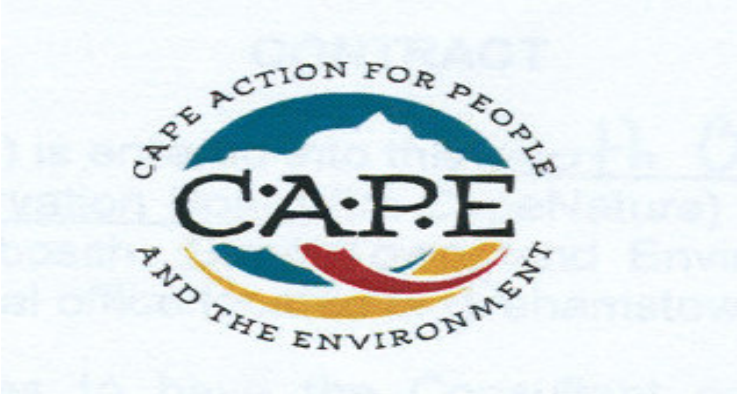
# C.A.P.E. ESTUARY MANAGEMENT PROGRAMME





# INTEGRATED MANAGEMENT PLAN: SWARTKOPS ESTUARY AND THE SWARTKOPS RIVER VALLEY AND ALOES NATURE RESERVES

## VOLUME II – FINAL REPORT

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# TABLE OF CONTENTS

# LIST OF TABLES



# LIST OF PLATES AND FIGURES

# ABBREVIATIONS & ACRONYMS

| | |
|---|---|
| C.A.P.E. | Cape Action for People and the Environment |
| Cape Nature | Western Cape Nature Conservation Board |
| CARA | Conservation of Agricultural resources Act (Act 43 of 1983) |
| CBA | Critical Biodiversity Area |
| CBO | Community Based Organization |
| CFR | Cape Floristic Region |
| CMA | Catchment Management Agency |
| CMF | Catchment Management Forum |
| CMS | Catchment Management Strategy |
| CPUE | Catch-per-unit-effort |
| CSIR | Council for Scientific and Industrial Research |
| DAFF | Department of Agriculture, Forestry and Fisheries |
| DEDEA | Department of Economic Development and Environmental Affairs |
| DEA | Department of Environmental Affairs |
| DWA | Department of Water Affairs |
| DWEA | Department of Water and Environmental Affairs |
| ECDC | Eastern Cape Development Corporation |
| EFA | Enviro-Fish Africa (Pty) Ltd. |
| EIA | Environmental Impact Assessment |
| EMI | Estuarine Management Institution (comprising the SMF and executive) |
| EMP | Estuary Management Plan |
| ERI | Ecological Reserve Implementation (Programme) |
| ESO | Environmental Site Officer |
| EZP | Estuarine Zonation Plan |
| FPA | Fire Protection Association |
| FMP | Fire Management Plan |
| HFCO | Honorary Fisheries Control Officer (now Zwartkops Honourees) |
| ICM Act / ICMA | Integrated Coastal Management Act (Act 24 of 2008) |
| I&AP | Interested & Affected Party |
| IEM | Integrated Environmental Management |
| IDP | Integrated Development Plan |
| IMP | Integrated Management Plan |
| LED | Local Economic Development |
| MAP | Management Action Plan |
| MCM | Branch: Marine and Coastal Management (ex-DEAT) |
| MLRA | Marine Living Resources Act (Act 18 of 1998) |
| MOA | Memorandum of Understanding |
| MSL | Mean Sea Level |
| NEMA | National Environmental Management Act (Act 107 of 1998) |
| NEM:BA | National Environmental Management: Biodiversity Act (Act 10 of 2004) |
| NEM:PAA | National Environmental Management: Protected Areas Act (Act 57 of 2003) |
| NEMP | National Estuarine Management Protocol |
| NFA | National Forests Act (Act 84 of 1998) |
| NGO | Non-governmental Organization |
| NHRA | National Heritage Resources Act (Act 25 of 1999) |
| NMBM | Nelson Mandela Bay Municipality |
| NRF | National Research Foundation |

| | |
|---|---|
| NVFFA | National Veld and Forest Fire Act (Act 101 of 1998) |
| NWA | National Water Act (Act 36 of 1998) |
| NWRS | National Water Resources Strategies |
| ORV Regulations | Control of Vehicles in the Coastal Zone Regulations (Government Notice 1399; 2001) |
| PDC | Previously Disadvantaged Community |
| PHRA | Provincial Heritage Resources Agency |
| PPP | Public Participation Process |
| RDM | Resource Directed Measures |
| ROD | Record of Decision |
| RQO | Resource Quality Objectives |
| RZP | Reserve Zonation Plan |
| SA | Seashore Act (Act 21 of 1935; Amended 1993) |
| SAEON | South African Environmental Observation Network |
| SAIAB | South African Institute for Aquatic Biodiversity |
| SANCOR | South African Network for Coastal and Oceanic Research |
| SDF | Spatial Development Framework |
| SEA | Strategic Environmental Assessment |
| SMF | Swartkops Management Forum |
| TPC | Threshold of Potential Concern |
| WUA | Water User Association |
| ZC | Zwartkops Conservancy (formerly Zwartkops Trust) |
| ZT | Zwartkops Trust |

# CHAPTER 1- INTRODUCTION

Estuarine ecosystems are not isolated systems. They form an interface between marine and freshwater systems and are part of regional, national and global ecosystems either directly via water flows or indirectly through the movement of fauna. In addition to the biota that these estuaries support, they provide a range of goods and services (uses) to the inhabitants of the various regions. Disturbances in one estuary can influence a wide variety of habitats and organisms in the broader freshwater or marine ecosystem. Thus, the interaction between the systems and users creates a delicate balance, the sustainability of which needs to be addressed by some form of management plan.

In order to address this in a consistent manner in the Cape Floristic Region (CFR), the Cape Action for People and the Environment (C.A.P.E.) Estuaries Management Programme has developed a holistic and inclusive management process representative of all stakeholders. The programme is governed by a Task Team comprising of officials from C.A.P.E., Cape Nature, Marine and Coastal Management (MCM; now Directorate: Oceans and Coast), the Department of Water Affairs and Forestry (DWEA), the Eastern Cape Parks Board (ECPB) and the Council for Scientific and Industrial Research (CSIR), which heads the technical support group.

The urgent need for Estuary Management Plans (EMPs) became apparent during the development of the Integrated Coastal Management Act (Act 24 of 2008; ICM Act). Estuaries and the management thereof have not been adequately addressed by past marine, freshwater and biodiversity conservation Acts. Estuaries and estuaries management have been marginalized due to the fact that historically they did not fit the ambit of any one government Department. Estuaries and the management thereof now form an integral part of the ICM ACT, which identifies the need for the development of EMPs, as these would help to align and coordinate estuaries management at a local level.

The Swartkops Valley and Aloes Nature Reserves, located to the immediate north of the Swartkops Estuary have been recognized as priority areas for biodiversity conservation and form an integral part of the proposed Nelson Mandela Metropolitan Open Space System (NMMOSS), which prescribes a network of protected areas to ensure the conservation of a representative portion of biodiversity and natural features (SRK 2007a). Both the Swartkops Estuary (and River) and the two Nature Reserves have been designated as Critical Biodiversity Areas (CBAs) that need to be protected. Within this category, the Swartkops River/Estuary has been assigned a category of Critical Biodiversity Area 1 (CB1) with the recommendation that it should form part of the formal protected area system. The Swartkops Valley and Aloes Reserve complex has been assigned a category of Protected Area (PA1 or 2), with the PA2 designation indicating that formal declaration (proclamation) is still pending (Aloes).

Enviro-Fish Africa (Pty) Ltd. (EFA) has been contracted by the Nelson Mandela Bay Municipality (NMBM) to address the development of an Integrated Management Plan (IMP) for the Swartkops Estuary and the Swartkops Valley and Aloes Nature Reserves. This report follows on from the Situation Assessment (EFA 2009) and fulfills the requirements of Objective 2, namely the development of an IMP.

# CHAPTER 2 - THE GENERIC EMP FRAMEWORK

Chapter 4, Section 33 of the ICM ACT outlines the requirement for EMPs to be developed in accordance with a National Estuarine Management Protocol. However, a protocol has yet to be developed by the Minister. Until such time as this has been addressed, all EMPs are developed in accordance with the Generic EMP Framework, developed by Van Niekerk & Taljaard (2007; Figure 2.1). For the purposes of this IMP, A Mission statement has been included to follow on from the Vision.

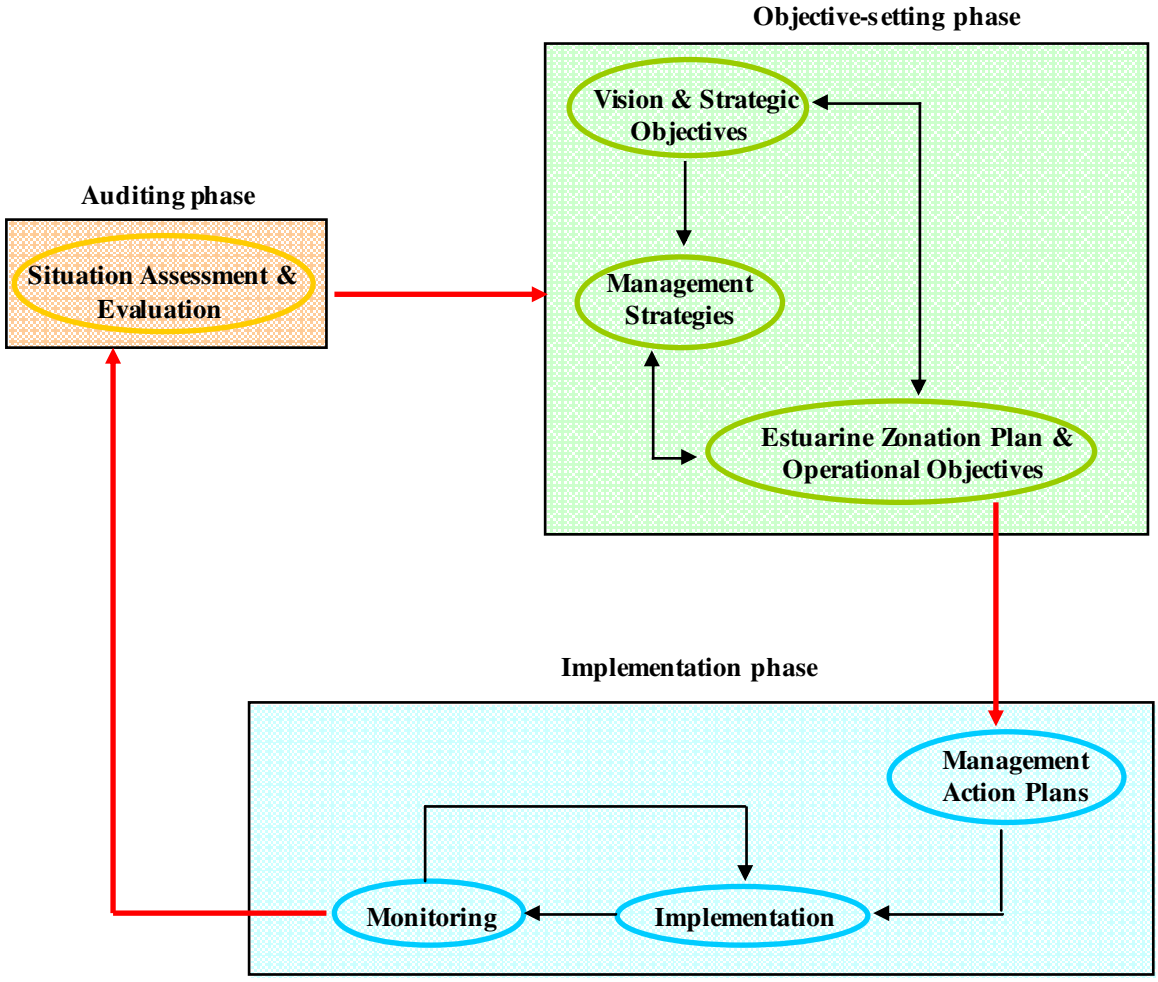


**Figure 2.1** Generic framework for the development and implementation of an EMP (from Van Niekerk & Taljaard 2007).

Chapter 4, Section 39 of the National Environmental Management: Protected Areas Act (Act 57 of 2003; NEM:PAA) calls for the development of management plans for protected areas. It is further stated in Section 38 (4), that marine and terrestrial protected areas with common boundaries must be managed as an integrated protected area by a single management authority. The Swartkops Estuary is an extension of the marine environment and the

Swartkops Valley Nature Reserve adjoins the estuary on its northern bank (see Plate 1.1). The Aloes Nature Reserve is located in close proximity to the estuary but does not share a common boundary. Nevertheless, the close association of all three entities means that a single IMP can be developed. The IMP will be developed in accordance with the Generic EMP Framework referred to above. The lead management authority will be the NMBM.

It is essential to understand that the IMP developed within this framework is not cast in stone but will instead become a living document that can be adapted according to the changing requirements of the system itself and its users. A feedback system involving a regulated monitoring programme and a detailed situation assessment once every five years will allow for changes to be made. However, in order for this system to function, a management institution comprising representatives of all stakeholder groups must be formed. This management institution serves to focus and coordinate management efforts and facilitates communication between users and managers in order to achieve a common goal. In addition, the IMP does not introduce any new legislation but serves to regulate and coordinate all activities within the boundaries of existing legislation.

# CHAPTER 3 – VISION, MISSION & STRATEGIC OBJECTIVES

## 3.1 INTRODUCTION

The Situation Assessment Report provided a sound basis from which to set a realistic and achievable Vision, as well as Strategic Objectives for the Swartkops Estuary and associated Nature Reserves. It also ensured that, at the time of the stakeholder workshops, expectations were aligned with the opportunities and constraints of the ecological and socio-economic environments prevailing at the time. The developed Vision and Strategic Objectives may not conflict with that developed for the CFR, and Strategic Objectives should form the foundation for quantitative Operational Objectives. Subsequent to extensive public participation, it became apparent that a Mission statement would also be required.

## 3.2 VISION

According to the Generic Framework, the Vision should be inspirational, representing a higher level statement of strategic intent, and should take into account the overall Vision set for estuaries within the greater CFR.

> ***Vision for Estuaries in the CFR:*** *Our estuaries are beautiful, rich in plants and animals, they attract visitors, sustain our livelihoods and uplift our spirits*

The Vision for the Swartkops Estuary and the Swartkops Valley and Aloes Nature Reserves is as follows:

> ***The Swartkops Estuary and the Swartkops Valley and Aloes Nature Reserves are unique national assets that are rich in biodiversity, and must be restored and protected to a level (Category C/B) that will attract visitors, uplift our spirits, sustain our livelihoods, and preserve our natural, cultural and recreational heritage.***

The C/B category is based on a series of generic ecological categories for estuaries that indicate their condition relative to the reference or original state. Category B indicates a system that is largely natural with few modifications and Category C indicates a system that is moderately modified. Overall, a combined Category C/B indicates a small degree of change from the reference/original conditions.

It must be noted at this point that the Zwartkops Conservancy has a Vision to acquire RAMSAR status for the Swartkops Estuary, possibly as far upstream as Perseverance. This initiative stems from The Convention on Wetlands of International Importance, otherwise known as the Ramsar Convention (held at Ramsar, Iran in 1971).

## 3.3 MISSION

In order to help realize this Vision, it is the Mission of the Swartkops Management Forum, via the implementation of the Integrated Management Plan (IMP), to[1]:

- Promote the conservation of the Swartkops environment, maintain its natural attributes and to ensure that development and the use of its natural resources is socially and economically justifiable and ecologically sustainable;
- define rights and duties (including the responsibilities of organs of state) in relation to the Swartkops management area; and
- control pollution, inappropriate development and other adverse effects within the Swartkops management area.

## 3.4 STRATEGIC OBJECTIVES

Strategic Objectives are generally qualitative statements of the values defined in the Vision and should be statements of outcomes rather than means of achievement. The following key result areas need to be specifically addressed in terms of Strategic Objectives:

- Water quality & quantity
- Living resources and conservation (grouped together for the Strategic Objectives but dealt with separately in the Management Action Plans – Chapter 6).
- Land use & infrastructure
- Institutional & management structures
- Sustainable livelihoods
- Tourism and recreational use
- Education and awareness

The Strategic Objectives for the key result areas mentioned above are as follows:

### 3.4.1 WATER QUALITY & QUANTITY

*Resource Quality Objectives and the Ecological Reserve requirements must be implemented to ensure that all ecological processes and livelihoods are sustained.*

### 3.4.2 LIVING RESOURCES & CONSERVATION

*Ensure a sustainable balance between the conservation, protection and exploitation of living and heritage resources.*

### 3.4.3 LAND USE & INFRASTRUCTURE

*Development and associated activities within the designated management area are controlled via legislation in such a way as to sustain existing livelihoods and ensure the maintenance of ecosystem functioning and services.*

[1] The Mission statement has been based on the introduction to the ICM Act, which defines the purpose of that Act. The Swartkops Management Forum will be the institution, comprising all stakeholders, responsible for driving the implementation of the IMP (see Chapter 7).

### 3.4.4 INSTITUTIONAL & MANAGEMENT STRUCTURES

*The Swartkops Estuary, and the Swartkops Valley and Aloes Nature Reserves are managed cooperatively and effectively by relevant spheres of government and civil society.*

### 3.4.5 SUSTAINABLE LIVELIHOODS

*Manage existing activities and promote additional opportunities in a way that ensures compliance with legislation and the maintenance of ecosystem functioning and services.*

### 3.4.6 TOURISM AND RECREATIONAL USE

*The tourism and recreational potential of the management area must be exploited in a responsible manner so as to benefit all users while ensuring the maintenance of ecosystem functioning and services.*

### 3.4.7 EDUCATION & AWARENESS

*To create an awareness, through research and education, of the value of the management area, a sense of ownership and the need for integrated, informed and cooperative management that will ensure the maintenance of ecosystem functioning and services.*

# CHAPTER 4 - MANAGEMENT STRATEGIES

## 4.1 INTRODUCTION

The Vision, Mission and Strategic Objectives may be achievable through various Management Strategies and these should be investigated and evaluated so as to optimally utilize financial and human resources that are detailed in the Management Action Plans. The following Management Strategies are available for achieving the Strategic Objectives for the various key result areas referred to in Chapter 3.

Several National Acts contain provisions that dictate to authorities (includes managers), land owners and recreational users with regards to activities that are allowed or at least should be regulated within estuaries and nature reserves or within prescribed distances from estuaries and nature reserves. It must be clearly understood that all management recommendations (including aspects of the Zonation Plan) made in this IMP are based on this existing legislation. As such, all existing activities, whether within urban, rural, estuarine or protected areas, should already conform to these recommendations. This IMP merely serves to create an awareness of what activities should be considered according to the existing legislation. In so doing, the sustainable use of land and resources should be optimized to benefit all user groups and the terrestrial and estuarine ecosystem itself.

## 4.2 WATER QUALITY & QUANTITY

- Enforce existing legislation in terms of the National Water Act (Act 36 of 1998; NWA) with respect to water use (Chapter 4, Parts 1 to 6), catchment management (Chapter 2, Part 2) and water quality (Chapter 3, Part 4) and the NMBM Draft By-Laws (including Public Amenities, Waste Management and Municipal Health).
- The National Water Resource Strategy (NWRS; NWA Chapter 2, Part 1) provides a framework for the protection, use, development, conservation, management and control of water resources for the country as a whole and within defined water management areas such as specific catchments. This strategy is given effect by a water management institution such as a catchment management agency (CMA) or water user association (WUA), neither of which currently exist.
- A Catchment Management Strategy (CMS) developed by the CMA in accordance with the NWA (Chapter 2, Part 2) for the protection, use, development, conservation, management and control of water resources within its water management area. Specifically this includes the classification of the water resource and the resource quality objectives (RQOs; NWA Chapter 3, Parts 1 & 2) aligned with that particular classification, i.e. Reserve Study. This latter aspect should incorporate a Comprehensive Reserve Study that will validate/substantiate the Desktop and Intermediate Studies that has already been done. Although both the Desktop and the Intermediate Study stated that the Recommended Ecological Category for Swartkops should be D, stakeholders want to see the system achieve a better status. Therefore, in line with the Vision, the desired classification of the resource is Category C/B.

It must be noted here that due to the ongoing issue with regards poor water quality (primarily sewerage and the associated *E. coli* health risk) in the Swartkops Estuary, the Zwartkops Conservancy (ZC; formerly the Zwartkops Trust) has addressed their concern through several attorneys in the form of letters to the NMBM and the Minister of Environmental & Water

Affairs. The Minister has requested that the NMBM provide her with a plan of action. At the time of this Report, the outcome of this remains unclear.

## 4.3 LIVING RESOURCES & CONSERVATION

- Estuary Protected Areas proclaimed (and demarcated) in terms of the NEM:PAA (Chapter 3, Part 4) that incorporate a variety of habitats (e.g. wetland, inter- and supra-tidal saltmarsh, sandbanks and mudbanks) and species and which would be closed to all forms of human disturbance. In the case of the Swartkops Estuary, the proposed protected areas will afford protection to the intertidal and supratidal saltmarsh habitat and all their associated fauna & flora. This will include many of the targeted bait organisms as well as feeding (wading), breeding and roosting birds. While it is envisaged that these Protected Areas will be permanent features, they could reviewed after a period of time with a view to opening them (withdrawal of declaration; Chapter 3, Part 4) and proclaiming alternative Protected Areas.
- Proclamation and demarcation of Aloes Nature Reserve in terms of the NEM:PAA (Chapter 3, Part 3).
- Conservation Areas in which Municipal by-laws may be applied to protect habitats or resources, e.g. restriction of bait collection to daylight hours to avoid trampling of substrate at night when larval release and post-larval settlement are at a peak (mudprawns); restrict number of boats according to carrying capacity within designated zones; and wake-free zones.
- Increase capacity of law enforcement officers (includes Honorary Fisheries Control Officers) and enforce existing legislation that pertains to activities that impact of terrestrial and estuary ecosystems, particularly in terms of the Marine Living Resources Act (Act 18 of 1998; MLRA), National Environmental Management Act (Act 107 of 1998; NEMA) and associated EIA Regulations, NWA, Conservation of Agricultural Resources Act (Act 43 of 1983; CARA), National Forests Act (Act 84 of 1998; NFA), NEM:PAA and the ICM Act.
- Strictly control the number of subsistence bait collecting permits and the conditions attached to these permits, e.g. quotas, digging and selling conditions. The status quo should remain until research can show whether the system can sustain the current levels and methods of exploitation. The objection of several stakeholders to the existing status quo is noted, but a total ban on all subsistence activities (even for two years until scientific research can determine sustainable levels of exploitation) is not realistic given the expectations and existing rights accorded to the subsistence fishers by DAFF. This IMP recommends several management options to help curb levels of use, including changes in permit conditions and no increase in permit numbers. DAFF will need to be engaged to ensure that the management of this fishery in future is based on scientific research and not just socio-economic pressures.
- Promote a catch-and-release format for all fishing competitions; these should be managed on a measure & release basis; no weighing of fish prior to release to reduce stress and damage.
- Protect and rehabilitate sensitive estuary riparian areas (particularly the damaged supratidal saltmarsh areas) and impacted terrestrial areas by controlling access by boats, vehicles, people (walking and dumping) and cattle to reduce impacts and erosion. The extent of this area on privately owned (or leased) land will need to be discussed and agreed upon with the landowners and lessees.
- Develop an Estuary Zonation Plan (EZP) and Reserve Zonation Plan (RZP) that denotes certain activities within certain zones, e.g. sanctuary area, fishing & bait collecting zones,

jetties & slipways, water skiing & power boating, vehicle paths, hiking and biking trails and priority rehabilitation areas to control bank collapse and erosion.
- Promote low-impact, non-consumptive activities such as hiking (and game trails), bird watching, canoeing and sports events.
- Retain the recreational and subsistence fisheries as the only forms of consumptive use; no commercial fisheries are to be considered for the Swartkops system.
- Removal of alien vegetation within the catchment, estuary and reserve areas.
- Enforce the provisions of the National Heritage Resources Act (Act 25 of 1999).

## 4.4 LAND USE & INFRASTRUCTURE

- Regulate all activities within 100 m of the high water mark in accordance with the EIA Regulations, within the 100 and 1 000m coastal protection zones in accordance with the ICM ACT (Chapter 1, Sections 16 and 17)[2] and in accordance with the Off Road Vehicle Regulations and the Seashore Act.
  - This strategy would include the licensing and operation (or closure) of slipways and the leasing of structures below the high water mark. Private slipways and jetties are administered under the Seashore Act, while Municipal or Provincial slipways are administered under the ORV Regulations. However, once the relevant sections of the ICM Act are promulgated (Chapter 7, Section 65 and Chapter 12, Section 95) and the Seashore Act is repealed, leasing will be administered under the former and owners will have 24 months in which to re-apply. If no existing lease is in place or the structures are in a severe state if disrepair, a Repair and Removal order can also be extended under the ICM Act (Chapter 12, Section 96). The situation at Swartkops is, however, complicated by several issues, namely;
    - It is unclear whether DEDEA has delegated responsibility to the NMBM with regards the leasing of jetties and slipways; and whether any existing arrangements will continue once the relevant sections of the ICM Act are promulgated.
    - The Municipal by-laws (Section 33) also refer to the construction, maintenance and location of jetties.
- Promote equitable and controlled access to coastal public property as defined in the ICM Act (Chapter 2, Sections 7 and 13). This includes restricted access to the proposed estuary protected areas.
- Promote agricultural practices in accordance with the CARA so as to avoid (minimize) erosion and damage to sensitive habitats and indigenous vegetation (catchment).
- Develop and enforce an EZP that regulates land use and development (as defined in the ICM ACT[3]) within the terrestrial portion of the designated estuary area. As can be seen from the definition of "development" below, this does NOT refer to farming activities such as planting and grazing, unless it involves the removal of indigenous vegetation. If this is the case then an assessment will need to be conducted to determine the impact and methods of minimizing this impact.
- Develop and enforce an RZP that regulates land use and activities within the designated Nature Reserve areas.

[2] Note that at the time of this Report, the EIA Regulations were being revised and the NMBM were in the process of developing setback lines that would more clearly define the coastal protection zone – this may include extending the zone to beyond the 100 and 1 000 m defined in the ICM Act.

[3] **"development",** in relation to a place, means any process initiated by a person to change the use, physical nature or appearance of that place, and includes—
*(a)* the construction, erection, alteration, demolition or removal of a structure or building:
*(b)* a process to rezone, subdivide or consolidate land;
*(c)* changes to the existing or natural topography of the coastal zone; and
*(d)* the destruction or removal of indigenous or protected vegetation;

- Incorporate the recommendations (including the EZP and RZP) from the IMP into the Municipal Spatial Development Framework (SDF), which in turn will inform the Integrated Development Plan (IDP).
- Management of structures in such a way as to prevent further bank erosion, siltation of the estuary and damage during flood events.
- Provide incentives (e.g. rates rebates; Municipal Property Rates Act 6 of 2004) for landowners or lessees to manage portions of their land as conservation areas to protect biodiversity.
- Apply the guidelines from the Conservation Assessment and Plan for the NMBM (SRK 2007a) with regards procedures to be followed for applications for developments or land-use change, restrictions on activities and opportunities for activities (estuary and reserves). These include;
  - All applications will require an EIA, no additional loss of the area and no impacts, and degraded areas should be rehabilitated (e.g. saltmarsh areas and Tiger Bay).
  - No loss of area and no further impacts.
  - Surrounding areas to be considered for eco-friendly, nature-based activities with low impacts, and degraded areas to be prioritized for IDP restoration projects and proclamation as conservation areas.

## 4.5 INSTITUTIONAL & MANAGEMENT STRUCTURES

- Ensure that a local management institution (Swartkops Management Forum; SMF), representative of all relevant spheres of government and civil society, is formed to ensure the implementation of the IMP; this includes ensuring that relevant government departments fulfill their obligations (e.g. DEDEA, DEA, DWA and DAFF) and that the ideals of the IMP are captured within all relevant management and planning documents, e.g. SDF, IDP and a CMS that includes the setting of RQOs. This will ensure that all management decisions are made cooperatively and with the knowledge and input from all stakeholders (e.g. leasing of structures and closing of slipways).
- Create awareness and ensure accountability amongst government institutions that have a mandate to enforce all forms of legislation applicable to the management area.
- Ensure that all arrangements between government departments with regards administering legislation are made clear to all affected stakeholders (e.g. administration of Seashore Act and ICM Act with regards leasing and closure of jetties and slipways).

## 4.6 SUSTAINABLE LIVELIHOODS

- Ensure compliance of all existing activities (e.g. subsistence and recreational fisheries) with legislation and management plans that regulate against potential impacts on the management area, its inhabitants and users.
- Promote the development of new initiatives that will benefit previously disadvantaged communities and that will comply with legislation and management plans that regulate against potential impacts on the management area, its inhabitants and users. These new initiatives could represent an opportunity for alternative livelihoods for the existing subsistence fishers in order to reduce the pressure on the estuarys' living resources.
- Develop a business plan for the operation of the bait selling outlets at Tiger Bay and the Wylde Bridge, in order to increase the benefits to the subsistence community while reducing waste through discarding of unsold bait.

## 4.7 TOURISM AND RECREATIONAL USE

- Market and promote the Swartkops Estuary and the Swartkops Valley and Aloes Nature Reserves as eco-friendly destinations and highlight conservation initiatives and importance to biodiversity protection.
- Promote non-consumptive recreational activities within the management area that include activities for the general public as well as organized sporting events (e.g. swimming, sailing, rowing, game trails and mountain biking).
- Implement all aspects of the NMBM Draft By-Laws that pertain to the management area (includes Public Amenities, Waste Management, Municipal Health, Air Pollution Control and Operations and Management of Initiation Schools).

## 4.7 EDUCATION & AWARENESS

- Educational workshops for local authorities, in particular town planners and directors, about the value of estuaries and nature reserves (ecological, social and economic), the IMP and its context within all forms of legislation (e.g. MLRA, ICM ACT, NEMA & EIA Regulations and the NEM:PAA) and planning schemes (e.g. SDF and IDP) and the consequences of irresponsible development within the designated management area.
- Training courses for estuary and terrestrial reserve managers, municipal authorities, local management institution members, catchment management agencies and water user association members; includes the Eastern Cape Estuaries Management Programmes' Introductory Training Course on Estuarine Management in South Africa; DWEAs' Resource Directed Measures: Estuarine Reserve Training Course; and higher degrees for those managers who already possess a degree or diploma.
- Public awareness campaign (estuary and terrestrial reserve value/natural heritage, biodiversity, threats and conservation efforts) via pamphlets, notice boards, school tour groups and illustrated talks given by government department representatives (e.g. DWA and DEA, Directorate Oceans and Coast), research scientists, members of the local management institution, the Zwartkops Conservancy (already in place) and Honorary Fisheries Control Officers (HFCOs).
- Empower Fisheries inspectors and municipal authorities (conservation officers; river control officer; nature reserve rangers) through an education initiative involving relevant national and regional legislation, local by-laws, zoning of the estuary and reserves and general knowledge of fauna and flora within the management area. This should include an initiative to train subsistence members to become (initially) catch monitors and (ultimately) HFCOs.
- Research projects (tertiary institutions) aimed at enhancing our existing knowledge and filling in knowledge gaps of the Swartkops Estuary and the Nature Reserves and thus the efficacy of the IMP through amended MAPs and monitoring programmes.

# CHAPTER 5 - ZONATION PLANS & OPERATIONAL OBJECTIVES

## 5.1 INTRODUCTION

Management strategies for the management area need to be translated into Zonation Plans and Operational Objectives. Although Operational Objectives may be developed for all management strategies within the seven key result areas, not all key result areas can be depicted in a Zonation Plan. For example, strategies for water quantity & quality, education & awareness programmes, institutional & management structures and sustainable livelihoods cannot be visually displayed. As such the respective EZP and RZP mainly reflects the strategies devised for living resources & conservation and land use & infrastructure.

## 5.2 ESTUARY ZONATION PLAN

The EZP for the Swartkops Estuary is represented visually in Figures 5.1 to 5.4 and comprises the following:

### 5.2.1 GEOGRAPHICAL BOUNDARY

The C.A.P.E. Estuaries Programme considers the NWA definition of an estuary as the most appropriate. It reads as follows; **"a partially or fully enclosed water body that is open to the sea permanently or periodically, and within which the seawater can be diluted, to an extent that is measurable, with freshwater drained from land."** For the purposes of determining the Resource Directed Measures (RDM), DWEA defines the geographical boundaries of an estuary as follows; **"the seaward boundary is the estuary mouth and the upper boundary the full extent of tidal influence or saline intrusion, whichever is furthest upstream, with the five meter above mean sea level (MSL) contour defined as the lateral boundaries."**

For the purposes of this IMP, the geographical boundaries of the tidal portion of the Swartkops Estuary have been defined in terms of the NWA definition, with the terrestrial management component being defined by the extent of the coastal protection zone as defined in the ICM ACT. The location of the 1:50 and 1:100-year floodlines (SRK 2010) are also shown and should also be used to inform the development of future planning documents. Historically, the full extent of the tidal influence extended as far as the causeway at Perseverance. However, since the removal of the causeway two years ago, tidal waters now push further upstream and the location and extent of the River-Estuarine Interface (REI) where fresh and salt water mix is unknown. For the purposes of this IMP, the upper limit of the estuary is indicated at a few kilometers upstream of Perseverance until the extent of the tidal intrusion can be determined.

The use of the 5 m contour line as a terrestrial boundary has no legal context and is therefore difficult to implement in terms of planning and management. It does, however, provide a useful guideline for a development set-back line, as much of the land below this mark is currently subject to flooding or may be in the future due to climate change (sea-level rise and increased flooding). This area also includes the majority of estuary-associated habitats and species in most estuaries, including the Swartkops.

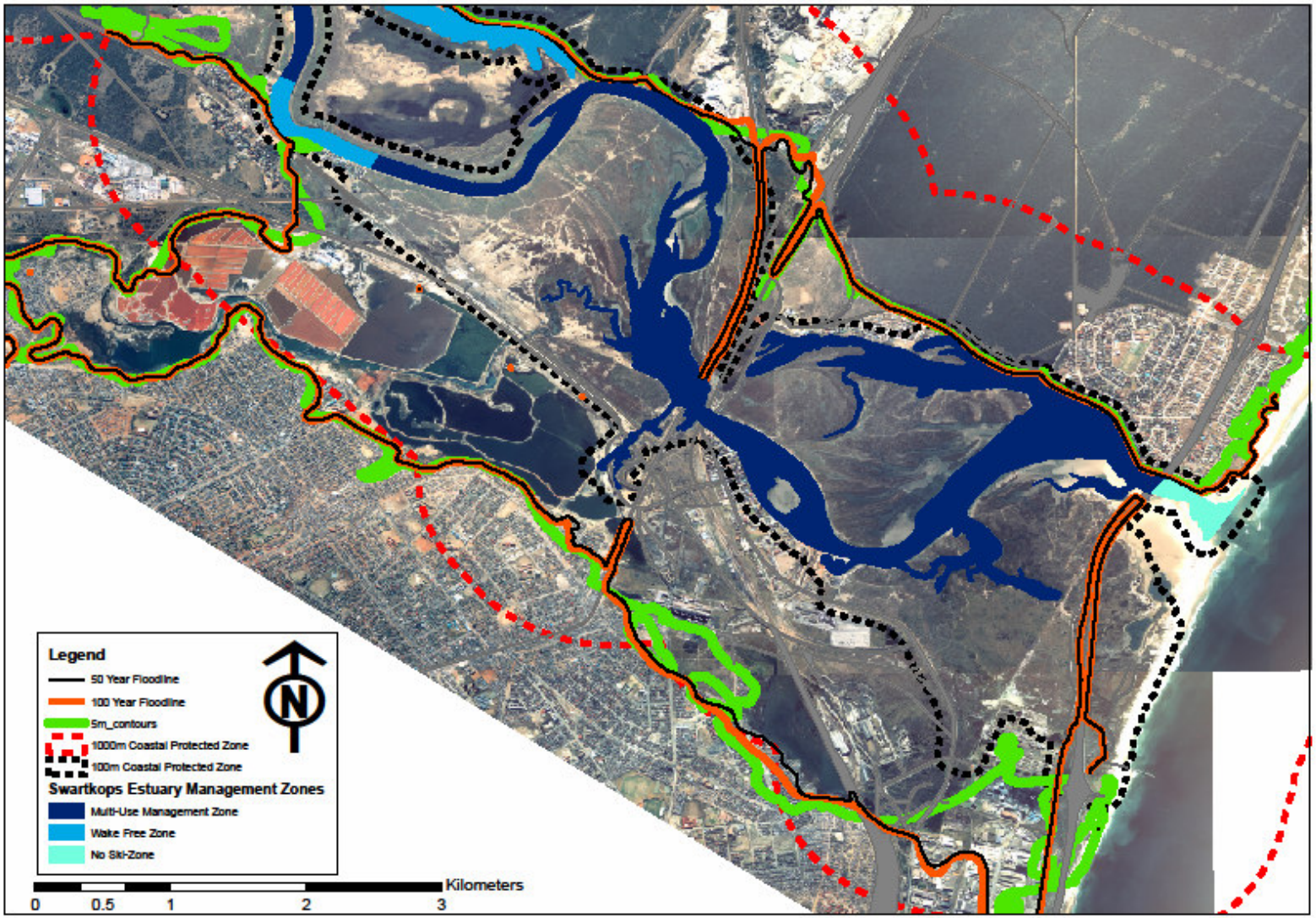


**Figure 5.1** Swartkops Estuary Zonation Plan (lower half); geographical boundaries and buffer zones.

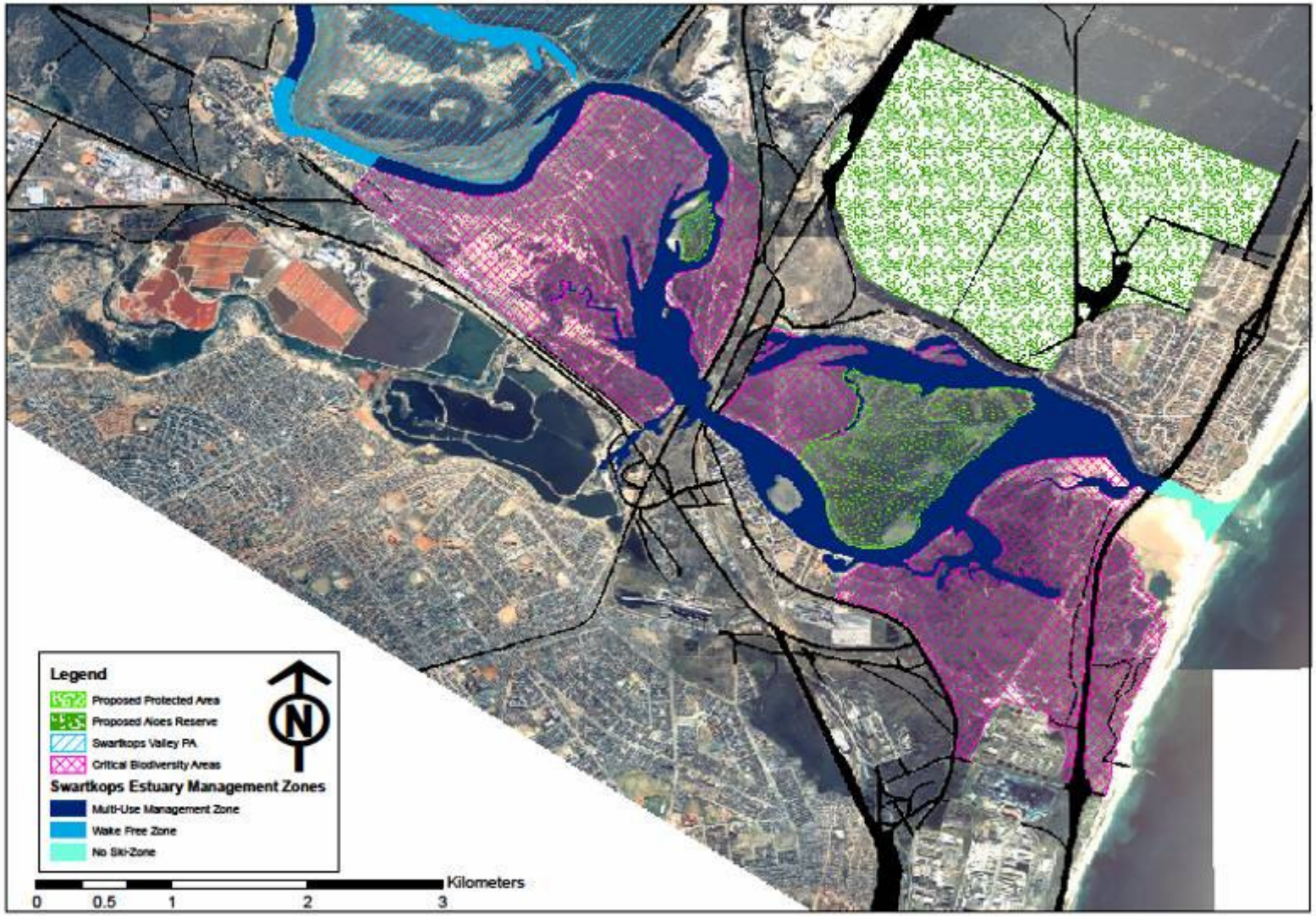


**Figure 5.2** Swartkops Estuary Zonation Plan (lower half); recreational use areas, Protected Areas and Critical Biodiversity Areas.

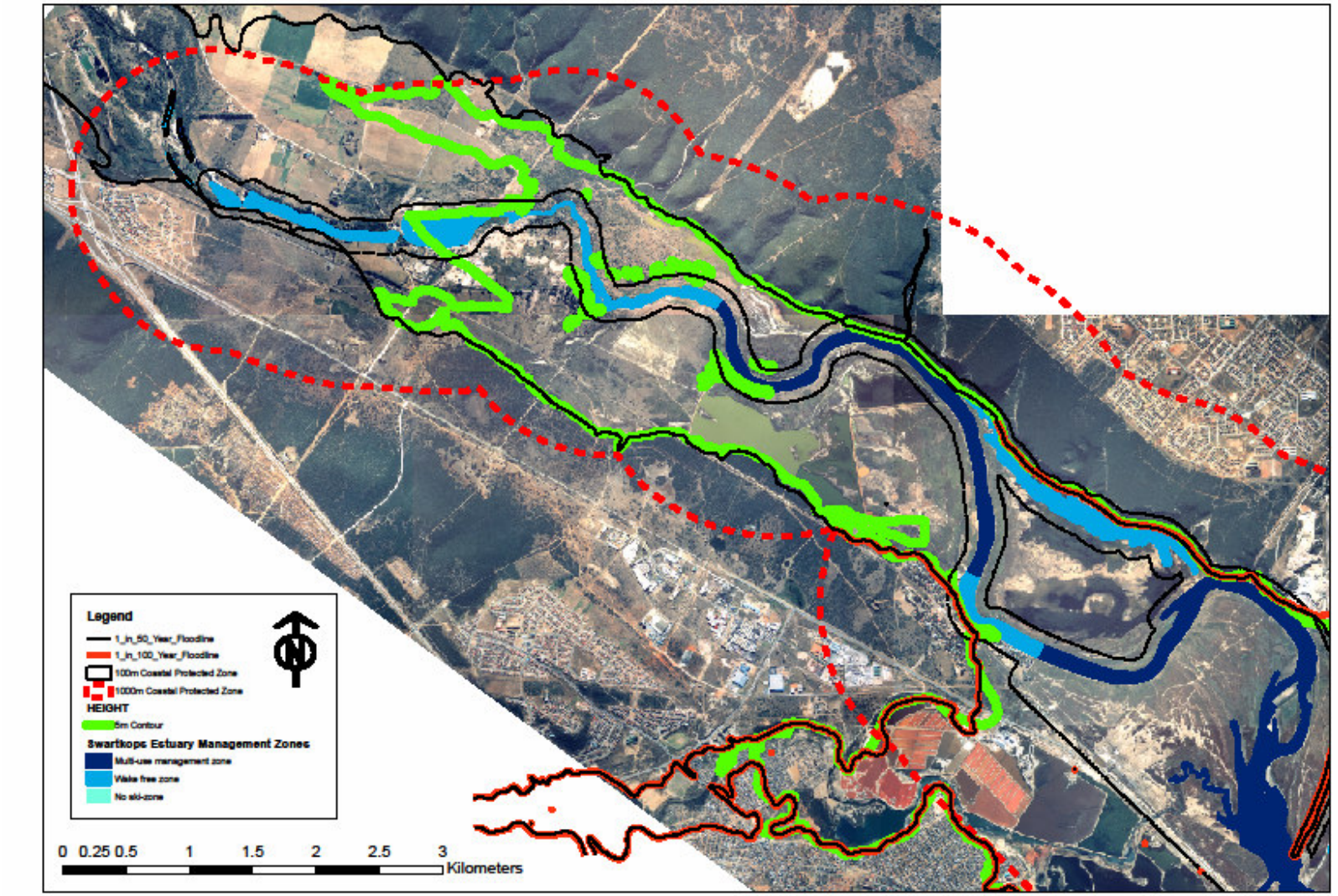


**Figure 5.3** Swartkops Estuary Zonation Plan (upper half); geographical boundaries and buffer zones.

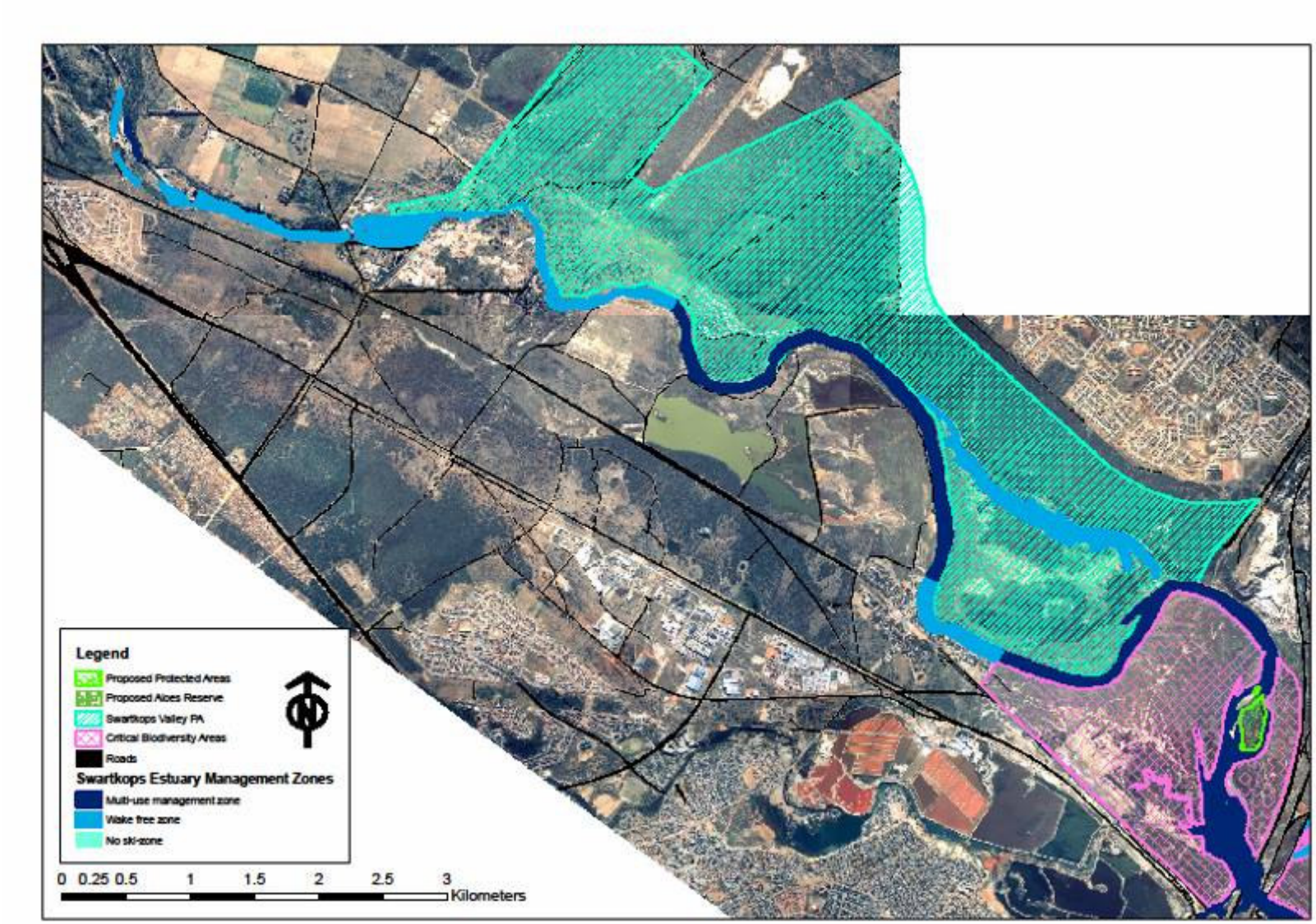


**Figure 5.4** Swartkops Estuary Zonation Plan (upper half); recreational use areas, Protected Areas and Critical Biodiversity Areas.

Three additional set-back lines are useful in defining the terrestrial extent of the estuary area. The first two are the 100 and 1 000 m set-back lines. The 1 000 m zone provides an indication of the extent of the coastal protection zone for land zoned as agriculture or undetermined use, or for land that was not zoned and not part of a lawfully established township, urban area or other human settlement when the ICM Act came into effect. The 100 m zone provides an indication of the area in which listed activities are regulated relative to the high water mark in accordance with the EIA Regulations, and the extent of the coastal protection zone for all land-uses not referred to under the 1 000 m zone. It must also be noted that, according to the ICM Act, the coastal protection zone must also include all land that would be inundated by a 1:50-year flood (river) or storm event (sea). As can be seen in Figures 5.1 and 5.3, this includes much of the urban areas located on the Swartkops floodplain and all the area located within 100 m of the high water mark.

It must be made clear that these zones are designed to restrict certain activities that may interfere with the estuary and its sensitive riparian areas, but it does NOT mean that no activities may take place. Activities that should be restricted, or at least assessed prior to authorization are those listed in the NWA that require a license (e.g. water use), the EIA Regulations (see Government Notices R386 & R387) and those affecting sustainable development and sensitive ecosystems as defined in the principles of Chapter 1 (Section 2) of the NEMA. These zones do NOT indicate that landowners may not operate within their boundary, i.e. they do not lose this land, but they must adhere to sound environmental principles when conducting any activities. In terms of the ICM ACT, no privately owned land can be expropriated unless there is some form of compensation (see ICM ACT Section 9), and only for the purpose of extending the coastal public property zone, i.e. this does NOT apply to the 100 and 1 000 meter coastal protection zone areas. The coastal protection zone may be extended beyond the 100 and 1 000 m limits if circumstances dictate that it will be beneficial to the environment or affected habitat (e.g. future NMBM setback lines).

The third set-back line is the 1:100-year floodline, and this provides an important guideline for land-use and town planning, in that it indicates areas of high risk where development should not be allowed. Not only must future town planning schemes take this into account, but it would also provide an indication to landowners with regards existing activities or structures that are at risk.

At the time of this Report, the development of coastal setback lines by the NMBM had not yet been completed. These setback lines will be based on the worse case scenario with regards potential flooding (includes storms) and sea-level rise. They will likely include the existing coastal protection zone and will in all probability extend this zone beyond the 100 and 1 000 meters prescribed as the minimum by the ICM Act. Future versions of the IMP will make use of these setback lines to define the estuary management area where they exceed the existing coastal protection zone demarcations.

### 5.2.2 PROTECTED & CONSERVATION ZONES

**Protected Zones**

No human activities may take place within the designated Protected Zones. This includes walking (also includes dogs), angling, bait collecting and mooring of boats. Exemption may be obtained for *bona fide* scientific research.

1. The larger proposed protected area below the Wylde Bridge was selected for the following reasons:
   a. It includes a large intertidal saltmarsh area, and considering that Swartkops has the third largest area of saltmarsh in the country it is important to protect some of this habitat. When inundated at high tides, this habitat also provides a refuge and feeding area for numerous organisms and contributes significantly to the organic and inorganic inputs into the system. When looking at the vegetation map from Baird *et al.* (1986), the proposed protected area represents an estimated 25% of the estuaries' intertidal saltmarsh cover. The dominant species is *Spartina maritima,* with *Sarcocornia perennis, Chenolea diffusa* and *Limonium linifolium* accounting for the majority of the remaining cover. The area covered by intertidal saltmarsh prior to any development has been estimated at 215 hectares (Colloty *et al.* 2000), but by 1939 approximately 45 hectares were lost when the Swartkops and Redhouse Villages were developed. By 1957 additional areas were lost to developments and saltmarsh covered an area of 168 hectares. Since then the area covered appears to have stayed fairly constant, and by 1996 saltmarsh occupied 166 hectares.
   b. It includes a large section of intertidal habitat that is heavily exploited at present by subsistence and recreational bait collectors. A recent survey by Fielding (2009) compared bait organism densities in the intertidal areas below the railway bridge to densities from a study in late 1970s (Hanekom 1980). Most of the collecting activity occurs in these lower reaches and in areas that are heavily exploited at present (Middlebank*, Oom Piet*, Phone Box*[4] and Modderspruit), mudprawns were on average at 50% of the densities in 1980. Data collected by Fielding (2009) can now be used as a basis for monitoring of these species and can be used for consideration for additional closed areas to protect them in future (a process and decision that will be driven by the SMF). Within the proposed area, mudprawn will be the principal bait organism that will be protected, but the other target organisms such as bloodworm, pencilbait, tapeworm, coralworm and tongueworm will also be protected. Sandprawn are, however, not protected and although Fielding (2009) shows their numbers to be healthy relative to 1980, an additional site for their protection may need to be considered in the future.
   c. The southern half of the proposed area (Middlebank and Oom Piet) is a very important feeding area for birds, particularly waders, with up to 40% of the estuarine associated bird species being concentrated in this area. Amongst these are the rare Terek and Curlew sandpipers and the Bartail Godwit.
   d. The submerged macrophyte *Zostera* is found along the lower part of the tidal gradient and within the Northwest passage, and contributes to the nutrient cycle and affords small and juvenile fish species a feeding and refuge habitat.
2. The smaller supra-tidal Brickfields Island located above the Wylde Bridge has been proposed because it is an important breeding and roosting area for Kelp Gulls, Sacred Ibis and several pairs of African Black Oystercatchers. This small island is isolated in the middle of the channel and therefore easy to demarcate and monitor.

With regards the terrestrial riparian areas (comprising mostly supratidal saltmarsh, lower terrace and saltpans), large parts of the undeveloped sections of the northern shores are incorporated into the Swartkops Valley Nature Reserve. In addition, two recent reports (SRK 2007a; 2008) have identified the Swartkops Valley, incorporating the estuary and surrounds, as a Core Conservation Zone (also known as a Critical Biodiversity Area and Critical

[4] *These three areas are located within the proposed protected area.

Ecosystem Process Area) in which critically important habitats and ecological processes need to be protected. These recommendations have been incorporated into the EZP and all the functioning supratidal areas that are not included in the protected areas have been designated as Critical Biodiversity Areas. This needs to be reflected in the Municipal Spatial Development Framework, where recommendations for these areas include no additional loss of habitat or area and also that degraded areas should be rehabilitated. Essentially this means that the undeveloped supratidal riparian areas are already afforded protection from further loss/damage and the degraded supratidal areas will need to be prioritized for rehabilitation. As such, specific areas along the shoreline, particularly along the southern shore do not need to be identified as protected areas, However, these areas will need to be highlighted in Municipal planning policies as no-go areas and agreements will need to be entered into with landowners and lessees where applicable; this issue is addressed under the Living Resources & Conservation key result area.

**Conservation or Multi-use Management Zones**

The remaining zones or sections of the estuary water body, it's associated habitats and the terrestrial areas set 100 and 1 000 m from the high water mark have been proposed as conservation areas. This does NOT mean that activities within these conservation zones are not allowed, but they will need to be regulated according to legislation, e.g. the Seashore Act (SA; Act 21 of 1935; amended 1993; until repealed by the ICM ACT), NEMA and the associated EIA Regulations, CARA, ICM ACT and Municipal by-laws, and in consultation with the landowners, to ensure sound environmental practices that benefit the users and estuary. The 1:100 year flood line, which can also be used as a guideline to limit activities, will also need to be considered.

Activities that would need to be controlled or restricted to specific areas include wake-free zones, skiing/power boating areas, recreational swimming areas, organized sporting events, angling, the use of jet-skis, building of jetties, slipways and other permanent structures, bird watching and access to the water's edge for people and vehicles.

***Wake free zones***

The following is applicable to wake-free zones in accordance with Government Notice R1852 in Government Gazette No. 12681 (10 August 1990; referred to as the by-laws elsewhere in this document) and the Draft Public Amenities By-Laws (October 2009; referred to as the Draft by-laws elsewhere in this document).

Section 15 (d) of the by-laws states that no vessel should operate in excess of 10km/h within 50 m of a jetty or slipway. This by-law must remain in force with the exception that the words "wake-free" must replace the designated 10km/h speed limit. Section 19(7) of the Draft by-laws state that no vessel may operate above a no-wake speed within 10 m of a jetty, slipway or vessel. The discrepancy between the 10 and 50 m distance needs to be addressed; it is the recommendation of this IMP that the 10 m designation is sufficient.

Section 21 of the by-laws state that no vessel should operate in excess of 10 km/h between sunset and sunrise. This by-law should remain in place, but should be worded so that it is clear that the wake-free speed is still applicable in the wake-free zones during this time. Section 10(d) of the Draft by-laws state that no vessels may operate above a non-wake speed between sunset and sunrise

Section 22 of the by-laws refers to an existing wake-free zone at Redhouse bounded by Girdlestone Avenue and the inlet upstream of the Yacht Club. The by-law states that a speed of 10km/h shall not be exceeded. This wake-free zone shall remain as is with the exception that the words "wake-free" must replace the designated 10km/h speed limit.

The northwest passage that forms part of the lower estuary Protected Area has been designated wake-free, although due to its inclusion in the Protected Area, no power boats will be permitted access anyway.

The entire section of the estuary located above the power lines has been designated as wake-free.

***No-skiing and no-swimming zones***

- The area between the N2 Bridge and the estuary mouth has been proposed as a no-skiing and no-swimming zone. This is based purely on safety issues as the tidal currents are known to be severe and the potential for people and boats to be swept out to sea when something goes wrong is sufficient to warrant this. This zone only extends to the sandbar at the mouth; the activity where boats or jet-skis "tow-in" surfers beyond the mouth will not be affected.
- No skiing will be permitted in designated wake-free zones.
- In accordance with the wake-free discussion above, no skiing can take place between sunset and sunrise or within 10 m of any jetty, slipway or vessel.

***Tippers Creek***

It has not been possible to reach an agreement between stakeholder groups with regards a no skiing zoning for Tippers Creek. A compromise to zone half the creek as a no skiing area has also not been accepted by some user groups. Until this issue can be resolved, this IMP must recommend that the zoning remain as it is at present, i.e. skiing will be allowed. Stakeholder groups with opposing viewpoints will be provided the opportunity to present their respective cases to the ZMF. However, it is likely that stakeholders will call for a dedicated study to determine the effects of a non wake-free zoning on the functioning of Tippers Creek. The results of this study can be used to inform the ZMF after five years when the IMP comes under review.

***Jet-skis***

In accordance with Section 2(c) of the by-laws and Section 20 of the Draft by-laws, no jet-ski, jet-bike or wet-bike may be operated anywhere on the Swartkops Estuary unless it is within demarcated areas. There are presently no such demarcated areas and this should remain as such; this does not apply to craft that launch for the specific purpose of gaining access to the sea – launching may take place at the slipway at the seaward extent of Amsterdamhoek near the N2 Bridge. It is the recommendation of this IMP that the by-laws be amended to include jet boats as well.

***Organized sporting events***

Organized events such as fishing competitions, sailing, rowing and swimming currently take place on the Swartkops Estuary. Although these activities usually take place within certain areas (e.g. rowing in the Redhouse section of the estuary), they are not restricted by any by-law to a specific area. The organization of such events is however subject to approval and

conditions by Council in accordance with Section 32 of the by-laws and Section 7 of the Draft by-laws.

***Angling***
Angling may take place anywhere within the water body of the Swartkops Estuary with the following provisions in accordance with Section 31 of the by-laws and Section 23 of the Draft by-laws:

- No fishing from any bridge over the estuary
- No navigational channel may be impeded by a fishing line
- No fishing line may be left unattended in or near a navigation channel
- No spearfishing

In addition, no angling would be permitted from the shore within the designated Protected Areas.

***Jetties and slipways***
The construction, location, maintenance and leasing of jetties and slipways should be done in accordance with NEMA and the EIA Regulations, Seashore Act (until repealed), ICM Act and Municipal by-laws (section 33). See Section 4.4 for a more detailed description of the issues surrounding slipways and jetties.

### 5.2.3 REHABILITATION ZONES

Rehabilitation, primarily in the form of alien vegetation removal, bank stabilization and improving degraded saltmarsh areas will need to be addressed. However, although the removal of alien vegetation within the riparian estuarine area is seen as a priority this must not be done to the detriment of bank stability. Many sections of the estuary bank in the middle and upper reaches show signs of severe erosion and collapse. While flood waters are largely responsible for this, the situation may be exacerbated through the removal of stabilizing vegetation, structures that alter flow (e.g. Railway Bridge) and the movement of people and vehicles along the top section of the bank close to the waters edge. Tiger Bay is also in need of rehabilitation, as past attempts have not been entirely successful. Rehabilitation of the supratidal saltmarshes in the Brickfields area and below the Wylde Bridge, where numerous footpaths have destroyed vegetation, needs to be prioritized. Single footpaths allowing access to the waters edge need to be introduced and the impacted areas allowed to recover on their own.

There are also two sections of supratidal saltmarsh located to the west of the R102 (south of Swartkops Village) that have been isolated from the estuary for a long period and consideration needs to be given for their rehabilitation.

The effectiveness of the rehabilitation wetland project at Motherwell Canal (still at a trial phase) must be monitored and consideration given to a similar project in the vicinity of the Chatty River inlet, which is another major point source of pollution in the estuary.

## 5.3 ALOES AND SWARTKOPS VALLEY NATURE RESERVES

The Conservation Development Framework developed by SRK (2008) for the Aloes and Swartkops Valley Nature Reserves included a proposed Zonation Plan. Aspects of this zonation plan that are relevant to the two reserve areas only will be used in this IMP (Figure

5.5). The majority of the Swartkops management area falls within what has been classed as a Core Conservation Zone and there are a few smaller designated Eco-Tourism Amenity nodes. Activities that already occur along some the fringes, e.g. abakwetha, residential and community have been indicated. As Nature Reserves, activities such as grazing cattle, walking of dogs and 4x4 driving (unless on designated tracks on game drives) will be excluded. The real challenge and management priority for these two areas is how to restrict access from the outside to prevent issues such as dumping, poaching and bush clearing from continuing.

A recent initiative to expand the Swartkops Valley Nature Reserve to sections of the west bank of the estuary will need to be considered by the SMF and perhaps be included in the IMP when it is reviewed in 5 years time.

### 5.3.1 CORE CONSERVATION ZONES

With the exception of the identified eco-tourism nodes (see below) the remaining areas within the terrestrial reserves are designated as core conservation zones, whose primary objective is biodiversity conservation. The following recommendations were made for these areas by the SRK (2008)[5] report.

- A precautionary approach should be adopted when the impact of an activity is unknown[6].
- No high or moderate intensity recreational activities.
- No livestock grazing.
- No poaching (includes snares, use of packs of hunting dogs[7], spears etc.), dumping (domestic waste and building rubble) and bush clearing.
- Only individuals or small groups allowed at any one time; impact of recreational activities need to be monitored and changes made where impacts are considered unacceptable.
- Any infrastructure must be developed according to the guidelines set out in the SRK (2007b) report.
- No new roads or trails, with the exception of a road along the northern boundaries to facilitate patrols and monitoring. All activities (e.g. mountain biking and walking) should be restricted to these roads and trails.
- Access must be via the points at Motherwell Canal and at the eco-tourism nodes.
- A 5 m-wide strip of land must be cleared on the outside of the reserves to allow for effective monitoring of the fence and illegal activities (this will need to be done in cooperation with private landowners where applicable).
- Signage needs to be erected with information about the reserves and activities that are permitted and/or considered illegal (penalties can be included).
- No waste transfer stations to be developed immediately adjacent to the reserves.
- Access roads to the Cerebos saltpans must be controlled and for the use of Cerebos and reserve management staff only. Identify unnecessary access roads and close them to allow for rehabilitation.

[5] Comments in parentheses are additions by this report.

[6] It is the recommendation of this IMP that no activity should be allowed (even with a precautionary approach, as this open to interpretation) until the impact can be determined.

[7] The use of hunting dogs is a feature not only in the terrestrial reserves, but also along the banks of the estuary, particularly in the Redhouse area and upstream closer to Perseverance.

### 5.3.2 ECO-TOURISM NODES

The three nodes identified are:

- An environmental education and day restaurant/tea room in the southeast corner of the Aloes Nature Reserve. This site is partly degraded but also comprises some pristine areas with low sensitivity value.
- A conference facility, accommodation and restaurant along the escarpment in the center of the Swartkops Valley Nature Reserve. This site is partly degraded
- A public access site adjacent to the Motherwell Canal. This site is currently degraded and already used for access; it needs to be secured and upgraded to be aesthetically appealing.

The following guidelines have been proposed by SRK (2008) and fully supported by this IMP:

- EIAs must be conducted prior to any development of the nodes – this includes the expansion of the car park at the Aloes Nature Reserve site.
- Any infrastructure must be developed according to the guidelines set out in the SRK (2007b) report.
- Expansion of the footprints of these nodes is not encouraged and should only be contemplated after detailed investigations into the impact on the surrounding Core Conservation Zone.

## 5.4 OPERATIONAL OBJECTIVES

The Operational Objectives specify quantitative, measurable standards, target values and limits or thresholds of potential concern (TPCs) for indicators relevant to issues within each of the key result areas. These need to take into account any existing standards, regulations (legislation), and operational policies or guidelines, as well as available resources. TPCs are defined as measurable end-points related to specific indicators that, if reached, prompt management intervention. In essence, TPC end-points should be defined in such a way that they provide early warning signals of potential non-compliance with operational objectives (Taljaard & Van Niekerk 2007a). Relevant indicators and recommended TPCs for many of the operational objectives detailed below have been taken from McGwynne & Adams (2004). Operational objectives for conservation and living resources have been dealt with separately. The overwhelming number of issues and operational objectives cannot conceivably be dealt with or achieved all at once, and will need to be prioritized. Recommendations have been made in this regard in Section 7.3, but this is also an aspect that can be discussed by the SMF.


**Figure 5.5** Zonation Plan for the Swartkops Valley and Aloes Nature Reserves (from SRK 2008).

### 5.4.1 WATER QUALITY & QUANTITY

The NWRS, which provides for the development of a catchment management strategy by a CMA or WUA, will ensure both the classification of the water resource (Swartkops system) and the required RQOs. The RQOs for a catchment and its associated riverine and estuarine systems relate to the following aspects:

- The water quantity of freshwater inflow into the estuary (ecological reserve); and
- the water quality of freshwater inflow at the head of the estuary and water quality within the estuary.

The Desktop Ecological Reserve Assessment for the Swartkops (DWAF 2000) classified the various components as follows:

- Present Ecological State (PES) – Category E-F
- Ecological Importance and Sensitivity (EIS) – High
- Recommended Ecological Category (REC) – Category D

Where;
- Category E-F indicates a system that is critically/extremely modified, i.e. there has been serious change resulting in extensive loss of natural habitat, biota and ecosystem functioning; and
- Category D indicates a system that is largely modified where there has been a large loss of natural habitat, biota and ecosystem functioning.

A more detailed Intermediate Ecological Reserve Assessment (DWAF 2001) classified the PES as Category E and the REC as Category D; the Vision for the IMP is to improve on this REC and attain a Category C/B classification.

If the Classification of the Swartkops Estuary is to be improved, the freshwater inflow requirements will need to be met. Based on historical data, mean inflow is 0.82 $m^3/s$ at spring tide. Therefore if the Category C/B is to be attained, there will need to be an increase in the amount of freshwater inflow (potentially in the region of 1 $m^3/s$). However, since the removal of the causeway at Perseverance a few years ago, these historical estimates are unlikely to be valid anymore. Essentially what is now needed is an accurate assessment of what the present state and REC of the estuary is, and what freshwater inflows and water quality conditions will be needed to maintain the REC, i.e. a Comprehensive Ecological Reserve Assessment. However, to achieve this with some accuracy, data will be needed on the hydrodynamics of the system, and adequate water level recording data would need to be available. Until a more comprehensive Reserve Assessment can be carried out, the ecological flow requirements will need to be based on the Intermediate Assessment conducted by DWAF (2001).

The following components, listed in Chapter 3 (Section 13) of the NWA, form the basis of all RQO determinations:
- The Ecological Reserve for human needs (e.g. irrigation and household use) and the ecological requirements of the estuary;
- the instream flow;
- the water level;

- the presence and concentration of particular substances in the water (nutrients, physical variables and toxic substances);
- the characteristics and quality of the water resource and the instream and riparian habitat;
- the characteristics and distribution of aquatic biota; and
- any other characteristic of the water resource in question.

Based on available information and in the absence of a Comprehensive Reserve Assessment, the TPCs for the above components should be as follows:

- Ecological Reserve – no TPC for human requirements in the absence of a Comprehensive Reserve Assessment. The TPC for estuary requirements, based on DWAF (20010) is < 9.531 million $m^3$/annum (equates to 11.44% of the MAR).
- Instream flow – a preliminary TPC based on historical flow data and the PES of the system may be in the region of < 1 $m^3$/s, however in the absence of a comprehensive assessment and more details regarding the effect of the removal of the Perseverance causeway, the required instream flow cannot be known with any degree of confidence.
- Water level – no TPC for water level in absence of a Comprehensive Reserve Assessment.
- Pollutants – TPCs expressed in appropriate units (standards set by DWAFs' Water Quality Guidelines for the Natural Marine Environment – see Appendix 1; DWAF 1995a) for physical/chemical variables, inorganic nutrients and toxic substances. All industries that could potentially pose a threat to the management area (e.g. Waste-Tech and Algorax) are already registered with and monitored by the NMBM. Details in this regard are available from the NMBM on request.
- Microbial organism and pathogens, including total coliforms, faecal coliform, faecal streptococci, Salmonella, Enteroviruses and Protozoa. TPCs expressed in appropriate units (standards set by DWAF's Water Quality Guidelines for Recreational Use – see Appendix 1; DWAF 1995b). For example, the TPC for *E. coli* is a range of >100units /100 ml in 80% of samples and 2 000 units/100 ml in 95% of samples for full and intermediate contact recreation for marine (and estuarine) waters.
- Characteristics and distribution of key aquatic invertebrate biota (mudprawns, sandprawns and pencilbait) as indicators of water quality problems – a TPC of 70% below baseline counts (estimates) should be set. This is dealt with under the Conservation (Biodiversity and Human Activities) and Living Resources Operational Objectives detailed below. Caution is advised as decreases may be due to factors other than water quality or quantity (freshwater inflow), such as poor recruitment, natural predation, human exploitation or flooding/storm events.
- In addition, a CMA (or WUA initially) needs to be established so that a catchment management strategy (CMS) can be developed. This will facilitate a catchment to coast management approach and assist in the development of a comprehensive reserve assessment that will define the RQOs. The TPC would be if a CMA was not established and a CMS not developed. The establishment of a CMA and development of a CMS is not a direct action required by the IMP, however they are seen as vital components within an integrated catchment to coast approach and are therefore viewed as a priority.

### 5.4.2 CONSERVATION

Operational objectives for conservation purposes should be targeted at protecting biodiversity within the Swartkops Estuary and the Nature Reserves by ensuring that the diversity, distribution and abundance of plant, animal, bird, fish and benthic invertebrate communities

is maintained or restored. These objectives can be defined in terms of TPCs for a range of indicators that firstly reflect aspects of biodiversity itself, secondly are aimed at controlling human activities that may impact on habitats and living resources and thirdly deal with enforcement issues. The conservation of heritage resources is dealt with separately.

***Biodiversity***

- Presence and extent of plant communities. The recommended TPC is a 10% reduction in area covered by each plant community type. Baseline data on coverage can be obtained from aerial photographs or reference photographs from elevated vantage points along the estuary.
- Infestation by alien vegetation. The TPC is an area >10% of the total indigenous vegetation that is occupied by alien invasives. Baseline and reference data can be obtained from aerial photographs and on-site line transects.
- Densities of intertidal invertebrate species such as mudprawn, sandprawn and pencilbait. A decrease in population density to below 90% of baseline counts is the recommended TPC under normal conditions, i.e. excluding mouth closure events and flooding. Baseline data can be obtained from recent surveys (Fielding 2009) or regular seasonal counts of burrows using random quadrats over an initial two-year period. If declines are due to human activities then management actions will be as for those detailed under the Human Activities section below. If water quality is the problem, then management actions will be as for those detailed under the Water Quality & Quantity Operational Objectives above (see Table 6.1).
- Presence and abundance of waterbird communities, with a focus on red-data species, those that are highly or partially dependent on estuaries, breeding aggregations or activity and the presence of nests. Since rare or specialized birds are usually the first to be affected by change, the TPC for species richness should be the loss of one or two species over a short period of time. The TPC for species diversity should be a 20% loss over a long (5-6 year) period. There are two TPCs for numbers of birds; a drop in 20% for resident species over a five-year period; and a drop in 20% for migratory species over a 10-year period. Baseline data should be in the form of data from the Animal Demography Unit's (ADU; based at UCT) Coordinated Waterbird Counts (CWAC). Data from several sites are available, namely Bar None Saltpan (Site Code – 33502533), Chatty Saltpans (Site Code – 33512535), Redhouse Saltpans (Site Code – 33502535) and the Perseverance Vleis (Site Code – 33502532). Additional data can also be sourced from residents who have compiled their own historical records.
- Fish abundance as measured by catch-per-unit-effort (*cpue*); this indicator and its associated TPC is also relevant to the operational objectives for living resources. There are currently no recommended TPCs for *cpue* probably because catch data is not widely available for individual estuaries, however it is recommended that a decrease of >10% from baseline values for dusky kob, white steenbras and leervis and a decline of >20% from baseline values for all other species be adopted. Baseline data can be collected from a dedicated fisheries survey of the estuary over a minimum of two years. Should the TPC be reached it must be noted that the cause may not be attributed to fishing pressure on the Swartkops alone as we are dealing with a National resource. Declines can be due to fishing pressure elsewhere or recruitment failure due to natural events.
- Location and proportion of estuary habitat type under formal protection (protected areas). TPCs and baseline data for this objective are not available but the recommendation from Turpie & Clark (2007) is that half the system be formally protected. This is unrealistic given the user dynamics and land-use surrounding the Swartkops Estuary, but the proposed protected areas comprise a range of intertidal habitats and associated fauna &

flora as well as an important breeding, roosting and feeding sites for birds. Supra-tidal saltmarsh will be afforded protection as it is classed as a Critical Biodiversity Area, i.e. no additional development or activities that may impact on it. A preliminary TPC would be any decrease in the total protected area taking into account the level of habitat protection in other estuaries.

- Proclamation and demarcation of the Estuary Protected Areas in accordance with Chapter 3, Part 4 of the NEM:PAA; TPC is if Protected Areas are not proclaimed. Possible review after five years.
- Proclamation and clear demarcation of the Aloes Nature Reserve in accordance with Chapter 3, Part 3 of the NEM:PAA; TPC is if Reserve is not proclaimed (included in this objective would also be the clear demarcation of the Swartkops Valley Nature Reserve).
- Presence and abundance of terrestrial mammals. Due to the small size of the two terrestrial reserves and the threat of poaching, the TPC should be high, i.e. 5 – 10% drop in abundance. Census data that can be used as a baseline is unavailable and needs to be addressed. At present there is an idea of presence or absence of species and this can be used as a starting point, with a TPC being if a species known to occur historically is no longer present.
- Establish and register a Fire Protection Association (FPA) and develop a Fire Management Plan (FMP) for the terrestrial reserves in accordance with the National Veld and Forest Fire Act (Act 101 of 1998; NVFFA) and prevent uncontrolled burning or making of fires in the reserves in accordance with the NVFFA and aspects of the NEMA, NEM:BA and Municipal Public Amenities by-laws. The TPC would be if no FPA was established, an FMP was not developed and if uncontrolled fires were made within the reserves. See Appendix 2 for proposed structure of FMP.
- Investigate the feasibility of establishing a residential/conservation buffer zone between the northern boundary of the Aloes Nature Reserve and Wells Estate in accordance with the CDF recommendations (SRK 2008). The area is currently earmarked for residential expansion in the Municipal SDF and as such the SDF should be amended to set aside the buffer zone. If this is not feasible, then a section of bush behind the residential properties along the northern boundary must be left intact to provide a smaller buffer protection zone. The TPC would be if either the SDF is not amended or if bush clearing took place right up to the reserve boundary.

***Human activities***

- Number of persons visiting the estuary and their activity, i.e. carrying capacity. The physical, social (includes cultural and psychological aspects) and ecological carrying capacities (together grouped as recreational carrying capacity) have not been calculated for the Swartkops and a comprehensive study is required to determine these values; once calculated the TPCs for each would be any value in excess of that capacity. Baseline data can be collected during a survey that records the different types of activities and the respective number of participants on the water and on the bank and the number of registered and unregistered boats on the water. Carrying capacity for boats can be calculated according to a DWA model but may also be regulated by estuary stakeholders (the SMF) in line with the estuary Vision.
- Bait collecting, including number of collectors, collecting methods, rate of removal, number of licensed operators, adherence to permit conditions (quotas, collecting times and collecting methods) and exclusion of certain species (bloodworm, tapeworm and pencilbait). The TPC for any bait organism is a 10% reduction in population size due to collecting activities, which include legal and illegal methods and the associated trampling of the substrate. In the absence of scientific data supporting the sustainability of bait

collecting, the TPC for levels of effort should be the increase in number of subsistence permits. Given the dynamic nature of the Swartkops bait fishery and the potential for conflict between user groups who accord blame to one another, the TPC for compliance with the MLRA Regulations and the subsistence permit conditions should be very high, i.e. a single person operating outside the law should be cause for concern. Baseline data can be collected as part of a more detailed fishery survey and should include numbers of collectors, collecting sites, methods used, number of bait organisms taken and bait collecting licenses. Compliance records are also available from the Honorary Fisheries Control Officers (HFCOs). This aspect is also dealt with under operational objectives for living resources.

- Number of fishing competitions. There is no defined TPC for this indicator as a reduction in fish and bait organism populations is unlikely to be as a result of fishing competitions alone. However, given the national status of many target fish species, a TPC should be any increase above the baseline number of competitions currently held. Baseline data can be the number of competitions held annually in 2008 and 2009. Municipal by-laws require that Council grant permission to hold competitions and so these can be regulated easily.
- Litter (solid waste) accumulation. Sources of litter that may accumulate in the estuary and reserves varies, and may come directly from residents (riparian landowners), estuary users, poachers in the reserves and from illegal dumping in the reserves. It is also acknowledged that litter may be blown into the estuary and reserves from distant sources or even the registered dumpsites. There should be a zero tolerance for litter, so the TPC should be any visible increase in the volume of solid waste in or adjacent to the estuary or within the reserves when compared to baseline data. Baseline data can be collected for the first year and should be measured as volume collected in standard garbage bags after certain activities or times, e.g. peak holidays.
- Human activities that impact on the integrity of the Nature Reserves, including poaching (snares and hunting with dogs), grazing of cattle, removal of vegetation and dumping of waste (domestic and building rubble). The TPC for this should be very high and a single incident must be cause for concern.
- Relocation of the waste transfer/garden refuse station located adjacent to the Aloes Nature Reserve eco-tourism node as per the CDF recommendations (SRK 2008). The TPC would be if the operation of the existing site were to continue.
- Human activities within the estuary Protected Areas - no activities should be allowed; this includes power boating (canoeing will be allowed in the northwest passage), fishing, bait collecting and walking (tramples habitat; includes dogs). TPC should be high, i.e. a single incident should be cause for concern.

***Law enforcement***

- Number of law enforcement officers assigned to the estuary, the frequency of patrols and number of offences, arrests and convictions in terms of the legislation (includes MLRA, ICM Act, NEMA, EIA Regulations, NEM:PAA, NEM:BA, NWA, Seashore Act and Municipal By-laws). Effective patrolling and adequate numbers of enforcement officers should act as a deterrent to illegal activities and promote compliance. Competent enforcement should also ensure a high conviction rate for offenders. The TPCs for this objective should therefore be the incidence of offenders, with a designated number per month or per patrol being set as the threshold and the rate of convictions in relation to arrests made. The aim would be to reduce the number of offenders to zero such that the TPC would be a single offender at any given time and to achieve a high conviction rate. Baseline data would be in the form of number of existing incidents (over the last 2 years),

conviction rates, frequency of patrols, type of offences and the number of offenders (obtained from Municipal authorities, DEDEA, DWA, DEA, HFCOs and ex-MCM inspectors). Parts of this aspect are also dealt with under operational objectives for living resources.

- Number of law enforcement officers assigned to the terrestrial reserves, the frequency of patrols and number of offences, arrests and convictions in terms of the legislation (includes NEM:PAA, NEM:PA, NEMA, EIA Regulations, NFA and Municipal By-laws). Effective patrolling and adequate numbers of enforcement officers should act as a deterrent to illegal activities and promote compliance. Competent enforcement should also ensure a high conviction rate for offenders. The TPCs for this objective should therefore be the incidence of offenders, with a designated number per month or per patrol being set as the threshold and the rate of convictions in relation to arrests made. The aim would be to reduce the number of offenders to zero such that the TPC would be a single offender at any given time and to achieve a high conviction rate. Baseline data are not available and would need to be collected from the time of implementation.
- Construction of new roads along the northern boundaries of both terrestrial reserves to allow for effective patrols to combat illegal access and illegal activities. TPC would be if no new road were to be developed and uncontrolled access were to continue; number of incidents that should be cause for concern can be 10/month within the first year after road construction and 5/month thereafter.
- Enforcement and monitoring of conditions in terms of records of decision (ROD) for developments as the result of the EIA process. Due to the sensitive nature of estuarine systems, all developments will have some degree of a negative impact (direct and indirect) on their functioning, irrespective of intentions. The TPC for this objective must be very high and even a single offence must be seen as unacceptable. Baseline data is set out in the form of recommendations as a part of the conditions of the ROD; these recommendations must be complied with and enforced by independent environmental site officers in order to reduce impacts.

***Heritage resources***

- The identification, evaluation[8] and preservation of all heritage resources in terms of the NHRA. Within the Nature Reserves, this would include Wynrock's Old Donkey Paddock located in the southern corner of the Aloes Reserve. According to Section 34 of the NHRA, no structure older than 60 years may be altered or demolished without a permit issued by the Provincial Heritage Resources Agency. In the context of the Swartkops management area this would be all-inclusive and would also apply to structures such as jetties and slipways[9]. The TPC should be high, and damage or removal of structures older than 60 years should not be permitted unless they are in such a state of deterioration that they pose a health and safety risk or impact on the aesthetics of the area. However, the issuing of repair or removal orders for jetties and slipways under the Seashore Act and the ICM Act needs to abide by the requisite provisions of the NHRA as well.

### 5.4.3 EXPLOITATION OF LIVING RESOURCES

Operational objectives for the exploitation of living resources should be targeted at enforcing Protected Areas that designed to protect a variety of habitats and species, local by-laws to

[8] Evaluation criteria consist of historical significance, scientific importance, emotional/social/religious importance, uniqueness and contextual significance (SRK 2008).

[9] Any repair work on jetties and slipways must be done in accordance with the original plans otherwise it must be seen as upgrading or improving and not a repairing.

protect habitat or resources, existing legislation (e.g. MLRA, NEM:PAA, NEM:BA and NFA) and the regulation of fishing competitions.

***Estuary Protected Areas***

- All exploitation of living resources (all forms of shore-based angling, bait collecting and hunting) is prohibited in the Protected Area. The TPC for compliance to this regulation should be very high, i.e. a single person operating outside the law should be cause for concern.

***Nature Reserves***

- All exploitation of living resources (hunting/poaching and harvesting of plants/vegetation) is prohibited in the Nature Reserves. The TPC for compliance to this regulation should be very high, i.e. a single person operating outside the law should be cause for concern.

***Exploitation of bait organisms***

- All recreational individuals exploiting bait organisms in the estuary must adhere to regulations stipulated in the MLRA (bag limits, collection methods & licenses) and any estuary specific by-laws within the conservation multi-use management areas. The TPC for compliance should be very high, i.e. a single person operating outside the law should be cause for concern, while the TPC for populations of bait organisms should be a 10% reduction in baseline values (see also Biodiversity and Human Activities operational objectives above). Baseline data can be obtained from recent surveys (Fielding 2009) or regular seasonal counts of burrows using random quadrats over an initial two-year period.
- All subsistence bait collectors must be possession of a permit issued by DAFF and must adhere to its conditions with regards bag limits, collecting methods, collecting times and selling conditions. The TPC for compliance should be very high, i.e. a single person operating outside the law or repeat offenders should be cause for concern. Consideration needs to given to amending permit conditions to exclude the destructive practice of digging and a moratorium on certain species, particularly pencilbait, bloodworm and tapeworm, until research can show that these species have recovered and can be exploited sustainably. Subsistence permit holders that contravene their permit conditions must have the permit revoked and should not be considered eligible for a permit the following year.
- The number of subsistence permits must not be increased before the current levels of exploitation are assessed and it is determined whether it is sustainable. This aspect needs to be acknowledged by all role players. Scientific surveys should be combined with data collected by HFCOs pertaining to exploitation levels, impacted areas and compliance. The TPC should be any increase above the existing number (53) of permits (ideally this should be decreased to the number issued in 2009 (36), but socio-economic pressures make this highly unlikely.

***Exploitation of fish***

- All fishers must be in possession of valid licenses (recreational or subsistence) and adhere to all regulations specified in the MLRA or specific conditions of the subsistence permits (size limits, bag limits, sale of fish etc.). The TPC for compliance to these regulations should be very high, i.e. a single person operating outside the law should be cause for concern. This aspect will include the gill netting taking place on the estuary.
- Maintenance of fish abundance; measured by catch-per-unit-effort (*cpue*; see also biodiversity conservation above). There are currently no recommended TPCs for *cpue* probably because catch data is not widely available for individual estuaries, however it is recommended that a decrease of >10% from baseline values for dusky kob, white

steenbras and leervis and a decline of >20% from baseline values for all other species be adopted. Baseline data can be collected from a dedicated fisheries survey of the estuary over a minimum of two years. Should the TPC be reached it must be noted that the cause may not be attributed to fishing pressure on the Swartkops alone as we are dealing with a National resource. Declines can be due to fishing pressure elsewhere or recruitment failure due to natural events.

***Fishing competitions***

- Competitive angling structures (e.g. EPLTBAA or local clubs) hosting the event must adhere to the conditions specified by the Municipality. There is no defined TPC for this indicator as fishing competitions alone are unlikely to be the direct cause of the reduction in fish populations on a National scale. However, the TPC for compliance to the MLRA and estuary specific regulations during competitions should be very high, i.e. a single person operating outside the law should be cause for concern, possibly resulting in a moratorium on all future events. There is no defined TPC for compliance to the rules of participation during fishing competitions and these would need to be determined through consultation between organized angling bodies, the NMBM and the SMF, e.g. the feasibility of initiating a catch-and-release format for all competitions should be investigated.

### 5.4.4 LAND-USE & INFRASTRUCTURE

- Nature and extent of land use and infrastructure associated with the estuary and catchment. The TPCs for this objective are not in the form of target values or quantitative, measurable standards but are instead broad statements of intent as follows:
  - Planning should allow for the maintenance of a riparian zone along the length of the estuary where sensitive habitats (e.g. supratidal saltmarsh and indigenous vegetation) occur. The application of the coastal protection zone, Municipal coastal setback lines (in the process of being developed) and inclusion of Critical Biodiversity Areas in all planning schemes should allow for this.
  - No additional development (structures) on the floodplain (coastal protection zone; 1:100 year flood line) for safety reasons and sense of place. Agricultural activities within this area are at risk from floods, but compensation for damages is at least covered by the CARA.
  - Developments and land use in the catchment and estuarine area should not lower water quality or interfere with normal hydrodynamic or sedimentary processes and cycles; the issues of contaminated runoff via Motherwell or the Chatty River and the potential threat from leaching at the Waste-Tech dumpsite would be dealt with under this statement.
  - Development proposals (includes private developments and NMBM developments such as proposed eco-tourism nodes in the terrestrial reserves) and should be evaluated through the EIA procedure and guided by the IMP specifically and the broader catchment management plan once it is developed.

  Baseline data would be in the form of town planning schemes or development frameworks (e.g. SDF and IDP) that would need to be compared to a visual display (map) of all activities and infrastructure within the defined estuarine area to ascertain compliance and conformity with the estuary Vision.
- Number of applications for new development and/or rezoning of land associated with the estuary. There is currently no quantitative value defining a TPC for this objective's indicator but any increase in the number of applications compared to the last five years should be cause for concern. It is recommended that all applications be subject to the EIA

process and in addition to the Municipality, all applications should be considered by the local SMF prior to their submission to the authorities. Should applications receive a favorable ROD, the development should be assessed by an independent environmental auditor approved by both the DEDEA and the local SMF to ensure compliance. Any deviations from the ROD conditions should be regarded as unacceptable. Baseline data in the form of development/rezoning applications can be obtained from the NMBM or DEDEA; ideally the number of applications should decrease, as the Vision of the estuary becomes a reality.

- Development (permanent structures) and activities (e.g. game drives or walks) within the terrestrial reserves should be restricted to the proposed tourist/education facilities detailed in the Zonation Plan and existing roads or tracks. The location and design of the proposed eco-tourism center in the Swartkops Valley Nature Reserve needs to be re-assessed. Additional structures or movement of vehicles and people outside of designated tracks should be cause for concern.
- Use of planning and management tools such as IMPs, Conservation Development Frameworks, SDFs, IDPs, Strategic Environmental Assessments (SEA) and Integrated Environmental Management (IEM) in the form of EIAs to guide planning and development. The TPC for this objective indicator would be if the estuary and Nature Reserves were not considered at all in planning and management documents. The functioning and value of the Swartkops Estuary and the terrestrial reserves need to be reflected in the SDF and IDP, and should be a significant factor in any EIA assessment. All decisions regarding development and planning in the management area need to be guided by these planning and management tools. Baseline data is available in the form of current SDF and IDP documents, this IMP, the Conservation Assessment and Plan for the NMBM, the Conservation development Framework for the two reserves and records showing the extent to which development and planning in the management area have been guided by these tools in the past.
- The issue surrounding the operation and leasing of jetties and slipways needs to be resolved via a meeting of the relevant stakeholders. These would include all owners/lessees, NMBM, DEDEA and DEA[10]. The TPC would be if no such meeting took place and the *status quo* (conflict and uncertainty in terms of relevant legislation and responsible implementing authorities) remained.
- Equitable and controlled access to the coastal public property for all estuary users. This would require an assessment of existing access points and an identification of either additional access points or closure of existing points (if they are detrimental to the well-being of the system, e.g. multiple access points through the supratidal saltmarsh areas). TPC would be if equitable and controlled access were not achieved.
- Upgrading and control of the Municipal slipway immediately upstream of Redhouse. TPC would be if this site continued in its run-down state; the alternative would be to issue a repair or removal notice and close the site.
- Construction of additional stormwater canals that may drain into the Swartkops Estuary, and maintenance of existing canals (Motherwell and Markman). The TPC would be if additional canals were constructed without effective services and waste management being in place and if existing canals continued to pollute the system due to inadequate infrastructure and waste management.
- Determine the NMBM's plans for the future of the Fishwater Flats WWTW, specifically with regards any possible expansion and the feasibility of relocating the facility away

[10] The Port Elizabeth harbour limits include the area up to the HWM at the mouth of the estuary. As such, Portnet are not a stakeholder with regards the leasing issue.

from the immediate estuary area. The WWTW pose a significant risk to the water quality of the estuary, a risk that may become more severe in future if the facility is expanded or if it is flooded by storm or freshwater events. The TPC would be if the issue was not addressed or if there were plans to expand the facility at its present location.

### 5.4.5 INSTITUTIONAL & MANAGEMENT STRUCTURES

- Establishment of a local Swartkops Management Forum (SMF) to engage government (at all levels) on planning and management issues. The TPC for the Swartkops management area would clearly be the absence of such a local forum. Any such forum needs to reflect the needs and aspirations of all stakeholders and should be based on democratic principles to represent all civil society stakeholder groups and local, regional and national government institutions.
- Establishment of a CMA, WUA and CMF to manage water resources and water related activities in the catchment. Essentially CMAs develop and implement strategies for water resource use according to the NWRS; this would include the RQOs needed to manage water quantity & quality aspects of the EMP. The WUA falls under the CMA and comprises a management committee whose role it is to effectively manage water resource activities on behalf of its members. A CMF will fulfill a similar function to the SMF and should ideally be incorporated into the SMF via a representative. The TPC for the Swartkops catchment would be the absence of any such institutions or bodies. Any such agency or association needs to reflect the needs and aspirations of all stakeholders and should be represented by all civil society groups and local, regional and national government institutions.
- Degree of interaction and cooperation between the management of the Swartkops management area and the management of catchments. The TPC for this objective would be if the local SMF and the CMA, WUA and CMF did not interact to ensure the management of the catchment and the Swartkops management area as a single ecological entity. Once these institutions have been formed a record needs to be kept of the number and type of projects or initiatives that require cooperation; the more cooperative ventures there are, the more successful this objective will be.
- Ensure that all arrangements between government departments with respect to administering legislation are made clear. When responsibility is delegated to another authority this must be accompanied by a Memorandum of Understanding (MOU) and a budget. The TPC would be if incidences of conflict and misunderstanding continue to occur (e.g. leasing of jetties and closure of slipways) or if formal agreements were not signed and budgets were not allocated.
- Ensure that all government departments fulfill their obligations in terms of the legislation pertaining to public participation when any management interventions within the management area are being considered. This can be achieved via the SMF who represent all stakeholders. The TPC would be if incidents, such as the closure of slipways where there was a perception that the stakeholders were not sufficiently engaged or informed, continued to occur.

### 5.4.6 SUSTAINABLE LIVELIHOODS

- Existing activities must all comply with legislation, management plans and planning documents that regulate against potential impacts on the management area, its inhabitants and users. The TPC should be a single activity that does not comply with legislation, management plans or planning documents. Baseline data would need to be acquired from

a variety of sources including DEDEA (for ROD on developments), the NMBM (for land-use authorizations, conformity with the SDF and IDP and infringements of by-laws), DWA (water quality) and DEA and DAFF (catch monitors and aspects pertaining to living resources; also HFCOs). An audit of all activities and developments should be conducted by an independent assessor in order to determine compliance and the need for corrective measures.

- Encourage the initiation of non-consumptive activities within the management area (canoe trails, bird watching, hiking trails, tours of historical & cultural interest etc.) that involve previously disadvantaged communities (PDCs) and that comply with legislation, management plans and planning documents. This could provide an alternative to subsistence fishing/bait collecting or even poaching (estuary and reserves). The TPCs would be if no activities involving PDCs were initiated and if those that were initiated failed to comply with legislation, management plans or planning documents. The local SMF would need to involve communities in combination with the NMBM and civic-based organizations to identify opportunities. A suggestion worth pursuing is a Museum dedicated to the history of the salt industry in the area. In addition to preserving the historical heritage of the area, the museum would attract tourists and provide employment.
- Development and implement a business plan for the subsistence fishery that would involve a single selling point (Tiger Bay) and the upgrading of that site. This would include facilities to store unsold bait organisms to prevent waste and the appointment of community members to manage the selling points – these members would receive bait from the subsistence collectors and sell on their behalf. The TPC would be if the existing *status quo* were to remain. An additional option would be to investigate the feasibility of commercially farming some of organisms (mud- and sandprawns) to relive pressure on the natural resource.
- The issue of training community members to become catch monitors is dealt with under the education & awareness key result area. Voluntary catch monitors or HFCOs do not necessarily benefit financially and so it is not considered to be a part of sustainable livelihoods.
- Supervision of the burning of Abakwetha sites to the northwest of the Swartkops Valley Nature reserve to prevent the spreading of fires to the reserves. The TPC would be if burning was not supervised or if fires spread to and destroyed vegetation within the reserve.

### 5.4.7 TOURISM AND RECREATIONAL USE

- Actively market the Swartkops Estuary and the terrestrial reserves as an eco-tourism destination by highlighting aspects such as biodiversity importance. Many tourism websites already highlight the Swartkops Estuary, its beauty and its importance to birds, but this needs to be expanded to include the terrestrial reserves. The NMBM should be encouraged to promote the management area as well. The TPC would be if this did not happen.
- Promote organized sporting events in addition to the ones already taking place so as to increase exposure and attract visitors. Although the Swartkops management area already hosts a variety of sporting events (e.g. swimming, sailing, rowing and mountain biking), the TPC would be if no new events (e.g. trail running and adventure racing) were to take place or if existing ones were to stop. The recent change of venue for the Redhouse River Mile due to water quality concerns is a case in point. In the context of this IMP, management actions would be triggered to ensure this does not happen again.

- Implement all aspects of the estuary and reserve Zonation Plans that apply to recreational use and enforce all Municipal Public Amenities by-laws. The TPC would be if recreational users did not abide by the Zonation Plan (use areas) and contravened by-laws; five incidents/month would be cause for concern in the first two years, thereafter a single incident should be cause for concern.
- Development of eco-tourism nodes in the Swartkops Valley Nature Reserve (accommodation, conference facility and restaurant; access adjacent to Motherwell Canal) and Aloes Nature Reserve (environmental education facility and day restaurant/tea room; parking area) in accordance with the CDF guidelines (SRK 2008). These state that the NMBM should enter into public-private partnerships that must be structured to deliver benefits to the previously disadvantaged communities (PDCs) of Wells Estate and Motherwell in particular, and that developments should not impact significantly on the sensitive environment (EIAs will be required) – this includes visual impacts of the proposed eco-tourism node in the Swartkops Valley Nature Reserve. The TPC would be if these nodes were not developed along strict environmental principles, if PDCs did not benefit or if their placement did not conform to the zonation plan.

### 5.4.8 EDUCATION & AWARENESS

- Educational workshops hosted by the SMF or NMBM should be organized at least once a year in order to educate local authorities, in particular town planners, municipal managers and estuary/reserve managers about the value of the management area, the IMP and its context within planning strategies, key legislation (e.g. ICM Act, MLRA, NWA) and the consequences of irresponsible development within the management area. Potential TPCs would be no workshops, poor attendance at workshops and ongoing poor decision making with regards issues affecting estuaries. A simple questionnaire for local authorities would provide baseline data as to their current awareness level with regards estuarine management.
- An interactive public awareness campaign should be introduced and aimed at all user groups and age groups. The TPCs would be a continued lack of easily accessible information (sign boards, pamphlets), poor participation by school groups and a general poor level of understanding of estuaries by the general public. Baseline data should comprise the extent of visual aids within the estuarine area and any public interaction with the local SMF or estuary/reserve managers. The ZC currently runs a successful educational programme and this can be used as an example of how to proceed.
- Training workshops for selected members from the PDCs to become initially catch monitors and ultimately HFCOs. The TPC would be if no PDC members were trained or appointed.
- Tertiary and research institutions as well as government departments (e.g. DWA, DEA and DAFF) need to be involved in research projects that will address specific management concerns, monitoring requirements and gaps in knowledge. The TPCs would either be a lack of research, a decrease in the number of research projects or the continued lack of data required to inform monitoring programmes (and the issuing of subsistence permits). Baseline data should comprise the number of tertiary institutions involved in research, the areas of research and the aspects that need to be addressed through directed research.

# CHAPTER 6 - MANAGEMENT ACTION PLANS

A full range of management actions has been identified in order to facilitate the achievement of the operational objectives within the eight key result areas (water quantity & quality, conservation, exploitation of living resources, land-use & infrastructure, institutional & management structures, sustainable livelihoods, tourism & recreational use and education & awareness). Within each of these key result areas, the management action plans (MAPs) include:

- A list of management actions required;
- Related legal, policy and/or best practice requirements of relevance to specific management actions;
- Monitoring plans to measure effectiveness of actions. If TPCs are brought under control then management actions can be considered effective, however if they continue to be exceeded then changes need to be made to management actions, the Zonation Plans or operational objectives;
- A work plan identifying when each action should be initiated and by whom; and
- A resource plan detailing the human resources, the sources of funding and, where possible, the finances required to achieve these actions.

The MAPs for all key result areas are detailed in Tables 6.1 to 6.8.

In the absence of a comprehensive ecological reserve assessment and updated research (data) on many aspects of the biology and ecology of the management area and its fauna and flora, some of the MAPs must be considered preliminary and may change as more information becomes available.

| TABLE 6.1: MANAGEMENT ACTION PLANS FOR WATER QUANTITY AND QUALITY STRATEGIC OBJECTIVES | | | | | |
|---|---|---|---|---|---|
| **Management actions** | **Legal requirements** | **Monitoring plans** | **Work plan** | **Currently addressed** | **Responsibility** |
| **Operational Objective W1: Ecological Reserve and instream flow; TPC is if < 9.531 million m3/s (11.44% of MAR) enters at the head of the estuary.** | | | | | |
| Ensure that the minimum flow requirements for the estuary are maintained via restricting water abstraction and impoundment activities in the catchment. | NWA - Chapter 3 (Parts 1 and 2) | Flow station to be constructed at head of the estuary and data monitored monthly. All water use activities and licenses in the catchment to be assessed. | DWA is responsible; should be initiated as soon as possible (within 2 years). | No. | **Human -** DWA Hydrology Unit: Mr Theo Geldenhuys (for guaging weirs); DWA RDM Unit: Mr Joseph Jacobs (for water use authorization). **Financial -** existing monitoring budgets from DW A (Resource Protection); Infrastructure Capital Projects Unit for construction of weirs. |
| **Operational Objective W2: Pollutants; TPCs will vary according to pollutants and DWAF water quality guidelines.** | | | | | |
| Identify source of pollution and take steps to remedy or mitigate. Sources include contaminated runoff (stormwater agricultural return flows) and leaching via groundwater (e.g. Waste-tech). The NMBM is to continue with the monitoring of industries that may potentially impact on the management area. | NWA - Chapter 3 (Part 4) DWAF Water Quality Guidelines (marine and freshwatert); Municipal by-laws (Waste Management and Municipal Health). ICM Act (Chapter 8, Section 69); CARA (Sections 6 and 8). | Regular water quality monitoring at set stations along the length of the estuary (including known point sources) and in the river above the head of the estuary. | Joint responsibility between NMBM and DWA. Monitoring is ongoing but needs to be standardized at more stations within the system. | Yes - DWA (RDM) and NMBM (Environmental Health) are undertaking separate processes. Need to coordinate and align to improve efficacy. | **Human -** DWA (Water Quality: Ronaldo Nell and Pieter Retief) and NMBM (Environmental Health: Faye Meltz and Anderson Mancotywa). **Financial -** existing monitoring budgets from NMBM and DWA; both institutions to source additional funds for expanded programme. |
| **Operational Objective W3: Microbial organisms and pathogens; TPCs will vary according to microbial organism or pathogen and DWAF water quality guidelines.** | | | | | |
| Identify source and type of contamination and take steps to remedy or mitigate (provision and maintenance of basic services and infrastructure). Main sources are spills from waste-water treatment works and urban runoff via the Motherwell and Markman Canals and Chetty River; raw sewage disposed at sea via pipeline from Fishwater Flats WWTW may affect estuary as well if tidal currents wash it towards the mouth. | NWA - Chapter 3 (Part 4) Chapter 4 (discharge pipelines, outfalls etc.); ICM Act (Chapter 8, Section 69); DWAF Water Quality Guidelines (marine); Municipal by-laws (Waste Management and Municipal Health). | Regular water monitoring at known point sources to specifically detect microbial and pathogen infestations. Monitoring should include extra sampling during times of heavy rains (increased runoff) and before organized sporting events. Licenses to discharge waste into the sea or water resource need to be assessed. | DWA (Water Quality) is lead authority on water quality but this is also conducted by the NMBM (Environmental Health); NMBM (Infrastructure & Engineering) for provision and maintenance of services and infrastructure. Checking of marine outfall licenses by DEA (Oceans & Coast: Marine & Coastal Pollution). | Yes for monitoring - data needs to be made available to stakeholders. No for adequate services and infrastructure. No details available for DWA licenses to discharge (taken over by DEA under the ICM Act). | **Human -** NMBM: Infrastructure & Engineering (Ben Govoni, Barry Martin and Tony Arthur); DWA: Water Quality (Ronaldo Nell); DEA: Oceans & Coast (Yazeed Peterson). **Financial -** existing budgets from NMBM; major requirement for service provision and maintenance (National treasury?). |
| **Operational Objective W4: Catchment Management Agency and/or Water User Association; TPC is if either CMA or WUA are not established** | | | | | |
| Lobby for the establishment of a CMA or at least a WUA (that can later become the CMA) in accordance with the requirements of the National Water Resource Strategy. | NWA; Chapter 2 Part 1 | Monitor whether either a CMA or its precursor, the WUA, is established. | Should be prioritized by DWA (RDM) and happen as soon a possible in order to facilitate W5 below. | No. | **Human** - Lobbying can be done by SMF Executive; DWA: Resource Protection (Ncamile Dweni) to drive process. **Financial** - unsure, but probably not more than R30 000 to establish. Running costs in the region of R20 000/annum. |

**Table 6.1 continued.**

| Operational Objective W5: Catchment management strategy and setting of RQOs through a comprehensive reserve study; TPC is if neither CMS nor RQOs are not developed. | | | | | |
|---|---|---|---|---|---|
| Once CMA is established, ensure that it developes a CMS that will include the determination of RQOs through a comprehensive reserve assessment (includes estuary- and river-specific water quality parameters and estuary- and river-specific water quantity requirements). | NWA; CMS ( Chapter 2 Part 2), RQOs (Chapter 3, Parts 1 and 2) | Monitor the development of a CMS and/or the RQOs for the catchment and estuary. Once these have been developed then the estuary- and river-specific parameters (water volume and physical parameters) can be monitored. | Critically important and must be done immediately. The DWA (RDM) has overall responsibility, but this is also the function of the CMA. | No CMS, but an intermediate reserve assessment has been done. | **Human -** DWA: RDM (Ncamile Dweni) and the CMA Executive for developing the CMS. Consultants or research institutions, such as CSIR, may be appointed to develop the RQO s. **Financial -** DWA (RDM) to assist development of CMS; cost of developing the RQOs may vary, but a comprehensive reserve assessment would be a minimum of R1 million. |

| TABLE 6.2: MANAGEMENT ACTION PLANS FOR CONSERVATION STRATEGIC OBJECTIVES (Biodiversity) | | | | | |
|---|---|---|---|---|---|
| **Management actions** | **Legal requirements** | **Monitoring plans** | **Work plan & mandate** | **Currently addressed** | **Responsibility** |
| **Operational Objective B1: Plant communities; TPC of 10% reduction in surface area of any plant community type is exceeded.** | | | | | |
| If declines are due to water quality then proceed as for MAPs detailed in Table 6.1 (W2 and W3). | Water quality legislation as for W2 and W3. | Aerial or fixed point photographs or on-site visual census can be used to determine vegetation type and cover. Water quality monitoring as for W2 and W3. | Plant cover monitoring to be done once a year by tertiary institute with help from SMP members. Water quality work plan and mandate as for W2 and W3. | Yes, plant community is monitored by NMMU at present. | **Human -** As for W2 and W3 if water quality is the cause; NMMU (Janine Adams and students). **Financial -** As for W2 and W3 is water quality is the cause; monitoring costs from NMMU research funding. |
| If cause is due to human disturbance then enforce Municipal by-laws and Zonation Plans to reduce trampling and damage from boat wakes and propellor-wash; enforce National legislation to prevent clearing of indigenous bush/thicket, riparian vegetation and damage to saltmarsh. | Municipal by-laws (for Zonation Plans); NEMA (Chapters 1 & 5; EIA Regulations); Seashore Act (Sections 3 & 10); NFA (Chapter 3, Section 1); NEM: BA (Chapter 4, Part 1). | Aerial or fixed point photographs or on-site visual census can be used to determine vegetation type and cover. Compliance w.r.t. Municipal by-laws and National legislation. | Plant cover monitoring to be done once a year by tertiary institute with help from SMP members. Management actions to be implemented as soon as TPC is attained. Responsible agents are DEA, DEDEA and NMBM. | Yes - DEDEA responsible for EIA authorizations for activities that may impact plant communities; NMBM need to adapt planning schemes (SDF) to protect against damage or loss of habitat. Clearing of bush/thicket in reserves currently not addressed. | **Human** - DEA: Biodiversity & Conservation, and Environmental Quality & Protection Directorates (Alan Boyd); DEDEA: Environmental Management (Jeff Govender) and NMBM: Environmental Management (Godfrey Murrell and Ken Pressley) and Land Planning & Management (Dawn McCarthy for SDF). **Financial** - existing budgets from National (DEA) & Provincial (DEDEA) government; NMBM (Public Health Directorate) monitoring costs from NMMU research funding. |
| **Operational Objective B2: Alien vegetation infestation; TPC of >10% of riparian vegetation infested by alien vegetation is exceeded.** | | | | | |
| Initiate clearing of vegetation in affected areas. | NEM: BA (Chapter 5, Part 2); NEMA; CARA (Sections 6 & 8) | Ensure eradication of alien vegetation to levels below the TPC; aerial photographs and transects can be used to assess cover. | Determine areas that are infected above the TPC. Lead agent for alien clearing is DWA and DAFF but in cooperation with landowners. | Minimal. | **Human -** Primarily DWA: Resource Protection (Portrait Tshatshu and Ncamile Dweni) and DAFF: Land Care with contracted service providers; private land owners can participate. **Financial -** National government (working for water) funds may be approved for landowners to conduct eradication/control. |

**Table 6.2 continued.**

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| **Operational Objective B3: Intertidal invertebrate species; TPC is densities below 90% of baseline counts.** | | | | | |
| If declines are due to water quality then proceed as for MAPs detailed in Table 6.1 (W2 and W3). | Water quality legislation as for W2 and W3. | Bi-annual quadrat counts to determine population density and health; water quality monitoring as for W2 and W3. | Invertebrate monitoring to be done bi-annually by tertiary institute. Water quality work plan and mandate as for W2 and W3 | Survey conducted in 2009 for assessment of bait fishery, but not a regular action. | **Human -** As for W2 and W3 if water quality is the cause; NMMU (Tris Wooldridge and students). **Financial** - As for W2 and W3 is water quality is the cause; monitoring costs from NMMU research funding. |
| If declines are due to human disturbance, then enforce Municipal by-laws and EZP (Protected Areas) to reduce trampling; enforce National legislation to limit bait collection according to permit conditions; review number of subsistence permits and conditions (especially with regards quotas and digging) and consider exclusion of locally threatened species such as bloodworm, tapeworm and pencilbait. | Municipal by-laws; MLRA (Chapter 3, Section 14). | Bi-annual quadrat counts to determine population density and health. Compliance w.r.t. Municipal by-laws and National legislation. | Invertebrate monitoring to be done bi-annually by tertiary institute. Mnagament actions to be implemented as soon as TPC is attained. Responsible agents are DEA and DAFF for MLRA and permit conditions, and NMBM for by-laws (EZP); tertiary institutions for population assessment. | Yes - Fisheries inspectors and HFCOs are very active; quadrat counts not done regularly (data from Fielding 2009 available). | **Human** - DAFF: Resource Management and Monitoring, Control and Surveillance Directorates (Mr V. Jozana) and HFCOs (Wayne Rudman); DEA: Biodiversity & Conservation )Alan Boyd); NMBM: Environmental Management (Godfrey Murrell and Ken Pressley); tertiary institutions for quadrat counts. **Financial** - National government (DEA and DAFF); NMBM (Public Health) monitoring costs from NMMU research funds. |
| **Operational Objective B4: Waterbirds partially or highly dependent on estuaries; TPC for species richness (rare/endangered) is one species; TPC for diversity is 20% loss over 5 years; TPC for number of resident birds is 20% loss over 5 years; TPC for migratory birds is 20% loss over 10 years.** | | | | | |
| If decline is due to human activities, then prevent loss of habitat and food source due to human interference by enforcing National legislation and Municipal by-laws pertaining to EZP and human activities; prevent loss of habitat by restricting development (SDF). | MLRA (Sections 14 & 43); NEM: PAA (Chapter 4); NEM: BA (Chapter 4, Part 1); Sea Birds and Seals Protection Act (Act 46 of 1973; Section 3b); NEMA (Chapters 1 & 5; EIA Regulations); municipal by-laws (pertaining to EZP); SDF. | Compliance with national legislation, SDF and municipal by-laws (EZP); recovery of populations (bi-annual bird counts). | As soon as any of the TPCs are attained. Responsible authorities are DEA, DEDEA and NMBM; monitoring of birds by UCT's ADU and private residents. | Yes - biannual CWAC data is available from several sites within the management area. | **Human** - DEA: Biodiversity & Conservation, Environmental Quality & Protection, and Oceans & Coast Directorates); DEDEA: Environmental Management (Jeff Govender); NMBM: Environmental Management (Godfrey Murrell and Ken Pressley), and Land Planning & Management (Dawn McCarthy); UCT's ADU (Doug Harebottle) and private residents (Paul Martin) for bird counts. **Financial** - National (DEA) and Provincial (DEDEA) government; NMBM (Public Health) monitoring costs covered by UCT's ADU or private residents. |

**Table 6.2 continued.**

| | | | | | |
|---|---|---|---|---|---|
| If declines are due to water quality then proceed as for MAPs detailed in Table 6.1 (W2 and W3). | Water quality legislation as for W2 and W3. | Bi-annual bird counts; water quality monitoring as for W2 and W3. | Bi-annual bird counts to be done by UCT's ADU (CWAC counts) or Birdlife Plett; water quality work plan and manadate as for W2 and W3. | Yes - biannual CWAC data is available from several sites within the management area. | **Human -** As for W2 and W3 if water quality is the cause; UCT's ADU (Doug Harebottle) and private residents (Paul Martin). **Financial -** As for W2 and W3 is water quality is the cause; monitoring costs covered by UCT's ADU or private residents. |
| **Operational Objective B5: Fish abundance; TPC for dusky kob & white steenbras is >10% decrease from baseline values and >20% from baseline values for all other species.** | | | | | |
| Address levels of fishing effort and ensure compliance with regulations. | MLRA (Sections 14 & 43); NEM: BA (Chapter 4, Part 2). | Compliance with legislation; levels of effort and cpue to be measured by dedicated fisheries survey. | Continuous from implementation of IMP. DAFF is responsible national authority with help from HFCOs; tertiary institutions to conduct fishery survey. | Fisheries inspectors and HFCOs are very active; no fishery survey currently being undertaken. | **Human** - DAFF: Resource Management (Mr V. Jozana) and HFCOs (Wayne Rudman); research students (NMMU or Rhodes). **Financial** - National government (DAFF: MLRF); boat registration/launch fees and competition levies to assist HFCOs; independent research funds. |
| **Operational Objective B6: Extent and location of formally protected estuarine habitat; TPC is the decline in terms of surface area of sanctuary areas.** | | | | | |
| Enforce legislation pertaining to protected areas; ensure compliance with EZP and other legislation pertaining to human activities and land-use. | NEM: Protected Areas Act (Chapter 3, Section 28; Chapter 4); NEM: Biodiversity Act (Chapter 4, Part 1) MLRA (Section 43); ICMA (Chapter 2, Sections 23 & 24); NEMA (Chapters 1 & 5; EIA Regulations); NFA (Chapter 3, Section 2). | Compliance with relevant legislation to ensure sanctity of protected areas. | Continuous from implementation of IMP. DEA is lead agent (may devolve to NMBM: Environmental Management); assistance from estuary users and HFCOs to monitor non-compliance. | No - there are currently no protected or sanctuary areas on the estuary. | **Human -** DEA: Biodiversity & Conservation Directorate (Alan Boyd) and Oceans & Coast (Ayanda Matoti); HFCOs; estuary users. **Financial -** National government (DEA); levies from boat registration or angling competitions to assist HFCOs. |
| **Operational Objective B7: Proclamation and demarcation of Swartkops Estuary Protected Areas; TPC is if the Sanctuary Areas are not proclaimed.** | | | | | |
| Officially proclaim the Estuary Protected Areas; demarcate with signboards; (review efficacy after five years through research project). | NEM: Protected Areas Act (Chapter 3, Section 28); ICM Act (Chapter 2, Sections 23 & 24). | Monitor process of proclamation. | Implement immediately; DEA is lead authority with assistance from NMBM and SMF. | No. | **Human -** DEA: Biodiversity & Conservation (Alan Boyd); NMBM: Environmental Management (Joram Mkosana); SMF executive. **Financial -** DEA (Biodiversity & Conservation). |

**Table 6.2 continued.**

| | | | | | |
|---|---|---|---|---|---|
| **Operational Objective B8: Proclamation and demarcation of Aloes Nature Reserve; TPC is if the Reserve is not proclaimed.** | | | | | |
| Officially proclaim the Aloes Nature Reserve; demarcate with signboards and fencing (includes Swartkops Valley Nature Reserve). | NEM: PA (Chapter 3, Section 23). | Monitor process of proclamation. | Implement immediately; NMBM in cooperation with , DEDEA and SMF. | No. | **Human -** NMBM: Environmental Management (Joram Mkosana and Ken Pressley), DEDEA: Biodiversity Management (Andries Struwig), SMF executive. **Financial -** NMBM (Public Health) with assistance from DEDEA (Environmental Management Directorate). |
| **Operational Objective B9: Maintain terrestrial mammal populations; TPC is 5-10% drop in population or exclusion of a single species.** | | | | | |
| Restrict access and prevent poaching; census of mammal populations required. | NEM: BA for threatened or protected species (Chapter 4, Part 2). | Initial census of populations and annual census to monitor change; patrols to control access. | Implement immediately; NMBM as lead management agency for terrestrial reserves. NMMU for monitoring together with NMBM. | No. | **Human -** NMBM: (Environmental Management (Ken Pressley). NMMU: Centre for African Conservation Ecology (Graham Kerley). **Financial -** NMBM (Public Health); research funds from NMMU. |
| **Operational Objective B10: Establish a Fire Protection Association and develop a Fire Management Plan for the terrestrial reserves and prevent uncontrolled fires in the reserves; TPC is if FPA is not established and an FMP is not developed and if uncontrolled fires are allowed in the reserves.** | | | | | |
| Establish and register a FPA, which will be responsible for developing the FMP. Enforce Municipal by-laws pertaining to fires within public areas (only in designated areas). | NVFFA (Chapter 2, Sections 3, 4 and 5); NMBM Public Amenities by-laws. | Monitor progress of FPA and FMP; incidents of uncontrolled fires. | Implement immediately; NMBM as lead management agency for terrestrial reserves. | No. | **Human -** NMBM: Environmental Management (Ken Pressley) and Disaster Management (Shane Brown). **Financial -** NMBM (Public Health with assistance from Disaster management; financial assistance from the Minister in accordance with NVFFA (Chapter 2, Section 7). |
| **Operational Objective B11: Establish a residential/conservation buffer zone between Wells Estate and the northern boundary of the Aloes Nature Reserve; TPC is if SDF cannot be amended or if bush clearing took place behind the properties.** | | | | | |
| Amend the NMBM SDF to include a buffer zone between Wells Estate and the northern boundary of the reserve.<br>If amendment of SDF is not possible, institute a no bush clearing policy along the northern border to provide a smaller buffer. | No legal requirement for this buffer zone, but SDF can be amended under the Municipal Systems Act. | Monitor progress of SDF amendment or development of no bush clearing policy (compliance with no clearing will need to be monitored). | Implement when SDF is next reviewed in 2011 NMBM is responsible authority. | No. | **Human -** NMBM: Land Planning & Management (Dawn McCarthy) reserve staff can monitor bush clearing during patrols. **Financial -** NMBM (Housing & Land Directorate). |

**Table 6.2 continued.**

| TABLE 6.2: MANAGEMENT ACTION PLANS FOR CONSERVATION STRATEGIC OBJECTIVES (Human Activities) | | | | | |
|---|---|---|---|---|---|
| **Management actions** | **Legal requirements** | **Monitoring plans** | **Work plan & mandate** | **Currently addressed** | **Responsibility** |
| **Operational Objective HA1: Carrying capacity (to be determined by SMF based on DWAF (now DWA) models); TPC is when numbers exceed carrying capacity.** | | | | | |
| Regulate number of boats launching or taking part in a specific activity (e.g. angling competitions). | Operational Policy for Recreational Water Use (DWAF; August 2004) | Visual counts of boats on the water or at each launch site; counts of numbers of users engaged in recreational activities. | Number of users should be monitored at peak times (weekends, holidays and during competitions); restrictions come into play when carrying capacity is exceeded; NMBM responsible for registration of boats and number of boats on the water. | No - numbers not regulated but all boats are required to register. | **Human** - NMBM: Environmental Management (Ken Pressley). **Financial** - NMBM (Public Health) augmented by boat registration/launch and competition levies. |
| **Operational Objective HA2: Bait collecting; TPC is a 10% decrease in population size of any bait organism; and a single user that is non-compliant.** | | | | | |
| Enforce MLRA regulations to ensure compliance. | MLRA (Section 14; Section 19 and Chapter 6). | Monitor bait collectors (recreational and subsistence); bi-annual random quadrats within designated sites for population density estimates as per B3. | Ongoing from time of IMP inception; lead agent is DAFF for compliance, DEA for protected areas (may be devolved to NMBM); tertiary institutions for population density estimates. | Fisheries inspectors and HFCOs very active. | **Human** - DAFF: Resource Protection (Mr V. Jozana) and HFCOs; DEA: Biodiversity & Conservation (Alan Boyd); NMMU (Tris Wooldridge and students). **Financial** - National government (DAFF and DEA); independent research funds; boat registration/launch levies to assist HFCOs. |
| Police protected areas. | NEM: Protected Areas Act (Chapter 4); Municipal by-laws pertaining to EZP. | | | No - there are currently no protected or sanctuary areas on the estuary. | |
| Consider additional protected areas or control collection activities, e.g. daytime only; collecting methods (ban the use of forks); restrict number of subsistence permits; exclusion of threatened species such as bloodworm, tapeworm and pencilbait. | NEM: Protected Areas Act (Chapter 3, Section 28); NEM: Biodiversity Act (Chapter 4, Part 1); Municipal by-laws pertaining to EZP. | | | No - this can only be done after efficacy of proposed protected areas has been assessed. | |
| **Operational Objective HA3: Number of fishing competitions and participants; TPC is an increase from current number of competitions and participants.** | | | | | |
| Regulate number of fishing competitions and participants. | Municipal Public Amenities By-laws (regulating recreational activities on estuary); policies of angling clubs or organizations. | Monitor number of competitions and count number of participants. | Implement immediately; use records from past two years to set standard; NMBM Council can restrict number of competitions. | No - number of competitions not actively regulated but permission is required from Council. | **Human** - NMBM Council; SMF and angling clubs or organizing bodies. **Financial** - No costs involved. |
| **Operational Objective HA4: Litter accumulation; TPC is an increase in volume from baseline values.** | | | | | |
| Initiate clean-up operations on a regular basis; all boats to return to launch site with litter in plastic bags; all visitors to reserves to return to entrance with litter in plastic bags; consider implementing punitive measures for responsible individuals or organizations (e.g. school tour groups or angling clubs after competitions). | NEMA (Chapter 1); NWA (Section 19); Municipal Health and Public Amenities by-laws. | Monitor volume of litter collected by the number of standard garbage bags filled. | Ongoing from time of IMP inception; organized clean-up operations during peak season or after high winds and during marine week (organized by NMBM, SMF or ZC); clean-up operations by angling club members after competitions. | Yes - the ZC has organized clean-ups. | **Human** - Lead agent is DEA, but responsibility will be with NMBM Environmental Health (Norman Gumede) and Waste Management (Estelle Barnard and Analisa Dyakala); estuary users and visitors to the reserves. SMF and SC can organize clean-up days. **Financial** - NMBM (Public Health); boat registration & launch levies; angling competition levy. |

**Table 6.2 continued.**

| | | | | | |
|---|---|---|---|---|---|
| **Operational Objective HA5: Regulate activities that impact on the Nature Reserves; TPC is if poaching, dumping, grazing and harvesting of vegetation continue to occur.** | | | | | |
| Control access via fencing, sign boards and regular patrols to ensure compliance. Fencing may not be an option due to theft of materials and regular patrols may be the most cost effective way; will require two full-time rangers and vehicle to patrol both reserves. | NEM: Protected Areas Act (Chapter 4, Part 3); NMBM Waste Management by-laws. | Monitor incidents of poaching, cattle grazing dumping and harvesting of vegetation during routine patrols by reserve rangers. | Implement immediately over next two years; responsible authority is NMBM, with assistance from DEDEA, general public and SMF. | No. | **Human** - NMBM: Environmental Management (Ken Pressley) and Waste Management (Estelle Barnard and Analisa Dyakala). **Financial** - NMBM (Public Health) possible assistance from Strategic Pojects for cost of fencing and signboards. Cost of erecting and maintaining fence could be prohibitive; cost of signboards R50 000; cost of ranger R60 000/year; vehicle R200 000; running costs R30 000/year. |
| **Operational Objective HA6: Relocation of the existing waste transfer/garden refuse station in Aloes Nature Reserve; TPC is if existing station continued to operate.** | | | | | |
| Identify new site that will service the Blue Water Bay, Amsterdamhoek and Wells Estate communities; rehabilitate the old site. | Identification and operation of new site will need to comply with the EIA Regulations and NMBM Waste Management by-laws. | Monitor establishment of new site and rehabilitation of existing site. | Implement over next three years; NMBM is responsible authority with DEDEA for involvement with EIA process. | No. | **Human** - NMBM: Waste Management (Estell Barnard and Analisa Dyakala); DEDEA Environmental Quality Management (Andries Struwig). **Financial** - NMBM (Public Health). |
| **Operational Objective HA7: Regulate activities impacting on Estuary Protected Areas; TPC is if people walk, fish, collect bait and use powered vessels in Protected Areas.** | | | | | |
| Control access via sign boards and markers; conduct regular patrols to ensure compliance. | NEM: Protected Areas Act (Chapter 4, Part 3). | Monitor incidents involving poaching and access. | Implement immediately over next two years; responsible authority will be NMBM with assistance from DEA, general public and SMF. | No - Protected Areas not yet proclaimed. | **Human** - Lead agent is DEA Biodiversity & Conservation (Alan Boyd) but is likely to be devolved to NMBM: Environmental Management (Joram Mkosana); dedicated river patrol ranger appointed in terms of MLRA; estuary users and SMF can also be eyes and ears. **Financial** - DEA and NMBM (Public Health) cost of signboards R50 000; cost of ranger R60 000/year; boat R60 000 running costs R30 000/year; assistance from boat registration & launch levies. |

**Table 6.2 continued.**

| TABLE 6.2: MANAGEMENT ACTION PLANS FOR CONSERVATION STRATEGIC OBJECTIVES (Law Enforcement) | | | | | |
|---|---|---|---|---|---|
| **Operational Objective LE1: Law enforcement capacity; TPCs are non-compliant users and a low conviction rate.** | | | | | |
| Increase presence of law enforcement personnel on estuary (include catch monitors from within the subsistence community) and within terrestrial reserves; education & awareness programmes for enforcement officers and users. | MLRA (Chapter 6); NEM:PAA (Chapter 4, Parts 1 & 2); White Paper for Sustainable Coastal Development (Section C, Chapter 10). | Monitor number of patrols and non-compliant users; survey to assess effectiveness of education & awareness programme. | Ongoing from time of IMP inception; DEA and DAFF are lead agents on estuary with assistance from NMBM; NMBM is lead agent in terrestrial reserves with assistance from DEDEA. SMF and ZC can assist with education & awareness. | Yes - Fisheries inspectors and HFCOs active on estuary. Dedicated river patrol ranger and terrestrial reserve rangers urgently required. | **Human** - DEA: Biodiversity & Conservation (Alan Boyd); DAFF Resource Protection (Mr V. Jozana). HFCOs and MLRA appointed ranger for estuary; NMBM: Environmental Management (Ken Pressley and two terrestrial reserve rangers); DEDEA (Biodiversity Management and Environmental Compliance & enforcement (Leon Els, Jan Kapp and Andries Struwig); SMF and ZC for education. **Financial** - costs for rangers and running costs as above. DEA and NMBM (Public Health) for education programmes; DAFF (MLRF) for training subsistence catch monitors. |
| **Operational Objective LE2: Develop new roads along northern boundaries of terrestrial reserves to assist patrols; TPC is if roads were not developed and uncontrolled access and activities were to continue (initially 10 incidents/month but 5/month a year after road development.** | | | | | |
| Conduct EIA and establish new roads. | EIA Regulations; NEM:PAA (Chapter 4, Parts 3 and 4). | Monitor progress of roads and incidents of uncontrolled access and illegal activities. | NMBM is responsible authority with DEDEA for EIA process; to be done within the next three years. | No. | **Human -** NMBM: Environmental Management (Joram Mkozana) and Infrastructure & Engineering (Ben Govoni); DEDEA: Environmental Quality & Management (Andries Struwig). **Financial -** NMBM (Public Health and Infrastructure & Engineering - Roads, Sotrmwater & Transportation Division); possible assistance from DEDEA (Environmental Management). |

**Table 6.2 continued.**

| | | | | | |
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| **Operational Objective LE3: Enforce & monitor developments in the context of their RODs; TPC is any non-compliance with the ROD conditions.** | | | | | |
| Enforce compliance with ROD conditions and report any infringements. | All legislation referred to in ROD - this will vary according to nature of development or activity; NEMA and EIA Regulations. | Inspections of all sites where activities or developments are taking place; ensure independent environmental control officer is appointed. | Regular (weekly) from the time an activity or development is authorized; responsible authority is mostly DEDEA but may include other government agencies such as DWA or DEA independent environmental control officer. | Yes, but effectiveness can be improved; DEDEA has limited capacity to monitor all authorizations. | **Human -** DEDEA: Environmental Quality Management and Environmental Compliance & Enforcement (Jeff Govender and Andries Struwig); independent environmental control officer. **Financial -** costs will vary depending on scope of project, but developer must cover the costs. |
| **TABLE 6.2: MANAGEMENT ACTION PLANS FOR CONSERVATION STRATEGIC OBJECTIVES (Heritage Resources)** | | | | | |
| **Operational Objective HR1: Identification and preservation of heritage resources; TPC is if resources are not identified and protected or if they are ignored by other legislation.** | | | | | |
| Identify and list all heritage resources in the management area (includes all structures older than 60 years) and ensure they are preserved and protected (includes many jetties, some slipways and many land-based structures in the management area). Ensure NHRA is applied in conjunction with other legislation. | NHRA - Chapter 2 (Sections 27 to 47); Chapter 3 (Sections 48 to 51). | Monitor compilation of heritage resources and structures list and any activities that involve or may impact on these resources and structures. | PHRA in cooperation with owners and lessees. This should be done as a matter of urgency as it involves the issues surrounding many of the jetties and slipways. | PHRA may have a few listings but it is by no means complete. | **Human** - PHRA (no listing for a Provincial office but there is a Grahamstown Education Centre) in cooperation with the SMF executive. **Financial** - costs to be covered by PHRA for listings; maintenance of resources to be covered by owners or lessees. |

| TABLE 6.3: MANAGEMENT ACTION PLANS FOR EXPLOITATION OF LIVING RESOURCES STRATEGIC OBJECTIVES | | | | | |
|---|---|---|---|---|---|
| **Management actions** | **Legal requirements** | **Monitoring plans** | **Work plan & mandate** | **Currently addressed** | **Responsibility** |
| **Operational Objective E1: Protection of living resources in estuary Protected Areas and terrestrial reserves; TPC in the number of non-compliant individuals annually.** | | | | | |
| Enforce no access and no take. | NEM: PAA (Chapter 4). | Compliance with relevant legislation to ensure sanctity of protected areas. | Continuous from implementation of IMP. DEA is lead agent for estuary (assisted by HFCOs and NMBM); NMBM and DEDEA for terrestria reserves. Enforcement personnel to operate on a daily basis to monitor non-compliance; estuary users, SMF and visitors to reserves can assist by reporting incidents of non-compliance. | No Protected Areas on estuary at present; limited patrols in Swartkops Valley Nature Reserve. | **Human** - DEA: Biodiversity & Conservation and Oceans & Coast (Alan Boyd and Ayanda Matoti) - most likely NMBM: Environmental Management (Ken Pressley, Godfrey Murrell and field rangers) and HFCOs. **Financial** - DEA (Biodiversity & Conservation and Oceans & Coast); NMBM (Public Health) with assistance from DEDEA (Biodiversity Management) costs for rangers and river patrol officer, equipment and running costs as for HA5 and HA7 above; HFCOs may be assisted levies from boat registration. |
| **Operational Objective E2: Protection of bait organisms; TPC for any bait organism is a 10% reduction (from baseline) in the bait organism.** | | | | | |
| Enforce legislation pertaining to bait collection. Assess sustainability of current levels of subsistence exploitation - includes possible banning of forks, reduction in number of permits and more severe restrictions on certain bait items most notably pencil bait, bloodworm and tapeworm. Subsistence collectors who contravene permit conditions must be excluded from being issued a permit the following year. | MLRA (recreational and subsistence fishing regulations); NEM:PAA (Chapter 4 for Protected Areas). | Inspection of activities and collectors to ensure compliance with MLRA regulations (recreational licenses and subsistence permit conditions) and no-take in Protected Areas. Monitor impact of subsistence fishery. | Continuous from implementation of IMP. DAFF is lead agent with assistance from HFCOs and NMBM. Enforcement personnel to operate on a daily basis to monitor non-compliance; estuary users and SMF can assist by reporting incidents of non-compliance. DAFF to initiate monitoring study of subsistence fishery and reserach into sustainability of fishery. | Fisheries inspectors and HFCOs are active on the Swartkops; need to ensure equal monitoring of all user groups; empower HFCOs to act in terms of NEM: PAA. | **Human** - DAFF: resource Protection (Mr V. Jozana), HFCOs and additional MLRA and NEM: PAA appointed personnel; NMBM Environmental Management (Ken Pressley and river patrol ranger) DAFF appointed researchers. **Financial** - DAFF (Resource Management) and NMBM (Public Health); costs for river patrol ranger as for HA7 above; HFCOs may be assisted from levies from boat registration. |
| **Operational Objective E3: Protection of fish populations; TPCs are noncompliant individuals; a decrease of >10% from baseline cpue values for dusky kob, white steenbras and leervis; and a decrease off >20% from baseline cpue values for all other species.** | | | | | |
| Enforce legislation in the form of MLRA regulations. | MLRA (Chapter 3, Section 14 & Chapter 6). | Inspection of activities and fishermen to ensure compliance with MLRA regulations. | Continuous from implementation of IMP. DAFF is lead agent with assistance from HFCOs and Municipal river patrol ranger. Enforcement personnel to operate on a daily basis to monitor non-compliance; estuary users can assist by reporting incidents of non-compliance. | Fisheries inspectors and HFCOs are active on the Swartkops; need to ensure equal monitoring of all user groups. | **Human** - DAFF: Resource Protection (Mr V. Jozana), HFCOs and additional MLRA appointed river ranger (NMBM). **Financial** - DAFF (Resource Management) and NMBM (Public Health); costs for river patrol ranger as for HA7 above. HFCOs may be assisted from levies from boat registration. |

**Table 6.3 continued.**

| Operational Objective E4: Regulate number and format of competitions. TPCs are increase in competitions and non-compliance with the rules of participation. | | | | | |
|---|---|---|---|---|---|
| Maintain a limited and predetermined number of well structured, regulated fishing competitions | MLRA (Section 14 & Chapter 6); Municipal By-Laws for organized events; organized angling (local clubs and SALTBAA / EPLTBAA) policies. | Number of competitions to be determined and monitored; participants to be assessed for compliance with MLRA regulations and/or competition specific rules. | Continuous from implementation of IMP. The Municipality (Council) is the authority that may grant permission to hold competitions; SMF to coordinate with organized angling structures to investigate feasibility of catch-and-release format. | Competitions take place regularly; unknown whether permission is obtained from Council; format is mostly not catch-and-release at present. | **Human** - organized angling bodies (EPLTBAA - Alan van Vuuren) in coordination with NMBM (Public Health and Council) and SMF. **Financial** - no cost apart from levy that may be applied by Council to hold competitions. |

## TABLE 6.4: MANAGEMENT ACTION PLANS FOR LAND-USE & INFRASTRUCTURE STRATEGIC OBJECTIVES

| Management actions | Legal requirements | Monitoring plans | Work plan & mandate | Currently addressed | Responsibility |
|---|---|---|---|---|---|
| **Operational Objective LU1: Nature & extent of land-use & infrastructure; TPCs are broad statements of intent (see italics below).** | | | | | |
| Maintenance of the 100 m & 1 000m coastal protection zones , Municipal coastal setback lines and Critical Biodiversity Areas - ensure all activities taking place are in accordance with relevant legislation; offer incentives (rates rebates) for private landowners to manage areas as conservation zones. | NEM:BA (Chapter 4, Part 1); NEMA (Chapter 5; EIA Regulations); ICMA (Chapter 2 Section 16); CARA (Section 6); Municipal SDF. | Compliance with legislation controlling activities in this zone; monitor applications for activities within the zone. | Initiate as soon as IMP is implemented and integrate with SDF; DEA, DAFF (also in catchment), DEDEA & NMBM are responsible; DAFF in catchment; SMF can monitor infringements and register as I&APs in any applications. | No demarcated riparian buffer zone currently exists; many activities take place right up to the waters edge; activities governed by EIA Regulations. | **Human** - DEDEA: Environmental Management and Coastal Zone Management (Leon Els, Jeff Govender and Jan Kapp), DAFF: Land Care and DEA: Oceans & Coast (Ayanda Matoti and Niel Malan); NMBM: Housing & Land (Dawn McCarthy) and Environmental Management (Joram Mkosana); SMF executive. **Financial** - DEA, DAFF, DEDEA and NMBM budgets - part of existing responsibilities. |
| No additional development (structures) on the floodplain within the 1:100 flood line and coastal protection zone (this includes Critical Biodiversity Areas) - enforce recommendations in planning frameworks (SDF); offer incentives (rates rebates) for private landowners to manage areas as conservation zones. | NEM:BA (Chapter 4, Part 1); NEMA (Chapter 5; EIA Regulations); ICMA (Chapter 2, Section 16; Chapter 3, Section 28); SDF/IDP; CARA (Section 6); Municipal SDF. | Compliance with legislation restricting activities in this zone; monitor applications for activities within the floodplain or 1:100-year floodline. | | No indication of the extent of the 1:100 flood line or demarcation of coastal protection zone. | |
| Developments and land use in the catchment and estuarine area should not lower water quality or interfere with normal hydrodynamic or sedimentary processes - ensure all developments and activities do not impact negatively on water quality by enforcing relevant legislation. | NWA (Sections 19 & 21); NEMA (Chapter 5; EIA Regulations); ICMA (Chapter 8, Section 69) CARA (Sections 6 & 12); Municipal SDF/IDP. | Monitor EIA process to ensure all impacts are adequately mitigated; ensure compliance with ROD conditions; monitor water quality parameters according to RQOs (as for W2 and W3); ensure compliance with legislation and planning frameworks. | Initiate as soon as IMP is implemented and integrate with SDF; DEDEA, DWA and NMBM are responsible agents; DAFF in catchment; SMF, CMA and WUA can monitor infringements and register as I&APs for any applications within estuarine area. NMBM need to provide and maintain basic services to avoid contaminated runoff (see W2 and W3). | EIAs are conducted, but limited capacity means all projects cannot be fully monitored for ROD compliance. Provision and maintenance of basic services is ongoing but not effective in preventing contamination of runoff water. | **Human -** DEDEA: Environmental Quality Management, Compliance & Enforcement and Coastal Zone Management (Andries Struwig, Jeff Govender and Jan Kapp), DWA: Water Quality (Ronaldo Nell and Pieter Retief); DAFF: Land Care, NMBM: Housing & Land (Dawn McCarthy), Environmental Management (Joram Mkosana) and Infrastructure & Engineering (Barry Martin and Tony Arthur). **Financial** - developers to cover costs of EIA and monitoring of ROD conditions, NMBM (Infratsructure & Engineering) for supply and maintenance of basic services. |
| Development proposals should be evaluated through the EIA procedure and guided by the IMP specifically and the broader catchment management plan - register as I&AP for all development applications and ensure compliance with all legislation. | All legislation controlling aspects of development within the EIA process - this will vary according to nature of development or activity but will include aspects covered by the NWA (Section 19; Chapter 4), NFA (Chapter 3, Section 1), NEMA (Chapter 5; EIA Regulations), CARA (Sections 6 & 12), NHRA (Chapter 2, Parts 1&2), ICMA (Chapter 2, Section 16; Chapter 3, Section 28) & Municipal SDF/IDP. | Monitor the EIA process for each application and ensure compliance with all legal requirements. | Initiate immediately - for all new applications and review of applications currently under consideration; DEDEA is EIA authority. SMF can register as I&APs. | EIAs are currently conducted, but are not guided by an IMP. | **Human** - DEDEA: Environmental Quality Management (Jeff Govender and Andries Struwig). **Financial** - no additional cost to existing running costs of DEDEA. |

**Table 6.4 continued.**

| | | | | | |
|---|---|---|---|---|---|
| **Operational Objective LU2: Number of applications for development and/or rezoning of land within estuarine area; there are no quantitative TPCs but an increase in applications over a five-year period should be cause for concern.** | | | | | |
| Register as I&AP for all development and rezoning applications and ensure compliance with all legislation and planning frameworks. | All legislation controlling aspects of development within the EIA process - this will vary according to nature of development or activity but will include aspects covered by the NWA (Section 19; Chapter 4) NFA (Chapter 3, Section 1) NEMA (Chapter 5; EIA Regulations), CARA (Sections 6 & 12), NHRA (Chapter 2, Parts 1&2), ICMA (Chapter 2, Section 16; Chapter 3, Section 28) & Municipal SDF/IDP. | Record numbers of new applications for comparison to recent years; monitor the EIA process for each application to ensure it fulfills legal requirements. | Register as I&AP for all new applications and check municipal records for compliance regarding older applications; DEDEA and NMBM are responsible for ensuring correct procedures are followed. | EIAs currently undertaken for listed activities; SMF need to register as I&APs for all new applications. | **Human** - DEDEA: Environmental Quality Management, Compliance & Enforcement and Coastal Zone Management (Jeff Govender, Andries Struwig and Jan Kapp); NMBM: Environmental Management (Joram Mkosana); SMF executive. **Financial** - no additional cost to existing running costs of DEDEA or NMBM.. |
| **Operational Objective LU3: Regulation of structures within Nature Reserves; TPC is if permanent structures and roads are not developed in accordance with the Zonation Plan.** | | | | | |
| Ensure compliance with Zonation Plan and EIA Regulations location and design of proposed eco-tourism centre in Swartkops Valley Nature Reserve needs to be addressed. | NEMA (Chapter 5; EIA Regulations); Reserve Zonation Plan. | Monitor number and location of structures and roads/tracks. | NMBM will be responsible agent in ensuring implementation of Zonation Plan and initiation of EIA process if required; DEDEA are EIA authority. | Zonation Plan not yet implemented. | **Human** - NMBM: Environmental Management (Joram Mkosana); DEDEA: Environmental Quality Management (Jeff Govender/Andries Struwig). **Financial** - NMBM (Public Health) to implement Zonation Plan; cost of EIA if required will vary - minimum of R200 000. |
| **Operational Objective LU4: Use of planning and management tools to guide development; TPC would be the exclusion of the Swartkops management area in any of these frameworks.** | | | | | |
| Ensure that the Swartkops management area is specifically addressed in all planning and management frameworks. | ICMA (Chapter 4); SDF/IDP (in the form of specific management plans such as this IMP and a future CMS); SEAs or Conservation Development Frameworks. | Review of all existing planning and management frameworks; monitor progress of all new management & planning documents through direct participation. | Initiate immediately and register SMF as civic organization that must be consulted; NMBM responsible for addressing management area in frameworks. | Conservation worthy areas have been identified in the past and together with this IMP should inform all future planning schemes. | **Human** - SMF executive; NMBM Chief Operating Officer for IDP (Dr S.W. Vatala) and Housing & Land (Dawn McCarthy). **Financial** - NMBM (various departments) for developing frameworks. |

**Table 6.4 continued.**

| | | | | | |
|---|---|---|---|---|---|
| **Operational Objective LU5: Resolution of issues surrounding the operation and leasing of jetties and slipways; TPC would be the continued air of uncertainty surrounding this issue.** | | | | | |
| Coordinate a meeting between all relevant stakeholders. | ORV Regulations (Sections 7 and 4); ICMA (Sections 65, 66 and 95 - when promulgated); Seashore Act (Sections 3, 4, 10 and 11). | Ensure that the SMF coordinates such a meeting. | Initiate immediately. Relevant stakeholders include the SMF, NMBM, DEDEA and DEA. | No. | **Human** - SMF executive; NMBM: Environmental Management (Joram Mkosana/Godfrey Murrell) and Chief Operating Officer (Adv. Job Malobola); DEDEA: Coastal Zone Management (Jan Kapp); DEA: Oceans & Coast (Niel Malan). **Financial** - Cost of meeting to be covered by those attending. |
| **Operational Objective LU6: Equitable and controlled access to Coastal Public Property; TPC would be if this was not achieved or addressed.** | | | | | |
| Review existing access points and assess feasibility of additional access or closure of existing points. | ICMA (Chapter 2, Section 13). | Monitor stakeholder opinions with regards access issues; recovery of impacted areas after closure of uncontrolled access sites. | DEA and DEDEA to determine access points; NMBM to control access. | Access is open in most areas but needs to be controlled to avoid environmental damage. | **Human** - DEA: Oceans & Coast (Ayanda Matoti/Niel Malan); DEDEA: Coastal Zone Management (Jeff Govender/Jan Kapp); NMBM: Environmental Management (Godfrey Murrell). **Financial** - DEA (Oceans & Coast), DEDEA (Environmental Management) and NMBM (Environmental Management) for costs of survey and control of access points. |
| **Operational Objective LU7: Upgrading of Municipal slipway at redhouse; TPC would be if the site continued to operate in its dilapidated state.** | | | | | |
| Upgrade or issue a "repair or removal' notice prior to closing it down and being rehabilitated. | Seashore Act (Section 10); ICMA (Chapter 7, Section 60). | Monitor progress with regards upgrading facilities; alternatively monitor progress with regards removal of the structures and rehabilitation of the site. | DEDEA is the lead agent for issuing repair notice and NMBM is responsible for repair and/or removal and subsequent rehabilitation. | No. | **Human** - DEDEA: Coastal Zone Management (Jan Kapp/Jeff Govender) and NMBM: Corporate Services (Facilities Management). **Financial** - NMBM (Corporate Services) for costs of repair or removal and rehabilitation. |
| **Operational Objective LU8: Maintenance of existing stormwater canals and services and construction of new canals and services; TPCs would be continued inadequate services and contaminated stormwater and new canals that are contaminated due to inadequate services.** | | | | | |
| Upgrade services to reduce contamination of existing stormwater canals (Motherwell and Markman). Provision of services prior to construction of new canals to prevent contamination of runoff. | Water Services Act (Chapter 1, Section 3); Municipal Systems Act (Chapter 8, part 2) Municipal By-laws (Public Health and Waste Management). | Monitor contamination of runoff in existing canals and upgrading of services such as sanitation and waste management. | Initiate immediately for existing canals and prior to construction of any new canals. | Contamination is monitored but services are still inadequate. | **Human** - NMBM: Roads, Stormwater & Transportation (Ben Govoni), Water & Sanitation (Barry Martin/Tony Arthur) and Environmental Health (Norman Gumede). **Financial** - NMBM (Infrastructure & Engineering). |

**Table 6.4 continued.**

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|---|---|---|---|---|---|
| **Operational Objective LU9: Determine the future of the Fishwater Flats WWTW; the TPC would be if the facility was to be expanded at its present site or if no consideration was given to its relocation.** | | | | | |
| The SMF to meet with the NMBM to discuss the future of the WWTW and options for possible relocation. | None directly applicable, but if expansion or relocation were to be considered then the EIA and other relevant legislation would come into play. | Monitor progress of meetings with the NMBM. Levels of floodwaters in relation to the WWTW can be recorded along with any sewerage spills that contaminate the management area. | Initiate meeting between the SMF and NMBM within the next two years; monitoring of floodwater levels and spills can start immediately and be done by residents and/or estuary users. | No. | **Human** - NMBM: Water & Sanitation (Barry Martin/Tony Arthur) and Environmental Health (Norman Gumede). **Financial** - NMBM (Infrastructure & Engineering). |

| **TABLE 6.5: MANAGEMENT ACTION PLANS FOR INSTITUTIONAL & MANAGEMENT STRUCTURES STRATEGIC OBJECTIVES** | | | | | |
|---|---|---|---|---|---|
| **Management actions** | **Legal requirements** | **Monitoring plans** | **Work plan & mandate** | | **Responsibility** |
| **Operational Objective IMS1: Establishment of a local Management Forum; TPC would be the absence of such an institution.** | | | | | |
| Establish and constitute the Swartkops Management Forum (SMF) so that all management issues pertaining to the management area can be coordinated with all stakeholders and relevant authorities can be held accountable; integrate with Coastal Management Committee. | None yet - will be part of Estuary Management Protocol when developed (ICMA; Chapter 4). | Monitor progress of SMF and ensure it fulfills its obligations; ensure integration with Coastal Management Committee. | Initiate immediately - assemble members and elect chairman and executive committee constitute SMF and set mandate and responsibilities. NMBM will be lead authority EFA to facilitate this process. | No. | **Human** - EFA and all stakeholders NMBM: Environmental Management (Godfrey Murrell for Coastal Management Committee). **Financial** - NMBM: Public Health (implementation phase budget for startup then R10 000 per year for running costs). |
| **Operational Objective IMS2: Establishment of CMA, WUA and Catchment Management Forum; TPC would be the absence of any such institutions.** | | | | | |
| Form CMA & WUA and associated CMF. | NWA (Chapter 2, Part 2; Chapter 8). | Monitor progress of CMA, WUA and CMF and ensure they fulfill their obligations. | Initiate immediately - DWA to assemble all interest groups and form CMA and CMF; set mandate and responsibilities. | No. | **Human -** DWA: Various Directorates (liaison Ncamile Dweni); representatives from all relevant stakeholder groups. **Financial -** DWA (RDM). |
| **Operational Objective IMS3: Interaction between SMF, CMA, WUA and catchment forum; TPC would be if no integration and interaction existed between these institutions.** | | | | | |
| Integrate CMF representatives with SMF (and vice versa) and host regular meetings. | None that specifically deals with integration, but this is advisable to ensure effective cooperative governance from catchment to coast. | Ensure integration and keep record of number and types of projects or management scenarios that are resolved or addressed cooperatively. | Initiate as soon as CMF is set up; integrate CMF representatives within the SMF (primarily water quality & quantity and land-use) and identify opportunities to interact. Institutions are themselves responsible for integration assisted by DWA and NMBM. | No. | **Human -** CMF and SMF chairpersons; DWA: Resource Protection (Ncamile Dweni) with assistance from NMBM: Environmental management (Joram Mkosana). **Financial -** DWA (RDM) and NMBM (Environmental Management). |

**Table 6.5 continued.**

| | | | | | |
|---|---|---|---|---|---|
| **Operational Objective IMS4: Inter-governmental department arrangements; TPC would be if incidents of misunderstanding and (resulting) conflict were to continue or if formal agreements were not signed and budgets were not made available.** | | | | | |
| Determine which government departments are responsible for administering legislation on behalf of other departments; draw up an MOU and assign a budget in each case; disseminate information to stakeholders. | Various Acts make provisions for the responsibility of administering the Act to be devolved to agencies other than the prescribed lead agency. | SMF to receive clarification from all relevant government departments with regards their responsibilities under specific legislation; authorities to sign MOUs and secure budgets. | Initiate once SMF has been established; SMF executive and NMBM can take the lead role. | No. | **Human -** SMF executive with NMBM (various departments but lead by Environmental management) and all government departments that are key role players. **Financial** - no costs to produce a report from each government department providing clarification of arrangements. |
| **Operational Objective IMS5: Responsibilities with regards public participation; TPC would be if the perception of management intervention without consultation were to continue.** | | | | | |
| Ensure that all management authorities fulfill their obligations in terms of the public participation process prior to initiating any management interventions. | e.g. NEMA (Sections 2(4), 23, 24(7) and 45); ICMA (Chapter 6, Part 5); EIA Regulations. | All management interventions will come through the SMF, as such they can ensure that public participation requirements are met. | Initiate once SMF has been established; SMF executive can take the lead role. | Yes, but not the extent that satisfies all stakeholders. | **Human -** SMF executive to coordinate with all management authorities and/or government departments. **Financial** - no cost part of SMF activities. |

| **TABLE 6.6: MANAGEMENT ACTION PLANS FOR SUSTAINABLE LIVELIHOODS STRATEGIC OBJECTIVES** | | | | | |
|---|---|---|---|---|---|
| **Management actions** | **Legal requirements** | **Monitoring plans** | **Work plan & mandate** | | **Responsibility** |
| **Operational Objective SL1: Existing activities compliant with all forms of legislation and planning frameworks; TPC would be any activity not complying with these regulations.** | | | | | |
| Engage relevant government authorities to address activities that do not comply with legislation and planning frameworks. | Applicable legislation is contained in the NWA (Sections 19 & 21); MLRA (Chapter 3, Section 14; Chapter 6); NEMA (Chapter 5; EIA Regulations); NFA (Chapter 3, Sections 1&2); ICMA (Chapter 2, Section16; Chapter 3, Section 28); CARA (Section 6); NHRA (Chapter 2, Parts 1&2); NEM: BA (Chapter 4); NEM: PAA (Chapter 4); SDF/IDP; Municipal by-laws and local management plans. | Review all existing activities for compliance with legislation and planning frameworks; monitor all proposed new activities for compliance; monitor rehabilitation where applicable. | Initiate immediately; members of SMF to engage NMBM and government departments such as DEDEA, DWA, DAFF and DEA to enforce applicable legislation and planning frameworks. | Occurs to some extent for certain activities, e.g. monitoring of bait fishery. | **Human -** SMF executive to engage government representatives from DEDEA: Environmental Compliance & Enforcement and Economic Development Services (Leon Els) DWA: Authorizations and Water Use (Portrait Tshatshu and Joseph Jacobs), DEA: Oceans & Coast and Biodiversity & Conservation (Ayanda matoti and Alan Boyd); NMBM: Environmental Management (Joram Mkosana), Land Planning & Management (Dawn McCarthy), Sector Development (Lulama Mxenge) and Strategic Projects (Amelia Buchner). **Financial -** no costs. |

**Table 6.6 continued.**

| | | | | | |
|---|---|---|---|---|---|
| **Operational Objective SL2: Promote non-consumptive enterprises involving previously disadvantaged communities which are compliant with all forms of legislation and planning frameworks; TPC would be no new initiatives and non-compliance with these regulations.** | | | | | |
| Engage community representatives, NMBM, DEDEA and civic organizations to identify opportunities and ensure they are compliant with all forms of legislation. Efforts should concentrate on the subsistence bait collectors to reduce the impact on living resources. | Applicable legislation is contained in the NWA (Sections 19 & 21); NEMA (Chapter 5; EIA Regulations); NFA (Chapter 3, Sections 1&2); ICMA (Chapter 2, Section 16; Chapter 3, Section 28); CARA (Section 6); NHRA (Chapter 2, Parts 1&2); NEM: BA (Chapter 4); NEM: PAA (Chapter 4); SDF/IDP; Municipal by-laws and local management plans. | Monitor progress with regards initiation of new activities and their compliance with regulations. | Initiate immediately; NMBM with assistance from DEDEA and community leaders to engage all stakeholders to identify opportunities and draft operational frameworks to ensure compliance. | No. | **Human** - NMBM: Sector Development (Lulama Mxenge) and Strategic Projects (Amelia Buchner); DEDEA: Economic Development Services (Leon Els). **Financial** - NMBM (Economic Development and Recreational Services); DEDEA (economic Development Services); possible assistance from National Government (e.g. poverty alleviation fund). |
| **Operational Objective SL3: Development of a business plan for the subsistence fishery; TPC would be if no plan was developed and the *status quo* remained.** | | | | | |
| 1. Develop a business plan (include independent financial manager; prices; upgrade and maintenance costs; selling point managers, commercial farming etc.). | None | Progress of business plan. | Initiate immediately; combined responsibility of DAFF and NMBM with assist from DEDEA. Rhodes University can be approached for assistance with commercial farming aspect. | No. | **Human** - DAFF: Coastal Livelihoods/Social Economic Devel (Mr W. Lucas); NMBM: Sector Development (Lulama Mxenge) and Strategic Projects (Amelia Buchner); DEDEA: Economic Development Services (Leon Els); may contract development of business plan to consultants. **Financial** - DAFF (Social Economic Development); NMBM (Economic Development and Recreational Services); possibly ECDC. |
| 2. Upgrade the Tiger Bay facility primarily by supplying aquariums, fridges and freezers to store bait organisms collected from the estuary; can include other items such as pilchard and chokka. Other selling points to be closed down. | | Progress of upgrading and ongoing maintenance of facilities; monitor waste due to discarding unsold bait. | | | |
| 3. Appoint selling point managers (collectors do not sell bait themselves ); managers may only accept bait from licensed collectors and then only once per day and only the legal quota (or they lose their job). | | Monitor effectiveness of operation and activity of illegal collectors. | | | |
| **Operational Objective SL4: Supervision of the burning of Abakwetha sites; TPC would be if no supervision occurred or if fires spread to the Swartkops Valley Nature Reserve.** | | | | | |
| Liaise with traditional authority as to timing of burning and supervise this activity; implement reserve fire management plan if fires spread. | Primarily the NVFFA; aspects of NEMA, NEM:BA and Municipal Public Amenities by-laws also apply; reserve fire management plan. | Monitor burning of sites. | Initiate immediately. The reserve management staff is responsible for reserve fire management plan; NMBM to liaise with traditional authority. | No. | **Human** - NMBM: Environmental management (Ken Pressley) and Disaster Management (Shane Brown) in cooperation with traditional authority. **Financial** - No cost to monitoring; implementation of fire management plan is funded through reserve budgets. |

| TABLE 6.7: MANAGEMENT ACTION PLANS FOR TOURISM AND RECREATIONAL USE STRATEGIC OBJECTIVES | | | | | |
|---|---|---|---|---|---|
| **Management actions** | **Legal requirements** | **Monitoring plans** | **Work plan & mandate** | | **Responsibility** |
| **Operational Objective T1: Recognition of the Swartkops management area as a premier eco-tourism destination; TPC would be if this were not to happen.** | | | | | |
| Lobby NMBM tourism to market the area on their website and in brochures; lobby tourist operators and guesthouses/B&Bs to promote the area on their websites. | None. | Monitor websites and tourism information for brochures etc. | Initiate immediately. SMF executive to interact with NMBM tourism, tourism industry and DEDEA. | Swartkops Estuary is marketed on some websites but needs to be more inclusive (reserves) and highlight biodiversity aspects. | **Human** - SMF executive and selected operators from the tourist industry, NMBM: Tourism (Mandlakazi Skefile) and DEDEA Trade & Industry Development (Leon Els). **Financial** - No significant cost to SMF (e-mail, phone calls, internet searches), NMBM Tourism budget. |
| **Operational Objective T2: Promote organized sporting events; TPC would be if no additional events took place or if existing events were cancelled.** | | | | | |
| Engage NMBM to promote the area as a sporting venue and ensure safe and healthy environment; engage sporting organizations. | None *per se* but aspects detailed in water quality MAPs will apply indirectly here as well. | Monitor number of events being held and compare to historical records. | Initiate immediately. NMBM to interact with sports bodies; safe and healthy environment needs to be ensured (see W2 and W3). | Several events already occur, but additional are required and need to ensure events are not lost to the Swartkops due to health risks. | **Human** - NMBM: Sport and Recreation (Mpamie Odolo) and sporting bodies. **Financial** - costs to host events covered by sporting bodies, NMBM (Economic Development & recreational Services) and sponsors. |
| **Operational Objective T3: Enforce Zonation Plans and Municipal Public Amenities by-laws; TPC would be if recreational users did not adhere to the regulations and use areas.** | | | | | |
| Implement Zonation Plans and by-laws using signage and effective compliance monitoring. | Municipal Public Amenities by-laws; Zonation Plans in Gazetted IMP. | Monitor levels of compliance and frequency/number of incidents of non-compliance. | Initiate immediately. NMBM is responsible for administering Zonation Plans and by-laws. | No significant compliance monitoring of existing by-laws. | **Human** - NMBM: Environmental Health (Joram Mkozana, Godfrey Murrell, Ken Pressley, reserve and river rangers). **Financial** - appointment of terrestrial reserve rangers and river control officer, signage (costs as detailed in HA5 and HA7). |
| **Operational Objective T4: Development of eco-tourism nodes in terrestrial reserves; TPCs would be no development, no benefit to PDCs, incorrect placement and damage to sensitive environment.** | | | | | |
| Identify funding through public-private partnerships; develop facilities in accordance with CDF (SRK 2008) and reserve zonation plans. | No legislation that requires these developments, but they must be done in accordance with EIA Regulations and the NEM:PAA (Chapter 4, Sections 49 to 52 and Chapter 7, Sections 86 and 87). | Monitor progress of development, location of nodes, impact on the environment and benefits to PDCs. | NMBM has responsibility with assistance from DEDEA; timing and workplan will depend on acquisition of funds, but should be within the next five years. | No. | **Human** - NMBM: Environmental Management (Joram Mkosana/Ken Pressley) and Strategic Projects (Amelia Buchner); DEDEA Economic Development Services (Leon Els). **Financial** - source funds via public-private partnerships, assistance from DEDEA and NMBM (Economic Development). |

| TABLE 6.8: MANAGEMENT ACTION PLANS FOR EDUCATION & AWARENESS STRATEGIC OBJECTIVES | | | | | |
|---|---|---|---|---|---|
| **Management actions** | **Legal requirements** | **Monitoring plans** | **Work plan & mandate** | | **Responsibility** |
| **Operational Objective EA1: Educational workshops on value of estuaries and terrestrial reserves, their context within planning frameworks and legislation and consequences of poor decision making; TPCs would be no workshops, poor attendance or continued poor decision making that affects estuaries.** | | | | | |
| Initiate series of workshops with help from DEA, DWA, DAFF and NMBM. | White Paper for Sustainable Coastal Development (Section C, Chapter 10); ICMA (Chapter 5, Section 38). | Keep record of number of workshops and attendance by government department and NMBM staff; participants to submit to a questionnaire to test awareness, understanding and effectiveness of workshop. | Initiate immediately. DEA (e.g. CoastCare Programme) is responsible for marine/coastal education on a national level, but the workshops can be hosted by the SMF, NMBM (for terrestrial reserves) and even NMMU. | No. | **Human** - DEA (various directorates but mainly Environmental Quality & Protection - Alan Boyd and Ayanda Matoti); NMBM: Environmental Management (Godfrey Murrell/Clyde Scott); participating government and municipal staff; SMF executive; specialists from tertiary and research institutions. **Financial** - primarily DEA (Environmental Quality & Protection and NMBM (Environmental Management); possibly the Siyakhula Trust (a DAFF initiative). |
| **Operational Objective EA2: Interactive public awareness campaign; TPCs would be no visual aids, lack of public interest and poor level of understanding of estuaries and the regulations that govern their well-being.** | | | | | |
| Ensure that visual aids (notice boards) are erected at key points (launch sites and resorts); host school groups for interactive tours of the management area. | White Paper for Sustainable Coastal Development (Section C, Chapter 10); ICMA (Chapter 5, Section 38). | Monitor placing of notice boards and ensure their content is relevant to the Swartkops management area scenario; provide school groups and general public (distribute through organizations or clubs) with a questionnaire to determine effectiveness of the programme. | Initiate immediately. DEA (e.g. CoastCare Programme) is responsible for education on a national level and should coordinate visual content of sign boards with NMBM; SMF can host school groups; Zwartkops Conservancy to continue with its educational initiatives and advise SMF on way forward. | Some notice boards are erected at a few sites but more are required. Zwartkops Conservancy conducts educational programme for kids. | **Human** - DEA: Environmental Quality & protection (Ayanda Matoti and Alan Boyd) to supply notice boards with NMBM: Environmental management (Godfrey Murrell/Ken Pressley) input; SMF executive; Zwartkops Conservancy (Jenny Rump); specialists from tertiary and research institutions. **Financial** - primarily DEA and NMBM; investigate corporate sponsorship; Siyakhula Trust; cost of additional signage R50 000. |

**Table 6.8 continued.**

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| **Operational Objective EA3: Training of members from PDCs to become catch monitors to assist HFCOs in compliance monitoring; TPC would be if no training took place.** | | | | | |
| Select 4 candidates for training and ensure they attend course and are appointed in terms of legislation; supply candidates with equipment (clothing, stationary and backpacks); ensure cooperation with HFCOs activities. | No legislation that requires this to be done, but they must be appointed in terms of the MLRA (Chapter 2, Section 9). | Monitor progress of candidates and interaction with HFCOs. | Training either by NMBM or DAFF within the next two years; selection of candidates initially by PDCs but they need to qualify (e.g. level of education, no criminal record etc.); HFCOs to assist with on the job training. | No - the concept of catch monitors has been tried in the past but was not successful. | **Human** - suitable PDC candidates; DAFF: Social Economic Development (Mr W. Lucas) and HFCOs to assist with training and responsibilities; NMBM: Environmental Management (Clyde Scott). **Financial** - training costs to be covered either by DAFF (e.g. Marine Living Resources Fund) or NMBM (Environmental Management or Economic Development); equipment costs by DAFF (Social Economic Development) or corporate sponsors; training may also be facilitated and funded by the Siyakhula Trust. |
| **Operational Objective EA4: Research projects by tertiary & research institutions and government departments; TPCs would be no research projects or the continued lack of information/data required for monitoring programmes and addressing management concerns.** | | | | | |
| Identify key areas where research efforts should be concentrated (e.g. water quality & quantity; fishery survey; sustainability of subsistence bait fishery; rehabilitation areas/methods; terrestrial poaching); actively engage government and tertiary & research institutions to initiate projects. | None | Monitor progress of all research activities concerned with the Swartkops management area and ensure that outcomes are practical and effectively used in long term monitoring programmes that will guide the implementation of the IMP. | Initiate immediately; SMF can interact with government and tertiary & research institutions (includes SANCOR and NRF facilities). Government departments such as DWA and DEA may initiate projects on their own and institutions such as CSIR and SAEON can be involved in long term monitoring projects. Members of organizations such as SMF or ZT can also participate in monitoring programmes. | Yes - but to a limited extent. Much of the available data is outdated. This IMP will address this requirement. | **Human -** SMF executive to identify research needs in cooperation with tertiary institutions. **Financial -** major research programmes are funded from a variety of sources - may be direct from government departments or through institutions such as the NRF, CSIR or SANCOR; corporate sponsors may also be approached. |

# CHAPTER 7 - IMPLEMENTATION

## 7.1 INTRODUCTION

The successful implementation of the IMP itself will depend on the participation of all stakeholders, although the lead authority is usually one or other Government department. In the case of the Swartkops IMP, it is proposed that the NMBM is the lead authority. Implementation is facilitated through a local management institution, which we propose to call the Swartkops Management Forum (SMF). This SMF should comprise all stakeholders and be headed by a Chairman and Executive Committee. The SMF executive will serve to keep all stakeholders informed of the progress and effectiveness of the IMP, identify areas of concern and make recommendations that may need to be incorporated into later versions of the IMP, liaise with government departments to ensure they fulfill their legal obligations and interact with tertiary & research institutions to help coordinate research programmes. The executive may also establish *ad hoc* working groups to deal with specific management issues as they arise within each of the key result areas.

When a technical working group is established, it should have a representative from the relevant government department(s) which has executive powers in terms of legislation that is specific to the management issue or the relevant key result area, e.g. living resources should be represented by DEA and DAFF; conservation by DEA and DEDEA; land-use & infrastructure by DEDEA, DAFF and the NMBM; and water quantity & quality by DWA and NMBM. These working groups will focus on addressing issues as they arise.

The SMF and its members may also be directly involved with monitoring programmes by collecting data (physical measurements or visual observations) and can act as the eyes and ears for law enforcement authorities. All members of the SMF executive must be provided with a list of contact numbers for government department representatives who have the mandate to act so that they may be contacted whenever stakeholders observe activities that do not comply with the IMP requirements.

Guidelines for the establishment of a local management forum have been adapted from (Van Niekerk & Taljaard 2007) and are summarized below.

## 7.2 ESTABLISHMENT OF A LOCAL MANAGEMENT FORUM

The process of establishing a local management forum should be initiated by a competent local authority or NGO who should organize a meeting of all relevant government authorities and interest groups who have a direct stake in the well being of any management area. In the case of the Swartkops, EFA is likely to fulfill this function. It is recommended that the following institutions and interest groups are included:

- The Department of Environmental Affairs; Department of Water Affairs; Department of Agriculture, Forestry and Fisheries; Department of Economic Development and Environmental Affairs;
- C.A.P.E.;
- The NMBM;
- The Catchment Management Agency and/or the Water User Association;
- Provincial Heritage Resources Agency;

- Tourism operators;
- The local concern groups (e.g. Swartkops Riparian Owners Association; Zwartkops Conservancy; Ratepayers Associations; Zwartkops Rowing Club; Swartkops Yacht Club; Bluewater Bay Surf Lifesaving Club);
- Honorary Fisheries Control Officers (Zwartkops Honourees) and catch monitors;
- Local developers and industries;
- Individual landowners (may be represented through local concern groups);
- Organized angling (EPLTBAA and local clubs); non-affiliated recreational anglers;
- Subsistence fishers;
- Individual recreational users;
- Non-governmental organizations (NGOs such as WESSA); community-based organizations (CBOs such as the Siykhula Project); and
- Ecological, social and resource specialists.

The local SMF that is to be established for the Swartkops management area must consist of the following:

1. The **Executive,** which comprises nominated representatives from all interest groups and government institutions and a **chairperson** elected by the members of the executive who will take the lead in the coordination and implementation of the IMP. This executive represents the interests of the broader stakeholder base.
2. **Technical working groups** that can be established on an *ad hoc* basis to address specific management issues as they arise within each of the key result areas.

Although members of the EFA project team may be available on an advisory basis during the initial implementation of the IMP, the management plan's long-term implementation will become the responsibility of the local SMF. The SMF will need to enter into discussions with the NMBM to determine the capacity of the NMBM to fulfill its obligations with regards implementing the IMP and to ascertain the legal implications of not being able to fulfill it obligations. It may be necessary to outsource certain aspects of implementation if the NMBM does not have the capacity. In these cases, agreements or contracts (memoranda of understanding) will need to be entered into.

## 7.3 FIVE-YEAR PLAN

It is the recommendation of this report that the following aspects of the IMP be implemented as a matter of priority **within the next year**:

- Establish a SMF that is democratic and representative of all stakeholders, interest groups and government departments.
- Ensure that the IMP is accepted by the NMBM and the MEC, and then Gazetted and incorporated into the Municipal SDF and IDP frameworks.
- Establish the zoning of the estuary and terrestrial reserves in accordance with the Zonation Plans (includes proclamation of estuary protected areas and Aloes Nature Reserve).
- Coordinate a meeting with all stakeholders to resolve the issue surrounding the operation and leasing of jetties and slipways.
- Investigate the feasibility of conducting a comprehensive reserve assessment (this may need to take place over a five-year period).

- All aspects related to water quality.
- All aspects relating to land-use & infrastructure within the estuarine area.
- Increase capacity for compliance monitoring.
- Establish a FPA and develop a FMP for the Aloes and Swartkops Valley Nature Reserves.
- Initiate monitoring/supervision of burning of Abakwetha sites northwest of the Swartkops Valley Nature Reserve.
- Identification of monitoring and research requirements (priority must be given to sustainability of resources in the context of bait exploitation; and the effects of poor water quality on ecosystem health and functioning).
- Development of a business plan to upgrade and improve the operation of the subsistence bait selling points.
- Clear indication of government department responsibilities and inter-governmental arrangements for administration of legislation.

The following aspects of the IMP should be addressed within the time frames indicated:

- Training of subsistence members to become catch monitors and HFCOs **within the next two years**.
- Upgrading or removal (and rehabilitation of site) of Municipal slipway at Redhouse **within the next two years**.
- Determine the future plans for the Fishwater Flats WWTW and the feasibility of relocation **within the next two years**.
- Investigate the feasibility of using locally generated funds for management and SMF activities, e.g. boat registration and launching fees, competition or organized sporting event levies and access fees for terrestrial reserves by the end of the **second year**.
- Initiate all other monitoring programmes and coordinate with research projects where appropriate within the **next three years**.
- All outstanding aspects pertaining to the MAPs for all conservation, living resources and management & institutional arrangements within the **next three years**.
- The education & awareness and tourism programmes within the **next three years**.
- Establishment of catchment management institutions and management plan **within next three years**.
- Relocate and rehabilitate waste site adjacent to Aloes Nature Reserve **within the next three years**.
- Regulation of existing livelihoods and the identification of additional opportunities involving members of previously disadvantaged communities within the **next four years**.
- Develop the eco-tourism nodes within the terrestrial reserves over the **next five years**.
- Review the efficacy of the estuary Protected Areas **after five years** with a view to re-opening them and proclaiming alternative sites. Caution is advised when this option is being considered as it promotes irresponsible behaviour in open areas with the knowledge that protected areas will become available for exploitation in the future.

The IMP in its current form will be reviewed **after five years**. It will be the responsibility of the SMF executive team to produce a State-of-the-Estuary Report, which essentially involves revisiting the Situation Assessment and Evaluation that was performed in Phase I of this project. This will be followed by a round of revision and/or refinements of the Objective-setting and Implementation phases as and where necessary, e.g. it may be necessary to adjust aspects of a MAP or monitoring programme.

# CHAPTER 8 - MONITORING AND EVALUATION

## 8.1 MONITORING

There are two components to monitoring, namely baseline measurement programmes and long-term monitoring programmes, and it is important to note the difference between them in the context of the IMP framework (Taljaard & van Niekerk 2007b). Baseline measurement programmes usually refer to short-term or once-off, intensive investigations of a wide range of parameters to obtain a better understanding of ecosystem functioning; they may also involve the investigation of non-ecological data to determine an existing situation with regards to compliance, land-use patterns, institutional & management structures, alternative livelihoods, tourism and education & awareness initiatives. These programmes would normally be a part of the Situation Assessment & Evaluation and the Objective-Setting Phases within the framework; knowledge gaps and programmes are also identified through the Situation Assessment & Evaluation process. In the context of this IMP baseline data is required in order to determine many of the TPCs for the management actions described in the MAPs.

Long-term monitoring programmes refer to ongoing data-collection programmes that are done to evaluate continuously the effectiveness of management strategies and management actions within MAPs that are designed to maintain a desired environmental state. Data from these programmes is used to determine or anticipate when particular TPCs have been or will be exceeded so that responses to potentially negative impacts, including cumulative effects, can be implemented in good time. Long-term programmes usually involve biotic and abiotic components concerned with the biophysical aspects such as water quantity & quality, conservation and living resources. However, accumulated data from baseline programmes associated with land-use & infrastructure, management & institutional structures, sustainable livelihoods, tourism and education & awareness can be analyzed over the long-term as well to ensure that the Vision for the Swartkops management area is achieved and maintained. Long-term programmes often form part of detailed scientific surveys or research projects conducted by tertiary and research institutions, but they may also take the form of less complex initiatives such as fisheries regulations compliance and activities in the context of the Zonation Plans or Municipal By-laws.

### 8.1.1 BASELINE PROGRAMMES

A detailed description of the baseline requirements, spatial & temporal scales, required resources and sampling & analysis techniques with regards the TPCs referred to in some of the MAPs (Chapter 6; Tables 6.1 to 6.8) is provided in Tables 8.1 to 8.7 below (see McGwynne & Adams 2004 for rationale behind monitoring). Baseline monitoring programmes are not required for all aspects of the IMP, e.g. establishing the SMF, amending the SDF to allow for a residential/conservation buffer zone for the terrestrial reserves, identification and evaluation of heritage resources and the Institutional & Management Structures. Some aspects of these baseline programmes, e.g. *cpue* and population (invertebrates and birds) monitoring will also form part of long-term programmes (see Section 8.1.2 below).

### 8.1.2 LONG-TERM MONITORING

The long-term monitoring programmes described in this section (Table 8.8 to 8.10) were initially developed to determine the requirements for the ecological reserve and then to assess the effectiveness of the prescribed reserve for estuaries (see Taljaard & Van Niekerk 2007b). However, in most instances data from these programmes can also be used as indicators of other management concerns where the ecological reserve specifically is not responsible for the observed pattern or scenario. For example, the long-term monitoring of fish could reveal a decline in biodiversity or species richness that could be due to RQO parameters but could equally be due to human activities such as fishing, episodic events causing habitat change, seasonal migrations, national trends in fish populations or large-scale fluctuations in climate. A long-term programme for mammals in the terrestrial reserves has also been included.

Unlike many of the baseline programmes where data can be gathered and in many instances analyzed by SMF members, long-term monitoring programmes tend to be the responsibility of government departments such as DWEA who usually contract the services of tertiary & research institutes such as CSIR, SAIAB, SAEON and Universities. However, at all times the SMF executive should be involved so as to ensure that programmes will be beneficial to the effective implementation of the IMP.

Long-term monitoring programmes for the following components are proposed, namely hydrology, sediment dynamics, hydrodynamics, water & sediment quality, microalgae, macrophytes, terrestrial vegetation, invertebrates, fish, birds and mammals. The protocols for carrying out these programmes has been taken from Taljaard & Van Niekerk (2007b) and adapted to suit the Swartkops scenario where applicable.

## 8.2 EVALUATION

Evaluation of the IMP will become the responsibility of the local management forum. Ideally technical working groups responsible for the various key result areas should evaluate the effectiveness of the IMP in the context of their area of responsibility. It is essential that representatives from the CMF, once it has been established, are included within the SMF structure to address the catchment RQO-related issues.

The evaluation process will be carried out every five years when a Situation Assessment Report, which utilizes the data from monitoring programmes, will indicate whether the Vision and Strategic Objectives have been achieved. In a situation where this has not been achieved, the SMF executive will need to determine which aspects of the IMP need to be altered in order to rectify these shortfalls. Usually this will involve the adaptation of management strategies or aspects of the MAPs themselves, although the problem may be with implementation (capacity and finance). Monitoring programmes may also be altered to supply specific data to fill existing knowledge gaps.

| TABLE 8.1: BASELINE MONITORING PROGRAMMES FOR WATER QUANTITY (HYDRODYNAMIC AND SEDIMENTARY PROCESSES) | | | | | |
|---|---|---|---|---|---|
| **Objective** | **Indicator & TPC** | **Responsibility** | **Spatial Scale** | **Temporal Scale** | **Sampling & Analysis** |
| WHS1: Record freshwater inflow at head of estuary. | Recommended inflow according to Intermediate Reserve determination (1m3/s); TPC is inflow volume less than the recommendation; or unseasonal change in sedimentation patterns or mouth dynamics. | **Human -** DWA. **Budget -** DWA - cost of flow gauging station installation and analysis of data. | Flow gauging station above head of estuary; various sites along estuary and at the mouth for sedimentation patterns and mouth dynamics. | Data is logged daily sedimentation and mouth dynamics monitored seasonally. | Flow data logged daily and collected bi-annually for analysis; sedimentation and mouth dynamics monitored seasonally. XY graphs of flow against time; reference photos of mouth and sediment patterns. Decrease flow could indicate increased abstraction or impoundment but could be natural cycle. |
| WHS2: Frequency and duration of episodic events. | Type of event (flood) and duration this is a natural phenomenon and TPCs are not relevant. | **Human** - SMF and NMBM. **Budget** - no costs. | The estuarine area. | Whenever the events occur. | Record the event, its duration and time of year. These data are important as they help explain sedimentation patterns, scouring, duration periods for recovery and mouth dynamics. |
| WHS4: Changes in bathymetry as a measure of long-term sedimentation processes. | Depth profile of estuary at selected sites; TPC is a bathymetric profile that varies significantly from the natural range. | **Human -** estuarine sediment dynamics specialist (consultant or from tertiary/research institution). **Budget -** research funding from tertiary institutions. | Water body within the designated estuarine area. | Every three years or after episodic flood events. | Graphic display of bathymetry at sites over time. Sediment accumulation could indicate increased erosion due to bad land-use practices or increased input from marine and Aeolian origins; could ultimately lead to mouth closure. |

| TABLE 8.1: BASELINE MONITORING PROGRAMMES FOR WATER QUALITY | | | | | |
|---|---|---|---|---|---|
| **Objective** | **Indicator & TPC** | **Responsibility** | **Spatial Scale** | **Temporal Scale** | **Sampling & Analysis** |
| WQ1: Concentrations of water quality parameters in river inflow. | Levels of sediment (silt), nutrients and pollutants. TPCs are determined by safety & health standards. | **Human -** DWA. **Budget -** DWA - cost of water sampling and analysis from above head of estuary. | Sample station at a site above the head of the estuary. | Every week with additional samples prior to and during sporting events. | Water sample analysis and presentation of data in XY graphs to show temporal fluctuations of each parameter. Values outside the norm can indicate pollution or contamination of water. |
| WQ2: Frequency and location of fish & invertebrate kills; macro- and micro-algal blooms; non-natural floating objects and surface contaminants; and areas with bad smells. | Observe the occurrence and location of these aspects. TPCs are not defined *per se* but are exceeded when indicators are visible. | **Human -** SMF, river users and river control officer. **Budget -** none for observations; DWEA or NMBM for investigation of cause. | Designated estuarine area. | Observations can be made during normal activity. | Occurrence and location to be recorded; cause to be investigated by DWEA or NMBM. Analysis could show pollution by effluent discharge, nutrient enrichment or low oxygen levels; cause may also be natural, e.g. low temperature. |
| WQ3: Concentration of bacteriological contaminants. | Total coliform (*E. coli*) counts. TPC for estuary - counts in 80% of samples over time should be <100 counts/100 ml and < 2000 counts/100 ml in 95% of samples. | **Human** - NMBM (can be assisted by SMF or Zwartkops Trust). **Budget** - operating budget from Community Protection Services. | Water body within the designated estuarine area. | Weekly samples; prior to organized sporting events when bad odors or sewage spills are noticed. | Plot *E. coli* counts as XY graphs against time for each station. Increase in counts to above the TPC indicates contamination and hence a health hazard to estuary users. |
| WQ4: Concentrations of constituents that determine water quality. | All water quality parameters, e.g. oxygen, nutrients, turbidity and heavy metals. TPCs are the values recommended by the DWAF Water Quality Guidleines for the natural marine environment (Appendix 1). | **Human** - specialists either from SMF or research/tertiary institution. **Budget** - NMBM or funding from tertiary /research institutions. | Several stations (every 1-2 km) along estuary including mouth and head region. | At least seasonally (monthly if possible); at high tide during neap tide cycle allowing for tidal lag for stations upstream of the mouth. | Natural variability to be determined over five-year period. Plot data as XY graph against time for each station and constituent. Increased levels of most constituents could indicate or lead to increased eutrophication, algal blooms or contamination. Low oxygen could lead to or explain mass mortalities and indicate eutrophication. |

**TABLE 8.2: BASELINE MONITORING PROGRAMMES FOR CONSERVATION (BIODIVERSITY)**

| Objective | Indicator & TPC | Responsibility | Spatial Scale | Temporal Scale | Sampling & Analysis |
|---|---|---|---|---|---|
| B1: Maintenance of plant communities. | Area of cover; TPC is 10% reduction in area covered by any plant community type. | **Human** - members of SMF or municipal environmental officer. **Budget** - cost of aerial and/or reference photographs. | The designated estuarine area; should include sand and mudbanks for sediment distribution patterns. | Aerial photographs every 5 years for Situation Assessment; reference photographs bi-annually for seasonal variation at selected sites. | Aerial photos from Dept. of Surveys & Mapping; reference photos from fixed elevated positions at low tide. Surface area of each community type plotted on a map; habitat type and plant cover at reference sites plotted; XY graphs of plant community area for each season over 5-year period. |
| B2: Control of alien vegetation. | Area of cover; TPC is if more than 10% of riparian area is infested with alien vegetation. | **Human -** DWA & DAFF. **Budget -** cost of aerial photographs and reference transects. | Riparian region within the designated estuarine area and the greater catchment. | Aerial photographs every 5 years for Situation Assessment; reference transects at disturbed sites annually. | Aerial photos from Dept. of Surveys & Mapping; reference transects at disturbed or cleared sites. Surface area of indigenous & alien vegetation plotted on a map every 5 years; XY graphs of vegetation type against year in disturbed areas to track recovery. |
| B3: Maintenance of invertebrate populations (mudprawn, sandprawn and bloodworm). | Population densities; TPC is densities below 90% of baseline counts. | **Human** - members of SMF; more likely students or staff from tertiary or research institute. **Budget** - research funding from tertiary or research institutions. | Several representative habitats for major invertebrate species; including control sites where human activities are excluded. | Bi-annual. | Random quadrats above low spring tide level where number of burrows are counted; sampling to include breeding and recruitment seasons. Baseline data set may be set up after 2 years; plot XY graphs of number of burrows against time of year. Reasons for decrease may not be human induced and could be due to natural variation. Also use Fielding (2009) data. |
| B4: Maintenance of waterbird populations. | Species richness; TPC is loss of a single rare/endangered species.<br>Species diversity; TPC is 20% loss over 5 years.<br>Bird numbers; TPC is 20% decrease for resident species over 5 years and decrease of 20% for migratory species over 10 years. | **Human** - members of SMF; students or staff from tertiary or research institute. **Budget** - research funding from tertiary or research institutions; subsidy from CWAC at UCT. | Reference sites in the mouth region, floodplain in middle reaches and above road bridge in Protected area. | Twice yearly in winter (June-July) and summer (January-February). | Counts to be done over spring low tide period and outside peak disturbance periods and record prevailing conditions; counting areas mapped and representative of a range of estuary habitat types. Plot species richness, diversity and numbers against time of year and habitat type; long-term period (5 to 10 years) is required to allow for detection of natural fluctuations; detailed analysis to be done by CWAC. |
| B5: Maintenance of fish populations. | CPUE; TPC for dusky kob, white steenbras and leervis is 10% reduction in baseline values; TPC for all other species is 20% reduction in baseline values. | **Human -** DEA inspectors and MLRA appointed personnel; students or staff from tertiary or research institute. **Budget -** research funding from tertiary or research institutions; funding from DEA for increased MLRA inspector capacity. | Water body within the designated estuarine area. | Ongoing for catch monitors research project comprising fishery survey to be conducted every 5 years. | Boat inspections and shore patrols in the form of roving creel surveys; access point inspections; weekdays, weekends and holidays to be included; catch (number & weight) and time fished is relevant data. CPUE to be plotted against time for each species; analysis of research data and catch monitors data can be combined. |
| B6: Maintenance of estuarine habitats within formally protected areas. | Proportion of various habitat types under protection; TPC would be a reduction in this proportion on a National scale. | **Human -** DEA or municipal environmental officer; specialist consultant for analysis. **Budget -** DEA funding for cost of survey, annotated maps or photos and specialist analysis. | Designated estuarine protected areas and Protected areas in other CFR estuaries. | Annotated maps or aerial photographs every 5 years. | Aerial photos from B1 can be used and annotated with habitat type and extent within formally protected areas. Analysis needs to be done in the context of habitat types protected in other CFR estuaries and should be done by DEA or estuarine specialists from tertiary/research institutions. |

## Table 8.2 continued.

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| B9: Maintenance of terrestrial mammal populations within the terrestrial reserves. | Presence and abundance of species; TPC is loss of species or 10% drop in abundance. | **Human** - NMBM reserve management staff; NMMU. **Budget** - NMBM for reserve staff and research funds from NMMU. | Designated terrestrial area of Swartkops Valley and Aloes Nature Reserves. | Within 5 years of implementation of IMP. | Initial census to be conducted, followed by annual census to detect change. Disappearance of a species or decline in numbers can be compared between annual census data. |
| B10: Establishment of FPA and FMP; prevention of uncontrolled fires. | Existence of FPA and FMP and presence of uncontrolled fires; TPC is no FPA or FMP and any uncontrolled fires. | **Human** - NMBM reserve management staff. **Budget** - costs for monitoring part of reserve management budget. | Designated terrestrial area of Swartkops Valley and Aloes Nature Reserves. | Implement immediately. | Record number and causes of uncontrolled fires so that steps can be taken to remedy the situation. |

**TABLE 8.2: BASELINE MONITORING PROGRAMMES FOR CONSERVATION (Human Activities)**

| Objective | Indicator & TPC | Responsibility | Spatial Scale | Temporal Scale | Sampling & Analysis |
|---|---|---|---|---|---|
| HA1: Ensure carrying capacity of estuary is not exceeded. | Number of recreational users in each sector; TPC is when carrying capacity is exceeded. | **Human** - members of SMF or municipal river control officer. **Budget** counts can be done as part of normal daily activities or responsibilities, i.e. no additional cost. | Designated estuarine area may be limited to specific zones based on type of activity in accordance with the EZP. | Twice a month outside of peak periods (weekday and weekend day) and once a week during peak holiday periods. | Count number of people engaged in each activity; record number of activities and associated users. Plot number of users in each activity against time of year and compare to carrying capacity values. |
| HA2: Control human activities that impact on invertebrate (bait organism) populations. | Population densities; TPC is 10% reduction in population densities from baseline values.<br>Compliance with regulations (bag limits, collecting methods, licenses, closed areas); TPC is continued instances of non-compliance. | **Human** - MLRA appointed personnel; members of SMF; students or staff from tertiary or research institute. **Budget** - research funding from tertiary or research institutions. | Designated estuarine area. | Once a week during the neap and spring-tide cycles for population density; and daily for compliance. | Weekly surveys over low tide to record number of collectors, collection methods, adherence to bag limits and licenses; random quadrats to determine densities (use data from B3 research surveys). Plot XY graph of densities to time of year and relate to number of users and level of compliance; plot XY graph of instances of non-compliance with time of year and bait organism. |
| HA3: Protect linefish and bait organism populations by restricting fishing competitions. | Number of competitions and participants; TPC is an increase in current numbers. | **Human** - members of SMF and organized angling representatives. **Budget** - counts can be done as part of normal daily activities or responsibilities, i.e. no additional cost. | Water body within designated estuarine area. | Once a year when applications to hold competitions are submitted to municipality. | Record number of competitions and number of participants (boats and anglers). Plot XY graph of each against time of year over a 5-year period. |
| HA4: Reduce the amount of litter (solid waste) within the estuarine area. | Volume of litter measured in standard garbage bags. | **Human** - members of SMF; municipal environmental officer. **Budget** - can be done as part of normal daily activities or responsibilities, i.e. no additional cost. | Designated estuarine area, in particular the water body and immediate riparian area. | During or after each organized event; at least once a month during peak periods; and twice during the year outside of peak periods. | Record number of standard garbage bags filled with litter after organized events, during peak periods and during the year. Plot XY graph of volume against time of year and related activity. |
| HA5: Regulate activities impacting on integrity of terrestrial nature reserves. | Incidents such as poaching, grazing and harvesting of vegetation; TPC is the continued occurrence of such incidents. | **Human** - NMBM reserve staff personnel. **Budget** - NMBM for cost of regular patrols and equipment. | Swartkops Valley and Aloes Nature Reserves. | At least twice weekly from implementation of IMP. | Record number of incidents of each type and record (XY graph) on monthly basis throughout the year. |

**Table 8.2 continued.**

| | | | | | |
|---|---|---|---|---|---|
| HA7: Regulate activities impacting on integrity of estuary Protected areas. | Incidents such as uncontrolled access, fishing and bait collection. TPC is the continued occurrence of such incidents. | **Human -** NMBM river control officer and MLRA appointed personnel (DEA and HFCOs). **Budget -** NMBM for cost of patrols (and equipment) by river control; part of DEA duties; no cost to HFCOs. | Designated estuary Protected areas. | Patrols should be conducted daily; effort spread between river control, DEA and HFCOs. | Record number of incidents of each type and record (XY graph) on monthly basis throughout the year. |
| **TABLE 8.2: BASELINES MONITORING PROGRAMMES FOR CONSERVATION (Law Enforcement)** | | | | | |
| **Objective** | **Indicator & TPC** | **Responsibility** | **Spatial Scale** | **Temporal Scale** | **Sampling & Analysis** |
| LE1: Improve law enforcement capacity. | Incidence of non-compliance and high conviction rate; TPC is an increase in incidents of non-compliance with MLRA, NEM:BA and NEM:PAA and a decrease in conviction rate. | **Human -** MLRA appointed personnel; NMBM reserve staff. **Budget -** cost of additional terrestrial reserve staff (NMBM) or MLRA appointed personnel (DEA or private costs fro HFCOs). | IMP management area. | Capacity should be improved within 2 years of IMP implementation. | Record number of law enforcement personnel after 2 years and compare to existing numbers. Record numbers of incidents of non-compliance and successful convictions annually and compare between years. |
| LE3: Compliance with RODs issued as part of EIA process. | Incidence of non-compliance; TPC is any form of non-compliance. | **Human -** DWEA, DEDEA and NMBM officials; independent environmental control officer appointed in terms of the ROD; SMF members as registered I&APs. **Budget -** part of normal responsibilities for government departments; developer pays for environmental control officer. | IMP management area. | Initiate immediately upon implementation of IMP. | Record number and type of developments approved; note activities of environmental site officer and incidents of non-compliance with the ROD conditions. Data should be tabulated and presented to authorities for analysis and further action against non-compliant developers. |

**TABLE 8.3: BASELINE MONITORING PROGRAMMES FOR EXPLOITATION OF LIVING RESOURCES**

| Objective | Indicator and TPC | Responsibility | Spatial Scale | Temporal Scale | Sampling and Analysis |
|---|---|---|---|---|---|
| E1: Ensure sanctity of estuary Protected Areas and terrestrial Nature Reserves through compliance monitoring. | Incidence of non-compliance; TPC is any form of non-compliance. | **Human -** DEA and MLRA appointed personnel (estuary); NMBM reserve staff; SMF members and public to report incidents. **Budget -** DEA for estuary areas and NMBM and DEDEA for terrestrial reserves. | Designated Protected Areas within estuary; Swartkops Valley and Aloes Nature Reserves. | Daily patrols within estuarine area and initially at least twice weekly for terrestrial reserves (can become daily once capacity is improved). | MLRA appointed personnel, terrestrial reserve staff, SMF members and general public can monitor compliance during daily activities or responsibilities. Incidents of non-compliance can be recorded for each month and plotted against years for a 5-year period. Analysis can be done by NMBM or SMF executive or a researcher as part of fishery survey (estuary). |
| E2: Ensure maintenance of bait organism populations. | Population densities; TPC is densities below 90% of baseline counts. Compliance with regulations; TPC is continued instances of non-compliance. | **Human** - MLRA appointed personnel; SMF members and research students. **Budget** - part of responsibilities for MLRA personnel; research funds. | Invertebrate organism habitats within estuarine area. | Population densities twice a year; compliance daily. | Daily compliance monitoring to record number of collectors, collection methods, adherence to bag limits and licenses; random quadrats to determine densities (use data from B3 research surveys and Fielding 2009). Plot XY graph of densities to time of year and relate to number of users and level of compliance; plot XY graph of instances of non-compliance with time of year and bait organism. |
| E3: Maintenance of fish populations. | CPUE; TPC for dusky kob, white steenbras and leervis is 10% reduction in baseline values; TPC for all other species is 20% reduction in baseline values. | **Human** - MLRA appointed personnel; students or staff from tertiary or research institute. **Budget** - research funding from tertiary or research institutions; funding from DEA for increased MLRA inspector capacity. | Water body within the designated estuarine area. | Ongoing for MLRA appointed personnel; research project comprising fishery survey to be conducted every 5 years. | Boat inspections and shore patrols in the form of roving creel surveys; access point inspections; weekdays, weekends and holidays to be included; catch (number & weight) and time fished is relevant data. CPUE to be plotted against time for each species; analysis of research data and catch monitors data can be combined. |
| E4: Restrict number of competitions and participants and maintain high level of compliance with MLRA regulations and competition-specific rules. | Number of competitions & participants; TPC is an increase above existing levels. Compliance TPC would be any incidents of non-compliance with MLRA and competition-specific rules. | **Human** - SMF executive; MLRA appointed personnel; organized angling representatives; angling club committee members. **Budget** - part of current responsibilities, no additional funds required; any expenses by SMF executive to be covered by competition levies. | Water body within the designated estuarine area. | Compliance during each competition; number of competitions to be decided at the start of each year. | Compliance with regulations to be recorded for each competition and plotted against years over a 5-year period. Record number of competitions and number of participants (boats and anglers). Plot XY graph of each against time of year over a 5-year period. Data can be analyzed by a researcher as part of the five-yearly fishery survey. |

| TABLE 8.4: BASELINE MONITORING PROGRAMMES FOR LAND-USE & INFRASTRUCTURE | | | | | |
|---|---|---|---|---|---|
| **Objective** | **Indicator & TPC** | **Responsibility** | **Spatial Scale** | **Temporal Scale** | **Sampling & Analysis** |
| **LU1, 2, 3 & 4: Nature and extent of land use and infrastructure and use of management frameworks to guide development.** | | | | | |
| LU1: Maintenance of demarcated 100 and 1 000 meter buffer zones, coastal setback lines and Critical Biodiversity Areas. | Compliance with legislation applicable to the various zones TPC is any infringements within these zones. | **Human -** DEDEA, DWEA & DAFF officials; environmental control officer appointed in terms of the RODs; municipal environmental officer and town planning; members of SMF. **Budget -** part of normal responsibilities for government departments; developer pays for environmental control officer and rehabilitation. | Estuary management area. | Visual monitoring can be done on an *ad hoc* basis during normal daily activities or responsibilities. | Land-use patterns adjacent to the estuary to be mapped; records kept of applications for activities that will infringe on this riparian zone and registration of the SMF as an I&AP; amount of bank erosion and habitat degradation in the vicinity of existing developments to be noted; non-compliance with regards the buffer zones and CBAs to be noted and plotted against each year over a 5-year period. |
| LU1: Restrict additional development (structures) on the floodplain or within the 1:100-year floodline. | Number of applications for new developments within the floodplain or 100-year floodline; TPC is any new applications for development. | | Floodplain or 100-year floodline within the designated estuary management area. | Visual monitoring can be done on an *ad hoc* basis during normal daily activities or responsibilities. | Land-use patterns adjacent to the estuary to be mapped; records kept of applications for activities that will infringe on the floodplain area and registration of the SMF as an I&AP. Number of new developments to be plotted against each year over a 5-year period. |
| LU1: Maintenance of water quality and normal hydrodynamic & sedimentary cycles. | RQO parameters; TPC would be any activity that negatively impacts on the RQOs. | **Human -** DEDEA and DWA personnel; environmental site officer appointed in terms of the RODs. **Budget -** part of normal responsibilities for government departments. | Designated estuarine area and catchment. | Bi-annual for DWA (may form part of more detailed long-term monitoring programme) and ongoing for DEDEA and ESO as activities are approved and ROD issued. | DWA to perform regular sampling of RQOs and analyze in the context of activities that may have negative impacts. DEDEA and ESO to ensure conditions and mitigation detailed in RODs are complied with. |
| LU1,2,3,4: Land-use & development proposals evaluated through EIA procedure and guided by IMP (Zonation Plans) and Catchment Management Strategy. Record number of applications for development or rezoning. | Compliance with EIA procedure and adherence to IMP (Zonation Plan) and CMP ideals; TPC is non-compliance in this regard and lack of regard for management framework recommendations. Number of applications; TPC is an increase in applications for development or rezoning or incidents of non-compliance. | **Human -** DEDEA, DWEA, DAFF and NMBM reserve staff; representatives of SMF and CMF/WUA. **Budget -** part of normal responsibilities for government departments. | Swartkops management area and catchment. | Ongoing; exact timing will depend on when applications for activities are received by DEDEA, DWEA or DAFF. | All activities to be reported to DEDEA, DWEA, DAFF, NMBM and SMF to determine whether they comply with EIA requirements and existing management frameworks. SMF to register as I&AP for all proposed activities to ensure procedure is followed and ideals of IMP and CMS are considered in assessment and decision-making process. Number of applications to be plotted against year over a 5-year period and number of applications approved without adhering to management framework recommendations to be plotted against year over a 5-year period. |

## TABLE 8.5: BASELINE MONITORING PROGRAMMES FOR SUSTAINABLE LIVELIHOODS

| Objective | Indicator & TPC | Responsibility | Spatial Scale | Temporal Scale | Sampling & Analysis |
|---|---|---|---|---|---|
| SL1: Ensure all existing activities and livelihoods dependant on the estuary comply with legislation and frameworks. | Compliance with legislation and planning & management frameworks; TPC would be any non compliance. | **Human** - Various National/provincial government and municipal departments; tourism representatives; SMF executive. **Budget** - Part of normal responsibilities for government departments and municipality. | Designated Swartkops management area and catchment area. | Within four years of IMP implementation. | Assess all existing activities in the context of legislation (e.g. MLRA, NEMA & EIA regulations, NWA, NFA, CARA, NHRA) and frameworks (e.g. SDF/IDP, IMP and CMS). Record areas of non-compliance and report to responsible authorities (e.g. municipal planning, DWEA or DEDEA) then monitor response from authorities. |
| SL3: Business plan for the subsistence fishery. | Development of business plan progress of facility upgrade effectiveness of operation and compliance; TPC would be if existing operation continued unchanged. | **Human -** DAFF and NMBM to monitor progress. **Budget -** no cost to monitor progress. | Subsistence selling points at Tiger Bay and Wylde Bridge. | Initiate immediately. | Effectiveness can be measured by level of waste (discarded bait organisms) compared to existing levels, visual appearance of selling points, availability of bait to users and decline in activity of illegal operators. |
| SL4: Burning of Abakwetha sites northwest of Swartkops Valley Nature Reserve.. | Supervision of burning; TPC is if this did not happen and fires spread to the reserve. | **Human -** NMBM reserve management staff. **Budget -** no cost to monitor. | Abakwetha sites to the northwest of the reserve. | Initiate immediately and every time burning is required. | Record number and timing of burning events and prevailing conditions (wind). Record incidents of uncontrolled spreading under these conditions and develop actions to prevent in future. |

## TABLE 8.6: BASELINE MONITORING PROGRAMMES FOR TOURISM AND RECREATIONAL USE

| Objective | Indicator & TPC | Responsibility | Spatial Scale | Temporal Scale | Sampling & Analysis |
|---|---|---|---|---|---|
| T1: Recognition of Swartkops management area as eco-tourism destination. | Websites and brochures featuring the management area; TPC is if this didn't happen or if occurrence was low. | **Human** - NMBM tourism in cooperation with SMF and tourist operators. **Budget** - costs insignificant (mainly time). | Initially the immediate NMBM area, but can expand to Provincial and finally National. | Initial stage after 2 years leading up to National exposure after 5 to 10 years. | Record number of websites and/or brochures that specifically mention the Swartkops management area and its attraction for tourists. Plot number of "hits" per year to illustrate improvement. |
| T2: Promotion of organized sporting events. | Number of events held per annum TPC would be no increase or a reduction. | **Human** - SMF to engage with NMBM and organized sports representatives. **Budget** - costs to SMF insignificant (mainly time). | Initially locally (e.g. schools events) to increase events then expand to include more National events. | Initiate immediately upon IMP implementation. | Record number of organized sporting events in past decade and compare to number over the 5 years after IMP implementation. Reasons for decline in number of events must be ascertained (e.g. water quality). |
| T3: Enforce Zonation Plans and by-laws. | Levels of compliance; TPC would be if incidents of non-compliance were recorded (initially 5/month thereafter a single incident). | **Human** - NMBM (estuary officer and terrestrial reserve staff. **Budget** - cost of monitoring will form part of running costs for the estuary officer and reserve staff. | Swartkops management area. | Initiate immediately. | Number of incidents of non-compliance can be recorded per month and plotted on an X/Y graph. Areas of non-compliance can be recorded as well to detect where changes need to be made or efforts concentrated. |
| T4: Develop eco-tourism nodes in the terrestrial reserves. | Progress and location of development, benefits to PDCs and environmental impact; TPC would be no development, no benefits incorrect placement of nodes and environmental damage. | **Human** - NMBM. **Budget** - cost of monitoring this will be negligible. | Identified nodes within the terrestrial reserves (see Zonation Plan). | Over the next five years. | Location and environmental impact needs to adhere to CDF recommendations (SRK 2008). Benefits to PDCs can be monitored by independent auditors. |

| TABLE 8.7: BASELINE MONITORING PROGRAMMES FOR EDUCATION & AWARENESS | | | | | |
|---|---|---|---|---|---|
| **Objective** | **Indicator & TPC** | **Responsibility** | **Spatial Scale** | **Temporal Scale** | **Sampling & Analysis** |
| EA1: Increase awareness of estuaries and terrestrial reserves and their value amongst government and municipal workers and managers. | Attendance at workshops and questionnaire; TPC would be poor workshop attendance and failure to complete questionnaire. | **Human -** DEA and NMBM with assistance from SMF executive and specialists from tertiary & research institutes. **Budget -** National government (DEA), NMBM and organizations such as the Siyakhula Trust. | NMBM. | Once a year. | Attendance at workshops and successful completion of questionnaires to be recorded once a year and plotted against years over a 5-year period. Analysis should show a steady attendance record and an increase in the level of understanding estuaries and terrestrial reserves and their importance. |
| EA2: Increased public awareness of the Swartkops management area. | Number of public notice boards number of school groups and questionnaire; TPC would be no visible notice boards, few school tour groups and continued public ignorance. | **Human -** SMF can monitor signage and levels of awareness through questionnaires. **Budget -** DEA to cover costs of questionnaires. | Swartkops Management area. | Notice boards and signage to be erected within two years of IMP implementation, educational drive can start immediately. | Assess placement of notice boards and their content; record number of school tour groups; and assess completion of questionnaires. Analysis should show a an increase level of understanding through successful completion of questionnaires and a steady attendance by school groups (includes return visits from schools each year). |
| EA4: Research projects initiated that fill knowledge gaps and provide information for monitoring programmes. | Number of research projects; TPCs would be few research projects and continued lack of data for monitoring programmes. | **Human -** SMF executive to monitor number of research projects. **Financial -** no costs involved for monitoring. | Swartkops Management area. | Within three years of IMP implementation. | Number and type of research projects to be recorded and related to areas of concern with regards knowledge gaps and monitoring data. Must ensure interaction between SMF and tertiary & research institutions and a sharing of knowledge. |

| TABLE 8.8: LONG-TERM MONITORING PROGRAMMES FOR WATER | | | |
|---|---|---|---|
| **HYDROLOGY** | | | |
| **SAMPLING PROCEDURE** | **SPATIAL SCALE** | **TEMPORAL SCALE** | **COMMENTS** |
| Simulated data for runoff and flood hydrographs. | Head of the estuary. | **Runoff** - average monthly flows over a 50 to 80 year period. **Flood hydrographs** - hourly flows for duration of flood. | Used for initial reserve determination and not long-term monitoring |
| **SEDIMENT DYNAMICS** | | | |
| Sediment grabs for particle analysis. | Entire estuary at 1000 m intervals. | Every 5 years and after flood events. | Difference between long-term equilibrium patterns and short term variations need to be determined. Sediment processes are better monitored over the long-term and floods may be infrequent and their effects only recorded in the long-term. |
| Sediment cores for historical characterization. | Entire estuary; 50 m intervals at mouth and 1000 m intervals elsewhere. | | |
| Bathymetric surveys for mouth dynamics and cross-sectional profiles. | Entire estuary; 50 m intervals at mouth and 1000 m intervals elsewhere. | | |
| Sediment loads. | Head of the estuary. | Ideally daily records; once per week may suffice. | |
| **HYDRODYNAMICS** | | | |
| Record river inflow at flow-gauging station. | Head of the estuary. | Continuous. | Construction of flow-gauging weirs must not impede migratory movements of aquatic organisms. Baseline data for inflow and water level are required for initial reserve determination and a minimum 5-year data set is recommended. |
| Record water level. | Mouth area and four stations along estuary length. | | |
| Aerial photographs. | Entire estuary if possible otherwise mouth area. | Annually. | |
| **WATER & SEDIMENT QUALITY** | | | |
| River inflow - measure system variables nutrients & toxic substances. | Head of the estuary. | Monthly. | Water quality parameters depend on riverine and marine waters and biochemical processes. Baseline data for water quality should be obtained from a minimum 5-year data set. Toxic substances accumulate and integrate over time, therefore sediments would provide the best evidence of elevated levels or build-up. Data collection can coincide with biological monitoring programmes to help with interpretation of biotic data. |
| Nearshore marine environment water quality at the mouth; from literature. | Immediate vicinity of mouth or general nearshore/surf zone conditions. | N/A | |
| Estuary water quality - measure salinity temperature, system variables & inorganic nutrients. | Ten stations equally spaced along estuary and one each in river and surf zone. | Seasonal and/or at times during biological surveys. | |
| Measure parameters at effluent discharge sites. | At discharge site prior to entering estuary. | Weekly. | |
| Sediment samples for toxic substances (trace metals, hydrocarbons, pesticides & herbicides). | Estuarine area where fine sediments have recently been deposited. | Once every 5 years or after flood events. | |

| TABLE 8.9: LONG-TERM MONITORING PROGRAMMES FOR PLANTS | | | |
|---|---|---|---|
| **MICROALGAE** | | | |
| **SAMPLING PROCEDURE** | **SPATIAL SCALE** | **TEMPORAL SCALE** | **COMMENTS** |
| Phytoplankton biomass - duplicate samples at surface and 0.5 m depths for chlorophyll-a; cell counts for species composition and distribution. | Ten stations equally spaced from mouth to head of the estuary. | Initially a summer and winter sample two years after IMP implementation; summer and winter samples every three years thereafter. | Combine sampling times when water & sediment quality studies are done; also coincide with invertebrate sampling to help with interpretation of zooplankton data. |
| Benthic microalgae - intertidal and subtidal samples for chlorophyll-a; determine relative abundance of dominant species. | | | |
| Measure salinity, inorganic nutrients, sediment particle size distribution & organic content and light penetration at each site. | | | |
| **MACROPHYTES** | | | |
| Aerial photographs - record number of plant community types, area covered by each, historical changes in community distribution & size and extent of anthropogenic impacts. | Entire estuary | Initially a summer survey two years after IMP implementation; summer surveys every three years thereafter. If aerial photographs are available for intermediate period these should be analyzed too. | The following plant habitat types are relevant to the Swartkops: open surface water, intertidal sand & mudbanks, submerged macrophyte beds, macroalgae, intertidal & supratidal salt marsh and reed & sedges. |
| Field data for ground truthing of aerial photographs - record number of plant community types, area covered by each, species list within each community and extent of anthropogenic impacts. | | | |
| Permanent transects at reference sites to record changes in plant habitats and quadrats to determine percentage change in species composition within communities. Specific data along transects to include elevation and water level, water salinity & turbidity, sediment salinity composition and moisture content. | At least two transects each in lower and middle reaches covering dominant habitats, e.g. salt marshes, *Zostera* beds and reeds/sedges. Additional transects as needed where communities sensitive to freshwater flow are located. | | |
| **TERRESTRIAL VEGETATION** | | | |
| Aerial photographs - record number of plant community types, area covered by each, historical changes in community distribution & size and extent of anthropogenic impacts. | Swartkops Valley and Aloes Nature Reserves. | Once a year after implementation of IMP. Historical records can be used as a baseline. | All indigenous vegetation types should be monitored, but of primary concern are the Motherwell Karroid Thicket, Sundays Doringveld Thicket, Grassridge Bontveld, Sundays and Swartkops Escarpment Valley Thicket and Sundays Valley Thicket. |

## TABLE 8.10: LONG-TERM MONITORING PROGRAMMES FOR INVERTEBRATES, FISH, BIRDS AND MAMMALS

### INVERTEBRATES

| SAMPLING PROCEDURE | SPATIAL SCALE | TEMPORAL SCALE | COMMENTS |
|---|---|---|---|
| Zooplankton - quantitative duplicate samples at night during neap tides using net trawls pulled diagonally across the estuary; record species composition and abundance. Collect phytoplankton & benthic microalgae at each site for chlorophyll-a analysis. | One station in the river; other stations within defined salinity zones (0-10ppt, 10-20ppt and 20-35ppt); minimum of ten stations along estuary length. Stations in each zone should include dominant habitats, bird feeding areas and areas vulnerable to changes in river inflow. | Initially a summer and winter sample immediatley after IMP implementation; summer and winter samples every three years thereafter. | High variability in invertebrate response to flow and rapid changes in community composition and species abundance requires a long-term data set for baseline data. Sampling stations should try overlap macrophyte sites to link invertebrate patterns to habitat types. Coordinate sampling with water & sediment quality surveys for cost-effectiveness and interpretation of patterns. |
| Benthic invertebrates - subtidal samples collected by grab; intertidal samples using core-sampler or quadrat counts for burrow densities; minimum of five replicates per site. Identify all to species level, record densities and abundance and if *Zostera* is present. Sediment samples at each site to be analyzed for particle size and organic content. | | | |
| Macrocrustaceans - replicate quantitative benthic sled samples at same stations used for zooplankton at neap tide; can also set prawn/crab traps overnight (difficult to quantify). Identify to species level and record species composition and abundance. | | | |

### FISH

| SAMPLING PROCEDURE | SPATIAL SCALE | TEMPORAL SCALE | COMMENTS |
|---|---|---|---|
| Fish community - sampling gear needs to suit habitat types. Seine and gill nets will be primary gear, but also otter trawls (deep channels), cast nets and Fyke nets (strong flow and dense vegetation). Record species composition, abundance, distribution and length frequencies. Sub-samples may be required for feeding, reproduction and genetic studies. | Stations in the river and at least ten spread over representative salinity zones (0-10ppt, 10-20ppt;20-30ppt and 30-35ppt); stations in each zone must include all major habitats. | Initially a summer and winter sample two years after IMP implementation; summer and winter samples every three years thereafter. Additional sampling after any fish kill and two months later. | Non-destructive sampling to be carried out where possible, i.e. measure and release. Multiple gears are required to ensure entire community is sampled. Sampling should coincide with water quality surveys. Fish are good indicator species and respond rapidly to changes in flow regime but may be more tolerant to substances that are harmful to other organisms (plants and invertebrates) and may also not be as susceptible to pollutants or other toxins as they are mobile and can swim away. |

### BIRDS

| SAMPLING PROCEDURE | SPATIAL SCALE | TEMPORAL SCALE | COMMENTS |
|---|---|---|---|
| Divide estuary into sections based on habitat type and within each section at low tide record species and abundance (special note of rare or endangered species), state of habitat, level of human activity/disturbance, breeding activity and nesting sites. | Estuarine area and floodplain including surf zone at mouth to beyond backline breakers and 500 m either side of mouth position. | Summer and winter count every year. | Sections where counts take place must be labeled as "distance from mouth"; summer counts to be done outside of holiday period, preferably February/March; annual counts are required to detect cycles of variability which may have a three-year periodicity; seasonal counts required for migratory species; CWAC analyses and collates data but counts can be done by private residents or SMF members; birds are good indicator species for large permanently open estuaries. |

### MAMMALS

| SAMPLING PROCEDURE | SPATIAL SCALE | TEMPORAL SCALE | COMMENTS |
|---|---|---|---|
| Visual census of mammals to include species richness and abundance (special note of rare or endangered species), state of habitat, level of human activity/disturbance and breeding activity/success. | Swartkops Valley and Aloes Nature Reserves. | Initial comprehensive census may take much of first year; after this census may be done once a year (summer or winter) but guidance from Terrestrial Ecology Unit at NMMU is advised. | Annual counts are necessary to account for long-term variability that may have cycles of more than a year. The decline in numbers or disappearance of species listed as threatened, rare or endangered should be the priority area of concern. |

# CHAPTER 9 - RESEARCH

The following research needs that should fill the knowledge gaps and provide supplementary data for monitoring programmes have been identified and should be initiated as soon as possible. Although a wealth of information is available, particularly for the Swartkops Estuary, much of it is outdated, and new research efforts are needed to update our knowledge of the system. The local management forum may approach tertiary and research institutions such as Universities, the CSIR and NRF institutions such as SANCOR, SAIAB and SAEON to create an awareness of what is required. There may be a degree of overlap with the long-term monitoring programmes defined in Section 8 above.

- Fishery survey comprising bait organisms and fish. Key elements include fishing/collecting effort, *cpue*, user dynamics, target fish species, catch composition, bait utilization in relation to existing regulations (waste), motivation for using resource, economic value of the fishery, degree of compliance and conflict between different fishing fraternities.
- Invertebrate organisms - key elements should include densities (in and outside protected areas and in open-access areas), recovery periods after disturbance (collecting and trampling that alter habitat), impact of various collecting methods (pumps vs. digging), community structures before and after disturbance, effect of pollutants in the sediment, mortality due to birds foraging after collection activities, effect on birds by bait collectors and larval settlement times & location along the tidal cross-section. Certain species such as pencilbait, tapeworm and bloodworm have been decimated in some areas and it appears that current levels (and methods) of exploitation are not sustainable. Due to the levels of exploitation (subsistence and recreational) and ongoing water quality issues, annual monitoring of selected species is recommended. These data can be used to make recommendations as to the number of subsistence permits to be issued each year.
- Effectiveness of estuary Protected Areas with regards invertebrate populations, health of estuarine habitat and birds (species richness and breeding success). The study should include an assessment of the impact on bait species due to the concentration of collecting effort in open areas.
- The importance of Tippers Creek (and the *Zostera* beds) to the overall functioning of the estuary and the effect of power driven vessels (both at speed and at no-wake speeds) on this section of the estuary.
- The carrying capacity of the estuary needs to be determined so that the SMF can make an informed decision about the numbers of users utilizing the system at any given time. Some data can be collected as part of the fishery survey, but some aspects such as sense of place, pollution due to engine emissions and incidents of confrontation between all user groups will need to be addressed by a dedicated project.
- A social based project to determine the effectiveness of the education & awareness programme and the attitude toward the IMP and those management actions which have directly affected users, e.g. restricted access to sanctuary areas.
- A comparison between biodiversity and habitat health within the estuary protected areas compared to the conservation areas in the rest of the system.
- A Comprehensive Reserve Assessment to substantiate the results from the Intermediate study that has been conducted. This will be required if the Vision of a Category C/B system is to be realized.
- Long term monitoring of habitats and community structures in relation to RQOs to determine requirements and effectiveness of the ecological reserve.
- The affect of poor water quality (sewerage and heavy metals) on ecosystem functioning.

- A multi-disciplinary study aimed at resolving the issues surrounding the subsistence bait fishery. The study will need to cover social, economic and resource-based aspects and ultimately determine whether this industry is sustainable at present levels of effort (permit numbers and quotas) and with existing collecting methods (e.g. digging). The feasibility of a commercial farming venture should also be investigated. Recommendations as to sustainable levels of effort can be made or alternatively recommendations as to alternate livelihoods for participants can be made.
- The effect of the removal of the Perseverance causeway on the biological community of the estuary. This will have altered the extent and influence of the REI. There should be significant impacts on the productivity, primarily in the upper reaches, which will have a knock-on effect on the entire system).
- Sediment accumulation below the Wylde Bridge.
- Tidal flows, salinity intrusion and freshwater inflow in the upper reaches (the effect of the removal of the Perseverance causeway on the extent of the REI).
- Effectiveness of Swartkops Valley and Aloes Nature Reserves in preserving terrestrial habitat types and maintaining faunal populations. This will involve monitoring the recovery of fauna and flora once access is controlled and activities such as poaching, grazing of cattle, dumping of waste and harvesting of firewood have been stopped.

# CHAPTER 10 - REFERENCES

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# APPENDIX 1

## WATER QUALITY GUIDELINES – TARGETS FOR THE NATURAL MARINE ENVIRONMENT (DWAF 1995a and b). See reference list for sources (EEC – Water Research Centre).

| | Canada | US-EPA | EEC (after UK) | Australia | DWAF (1995a) |
|---|---|---|---|---|---|
| **Physico-chemical Properties** | | | | | |
| pH | 6.5 to 8.5 | | 6 to 9 | 5 to 9 | No target value selected but 6.5 to 8.5 is optimal. |
| Floating matter (including oil and grease) | Free of substances that form objectionable deposits or that float (debris, scum, oil and nuisance organisms). | Free of substances that form objectionable deposits or that float (debris, scum and oil). | Floating materials such as wood, plastic articles, etc. should be absent | Oil and petrochemicals should not be noticeable as a visible film. | No floating particulate matter, debris, oil, grease, wax, scum, foam and residues from land-based sources that may cause nuisance. |
| | Should not be present in concentrations that could be visible, detected by odour or deposited on the shoreline (oil and grease). | | No visible film on surface of the water (oil). | Nuisance organisms (phytoplankton scum, macrophytes) should not be present in excessive amounts. | No material from non-natural land-based sources, which will settle to form putrescence. |
| | | | No lasting foam. | | No submerged objects ad other sub-surface hazards, which arise from non-natural origins and which would be a danger, cause nuisance or interfere with any designated or recognized use. |
| Suspended solids | | | | | No increase by >10% of ambient concentration. |
| Colour/turbidity/clarity | Turbidity should not be increased > 5 NTU over natural turbidity when turbidity is low (< 50 NTU). | Water should be free from substances producing objectionable colour or turbidity. | No abnormal change in colour. | Natural clarity should not be reduced by more than 20%. | Turbidity and colour acting singly or in combination should not reduce photic zone by >10 % of background levels. |
| | Clarity (Secchi disc) - 1.2 m; swimming areas clear to the bottom. | | Secchi disc depth - 1 m (90%ile; guide) and 2 m (95%ile; mandatory). | Natural reflectance should not be changed by more than 50%. | Colour (substances in solution) of water should not exceed background levels by > 35 Hazen units. |
| | Colour - maximum limit of 100 Pt-Co counts. | | | Horizontal sighting of a 200 mm black disc should exceed 1.6 m. | |
| Dissolved oxygen | | | 80 to 120% saturation (90%ile). | | |

| | Canada | US-EPA | EEC (after UK) | Australia | DWAF (1995a) |
|---|---|---|---|---|---|
| **Nutrients** | | | | | |
| General | Waters should be free of substances that produce undesirable aquatic life. | Waters should be free of substances that produce undesirable or nuisance aquatic life. | | | |
| Nitrate | | | | No single value. Levels at which problems have been experienced are between 10 and 60 ug/l. | |
| Phosphate | | | | No single value. Levels at which problems have been experienced are between 1 and 10 ug/l. | |
| Total phosphorous | | 0.1 ug/l (elemental). | | | |
| **Inorganic nutrients** | | | | | |
| Cyanide | | | | 0.1 mg/l. | |
| Hydrogen sulphide | | | 40 ug/l (24 hr max average). | | No target value - can cause unpleasant odours. |
| Gypsum | | | | | |
| Arsenic | | | 500 ug/l total (95%ile). | 0.05 mg/l. | |
| Cadmium | | | | 0.005 mg/l. | |
| Chromium | | | 500 ug/l total (95%ile). | 0.05 mg/l. | |
| Copper | | | 500 ug/l total (95%ile). | | |
| Iron | | | 3 000 ug/l total (95%ile). | | |
| Lead | | | 500 ug/l total (95%ile). | 0.05 mg/l. | |
| Mercury | | | | 0.001mg/l. | |
| Nickle | | | 500 ug/l total (annual arithmetic mean). | 0.1 mg/l. | |
| Silver | | | | 0.05 mg/l. | |
| Zinc | | | 500 ug/l total (95%ile). | | |
| **Inorganic nutrients** | | | | | |
| Total petroleum hydrocarbons | | | 0.3 mg/l 90%ile (mineral oils). | | |
| Polycyclic aromatic hydrocarbons | | | | 0.01 ug/l. | |

| | Canada | US-EPA | EEC (after UK) | Australia | DWAF (1995b) |
|---|---|---|---|---|---|
| **Microbial organisms and pathogens** | | | | | |
| Total coliform | | | Guide: 500/100 ml (80%ile). Mandatory: 10 000/100 ml (95%ile). | | |
| Faecal coliform | 2 000 counts/l (mean of at least 5 samples over 30 days); resample if > 4 000 counts/l. | | Guide: 100/100 ml (80%ile). Mandatory: 2 000/100 ml (95%ile). | Primary contact: 150/100 ml. Secondary contact: 1 000 /100 ml (median over bathing season). | |
| *E. coli* | | | | | 100 units/100 ml in 80% of samples and 2 000 units/100 ml in 95% of samples. |
| Faecal streptococci | 350 counts/l (mean of at least 5 samples over 30 days); resample if > 700 counts/l. | 350 counts/l (mean of at least 5 samples over 30 days). | Guide: 100/100 ml (90%ile). | Primary contact: 35/100 ml. Secondary contact: 230/100 ml (median over bathing season). | |
| Salmonella | | | 0 per litre. | | |
| Enteroviruses | | | 0 PFU per 10 litre. | | |
| Protozoa | | | | Should be absent. | |

# APPENDIX 2

## PROPOSED STRUCTURE FOR A FIRE MANAGEMENT PLAN FOR THE SWARTKOPS VALLEY AND ALOES NATURE RESERVES

**Table of contents taken from Venter (2008): Dwesa-Cwebe Nature Reserve Integrated Fire Management Plan (based on Forsyth *et al*. 2000).**