ESTUARINE MANAGEMENT PLAN FOR THE KOWIE ESTUARY

DRAFT REPORT

Province of the
EASTERN CAPE
ECONOMIC DEVELOPMENT,
ENVIRONMENTAL AFFAIRS AND TOURISM

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Report Details

Report Title	**Development of an Estuarine Management Plan for the Kowie Estuary: Draft Estuarine Management Plan**
Report Status	Draft Report
Report Date	September 2022
Purpose of this Report	The Estuarine Management Plan (EMP) addresses the requirements as set out in the 2021 National Estuarine Management Protocol (NEMP), and is ultimately intended to improve the state of the coastal, and specifically the estuarine environment, for the Kowie Estuary, whilst ensuring the on-going provision of benefits to society.
Prepared For	Eastern Cape Department of Economic Development, Environmental Affairs and Tourism (DEDEAT)
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List of Abbreviations

CML	Coastal Management Line
CMP	Coastal Management Programme
CoGTA	Cooperative Governance and Traditional Affairs
CTD	Conductivity-Temperature-Depth
DRDAR	Department of Rural Development and Agrarian Reform
DEA	Department of Environmental Affairs
DEDEAT	Eastern Cape Department of Economic Development, Environmental Affairs and Tourism
DFFE	Department of Forestry, Fisheries and the Environment
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAF	Estuary Advisory Forum
ECPTA	East Cape Parks and Tourism Agency
EFZ	Estuarine Functional Zone
EIA	Environmental Impact Assessment
EMP	Estuarine Management Plan
GIS	Geographic Information System
IAP	Invasive Alien Plant
ICM Act	National Environmental Management: Integrated Coastal Management Act
IDP	Integrated Development Plan
LED	Local Economic Development
LM	Local Municipality
LUMS	Land Use Management Scheme
MLRA	Marine Living Resources Act (No. 18 of 1998)
MUCH	Maritime and Underwater Cultural Heritage
NBA	National Biodiversity Assessment
NEMA	National Environmental Management Act
NEMP	National Estuarine Management Protocol
NHRA	National Heritage Resources Act
NMU	Nelson Mandela University
NWA	National Water Act
PES	Present Ecological State
REC	Recommended Ecological Category
REI	River-Estuarine Interface
RMA	Responsible Management Authority
RO	Reverse Osmosis
RQO	Resource Quality Objective
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
SAR	Situation Assessment Report
SDF	Spatial Development Framework
SuDS	Sustainable urban Drainage System
SZP	Spatial Zonation Plan
SWOT	Strengths, Weaknesses, Opportunities and Threats
WMA	Water Management Area
WWTW	Wastewater Treatment Works

1. Introduction

1.1 Background

The Kowie Estuary is an artificially permanently open system that meanders in a north-westerly direction for about 21 km from the coastal town of Port Alfred, within the Ndlambe Local Municipality, Eastern Cape province (Figure 1.1).

Figure 1.1: Locality of the Kowie Estuary, Port Alfred, Eastern Cape.

A key feature of the Kowie Estuary, and its surrounds, is the relatively large urban environment, including the Royal Alfred Marina, which is located within the lower reaches of the estuarine functional zone (EFZ). In addition to the marina and other existing developments located within the floodplain, there are also a variety of different land uses further upstream, including agricultural farming, game farming, residential, holiday accommodation, commercial facilities as well as limited light industrial operations. These, together with a large salt marsh area and an artificial permanently open river mouth, makes the Kowie Estuary a particularly complex system that requires a variety of management measures.

The Present Ecological State (PES) of the estuary is categorised as 'C' (Moderately Modified). While the Kowie Estuary is not a national priority estuary, it is regarded as vulnerable due to the poor protection of the system (not formerly conserved and this estuary type is poorly conserved at a national level). However, the estuary is still categorised as 'highly important' and is ranked 33rd in terms of biodiversity importance.

In accordance with the 2021 National Estuarine Management Protocol (NEMP), developed in line with the National Environmental Management: Integrated Coastal Management Act (Act 24 of 2008, as amended by Act 36 of 2014) (ICM Act), an Estuarine Management Plan (EMP) has been developed for the Kowie Estuary.

1.2 Estuary Management Process

The process undertaken complies with the ICM Act and the 2021 NEMP. The latter prescribes distinct components (minimum requirements) that must be included in the process of developing and implementing an EMP (Figure 1.2), and these are further detailed in the EMP Guidelines (DEA, 2015).

The minimum requirements of an EMP include:

1. A Situation Assessment;
2. A geographical description and a map of the estuary indicating the EFZ;
3. The setting of Visions and Objectives;
4. The identification of Management Objectives and Activities/Actions collated into action plans;
5. The spatial zonation of activities in a GIS map format;
6. The compilation of a detailed integrated monitoring plan with a list of performance indicators; and
7. Details of the institutional capacity and necessary arrangements to ensure the implementation of the plan and its constituent actions and projects.

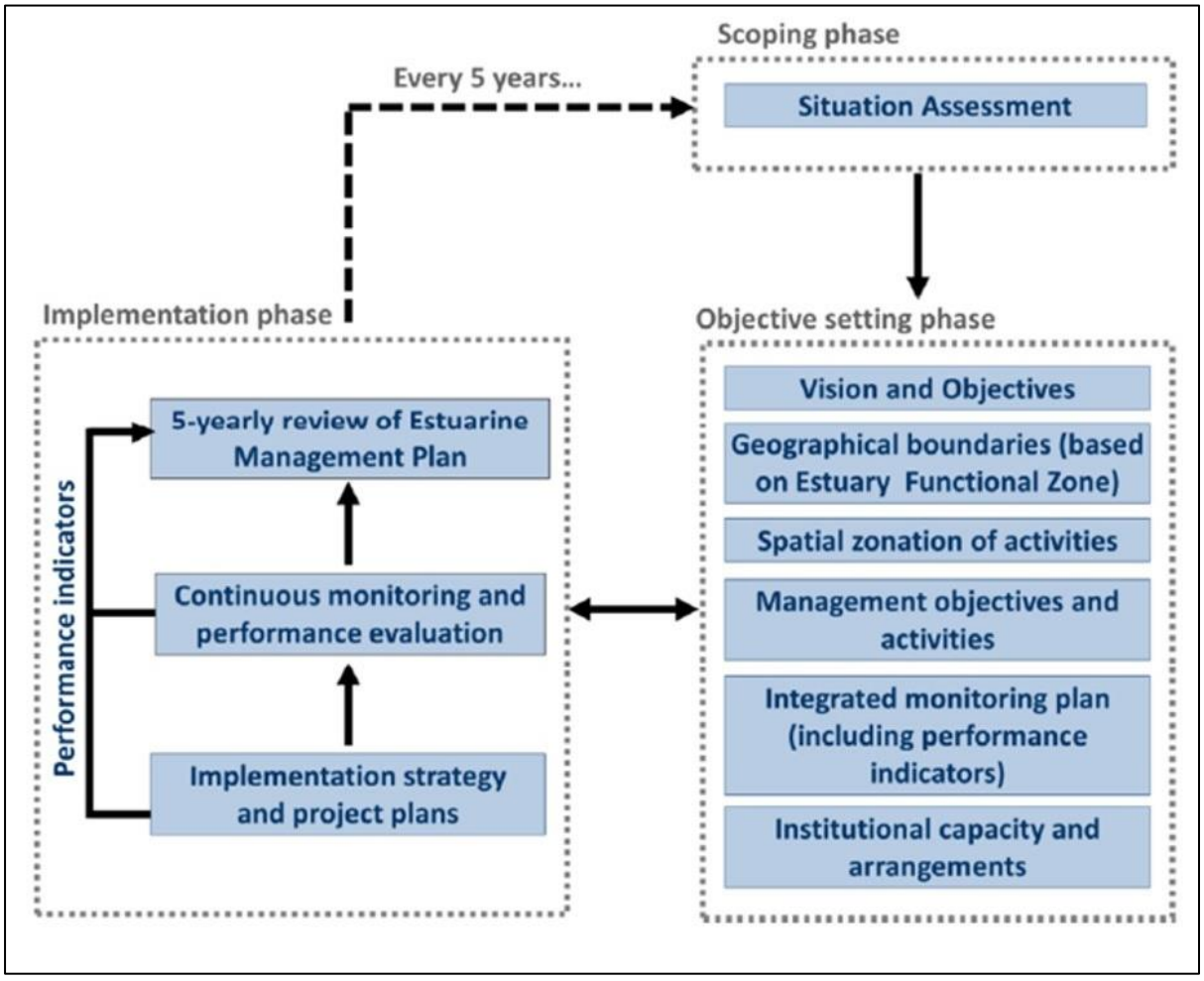

Figure 1.2: A framework for integrated estuarine management in South Africa (DEA, 2015).

The project has proceeded through two (2) main phases as prescribed in the 2021 NEMP and EMP Guideline document. Phase 1 entailed the Situation Assessment, which is the information gathering phase aimed at describing the status quo and identifying critical issues needing to be addressed, while Phase 2 focused on the compilation of the EMP (this report).

1.3 Purpose of the Estuarine Management Plan

This report constitutes the second objective and core component of the estuarine management planning process, namely the EMP. The purpose of the plan is to provide the overarching 'Vision' for the future desired state of the estuary, and thereby guide the management of human activities in and around the Kowie EFZ by setting out essential management objectives with related actions and activities.

The estuarine management process is, by definition, inclusive of coastal hinterland and marine influences, shoreline status, catchment management, human development impacts such as tourism, recreation and agriculture, and climate change, amongst many others. It is the primary document for use by the identified Responsible Management Authority (RMA) to facilitate coordination of the management interventions identified during the planning process to ultimately ensure the longevity of the estuarine system. It is also the critical reference document for the incorporation of estuarine management into the municipal Integrated Development Planning (IDP) and spatial planning processes (e.g. spatial development framework, land use management system / town planning scheme, etc.), as well as relevant national and provincial plans. This EMP comprises the following critical elements, as prescribed in the 2021 NEMP and EMP Guidelines:

- A geographical description and map of the estuary, based on the EFZ;
- A succinct Executive Summary of the SAR, highlighting key information;
- The local vision and overarching objectives (confirmed via stakeholder engagement);
- A priority list of management objectives and activities, established largely through stakeholder engagement, in the form of specific action plans;
- Intended spatial zonation of the system that indicates permissible and non-permissible activities within various proposed zones of the system, to be governed by specific organs of state and respective legislation;
- A detailed integrated monitoring plan with specific management actions, accompanied by a list of performance indicators for the gauging the progress of achieving the objectives of the EMP;
- A description of the institutional capacity and arrangements required for undertaking the identified actions, taking cognisance of the mandates of the implicated departments and institutions, and the existence of local forums; and
- A list of key research needs to address the gaps identified in the SAR, to facilitate effective management of the estuary.

1.4 Structure of the Report

The structure of this EMP is detailed as follows:

- **Chapter 2** provides a summary of the SAR;
- **Chapter 3** delineates the geographical boundaries of the Kowie Estuarine management area;
- **Chapter 4** sets out the Vision and Key Objectives for the management of the Kowie Estuary. It describes the desired future state for the system and provides the overarching logical framework for the action plans that have been developed;
- **Chapter 5** sets out the Management Objectives for the Kowie Estuary and includes a list of actions from which management priorities are selected;
- **Chapter 6** provides a description of the Spatial Zonation of the Kowie Estuary;
- **Chapter 7** describes the institutional arrangements for implementation of the EMP;
- **Chapter 8** sets out the Integrated Monitoring Plan required in respect to assessing the performance of the EMP in respect to achieving the stipulated objectives;
- **Chapter 9** provides the recommendations for addressing specific shortfalls or knowledge gaps in the EMP, and the conclusion to the document.

1.5 The Project Team

Habitat Link Consulting, in consultation with Coastwise Consulting, has included a number of specialists in the EMP who have contributed to various aspects of the process (Table 1.1).

Table 1.1: EMP project team.

Team Member	Qualifications	Experience (in years)
Christelle du Plessis Habitat Link Consulting *(Project Manager)*	• MSc Zoology	10
Roberto Almanza Habitat Link Consulting *(Report Writing and Public Participation)*	• MSc Geology	6
Tandi Breetzke Coastwise Consulting *(EMP Specialist)*	• BA Honours (Geography)	25
Catherine Meyer Coastwise Consulting *(Estuarine Ecologist)*	• MSc (Estuarine Ecology)	10
Susan Meiring SMC Consulting *(GIS Specialist)*	• MSc GIS	15
Mlu Matebese Leesa Social Facilitators *(Social Facilitator)*	• BA Communication	5

A close relationship between the project team, the Eastern Cape Department of Economic Development, Environmental Affairs and Tourism (DEDEAT) and their elected representatives, as well as the Ndlambe Local Municipality, has been maintained during the compilation of the Kowie EMP.

2. Summary of Situation Assessment

2.1 Overview

The first phase in the process of developing the EMP is an assessment of the *status quo* via a Situation Assessment, which explores and contextualises the Kowie Estuary relative to various environmental, social and economic aspects. The key findings of this assessment are captured below in order to prepare for the management planning process.

The Situation Assessment Report (SAR) locates the Kowie Estuary within the Ndlambe Local Municipality along the Eastern Cape coastline. A description of the broader catchment, including the catchment geology, climate, runoff, and land-use, is provided in the SAR. The current status of the estuary is then described through an assessment of the ecological characteristics and functioning of the system, its health status and importance, as well as the ecological goods and services it provides. Thereafter, the broader socio-economic context of the region and the social uses and activities that it supports are described. Current and potential impacts and/or impacting activities or threats to the ecological functioning of the system are detailed and the legal instruments and related strategies and plans, which impact the management of the estuary, along with the current institutional structures governing estuarine management, are listed.

The SAR concludes by detailing opportunities and constraints, which should be used to develop the necessary responses or actions, and by making recommendations to address identified information gaps for the EMP.

2.2 Legislative Instruments

The development of the EMP as well as the management of activities taking place in and around the EFZ is subject to various legislative requirements in terms of South African environmental law. Amongst others, the following legislation bears relevance to the development of an EMP for the Kowie Estuary:

Integrated Coastal Management Act (ICM Act)

The ICM Act is the key legislation relevant to the planning and the control of activities within the coastal zone, including estuaries. The ICM Act aims to facilitate the efficient and coordinated management of all estuaries, in accordance with the NEMP (or 'the Protocol') and EMPs for individual estuaries. The NEMP provides a national policy for estuarine management and guides the development of individual EMPs.

National Environmental Management Act (NEMA)

In terms of NEMA, estuaries require specific attention in management and planning procedures, especially those subjected to significant human resource usage and development. Various activities listed in the NEMA EIA Regulations relate to the coastal zone and require an Environmental Authorisation (EA) before they can proceed.

National Water Act (NWA)

Water quality and quantity are mainly controlled under the NWA, which is implemented and controlled by the Department of Water and Sanitation (DWS).

Marine Living Resources Act (MLRA)

The exploitation of marine living resources in South Africa (which includes estuarine resources) is governed by the MLRA. The MLRA defines the species that can be exploited, and protection measures for those species, such as closed areas, closed seasons and size and bag limits.

Other relevant legislation includes the Spatial Planning and Land Use Management Act, the National Environmental Management: Protected Areas Act, the National Environmental Management: Biodiversity Act, the Conservation of Agricultural Resources Act, the National Forests Act, the National Environmental Management: Air Quality Act, the National Environmental Management: Waste Act, the National Heritage Resources Act, National Health Act and Local Government: Municipal Systems Act.

Further to this, there is specific provincial and local legislation that pertains to estuarine management. The municipal bylaws are the primary instrument utilised by the Ndlambe environmental officers for the protection and management of the local estuarine systems, including the Kowie Estuary.

2.3 Present Ecological State and Desired Ecological State

The overall ecological health of the Kowie Estuary is a C Category (moderately modified). The Kowie Estuary is not part of the core set of priority estuaries in the 2018 National Biodiversity Assessment (NBA) National Estuary Biodiversity Plan, but was ranked as the 33rd most important estuary out of 256 estuaries assessed. The importance rating was given as 'Important to Very Important'. Furthermore, the Kowie Estuary is among the list of very important nursery areas, in terms of overall fish biodiversity, particularly for juvenile dusky kob and spotted grunter. Given that a large portion of the estuary has been irreversibly transformed by urban development and its associated impacts, the likelihood of implementing major changes that would not be detrimental to socio-economics of the area is fairly low. The Recommended Ecological Category (REC) for the Kowie Estuary was prescribed as Category C.

2.4 Goods and Services

Recreational use of the system is high, with the main activities being power-boating, water skiing, recreational and subsistence fishing, bait harvesting, kayaking/canoeing, and swimming. Commercial value of the estuary waterbody is related to the property market associated with the town of Port Alfred, the Royal Alfred Marina and the berthing of vessels in the small craft harbour. In terms of the economic value of estuaries and the ecosystem goods and services they provide, estuaries are globally recognised as being one of the most productive ecosystem types. The estimated values for the Kowie Estuary are as follows: Subsistence value of R 183 912 / annum; Property value of R 613.1 million; Recreational/tourism value of R 20 million / annum; and Nursery value of R 7.8 million / annum. The recreational and property values, in particular, are among the highest of the estuaries of the temperate coastline.

2.5 Socio-Economic Context

The population of the Ndlambe Local Municipality increased by 1.12 % over the ten-year period between 2001 and 2011. The bulk of the migration patterns experienced within the municipality are due to the influx of holiday makers (approximately 33 000) in the peak season. The influx of seasonal holiday makers equates to approximately 56 % of the permanent resident population and places tremendous pressure on the available infrastructure of the area. The economic activities of the municipality are largely focussed on the tourism and agricultural sector as the main economic drivers, with the services sector main source of permanent employment opportunities. Of the economically

active youth (15 to 34 years old), 39 % are unemployed. The value of the Kowie Estuary is linked to its recreational use, which peaks in holiday seasons. The estuary is a key fishing and bait collection area and is a nursery ground for numerous favoured marine fish species. Public access to the estuary is thus of great importance, but due to the largely built-up nature of the lower reaches of the Kowie Estuary, a number of areas remain inaccessible to the public.

2.6 Current or Potential Pressures and Impacts

There are numerous activities and developments that pose a threat to the future health state of the Kowie Estuary. It is evident that the system has experienced a loss and change in natural habitat and biota, although the basic ecosystem functions and processes are largely unchanged. There are numerous activities and developments that currently impact and pose a threat to the future health state of the estuary (Table 2.1).

Table 2.1: Current impacts and threats facing the Kowie Estuary.

NATURAL HAZARDS ASSOCIATED WITH CLIMATE CHANGE	
Drought	Given the semi-arid, low rainfall climate of the region, baseflow supply to the Kowie Estuary is already limited and has been altered by severe droughts in the region.
Flooding	The modification of the system through canalisation, and the extensive development in the EFZ, renders the system vulnerable to severe flood damage and unnatural erosion.
Sea-level rise	Climate change impacts, which affect sea level rise and increase the propensity for storm surges, will have a significant impact on the functioning of the estuary.
LAND USE IMPACTS	
Urban development	Extensive development occurs within the lower reaches of the Kowie EFZ. Failing bank stabilisation presents a navigation hazard and there are also several pipelines (sewage, bulk water services) which traverse the bed of the estuary in different locations. The system is subject to very high noise pollution from numerous anthropogenic sources.
Agricultural Activities	Changes in crops and farming methods in the catchment have likely affected the sediment load entering the river and estuary. It is possible that agricultural activities and trampling by livestock within the EFZ contributes to siltation, poor water quality and habitat degradation and fragmentation.
WATER QUANTITY AND QUALITY	
Altered Flow and Flood Regime	There has been some modification to the baseflow through abstraction in the catchment both for agriculture and potable water supply. In addition, saline water is being abstracted from the Kowie Estuary for use at the Reverse Osmosis (RO) plants.
Invasive Alien Plant Species	Terrestrial alien vegetation species within the Kowie catchment contributes to the reduction in freshwater flow reaching the estuary.
Waste Management	Littering and solid waste disposal are a key factor contributing to water pollution in the urbanised area of the EFZ. Leachate from the landfill site can also lead to both surface and groundwater pollution.
Water Quality Deterioration	Agricultural return flows, urban run-off, stormwater pollution, effluent discharge, brine effluent, malfunctioning/damaged sewage infrastructure, domestic solid waste and litter and water pollution from vessels are contributing to a decline in water quality in the Kowie Estuary In addition, increased nutrient inputs has resulted in visible macroalgal blooms in areas with reduced connectivity to the main channel.

EXPLORATION OF NATURAL RESOURCES	
Fishing and Bait Harvesting	Fishing as well as bait harvesting pressure, specifically for mudprawns, is high, particularly during peak holiday periods. Illegal harvesting of mudprawns and inappropriate harvesting methods are prevalent and can cause noteworthy damage to intertidal habitat.
Urban Development	The natural assets of the area have been exploited for their tourism and aesthetic value. This has resulted in extensive urban development in the EFZ and the resultant loss of estuarine habitat, as well as fragmentation and degradation of the remaining habitat.
Livestock Grazing	The main saltmarsh area as well as some areas in the middle to upper reaches are impacted by cattle grazing and movement.
Recreational Use	High speed powerboating and skiing results in the erosion of estuary banks, salt marsh vegetation and sensitive *Zostera* beds, and disturbance to wading bird populations, affecting the functional value of the estuary
Reverse Osmosis Plant	The return of hypersaline concentrate to the estuary may have negative impacts on the estuary water quality.
Alien Fish Species	Alien fish species (e.g. Mozambique tilapia and Largemouth bass) pose a threat to the indigenous species of the Kowie Estuary, particularly larval and juvenile life stages that would serve as prey food resources.

2.7 Opportunities and Constraints

A number of strengths, weaknesses, opportunities and threats have been identified in relation to the Kowie Estuary and its current situation and management. Stakeholders have suggested that, in order to prevent further habitat loss and reduce cumulative impacts, any development within the EFZ (outside of the existing urban edge) should be severely restricted. From an infrastructure point of view, stakeholders have indicated that the priority should be the maintenance and reconstruction of the collapsing stone wall banks between the Nico Malan Bridge and the river mouth, as this will become a navigational problem and will be unsightly. Other restoration should include the restoration, rehabilitation and ongoing maintenance of the salt marsh areas especially on the eastern bank adjacent to the Nico Malan Bridge, in order to reconnect these areas from a hydrological perspective.

2.8 Information Gaps to be Addressed in the Plan

Recommendations regarding future studies include bathymetry studies of the whole system, additional benthos studies, studies on marine megafauna, determination of the ecological reserve, long-term monitoring of invertebrates, monitoring of catch and effort data for recreational and small-scale fisheries and studies on the extent and importance of the River-Estuarine Interface (REI).

3. Geographical Boundaries

3.1 The Kowie River Catchment

The Kowie Estuary is located at the interface between the Kowie River and the Indian Ocean and falls within the Mzimvubu-Tsitsikamma Water Management Area (WMA 7). The Kowie River spans three (3) quaternary catchments, namely P40A (south-east of the Grahamstown/Makhanda area), P40B (north-west of Bathurst) and part of the P40C (Port Alfred and adjacent interior) (Figure 3.1).

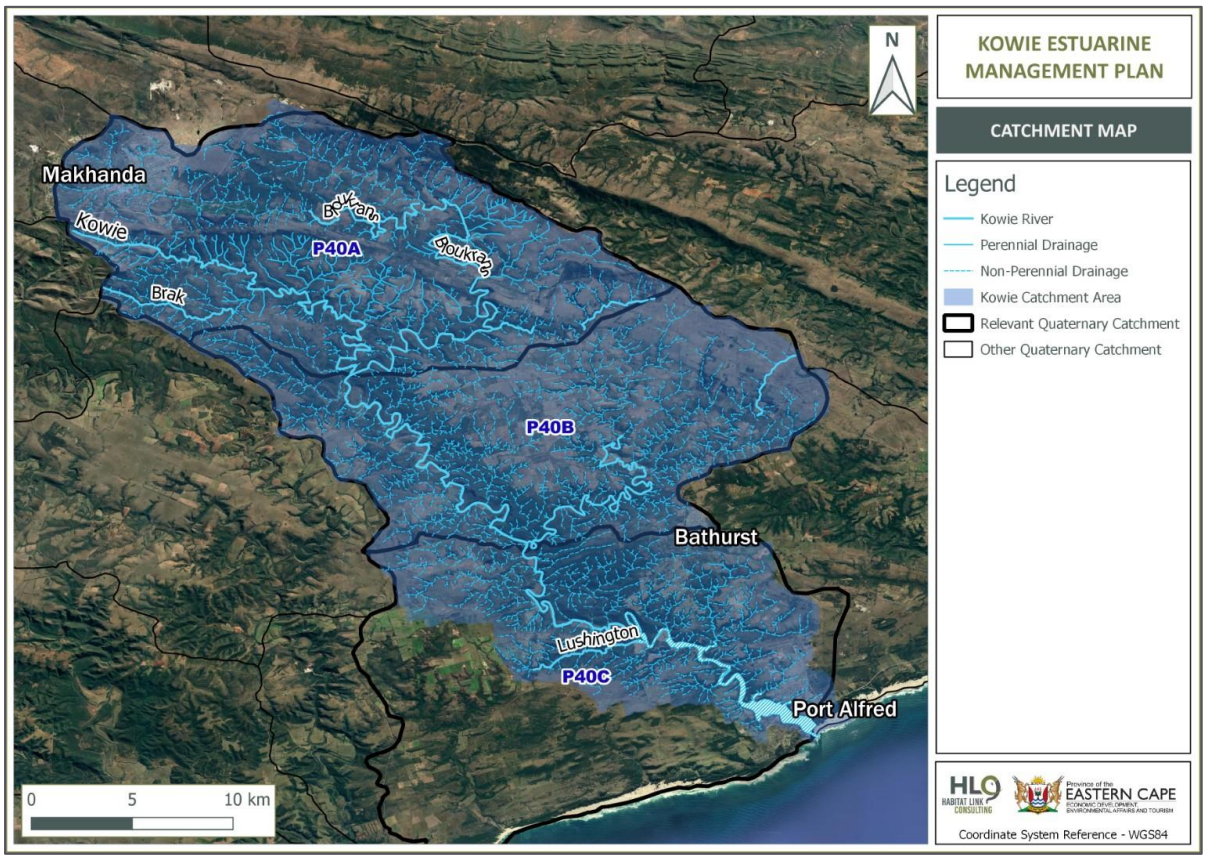

Figure 3.1: Quaternary catchments relevant to the Kowie River.

3.2 The Kowie Estuarine Functional Zone

The 2021 NEMP acknowledges the EFZ as the geographical boundary of an estuary in South Africa[1]. The Kowie Estuary extends 21 km upstream where its tidal influence ends at the 'Old Weir' (Table 3.1 and Figure 3.2).

Table 3.1: Geographical boundaries of the Kowie Estuary.

Downstream boundary	33°36'13.053" S; 26°54'5.882" E
Upstream boundary	33°32'40.98" S; 26°47'53.62" E
Lateral boundaries	5 m contour above Mean Sea Level (amsl) along each bank

[1] According to the 2014 EIA Regulations, the 'estuarine functional zone' means "the area in and around an estuary which includes the open water area, estuarine habitat (such as sand and mudflats, rock and plant communities) and the surrounding floodplain area, as defined by the area below the 5 m topographical contour (referenced from the indicative mean sea level)".

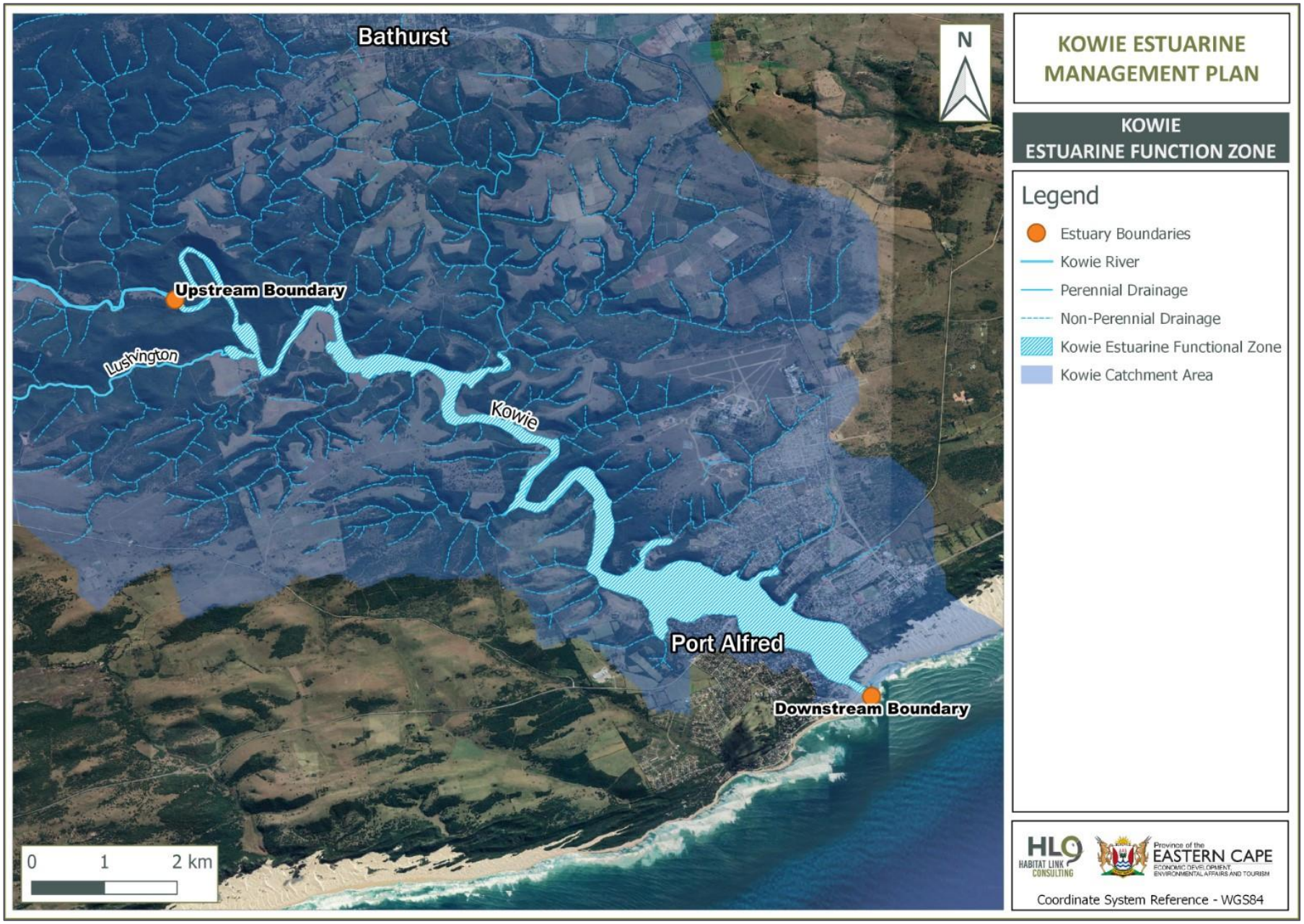

Figure 3.2: Geographical boundaries of the Kowie Estuary corresponding as captured in the 2018 National Biodiversity Assessment (Van Niekerk *et al.*, 2019).

4. Vision and Objectives

4.1 Vision

Based on subsequent discussions with key stakeholders and specialists, the following vision is proposed:

The Kowie Estuary is a healthy, resilient system which supports a rich biodiversity and provides safe recreational and economic opportunities, while preserving heritage land uses to ensure that its scenic beauty and cultural significance is maintained

4.2 Key Objectives

There are several 'categories' for objectives as prescribed by the EMP guidelines (Figure 4.1). For the Kowie Estuary, the overarching or 'Key Objectives' have been detailed according to the issues identified in the SAR.

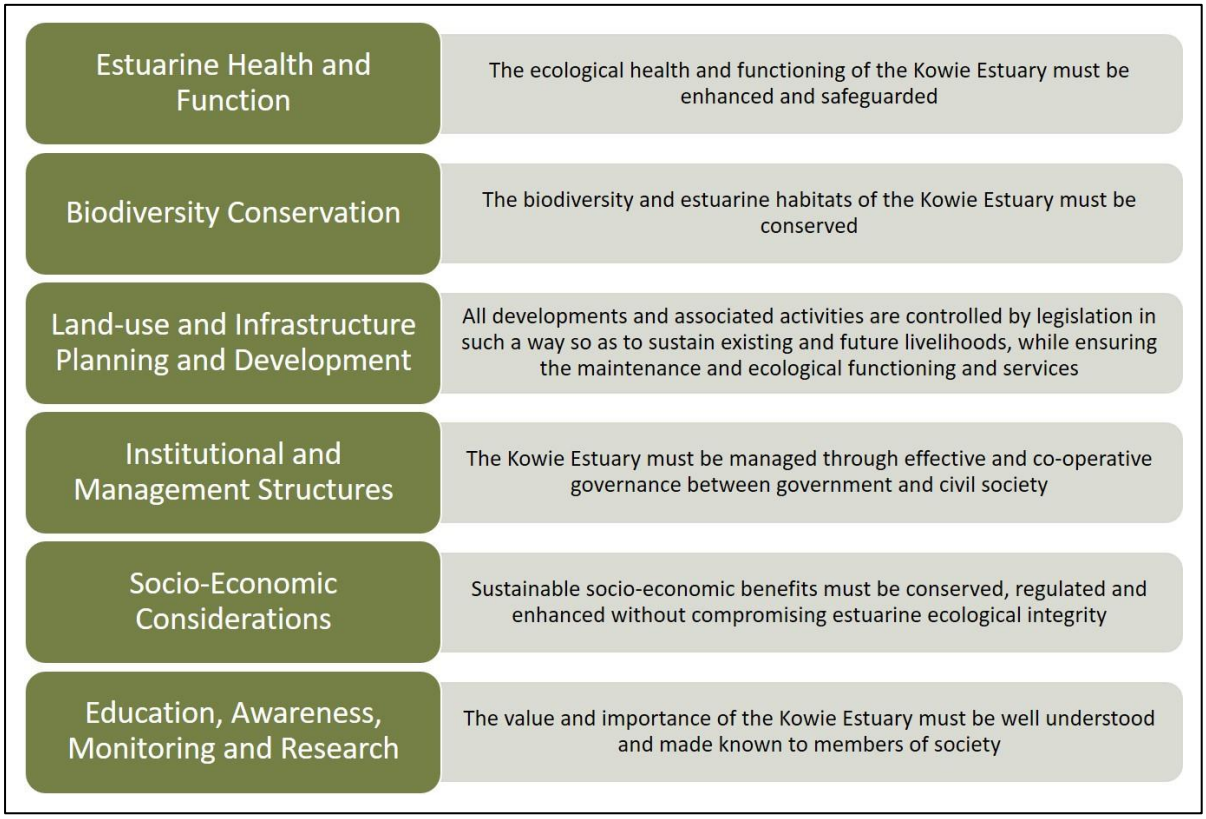

Figure 4.1: Key objectives relevant to the management of the Kowie Estuary.

5. Management Objectives, Actions & Priorities

The management objectives and actions were informed by the Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis undertaken during the Situation Assessment. Management objectives are grouped according to the key objectives, sectors or categories of issues (Figure 5.1). Proposed actions are unpacked for each management objective in the tables that follow, which also detail the ecological and socio-economic consequences of no action. These actions are assigned performance indicators in order to ensure that they are suitably achieved. The priority is ranked and the responsibility assigned for each action item (Table 5.1 – 5.6). This process includes both the required summary of management objectives requirements as well as the recommended management priorities requirements as detailed in the national guideline.

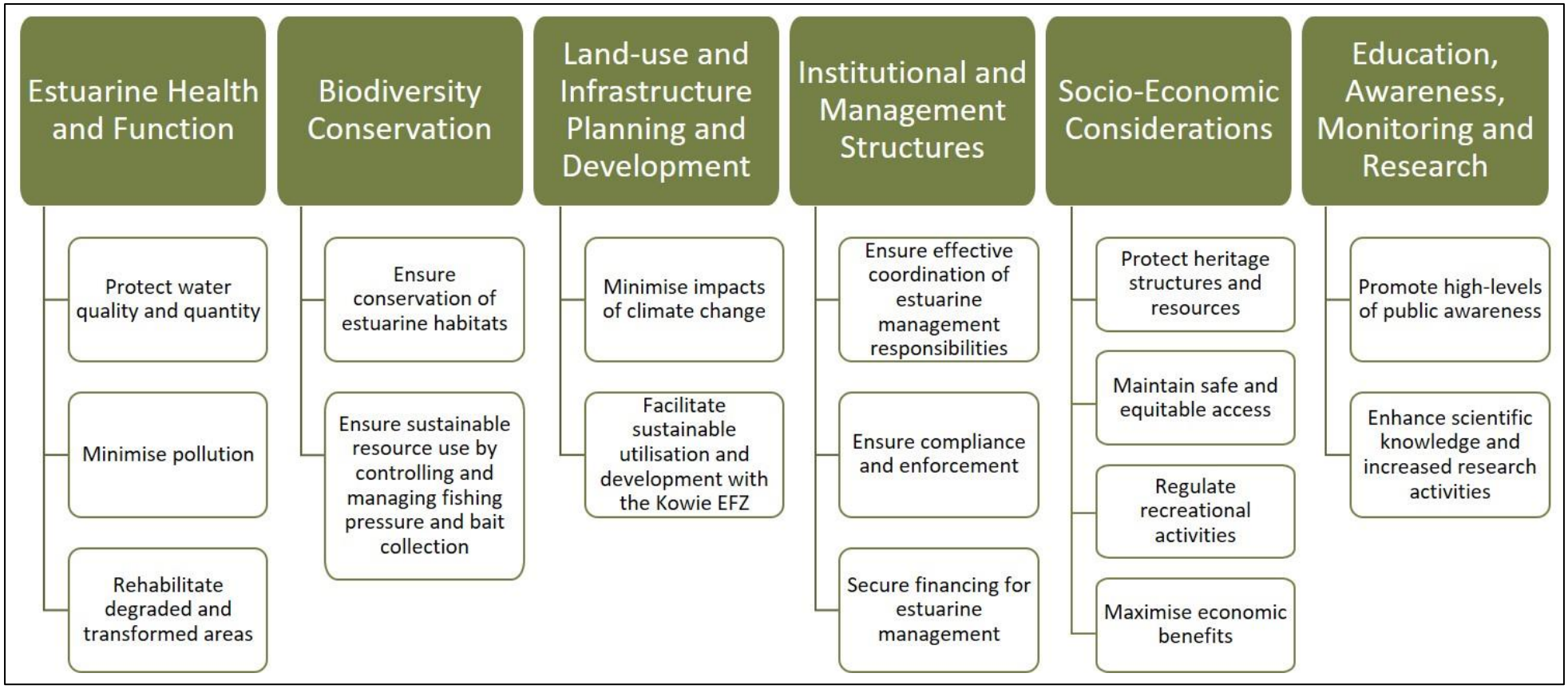

Figure 5.1: Key Management Objectives for the Kowie Estuary.

5.1 Estuarine Health and Function

The estuarine health and function key objective is subdivided into the following specific management objectives:

1. Protect water quality and quantity
2. Minimise pollution
3. Rehabilitate degraded and transformed areas

Table 5.1: The proposed actions associated with the abovementioned specific management objectives are detailed below.

Proposed Actions		Consequence of No Action	Performance Indicator	Priority	Responsibility
1.	Protect Water Quality and Quantity				
A	Develop a catchment management plan to support the EMP	Further degradation of the estuary, potential unsustainable abstraction and loss of services provided Risk to biodiversity: High Risk to socio-economics: High	• Freshwater baseflows reaching the estuary are maintained as per the outcome of the Reserve Determination • Resource Quality Objectives (RQOs) are adopted	MEDIUM	DWS
B	Finalise and adopt outcomes of the Reserve Determination[2] for the Kowie River catchment			HIGH	DWS
C	Prevent illegal abstraction and manage impoundments within the catchment in line with the Reserve Determination.			HIGH	DWS / Landowners
D	Continued removal of alien vegetation in riverine habitats according to a structured and approved IAP control plan	Continued spread of invasive species and resultant loss of freshwater inputs Risk to biodiversity: Medium Risk to socio-economics: Medium	• Level of infestation established • Priority species and areas identified • Engagements with farmers as well as DFFE Working for programmes e.g. Working for Water (WfW) and Working for the Coasts (WfC) • Training / education undertaken where required • Commitment obtained by farmers/DFFE for IAP control • Targets set (and achieved) for removal of alien vegetation	MEDIUM	DRDAR / DFFE / Ndlambe LM / Farmers' Associations
E	Implement agricultural best practice within the catchment in terms of irrigation, fertilisation, tilling,	Continued pollution of system and resultant negative impacts on biodiversity, tourism and human health Risk to biodiversity: High	• Education / awareness raising campaign undertaken with farmers (crop/industry specific)	MEDIUM	DRDAR / Ndlambe LM

[2] A Water Resource Classification Study is in progress for the Keiskamma and Fish to Tsitsikamma catchment areas.

	Proposed Actions	Consequence of No Action	Performance Indicator	Priority	Responsibility
	sustainable stocking rates (to prevent overgrazing and erosion), avoiding wetlands, etc.	Risk to socio-economics: Medium	• Commitment from farmers to implement best practice. • Targets for water reduction per hectare irrigated for crops (where feasible) • Improved quality of agricultural return flow • Increased river flow to estuary • Recovery of riparian margin and wetland areas • Inappropriate use of inorganic fertilisers reduced		/ Farmers' Associations
F	Continue to promote regulated saline water abstraction for reverse osmosis while ensuring that process effluent does not adversely impact on estuarine water quality	Unsustainable freshwater resource use and resultant over-abstraction from the upper catchment Risk to biodiversity: High Risk to socio-economics: Medium	• Measurable increases in usable water from (and ongoing operationality) of the RO plants • Effluent discharge in keeping with authorisation	LOW	Ndlambe LM
2.	Minimise Pollution				
A	Appoint a task team to identify point and non-point pollution sources	Continued pollution of system and resultant negative impacts on biodiversity, tourism and human health Risk to biodiversity: High Risk to socio-economics: High	• Meeting convened between DEDEAT and Ndlambe LM • Pollution task team commissioned • Critical pollution sources identified	MEDIUM	Ndlambe LM / DEDEAT
B	Develop a pollution action plan in response to the pollution study, which identifies appropriate strategies to reduce pollution in its various forms from the different sources		• Inter-departmental consultations • Pollution action plan compiled • Action items recorded in departmental budgets and project programmes	MEDIUM	Ndlambe LM
C	Improve solid waste management within waterside precincts		• Ensure that the municipal landfill site complies with permit conditions, IWMP and NEM:WA • Regular compliance monitoring undertaken • Regular maintenance undertaken and system is operating effectively and according to specification (limited / no non-compliance) • Penalties issued for non-compliance • Negligible impacts on estuarine water quality	HIGH	Ndlambe LM
D	Implement a reward-based litter collection and/or recycling programme			MEDIUM	Ndlambe LM
E	Monitor and address/mitigate (any) leachate as well as wind-blown litter from landfill site			HIGH	Ndlambe LM / DWS / DEDEAT
F	Continue to monitor effluent discharge water quality, especially from the Port Alfred Wastewater Treatment Works to			HIGH	Ndlambe LM / DWS

	Proposed Actions	Consequence of No Action	Performance Indicator	Priority	Responsibility
	ensure that effluent is being treated effectively				
G	Maintain and repair sewage infrastructure on an ongoing basis			HIGH	Ndlambe LM
H	Sewer master plan to take cognisance of EMP (i.e. sensitivity of the system, the RQOs when developed), with specific contingencies developed for estuary / floodplain-based infrastructure		• Infrastructure and planning department ensure development proposals align with EMP	MEDIUM	Ndlambe LM
I	Implement monitoring and management of effluent from businesses located within and adjacent to the EFZ		• Ongoing engagement with businesses and landowners, specifically in high-density areas • Development and implementation of action plan	HIGH	Ndlambe LM
J	Investigate alternative means of domestic sewage disposal (i.e. replacement of aged septic tanks and sewage infrastructure)			HIGH	Ndlambe LM
K	Revise and amend boating bylaws to include correct management of ancillary activities such as refuelling		• Environmental and legal review of boating bylaws undertaken • Gazetting of amended boating bylaws	LOW	Ndlambe LM
L	Ensure compliance with authorisation conditions for existing developments in and adjacent to the EFZ (e.g. Building approval, WULs and/or EAs)		• Due diligence and compliance audit of existing authorisations	MEDIUM	DEDEAT / DWS / Ndlambe LM
M	Monitor stormwater quality along major discharge points	Continued contaminated stormwater run-off, erosion and sedimentation Risk to biodiversity: High Risk to socio-economics: High	• SuDS investigation included in municipal infrastructure management budget • Training for officials convened and attended • SuDS applied by building control and technical services • Increased vegetated margin and 'natural' habitat where feasible • Improved overall habitat integrity as per resource monitoring outlined in Section 8.1	MEDIUM	Ndlambe LM
N	Install mesh screens at stormwater outlets to prevent large-scale litter from entering the estuarine system			HIGH	Ndlambe LM
O	Investigate opportunities for the installation of Sustainable urban drainage systems (SuDS) and ecological infrastructure to control stormwater run-off			MEDIUM	Ndlambe LM

	Proposed Actions	Consequence of No Action	Performance Indicator	Priority	Responsibility
3.	Rehabilitate Degraded and Transformed Areas				
A	Develop and implement a strategic rehabilitation plan (with ongoing care of rehabilitated areas)	Continued degradation of the estuarine habitat and biodiversity within the EFZ Risk to biodiversity: High Risk to socio-economics: High	• Rehabilitation plan developed and implemented • Priority degraded areas repaired / restored (taking NEMA / NWA into account) • Annual review of rehabilitated areas for ongoing maintenance	MEDIUM	DEDEAT / Ndlambe LM
B	Lobby for landowners to maintain / rectify damages / degraded areas on their property within the EFZ, as required (e.g. clearance/erosion on agricultural land, damaged/failing infrastructure along residential properties)		• Education / awareness raising campaign undertaken with relevant landowners • Degraded areas in the EFZ restored (e.g., planting of estuarine / coastal species and rehabilitation of estuarine margin) • Rehabilitate the margins of the marina to recreate shallow water refuge • Ongoing maintenance of all erosion defence interventions	MEDIUM	Ndlambe LM

5.2 Biodiversity Conservation

The biodiversity conservation key objective is subdivided into the following specific management objectives:

1. Ensure conservation of estuarine habitats
2. Ensure sustainable resource use by controlling and managing fishing pressure and bait collection

Table 5.2: The proposed actions associated with the abovementioned specific management objectives are detailed below:

	Proposed Actions	Consequence of No Action	Performance Indicator	Priority	Responsibility
1.	Ensure Conservation of Estuarine Habitats				
A	Ensure the estuary is appropriately zoned (including buffer zones) within the Ndlambe SDF to support the conservation of the estuarine ecosystem at a municipal level	Continued loss / degradation of EFZ and estuarine resources. Disturbance to, and over exploitation of, living resources Risk to biodiversity: High Risk to socio-economics: High	• Engagement with landowners regarding zonation held and agreement reached • Environmental protection of the Kowie Estuary provided for in the Ndlambe SDF • Management controls disseminated	HIGH	Ndlambe LM
B	Proposed conservation areas as per the EMP zonation plan to be adopted by the Ndlambe SDF and other spatial plans		• Landowners notified of EMP zonation (and associated restrictions contained in the management controls)	LOW	Ndlambe LM / DEDEAT / ECPTA
C	Inclusion of parts of the estuary into one (or some) of the existing protected areas within the upper EFZ and wider catchment	Additional demands on local municipality conservation management beyond their current capacity Risk to biodiversity: Medium Risk to socio-economics: Low	• Feasibility of informal / formal protected areas investigated • Proclamation of conservation areas to be implemented where possible • Meetings / workshops convened with DFFE / DEDEAT and/or ECPTA • Formal motivation submitted for consideration	LOW	Ndlambe LM / DEDEAT / ECPTA
D	Protect areas of conservation importance as identified in the EMP zonation plan (Chapter 6)	Continued loss / degradation of EFZ and estuarine resources. Risk to biodiversity: Medium Risk to socio-economics: Medium	• Reduced habitat disturbance / degradation / loss • Protection of identified habitats	MEDIUM	DEDEAT / Ndlambe LM
E	Revise and amend boating bylaws to support EMP zonation (e.g. no-wake zones)		• Improved habitat integrity and general estuarine health and appearance • Reduced noise and wake causing activities, particularly in the vicinity of wetland feeding areas	MEDIUM	Ndlambe LM
F	Demarcate specific zones using signage / buoys / markers	Ongoing inappropriate activities, behaviour and potential accidents. Loss of habitats and impacts on biodiversity	• Reduction / eradication of invasive fish populations. • Markers / buoys / signage installed	MEDIUM	Ndlambe LM

	Proposed Actions	Consequence of No Action	Performance Indicator	Priority	Responsibility
		Risk to biodiversity: Medium Risk to socio-economics: Medium	• Increased compliance monitoring during peak holiday season		
2.	Ensure Sustainable Resource Use by Controlling and Managing Fishing Pressure and Bait Collection				
A	Design and implement permitting system to control fishing and bait collection	No control of estuarine resources and resultant negative impacts on biodiversity and tourism Risk to biodiversity: High Risk to socio-economics: High	• Permitting system for fishing and bait harvesting implemented • Enforcement of fishing and bait harvesting regulations including permit requirement • Fishing sector managed appropriately, including the small-scale and subsistence fishers • Reduction / eradication of invasive fish populations • Designated zones demarcated and enforced (in respect to boating and fishing controls)	MEDIUM	Ndlambe LM / DFFE Fisheries
B	Enforce regulations as per the Marine Living Resources Act (MLRA) (i.e. bag limits, size limits, gear restrictions)			MEDIUM	
C	Restrict fishing and bait harvesting in no-take zones			MEDIUM	
D	Investigate and implement options for the effective control of alien fish (e.g. fishing competitions for targeted species)			HIGH	
E	Demarcate specific zones using signage / buoys / markers	Ongoing inappropriate activities, behaviour and potential accidents. Loss of habitats and impacts on biodiversity Risk to biodiversity: Medium Risk to socio-economics: Medium		MEDIUM	Ndlambe LM

5.3 Land-use and Infrastructure Planning and Development

The key objective regarding land-use and infrastructure planning and development is subdivided into the following specific management objectives:

1. Minimise impacts of climate change
2. Facilitate sustainable utilisation and development within the Kowie EFZ

Table 5.3: The proposed actions associated with the abovementioned specific management objectives are detailed below:

	Proposed Actions	Consequence of No Action	Performance Indicator	Priority	Responsibility
1.	Minimise Impacts of Climate Change				
A	Undertake climate change/sea-level rise risk assessment	Continued degradation of EFZ and negative impacts on biodiversity, tourism and human health and potential damage to property and loss of human life Risk to biodiversity: Medium Risk to socio-economics: High	• Sea level rise implications and coastal risk determined • Consultation undertaken • CML lines designated	MEDIUM	DEDEAT
B	Determine and designate the Coastal Management Line (CML)			MEDIUM	DEDEAT
C	Specific engagement with property owners within the EFZ / seaward of the CML in respect to potential risk and responses/interventions (e.g. innovative building techniques)		• Engagement with property owners regarding risks and appropriate interventions • Contingency plans developed for infrastructure at risk	HIGH	DEDEAT / Ndlambe LM
D	Update building restrictions & develop construction guideline for properties at risk			HIGH	Ndlambe LM
E	Obtain environmental authorisation for the construction, repair and/or maintenance of defence structures in high risk areas		• Determination of priority maintenance areas and rectification thereof • Cost of stabilisation and defence structures included in annual budget • Relevant authorisations obtained • Implementation of approved maintenance activities	HIGH	Ndlambe LM
F	Prevent bank erosion and repair damage to existing bank stabilisation infrastructure as per current / future approved Maintenance Management Plans			HIGH	Ndlambe LM
2.	Facilitate Sustainable Utilisation and Development within the Kowie EFZ				
A	Screen all new development activities in terms of environmental legislation to ensure compliance	Unsustainable development practice, changes to estuary marginal habitats, impacting on estuary processes and potential environmental damage Risk to biodiversity: High Risk to socio-economics: High	• Contact details of where transgressions can be reported provided • Effective reporting channels in place to ensure enforcement of legal requirements	MEDIUM	DEDEAT
B	Ensure maintenance and correct operation of existing facilities (e.g.			HIGH	DEDEAT / Ndlambe LM

	Proposed Actions	Consequence of No Action	Performance Indicator	Priority	Responsibility
	industries, restaurants, tourism facilities etc.) in line with SZP & by-laws		• Inspections undertaken / increased visibility of control		
C	Undertake strict compliance monitoring for new structures being built		• New developments and modifications are legally compliant • Transgressors prosecuted	MEDIUM	DEDEAT
D	Restrict and limit new developments according to EMP zonation		• Corrective action undertaken / effective results of increased inspections	MEDIUM	DEDEAT / Ndlambe LM
E	Encourage environmentally friendly developments and maintain sound and innovative building techniques		• Land use control decisions influenced (e.g., appropriate development only in disturbed areas of EFZ, implement SuDS, prevent removal of indigenous vegetation etc.) • No further loss of indigenous vegetation and habitat • Stormwater regulated on-site	LOW	DEDEAT / Ndlambe LM
F	Review dredging maintenance/management plan for Royal Alfred Marina and any other required dredging activities		• Dredging maintenance management plan reviewed, revised and approved via a stakeholder engagement process	LOW	Ndlambe LM
G	Removal / rehabilitation of jetties and slipways as per existing and future surveys		• Jetties and slipways database updated and maintained • All jetties and slipways are compliant • Non-compliant and unidentified (no owners) structures removed from the estuary	MEDIUM	DEDEAT / Landowners
H	Encourage use of communal jetties between neighbouring properties and remove the need for excess jetties			MEDIUM	DEDEAT / Landowners

5.4 Institutional and Management Structures

The institutional and management structure's key objective is subdivided into the following specific management objectives:

1. Ensure effective coordination of estuarine management responsibilities
2. Ensure compliance and enforcement
3. Secure financing for estuarine management

Table 5.4: The proposed actions associated with the abovementioned specific management objectives are detailed below:

Proposed Actions		Consequence of No Action	Performance Indicator	Priority	Responsibility
1.	Ensure Effective Coordination of Estuarine Management Responsibilities				
A	DEDEAT to obtain agreement from organs of state and other participating agencies with respect to their roles and responsibilities in estuarine management (and the implementation of this EMP)	Uncoordinated and ineffective implementation of EMP. Risk to biodiversity: Medium Risk to socio-economics: Medium Potential damage to EFZ with resultant negative impacts on biodiversity, tourism, property and human health Risk to biodiversity: High Risk to socio-economics: Medium	• Applicable agreements reached and signed between RMA and spheres of government and participating agencies	HIGH	DEDEAT
B	Define and co-ordinate estuarine management responsibilities		• Estuarine management coordination function assigned / established in Ndlambe	HIGH	DEDEAT
C	Establish an Estuary Advisory Forum (EAF) to link local and provincial role-players		• EAF appointed in the long term • Reports on the progress of EMP actions and achievements	MEDIUM	DEDEAT
D	Identify human resource and infrastructure needs for estuarine management		• Need and Desirability investigation undertaken	MEDIUM	DEDEAT / Ndlambe LM
E	Address training needs with the Ndlambe Local Municipality		• Motivation for acquisition drafted and approved • Official(s) attend accredited estuarine management course	MEDIUM	DEDEAT / DFFE / Ndlambe LM
F	Acquire necessary equipment (e.g. water quality monitoring equipment, patrol boats etc.)		• Equipment purchased and maintained	MEDIUM	DEDEAT / DFFE / Ndlambe LM
G	Incorporate the EMP into the IDP and SDF plans for the municipality as well as into relevant municipal legislation and planning programmes		• Environmental protection of the Kowie Estuary provided for in the Ndlambe SDF & IDP • Update river bylaws to include key estuarine issues	HIGH	Ndlambe LM

	Proposed Actions	Consequence of No Action	Performance Indicator	Priority	Responsibility
			• Municipal peak season planning programme to be implemented / updated to manage effects from peak season tourism		
H	Establish and manage a voluntary community monitoring team to monitor site-specific EMP compliance and manage the data collected	Uninformed stakeholders and unrealised potential for community involvement Risk to biodiversity: Medium Risk to socio-economics: Medium	• Voluntary champion / team details captured • Regular communication with voluntary team • Results of monitoring collated and documented	LOW	DEDEAT
I	Maintain a stakeholder database for the dissemination of information		• Stakeholder database developed and regularly updated • Engagement with tourism / hospitality industry	MEDIUM	DEDEAT / Ndlambe LM
J	Develop and maintain estuaries information repository and database		• Critical data and information collected and managed	LOW	DEDEAT
2.	Ensure Compliance and Enforcement				
A	Review of current compliance and enforcement operations	Unregulated recreational use of estuary / overexploitation, habitat disturbance and degradation, user conflict and safety risks Risk to biodiversity: Low Risk to socio-economics: Medium	• Review the needs of the compliance and enforcement officers • Budget to be approved • Training of EMIs, deployment of EMIs • Increased patrols • Equipment purchased and maintained • Corrective action undertaken / effective results of increased inspections	MEDIUM	DEDEAT / DFFE / Ndlambe LM
B	Implement penalties and fines system to be issued to offenders via relevant local and provincial legislation.		• Transgressors prosecuted	MEDIUM	DEDEAT / DFFE / Ndlambe LM
3.	Secure Financing for Estuarine Management				
A	Individual government agencies to make provision for the necessary resources in the short, medium and long-term expenditure frameworks to create and fill posts, and acquire necessary infrastructure and resources for effective management of the Kowie Estuary	Ineffective implementation of EMP, Potential damage to EFZ with resultant negative impacts on biodiversity, tourism, property and human health Risk to biodiversity: Medium Risk to socio-economics: Medium	• Funds secured for 5 years • An action plan for securing future funding drafted and approved	HIGH	CoGTA / DEDEAT / Ndlambe LM

	Proposed Actions	Consequence of No Action	Performance Indicator	Priority	Responsibility
B	Individual government agencies to develop long-term financial plans			MEDIUM	COGTA / DEDEAT / Ndlambe LM
C	Local budget to be set aside for management activities			HIGH	Ndlambe LM
D	Implement fundraising activities			LOW	DEDEAT / Ndlambe LM

5.5 Socio-economic Considerations

The socio-economic considerations key objective is subdivided into the following specific management objectives:

1. Protect heritage structures and resources
2. Maintain safe and equitable access
3. Regulate recreational activities
4. Maximise economic benefits

Table 5.5: The proposed actions associated with the abovementioned specific management objectives are detailed below:

	Proposed Actions	Consequence of No Action	Performance Indicator	Priority	Responsibility
1.	Protect heritage structures and resources				
A	Existing heritage structures (e.g. shipwrecks, historical buildings and structures) to be safeguarded and maintained/restored where necessary.	Transgression of legislation, loss of heritage resources and impacts on tourism and sense of place Risk to biodiversity: Low Risk to socio-economics: Medium	• Designated zones demarcated and enforced (in respect to boating and fishing controls) • Markers / buoys / signage installed	MEDIUM	ECPTA / SAHRA / Ndlambe LM
B	Maritime and Underwater Cultural Heritage (MUCH) resources to be protected and the relevant heritage resource authorities to be consulted regarding any relevant activities within the estuary.		• Engage with SAHRA and ECPTA regarding any future development within the EFZ	MEDIUM	ECPTA / SAHRA / Ndlambe LM
2.	Maintain Safe and Equitable Access				
A	Maintain existing public access points and ensure adequate public access points are made available	Loss of public amenity, conflict and safety risks Risk to biodiversity: Low Risk to socio-economics: High Unprotected / unsafe environment with resultant negative impacts on biodiversity, tourism, property and human health and safety Risk to biodiversity: Low Risk to socio-economics: High	• Budget allocated for on-going maintenance of public access and amenities • Scheduled maintenance programme in place for access areas and infrastructure • Maintenance of bank stabilisations	MEDIUM	Ndlambe LM
B	Prevent unauthorised 'privatisation' of estuarine access areas			MEDIUM	Ndlambe LM
C	Ensure navigability of the estuary by repairing / maintaining bank stabilisations and adjacent infrastructure		• Determination of priority maintenance areas and rectification thereof • Implementation of approved maintenance activities	HIGH	Ndlambe LM
D	Investigate suitable and safe areas for traditional / cultural activities		• Determination of current areas utilised for traditional/cultural areas together with a risk assessment	MEDIUM	Ndlambe LM / CoGTA

	Proposed Actions	Consequence of No Action	Performance Indicator	Priority	Responsibility
			• Engagement with traditional leaders and determination of a way forward aligning with the provisions of the EMP		
3.	Regulate Recreational Activities				
A	Adopt, demarcate and enforce spatial zonation plan (SZP) and its controls	Continued loss / degradation of EFZ and estuarine resources Risk to biodiversity: Medium Risk to socio-economics: Medium	• SZP incorporated into SDF and Land Use Management Scheme (LUMS) • SZP demarcated with markers / buoys / signage if necessary • SZP controls enforced according to bylaws and offenders prosecuted • Reduced habitat disturbance / degradation	MEDIUM	DEDEAT / Ndlambe LM
B	Ensure that public boat mooring and launch sites are well managed	Loss of public amenity, habitat disturbance, ecosystem degradation, conflict and safety risks Risk to biodiversity: Medium Risk to socio-economics: High	• Boat mooring and launch site applications renewed on an ongoing basis • Compliance with EMP and operating procedures • Facilities well maintained	MEDIUM	Ndlambe LM
4.	Maximise Economic Benefits				
A	Promote tourism activities and provide tourism operators with information pertaining to the appropriate usage of the Kowie Estuary in line with the EMP	Potential overexploitation of estuarine resources, decreased income earning opportunities, limited appreciation of estuarine resources and attributes, reduced buy-in from neighbouring land owners Risk to biodiversity: Low Risk to socio-economics: Medium	• Facilities maintained/ upgraded as necessary • Local Economic Development (LED) budget allocated accordingly • Degraded/transformed areas rehabilitated	MEDIUM	Ndlambe LM / ECPTA / Local Tourism Board / Business Chamber
B	Continue to facilitate/support opportunities for activities by commercial operators and/or local communities around services on the estuary and in the EFZ (particularly during peak seasons)			MEDIUM	
C	Impart knowledge and stewardship to encourage 'greener' business practices within the EFZ.			LOW	

5.6 Education, Awareness, Monitoring and Research

The education, awareness, monitoring and research key objective is subdivided into the following specific management objectives:

1. Promote high-levels of public awareness
2. Enhance scientific knowledge and increased research activities

Table 5.6: The proposed actions associated with the abovementioned specific management objectives are detailed below:

	Proposed Actions	Consequence of No Action	Performance Indicator	Priority	Responsibility
1.	Promote High-Levels of Public Awareness				
A	Develop an effective education and awareness programme for the residents and visitors	Potential overexploitation of estuarine resources, limited appreciation of estuarine resources and attributes, reduced buy-in from local communities and visitors Risk to biodiversity: Medium Risk to socio-economics: Medium	• Education programme developed and approved • Educational signage erected at strategic points	MEDIUM	Ndlambe LM / ECPTA / Local Tourism Board
B	Educational material (e.g. posters, pamphlets and webpages) to be developed and published		• Posters and pamphlets erected / disseminated • Utilise relevant municipal webpages and social media • Number of volunteer community monitors trained	MEDIUM	Ndlambe LM / ECPTA / Local Tourism Board
C	Provide an online platform for public comment and grievances (on municipal website)		• Register of grievances and actions maintained on an ongoing basis	LOW	Ndlambe LM
2.	Enhance Scientific Knowledge and Increased Research Activities				
A	Water quality monitoring to be aligned with the RQOs once these are finalised	Habitat disturbance and degradation, overexploitation of estuary living resources and natural environment, conflict Risk to biodiversity: High Risk to socio-economics: Medium	• Required basic monitoring undertaken • Data reported on against RQOs • EMP informed by monitoring results going forward	HIGH	DWS, DFFE
B	Solicit research funding support	Inability to undertake research and resultant lack of knowledge and understanding of systems Risk to biodiversity: Medium Risk to socio-economics: Medium	• Potential funders identified • Funding proposals submitted	MEDIUM	DWS, DFFE, DEDEAT
C	Engage academic and research institutions, organs of state and parastatals to undertake and/or collaborate on priority research projects		• Relevant institutions included in EAF • Consolidated monitoring programme implemented and maintained • Long-term database maintained • Data reported on against RQOs	MEDIUM	DEDEAT,DWS, DFFE

Proposed Actions		Consequence of No Action	Performance Indicator	Priority	Responsibility
			• EMP informed by monitoring results going forward		
D	Further research on system bathymetry, benthos, marine megafauna, invertebrates and REI	Lack of knowledge of estuarine functioning and misinformed management interventions due to lack of or misaligned data. Risk to biodiversity: Medium Risk to socio-economics: Medium	• Relevant studies to be included in relevant budgets • Service providers to be appointed	LOW	DEDEAT, DWS, DFFE

6. Spatial Zonation

There are numerous activities that take place on and in the surrounds of the Kowie Estuary. Spatial zonation of activities within an EFZ is necessary to avoid user conflict and to guide sustainable utilisation without further degradation of the estuarine environment. It also allows for the spatial representation of the desired state, addresses the aims of the management objectives, where applicable, and is informed by the following existing spatial frameworks:

- The geographical boundary of the estuary also indicating important habitats (e.g., floodplain, open water, reed beds, sandflats, etc.);
- The surrounding land uses and existing infrastructure, as per the local town planning scheme;
- Areas designated for the conservation and protection of biodiversity;
- Appropriate buffers in which land use and development are strictly controlled and monitored; and
- Zones where certain types of activities (recreational, commercial, agricultural, etc.) are permissible and others not permissible.

6.1 Habitat Zones

A habitat sensitivity analysis is the baseline that guides the differentiation of the various estuarine zones, specifically identifying:

- Threatened, ecologically important habitats as no-go or minimal disturbance zones;
- Those areas which can support controlled, sustainable exploitation of marine living resources; and
- Those areas where various forms and levels of appropriate water-based recreation are acceptable.

The most recent assessment of estuarine habitats and their extent in the Kowie Estuary was undertaken by the Nelson Mandela University (NMU) in 2021 (Figure 6.1). This habitat map is used as the baseline for the identification of sensitive estuarine habitats and informs the zonation of activities in the Kowie Estuary.

The entire wetland area at the Bay of Biscay must be considered a conservation area. Habitat connectivity is important as this wetland area is at the interface between estuarine, freshwater, mudflat, saltmarsh, reedbed and terrestrial habitats. Habitat loss, specifically saltmarsh habitat is a major issue for the Kowie Estuary, so preservation to avoid any further disturbance of this area is of upmost importance. This could be undertaken through a municipal conservation area like the "Duck Pond" and ensure that no development can be considered within these conservation areas. The value of these areas must be realised and it should not be fragmented in the future.

6.2 Water-based Zones within the EFZ

It must be noted that the river area of the Kowie Estuary has no specific zonation in terms of the Ndlambe SDF, but the Ndlambe Local Municipality has demarcated three (3) ski zones that are utilised for boating and recreational skiing (i.e. high-wake areas) (Figure 6.2). Furthermore, fishing and bait harvesting is currently not restricted in any particular part of the EFZ.

Based on stakeholder engagement during the compilation of the SAR, it has been proposed to remove the ski-zone at the Bay of Biscay, and to protect intertidal salt marsh species within the ‘Duck Pond’ and similar saltmarsh areas. In order to promote conservation within the Kowie EFZ, certain restrictions on activities needs to be implemented, including no skiing and, more specifically, no-wake zones for boating.

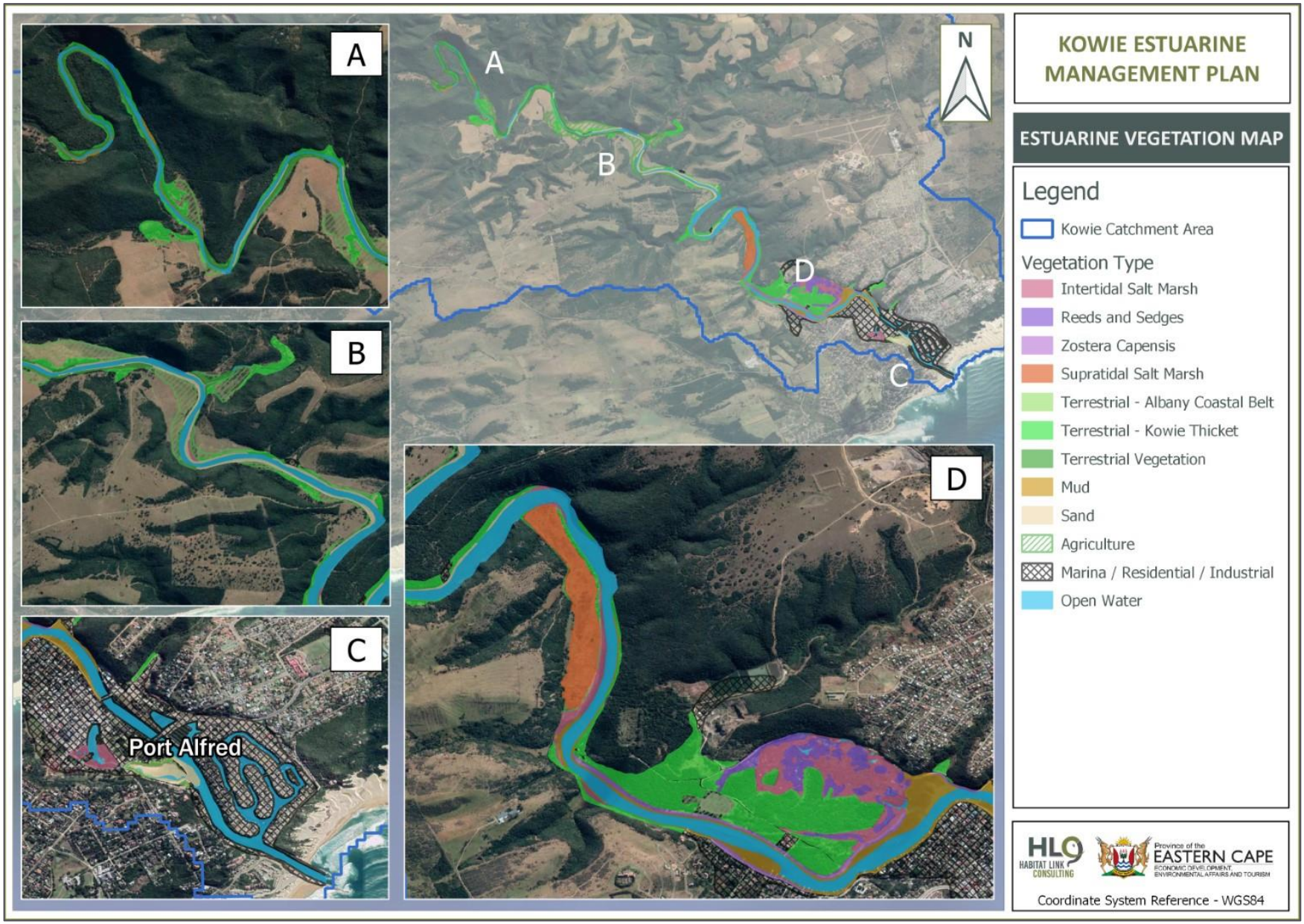

Figure 6.1: Distribution of macrophyte habitats of the Kowie Estuary (NMU, 2021).

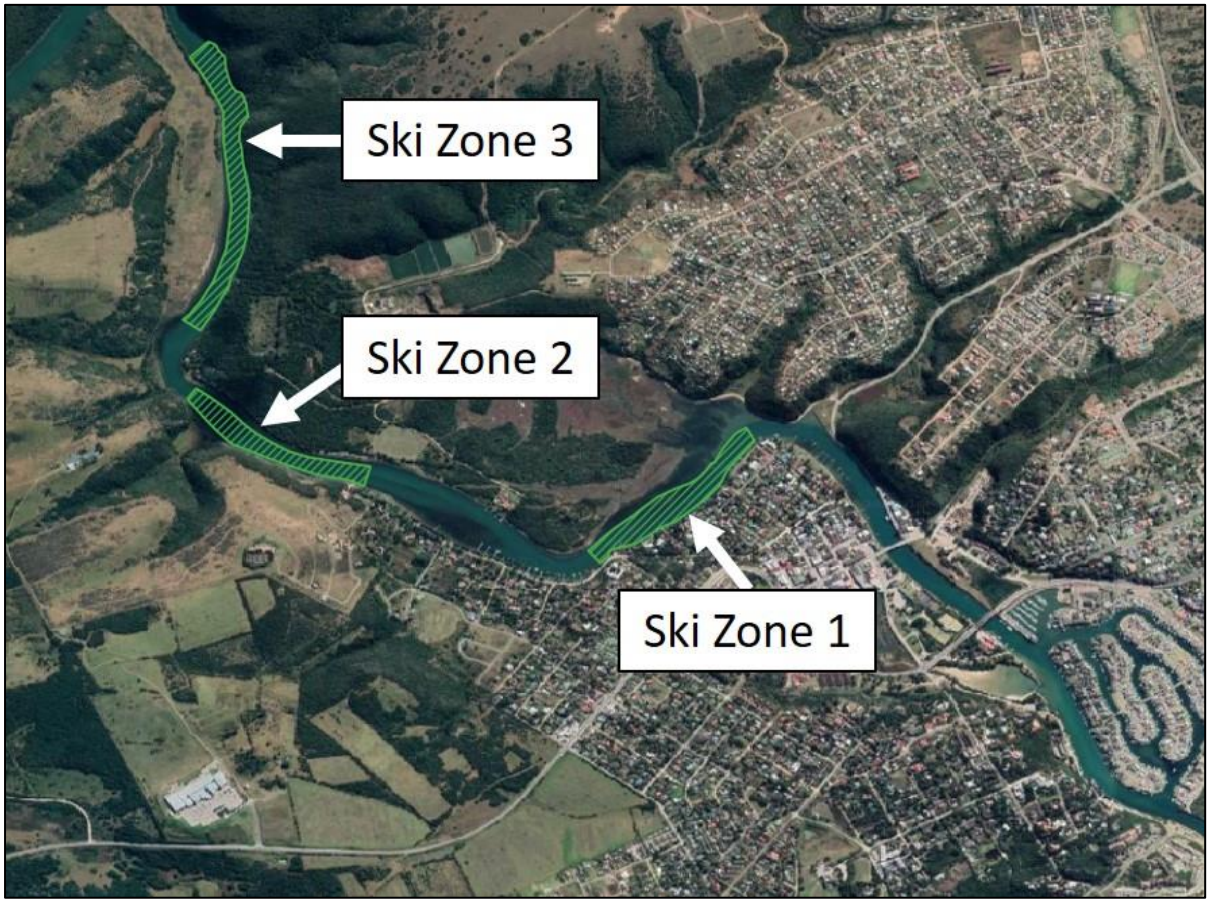

Figure 6.2: Existing water-based zones within the Kowie Estuary (ski-zones).

The no-wake zones are proposed specifically for the built-up areas of the estuary to support the prevention of further bank erosion and to ensure the safety of estuary users. This will include the section from the mouth the R72 road bridge and then from the Main Street bridge to the Bay of Biscay. The section between the two bridges is currently not a no-wake zone and this will remain as such subject to maintenance of the bank stabilisation structures. The no-wake zone will extend past the last residential development on the northern bank of the river at Centenary Park.

Furthermore, it is proposed that a no-wake zone is implemented in the upper reaches of the EFZ upstream of the 'Old Mill'. The river channel from this point further upstream is rocky and poses a navigational threat. The implementation of a no-wake zone in this area is beneficial and must be clearly stated as such in the boating by-laws and via the erection of relevant signage, although policing of this area would be difficult.

The existing ski-zones will be amended such that the previous 'Ski Zone 1' is removed and the previous 'Ski-Zone 2' is extended. Ski-Zone 3 will remain unchanged. The zones that are not classified as 'ski-zones' or 'no-wake' zones will simply be referred to as 'no-ski zones' and the only boating restriction would be regarding skiing and similar water-based activities.

Further protection of conservation areas must be undertaken via the implementation of zones where fishing and bait harvesting are disallowed (either seasonally or on a permanent basis). These restriction zones will also apply to any other activities which could result in pollution (e.g. dumping of waste or effluent disposal) or disturbance to the natural environment (e.g. cattle grazing, trampling by people or animals etc.). Restrictions must also be implemented to ensure the protection of heritage resources within the estuary (e.g. the shipwreck, old jetty and old mill). These are indicated on the zonation plan and must be protected and preserved.

The following restriction zones are included for the water body of the Kowie Estuary (Figure 6.3):

- **No Ski Zones** – The purpose of these zones is to allow for normal boating activities, but to disallow skiing activities to promote overall river safety;
- **No Wake Zones** - The purpose of these zones is to disallow all high-speed boating activity (including skiing) thus reducing erosion of river banks, noise disturbance to birds and sensitive habitats, and for safety of other river users; and
- **No Take Zones** - The purpose of these zones is to protect juvenile fish species utilising sections of the EFZ, to preserve shallow water habitat and support important habitat linkages, and promote the overall nursery function of the estuary. No fishing in any form is permitted in these areas, including catch and release. Furthermore, no bait harvesting will be permitted within these areas. Further to this, there areas may require rehabilitation via cattle grazing restrictions and removal of any past illegal dumping.
- **Heritage Sites** – These are indicated as markers on the zonation plan and serve the purpose of ensuring the protection and preservation of sites of heritage importance within the estuary.

The specific conditions of use for these particular water-based zones are provided together with the relevant authority responsible for ensuring compliance (Table 6.1).

Table 6.1: Water-based zonation prescriptions for the Kowie Estuary.

Restriction Zone	Conditions of Use	Enforcement
Zones of No Restriction	• Adherence to municipal boating by-laws • All motor boats must be registered and skippers in possession of a valid license • Tourism operators to be registered and regularised by local tourism board	Ndlambe LM
No Ski Zone	• As above • No jet-skis, water-skis, or towing of people / structures or similar activities permitted	Ndlambe LM
No Wake Zone	• As above • Speed restriction of 'idling speed' i.e. max 10 km per hour • Boating competitions for non-motorised boats only • Canoeing, rowing and swimming, where appropriate	Ndlambe LM
No Take Zone	• No fishing of any kind (except for approved research purposes) • No bait harvesting of any kind (except for approved research purposes or as per limited seasonal permitted subsistence harvesting) • No motorised boats. Non-motorised boats permitted for rehabilitation or research purposes only. • No fishing competitions • Bird hides permitted where appropriate • Access restricted to designated routes and trails • No cattle grazing or similar activities resulting in trampling and disturbance of natural areas • Control of visitor numbers, frequency and group sizes in marginal areas to reduce trampling and disturbance	Ndlambe LM / DFFE Fisheries
Heritage Site	• No physical access to heritage features (i.e. for observation only) • Control of visitor numbers, frequency and group sizes • No development activities within a 50m radius of heritage sites	Ndlambe LM / ECPTA / SAHRA

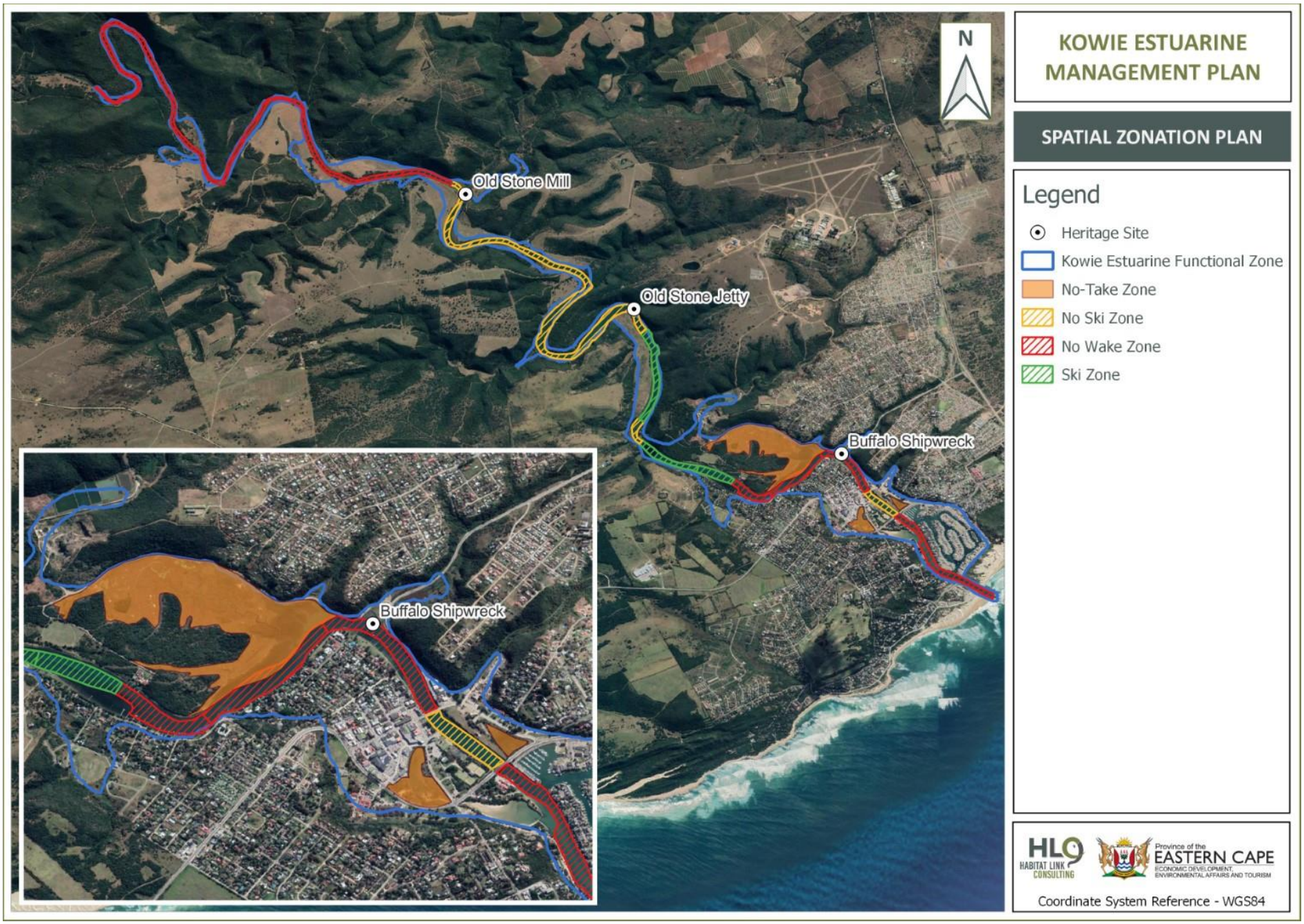

Figure 6.3: Proposed water-based zonation for the Kowie Estuary.

6.3 Land-based Zones within the EFZ

The zoning of the urban portion of the EFZ relates to land-based activities and developments (versus water-based activities above) and reflects the existing land use, and municipal zonation and accompanying land use controls as per the Ndlambe SDF. Several land use types for Port Alfred are listed as per the SDF, of which the majority take place within or adjacent to the Kowie Estuary. These have been summarised and simplified with the EFZ overlay (Figure 6.4). This summarised zoning will be used to inform the estuarine zonation for land-based activities within developed areas of the EFZ.

6.3.1 Built-Up Areas

Development has resulted in noteworthy modification of the estuary margin along a significant portion of the lower estuary, through the removal of natural vegetation in favour of formal development (residential, commercial, transport infrastructure, marina, etc.). Such encroachment places urban development at risk from riverine flooding, as well as tidal surges and marine storms. There are additional urban impacts relating to leaking sewage infrastructure, as well as stormwater run-off containing pollution and sediment.

In order to mitigate against climate change and potential future sea-level rises, development (or activities) within the built-up areas of the EFZ should only be permitted if assessed as having low/little to no negative impact on the health and functioning of the estuary. Any new developments along the river interface must be limited to non-permanent structures and will also need to comply with legislation before being developed. All jetties need to be registered and no new jetties or launch sites should be allowed unless the relevant legislative steps are taken. Maintenance of existing infrastructure may only be undertaken as per existing or future approved Maintenance Management Plans.

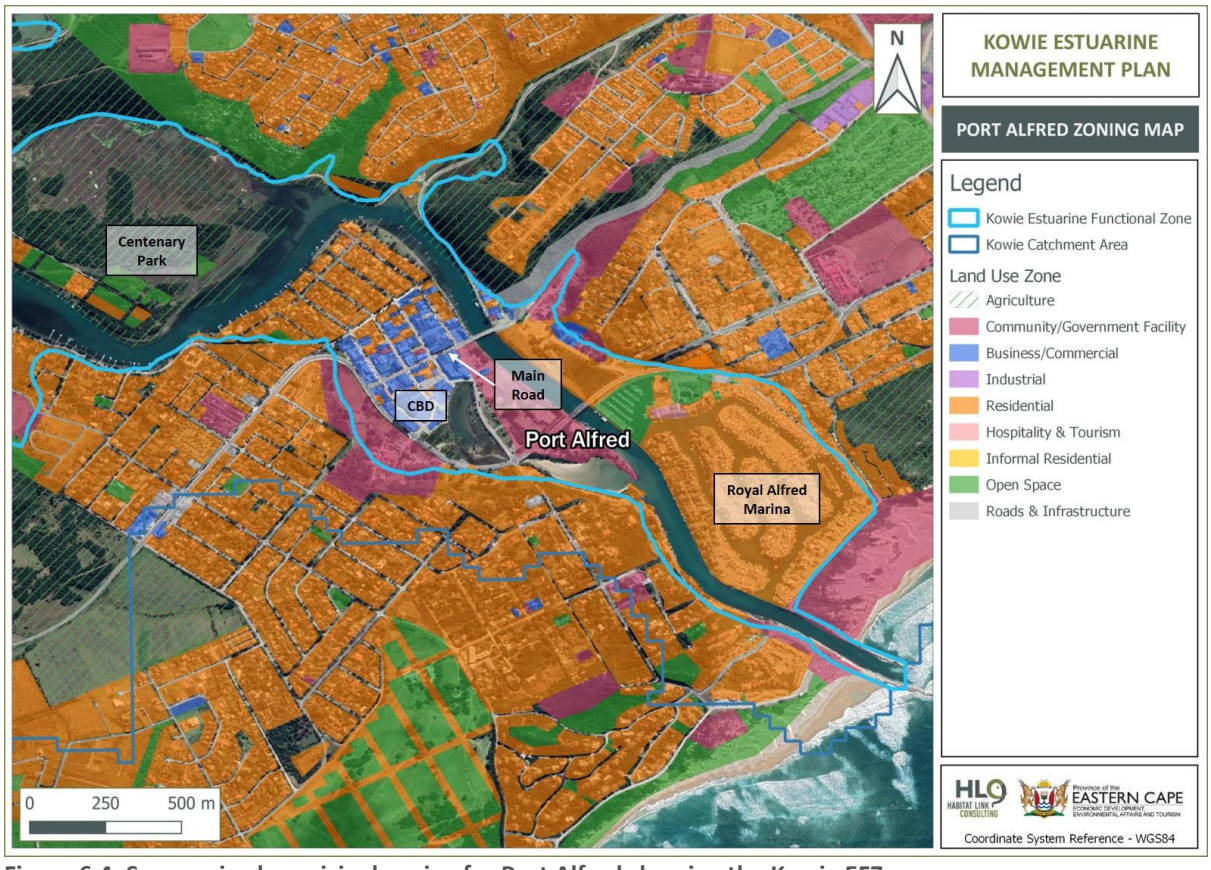

Figure 6.4: Summarised municipal zoning for Port Alfred showing the Kowie EFZ.

6.3.2 Agricultural Zone

The loss and transformation of estuarine habitat is the largest and most conspicuous impact on the estuary. There are large areas within and around the Kowie Estuary that have been historically transformed by agricultural activities, specifically cattle grazing, which has impacted and continues to impact on the system through reduced flood buffering, sedimentation, and water quality impacts. While reclaiming and restoring these transformed areas is the ideal (and potentially reversible in comparison to the permanently transformed urban area), there would be much resistance in prescribing the retreat or full extraction of agricultural activities from the EFZ. This would also impact negatively on the agricultural sector and contributions made to the local economy for communities and the municipality. A strategic retreat of certain agricultural activities from specific areas of the EFZ is therefore proposed. This will entail engagement and focussed discussions between DEDEAT and the landowners, to identify areas of high potential for restoration with ecosystem linkages/biodiversity corridors. These areas would typically include low-lying floodplain and freshwater drainage areas, which would help to filter agricultural return flows. Apart from strategic retreat, key management interventions within this zone should also be undertaken, including implementation of agricultural best practices, control of invasive alien vegetation, strict avoidance of remaining natural vegetation and rehabilitation of trampled/cleared areas of the riparian margin.

6.3.3 Open Space and Undeveloped Areas

In general, development must be avoided in existing open space and undeveloped (natural) land sections within the EFZ. Furthermore, it is proposed that the 10m contour around the EFZ is utilised as a development setback line (development buffer) for any future activities in undeveloped areas. Rehabilitated areas (as prescribed in Section 6.4 below) would also fall into this category for land-based zones.

6.4 Areas for Rehabilitation

Given the length and urbanised nature of the system, specifically the lower reaches of the EFZ, its complete and extensive rehabilitation may be considered both unrealistic and impractical. There are parts of the estuary that are irreversibly transformed and given the highly urbanised nature of the system, restoration to a near natural state is not feasible. However, there are some aspects that can contribute to the improved state of the estuary if rehabilitation is undertaken. The primary rehabilitation activity proposed by this EMP is the repair and maintenance to the river banks, specifically the failing bank stabilisation structures in lower urbanised section. Further to this, the rehabilitation of the intertidal salt marsh habitat within the 'Duck Pond' and similar saltmarsh areas where connectivity to the main estuary has become limited, is recommended to be undertaken. This must include consideration of stormwater run-off from the urban areas and road network carrying chemical and solid waste contamination into these confined areas.

The development of the Royal Alfred Marina resulted in the loss of substantial shallow water habitat. It is suggested that innovative means of reinstating important habitat be investigated through focussed research. These could include, for example, modifications to some sections of the sheer canal walls to promote shallow water habitat or increased occupation by estuarine marine). The control of invasive alien vegetation throughout the EFZ, extending into the adjacent properties and into the catchment, coupled with the rehabilitation of other degraded estuarine habitats are also priorities. These areas include the salt marsh habitats prescribed in the zonation plan as well as other areas identified in the strategic rehabilitation plan for the estuary. Beyond the EFZ, the potential upstream pollutants (e.g. wastewater treatment works and municipal landfill site) must be monitored (and maintained where necessary) to protect the estuarine health and function. A site-specific inventory of areas requiring rehabilitation is required and is specified as a management action in Chapter 5.

7. Institutional Capacity and Arrangements

It is important to note that this EMP is a strategic plan that guides the implementation of actions in respect to each management priority. The management priorities do not specify the resources (both human and financial) required for the execution of the specific actions. It does, however, offer a schedule or phased planning approach that incorporates capacity building and implementation at the local level over a five-year period.

7.1 Responsible Management Authority

In alignment with the 2021 NEMP, the responsibility for developing an EMP and coordinating the implementation thereof falls to the provincial environmental department, in this case, the DEDEAT. This needs to be undertaken in collaboration with the relevant municipalities, specifically the Ndlambe Local Municipality.

Specific implementation actions identified remain the responsibility of mandated organs of state as well as respective departments within the municipality. As an example, the DWS will monitor water quality, while the DFFE should ensure compliance with matters related to fisheries. The Ndlambe Local Municipality may be prescribed the role of RMA and accept the responsibility for coordinating the implementation of the Kowie EMP, with support from DEDEAT. The Ndlambe municipal departments identified as important role-players include:

- Infrastructure Development (infrastructure development and maintenance of such infrastructure, including roads and storm water systems, public transport infrastructure, public facilities, maintenance of buildings, etc.);
- Community Protection Services (environmental management, waste management, maintenance of recreational areas, safety, bylaws enforcement, crime prevention, disaster management); and
- Financial Management (financial provision, supply chain, service delivery and health programmes).
- Development Planning (Building Approvals, Spatial Planning, LED and IDP)

Monitoring forms an important part of ensuring the EMP remains valid and will help to address issues that may arise in due course. The RMA is responsible for monitoring the overall progress of implementing the EMP, whilst the different actions and activities must be monitored by the relevant governmental departments, organisations or elected groups and/or committees. Progress towards achieving the objectives set out in this EMP must be reviewed on an annual basis and communicated to stakeholders, as well as to DEDEAT and DFFE, via an annual report. This EMP must be revisited and updated after five (5) years to reflect goals that have been achieved and changing priorities.

7.2 Government Departments and Organs of State

The key to successful implementation of this EMP is the commitment and contribution of all spheres of government to the process, including:

- Ndlambe Local Municipality as the proposed RMA;
- Sarah Baartman District Municipality: Provision of management and technical support;
- Eastern Cape government departments: Legislatively mandated responsibilities as well as support, including compliance, funding, research and monitoring (e.g., DEDEAT, Cooperative Governance and Traditional Affairs (CoGTA) and Department of Rural Development and Agrarian Reform (DRDAR); and
- Relevant national government departments, especially DFFE, DWS, CoGTA, Department of Agriculture Land Reform and Rural Development and other conservation agencies.

7.3 Estuary Advisory Forum

Although the establishment of an EAF is no longer a requirement of the 2021 NEMP, this could be established to address critical estuarine matters as they arise. This will consist of the relevant officials from the DEDEAT and Ndlambe Local Municipality, as well as other key members of DFFE, DWS and/or other organs of state where necessary. The EAF should meet on a regular basis to discuss the implementation of the EMP and, where necessary, include relevant key stakeholders identified during this EMP process.

Organs of state should be represented on this EAF by delegates mandated by the respective departments. Each government representative on the EAF will be tasked to convey recommendations to his/her department and report back to the EAF on behalf of the department. Moreover, representatives from the authorities who have executive powers within the specific sector should also be present. This ensures that recommendations are executed and resources are made available for priority tasks or activities. This also streamlines the flow of information and decreases the turnaround time of required interventions. The various local members of the EAF will play an invaluable role in providing on the ground, local insight and support to the various authorities as well as to the RMA.

Effective implementation of this EMP requires the conversion of the priority actions into detailed project plans, which must be prepared and adopted into the respective departmental implementation strategies. A template for such project plans is provided in the EMP Development Guideline (DEA, 2015)[3]. This template can also be utilised to facilitate the implementation of other projects proposed in the EMP.

[3] Document current under review. Any updated EMP Development Guidelines would subsequently apply.

8. Integrated Monitoring Plan

According to the standards for estuarine management, management actions should be based on sound scientific evidence. Thus, monitoring is a crucial aspect of the adaptive estuarine management process as the generated data will be used to inform and update management decisions. However, the collection, processing and interpretation of such data, particularly ecological data, are generally costly, time-consuming and often require considerable scientific expertise.

In the context of estuarine management, there are three broad categories of monitoring which should be incorporated into an integrated monitoring plan, namely resource monitoring, compliance monitoring and performance monitoring (DEA, 2015). These components are discussed in the following sections.

8.1 Resource Monitoring

The primary aim of resource monitoring is to collect and evaluate data which will inform management on the ecological health of an estuary, as well as the intensity and nature of uses/activities that potentially influence its health (DEA, 2015). A summary of the current monitoring activities is provided below. Resource monitoring is closely linked to the reserve determination process and RQOs identified/agreed upon.

8.1.1 Current Resource Monitoring

A number of water quality monitoring programmes have been undertaken by various research institutions, often as part of a national (DFFE or DWS) project, during the course of the past forty years. A detailed account of the water quality research is provided in the SAR. Further to this, a basic ongoing water quality monitoring programme is implemented by the Ndlambe Local Municipality in order to monitor any changes to estuarine water quality over time. The sampling points are randomly selected, but are generally restricted to the areas downstream of the WWTW discharge point. It is understood that samples are taken on a monthly basis and several parameters are measured to determine any pollution effects. It is imperative that this monitoring programme is maintained and the data stored and utilised to inform the future management of the Kowie Estuary. Furthermore, it is recommended that sampling points are formalised and additional sampling is added to the monitoring regime.

8.1.2 Recommended Resource Monitoring

The purpose of the recommended long-term monitoring programme is to continuously improve understanding of ecosystem function. While all components in the long-term monitoring programme remain important, certain primary data are of highest priority (Table 8.1).

RQOs or Ecological Specifications (EcoSpecs) are clear and measurable specifications of ecological attributes (in the case of estuaries - hydrodynamics, sediment dynamics, water quality and different biotic components) that define a specific ecological category, in the case of the Kowie Estuary, a Category C. These will be formalised via the reserve determination process currently being undertaken for the catchment.

In general, there is significant research and data available for the Kowie Estuary that needs to be collated in a central repository/database and formalised as baseline information to inform the long-term monitoring. Other recommended resource monitoring is as per the information gaps and research need identified in the SAR (see Section 2.7 of this report).

Table 8.1: Recommended minimum requirements for long-term monitoring (DWS, 2015).

COMPONENT	MONITORING ACTION	TEMPORAL SCALE	SPATIAL SCALE
Hydrodynamics	• Record water levels	Continuous	Near the mouth of the estuary
	• Measure freshwater inflow into the estuary	Continuous	Near head of estuary
	• Aerial photographs of estuary (spring low tide)	Annually	Entire estuary
Sediment dynamics	• Bathymetric surveys: Series of cross section profiles and a longitudinal profile collected at fixed 500 m intervals, but in more detail in the mouth Vertical accuracy at least 5 cm.	Every three years (and after large resetting event)	Entire estuary
	• Collect sediment grab samples (at cross section profiles) for analysis of particle size distribution and organic content (and ideally origin, i.e., microscopic observations)	Every three years	Entire estuary
Water quality	• Collect data on conductivity, temperature, suspended solids, pH, inorganic nutrients (and organic content in river inflow	Quarterly, every 3 years	Inflow above estuary
	• Collect samples for pesticides/herbicide and metal determinations (toxic substances) in river inflow	Every 3 – 6 years if baseline shows contamination	Near head of estuary, and downstream of agricultural inflows
	• Water quality measurements taken along the length of the estuary (surface and bottom samples) for salinity, pH, dissolved oxygen, suspended solids/turbidity and inorganic nutrients. • Collect in situ continuous salinity data with mini Conductivity-Temperature-Depth (CTD) probe at a depth of about 1 m (should also include pH, DO, TSS/turbidity, and nutrients)	Continuous (monthly)	Along length of estuary (minimum of 10 stations), also include marginal habitats plus one site above the estuary and one in the marine environment
	• Record longitudinal in situ salinity and temperature pH, turbidity profiles over a spring and neap tide during high and low tide at end of low flow season and at peak of high flow season	Quarterly, every 3 years	Entire estuary (minimum of 10 stations)
	• Collect surface and bottom water samples for inorganic nutrients (and organic nutrient) and suspended solid analysis, together with in-situ profiles	As above or when significant change is expected	Entire estuary (minimum of 10 stations)
	• Measure pesticides/herbicides and metal accumulation (toxic substances) in sediments (for metals investigate establishment of distribution models)	Every 3 – 6 years, if results show contamination	Entire estuary (minimum of 10 stations)
	• Effluent discharge - measurements of flow rate and other parameters, as per discharge standards	Continuous (monthly)	Discharge point - just before entering the estuary

COMPONENT	MONITORING ACTION	TEMPORAL SCALE	SPATIAL SCALE
Microalgae	• Record relative abundance of dominant phytoplankton groups, i.e., flagellates, dinoflagellates, diatoms, chlorophytes and blue-green algae. • Chlorophyll-a measurements taken at the surface, 0.5 m and 1 m depths, under typically high and low flow conditions using a recognised technique, (e.g. spectrophotometer, High Performance Liquid Chromatography or fluoroprobe). • Intertidal and subtidal benthic chlorophyll-a measurements (4 replicates each) using a recognised technique (e.g., sediment corer or fluoroprobe).	Summer and winter surveys every three years	Along length of estuary (minimum ten stations)
Macrophytes	• Ground-truth maps to update the existing map and to check the areas covered by the different macrophyte habitats. • Record boundaries of macrophyte habitats and total number of macrophyte species in the field, rare and endangered species.. • Assess extent of invasive species within the EFZ.	Summer survey every three years	Entire estuary (minimum 10 stations)
Invertebrates	• Collect duplicate zooplankton samples at night from mid-water levels using WP2 nets (190 um mesh). • Collect grab samples (5 replicates) (day) from the bottom substrate in mid-channel areas at same sites as zooplankton (each sample to be sieved through 500 µm). • Collect sled samples (day) at same zooplankton sites for macrocrustaceans/ hyperbenthos (190 um). • Intertidal invertebrate hole counts using 0.25 m^2 grid (5 replicates per site). Establish the species concerned using a prawn pump. • Collect sediment samples using the grab for particle size analysis and organic content (at same sites as zooplankton).	Every two years, mid-summer (Summer and winter survey every three years)	Entire estuary (minimum 10 stations) For hole counts – three sites
Fish	▪ Record species and abundance of fish, based on seine net and gill net sampling. Sampling with a small beam trawl for channel fish should also be considered. ▪ Seine net specifications: 30 m x 2m, 15 mm bar mesh seine with a 5 mm bar mesh with a 5mm bar mesh 5 m either side and including the cod-end. ▪ Gill nets specifications: Set of gill nets each panel 30 m long by 2 m deep with mesh sizes of 44 mm, 48 mm, 51 mm, 54 mm, 75 mm, 100 mm and 145 mm. ▪ Trawl specification: 2 m wide by 3 m long, 10 mm bar nylon mesh in the main net body and a 5 mm bar in the cod-end. ▪ Sampling undertaken at intervals along the estuary, including all habitat types, e.g. Zostera beds, prawn beds, sand flats, and with at least one sample sets in the 0 to 1 ppt reach of the system.	Twice annually, Spring/Summer and autumn/winter (Summer and winter (low/high flow periods) survey every three years)	Entire estuary (minimum 10 stations)
Birds	Undertake counts of all non-passerine water birds, identified to species level.	Annual winter and summer surveys	Entire estuary (divided into counting areas, taking key habitats into account, must be standardised)

8.2 Compliance Monitoring

Compliance monitoring refers to the monitoring of the type and intensity of uses/activities and developments within an estuary/EFZ. Such monitoring is usually prescribed in relevant legislation, regulations, policies, standards, guidelines and or permits and license agreements (DEA, 2015). The purpose of this form of monitoring is to test whether activities are compliant with the established limits and objectives as well as to detect growing pressures on resources.

8.2.1 Current compliance monitoring

The Ndlambe Local Municipality boating by-laws relate to the management and use of rivers, including estuaries, specifically in respect to boats and vessels and are enforced by the Community Protection Services department of the municipality. Currently the river is patrolled by Ndlambe municipal officials on an approximately weekly basis, who fulfil the role of river compliance officers to enforce the relevant fishing and boating regulations. However, the compliance and enforcement responsibility for the Kowie Estuary is largely under-capacitated, given the length of the system and the surrounding dense population in the lower reaches, and subsequent human activities taking place, especially during peak holiday seasons.

8.2.2 Recommended compliance monitoring

By and large, compliance monitoring will continue to be the responsibility of the Ndlambe Local Municipality, and will be undertaken according to legislation and policies applicable, and by means of law enforcement and compliance monitoring protocols. This is proposed to be supported by the DEDEAT and DFFE compliance and enforcement departments where feasible. It is imperative that the current appointment of a river compliance officers remain in place, but additional personnel are required for more effective law enforcement and compliance monitoring, and could potentially include volunteers from the community or local tourism operators.

Further to this, the monitoring of compliance of structures within the EFZ (in relation to applicable legislation including municipal by-laws) must be implemented. This could include a similar process to the DEDEAT's jetty audit and could assess which structures have the necessary permits, leases and/or authorisations. This will provide a baseline to determine general compliance of structure located in Port Alfred as well as other areas within the Kowie EFZ.

It is recommended that an assessment of estuary usage is determined, targets and/or limits set and these policed to ensure compliance. A scheduled compliance/law enforcement programme must be implemented to enforce management controls as per this EMP, with more frequent monitoring undertaken during peak holiday periods (**Error! Reference source not found.** 8.2).

Table 8.2: Recommended compliance monitoring requirements.

Use / Activity	Indicator	Frequency	Target / Limit	Responsibility
FISHING / BAIT COLLECTION	• Number of fishers • Number of harvesters • Species targeted • Catch volume • Gear utilised • Number of offences / transgressions • Adherence to 'no-take' zones	Monthly, increased to weekly during peak season	Target species and limits as per MLRA regulations	DFFE / Ndlambe LM
BOATING	• Number of boats and other vessels • Main locations of boating	Monthly, increased to	Carrying capacity to be determined	Ndlambe LM

	• Number of boat licenses • Number of skipper's licenses • Adherence to 'no-wake' zone • Adherence to boating by-laws • Number of offences / transgressions	weekly during peak season		
BUILDINGS AND STRUCTURES	• Number of structures within the EFZ • Relevant approvals obtained • Compliance with approvals and any relevant legislation • Number of transgressions	Baseline audit required, thereafter annually where applicable	Improved number of permitted structures and overall increase in compliance	DEDEAT / Ndlambe LM

8.3 Performance Monitoring (Review & Evaluation)

A performance monitoring plan is used by the RMA, and/or identified implementing agents, to assess the effectiveness with which planned management activities contained in the EMP are being performed and ultimately to gauge progress in achieving the vision and objectives. This component utilises the performance indicators included for the various actions, specifically the management priorities, and includes a temporal scale or the frequency of the collection of the performance data and the targets that should be achieved (Table 8.3).

Ultimately, the EMP must be reviewed every five years from the date it was adopted, ideally in line with the review cycles of the applicable IDP, SDF and/or Coastal Management Programme (CMP). This review is the responsibility of the RMA and should include an assessment of:

- The effectiveness of the EMP and success with meeting the objectives (i.e. the performance monitoring plan);
- Environmental changes at a local or a wider scale that could affect the estuarine resources or the implementation of the EMP; and
- Changes (if any) to legislation, land-use planning, goals or policies that may require the EMP to be amended.

This review may involve revisiting the SAR to determine the progress or changes that have come about because of the implementation of the EMP in terms of the objectives that were originally set. It may also require the EMP to be amended, including a revision of the objectives, amendments to the management actions, and/or monitoring protocols. Ideally, representatives and experts in the major sectors (e.g. water quantity and quality, land-use and infrastructure planning and development, etc.), should evaluate the efficiency of the EMP in the context of their mandate or area of expertise. Public participation will be required before the amended EMP can be approved.

Table 8.3: Performance Monitoring Plan for the Kowie Estuary.

Management Output	Performance Indicator	Temporal Scale	Responsible Authority
Estuarine Health and Function			
1. Protect Water Quality and Quantity	• Freshwater baseflows reaching the estuary are maintained or improved • Alien vegetation removal target achieved • Improved quality of agricultural return flow • Recovery of riparian margin and wetland areas	Annual	DWS / Ndlambe LM
2. Minimise Pollution	• Improved effluent and stormwater discharge quality (meeting the DWS limits for discharge) • Improvement in groundwater quality surrounding landfill site • Improved estuarine water quality • Improved integrity of estuarine margins	Quarterly	DFFE / DWS / Ndlambe LM
3. Rehabilitate Degraded and Transformed Areas	• Rehabilitation plan developed and priority restoration/degraded areas restored (e.g. estuarine margin including margins of the marina) • Increased vegetated margin and 'natural' habitat • Improvement of erosion defence structures	Annual	DEDEAT / Ndlambe LM
Biodiversity Conservation			
1. Ensure Conservation of Estuarine Habitats	• SZP adopted and adhered to • Protected areas proclaimed and expanded along the estuary and estuarine boundaries • Reduced habitat disturbance / degradation / loss • Protection of identified habitats • Improved habitat integrity and general estuarine health and appearance	Annual	Ndlambe LM / DEDEAT / ECPTA
2. Ensure Sustainable Resource Use by Controlling and Managing Fishing Pressure and Bait Collection	• SZP demarcated and enforced using markers / buoys / signage • Compliance monitoring / patrols undertaken, findings documented and reported on • Relative decreases in incidents of illegal fishing, bait collection etc	Annual	Ndlambe LM / DFFE Fisheries
Land-use and Infrastructure Planning and Development			
1. Minimise Impacts of Climate Change	• Relevant climate change / sea-level rise studies undertaken and CML determined • Contingency plans developed and property owners engaged • Maintenance of stabilisation and defence structures undertaken	Once-off (review after 5 years or extreme events)	Ndlambe LM / DEDEAT
2. Facilitate Sustainable Utilisation and Development within the Kowie EFZ	• Inspections undertaken, transgressors prosecuted, and remedial actions implemented • Compliance monitoring and suitable rectification of non-compliances for existing and new developments that require authorisations • No further loss of indigenous vegetation and habitat within the EFZ • Dredging maintenance management plan reviewed, revised and approved via a stakeholder engagement process Jetty structures controlled to prevent environmental degradation	Ad hoc / Annual	Ndlambe LM / DEDEAT

Management Output	Performance Indicator	Temporal Scale	Responsible Authority
Institutional and Management Structures			
1. Ensure Effective Coordination of Estuarine Management Responsibilities	• Estuarine management coordination function assigned / established in Ndlambe • EAF appointed in the long term • Update of river bylaws to include key estuarine issues • Official(s) attend accredited estuarine management course • Municipal peak season planning programme to be implemented / updated to manage effects from peak season tourism • Stakeholder database developed and regularly updated • Municipal teams or assigned entities well equipped for estuarine management activities	Ad hoc / Biannual	DEDEAT / Ndlambe LM
2. Ensure Compliance and Enforcement	• Review and address the needs of the compliance and enforcement officers • Training of EMIs, deployment of EMIs • Increased patrols • Corrective action undertaken / effective results of increased inspections / transgressors prosecuted	Biannual	DEDEAT / Ndlambe LM
3. Secure Financing for Estuarine Management	• Funds secured for 5 years • Long term funding plan developed, and reviewed on an ongoing basis	Annual	CoGTA / DEDEAT / Ndlambe LM
Socio-economic Considerations			
1. Protect heritage structures and resources	• Markers / buoys / signage installed and maintained • Inclusion of heritage structures in local tourism sector • Heritage resources related to the estuary are identified and enhanced where possible	Ad hoc	ECPTA / SAHRA / Ndlambe LM
2. Maintain safe and equitable access	• Current access well maintained through a scheduled maintenance programme • Navigability of estuary maintained via repair/maintenance to bank stabilisation structures • Suitable / safe areas identified for traditional / cultural activities	Annual	Ndlambe LM
3. Regulate recreational activities	• Reduced habitat disturbance / degradation • Boating bylaws and EFZ controls enforced and offenders prosecuted • Boat mooring and launch site applications renewed on an ongoing basis • Signage procured, installed and maintained • Increased environmental awareness and education via informative signage	Annual	Ndlambe LM
4. Maximise economic benefits	• Recreational amenities well maintained to ensure persistence of local economic activities and benefits	Annual	Ndlambe LM

Management Output	Performance Indicator	Temporal Scale	Responsible Authority
Education, Awareness, Monitoring and Research			
1. Promote high-levels of public awareness	• Increased environmental awareness and education via informative signage, social media and educational programmes • Community volunteers signed-up and suitably trained • Grievances recorded and actioned	Annual	Ndlambe LM
2. Enhance scientific knowledge and increased research activities	• Required basic monitoring undertaken • Funding/research proposals submitted • EMP updated by data/monitoring results going forward	Annual	DEDEAT / DWS / DFFE

9. Conclusion and Recommendations

The Kowie Estuary has a long history of human modification, which persists today via transformation of large areas within the EFZ due to urbanisation in the lower reaches and agricultural activities in the upper reaches. Nevertheless, the estuary maintains important biodiversity and socio-economic value and provides critical goods and services to the natural environmental and local economy. It is for these reasons that further deterioration of the Kowie Estuary must be prevented through effective and co-ordinated management by all relevant institutions. The human activities which could negatively affect the integrity of the estuary must be managed appropriately and such activities should not continue without a level of compliance and control. It is important that implementation of this EMP be reviewed annually, and that both the EMP and SAR be updated at the mandatory 5-year interval to keep the document relevant and to enable adaptative management.

In conclusion, this plan adopts the principle of adaptive management and presents an integrated approach to addressing the environmental, social and economic impacts that affect the health of the Kowie Estuary. The actions proposed in this EMP reflect an ongoing process of implementation and should accommodate potential amendments due to changing circumstances. They are the first steps of a long-term process designed to secure ongoing and sustainable improvements to the current situation.

The following issues are considered critical towards the ultimate achievement of the vision for the Kowie Estuary and should be immediately addressed and/or receive greatest effort in respect to human/financial resources:

- Improved waste and effluent management via suitably engineered upgrades and/or maintenance of existing waste management infrastructure;
- Management of stormwater outfalls via installation (and regular cleaning) of mesh screens as well as ensuring the discontinuation of any illegal connections of sewage infrastructure to stormwater;
- Prevention of further development within the EFZ and suitable protection of existing estuarine defences / infrastructure primarily via the repair and maintenance of bank stabilisation infrastructure;
- Implementation of compliance and rectification strategies for the operation of existing facilities in and around the estuary (e.g. industries, restaurants, tourism facilities etc.) in line with proposed zonation and municipal by-laws;
- Determination of accountability for roles and responsibilities relating to estuarine management actions;
- Resource use must be controlled and a strong precedent of compliance and enforcement implemented to prevent future overexploitation;
- Provision of budget and resources for effective management of the Kowie Estuary, and
- Enhanced scientific research and data collection via water quality and other relevant ecological monitoring.

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