean sea level and average salinity is at or below 6 parts per thousand.
- **Second Year after a previous breach**: If water height is at or over 2.5 metres above mean sea level and average salinity is at or between 6 to 8 parts per thousand.
- **Third Year after a previous breach**: If water height is at or over 2.5 metres above mean sea level. Salinity is not considered.
- **Or**: A consensus decision (by the Bot River Estuary Advisory Committee - BREAC) to artificially breach may be considered should salinities fall below 6 ppt and a catastrophe is imminent (such as mass mortalities of fish) even though water level has not reached 2.5 metres above mean sea level.

The problem is that since data were and still are not available on the functioning of the Kleinmond Estuary, its influence on the Bot was largely ignored at the symposium held at Cape Town (Sloan, Branch & Bally, 1985; Fromme, 1985a). This led to some crucial decisions being made on the basis of only a part of the overall picture. The current management plan still makes no provision for the joint management of the two systems.

In the past 30 years, reduction in runoff from the catchments, artificial breaching of the Bot and Kleinmond, and anthropogenic changes in the berm heights has led to longer periods between breaching and to the present day ecology reflecting a more freshwater defined system. This led scientists in the past to assume that Bot is naturally developing into a fresh water coastal lake. An analysis of the water levels pointed out, the system would have breached more often if not for human intervention at the Kleinmond mouth and a reduction in run-off from the catchment.

There are still indications in the ecology that the natural state of the system is estuarine, e.g. the endemic species *Clinus spatulatus* (which prefers a more saline environment) and that the sand prawn's stops breeding if the salinity drops below 20ppt (Wooldridge, pers. comm.).

Advantages of breaching the mouth more frequently include more stable communities, and therefore a more balanced ecosystem, and prevention of extreme fluctuations in salinities. A more estuarine environment would in general increase the species diversity (Wooldridge, pers. comm.).

The main conclusion of this study is that, in recent years, the two major impacts resulting in the Bot River Estuary being more often closed are:

- The reduction in run-off from the Bot, Swart and Afdaks catchments.
- Changes in the berm heights of Bot and Kleinmond due to sediment stabilisation.
- Premature artificial breaching at the Kleinmond Estuary (which is currently being controlled by CapeNature).

These factors have compounded the earlier intervention of stabilising the dune field, resulting in the shift from an estuarine system towards a freshwater coastal lake. This shift is therefore not considered to be the natural phenomenon that it was previously held to be.

9.6 Recommendations

The following recommendations are made on the basis of the preliminary findings of this study:

- An Estuarine Ecological Water Requirement (RDM or Reserve) study must be done as required by the National Water Act (1998) to asses the changes in the run-off from the catchment, and the inflow of the river that is required to keep the system in its optimum state. The Reserve determination process has a protocol (DWAF, 2004) which clearly states the steps involved and the data required to undertake it. The results of previous studies (Stipinovich, 2005; Van Niekerk et al 2004) clearly indicate that the Bot/Kleinmond estuarine system is under tremendous development stress from the catchment and from surrounding communities, and confirm that there is an urgent need for such a study. Such a study would also re-evaluate the present health of the system, hind-cast the reference condition and make recommendations towards a refined Mouth Breaching Plan.
- A joint management plan for the Bot and Kleinmond estuaries must address the needs of both and consider the conditions required for the survival of all the dependant species, both estuarine and fresh water types.
- Artificial breaching at the Kleinmond mouth must be monitored and controlled (currently a CapeNature activity). The problem of contamination from stormwater needs to be addressed.
- Monitoring of the berm heights of the Kleinmond and Bot is required in order to determine the natural fluctuations of the heights of the two berms.
- Monitoring of the water levels in the Bot and Kleinmond must continue (currently a DWAF activity).[6]
- Additional gauges for water level monitoring must be placed at Fisherhaven Yacht Club and Meerensee for easy visual monitoring of levels during critical times. They should be positioned so that they are readable at all times – during very low and very high water levels – and calibrated to match either the existing Ysterklip or Meerensee gauges
- At present Cape Nature Conservation is monitoring the salinities in the Bot and should continue doing so in order to get a clear understanding of the processes involved. It is also recommended

[6] Since early in 2000 there has been a continuous water level recorder at Kleinmond to monitor the interactions between the two systems.

that the salinity at Kleinmond be measured at monthly intervals to get some indication of the flushing involved.

- Continued monitoring of the fish (Marine and Coastal Management), birds (CWAC) and Amphibians (CapeNature) is very important to understand long-term trends in the system.
- A surface and groundwater water quality monitoring programme must be instituted at the Bot/Kleinmond system to identify and monitor possible sources of pollution.
- The Breaching Policy for the Bot/Kleinmond system must be reviewed through a scientific study (e.g. Estuarine RDM study), taking into account new information and management objectives established through the EMP planning process. It is proposed that less stringent breaching criteria be developed for the Bot/Kleinmond system which would allow for natural variability and mitigate for the reduction in flow to the estuary. A proposal for consideration is provided below.

PROPOSAL FOR CONSIDERATION:

REVISED BREACHING POLICY FOR THE BOT ESTUARY

In principle, artificial Breaching should be initiated when:

- The salinity falls below 10ppt (seawater is 35ppt). This allow for a further 3 to 5 ppt decrease (before critical stress limit of 6 ppt is reached) in salinity if breaching criteria is not reached in any year. There is often not sufficient water in the system for breaching when the 6ppt limit is reached, leading to a further reduction before breaching level can be achieved in the following year (e.g. 4.8 ppt recorded in September 2008).
- The water level is at or over 2.5 metres above mean sea level, permitting flushing and adequate flow of freshwater into the marine environment to provide a cue for recruitment of marine fish into the estuary.
- Only during daylight hours.
- Preferably at spring high tide, but this shall not be considered a deciding factor.

FIRST YEAR AFTER A PREVIOUS BREACH:

- Only between 01 May and 31 August (this will safe guard breeding waterfowl);
- If water height is at or over 2.5 metres above mean sea level; and
- Average salinity is at or below 10 parts per thousand.

SECOND YEAR AFTER A PREVIOUS BREACH

- Any time of the year (this would allow for recruitment of fish and invertebrates if the rain comes in late winter or spring);
- If water height is at or over 2.5 metres above mean sea level; and
- Average salinity is less than 10 parts per thousand.

THIRD YEAR AFTER A PREVIOUS BREACH:

- If water height is at or over 2.5 metres above mean sea level.
- Salinity is not considered.

OR

- A consensus decision (by the authorised body) to artificially breach may be considered should salinities fall below 6 ppt and a catastrophe is imminent (such as mass mortalities of fish) even though water level has not reached 2.5 metres above mean sea level.

Figure 23 Breede River Water Management Area showing the Bot River catchment

10. Initial terrestrial biodiversity conservation assessment

The management of the catchment of the Bot River and surrounding terrestrial areas will directly impact on the health and functioning of the Bot / Kleinmond estuary in terms of hydrology and water quality. Critical to this is the land use and management of the catchment area, which needs to enable the achievement of both terrestrial habitat conservation targets and biodiversity process targets. The approach adopted therefore is to analyse the quaternary catchments draining into the Botriviersvlei in terms of land capability, historic vegetation distribution and ecosystem status, as well as level of formal protection and management. This in turn informs the role and function of terrestrial habitat associated with the estuarine system, the value-sensitivity analysis for the estuarine planning area. During the planning phase of the EMP development it will inform proposals for the conservation and development of land within the estuary margin as well as linkages beyond this immediate area to the catchment as a whole.

Key conservation planning outputs available to the study include:

- National Spatial Biodiversity Assessment (Driver et al, 2005)
- Conservation Plan for the Agulhas Plain (Cole et al, 2000) (incorporated in *Putting Biodiversity Plans to Work* documents prepared for Overstrand municipality)
- Cape Lowlands Renosterveld Plan (Von Hase, 2003) (incorporated in *Putting Biodiversity Plans to Work* documents prepared for Overstrand municipality)
- CapeNature ecosystem status assessment based on an updated remnant layer for the Overberg District Municipality (Kirkwood, 2007)
- Report on Sensitivity-Value Analysis and Zonation Process for the Boland Reserve Complex (Holness and Skowno, 2008).

In addition, GIS datasets listed in Chapter 4 have been used to generate this assessment.

10.1 Land capability and extent of cultivation

The Bot River catchment has been calculated as 907km² in area (Stipinovich 2005) and includes the urban settlements of Caledon, Botrivier, Fisherhaven, Kleinmond and Hawston and falls within the Breede River Water Management Area (see Figure 23). The catchment is divided into three main quaternary catchments: Bot River (G40E), the Swart River (G40F) and G40G incorporating the Afdaks River, Hopies River, the West Bank and estuary catchment areas. Table 17 provides a spatial analysis of land capability classes at a coarse scale, using the quaternary catchment boundaries.

Cultivated agriculture accounts for 37,167.30 ha (40.38% of the combined areas of all 3 catchments). Large tracts of commercial forestry land, mainly pine species, have been decommissioned in the western part the catchment, potentially rendering a significant volume of water available for re-allocation to the ecological reserve and/or users, but plans for removal of the trees and replacement land uses have not been finalised.

Table 17 Extent of Land capability classes

Bot sub catchment	Land capability classes			Cultivated fields (ha) (% of catchment)	Total catchment area (ha)
	Arable land (ha) (% of catchment)	Grazing (ha) (% of catchment)	Wildlife (ha) (% of catchment)		
G40E	2,463.80 (8.88%)	25,294.70 (91.12%)	-	9,276.81 (33.42%)	27,758.26
G40F	27,728.57 (65.63%)	14,518.49 (34.37%)	-	24,631.43 (58.30%)	42,249.45
G40G	-	20,743.38 (94.7%)	1,161.35 (5.30%)	3,259.06 (14.78%)	22,050.47
				TOTAL	92,058.18

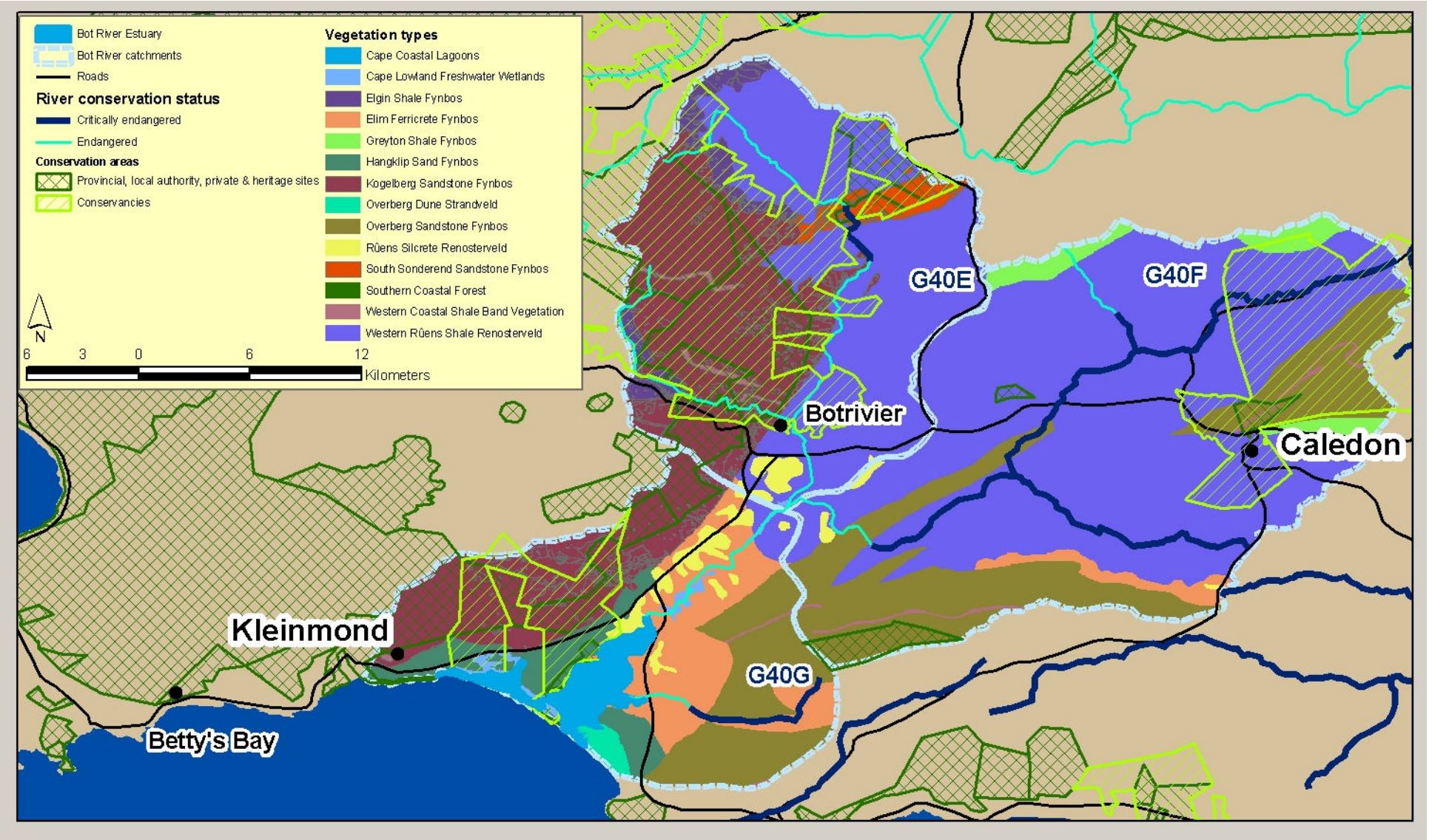

Figure 24 Catchment-wide Vegetation types and river conservation status (NBSAP)

Land cover analysis for the catchment has been undertaken by Stipinovich (2002) and adapted by Van Niekerk et al (2005). This provides a more detailed assessment of land cover categories using the sub-catchments for the estuary, Afdaks and Hopies River catchments (see Table 18).

Table 18 Land cover and estimated runoff for Bot River sub-catchments (after Van Niekerk et al, 2005)

Land-cover class	Area per subcatchment (ha)							% of Total catch-ment
	Bot River	Swart River	Afdaks River	Lower East bank	Lower West bank	Botvlei	TOTAL	
Urban built-up (town)	171	261	16	298	273	-	1018	1.1
Other built-up	30	126	13	168	219	-	555	0.6
Road surface (all classes)	196	370	24	73	105	-	767	0.8
Annual agriculture (cereals/grazing)	8611	27448	592	2071	1210	-	39931	44.0
Perennial agriculture (orchard, vineyard)	445	-	-	-	1744	-	2190	2.4
Forestry plantation	1286	717	284	-	171	-	2459	2.7
Cultivated fynbos	-	-	-	-	205	-	205	0.2
Natural fynbos	14697	9315	2459	1716	4347	-	32534	35.9
Sparse alien vegetation	54	81	97	660	776	-	1669	1.8
Dense alien vegetation	490	650	279	479	583	-	2481	2.7
Water surface: Dams	140	111	29	25	81	-	387	0.4
Water surface: Estuary	-	-	-	-	-	1359	1359	1.5
River course	66	147	20	56	45	-	332	0.4
Wetland	-	-	-	-	306	-	306	0.3
Bare rock (mountainous)	-	2807	-	640	390	-	3837	4.2
Other bare surface (beach, excavations)	87	158	33	86	330	-	694	0.8
Total Bot River catchment area (ha)	**26273**	**42192**	**3847**	**6270**	**10785**	**1359**	**90726**	100.0
% of Total catchment	29.0	46.5	4.2	6.9	11.9	1.5	100.0	
Estimated virgin runoff (10^6m^3)	37.22	21.65	29.67	?	?	?	**88.54**	
Estimated current runoff (10^6m^3)	24.78	18.70	23.7	?	?	?	**65.9**	

* Bot River at Roode Heuvel gauge
Sources: Land cover adapted from Stipinovich (2002); Schultz and Watson, 2002)

10.2 Historic vegetation distribution and ecosystem status

An assessment of historic vegetation distribution and extent was undertaken using the Overberg remnant layer (Kirkwood, 2007). (Refer Figure 24). Table 19 presents the ecosystem status of each represented vegetation type within the sub-catchments. Table 20 presents a summary per sub-catchment of areas that are classified according to ecosystem status.

Ecosystem Status is determined on the basis of the remaining extent of historic distributions available to meet conservation targets. The categories of ecosystem status are defined as follows:

CE	**Critically endangered**	Vegetation types for which the remaining extent is less than that required to meet the national targets
E	**Endangered**	Types with less remaining area that needed for the target plus an additional 15%
V	**Vulnerable**	Types with less than 60% of historic extent remaining
LT	**Least Threatened**	Types with more than 60% of historic extent remaining

Table 20 shows that 56.64% (52,136.08 ha) of the Bot River Catchment is considered to represent habitats that are critically endangered. On the basis of this analysis (i.e. using the Kirkwood update for the Overberg remnant layer), two vegetation types have different assigned status to that determined by the NSBA: Greyton Shale Fynbos moved from Vulnerable to Endangered, and Elim Ferricrete Fynbos moved from Endangered to Critically Endangered. The implications are, that further transformation of these identified habitats (Elim Ferricrete Fynbos, Greyton Shale Fynbos, Rûens Silcrete Renosterveld and Western Rûens Shale Renosterveld) should be prevented in line with the WCPSDF policy, and adequate planning for their protection and rehabilitation should be initiated.

Table 19 Catchment ecosystem status and vegetation distribution

Vegetation types	Ecosystem status	G40E Ha (% of catchment)	G40F Ha (% of catchment)	G40G Ha (% of catchment)	Total Ha (% of total area)
Cape Coastal Lagoons	LT	-	-	1,193.50 (5.41%)	1,193.50 (1.30%)
Cape Lowlands Freshwater Wetlands	LT	22.85 (0.08%)	44.81 (0.11%)	571.43 (2.59%)	639.08 (0.69%)
Cape Seashore Vegetation	LT	-	-	34.74 (0.16%)	34.74 (0.04%)
Elgin Shale Fynbos	CE	1,691.36 (6.09%)	-	-	1,691.36 (1.84%)
Elim Ferricrete Fynbos	CE	11.62 (0.04%)	781.64 (1.85%)	4,604.98 (20.89%)	5,398.24 (5.86%)
Greyton Shale Fynbos	E	9.14 (0.03%)	1,849.06 (4.38%)	-	1,858.20 (2.02%)
Hangklip Sand Fynbos	V	-	-	2,471.10 (11.21%)	2,471.10 (2.68%)
Kogelberg Sandstone Fynbos	LT	10,585.35 (38.13%)	-	6,830.46 (30.98%)	17,415.81 (18.92%)
Overberg Dune Strandveld	LT	-	-	444.65 (2.02%)	444.65 (0.48%)
Overberg Sandstone Fynbos	LT	-	9,596.07 (21.71%)	4,454.66 (20.21%)	14,050.73 (15.26%)
Rûens Silcrete Renosterveld	CE	406.72 (1.47%)	183.68 (0.43%)	925.47 (4.20%)	1,515.86 (1.65%)
South Sonderend Sandstone Fynbos	LT	1,168.02 (4.21%)	-	-	1,168.02 (1.27%)
Western Coastal Shale Band Vegetation	LT	261.91 (0.94%)	296.95 (0.70%)	81.75 (0.37%)	640.61 (0.70%)
Western Rûens Shale Renosterveld	CE	13,601.54 (49.00%)	29,494.85 (69.82%)	424.24 (1.97%)	43,530.63 (47.29%)

Table 20 Summary of area of vegetation types assignment of ecosystem status per catchment area

Ecosystem status	G40E Ha (% of catchment)	G40F Ha (% of catchment)	G40G Ha (% of catchment)	Total Ha (% of total area)
Critically endangered	15,711.23 (56.60%)	30,460.16 (72.10%)	5,964.69 (27.05%)	52,136.08 (56.64%)
Endangered	9.14 (0.03%)	1,849.06 (4.38%)	-	1,858.20 (2.02%)
Vulnerable	-	-	2,471.10 (11.21%)	2,471.10 (2.68%)
Least threatened	12,038.12 (43.37%)	9,937.84 (23.52%)	13,611.18 (61.74%)	35,587.14 (38.66)

10.3 Extent of transformation of habitats

Table 21 shows the distributions of land cover categories developed by Kirkwood (2007) within each sub-catchment and Table 22 shows the extent of remaining habitat, which conversely shows the extent of transformation of natural habitats.

The extent of transformation in G40F is largely due to agriculture on the productive shale soils. The result is that vegetation types such as Western Rûens Shale Renosterveld are largely confined to small isolated remnants; a conservation challenge being addressed through CapeNature's Stewardship programme and the Biodiversity and Wine Initiative.

Table 21 Analysis of broad land cover per sub-catchment

Broad land cover categories	G40E Ha (% of catchment)	G40F Ha (% of catchment)	G40G Ha (% of catchment)	Total Ha (% of total area)
Natural	12,849.46 (46.29%)	10,964.84 (25.95%)	11,247.39 (51.02%)	35,061.69 (38.09%)
Near natural	1.66 (0.01%)	3.79 (0.01%)	1,186.60 (5.38%)	1,192.05 (1.29%)
Uncertain – probably natural	3,947.50 (14.22%)	3,670.30 (8.69%)	4,142.73 (18.79%)	11,760.53 (12.28%)
Uncertain – probably transformed	528.84 (1.91%)	299.26 (0.71%)	270.21 (1.23%)	1,098.31 (1.19%)
Uncertain – probably degraded	191.41 (0.69%)	-	811.14 (3.68%)	1,002.56 (1.09%)
Transformed	10,239.63 (36.89%)	27,308.88 (64.64%)	4,388.88 (19.91%)	41,937.39 (45.56%)

Table 22 Distribution of only natural areas (as defined by broad landcover described by Kirkwood) of each vegetation type

Vegetation types	Ecosystem status	G40E Ha (% of catchment)	G40F Ha (% of catchment)	G40G Ha (% of catchment)	Total Ha (% of total area)
Cape Coastal Lagoons	LT	-	-	35.90 (3.01%)	35.90 (3.01%)
Cape Lowlands Freshwater Wetlands	LT	1.45 (6.36%)	10.92 (24.37%)	247.68 (43.34%)	260.06 (40.69%)
Cape Seashore Vegetation	LT	-	-	19.46 (56.00%)	19.46 (56.00%)
Elgin Shale Fynbos	CE	501.41 (29.65%)	-	-	501.41 (29.65%)
Elim Ferricrete Fynbos	CE	7.74 (66.61%)	137.00 (17.53%)	905.47 (19.66%)	1,050.21 (19.45%)
Greyton Shale Fynbos	E	0.46 (5.00%)	749.76 (40.55%)	-	750.22 (40.37%)
Hangklip Sand Fynbos	V	-	-	1,265.45 (51.21%)	1,265.45 (51.21%)
Kogelberg Sandstone Fynbos	LT	8,289.53 (78.31%)	-	5,107.52 (74.78%)	13,397.05 (76.92%)

Vegetation types	Ecosystem status	G40E Ha (% of catchment)	G40F Ha (% of catchment)	G40G Ha (% of catchment)	Total Ha (% of total area)
Overberg Dune Strandveld	LT	-	-	90.48 (20.35%)	90.48 (20.35%)
Overberg Sandstone Fynbos	LT	-	7,918.72 (82.52%)	3,283.74 (73.71%)	11,202.46 (79.73%)
Rûens Silcrete Renosterveld	CE	61.37 (15.09%)	26.12 (14.22%)	171.19 (18.50%)	258.68 (17.06%)
South Sonderend Sandstone Fynbos	LT	953.53 (81.64%)	-	-	953.53 (81.64%)
Western Coastal Shale Band Vegetation	LT	240.59 (91.86%)	255.58 (86.07%)	46.88 (57.34%)	543.05 (84.77%)
Western Rûens Shale Renosterveld	CE	2,793.39 (20.54%)	1,866.73 (6.33%)	73.64 (16.96%)	4,733.75 (10.87%)
Total area of each quaternary catchment (% remaining natural)		12,849.46 (46.29%)	10,964.84 (25.95%)	11,247.39 (51.02%)	35,061.69 (38.09%)

Note: % remaining is natural area/historic area

The analysis presented in Table 21 and Table 22 underscores the need to conserve remaining habitats within the Bot River catchments that represent critically endangered and endangered types in an integrated approach to catchment and estuarine conservation and management.

10.4 Level of protection within the Bot River sub-catchments

Existing protected areas within the sub-catchments of the Bot River are presented in Figure 25. Key elements of the protected area networks include the Kogelberg Biosphere Reserve, parts of which also form part of the Cape Floral Regional Protected Areas World Heritage Site.

The Kogelberg Biosphere Reserve was established in 1998 and is zoned into core, buffer and transitional areas. The buffer includes a marine component, currently being considered for designation of a Marine Protected Area. The core is made up largely of provincial nature reserves. As there is currently no legal framework and status that applies to Biosphere Reserves in South Africa, land management and development control for areas that fall outside of the formal protected network and within the transitional and buffer zones remain hotly contested in the public area.

The catchment of the Bot River include component reserves (specifically the Kogelberg and Hottentots Holland Nature Reserves) of the Boland Mountain (or Hottentots Holland) Complex, which is one of the eight serial protected areas that comprise the Cape Floral Region Protected Areas World Heritage Site (declared in June 2004).

Table 23 and Table 24 provide the details of the protected areas and areas under protection within the sub-catchments respectively.

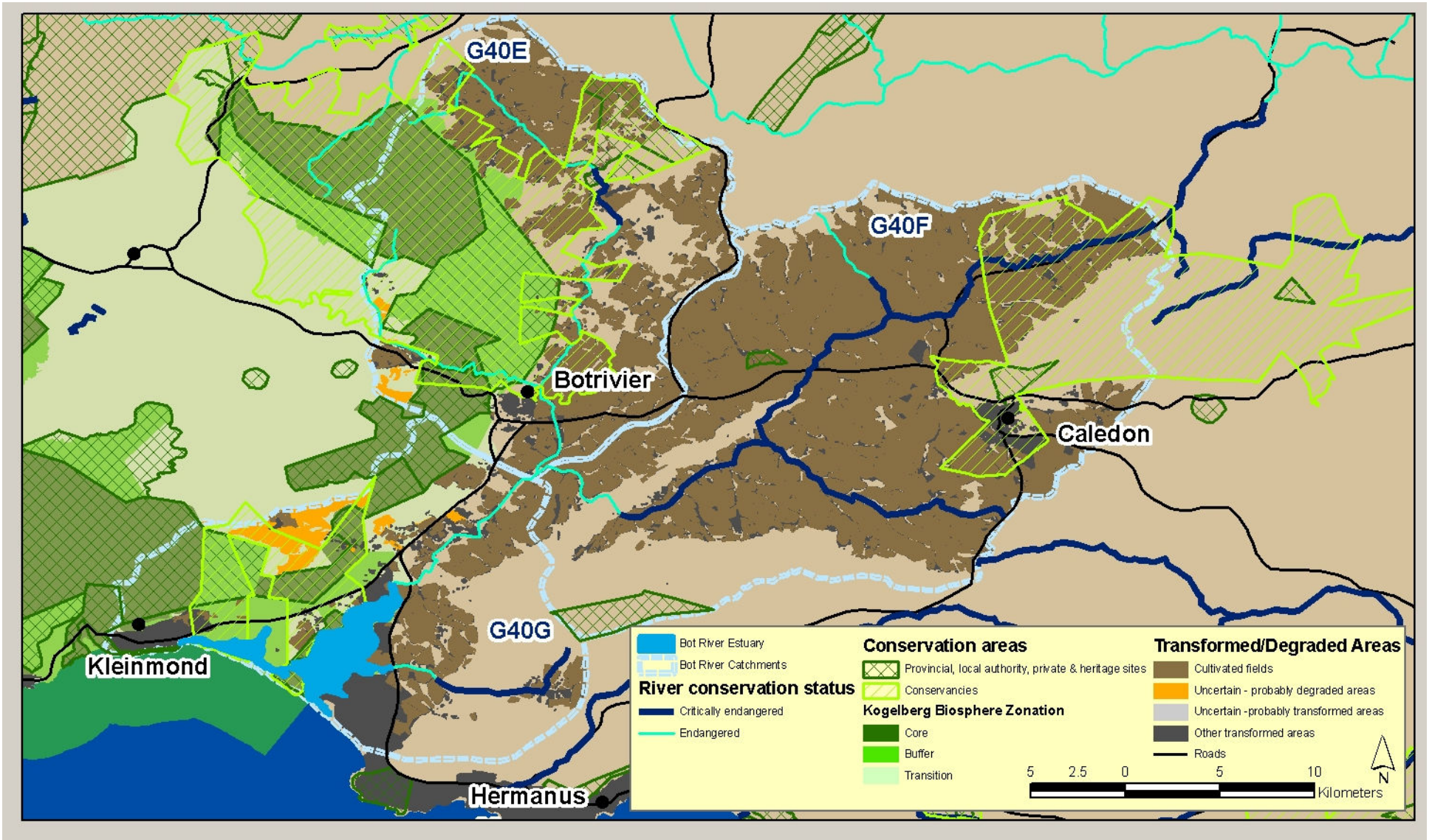

Figure 25 Protected areas and level of transformation of the Bot River catchment

Table 23 Protected Areas within the Bot River Catchment

Quaternary catchment	Protected Area name	Protected Area category	Size (Ha)
G40E	Diepklowe Private Nature Reserve	Private Nature Reserve	213.76
	Eagle Rock Private Nature Reserve	Private Nature Reserve	32.34
	Groenlandberg	Provincial Nature Reserve	2834.10
	Hottentots-holland	Mountain Catchment Area	3658.93
	Houwhoek	Provincial Nature Reserve	1522.86
	Klein Ezeljagt Private Nature Reserve	Private Nature Reserve	153.37
	Witdraai Private Nature Reserve	Private Nature Reserve	984.77
G40F	Babilonstoring	Provincial Nature Reserve	755.70
	Boontjieskraal	National Heritage Site	85.48
	Caledon	Local Authority Nature Reserve	261.53
G40G	Babilonstoring	Provincial Nature Reserve	14.22
	Rooisand	Provincial Nature Reserve	272.66
	Hottentots-holland	Mountain Catchment Area	1365.82
	Houwhoek	Provincial Nature Reserve	627.95
	Kleinmond Coast And Mountain	Local Authority Nature Reserve	61.40
	Kogelberg	Provincial Nature Reserve	1200.69
	Mt Hebron	Provincial Nature Reserve	756.55

Note: some protected areas straddle catchment boundaries.

Table 24 Extent of the Bot River sub-catchments under protection

	Provincial Nature Reserves (% of catchment)	National Heritage Sites (% of catchment)	Mountain Catchment Area	Private Nature Reserves (% of catchment)	Local Authority Reserves (% of catchment)	Total area per catchment protected (% of each catchment)
G40E	4,356.97 (15.70%)	-	3,658.93 (13.18%)	1,384.24 (4.99%)	-	9.400.13 (33.86%)
G40F	755.70 (1.79%)	85.48 (0.20%)	-	-	261.53 (0.62%)	1,102.13 (2.61%)
G40G	2,872.08 (13.03%)	-	1,365.82 (6.20%)	-	61.40 (0.28%)	4,299.29 (19.50%)
Total area per category (% of 3 catchments combined)	7,984.74 (8.67%)	85.48 (0.09%)	5,024.74 (5.46%)	1,384.24 (1.50%)	322.93 (0.35%)	14,802.14 (16.08%)

From the analysis in Table 24 it is apparent that a total area of 16.08% of the Bot River Catchment area is under some form of formal protection. While this total is over the 10% minimum described by the IUCN it is important to note that urgent action to secure national ecosystem targets is needed as lowland vegetation types, and specifically those referred to in section 10.2 are under-represented in protected areas (Holness & Skowno, 2008). Further, the combination of the significance of the estuary, the ecosystem and health status of the river systems, and that of the vegetation types, means that sound land management practices and bold plans will need to be implemented for conservation and rehabilitation within the Bot River catchment as a matter of priority.

10.5 Identified linkages for ecological and evolutionary processes

Based on the "Putting Plans to Work" project outputs for the Overstrand Municipality, Cole et al (2000) and Von Hase (2003) have informed Conservation 1 and 2 Spatial Planning Categories in the Overstrand SDF and enabled the identification of corridors and ecological process linkages within the spatial development framework. These include linkages from the marine and coastal areas to the Boland Mountain Complex (Figure 26). The implications for spatial planning and development would be the proactive and integrated establishment of conservation targets in terms of land and natural resource uses as well as protection of a network of terrestrial, riparian, estuarine and coastal habitats linking to the proposed Kogelberg Marine Protected Area.

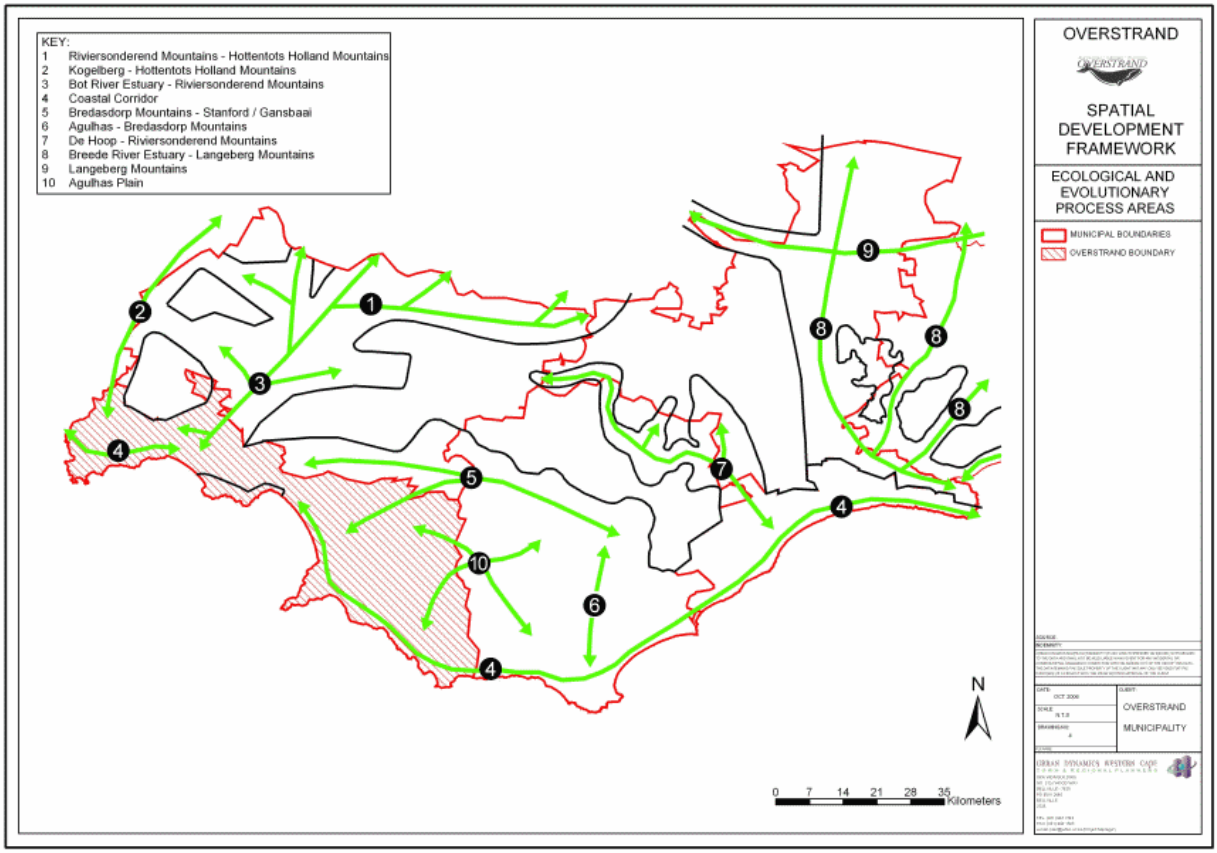

Figure 26 Overstrand SDF Ecological and Evolutionary Process Areas

10.6 Biodiversity Value-Sensitivity Analysis

Using a similar methodology applied to the biodiversity components of the analysis undertaken by Holness and Skowno (2008), a biodiversity value and sensitivity analysis has been undertaken for the estuarine quaternary catchment – G40G (Figure 27).

The overall approach in undertaking the biodiversity assessment has been to use existing spatial biodiversity data to derive terrestrial biodiversity value-sensitivity and hydrological sensitivity informants. The river corridors, the estuary and the marine ecosystems have been identified as important from biodiversity process perspectives. Further, areas important for coastal sediment and hydrological processes have also been identified.

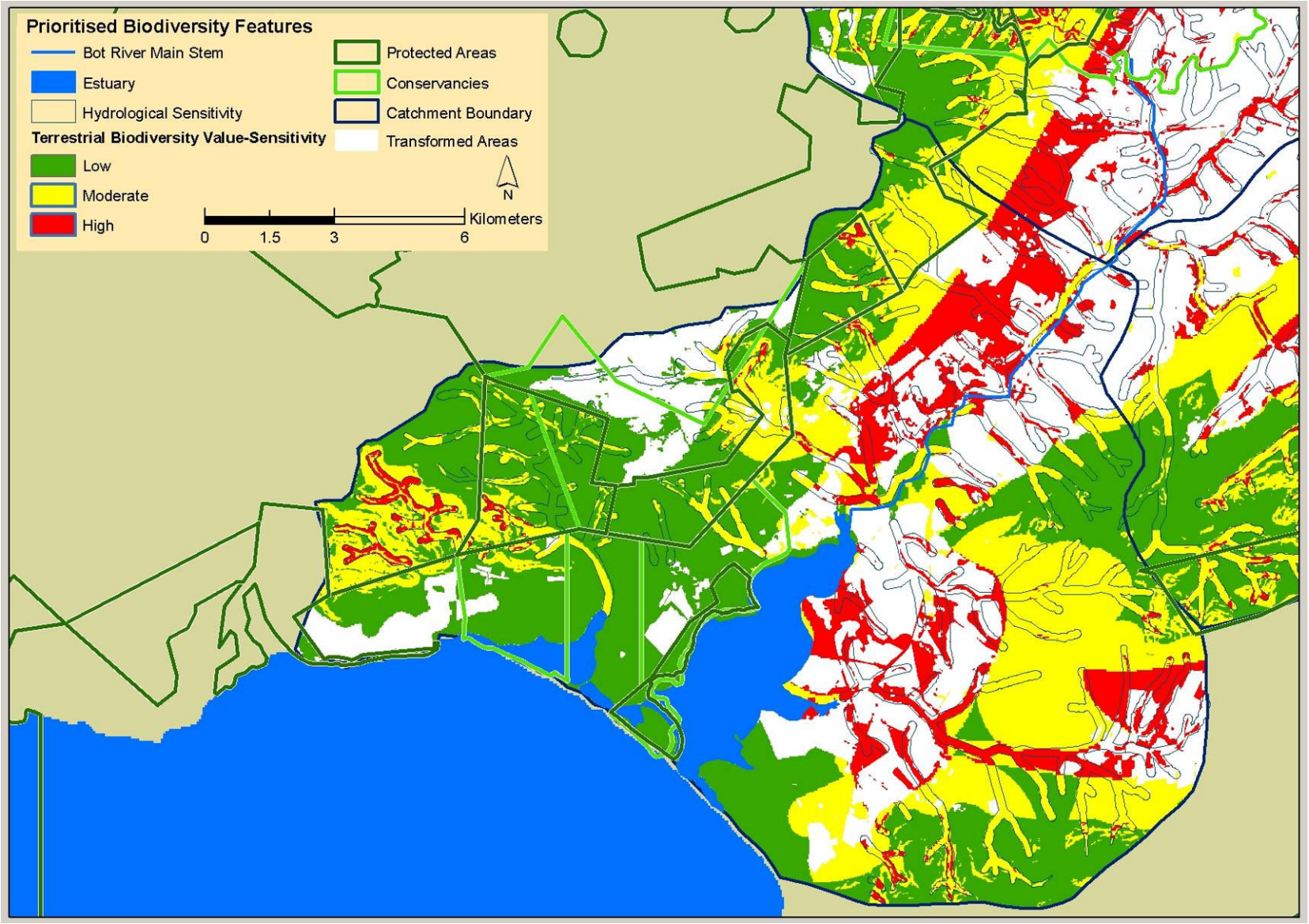

Figure 27 Hydrological and biodiversity value-sensitivity analysis for the estuarine catchment

The available data layers for the assessment are recorded in Chapter 4. The following is a summary of the method employed to undertake the biodiversity value-sensitivity analysis.

- A terrestrial biodiversity value layer was created by combining the analyses of the following factors, and classes were assigned for terrestrial vegetation types and habitats in the following way:
  - » Habitat conservation status (critically endangered, endangered and least threatened)
  - » Habitat ecosystem status (not protected, hardly protected, poorly protected, moderately protected and well protected)
  - » Special habitats (identified special habitats from Theewaterskloof, Overstrand and renosterveld putting plans to work datasets).
- A terrestrial biodiversity sensitivity layer was based on:
  - » Species sensitivity in terms of known locations of threatened species from the SANBI Threatened Species Programme
  - » Topographic sensitivity (all areas >20 degrees were prioritised)
  - » Hydrographic sensitivity (all river reaches were classified in terms of landform and then a margin width was allocated accordingly with upper slopes having narrower margins than flat slopes or valleys).
- The value and sensitivity layers were combined to derive a combined terrestrial biodiversity value-sensitivity layer.
- Hydrological value: Areas delimited fall within the margins identified for all river reaches classified in terms of landform, as above. The rivers assessment and ecosystem status classification in terms of the NBSAP are all either critically endangered or endangered (see Figure 24).

Caution must be exercised in interpreting Figure 27, as the assessment is highly dependent on terrestrial vegetation types and their analysis. Further assessment and integration of faunal and avifaunal elements as well as aquatic floral and faunal elements, geohydrology, and estuarine habitats will improve its local application.

10.7 Geohydrological considerations

According to Parsons (2005), “the Bot River Valley is a *classical horst and garben structure*, which extends from Bot River in the north to the coast”. A fault extends some 40 km north-eastwards and is the same structure explored by Weaver (1989) for water supply for the town of Botrivier. The upthrown north-western part of the fault comprises quartzites and sandstones of the Nardouw Subgroup of the Table Mountain Group (TMG) while the downthrown south-eastern component comprises weathered shales of the Bokkeveld Group. The TMG has direct relevance to the water supply potential of the area with yields from the Bokkeveld Group considered inferior to those of the TMG. Parsons (2005), however, points out that aquifers associated with the Bokkeveld Group and the unconsolidated sands play an important role in the ecological functioning of the area. “In general, groundwater from the TMG Aquifer is of extremely good quality, but can be corrosive, aggressive and yield high concentrations of iron and manganese. Groundwater abstracted from nearby boreholes yield between 5 and 30 mg/L Fe, thereby requiring treatment before use. Concentrations above 0.3 mg/L result in the taste of the water being objectionable. Electrical conductivity levels remain below 40 mS/m while pH fluctuates between 5 and 6 pH units. Except for the Fe and Mn concentrations, the groundwater is fit for domestic use” (Pietersen and Parsons, 2002).

In relation to the Lamloch Swamp, Parsons (2005) notes that groundwater levels north of the fault are expected to be variable but south of the fault, groundwater levels are generally very shallow (0 – 2 m), giving rise to the wetlands on the southern part of the property *De Draay*. Water is prevented from infiltrating from the overlying sands into the deeper subsurface Bokkeveld Group due to the low hydraulic conductivity of these weathered sediments and causes much of the area south of the fault to be waterlogged. While groundwater flow directions will mimic topography, local-scale anomalies may occur due to the heterogeneous nature of the subsurface.

Further investigation of the geohydrological conditions of the estuary margin area is required in order to inform a value-sensitivity analysis of the resource and potential impacts from land-uses.

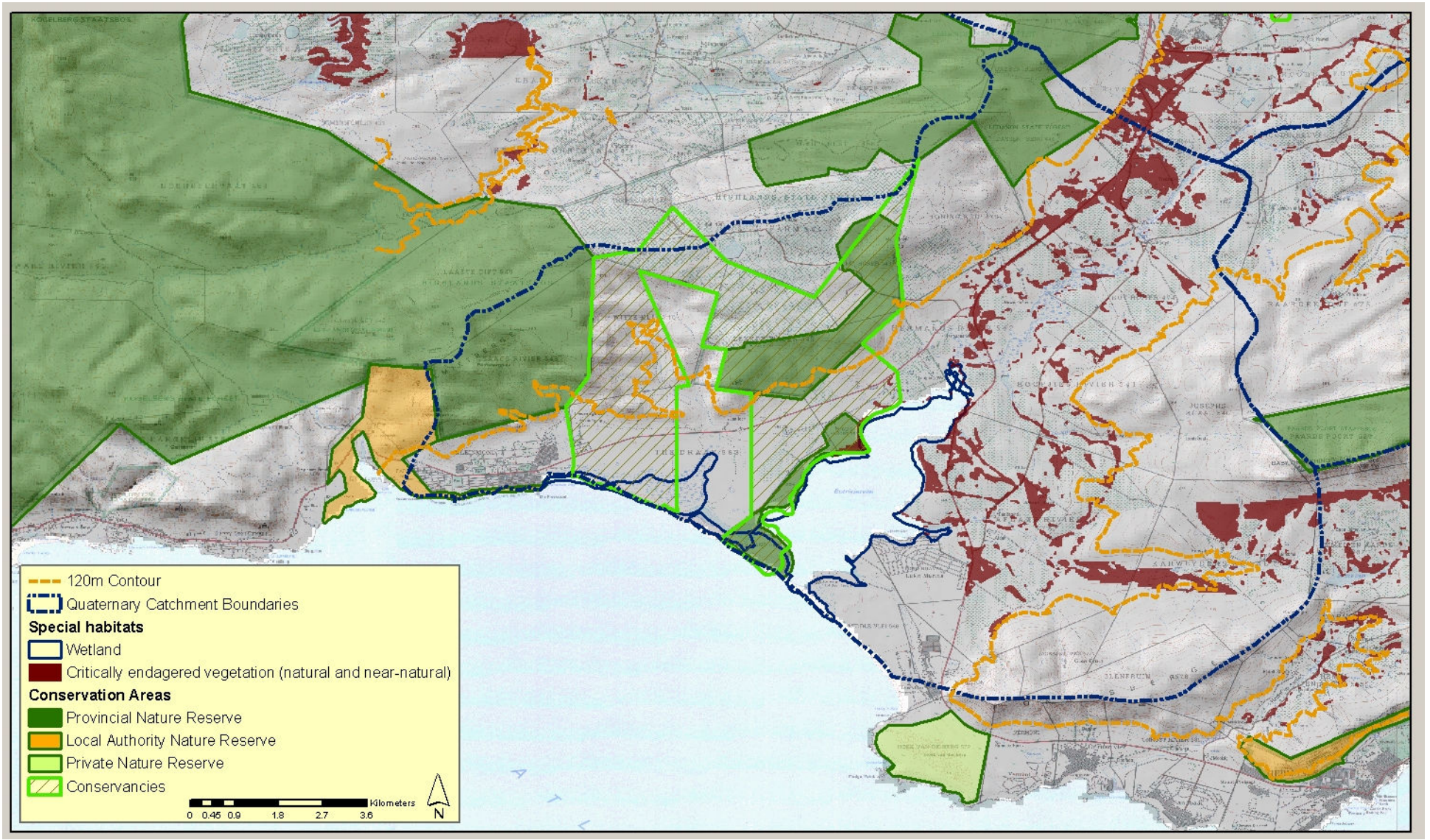

Figure 28 Location of areas of critically endangered vegetation in the estuarine catchment

10.8 Priority issues for EMP strategy and planning

The following highlight the key issues that should be considered in compiling the EMP:

- While much conservation planning has been undertaken that is relevant to the catchment, there is insufficient:
  - » integration between the terrestrial, freshwater, estuarine and marine biodiversity elements;
  - » detail for application at a cadastral level, i.e. the level at which land use management and environmental authorisations are addressed
  - » elevation of priority of conservation importance of terrestrial and aquatic habitats that are associated with the estuarine and coastal systems
- Areas identified in the SDF for further detailed planning (i.e. Rural Development Area for the Bot Estuary) are understood to be indicative and need to be adjusted for framework planning purposes to take account of all immediate factors affecting management in the estuarine catchment (G40G)
- Areas identified as Conservation 2 require active formalisation as the spatial proposals made in the SDF run counter to the conservation importance associated with these areas, e.g. areas on the eastern side of the Bot estuary which are identified for urban expansion include critically endangered terrestrial habitats. There appears to be little or no provision within the SDF for formalised habitat corridors. This is especially dangerous in the context of much of the eastern side of the estuary being privately owned and rapidly developing. See Figure 28. Further, the links and integration of the conservation zones into an open space system appears absent.
- SDF spatial proposals for expanded urban areas may not provide a sufficient buffer for the terrestrial-estuarine habitat ecotone in the context of climate change and increased water levels (for example, the eastern side of Kleinmond where the potential development influence on aquatic habitat appears ill-considered).
- In addressing the above issues, the EMP needs to:
  - » Enable strategic and integrated level conservation targets to enable conservation for terrestrial, freshwater and estuarine habitats at the local level. (The terrestrial margin target proposed by Turpie and Clarke 2007 is 50%, however this may need to increase depending on the conservation and protection status of areas in proximity to the estuary).
  - » Investigate further what measure are appropriate to protect groundwater and surface freshwater systems in the estuary margin.
  - » Prioritise meeting terrestrial conservation targets for types currently under-represented within the protected area network, firstly to arrest transformation of these habitats and secondly to secure their persistence as natural habitat.
  - » Recommend protected area linkages needed to reinforce the protection of terrestrial biodiversity and its positive influence on water resource management.
  - » Enable the functioning of the Bot River Estuary and surrounding conservation areas as well as the riparian corridors as a coast to interior linkage and large-scale ecological corridor.
  - » Propose a spatial framework for conservation and development that underpins further detailed planning for the Bot River Rural Development Area. The extent of the framework planning area will be defined by impact management considerations.
  - » Recommend the compilation of an Environmental Management Framework for the newly defined RDA that can bridge the gap between conservation planning at a regional and catchment scale and ongoing land use and environmental assessment and authorisations.
  - » Recommend appropriate development controls that enable an adequate terrestrial buffer for riparian and estuarine habitats.
  - » Recommend specific environmental performance targets, for example, water use, waste water treatment and sewage management for development within the margin or coastal protection zone.
  - » Enable monitoring of recreational use and its impact on terrestrial estuarine and freshwater habitats.

Part C: SYNTHESIS

11. Threats, opportunities and recommended management tools

The preceding chapters provide an assessment of the situation at the Bot / Kleinmond estuarine system from sectoral points of view. The strength of integrated management planning lies in its capacity to address a multiplicity of sectoral issues through the application of a few cross-cutting strategies.

In this chapter, as a tool for synthesising sectoral information from previous chapters, we have adapted a framework used by Kay and Alder (2005) for analysing coastal threats or issues in terms of their underlying social and economic drivers. The methodology enables a matching of individual issues or impacts with causal factors (drivers). Some of the causal factors cannot be addressed through a local level plan such as the EMP. The analysis makes it possible to separate them out and focus on the others – those that can be addressed through the EMP – and these are then linked to a set of cross-cutting planning and management tools.

Whilst some IAPs felt that the EMP should be focusing on the ecological aspects of estuary management only (discussed in the Preface to the Final draft), yet others considered the exclusion of certain issues through the planning process described above, to be unacceptable. It needs to be noted that their exclusion here does not mean that they do not deserve to be addressed; merely that they are issues that need to be addressed through a higher level vehicle than the EMP. So, for example, the strategic decision – taken by the Overstrand Municipality – to support urban expansion in the Hawston-Fisherhaven area, cannot be overturned within the scope of this Plan. What can, and has, been done is to consider at the local level where development should not be countenanced (such as on the Middelvlei dune field) and under what conditions it should be allowed in other areas (such as the extension and upgrading of the sewerage management system and the introduction of a riparian reserve). Higher level strategic decisions of the Municipality need to be addressed through the IDP process which, by law, is required to be a democratic process involving public participation.

Besides addressing threats and impacts, this chapter also elaborates on the opportunities and potential solutions that have emerged during the course of assessment and locates them in relation to the set of planning and management tools.

11.1 Key threats and their drivers

Environmental impacts are the result of a chain of causal factors, or drivers. Management effort directed at the impact itself does not always lead to sustainable solutions. The causal factors must also be addressed. The identification of causal factors for the Bot / Kleinmond system is summarised in Table 25. They are sorted into categories according to the scale and nature of the threat or impact.

Table 25 Threats to the Bot/Kleinmond estuarine ecosystem and associated drivers

Type of threat or impact	Social and economic drivers
Of global, national and/or regional significance	
Declining stocks of marine fish and impaired nursery function of the estuary	· Catchment-wide use of the freshwater resource for agriculture and commercial forestry. Also, to a lesser but increasing extent, industry, commerce and residential · Anthropogenic influences on sediment dynamics and flow, resulting in extended periods of mouth closure and an increasingly freshwater dominated system · Unsustainable levels of harvesting
Loss of biodiversity – terrestrial and estuarine	· Loss of habitats due to urban expansion and poor agricultural practices · Instability of the estuarine system as a result of anthropogenic

Type of threat or impact	Social and economic drivers
	influences on sediment dynamics and flow, resulting in extended periods of mouth closure and an increasingly freshwater dominated system · Siltation as a result of poor agricultural practices and eutrophic processing of nutrients from anthropogenic sources and bird excrement · Introduction of alien invasive vegetation and freshwater fish species · Lack of awareness and inadequate resources for eradication of alien invasive species
Fisherhaven / Hawston planned as a site for urban growth	· Greater Hermanus identified as a "leader town" for growth and development in Western Cape Provincial SDF · Fisherhaven / Hawston considered to be the most suitable area within Greater Hermanus to accommodate growth
Destruction or damage to cultural heritage sites and environments	· Use of off-road vehicles to obtain access to waterfront camping, fishing and watercraft launch sites · Urban expansion – authorisation of developments in sensitive areas without consideration of a heritage impact assessment
Disturbance of migrant bird habitats and breeding sites	· Recreational and resource use of the estuary and its margins · Loss of habitats due to urban expansion · Instability of the salinity profile and water levels
Of local significance – estuarine ecosystem health issues	
Conflicting opinions regarding management of the open/closed condition of the Bot River estuary	· Economic interests · Academic interests · Interests based on values and traditions · Interests based on perceived rights · Emergence of new information and data as a result of ongoing research and monitoring
Pollution: nutrient loading and toxins	· Urban expansion – discharge of treated effluent or leaching of effluent into the estuary via surface flows or groundwater system · Run-off from cultivated lands and managed landscapes – use of fertilisers and pesticides in the river catchment and estuarine margins · Gravity-driven piped sewerage system – low point coincides with estuarine and coastal margins. Pump stations lack back-up system to deal with untreated effluent during power interruptions. Frequency of power interruptions increasing due to load shedding policy · Little available information on geohydrological-sensitivity as a tool to inform spatial planning and thereby minimise contamination of groundwater systems
"Bare" – unvegetated – estuarine margin	· Instability of the estuarine system as a result of anthropogenic influences on sediment dynamics and flow, resulting in extended periods of mouth closure and an increasingly freshwater dominated system · Economic interests vested in scenic value identify this as a problem
Frequent artificial breaching of Kleinmond lagoon	· Accumulation of pollution due to nutrient loading while mouth is closed · Management objective favoured recreational use – Blue Flag status · Lack of information regarding the impact that breaching has on the Bot / Kleinmond system
Of local significance – land use, recreational use and infrastructure issues	
Urban sprawl	· Authorisation of new, low-density high-income residential and leisure

Type of threat or impact	Social and economic drivers
	developments beyond the edge of the core urban area · Further similar development underway and under consideration
In situ treatment of sewerage	· Older areas of Kleinmond, Hawston and Fisherhaven not connected to mains, reliant on septic tanks and conservancy tanks · Precedent set through authorisation of a new resort and residential estate in the estuarine margin, outside the core urban area, with a private sewerage treatment works located 300m from the water's edge
Littering and dumping of solid waste in the estuarine margins	· Lack of facilities at public recreation sites · Cost of transportation and entry fee for disposal at legal sites for disposal of builders rubble · Loss of sense of shared responsibility for public property
Development of new tourism/commercial leisure facilities at Kleinmond estuary	· Local economic development project to support Blue Flag beach status · Site has cultural heritage significance · Existing infrastructure in this area identified as targets for rehabilitation in the Estuaries Conservation Plan · Site under consideration extends across coastal public property
Non-compliance with municipal by-laws (boat use and camping)	· Perceptions of social and economic injustice · Loss of access to traditional site for camping · Inadequate communication and enforcement on boat use regulations · Loss of sense of shared responsibility for public property
Destabilisation of dune areas	· Use of off-road vehicles to obtain access to waterfront camping, fishing and watercraft launch sites · Urban expansion – proposed extension of urban edge to include Middelvlei dune field · Canalisation and piping of surface water run-off, impacting on groundwater and vegetation · High impact tourism activities in the estuarine margin, e.g. horse trails
Limited number of managed, legal access points to estuarine public property	· Restriction on off-road vehicular use imposed i.t.o. NEMA · Sensitivity of dune and temperate marsh environments · Economic interests vested in scenic value of natural landscape · Limitations of government capacity and resources to develop new sites · Private ownership of waterfront property and perceived rights over associated coastal public property · Privatisation of former state-owned recreation facilities
Damage to waterfront buildings and infrastructure during storm events	· Increasing intensity and frequency of storm events – floods and high seas – resulting from climate change · Structures built too close to the water's edge · Gravity-driven piped sewerage system – low point coincides with estuarine and coastal margins
Of local significance – harvesting of living resources	
Non-compliance with resource use regulations (fishing)	· Restriction of access to resources i.t.o. MLRA · Perceptions of social and economic injustice · Seasonal nature of livelihood and employment opportunities · Loss of sense of shared responsibility for public resources
Of local significance – institutional, governance and socio-economic issues	
Loss of fishery-based livelihoods	· Restrictions on access to resources i.t.o. MLRA · Declining stock of marine fish in the estuary due to unsustainable levels

Type of threat or impact	Social and economic drivers
	of harvesting, extended periods of mouth closure and an increasingly freshwater dominated system · Diminished return on fishing effort associated with illegal fishery due to the illicit nature of the activity and frequent abandonment of nets
Privatisation of management of public nature reserve	· Limitations of government capacity and resources · Economic interests vested in scenic value of natural landscape
Polarisation of users and interest groups	· Perceptions of social and economic injustice fuelled by rumours of deals and lack of transparency and access to information · Diversity of cultural values and economic capacity

It is suggested that certain items (Table 26) are beyond the scope of an EMP to change, either because they do not fall within the mandates of estuarine co-management structures, or because they are historical actions, or processes that are outside human ability to reliably control. Some of them will, however, be indirectly or partially addressed through the EMP by virtue of their connection with other issues.

Table 26 Selection of drivers that fall outside of the ambit of the EMP including historical actions that cannot be reversed and environmental characteristics that are beyond the capacity of management actions to alter

Drivers that are outside the scope of the EMP to change
· Cost of transportation and entry fee for disposal at legal sites for disposal of builders rubble · Diversity of cultural values and economic capacity · Strategic decision taken by the Overstrand Municipality that Fisherhaven / Hawston is the most suitable area within Greater Hermanus to accommodate growth · Frequency of power interruptions increasing due to Eskom load shedding policy · Gravity-driven piped sewerage system – low point coincides with estuarine and coastal margins · Greater Hermanus identified as a “leader town” for growth and development in Western Cape Provincial SDF · Historical anthropogenic influences on sediment dynamics and flow · Historical authorisation of developments in sensitive areas without consideration of a heritage impact assessment · Historical authorisation of new, low-density high-income residential and leisure developments beyond the edge of the core urban area · Historical introduction of alien invasive vegetation and freshwater fish species · Increasing intensity and frequency of storm events – floods and high seas – resulting from climate change · Instability of the estuarine system · Loss of sense of shared responsibility for public property · Perceptions of social and economic injustice · Precedent set through authorisation of a private sewerage treatment within the estuarine catchment · Private ownership of waterfront property · Privatisation of former state-owned recreation facilities, loss of access to traditional site for camping · Restriction of access to resources i.t.o. MLRA · Restriction on off-road vehicular use imposed i.t.o. NEMA. · Sensitivity of dune and temperate marsh environments · Site for development at Kleinmond beach has cultural heritage significance · The range of drivers motivating IAP interests in the process: Economic interests, Academic interests, Interests based on values and traditions, Interests based on perceived rights, Economic interests vested in scenic value of the natural landscape.

Table 27 Selection of drivers that fall within the ambit of the EMP, that can potentially be addressed through estuary management actions

Drivers that can be addressed through the EMP
· Accumulation of pollution due to nutrient loading while mouth is closed
· Anthropogenic influences on sediment dynamics and flow, resulting in extended periods of mouth closure and an increasingly freshwater dominated system
· Authorisation of new, low-density high-income residential and leisure developments beyond the edge of the core urban area
· Canalisation and piping of surface water run-off, impacting on groundwater and vegetation
· Catchment-wide use of the freshwater resource
· Current anthropogenic influences on sediment dynamics and flow
· Declining stock of marine fish in the estuary
· Diminished return on fishing effort associated with illegal fishery due to the illicit nature of the activity and frequent abandonment of nets
· Economic interests vested in scenic value identify bare margin as a problem
· Emergence of new information and data as a result of ongoing research and monitoring
· Existing infrastructure at Kleinmond identified as a target for rehabilitation
· Further low-density high-income residential and leisure developments beyond the edge of the core urban area that are underway and under consideration
· High impact tourism activities in the estuarine margin, e.g. horse trails
· Inadequate communication and enforcement on boat use regulations
· Instability of the salinity profile and water levels
· Introduction of alien invasive vegetation and freshwater fish species
· Lack of awareness and inadequate resources for eradication of alien invasive species
· Lack of facilities at public recreation sites
· Lack of information regarding the impact that breaching has on the Bot / Kleinmond system
· Limitations of government capacity and resources generally
· Limitations of government capacity and resources to develop new sites for recreation, specifically
· Little available information on geohydrological-sensitivity as a tool to inform spatial planning and thereby minimise contamination of groundwater systems
· Local economic development project to support Blue Flag beach status
· Loss of access to traditional site for camping
· Loss of habitats due to urban expansion and poor agricultural practices
· Loss of sense of shared responsibility for public resources
· Management objectives for Kleinmond estuary weighted in favour of recreational use
· Older areas of Kleinmond, Hawston and Fisherhaven not connected to mains, reliant on septic tanks and conservancy tanks
· Perceived rights over coastal public property
· Perceptions of social and economic injustice fuelled by rumours of deals and lack of transparency and access to information
· Recreational and resource use of the estuary and its margins
· Run-off from cultivated lands and intensively managed landscapes
· Seasonal nature of livelihood and employment opportunities
· Sewage pump stations lack back-up system to deal with untreated effluent during power cuts.
· Siltation as a result of poor agricultural practices and eutrophic processing of nutrients from anthropogenic sources and bird excrement
· Site under consideration for development at Kleinmond estuary extends across coastal public property
· Structures built too close to the water's edge
· Unsustainable levels of harvesting
· Urban expansion – authorisation of developments in sensitive areas without consideration of a heritage impact assessment
· Urban expansion – discharge of treated effluent or leaching of effluent into the estuary via surface flows or groundwater system
· Urban expansion – proposed extension of urban edge to include Middelvlei dune field

Drivers that can be addressed through the EMP

- Use of off-road vehicles to obtain access to waterfront camping, fishing and watercraft launch sites

Those drivers that are considered to fall within the scope of the EMP (Table 27) – are either issues to be addressed directly or through co-operative arrangements with government departments that have a stake in estuarine management. They are discussed in the following pages in terms of their impacts on the estuarine system and the implications for management.

11.1.1 Use of the freshwater resource

'Water-thirsty' land uses in the Bot River catchment, notably pine plantations and extensive and irrigated agriculture, and to a lesser extent abstraction for industrial, commercial and residential purposes, results in a reduction of fresh water flow into the Bot estuary. The town of Botrivier has been identified in the Theewaterskloof IDP (2008-09) as a potential industrial hub for the Overberg. Flows to the Kleinmond estuary are considered to be under threat from a proposed new residential development that will draw water from the Isaacs River. There is no water user association for the Kleinmond area, and no reserve determination has been done to date on either the Bot or Kleinmond rivers.

Reduced flow of fresh water into the estuary contributes to the extended periods of closed mouth condition at the Bot estuary. This impacts on the nursery value: a large amount of fresh water needs to be released into the marine environment to produce the cue for recruitment of fish into the estuary. The EMP will aim to prioritise an ecological reserve determination for the Bot / Kleinmond system.

11.1.2 Urban expansion and new development

Greater Hermanus is one of the Western Cape's "leader" towns with high potential for growth (CNdV Africa, 2005). The Overstrand Municipality has identified directions for growth as being restricted to densification of the existing urban fabric and expansion of the urban footprint in the Fisherhaven / Hawston area (OSM SDF, 2006). The latter occupies the eastern portion of the Bot River estuarine corridor and any development in this area requires careful planning and management in order to minimise and mitigate impacts on the estuary and associated coastal wetlands and dune systems. The direct threats to the estuary relate to contamination, re-direction or interruption of groundwater and surface water run-off, destabilisation of dynamic dune systems, disturbance or destruction of heritage resources, and the consequences of damage to infrastructure as a result of increased intensity of storm events. The proposed expansion of the urban area north of the Kleinmond estuary requires a similar precautionary approach to planning and management.

A precedent for 'leap-frogging' of urban development beyond the edge of the core urban area has been established through admission of the Arabella and Benguela Cove residential estates. Application for expansion of the former is under way. The threat of contamination of groundwater and surface water run-off, arising from in situ treatment of sewerage and the use of fertilisers and pesticides, is heightened in these situations, as is the potential for consequential damage resulting from storm events. Consideration must also be given to the impact of urban sprawl on the visual amenity of the estuarine landscape, and the restriction imposed by gated estates on public access to coastal public property.

The spread of development and land under cultivation also represents a threat to a network of small biodiversity 'hotspots', located primarily in the eastern portion of the estuarine corridor. Their protection and consolidation into corridors and/or urban open space systems is required for the purpose of attaining targets for terrestrial biodiversity conservation.

With regards individual development projects under consideration – beach facilities at Kleinmond and an environmental education centre at Rooisand Nature Reserve – key aspects for consideration are their impact in relation to cultural heritage, public access, the threat of contamination from sewerage or surface water run-off, treatment of the interface between structures or landscaping and estuarine habitats, the consequences of damage resulting from storm events, and their visual impact on the estuarine landscape.

11.1.3 Ground- and surface water contamination

Pollution of estuarine waters generally is due in some part to direct deposits (such as oil spills) but more often the result of the transportation of pollutants of anthropogenic origin either via sub-surface groundwater systems or stormwater run-off via streams and rivers and, in urban areas, via roads, pavements, drains and outfalls. The water carries pollutants such as *E.coli* bacteria, nitrogen and phosphorus from human sewage, toxic leachate from human waste disposal sites, chemical components of pesticides and fertilisers used on farm lands, golf courses and other cultivated areas, engine oil, plastic and other substances that are potentially harmful once they enter estuarine and marine waters. The source of pollution may be many miles away but the estuary and sea are the receiving environments. The impact on estuarine water quality, particularly during closed periods, is measurable and, in severe cases, visible. High levels of nutrients in the system can lead to eutrophication, where the removal of oxygen from the water by toxic algal blooms can result in fish kills. High nutrient load also leads to the accumulation of organic sediments (siltation).

Nutrient cycling is a naturally occurring function within estuaries but excessively loads of introduced nutrients can cause a collapse of the system when the critical threshold is exceeded. Reference to ecological carrying capacity is normally a reference to this aspect of estuarine functioning, which would involve the measure of its resilience. Scientists have not yet developed reliable methods for monitoring programmes that are capable of discerning the imminence of the critical threshold in time for adaptive measures to be taken to avoid collapse.

The Kleinmond estuary has, in the past, been artificially breached because pollution levels were unacceptable for recreational use of the lagoon. The presence of introduced nutrients in the Bot estuary appears to be localised at present but infrastructure capacity limits have been reached in Kleinmond and Hawston, and the extent of land under urban development or cultivation is expanding. The situation calls for vigilant monitoring using scientifically acceptable methods and urgent action by the Municipality to upgrade infrastructure before any further developments are authorised for connection.

Impacts can be reduced through enforcement of a riparian reserve as a filtering device in the estuarine and river margins and, throughout the catchment, in areas defined by the hydrographical sensitivity analysis.

11.1.4 Recreational use in the estuarine margins

The launching of water-craft and boats from managed sites, and nature-based activities such as hiking and bird-watching, are popular activities in the Bot/Kleinmond system which have minimal impact and pose little threat to the environment in the estuarine margins. Provided that launch sites are licensed and managed so as to minimise impacts on adjacent sites, these are activities that can be encouraged and supported for tourism development purposes. Current limitations on access and supporting facilities (bird-hides, toilets, parking) need to be addressed. Site selection, site planning and the details of design and waste disposal proposals must be undertaken within the framework of EMP objectives, particularly in view of the sensitivities and surveillance issues associated with the dune and temperate marsh environments in the estuarine margins.

The beach at Kleinmond estuary is managed to Blue Flag standards. Facilities in this area are listed in the rehabilitation measures for the system in the Estuaries Conservation Plan (Turpie & Clark, 2007). A project is identified in the IDP, for implementation by the Overstrand Local Economic Development Agency. Alignment of project objectives with estuarine management objectives must be facilitated at an early stage of project planning to ensure that these are included in the design and development terms of reference.

Horse trails and the use of off-road vehicles are high impact activities in dune environments, with the potential to cause destabilisation and, consequently, blow-outs and deposition of sediments in locations where they constitute a management problem (drains, for example). Route planning, visitor management and monitoring in support of a 'limits of acceptable change' approach is required for the horse trails. Clarity around off-limits areas for ORVs needs to be established through an awareness campaign and then rigorously enforced.

Impacts associated with seasonal informal seasonal camping in the estuarine margins relate to the use of vehicles in dune environments, and the disposal of waste. The activity involves other aspects that have a management implication, of a social nature, discussed elsewhere in this chapter. The activity warrants an integrated approach to finding a solution.

11.1.5 Recreational use of the water body

No data on recreational use were found during the course of the assessment. An initiative has been ongoing for a number of years to amend the municipal by-laws relating to boat use on the estuary, by inserting sub-zones of existing zones established through provincial legislation, to establish sanctuary areas for birds in the margins, and a safe swimming area in the vicinity of the public slipway at Fisherhaven. The intent of the provincial proclamation, dated 1972, was to set aside areas in favour of angling and netting and to restrict high-speed water sports to a central zone. The proposed amendments provide further restrictions on both angling and water sports in favour of conservation of bird habitats. They support a concurrent application for declaration of the system as a Ramsar site.

Since one of the required outputs of the Estuary Management Planning project is a zoning plan, a review of the existing zoning plan and proposed amendments will be undertaken during the planning phase. This will be done by assessing existing plans in terms of their achievement of EMP objectives, including conservation targets established in the C.A.P.E. Estuaries Conservation Plan (Turpie & Clark, 2007), and making recommendations accordingly.

11.1.6 Anthropogenic influences on estuarine dynamics

Declining fish stocks and reduced nursery value of the estuary is ascribed not only to overexploitation but also to increasingly freshwater dominated conditions. Some scientists have ascribed this to a natural process of the estuary's evolution to a freshwater lake. Others point to a number of factors of anthropogenic origin that have influenced the situation, namely,

- the reduced inflow of freshwater from the catchment, due to pine plantations and abstraction, which reduces the scouring and flushing capacity of the water flow and the time that it takes to build up enough of a head of water to break through the dune barrier during closed periods.
- the link between the Bot and Kleinmond estuaries, via Rooisand and Lamloch Swamps, which causes the Bot River estuary to 'leak' via the lowest point, which is not at the mouth, and thereby further reducing its capacity to break through the dune barrier during closed periods. This is exacerbated when the Kleinmond estuary is breached and water levels on that side are low.
- the increasing resistance of the dune barrier at the mouth, due to the introduction of vegetation to the Middelvlei dune field in the early part of the twentieth century, for stabilisation purposes. This caused sediment being transported by wind along the coast from west to east to be 'dumped' in the mouth area instead of in the dune field.

Artificial breaching has been practiced at the mouth of the Bot as a matter of course, in recent years on a 3-yearly basis in accordance with a management policy adopted in 2003. The policy is due for review in April 2009. The Estuarine Management Planning process will aim to contribute to this review through the assembly of information in this assessment and the formulation of objectives for the management of the estuarine system.

The road bridge for the R43 above the head of the Bot River estuary, and also the pedestrian bridge at Kleinmond estuary, have also been implicated in the debates around human disruption of sediment dynamics and flow.

11.1.7 Use of estuarine living resources

The main activity with regards harvesting of living resources in the Bot/Kleinmond system is an unlicensed gillnet fishery maintained by an estimated 20 groups of fishers assumed to be resident in the area. Its direct use value is estimated to be within the range of R110,000 to R550,000 per annum (Turpie & Clark, 2007). The illicit nature of the activity means that it is not well managed and much of the harvest goes to waste due to nets being abandoned or stranded. The fishery is used as a fall-back when the weather prevents the fishers from going to sea. The direct impact of this activity is that the larger fish are caught in the nets and 'mined' out of the system during periods when the mouth is closed. Most of these species are resident in the estuary only during their juvenile stage, and need to migrate to the sea to spawn and thereby contribute to the replenishment of stock. The estimated direct use value of the nursery function – R22 to R55 million – is significantly higher than that of the local fishery and underpins a regional, if not national, resource. The nursery environment provided by the extensive sheltered waters of the Bot River estuary is an irreplaceable national asset.

Collection of bait worms and sand prawn has declined with the abundance of the resource since the system has been less frequently open. Commercial licenses were awarded in the Hawston/Hermanus area for linefish, west coast lobster and abalone. Data on recreational fishing effort in the estuary were not encountered.

11.1.8 Restriction of access to resources i.t.o. MLRA

Unsustainable levels of harvesting are a matter of concern not just in the estuaries but nationally – in South Africa's coastal waters – and globally, as fisheries around the world are collapsing due to depleted stocks caused by overexploitation. The response to this, internationally, has been a two-pronged approach, of managing the harvest and improving the renewability of the resource through the establishment of marine protected areas.

At the Bot River estuary, this has resulted in the withholding of commercial fishing licenses. According to Cilliers and de Jager (1997), between 1966 and 1971 the number of permits issued dropped from 19 to 7, and only two commercial permits were issued. Currently there are none. The impact of this, coupled with the closure of the abalone fishery, has been devastating to Hawston residents whose livelihoods and lifestyles traditionally revolved around fishing since the area was settled in 1859. As a result, non-compliance is widely practiced.

The WWF Marine Programme is currently investigating the potential for establishing a Marine Protected Area related to the Kogelberg Biosphere Reserve. The proposed eastern boundary is aligned with the mouth of the Bot River estuary.

11.1.9 Limitations on available state resources

A 'wish-list' of projects and activities relating to rehabilitation, development and management of estuarine resources is a useful indicator of the aspirations of interested and affected parties but should not be confused with an implementation plan. The latter needs to take into account the constraints on the resources that are available or could be mobilised for allocation, given the human capacity that is available and could be mobilised for management purposes.

The advantage of an integrated management plan is that it draws on the capacities of a number of government departments as well as private resources, NGOs and community based organisations. Responsibility for funding and implementation generally will be linked to the legislated mandate for management. Although much of the scope of implementation responsibility is likely to be for the local municipality, large portions of funding will need to be provided by line departments such as DWAF and DEAT.

The plan should also aim to raise awareness of the financial costs associated with environmental rehabilitation as part of a 'prevention is better than cure' campaign. The current cost to clear land of medium- to heavily infested alien invasive vegetation averages at R8,000 per hectare (C.A.P.E. E-News, 11-09-2008).

11.1.10 Local economic interests

The natural heritage – scenic value and natural resources – are identified in the Overstrand IDP as the area's most valuable economic asset. Considerable investment has been made in property development in the upper reaches of the lagoon. These are occupied by seasonal visitors, tourists and some permanent residents. Economic interests are held by developers and property owners. The golf course at Arabella is an international standard championship course. The tourism value of the Bot / Kleinmond estuarine system is considered to be underexploited as a result of the seasonality of visits and the lack of facilities and access. Seasonality has a significant impact on the livelihoods of unskilled and semi-skilled workers as it affects the tourism, construction and agricultural sectors, as well as licensed marine resource harvesting enterprises. The latter includes commercial diving, boat crewing and processing factories in Hermanus. Exploitation of natural resources underpins the local mainstay of the 'third economy' – illegal fishing and harvesting of abalone for commercial purposes. Subsistence users are mostly dependent on shore angling (line fish) and bait collection. The large majority of residents of Hawston and Kleinmond have incomes below the household subsistence level of R1,600 per month.

The issue of mouth management is significantly influenced by economic interests. High water levels resulting from a closed mouth are preferred by those who prioritise scenic value and recreational uses (boating and swimming) and by those who subscribe to an environmental ideology of non-interference. It appears that this condition is also favoured by bird-watching

enthusiasts. More frequent mouth opening is recommended for enhancing the sustainability of marine living resources and supporting a greater degree of biodiversity generally. Inter alia, it would allow fish to leave the nursery area to spawn before they reach a size targeted by gill nets. This policy is also supported by the subsistence fishers on the basis that it increases recruitment of marine species into the estuary.

11.1.11 Perceptions of social and economic injustice and diversity in income profiles

The huge diversity in the wealth of residents and property owners in the Bot / Kleinmond estuary environs is indicated by the disparity between the estimated R25 to R40 million annual contribution of properties in the area to the real estate sector, and the monthly earnings of the large majority of residents, which is less than R1,600 per month. This diversity brings with it all of the associated social ills: an 'us and them' polarity, mistrust, defensiveness, diverse and sometimes conflicting values, and a perceived lack of equality, amongst others.

Attitudes to conservation tend to follow income profile, which coincides with race, with cash-poor people placing a higher emphasis on use of the estuary's resources and amenities than those who are financially self-reliant and tend to prioritise conservation over access and use or who enjoy a higher level of access by virtue of their riparian property location., The cash-poor residents tend to see environmentalists as elitist and exclusionary, dismissive of traditional resource management knowledge, and resident middle-class volunteer conservationists tend to see themselves as being the custodians and protectors of the natural heritage.

The cash-poor residents claim rights conferred by cultural traditions and historical precedence. The wealthy use their economic influence and social status to leverage deals and access advantageous information. The cash-poor residents resort to non-compliance and anti-social behaviour, causing the others to call upon the instruments of law and invest in physical barriers to control movement in the estuarine environment.

Specific issues that need to be addressed in this regard include negotiations relating to management of the Rooisand Nature Reserve, transparency around the matter of the sale and privatisation of the state-owned camping facilities and boat launch site at Sonesta (now referred to as Meerensee, Meerenbos and Sandown), and camping during festive seasons at the area referred to as Middelvlei State Ground.

11.1.12 Data availability

A lack of ready access to information, particularly when it is information that is required to be accessible to the public, adds fuel to the perceptions described above.

Maps of the Greater Hermanus and Kleinmond town planning schemes, which are meant to be readily available in the public domain (LUPO, 1985), could not be accessed during the course of the assessment. No response was received to requests for further information, relating to the current status of the Overstrand SDF (Final Draft, 2006), intentions regarding urban expansion areas in the Hawston/Fisherhaven corridor, controversy surrounding the urban edge, and other aspects of spatial planning and land use management in the Overstrand Local Municipality. Municipal documents support the impression that land use management within gated residential estates and resorts falls outside the domain of the municipality. Benguela Cove is shown on the SDF map as 100% residential land. The site contains areas of critically endangered vegetation and the estate advertises its 80 Ha Renosterveld Nature Reserve but this is not reflected in the SDF as part of the open space system.

11.2 Recommended management tools

There are a 'tried and tested' management tools which have an application in addressing the issues described above which form the core of proposals presented in the Estuarine Management Plan. Most of the tools proposed are of a cross-cutting nature, designed to address a range of the impacts and drivers described in the previous section. These relationships are analysed in Table 28.

Table 28 The relationship between impact drivers and recommended management tools

Impact driver / causal factor	Recommended management tool
Use of the freshwater resource	Comprehensive Resource Directed Measures, Targets / monitoring
Urban expansion and new development	EMP Spatial Conservation and Development Framework and associated Land Use Guidelines, Catchment-wide Riparian reserve, Conservation Plan, Targets / monitoring
Ground- and surface water contamination	Comprehensive Resource Directed Measures, EMP Spatial Conservation and Development Framework and associated Land Use Guidelines, Targets / monitoring, Compliance strategy
Recreational use in the estuarine margins	EMP Spatial Conservation and Development Framework and associated Land Use Guidelines, Targets / monitoring, Compliance strategy
Recreational use of the water body	EMP Spatial Conservation and Development Framework and associated Land Use Guidelines, Targets / monitoring, Compliance strategy
Anthropogenic influences on estuarine dynamics	Comprehensive Resource Directed Measures, Catchment-wide Riparian reserve, Mouth Management Policy, Targets / monitoring, Compliance strategy
Use of estuarine living resources	Sustainable livelihoods development, Conservation plan, Targets / monitoring, Compliance strategy
Restriction of access to resources i.t.o. MLRA	Sustainable livelihoods development, Compliance strategy
Limitations on available state resources	Co-operative management
Local economic interests	Sustainable livelihoods development, EMP Spatial Conservation and Development Framework and associated Land Use Guidelines, Catchment-wide Riparian reserve, Conservation plan
Perceptions of social and economic injustice and the local wealth gap	Compliance strategy, Co-operative management, EMP Spatial Conservation and Development Framework and associated Land Use Guidelines, Catchment-wide Riparian reserve
Data availability	Co-operative management

11.3 Opportunities and potential solutions

A weakness of an issues-based approach to planning is that it tends to focus on problems, so that opportunities, such as under-exploited assets and strengths, are sometimes overlooked. The

discussion below is intended to highlight potential that could be harnessed in the development of EMP strategies. As in the previous section, these opportunities and solutions have been paired with management tools in Table 29.

11.3.1 Exploitation of the natural heritage value

In the economic assessment, the tourism value of the estuary was found to be lower than other estuaries. This was ascribed to the limited amount of facilities and access for visitors, and the seasonal nature of current visitor use.

The assessment of the natural heritage reveals immense social and biophysical value, particularly considering the rate at which coastal marshes are disappearing worldwide due to the global phenomenon of urban expansion at the coast. The diversity of habitat types within the system, and the expanse of the water body, make it unique in South Africa – an irreplaceable asset of national importance. The nursery value of the Bot estuary to the fisheries industry will continue to grow in potential as the economics of scarcity respond to the global collapse of fisheries due to overexploitation and species extinctions.

The full potential of the natural heritage and tourism value of the system can only be realised if management objectives are attuned to these values. This would involve focusing on securing the health of the ecosystem, the sustainability of the nursery resource, the development of visitor support services and infrastructure, and curtailing forms of development that would negatively impact on ecosystem functioning and visitor experience.

11.3.2 Sustainable livelihood opportunities

The withdrawal of individual rights of access to the formerly common resource of fish stocks has resulted in a social and economic crisis within some of the communities in the study area. The consideration of solutions needs to take into account their long-standing traditions, considerable skills, knowledge and connection to the sea and *die Vlei*. For these affected parties, resource management, skippering and crewing, and the spinning of fishermen's yarns are more likely to be adopted and developed into sustainable activities in the local economy than, for example, alien vegetation eradication. The skills and knowledge that exist within this community need to be viewed as an asset, just as the natural heritage is an asset, to be factored into the solution. Currently low levels of exploitation of the recreational and tourism potential of the estuarine catchment represent an opportunity for ecotourism development, which could be designed to target development of activities that draw on traditional knowledge and provide entrepreneurial opportunities for fisher families who have been disadvantaged by the withdrawal of commercial fishing licenses.

11.3.3 Forward planning

The timeous nature of the EMP intervention, when development in the margins is still relatively contained, is an opportunity to guide future development into areas that have the least impact, in terms of an overarching vision and objectives for integrated management of the estuarine catchment.

Advances in planning for biodiversity conservation enable fine-scale identification of small areas of vegetation that need to be conserved through linked open-space systems and corridors, to become effective vehicles for habitat and species sustainability, thereby contributing to achievement of national targets for biodiversity conservation. It does not mean that land must be 'locked up' and sterilised; rather, that biodiversity conservation needs to be integrated into land use management at the micro scale of individual farms, or urban neighbourhoods.

Provision must be made for private land owners to be supported in this, through financial incentives, technical advisory services and participatory fora.

The local municipality task of managing land use, particularly in response to profit-driven proposals, is greatly eased when there are well- founded and supported development frameworks in place to guide decision-making.

Overstrand Municipality has made provision in its SDF for a local-level planning framework in the Bot / Kleinmond estuaries environment, in the form a proposal for establishing a Rural Development Area (RDA). An RDA could be described as the rural equivalent of a town, requiring an equivalent planning scheme which establishes the basis for land use decision-

making. A prerequisite for this is a Rural Development Framework – the fine-scale equivalent, and component of, the Spatial Development Framework, with similar objectives.

The EMP, as one of the Overstrand Municipality's sector plans, can contribute to the establishment of the Rural Development Area, through configuration of the EMP Spatial Conservation and Development Framework and associated Land Use Guidelines as a local level spatial development framework.

11.3.4 Urban expansion

Hermanus has been identified, with good reason, as a town that should grow, and in terms of strategic decisions taken by the Municipality, the direction that it will grow in is the Fisherhaven / Hawston area. The EMP, as a local level plan, is required to embrace this macro-planning strategy and look at the detail, at the local level, of its implementation. Certain areas identified in the municipal SDF for urban expansion, such as the Middelvlei dune field, are considered unsuitable for development, thereby reducing the extent of the area available to accommodate growth. However, by adopting a visionary approach to planning the remaining urban expansion areas, it becomes possible to manage one of the greatest threats to the estuarine system – urban sprawl.

The instrument that raises the problem through its identification of Greater Hermanus as a leader town for growth – the WCP SDF (CNdV, 2005) – also provides a potential solution: Strategy No. 8.4.19 – Socio-economic Integration, involving the principle of a Socio-Economic Gradient: "This principle acknowledges that people of different levels of income and social kinship ties can live far closer to one another than is the case in most urban settlements in the Province. However, care should be taken to ensure that there are small differences rather than large gaps between different sectors of a community living close to one another, hence the concept of 'gradient'" (p8-37).

The undeveloped land between Hawston and Fisherhaven represents an opportunity to apply the strategy of socio-economic integration to support the Municipality's proposals, as per the SDF (2006), to develop residential areas and a locally accessible town centre with associated social and commercial facilities. Instead of being a divisive element, the open space could be developed into a connector. With a 'new urbanism' design approach, this could become a big attraction for investors in tourism, commercial and residential development.

The creation of a focus that attracts development of a higher density order, into a contained area, would serve to counteract the threat of urban sprawl and optimise the Municipality's investment in infrastructural improvements.

11.3.5 Capitalising on existing initiatives

There are a number of initiatives already underway that provide potentially mutually beneficial synergies for the EMP:

- Current investigation of the establishment of a marine protected area associated with the Kogelberg Biosphere Reserve presents the opportunity for considering incorporation of a portion of the Bot / Kleinmond estuarine system into the protected area, thereby supporting a marine-estuarine linkage and providing a platform for securing a designated and integrally managed sanctuary area within the estuarine system.
- The CAPE Stewardship program has identified the Lamloch swamps between Kleinmond and Arabella as a priority biodiversity corridor within the Kogelberg Biosphere Reserve and is currently in the process of investigating this initiative.
- The Bot River Estuary Advisory Committee (BREAC), since 1993 to date, has fulfilled an advisory function for considering and making decisions on all matters concerning the Bot River estuary, associated wetlands and coastal strip. Options for the institutional arrangements for implementation of the EMP, including the continued or possibly expanded or restructured role of BREAC, need to be assessed strategically in terms of emerging new legislation and associated mandates, and the expanded social, administrative and financial demands associated with implementation of an integrated estuary management plan. The considerable capacity that has been built within the Committee represents an invaluable asset and future arrangements should be designed so as to ensure that this capacity is harnessed.

- A review of the Breaching Policy is scheduled to take place in April 2009. This provides the opportunity for formulation of a revised policy that is informed by the management objectives established through the EMP process.
- There are monitoring programmes underway in the estuarine environment than can be supplemented, where required, and co-ordinated so that information is of a consistent and acceptable quality (e.g. water quality testing carried out by a marine laboratory), is stored in a centralised database, and evaluation and reporting is co-ordinated by a mandated estuarine management agency.
- There are existing environmental education and awareness raising campaigns underway in the area, that can be enlisted and supported to address estuarine issues.
- Local environmentalists, fishers and other interested and affected parties represent a huge resource of human energy that have and can be directed towards managing the estuary's natural assets and the protection thereof. Their common ground is their passion for the estuary / *die Vlei* . The key to the success of the EMP is the identification and adoption of a set of objectives that provides a channel for all parties to exercise their particular interest.

Table 29 matches the abovementioned opportunities and solutions with tools that could be enlisted in the EMP to effect their realisation.

Table 29 Management tools for opportunities and solutions

Opportunity / potential solution	Recommended management tool
Exploitation of the natural heritage value	Comprehensive Resource Directed Measures, Targets / monitoring EMP Spatial Conservation and Development Framework and associated Land Use Guidelines, Catchment-wide Riparian reserve, Conservation Plan, Mouth Management Policy, Sustainable livelihoods development, Compliance strategy
Sustainable livelihoods opportunities	Sustainable livelihoods development, Compliance strategy Co-operative management
Forward planning	EMP Spatial Conservation and Development Framework and associated Land Use Guidelines, Conservation Plan, Comprehensive Resource Directed Measures, Targets / monitoring Catchment-wide Riparian reserve Co-operative management.
Urban expansion	EMP Spatial Conservation and Development Framework and associated Land Use Guidelines, Conservation Plan Co-operative management.
Capitalising on existing initiatives	Co-operative management Targets / monitoring

11.4 Concluding notes

Through the synthesis and analysis recorded in this chapter, a set of management strategies emerge as the recommended tools to be invoked in the Bot / Kleinmond EMP. The EMP must use these tools to give effect to strategic management objectives that are supported by IAPs. They are:

» Establishment and enforcement of a catchment-wide riparian reserve
» Establishment and maintenance of a co-operative management structure
» Design and implementation of a compliance strategy

» Formulation and implementation of comprehensive Resource Directed Measures
» Development and implementation of a Conservation Plan
» Development and adoption of a EMP Spatial Conservation and Development Framework, associated Land Use Guidelines and a Coastal Planning Scheme for inclusion in the Overstrand Municipality's Land Use Management System
» Review and implementation of a Mouth Management Policy for Bot and Kleinmond estuaries
» Development and implementation of a Strategy for unlocking the tourism potential and thereby providing opportunities for alternative and sustainable estuarine-based livelihoods for former fisher families
» Setting of targets and maintenance of a Monitoring, Evaluation and Reporting programme.

12. Conclusion

Of all the findings of this assessment, the one that has had the greatest impact on the EMP development process has been the exposure of a radically polarised 'community' of interested and affected parties. The situation is so extreme that it was considered unfeasible to convene a meeting that had, as its proposed outcome, an agreed vision and strategic objectives for the management of the estuary, on the originally scheduled date.

The common ground for most of the directly affected parties is an emotional attachment to the estuary / *Die Vlei*, which is driven by the lifestyle that the environment affords them. There are other interests, founded in the economies of property and tourism development, public service and academia, all of which offer advantages that can be harnessed for estuarine management objectives provided that they are managed appropriately.

These interests are the drivers of opposing views on the issue of whether or not, and how, the Bot River estuary should be artificially breached. An extensive and well-documented body of academic research exists to support the formulation of a breaching policy but what is absent is a clear and consensual decision on what the breaching policy should aim to achieve. The debate centres around the marine living resources management aspect of the Bot River estuary, on the one hand, and the maintenance of scenic value, recreational amenity and, possibly, the security of bird habitats, on the other hand.

The findings of this assessment support the view that the current Breaching Policy should be reviewed and revised, to address considerations as follows:

- New information on the biophysical aspects of the Bot / Kleinmond system has been documented and must be taken into consideration in the design of the management plan. This includes the view that the current paucity of natural breaching occurrences is a direct result of anthropogenic impacts and therefore justifies an anthropogenic intervention aimed at rehabilitation and restoration of naturally induced processes.
- Pressure on food resources, globally, has been transferred to local fisheries and the value of the nursery function of the Bot River estuary will increase as a result of its irreplaceability, adding weight to the business case for managing the estuary as a resource-orientated service area in the interests of the regional economy and global food security.
- The potential losses associated with displaced interests resulting from adoption of a revised policy need to be acknowledged and addressed, and offset through creative planning for gains that capitalise on the natural heritage and human resource base.
- The outcomes of the EMP planning process, of particular relevance the strategic management objectives, provide a contextual framework for the review process.

The issue of mouth management tends to dominate, to the exclusion of other issues that require management attention. The most urgent of these (after agreement on strategic objectives and mouth management) are:

- Establishing an organisational structure that supports implementation of the EMP and co-ordinates a monitoring, evaluation and reporting programme
- Ensuring that current levels of water quality are maintained, and improved in specific locations including Kleinmond, through *inter alia* attention to infrastructure-related problems and establishment of a catchment-wide riparian reserve
- Securing an ecological reserve determination for the Bot and Kleinmond estuaries, as a priority aspect of comprehensive Resource Directed Measures
- Establishing a spatial framework, that supports the agreed strategic objectives, for conservation, development and recreational use of the land within the estuarine catchment, and the water body
- Developing a business plan for the assembly of the conservation components of the conservation and development framework
- Establishing working groups to give effect to implementation of strategies relating to specific aspects of the EMP, including the catchment-wide riparian reserve, compliance strategy and livelihoods support strategies

- Designing and implementing a strategy aimed at identifying and realising sustainable alternative livelihood opportunities, potentially through the development of responsible ecotourism, that provide meaningful prospects for displaced parties
- Facilitating agreement on targets as a basis for evaluation of efficacy of the agreed strategies and their implementation.

Assessment will continue to inform the process through the planning and adoption stages of the Estuarine Management Plan, and will be built into the plan through application of the principle of adaptive management.

The targets established in the Regional Estuaries Conservation Plan (Turpie & Clark, 2007) for the Bot / Kleinmond system appear, on the basis of this assessment, to be technically achievable. Securing the necessary resources and protection is, however, a long-term process to be addressed in the course of implementation of the EMP through the mobilisation of stakeholder support.

The best laid plans will fail unless a culture of co-operative engagement toward the achievement of a shared and meaningful vision is established. The ongoing involvement of a facilitative agency – a 'champion' – whether it is C.A.P.E. Estuaries Programme, Cape Nature, the Overstrand Municipality, or another, is critical to the process.

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