



ESTUARINE MANAGEMENT PLAN FOR THE IZINKWAZI ESTUARY



KWAZULU-NATAL PROVINCE

ECONOMIC DEVELOPMENT, TOURISM
AND ENVIRONMENTAL AFFAIRS
REPUBLIC OF SOUTH AFRICA

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Image Front Page:

iZinkwazi Estuary 2016

KwaZulu-Natal Department of Economic Development Tourism and Environmental Affairs

Source: CoastKZN 2021

EXECUTIVE SUMMARY

Introduction

Estuaries are recognised as particularly sensitive and dynamic ecosystems, and therefore require above-average care in the planning and control of activities related to their use and management. For this reason, the National Environmental Management: Integrated Coastal Management Act (No. 24 of 2008, as amended by Act 36 of 2014) (ICMA), via the prescriptions of the updated 2021 National Estuarine Management Protocol (NEMP) (DEA 2013, DEFF 2021), require Estuary Management Plans (EMPs) to be prepared for all estuaries in order to create informed platforms for efficient and coordinated estuarine management. In light of this, the KZN Department of Economic Development, Tourism and Environmental Affairs (EDTEA) prioritised the development of an EMP for the iZinkwazi Estuary, the purpose of which is to provide the overarching Vision for the future desired state of the estuary, and thereby guide the management of the human activities in and around this system by setting out essential management objectives and related actions/activities.

This EMP applies to the Estuarine Functional Zone (EFZ) of the iZinkwazi Estuary, that is, the area below the 10 m topographical contour, which encapsulates the flood plain, a range of estuarine habitats, and variable estuarine processes and functions, such as backflooding.

Summary of Situation Assessment

The Situation Assessment Report, or status quo assessment, locates the iZinkwazi Estuary within the KwaDukuza Municipality (KDM) while delineating the boundaries of the estuarine system as well as a description of the broader catchment, including the catchments geology, climate, runoff, and land-use. 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 and 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 described prior to unpacking the legal instruments and related strategies and plans which govern the management of the estuary, along with the current institutional structures governing estuarine management. The Situation Assessment Report 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.

Vision and Management Objectives

The vision for the iZinkwazi Estuary is as follows:

The beauty and ecological well-being of the Zinkwazi Estuary is enhanced and protected, ensuring that all present and future users have access to a healthy and safe environment

Management Objectives and Activities

A comprehensive list of proposed management objectives for the iZinkwazi Estuary was compiled using the critical issues identified as part of the scoping phase, including inputs received during public participation, and the SWOT analysis. These management objectives are grouped into categories of specific issues. The ecological and socio-economic consequences of 'no action', expected availability of resources, cost and expected duration are included and aid in the selection of management priorities for the 5-year cycle of this EMP.

Spatial Zonation

Spatial zonation of activities within an EFZ is necessary to avoid user conflict and to guide sustainable utilization without degradation of the estuarine environment. It also allows for the spatial representation of the desired state and the aims of the management objectives, where applicable, and is informed by DEA (2015) 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; 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 (e.g. recreational boat usage, fishing, etc.) are permissible and others not permissible. The revised spatial zonation plan includes the former zonation with additions, and minor amendments as follows:

- **Legislated environmental zones, buffers, and setbacks**, including the proposed Development Buffer Zone (10m contour);
- **Marine Zone**: the Thukela Inshore Controlled Zone (informed by and in support of the Thukela MPA zonation);
- **Controlled fishing/ High Impact Recreation Zone**: estuary mouth to the urban edge of Zinkwazi Beach Village, permissible wake zone;
- **No-Take/Medium Impact Recreation Zone**: urban edge of Zinkwazi Beach Village to the first bridge (to Tugela) (permissible wake zone);
- **Quiet/Low Impact Recreation Zone**: first bridge to head of estuary, spanning approximately 8 km fishing area, no wake zone);
- **Urban Zone (new zone)**: aligning with the urban demarcation of Zinkwazi Beach Village within the EFZ; and
- **Agriculture Zone (new zone)**: remaining portions of EFZ under cultivation.

Rehabilitation of the iZinkwazi Estuary relates predominantly to rehabilitation of the estuarine margin, namely areas under sugar cane cultivation in collaboration with the landowner Tongaat Hulett Developments, and invasive alien vegetation removal, and encouraging biodiversity stewardship by waterfront property owners in respect to activities affecting the estuary margin (vegetation removal, septic tank maintenance, etc.).

Institutional Capacity and Arrangements

The KDM has identified its role as the Responsible Management Authority (RMA) and accepted the responsibility for coordinating the implementation of the iZinkwazi EMP, with support from provincial and national authorities. Specific implementation actions identified remain the responsibility of mandated government departments as well as respective departments within the KDM.

The key to successful implementation of this EMP is the commitment and contribution of all spheres of government to the process. Both co-management and effective governance have already been identified as the keystones to the efficient and effective management of estuaries within the KDM Area, with the continued co-management agreement between KDM and the Zinkwazi Ski Boat Club (ZSBC) needing to be formalised. 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.

Management Priorities

A full range of priority management actions have been identified to facilitate the achievement of the management objectives. These include the specific management priorities; actions required to achieve them; related legal basis for the specific priority actions; performance indicators against which to measure implementation or effectiveness of the actions; and a work plan identifying the actions priority and the responsible agent or institution. These management priorities are summarised below.

	Category	Key Objective	Management Priorities	Performance Indicators	Priority
1	Estuarine health and functioning	The ecological health and natural functioning of the iZinkwazi Estuary is enhanced and safeguarded	- Secure adequate quantity and quality of freshwater input to improve and maintain ecosystem health and functioning - Minimise pollution by identifying and addressing activities that lead to poor water quality - Promote sustainable agriculture - Control the spread and densification of invasive alien plant species - Rehabilitate degraded and transformed areas	- Flows reaching estuary are secured - Pollution risks are reduced and water quality is improved - Improved agricultural practices - Reduction in invasive alien plant coverage - Estuarine habitat is regained and restored through strategic retreat - Ecological health of estuary is improved from a category C to category B state - National priority status is maintained	High
2	Conservation	The biodiversity and estuarine habitats of the iZinkwazi Estuary are conserved	- Ensure the conservation of estuarine habitats - Ensure sustainable resource use through an effective level of compliance management	- Inclusion of the estuary in the Thukela MPA is tabled and under discussion - Estuary received designated municipal zonation under of the TPS - Biodiversity Stewardship Agreement signed with THD - Increased stewardship of property owners - Estuarine habitat is regained and restored - Resources are sustainably utilised - Healthy fish nursery function	High
3	Land-use and Infrastructure Planning and Development	All developments, associated activities, and proposed changes in land-use, which impacts or could impact, on the iZinkwazi Estuary, are controlled by legislation in such a way so as to sustain existing and future livelihoods, while ensuring the maintenance and ecological functioning and services	- Ensure effective implementation of the EMP - Minimise the potential impacts of climate change - Facilitate and manage the sustainable utilisation and development of the areas within the Estuarine Functional Zone	- Incorporation of the EMP into the municipal IDP, SDF, LUMS and CMP - Impacts of climate change are minimised by adhering to the CML, developing contingency plans, and innovative building techniques - All development and land use changes surrounding and within the EFZ comply with environmental legislation and environmental best practice / risk aversion approach - Strict compliance monitoring of all new developments and alterations	Medium
4	Institutional and	The iZinkwazi Estuary is well managed through effective	Ensure effective co-ordination of estuarine management responsibilities	Estuarine management co-ordination function adopted by KDM	Medium

	Management Structures	and co-operative governance between government and civil society	• Confirm co-operative governance arrangements for the iZinkwazi Estuary • Secure financing for estuarine management initiatives	• Ongoing co-management function by the ZSBC supported by the ZBC and ZBRRA • Estuarine bylaws are drafted (or environmental / boating bylaws updated) • Estuary sub-committee of the iLembe MCC established (Regional Estuary Advisory Forum) and ongoing meetings held	
5	Socio-economic considerations	Sustainable socio-economic benefits are conserved, regulated and enhanced without compromising estuarine ecological integrity	• Maintain safe, clean, equitable and controlled access • Regulate recreational use in and around the iZinkwazi Estuary • Maintain economic benefits	• Beach/ estuary access controlled and well maintained • Beach amenities well maintained • Recreational use regulated to reduce habitat disturbance and degradation • Economic value of the estuary is appreciated • Economic value of the estuary and dependencies are upheld and enhanced	Medium
6	Education, awareness, monitoring and research	Society is aware of, and sensitive to, the value and importance of the iZinkwazi Estuary	• Promote high levels of public awareness and appreciation of the value of the iZinkwazi Estuary • Enhance the knowledge and understanding of the iZinkwazi Estuary through monitoring and research	• Signage erected; information disseminated; awareness increased. • Community stewardship and Citizen Science involvement increased • Knowledge and understanding enhanced through monitoring and increased number of research projects pertaining to key issues • Annual meetings with key stakeholders (farmers, fishers)	Medium

Integrated Monitoring Plan

According to the standards for estuarine management, management actions should be based on evidence. Thus, monitoring is a crucial aspect of the adaptive estuarine management planning 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 and 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).

Concluding Remarks

Through this EMP development process, it is unambiguously apparent that the iZinkwazi Estuary has a long history of human modification which persists today. Despite transformation of large areas within the EFZ due to agriculture, as well as water edge development at the estuary mouth, the iZinkwazi Estuary maintains important biodiversity and socio-economic value. The system is among the country's most important estuaries and it has the potential to influence the functioning and success of the Thukela MPA. It is for these reasons that further deterioration of iZinkwazi Estuary must be prevented through effective and co-ordinated management by the relevant institutions. It is not the estuary itself that needs to be managed, but rather human activities which could negatively affect the integrity of the estuary and the ecosystem goods and services it provides, if they continue without a level of control. Overall, what is required is a stronger appreciation of the importance of this estuarine ecosystem as a valuable asset worthy of conservation and conscientious use for the benefit of both the environment and coastal communities.

It is important that implementation of this EMP be reviewed annually, and both the EMP and SAR be updated at the mandatory 5-year interval to keep the document relevant and to enable adaptative management. However, updates can also be made as and when critical information becomes available.

In conclusion, priority actions requiring immediate attention are summarised as:

- Begin process to lobby for inclusion of the iZinkwazi Estuary into the Thukela MPA;
- Enter engagements with THD for the strategic setback/retreat from the estuary margin and rehabilitation of degraded areas for biodiversity preservation purposes through a formal signed Biodiversity Stewardship Agreement;
- Update the KDM town planning scheme to include a zonation for the estuary;
- Connect the existing infrastructure (secondary conservancy tank in the parking area) to the beach ablution facilities to alleviate pollution risk to estuary during peak holiday periods until the planned upgrades to the ablution facilities are initiated;
- Obtain a formal signed agreement or MOU for roles and responsibilities of the ZSBC in respect to managing boating activities on the estuary; and
- Determine the terms for establishment of the iLembe District Coastal Committee: Estuaries sub-committee.

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LIST OF ACRONYMS

BOSMap	KwaDukuza Biodiversity and Open Space Management Plan	EMF	Environmental Management Framework
CARA	Conservation of Agricultural Resources Act (No. 43 of 1983)	EMP	Estuarine Management Plan
CBA	Critical Biodiversity Area	EMPr	Environmental Management Programme
CCRS	Climate Change Response Strategy	EPIP	Environmental Protection and Infrastructure Programmes
CMA	Catchment Management Authority	Ezemvelo/EKZNW	Ezemvelo KZN Wildlife
CML	Coastal Management Line	GHG	Green House Gas
CMO	Coastal Management Overlay	HWM	High Water Mark
CMP	Coastal Management Programme	ICMA	Integrated Coastal Management Act (No. 24 of 2008)
COGTA	Cooperative Governance and Traditional Affairs	IDM	iLembe District Municipality
CPP	Coastal Public Property	IDP	Integrated Development Plan
CPZ	Coastal Protection Zone	IAPS	Invasive Alien Plants
CVI	Coastal Vulnerability Index	I&APs	Interested and Affected Parties
DAFF	Department of Agriculture, Forestry and Fisheries	KDM	KwaDukuza (Local) Municipality
DARD	KZN Department of Agriculture and Rural Development	KZN	KwaZulu-Natal
DRDLR	Department of Rural Development and Land Reform	LED	Local Economic Development
DEA	Department of Environmental Affairs	LM	Local Municipality
DFFE	Department of Forestry, Fisheries and the Environment (formerly DEFF)	LUMS	Land Use Management System
DM	District Municipality	MAR	Mean Annual Run-off
DPSIR	Drivers, Pressures, State, Impact and Response framework	MCC	Municipal Coastal Committee
DST	Department of Science and Technology	MFMA	Municipal Finance Management Act (No.56 of 2003)
DWA	Department of Water Affairs	MLRA	Marine Living Resources Act (No. 18 of 1998)
DWAF	Department of Water Affairs and Forestry	MOU	Memorandum of Understanding
DWS	Department of Water and Sanitation	MPA	Marine Protected Area
EAf	Estuary Advisory Forum	MSA	Municipal Systems Act (No. 32 of 2000)
EDTEA	KZN Department of Economic Development, Tourism and Environmental Affairs	n/a	Not applicable
EFZ	Estuarine Functional Zone	NBA	National Biodiversity Assessment
EHl	Estuarine Health Index	NEMA	National Environmental Management Act (No. 107 of 1998)
EI	Ecological Infrastructure	NEM:BA	National Environmental Management: Biodiversity Act (No. 10 of 2004)
EIA	Environmental Impact Assessment	NEMP	National Estuarine Management Protocol
EMC	Estuarine Management Coordinator	NEM:PAA	National Environmental Management: Protected Areas Act (No. 57 of 2003)

NFA	National Forests Act (Act 84 of 1998)	SDF	Spatial Development Framework
NGOs	Non-governmental Organisations	SLR	Sea Level Rise
NHA	National Health Act (No. 61 of 2004)	SPLUMA	Spatial Planning and Land Use Management Act (No. 16 of 2013)
NHRA	National Heritage Resources Act (No. 25 of 1999)	SZP	Spatial Zonation Plan
NWA	National Water Act (No. 36 of 1998)	STP	Sewage Treatment Plant
ORI	Oceanographic Research Institute	SUDS	Sustainable Urban Drainage Systems
ORV	Offroad Vehicle Regulations (GN R1426 in GG 27066 of 7 December 2004)	SWOT	Strengths, Weaknesses, Opportunities and Threats analysis
PAMP	Protected Area Management Plan	TBD	To Be Determined
PBLS	Public Boat Launch Site	THD	Tongaat Hulett Developments
PCC	Provincial Coastal Committee	TICZ	Thukela Inshore Controlled Zone
PES	Present Ecological State	TPS	Town Planning Scheme
PFMA	Public Finance Management (Act No. 1 of 1999)	WESSA	Wildlife and Environment Society of South Africa
PPP	Private Public Partnerships	WftC	Working for the Coast
REC	Recommended Ecological Category	WfW	Working for Water
RMA	Responsible Management Authority	WMA	Water Management Area
RQOs	Resource Quality Objective(s)	WUL	Water Use License
SAEON	South African Environmental Observation Network	ZBC	Zinkwazi Blythedale Conservancy
SAHRA	South African Heritage Resources Agency	ZBRRA	Zinkwazi Beach Ratepayers and Residents Association
SAMSA	South African Maritime Safety Authority Act (Act No. 5 of 1998)	ZSBC	Zinkwazi Ski Boat Club
SANBI	South African National Biodiversity Institute		
SAR	Situation Assessment Report		
SASRI	South African Sugarcane Research Institute		

DISCLAIMER, ASSUMPTIONS AND LIMITATIONS

This report has been prepared by Coastwise Consulting, with all reasonable skill, care and diligence within the terms of the contract with the KZN Department of Economic Development, Tourism and Environment Affairs (EDTEA) the Client. The findings in this report are based on the author/s' professional knowledge, data and resources available at the time and relevant information provided by the client. The nature of the study, and detail of assessment undertaken are dependent on the human and time resources committed to the study in agreement with the client prior to the assessment.

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1. INTRODUCTION

1.1. Background

The National Environmental Management: Integrated Coastal Management Act (Act No. 24 of 2008, as amended 2014) (ICM Act), requires that estuaries within South Africa are managed in a co-ordinated and efficient manner, and in accordance with the updated National Estuarine Management Protocol of 2021 (DEA 2013, DEFF 2021) (NEMP) which lays out specific objectives for management of the South African coastline, including estuaries. Management of estuaries should also take cognisance of the National Coastal Management Programme (CMP), the KwaZulu-Natal (KZN) provincial CMP as well as the KwaDukuza municipal CMP. However, it is important to recognise that it is not the estuarine ecosystem *per se* that requires management, but rather the human activities which impact on an estuary. The identified vehicle to manage estuaries is the Estuarine Management Plan (EMP).

In light of the above directive and the KwaZulu-Natal CMP, the KZN Department of Economic Development, Tourism and Environmental Affairs (EDTEA) prioritised the development of an EMP for the iZinkwazi Estuary. This process entailed the updating and refining the 2014/2015 draft inaugural EMP initially compiled by Zinkwazi Blythedale Conservancy (ZBC) and the KwaDukuza Municipality (KDM) (Roberts and Mthuli 2015).

1.2. 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 this component 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 iZinkwazi system by setting out essential management objectives and related actions/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. This is also the critical reference document for the incorporation of estuarine management into the municipal Integrated Development Planning (IDP) and spatial planning processes, as well as relevant national and provincial plans.

1.3. Document Structure

The structure of this EMP is detailed as follows:

- Section 2 delineates the geographical boundaries of the iZinkwazi Estuary management area, namely the estuarine functional zone (EFZ);
- Section 3 provides a Summary of the Situation Assessment Report (SAR) (Breetzke and Meyer 2021) – thereby providing context to the Vision, Key Objectives, Management Objectives and Management Priorities;

- Section 4 sets out the Vision and Key Objectives for the management of the iZinkwazi Estuary. It describes the desired future state for the system and provides the overarching logical framework for the action plans developed;
- Section 5 sets out the Management Objectives for the iZinkwazi Estuary and includes a list of actions from which management priorities are selected;
- Section 6 provides a description of the various zones and features included in the Spatial Zonation of the iZinkwazi Estuary;
- Section 7 describes the institutional arrangements for implementation of the EMP, in respect to the key role players and participating institutions, and the recommended projects provided for in the action plans; and
- Section 8 describes the recommended Management Priorities to be undertaken in the first five-year period, i.e., the required actions and activities to be undertaken in terms of implementing the EMP, captured as individual action plans;
- Section 9 sets out the Integrated Monitoring Plan required in respect to monitoring the biophysical components of the estuary, monitoring compliance, as well as assessing the performance of the EMP in respect to achieving the stipulated objectives;
- Sections 10 and 11 provide the recommendations for addressing specific shortfalls or knowledge gaps in the EMP, and the conclusion to the document, respectively.



2. GEOGRAPHICAL BOUNDARIES

The geographical boundaries of the iZinkwazi Estuary, as per the 2018 National Biodiversity Assessment (Van Niekerk et al. 2019a) and the EIA Regulations, are illustrated in Figure 1 below.

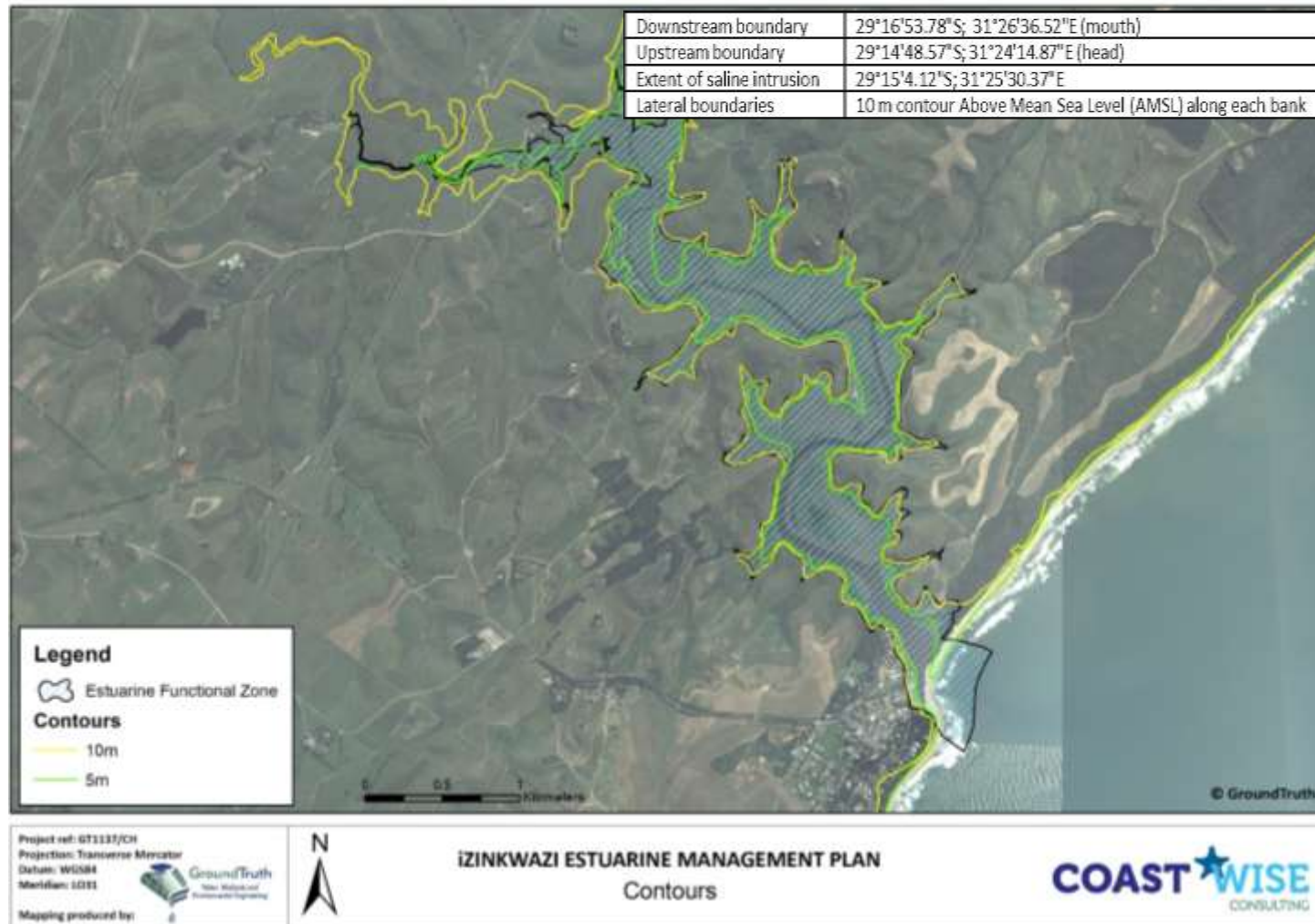


Figure 1: Delineation of the iZinkwazi Estuary illustrating the estuarine functional zone based on the 10 m contour and the 5 m contour (CoastKZN 2021)

3. SUMMARY OF SITUATION ASSESSMENT

Overview

The National Environmental Management: Integrated Coastal Management Act (Act No. 24 of 2008, as amended 2014) requires that estuaries within South Africa are managed in a co-ordinated and efficient manner, and in accordance with the National Estuarine Management Protocol via the development of an Estuarine Management Plan. The first phase in the process of developing an Estuarine Management Plan is an assessment of the *status quo* via a Situation Assessment, which explores and contextualises the iZinkwazi Estuary, a large temporarily closed estuary (TCE) located in the coastal holiday town of Zinkwazi Beach in KwaZulu-Natal, relative to various environmental, social and economic aspects. The key findings of this assessment, rather than an elaborate summary of the report, are captured below in order to both prepare for the management planning process.

The Situation Assessment Report locates the iZinkwazi Estuary within the KwaDukuza Municipality on the KwaZulu-Natal north coast; the boundaries of the estuarine system are delineated and a description of the broader catchment, including the catchments geology, climate, runoff, and land-use, is provided. 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, and 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 described prior to unpacking the legal instruments and related strategies and plans, which impact the management of the estuary, along with the current institutional structures governing estuarine management.

The Situation Assessment Report 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.

Present Ecological State and Desired Ecological State

Early assessments of the health of the iZinkwazi Estuary acknowledged the severe transformation of the catchment to sugar cane cultivation, and rated the overall condition of the system as 'Fair' (Heydorn 1986, Harrison et al. 2000, Whitfield 2000, Whitfield and Baliwe 2013).

In 2015, the status of the iZinkwazi Estuary was reassessed through the estuaries Ecological Water Requirement study, a component of the Water Resources Classification Study for the Mvoti -Umzimkulu Water Management Area. In this study, the health state of the estuary was rated as a Category B/C, i.e. largely natural to moderately modified. The 2018 NBA, the update to the 2011 NBA, incorporates and confirms this rating.

The iZinkwazi Estuary is among the priority estuaries identified as requiring formal protection in order to conserve South Africa estuarine biodiversity. It is recommended that the estuary be partially protected (i.e. inclusion of a no-take zone and areas of controlled usage), and that 50% of the estuary's margin remain undeveloped. The Recommended Ecological Category, or desired state, for the iZinkwazi Estuary is a Category A/B. However, this would be difficult to achieve with negative socio-economic implications. As a result, measures are required to be implemented to improve to a B, and the Target Ecological Category of a B (i.e. that which considers all users of the system as assigned by the Minister) is immediately applicable.

Goods and services or human use activities

Ecosystem goods and services are the products that emerge from the natural environment through various biological, chemical, and physical processes and functions, which are typically used by people and contribute to enhanced societal wellbeing. The types of ecosystem services include provisioning services (such as food, water and other resources), regulating services (e.g. climate regulation, as well as air and water purification), life-support services (such as nutrient cycling and soil formation) and cultural services (e.g. aesthetic, spiritual, recreational, educational and cultural benefits).

The level of ecosystem services provided by the iZinkwazi Estuary ranges from low to medium, directly related to the history of human modifications to the estuary margins and its catchment through agriculture, and settlement along the lower reaches and associated 'urban' impacts. The main ecosystem services currently offered relate to production of food (i.e. sugar cane in the floodplain, subsistence fishing), water quality improvement (i.e. waste treatment through dilution and assimilation), the export of nutrients and materials to the marine environment, provision of refugia / nursery services and noticeably socio-cultural services, namely recreational activities in the form of water activities (water skiing, recreational cruises, stand up paddle boarding, kayaking, jet-skiing), recreational fishing and bait harvesting, birding as well as aesthetic appreciation (supporting tourist and residential accommodation needs). The latter is rated to be of high importance, whilst overall socio-cultural importance of the iZinkwazi Estuary is rated as medium. Subsistence use of the system has been observed through the use of illegal gill nets.

Geographical socio-economic context

The Situation Assessment Report unpacks the demographics of the KwaDukuza Municipality detailing its geographical context, population statistics, and service provision. The municipality's economic profile is expanded noting the tourism sector leading the economy and the role that environmental assets and coastal infrastructure play in making the municipality a key tourism destination. As such, the improvement, protection and ongoing maintenance of the natural resource base and coastal infrastructure is vital to retaining and attracting new tourists, investment and economic development.

Zinkwazi Beach itself is outlined highlighting its role as a quiet residential, as well as, second holiday home village. The Zinkwazi Beach planning scheme and scheme controls were evaluated in preparation for the proposed zonation of activities and spatial depiction of the estuary's envisaged desired state. Currently, municipal zonation for the iZinkwazi Estuary is lacking. This is viewed as an important opportunity to be included in the EMP to increase protection of the system. The agricultural landholdings under different ownership are also presented as a means to identify key roleplayers for inclusion in the EMP.

Three key socio-economic considerations are thereafter elaborated upon, namely, the status of Zinkwazi Beach as pilot Blue Flag Beach, secondly the municipality's, town and surrounding property owner's dependency on the state of the system and its direct and indirect impact on livelihoods. The third aspect considered related to coastal vulnerability and risk, anticipated sea-level rise and the designation of coastal management lines.

Current or Potential Pressures and Impacts

The iZinkwazi Estuary is a moderately modified system with the level of cumulative pressure on the estuary considered to be low (Van Niekerk et al. 2019b). The generic pressures and impacts affecting estuaries are presented. A trial run of the DPSIR framework was undertaken during the inaugural EMP as a means to assess whether this framework would be adequate in setting some of the management objectives that were required for the iZinkwazi Estuary. This is supplemented by a summary of the current impacts and threats as determined from the available literature and assessments, site observations, and stakeholder input. The following

pressures are affecting the system at a moderate level: pollution (eutrophication, chemical contamination and litter), habitat loss, invasive alien species and sea-level rise. Fishing pressure (including bait harvesting) is rated to be high, whilst flow modification is rate is low. There is also infrequent unauthorised/illegal breaching of the estuary to protect low-lying croplands.

Opportunities and Constraints

A Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis was conducted for the management of the iZinkwazi Estuary, and estuarine management in the KwaDukuza Municipality in general and has been crudely divided into ecological, socio-economic and institutional spheres, however many of the recorded items are cross-cutting.

From an ecological perspective, the iZinkwazi Estuary is in a moderately modified/largely natural state, retaining much of its natural processes and biodiversity in general. The estuary and the adjacent beach form an important recreational and coastal tourism node, which links directly to the Thukela Marine Protected Area, and for these reasons warrants effective management. There are numerous environmental management tools and planning documents that have been developed by the Municipality, which support the preservation and management of KDM's environmental assets. Some farmers are environmentally conscious and have adopted custodianship of the estuary margin and implemented environmental best practices. Notwithstanding, there are large areas within the EFZ that have been transformed by agriculture and irreversibly by urban development that makes up Zinkwazi Beach. As result the water quality of the estuary is compromised by agricultural return flows and some urban input (septic tank, stormwater etc.). In addition, there is no formal policing to regulate fishing. There is a considerable opportunity to regain and rehabilitate a portion of the agriculture land and the riparian buffer, to implement agricultural best practices, and to ensure and preserve the natural functioning of the estuary by controlling future water use. Overall, improving the health of the estuary is easily attainable. Some of the threats to the health of the estuary include illegal artificial breaching to prevent flooding of crops, aging infrastructure (e.g. old septic tanks), alien invasive species, development pressure and encroachment, lack of policing in respect to fishing, and at a municipal level, a general lack of agency for the protection of sensitive natural assets. The conversion of agricultural land to urban development is an impending threat to the estuary, with a host of new and potentially more intensive pressures, in comparison to cultivated areas.

In terms of socio-economic aspects, the estuary possesses moderate to high recreational and aesthetic value and is an important element of the tourism industry in the region. Importantly, a local management body exists to oversee boating activities but has also fostered community custodianship of the estuary. Some of the main weaknesses are that the beach amenities, including ablutions are frequently flooded causing health and safety issues for beach and estuary users. Also, their placement directly on the beach, as well as development on the waterfront, makes these structures highly vulnerable to damage by marine events (storm surges etc.) as well as riverine flooding and backflooding. The latter has a negative effect on vast areas of low-lying agricultural land, which contributes to the agricultural sector. Opportunities identified include establishing a community-based advisory forum using the existing active community groups; increasing public awareness and education on estuarine health, function and value; strategic retreat of agriculture and subsequent rehabilitation of affected areas. The KDM identified tourism opportunities for the broader area that could impact both positively and negatively on the estuary. In general, the socio-economic value is threatened by the impacts of climate change. Other threats include possible unsustainable farming practices; indiscriminate artificial breaching; and conflict between undertaking artificial breaching to prevent flooding and preserving high water levels to support tourism and the natural estuarine processes.

From an institutional perspective, relevant institutional structures do exist, and inter-governmental cooperation appears active. The KDM also exhibits willingness to implement necessary management measures as well as engage with stakeholders more cooperatively on estuarine matters. The partnership with the Zinkwazi

Ski Boat Club appears effective in managing boating activities and general oversight of the estuary. A key weakness at the local municipal level is limited/inadequate financial resources to speedily implement the recommendations of environmental sector plans. Opportunities identified include collaboration/linking with the management structure for the Thukela MPA (Ezemvelo), formation of additional public-private partnerships between various government departments, agencies and institutions (e.g. Zinkwazi Blythedale Conservancy). The presence of third-party sugar cane growers and the opportunity to form partnerships with co-operatives and/or growers along the estuary and involve them in estuarine management is also encouraging. Issues that could prevent the success of the EMP include confusion/ignorance of authority roles and responsibilities; non- implementation of management actions / project plans; reallocation of funds; and lack of communication and co-operative governance.

Information gaps to be addressed in the plan

Given the biodiversity importance of the iZinkwazi Estuary, its connection to an MPA, and its contribution to tourism value both locally and regionally, it is important that our knowledge of the system is enhanced to improve overall management of activities that are negatively affecting the system. The following initiatives are recommended:

- Undertake a full Ecological Reserve study to fine-tune our understanding of the estuarine structure and functioning to better inform management decisions;
- Undertake ongoing basic monitoring toward establishing a long-term database, to monitor impacts and guide mitigation measures;
- Assess the types and numbers of boats/vessels;
- Establish the level of natural resource use (e.g. subsistence/ illegal gill-netting);
- Compile an inventory of estuarine pollution sources (e.g. establish nutrient and sediment levels entering the estuary as a direct result of farming activities, establish the location of any leaks from septic tanks, problematic stormwater outlets);
- Investigate new technology for replacing septic tanks;
- Investigate aquatic invasive species control/management, such as *Tarebia*, Limpopo/Hippo Grass (*Echinochloa* sp.) and Duckweed (*Lemna* spp.)
- Establish the contribution of the estuary, and other north coast systems, to the regional estuarine nursery function, including the Thukela MPA;
- Determine flood levels (i.e. the 1:100-year flood line), preferably in parallel with the determination of the CML, to formally establish flood risks and thus develop appropriate alerts and responses/mechanisms to mitigate these risks; and
- Undertake an economic evaluation of the ecosystem goods and services provided by the iZinkwazi Estuary to formulate a business case in favour of estuarine management.

4. VISION AND MANAGEMENT OBJECTIVES

4.1. Vision

As part of the 2015 inaugural EMP development process, a draft Vision for the iZinkwazi Estuary was formulated. This was presented for discussion, amendment and refinement during the 2021 EMP process:

The Zinkwazi Estuary is at a minimum kept at its current ecological state, while ensuring all present and future users have access to a healthy and safe environment

A period of general discussion took place around the unique aspects of the iZinkwazi Estuary and future aspirations for the state of the system. Based on this discussion and subsequent iterations across the stakeholder meetings, the following vision was confirmed by the stakeholders at the second and final stakeholder meeting:

The beauty and ecological well-being of the Zinkwazi Estuary is enhanced and protected, ensuring that all present and future users have access to a healthy and safe environment

Through the information gathered and stakeholder engagements, it was evident that management needs to be directed towards:

- **Improving/enhancing** the health and functioning of the estuary, specifically controlling activities that contribute to habitat degradation and poor water quality;
- **Managing development and activities** within the EFZ and on adjacent properties; and
- **Providing protection** for coastal fauna and flora, especially given the linkage to the Thukela Marine Protected Area.

4.2. Current impacts and threats

The iZinkwazi Estuary is a moderately modified system in which a loss and change of natural habitat and biota has occurred, but the basic ecosystem functions and processes remain predominantly unchanged. The 2018 NBA considers the level of cumulative pressure on the estuary to be low (Van Niekerk et al. 2019b). The impacts identified which are affecting the iZinkwazi Estuary are summarised in Table 1.

Table 1: Current impacts and pressures facing the iZinkwazi Estuary (Breetzke and Meyer, 2021)

IMPACT/THREAT	COMMENTS	2018 NBA RATING
1. Flow modification (Freshwater additions and diversions)	Under present-day conditions, the MAR to estuary has decreased marginally, with no change to the river baseflow. The estuary still receives approximately 97% of the natural MAR, i.e. there is limited abstraction or diversion. The system reportedly receives limited lateral input of treated waste water from the iZinkwazi Lagoon Lodge STP through natural percolation.	Low
2. Pollution: Eutrophication	The system is subject to periodic contamination by raw sewage arising from flooding of the septic tank in the estuary mouth (beach ablutions), and peak period overflows from this and other septic tanks associated with water-edge developments. Organic enrichment also includes washing of cane off-cuts into the system.	Moderate
3. Pollution: Chemical contamination	The system also likely receives agricultural run-off containing nutrients and sediments from the surrounding cane fields, run-off containing urban contaminants (heavy metals, fuels, oils and greases) through roadside stormwater systems, and potentially fuel from motorised craft operating in the estuary and beach driving/launching.	
4. Pollution: Litter/debris	Litter and solid waste can be deposited by beach goers and estuary users and through the roadside stormwater system.	
5. Habitat Loss / Disturbance	There has been significant agricultural encroachment and transformation of the EFZ through clearing of natural vegetation, crop cultivation, and sedimentation, as well as urban development on the south bank in the lower reaches, which have contributed to major habitat loss within the system. The catchment area is under intensive sugar cane cultivation, including draining and planting within wetlands and drainage lines (although there has been rehabilitation in some areas). Disturbance is brought about by recreational use, i.e. motor-boats, skiing, beach driving, clearing of vegetation for views and ease of access to the water's edge. There are also concerns of compaction of the sandbar by boat-launching vehicles.	Moderate
6. Resource exploitation	Fishing pressure is rated as High (2018 NBA). Illegal gill-netting has been observed by residents. Recreational fishing and bait harvesting increase during peak holiday seasons.	High
7. Breaching	Historical breaching has occurred to prevent flooding of croplands and poor water quality (bacterial contamination). More recently, unauthorised breaching has been reported allegedly in response to flooded croplands. Overall, unauthorised breaching is infrequent.	Unauthorised
8. Invasive alien species*	The remaining estuarine/ riparian margin is infested with IAPs. The invasive snail, <i>T. granifera</i> has been recorded in high abundance in the upper reaches of the system, but the impact on biodiversity is largely unknown. Aquatic invasive plants (e.g. Duckweed, <i>Lemna</i> spp.), also appear periodically.	Moderate*
9. Sea-level rise*	The risk of sea-level rise is moderate because of the wide seafront, limited natural remaining coastal vegetation in the mouth region, and low-lying properties at the estuary, countered by the relatively large estuary size and space for expansion.	Moderate*

*Not specifically assessed in 2018 NBA

4.3. Key objectives

The 'categories' for objectives as prescribed by the National guidelines (DEA 2015) are illustrated in Figure 2. Overarching or 'Key' objectives for the iZinkwazi Estuary are detailed in Table 2.

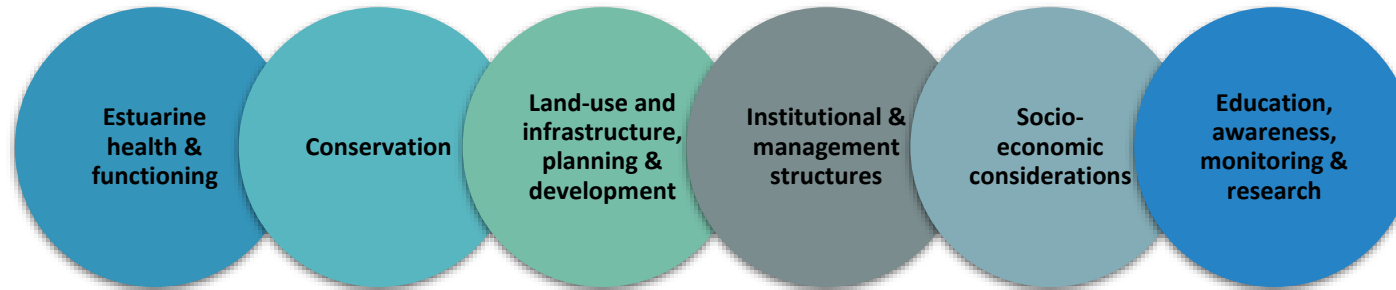


Figure 2: Sectors or categories of issues relevant to the management of the iZinkwazi Estuary

Table 2: Key Objectives for the management of the iZinkwazi Estuary, their indicators and level of priority

Sector / Category		Key Objective	Indicators	Priority
1	Estuarine health and functioning	The ecological health and natural functioning of the iZinkwazi Estuary is enhanced and safeguarded	- Flows reaching estuary are secured - Pollution risks are reduced and water quality is improved - Improved agricultural practices - Reduction in invasive alien plant coverage - Estuarine habitat is regained and restored through strategic retreat - Ecological health of estuary is improved from a category C to category B state - National priority status is maintained	HIGH
2	Conservation	The biodiversity and estuarine habitats of the iZinkwazi Estuary are conserved	- Inclusion of the estuary in the Thukela MPA is tabled and under discussion - Estuary received designated municipal zonation under the TPS - Biodiversity Stewardship Agreement signed with THD - Increased stewardship of property owners - Estuarine habitat is regained and restored - Resources are sustainably utilised - Healthy fish nursery function	HIGH
3	Land-use and Infrastructure Planning and Development	All developments, associated activities, and proposed changes in land-use, which impacts or could	- Incorporation of the EMP into the municipal IDP, SDF, LUMS and CMP - Impacts of climate change are minimised by adhering to the CML, developing contingency plans, and innovative building techniques	MEDIUM

		impact, on the iZinkwazi Estuary, are controlled by legislation in such a way so as to sustain existing and future livelihoods, while ensuring the maintenance and ecological functioning and services	• All development and land use changes surrounding and within the EFZ comply with environmental legislation and environmental best practice / risk aversion approach • Strict compliance monitoring of all new developments and alterations	
4	Institutional and Management Structures	The iZinkwazi Estuary is well managed through effective and co-operative governance between government and civil society	• Estuarine management co-ordination function adopted by KDM • Ongoing co-management function by the ZSBC supported by the ZBC and ZBRRA • Estuarine bylaws are drafted (or environmental bylaws updated) • Estuary sub-committee of the iLembe MCC established (Regional Estuary Advisory Forum) and ongoing meetings held • Estuarine bylaws are drafted (or environmental/boating bylaws updated) • EMP kept relevant through regular reviews and updates	MEDIUM
5	Socio-economic considerations	Sustainable socio-economic benefits are conserved, regulated and enhanced without compromising estuarine ecological integrity	• Beach/ estuary access controlled and well maintained • Beach amenities well maintained • Recreational use regulated to reduce habitat disturbance and degradation • Economic value of the estuary is appreciated • Economic value of the estuary and dependencies are upheld and enhanced	MEDIUM
6	Education, awareness, monitoring and research	Society is aware of, and sensitive to, the value and importance of the iZinkwazi Estuary	• Signage erected; information disseminated; awareness increased. • Community stewardship and Citizen Science involvement increased • Knowledge and understanding enhanced through monitoring and increased number of research projects pertaining to key issues • Annual meetings with key stakeholders (farmers, fishers)	MEDIUM

4.4. Management standards

Management standards, as included in the inaugural EMP (Roberts and Mthuli 2015), are carried through into this updated version as follows:

- Best Practice in respect to use and management of the estuary through having sound understanding of ecological principles that will ensure sustainability and co-operative governance;
- A holistic ecosystem approach needs to be followed, with consideration of all facets of the estuary functioning, including catchment- and coastal-related impacts; and
- The estuary should be managed according to its gazetted class, i.e. Class B, and it requires partial protection. Therefore, spatial zonation of the estuary must include areas of no-take, catch and release, and permissible resource use (extractive) zones. These will be overlaid with other zoned areas (see Spatial Zonation, pg. 41).

5. MANAGEMENT OBJECTIVES AND ACTIVITIES

The management objectives and activities were informed by the Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis undertaken during the Scoping Phase (Table 3), critical issues identified, as well as stakeholder input.

Table 3: SWOT analysis

Strengths (<i>highlights, uniqueness?</i>)	Weaknesses (<i>what could be improved?</i>)
ECOLOGICAL • Estuary condition is largely natural to moderately modified • Natural beauty, scenic routes and beautiful sea views • Estuary and adjacent beach form an important recreational and coastal tourism node, warranting effective management • BOSMaP, CCRS, EMF, draft CMP and GHG Inventory for the management of environmental assets (tools developed) • Environmental plans/programmes are mainstreamed into the spatial planning tools, such as the SDF • Support from active, environmentally conscious sugar cane farmers	ECOLOGICAL • Significant habitat loss (transformation) within the EFZ largely due to agriculture but also (limited) urban development • Reduced water quality due to land transformation, nutrient and sediment inputs • Faecal contamination by septic tanks, discharges/ overflows and flooding • No policing of resource use (fishing, bait harvesting) • Lack of zonation with specific development controls for the estuary and river • Inadequate financial resources to speedily implement recommendations of environmental sector plans
SOCIO-ECONOMIC • Natural beauty, scenic routes and beautiful sea views • Estuary and adjacent beach is an important recreational and coastal tourism node • Well-known, well-managed beach holiday destination • Presence of a local management body (i.e. the Ski Boat Club) and active community groups • Formation of partnerships (e.g. Ski Boat Club, Rate payers Assoc. etc.)	SOCIO-ECONOMIC • Flooding of beach amenity and properties due to closed mouth conditions • Vast areas of agricultural land in the EFZ affected by backflooding • Amenities vulnerable to impacts of climate change (SLR, floods, etc.) • Breaching/open conditions bad for tourism & negative public perceptions of drained systems
INSTITUTIONAL • KDM Environmental committee as well as iLembe District Coastal Committee in existence • Cooperative governance between spheres of government • Willingness of KDM to implement measures and engage stakeholders • Effective devolvement of some management responsibilities to local institutions (e.g. Ski Boat Club) • Environmental plans/programmes are mainstreamed into the spatial planning tools such as the SDF. • Life guard station on beach (municipal presence)	INSTITUTIONAL • Inadequate financial resources to speedily implement recommendations of environmental sector plans • Lack of policing, and compliance and enforcement monitoring (resource use)

Support from Ezemvelo in respect to proposed conservation efforts (provincial priority estuary)	
Opportunities (<i>Opportunities for positive change</i>)	Threats (<i>what could prevent the EMP from working?</i>)
ECOLOGICAL - Strategic retreat from EFZ, specifically irt agriculture and reinstatement/strengthening of riparian buffer - Rehabilitation of transformed/degraded habitat within EFZ to increase habitat availability, diversity, and carrying capacities - Rehabilitation of streams and wetlands within the catchment - Ensure natural estuarine cycles of mouth opening/closing and periods of high productivity - Improvement of estuarine condition (easily attainable) - Preserve sense of place - Improvement of catchment water quality through better land-use practices, buffers and wetland restoration - Implementation/strengthening of agricultural best practices (SUSFarms® by SASRI) - Investigate modern technologies to replace septic tanks on fronting properties - Regular long-term monitoring of water quality and mouth dynamics to inform management - Proposed local open space network for KwaDukuza residents (as detailed in the BOSMaP) which could be turned into vibrant public open spaces by the municipality (KDM) - Investigation for protected area status	ECOLOGICAL - Artificial breaching that negatively affects estuarine function and processes - Conflict between breaching (crop preservation) and protection of natural estuarine processes - Conversion of agricultural land to property development - Inadequate and aging infrastructure (e.g. septic tanks) - Infestation by invasive alien species - Encroachment of development upon critical biodiversity areas, and areas of ecosystem service provision importance - Uncontrolled and damaging/insensitive recreational activities - Development and tourism pressures may promote environmental degradation if not properly regulated/facilitated - Impacts of climate change (SLR, floods, erosion etc.) - Limited formally protected (proclaimed) environmentally sensitive areas (KDM) - Non-management of sensitive natural assets (KDM) - Environmental non-compliances and impingements
SOCIO-ECONOMIC - Establish community-based advisory forum to assist municipality/authorities, which allows designated members to take action - Strategic retreat of agriculture out of the EFZ - Instatement of estuary buffer zone for agriculture - Increase public awareness and education on estuarine health, function and value - Massive tourism possibilities and possibility for the development of a north coast equivalent of the midlands meander (KDM)	SOCIO-ECONOMIC - Inadequate and aging infrastructure - Poor/unsustainable agricultural practices - Artificial breaching - Lack of public awareness - Uncontrolled and damaging/insensitive recreational activities - Climate change related threats to - agricultural production (changing rainfall patterns), - tourism (heat & discomfort), - infrastructure (storms, floods) and - coastal properties (storms, tides & sea level rise combined).

INSTITUTIONAL

- Link to management structure and opportunities provided by the neighbouring Thukela MPA
- Formation of additional partnerships (public-private partnerships, e.g. ZBC, THD)
- Formation of partnerships with agricultural co-operatives/ third party growers
- Potential access to national funding

INSTITUTIONAL

- Lack of funds
- Potential reallocation of funds
- Lack of communication and co-operative governance between key role players

Figure 3, overleaf, represents an overview of the management objectives for the iZinkwazi Estuary. Management objectives are grouped according to the key objectives, sectors or categories of issues. Proposed activities are unpacked per management objective, and detail the ecological and socio-economic consequences of no action, expected availability of human resources, estimated cost and expected duration of activity. These more comprehensive lists are included to provide assistance in the selection of management priorities for the 5-year cycle of this EMP.



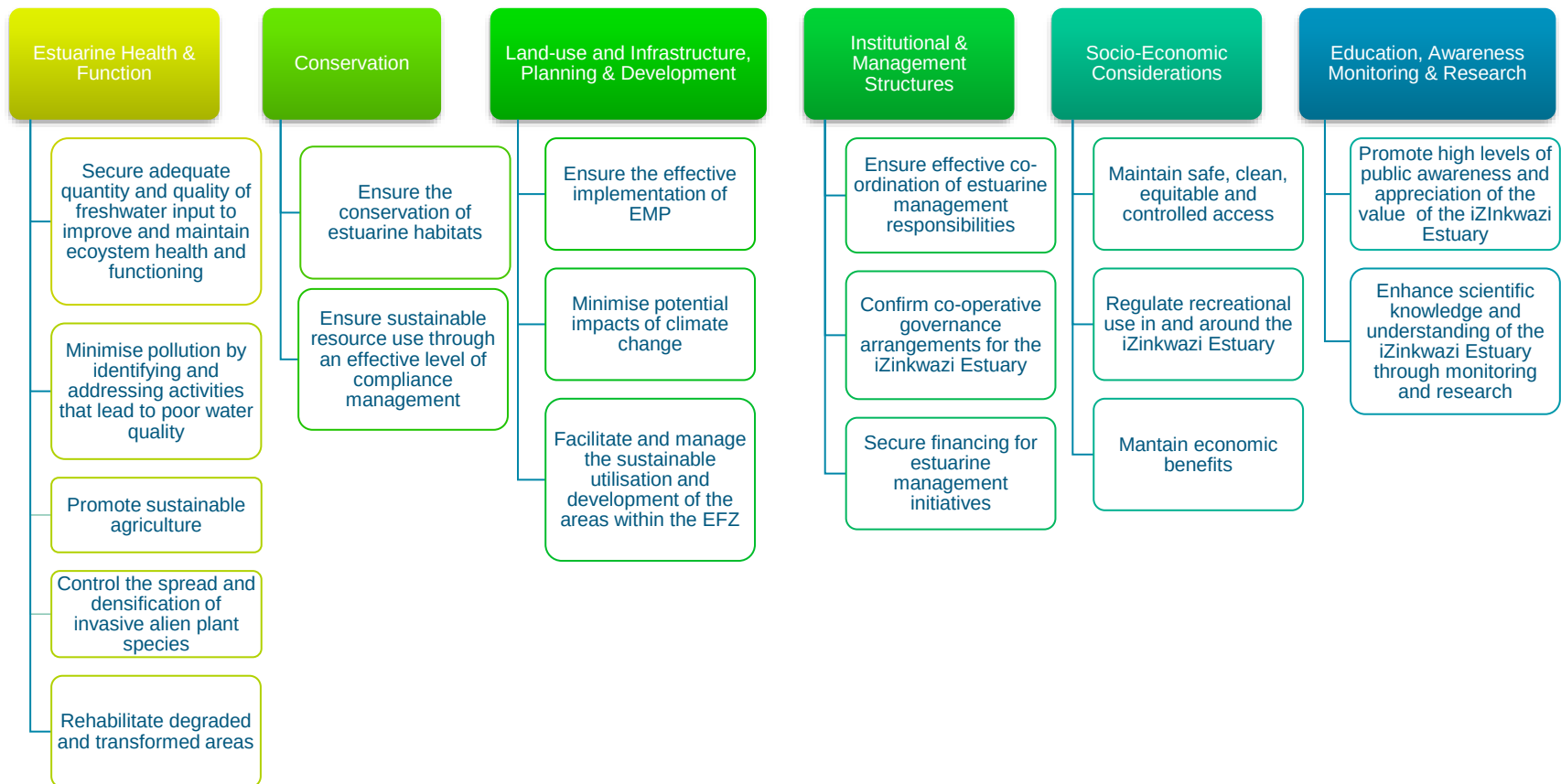


Figure 3: Management Objectives for the iZinkwazi Estuary

5.1. Estuarine Health and Functioning

The first key objective, estuarine health and functioning, is detailed in Table 4 below.

Table 4: Key Objective 1: Estuarine health and functioning

PROPOSED ACTIVITY	ECOLOGICAL IMPACT/SOCIO-ECONOMIC CONSEQUENCES OF NO ACTION	EXPECTED AVAILABILITY OF HUMAN RESOURCES	ESTIMATED COST	EXPECTED DURATION
Key Objective 1: The ecological health and natural functioning of the iZinkwazi Estuary is enhanced and safeguarded				
Management Objective 1.1: Secure adequate quantity and quality of freshwater input to improve and maintain ecosystem health and functioning				
Adopt and implement gazetted estuary and river Water Resource Classification outputs (REC, RQOs, etc.)	Further degradation of the estuary, potential unsustainable abstraction and loss of functioning To protect the water resource, maintain flow and nursery function/links to the MPA	Resources available in Municipality, DWS as well as NGOs	Part of mandate	6 months
Undertake a 5-yr review of abstractions within the catchment				6 months
Undertake a Reserve Determination Study		Limited financial resources nationally. Possible inclusion in MPA planning	>2M	More than one year
Management Objective 1.2: Minimise pollution by identifying and addressing activities that lead to poor water quality				
Connect and ensure the operation of existing secondary tank system serving the beach ablutions with immediate effect (before next December holiday period)	Continued pollution of system and resultant negative impacts on biodiversity, tourism and human health	Resources should be available in KDM	Part of mandate	immediately
KDM as owner of the beach ablutions to invest in estuarine rehabilitation (contingency funding) in the event of spillages or infrastructure failure	Continued pollution of system and resultant negative impacts on biodiversity, tourism and human health	Maintenance budget to be included in KDM budget	Part of mandate	As and when needed
Ensure that the Zinkwazi Lagoon Lodge STP is operating according to design specifications and an approved Water Use licence (WUL), with a maintenance and operations plan in place	Continued pollution of system and resultant negative impacts on biodiversity, tourism and human health	Private sector resources as a requirement of the authorisation	Part of operating costs	ongoing
Compile an inventory of the sources, types and loads/volumes of pollution entering the estuary (e.g. agricultural derived nutrients, sediment loads, leaking septic tanks)	Continued pollution of system and resultant negative impacts on biodiversity, tourism and human health	iLembe DM/ KDM have limited resources available	Part of mandate	ongoing
KDM together with waterfront property	Continued pollution of system and resultant	Resources limited	>R20M	Long term solution

PROPOSED ACTIVITY	ECOLOGICAL IMPACT/SOCIO-ECONOMIC CONSEQUENCES OF NO ACTION	EXPECTED AVAILABILITY OF HUMAN RESOURCES	ESTIMATED COST	EXPECTED DURATION
owners to investigate alternative means of domestic sewage disposal (i.e., replacement of historical/ aged septic tanks)	negative impacts on biodiversity, tourism and human health			
Investigate opportunities for the instalment of SUDS and ecological infrastructure (EI) to control stormwater run-off	Continued contaminated stormwater run-off, erosion and sedimentation	Resources available in Municipality, buy-in required	~R50 000	Once off training event
Management Objective 1.3: Promote sustainable agriculture				
Lobby THD (and subcontracted farmers) to implement agriculture best practice	Continued potential pollution of system and resultant negative impacts on biodiversity, tourism and human health	Resources are available	Part of operating costs	Ongoing
Management Objective 1.4: Control the spread and densification of invasive alien plant species				
Prioritise areas along the estuary followed by key areas in the catchment (e.g. adjacent to/in wetlands and CBA)	Continued spread of invasive species	Municipal resources available	Part of mandate	Ongoing
Lobby property owners (including THD and farm managers, residential and resort owners) to manage/control IAPs within the EFZ	Continued spread of invasive species	Legal requirement however resources may be limited	Part of maintenance costs	Ongoing
Management Objective 1.5: Rehabilitate degraded and transformed areas				
Convene formal engagements with THD to obtain buy-in for retreat and rehabilitation of strategic areas, and best practice (setback)	Continued degradation of the estuarine habitat and biodiversity within the EFZ	Resources available	Part of mandate	ASAP
Develop and implement strategic rehabilitation plan (with ongoing care of rehabilitated areas) based on formal engagements and agreements (Biodiversity Stewardship)	Continued degradation of the estuarine habitat and biodiversity within the EFZ	Resources available in EPIP programmes (WftC, WfW)	>R5M	ongoing
Lobby for landowners to maintain/rectify damages/ degraded areas on their property, as required, towards Biodiversity Stewardship	Continued degradation of the estuarine habitat and biodiversity within the EFZ	Resources available in KDM, EDTEA, Ezemvelo KZN Wildlife, I&APs (ZBRRRA, ZBC)	Part of mandate	Ongoing negotiations until programme developed

5.2. Conservation

The second key objective, conservation (protection of biodiversity), is detailed in Table 5 below.

Table 5: Key Objective 2: Conservation

PROPOSED ACTIVITY	ECOLOGICAL IMPACT/SOCIO-ECONOMIC CONSEQUENCES OF NO ACTION	EXPECTED AVAILABILITY OF HUMAN RESOURCES	ESTIMATED COST	EXPECTED DURATION
Key Objective 2: The biodiversity and estuarine habitats of the iZinkwazi Estuary are conserved				
Management Objective 2.1: Ensure the conservation of estuarine habitats				
Ensure the estuary is appropriately zoned (including buffer zones) within the municipal TPS to ensure the conservation of the estuarine ecosystem at a municipal level	Continued loss/degradation of EFZ and estuarine resources Lack of knowledge and awareness Ongoing inappropriate activities, behaviour and potential accidents Disturbance to and over exploitation of living resources	KDM environmental manager able to facilitate rezoning (but capacity constrained to ensure conservation)	~R20 000	>1 year
Ensure that the Admiralty Reserve is reflected in the municipal TPS	Lack of knowledge and awareness of Admiralty Reserve controls	Specific responsibility of KDM Manager Town Planning	Part of mandate	>1 year
Engage with landowners and stakeholders i.t.o. Biodiversity Stewardship Agreements (and other mechanisms of conservation) (e.g. MPA inclusion, conservation servitude, Duty of Care, etc.)	Lack of knowledge and awareness Continued loss/degradation of EFZ and estuarine resources	Specific responsibility of KDM Environmental Management	Part of mandate	Initial action, Ongoing
Investigate the feasibility of the inclusion of the estuary within the Thukela MPA	Continued loss/degradation of EFZ and estuarine resources Additional demands on KDM beyond their current capacity (conservation)	Feasible for MPA management and operational structures to be extended to include the iZinkwazi Estuary	Part of mandate	Ongoing
Adopt and implement the spatial zonation plan (incorporate in SDF/LUMS)	Lack of knowledge and awareness of zonation of activities Ongoing inappropriate activities, behaviour and potential accidents Disturbance to and over exploitation of living resources	Specific responsibility of KDM Manager Town Planning	~R50 000	Initial action, Ongoing
Develop and publish estuarine bylaws to support spatial zonation or update the	Continued loss/degradation of EFZ and estuarine resources	Appointment of service provider required	~R70 000	Once off

PROPOSED ACTIVITY	ECOLOGICAL IMPACT/SOCIO-ECONOMIC CONSEQUENCES OF NO ACTION	EXPECTED AVAILABILITY OF HUMAN RESOURCES	ESTIMATED COST	EXPECTED DURATION
existing environmental and boating bylaws to include estuarine management (if not included into MPA)				
Develop and publish a general code of conduct in respect to the various recreational activities	Lack of knowledge and awareness Continued loss/degradation of EFZ and estuarine resources	Appointment of service provider required	~R30 000	Once off
Instate educational signage to promote biodiversity stewardship, duty of care and conservation	Lack of knowledge and awareness of zonation of activities	Specific responsibility of KDM Environmental Management	~R50 000	Initial action, and then as when required
Management Objective 2.2: Ensure sustainable resource use through an effective level of compliance management				
Adopt and demarcate SZP using signage/buoys/markers	Lack of knowledge and awareness of zonation of activities Ongoing inappropriate activities, behaviour and potential accidents Disturbance to and over exploitation of living resources	Specific responsibility of KDM Environmental Management (if not included into MPA)	Part of mandate, Capital expenditure ~R40 000	Initial action, and ongoing maintenance
Enforce compliance with boating by-laws SZP and associated controls governing usage of the estuarine space	Lack of knowledge and awareness of zonation of activities Ongoing inappropriate activities, behaviour and potential accidents Disturbance to and over exploitation of living resources	DFFE has limited resources (i.r.t. MLRA), KDM has limited resources – Public Private Partnership (PPP) with ZSBC should be maintained	Part of mandate	Ongoing
Investigate and implement measures to control the use of living resources (i.e., MLRA)	No control of estuarine resources and resultant negative impacts on biodiversity and tourism	DFFE has limited resources (f not included into MPA)	Part of mandate	Ongoing

5.3. Land-use and Infrastructure Planning and Development

The third key objective, land use and infrastructure, planning and development, is detailed in Table 6 below.

Table 6: Key Objective 3: Land Use and Infrastructure Planning and Development

PROPOSED ACTIVITY	ECOLOGICAL IMPACT/SOCIO-ECONOMIC CONSEQUENCES OF NO ACTION	EXPECTED AVAILABILITY OF HUMAN RESOURCES	ESTIMATED COST	EXPECTED DURATION
Key Objective 3: All developments and proposed changes in land-use, including infrastructure, which impacts or could impact on the iZinkwazi Estuary, are controlled by legislation in such a way so as to sustain existing and future livelihoods, while ensuring the maintenance and ecological functioning and services				
Management Objective 3.1: Ensure the effective implementation of the EMP				
Ensure the incorporation of the iZinkwazi EMP into IDP and SDF	Wasted expenditure and uncoordinated estuarine management	Specific responsibility of KDM Manager Town Planning	Part of mandate	Cyclical review
Ensure that estuary spatial zonation and land use controls are reflected in the SDF and LUMS (during review cycle)	Continued degradation of EFZ, including habitat loss/destruction Wasted expenditure	Specific responsibility of KDM Manager Town Planning	Part of mandate	Cyclical review
Management Objective 3.2: Minimise the potential impacts of climate change				
Determine and designate the Coastal Management Line (CML)	Continued degradation of EFZ and negative impacts on biodiversity, tourism and human health, inappropriate development and potential damage to property and loss of human life	Resources within EDTEA and ORI currently supporting this process	Part of provincial mandate	Approximately 1 year
Incorporate CML into SDF / LUMS	Continued degradation of EFZ and negative impacts on biodiversity, tourism and human health, inappropriate development and potential damage to property and loss of human life	Resources available in Municipality	Part of mandate	Once CML designated and then in review cycle
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)	Inappropriate development and potential damage to property and loss of human life Unsustainable development practice	Resources available in Municipality (Building control) and EDTEA	Part of mandate	Ongoing
Specific engagement and resolution of the current beach ablation facilities (defence or relocation/removal)	Continued degradation of EFZ and negative impacts on biodiversity, tourism and human health	Dependant on resolution. Could form part of PPP	Part of mandate	Dependant on continued viability of building

PROPOSED ACTIVITY	ECOLOGICAL IMPACT/SOCIO-ECONOMIC CONSEQUENCES OF NO ACTION	EXPECTED AVAILABILITY OF HUMAN RESOURCES	ESTIMATED COST	EXPECTED DURATION
<i>Management Objective 3.3: Facilitate and manage the sustainable utilisation and development of the areas within the EFZ</i>				
Ensure that all proposed developments (and modifications) adhere to the full suite of relevant environmental legislation	Continued degradation of EFZ and negative impacts on biodiversity, tourism and human health. Inappropriate development and potential damage to property and loss of human life. Unsustainable development practice	Resources within KDM, EDTEA, and DWS	Part of mandate	ongoing
Undertake strict compliance monitoring for new structures being built and following natural disasters	Unsustainable development practice and potential environmental damage	Resources within KDM and EDTEA	Part of mandate	ongoing
Encourage environmentally friendly developments/developers and maintain sound/ innovative building techniques	Inappropriate development and potential damage to property and loss of human life Unsustainable development practice	Resources available in Municipality (Building control) and EDTEA	Part of mandate	ongoing
Ensure that all jetties are authorised and licensed	Inappropriate development, changes to estuary marginal habitat, water circulation and flow, impacting on estuary processes	Resources within KDM and EDTEA	Part of mandate	ongoing

5.4. Institutional and Management Structures

The fourth key objective, institutional and management structures, is detailed in Table 7 below.

Table 7: Key Objective 4: Institutional and Management Structures

PROPOSED ACTIVITY	ECOLOGICAL IMPACT/SOCIO-ECONOMIC CONSEQUENCES OF NO ACTION	EXPECTED AVAILABILITY OF HUMAN RESOURCES	ESTIMATED COST	EXPECTED DURATION
Key Objective 4: The iZinkwazi Estuary is well managed through effective and co-operative governance between government and civil society				
Management Objective 4.1: Ensure effective co-ordination of estuarine management responsibilities				
Establish an effective and sustainable organisational structure within KDM to co-ordinate estuarine management activities.	Uncoordinated and ineffective implementation of EMP. Potential damage to EFZ with resultant negative impacts on biodiversity, tourism, property and human health	Extension of mandate of KDM environmental management. Additional appointment recommended	~R300 000 per annum	ongoing
Monitor and report on the progress of EMP actions and achievements (and report back at iLembe Municipal Coastal Committee (MCC) meetings)	Uncoordinated and ineffective implementation of EMP Potential damage to EFZ with resultant negative impacts on biodiversity, tourism, property and human health		Part of mandate	Quarterly (municipal) and annual (DEA) reporting
Update environmental/ river bylaws include key estuarine issues (e.g., clearance of vegetation for views, preservation of estuarine habitat, interference with estuarine mouth, permissible/non permissible uses/activities i.r.t. to spatial zonation, e.g., boating)	Ineffective implementation and compliance with EMP Potential damage to EFZ with resultant negative impacts on biodiversity, tourism, property and human health		~R150 000 per bylaw	Ongoing
Maintain a stakeholder database for the dissemination of information	Uninformed stakeholders		Part of mandate	Ongoing
Establish and manage a voluntary community monitoring team and manage the data collected	Uninformed and ineffective co-ordination of monitoring undertaken		Part of mandate	Ongoing
Develop and maintain estuaries information repository and database	Uninformed and ineffective co-ordination of management interventions		Part of mandate	Ongoing
Individual agencies to identify and address training needs among staff involved in	Uninformed and ineffective co-ordination of management interventions	Support external service provider required	~R6 000 per candidate per course	Ad hoc

PROPOSED ACTIVITY	ECOLOGICAL IMPACT/SOCIO-ECONOMIC CONSEQUENCES OF NO ACTION	EXPECTED AVAILABILITY OF HUMAN RESOURCES	ESTIMATED COST	EXPECTED DURATION
estuarine management (KDM, IDM, DWS, DFFE (e.g., for monitoring, visitor regulation and assistance, etc)	Uncoordinated and ineffective implementation of EMP			
Individual agencies to acquire necessary equipment (e.g. office equip, water quality meter, boat, vehicle) (if not included as part of MPA)	Uncoordinated and ineffective implementation of EMP	Limited resources available. PPP with ZSBC should be maintained	Part of agreement (see management objective 4.2 below)	Ad hoc
Management Objective 4.2: Define co-operative governance arrangements for the iZinkwazi Estuary				
Maintain role of Zinkwazi Ski Boat Club (ZSBC) to enforce boating bylaws and boating regulations on the estuary and beach environment	Unregulated recreational use of estuary/overexploitation, habitat disturbance and degradation, user conflict and safety risks	Members of ZSBC supported by KDM Beach Manager	Part of agreement	Ongoing
KDM and IDM to obtain agreement from government departments and other participating agencies i.r.t. their roles and responsibilities in estuarine management (and the implementation of this EMP)	Uncoordinated and ineffective implementation of EMP Potential damage to EFZ with resultant negative impacts on biodiversity, tourism, property and human health	Limited resources available. Consolidation of meetings supported.	Part of mandate	Ongoing
Establish the terms for convening the iLembe MCC ad hoc estuarine sub-committee, chaired by the IDM		Draft TOR developed by EDTEA proposed to be applied	Part of mandate	Ongoing
IDM to convene and chair iLembe MCC ad hoc estuarine sub-committee meetings. iZinkwazi Estuary to be included on the agenda		Resources currently available	Part of mandate	Ad hoc
iLembe MCC (and ad hoc estuarine sub-committee) contributes to 5-year review of EMP		To be included in TOR of review process	Part of mandate	5 yr. Cyclical review
iLembe MCC estuarine sub-committee to be represented at the Pongola - Umzimkulu CMA forum to ensure that estuarine matters are tabled		Responsibility of IDM: Environmental Management	Part of mandate	Ongoing
Management Objective 4.3: Secure financing for estuarine management initiatives				
Individual government agencies to make provision for the necessary resources in the	Ineffective implementation of EMP, Potential damage to EFZ with resultant negative impacts	Limited resources, respective lead agencies	Part of mandate	unknown

PROPOSED ACTIVITY	ECOLOGICAL IMPACT/SOCIO-ECONOMIC CONSEQUENCES OF NO ACTION	EXPECTED AVAILABILITY OF HUMAN RESOURCES	ESTIMATED COST	EXPECTED DURATION
short, medium and long-term expenditure frameworks to create and fill posts, and acquire necessary infrastructure and resources for effective management of the iZinkwazi Estuary	on biodiversity, tourism, property and human health			
Individual government agencies to develop long-term financial plans	Ineffective implementation of EMP, Potential damage to EFZ with resultant negative impacts on biodiversity, tourism, property and human health	Specific responsibility of KDM Environmental Management and respective lead agencies	Part of mandate	Within cyclical requirements

5.5. Socio-economic Considerations

The fifth key objective, socio-economic considerations, is detailed in Table 8 below.

Table 8: Key Objective 5: Socio-economic considerations

PROPOSED ACTIVITY	ECOLOGICAL IMPACT/SOCIO-ECONOMIC CONSEQUENCES OF NO ACTION	EXPECTED AVAILABILITY OF HUMAN RESOURCES	ESTIMATED COST	EXPECTED DURATION
Key Objective 5: Sustainable socio-economic benefits are conserved, regulated and enhanced without compromising estuarine ecological integrity				
Management Objective 5.1: Maintain safe, clean, equitable and controlled access				
Maintain and control the current access to the iZinkwazi Beach and iZinkwazi Estuary margins	Potential damage to estuarine habitat and overexploitation of estuarine resources	Limited resources within KDM, private/public /partnerships (PPP) required	Part of mandate	ongoing
Management Objective 5.2: Regulate recreational use in and around the iZinkwazi Estuary				
Adopt, demarcate and enforce spatial zonation plan	Continued loss/degradation of EFZ and estuarine resources	Resources available in KDM	~R30 000	Initial action, Ongoing
Ensure that the Zinkwazi Beach Public Boat Launch Site is compliant and well managed	Overexploitation of estuary, habitat disturbance and degradation, conflict and safety risks	Resources available within the ZSBC	As per agreement	Ongoing

PROPOSED ACTIVITY	ECOLOGICAL IMPACT/SOCIO-ECONOMIC CONSEQUENCES OF NO ACTION	EXPECTED AVAILABILITY OF HUMAN RESOURCES	ESTIMATED COST	EXPECTED DURATION
Enforce boating bylaws and boating regulations on the estuary and beach environment	Overexploitation of estuary, habitat disturbance and degradation, conflict and safety risks	Resources available in KDM / part of ZSBC PPP or MPA	~R300 000	Ongoing
Instate educational signage at strategic locations to promote environmental awareness, biodiversity stewardship and conservation	Unprotected / unsafe environment with resultant negative impacts on biodiversity, tourism, property and human health and safety	Resources available in KDM	~R30 000	Initial action, Ongoing
Management Objective 5.3: Maintain economic benefits				
Maintain/increase the direct and indirect level of socio-economic dependency on the system (maintain healthy state of estuary)	Decreased income earning opportunities, limited appreciation of estuarine resources and attributes, reduced buy-in from neighbouring land owners	Resources available in KDM	Part of mandate	Ongoing
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)	Potential overexploitation of estuarine resources, limited appreciation of estuarine resources and attributes, reduced buy-in from local communities	Resources available in KDM	R150 000	Ongoing

5.6. Education, Awareness, Monitoring and Research

The sixth and final key objective, education, awareness, monitoring and research, is detailed in Table 9 below.

Table 9: Key Objective 6: Education, Awareness, Monitoring and Research

PROPOSED ACTIVITY	ECOLOGICAL IMPACT/SOCIO-ECONOMIC CONSEQUENCES OF NO ACTION	EXPECTED AVAILABILITY OF HUMAN RESOURCES	ESTIMATED COST	EXPECTED DURATION
Key Objective 6: Society is aware of, and sensitive to, the value and importance of the iZinkwazi Estuary				
Management Objective 6.1: Promote high levels of public awareness and appreciation of the value of the iZinkwazi Estuary				
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	Resources available in KDM / part of ZSBC PPP or MPA	Part of mandate	3 months
Source and/ or commission educational and informative material including signage, posters, pamphlets and webpage design			~R100 000	Initial action, Ongoing

PROPOSED ACTIVITY	ECOLOGICAL IMPACT/SOCIO-ECONOMIC CONSEQUENCES OF NO ACTION	EXPECTED AVAILABILITY OF HUMAN RESOURCES	ESTIMATED COST	EXPECTED DURATION
Facilitate annual discussions between farmers and DARD on suitable resource use and best farming practices	Continued potentially poor farming practises, increased habitat destruction, siltation and nutrient and chemical inputs, leading to poor water quality	Responsibility DARD with support from DFFE (and possibly Ezemvelo KZN Wildlife in support of MPA)	Part of mandate	Annually
Facilitate regular discussions between fishers and DFFE/Ezemvelo on sustainable resource use	Potential overexploitation of estuarine resources, reduced stocks contributing to Thukela MPA, limited appreciation of estuarine resources and attributes	Responsibility of DFFE	Part of mandate	Biennially
Management Objective 6.2: Enhance scientific knowledge and understanding of the iZinkwazi Estuary through monitoring and research				
Monitor the number of users on the estuary to determine resource uses and carrying capacity (specific study proposed once sufficient data collected)	Overexploitation of estuary, habitat disturbance and degradation, conflict and safety risks	Proposed responsibility of DFFE in support of MPA - with support from ZSBC	Part of mandate ~R400 000	Once off
Investigate and formalise the existing water quality monitoring activities by various institutions (IDM, KDM, DWS for STP)	Unknown levels of pollution of system, lack of knowledge of estuarine functioning Misinformed management interventions due to lack of or misaligned data.	Proposed responsibility of DWS and DFFE in support of MPA - with support from ZSBC and interested I&APs	Part of mandate Capital expenditure of R200 000 To be determined based on nature of monitoring agreed on	Once a month and after events/incidents
Monitor the condition of the estuary through the basic monitoring programme as outlined in section 9.1.2, against the RQOs	Overexploitation of estuary, habitat disturbance and degradation, conflict and safety risks		As per RQO requirements	As per RQO requirements
Undertake training of community monitors to participate in estuarine monitoring (Citizen Science support)	Overexploitation of estuary, habitat disturbance and degradation, conflict and safety risks		Part of mandate	Ad hoc
Engage academic and research institutions, government departments and parastatals to undertake and/or collaborate on priority research projects	Inability to undertake research and resultant lack of knowledge and understanding of systems		Part of mandate	Ongoing
Solicit research funding support	Inability to undertake research and further understanding of the system		Undetermined	Ad hoc

6. SPATIAL ZONATION

There are numerous activities that take place on and in the surrounds of the iZinkwazi Estuary. Spatial zonation of activities within an EFZ is necessary to avoid user conflict and to guide sustainable utilization without degradation of the estuarine environment. It also allows for the spatial representation of the desired state and the aims of the management objectives, where applicable, and is informed by (DEA, 2015):

- 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 (KDM 2018);
- 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, industrial, harvesting etc.) are permissible and others not permissible.

6.1. Current municipal zonations and uses

Table 10 below lists the land use types and zonations as per the KDM Town Planning Scheme (TPS) (KDM 2018) and activities occurring in and/or adjacent to the iZinkwazi Estuary.

It must be noted that the iZinkwazi Estuary has no specific zonation in terms of the TPS. It is strongly recommended that a suitable zonation is instated by the KDM to provide a basic form of environmental protection/conservation to the estuary. Examples of the common zone and forms of 'protection' assigned to riverine/estuarine ecosystems in TPSs include River Reserves, Amenity Reserves, Admiralty Reserves, and Conservation Servitudes. The KDM TPS provides for various zonations under the Environmental Services land-use category. By assigning one of these zonations, or developing a specific zone for rivers and estuaries, the iZinkwazi Estuary will be protected against development encroachment and inappropriate land-use activities.

In addition, the Admiralty Reserve extends along the estuary sand bar from the northern end and is currently not reflected in the KDM TPS. It is thus recommended that the Admiralty Reserve be included in the TPS as this will ensure that this area, and its associated controls, are duly acknowledged in respect of estuarine and coastal management considerations.

Table 10: Current zonations and activities occurring in the iZinkwazi EFZ

Purpose	Zonation (KDM TPS)	Description
Business	Core Mixed Use 5	Commercial enterprises, namely real estate agent, as well as postal services
Agriculture	Agriculture 1	Majority of land surrounding the urban settlement of Zinkwazi Beach, land under intensive sugar cane cultivation
Residential / holiday accommodation	Residential Only Detached 3, Residential Only Medium Density 3, Resort 4, Future Residential	Predominantly residential and holiday accommodation establishments, including the Zinkwazi Lagoon Lodge
Transport	Road reserve	Bridges: N2 coastal highway, local access and farm roads
Activities		
Fishing	Shoreline and boat-based angling, as well as, illegal gill-netting mostly in the upper reaches	
Boating	Motorised boating and skiing, as well as recreational canoeing and paddle boating, mostly in the lower reaches and increasing during peak holiday periods. Occasional use of jetskis – which is not supported by the local community	
Swimming	Swimming, particularly associated with Zinkwazi Beach area	

Taking cognisance of the KDM CMP Coastal Development Planning Tool: Coastal Management Overlay (CMO) (RHDHV 2016), the following typologies are included Table 11, which contribute some protection of the estuary: Coastal conservation (5m contour), and Coastal Rural (10 m contour). Collectively, these zones provide for the following, which strongly support estuarine conservation and management. The full suite of the typology controls are provided in Appendix C (Table 23 and Table 24).

Table 11: Spatially applicable legislative informants (RHDHV, 2016)

Coastal Conservation Intention (5m contour)	Coastal Rural Intention (10m contour-EFZ)
• Protect Critical Biodiversity areas • Limit construction in the estuarine functional zone • Protect sensitive coastal ecosystems	• To maintain a balance between the rural and urban environment • Protect indigenous fauna and flora • Limit ribbon development and control sprawling urban development • Address uncontrolled subdivision • Avoid hazards • Retain aesthetic values

6.2. Former and proposed spatial zonation

During the development of the inaugural iZinkwazi EMP (Roberts and Mthuli 2015), a spatial zonation plan (SZP) was proposed, comprising three Water Management Zones and a Development “Setback” zone. This zonation was reviewed during the recent stakeholder engagements and used as a basis for the updated iZinkwazi EMP and SZP. The revised SZP includes the former zonation with additions and minor amendments as follows:

- Legislated environmental zones, buffers, and setbacks, including the proposed Development Buffer Zone (10m contour);
- Marine Zone: the Thukela Inshore Controlled Zone (informed by and in support of the Thukela MPA zonation);
- Controlled fishing/ High Impact Recreation Zone: estuary mouth to the urban edge of Zinkwazi Beach Village, permissible wake zone;
- No-Take/Medium Impact Recreation Zone: urban edge of Zinkwazi Beach Village to the first bridge (to Tugela) (permissible wake zone);
- Quiet/Low Impact Recreation Zone: first bridge to head of estuary, spanning approximately 8 km fishing area, no wake zone);
- Urban Zone (new zone): aligning with the urban demarcation of Zinkwazi Beach Village within the EFZ; and
- Agriculture Zone (new zone): remaining portions of EFZ under cultivation.

The zonation was developed to ensure the preservation of the ecological functioning of system and thus maintaining it as a source of economic generation and availability for future generations. The research undertaken (see Mackay et al. (2013)), as well as current activities and stakeholder engagement were also taken into account. The zonation was kept simple to enable all stakeholders and estuary users to easily identify which area they are in and what activities are allowed in each area. The zones are to be clearly marked to allow users groups to easily identify with the zone and allow for more effective management.

A Development Buffer Zone or “set-back line” was also included, given that at least 50% of the estuary margin is to remain undeveloped (Turpie et al. 2012). The determination of a ‘setback’ takes into account various aspects which enable the estuary to maintain its ecological functionality and to allow for the improvement of the estuary to take place. The set-back is proposed as the 10m contour which is in support of the expanded boundary of the EFZ (as proposed by the 2018 NBA), and EDTEA’s conservative approach toward development planning, until this is legally adopted (see Section 6.4, pg. 45).

6.3. Spatially applicable legislative informants

The spatial zonation of the iZinkwazi EFZ is also informed by the National Environmental Management Act (Act No. 107 of 1998) (NEMA) 2014 EIA Regulations (as amended), as well as the ICM Act. These are detailed in Table 12. Any proposed development, or modification to existing developments or land use zonation must comply with the EIA Regulations, any possible Spatial Planning and Land Use Management Act, Act No. 16 of 2013 (SPLUMA) controls, conditions of the anticipated CML, local building regulations, and / or any other legal instruments.

Table 12: Spatially applicable legislative informants (adapted from DEA and Royal HaskoningDHV (2017))

Legislation	Zone/Delineation	Description
ICM Act	Coastal Protection Zone (CPZ)	The CPZ consists of: • sensitive coastal areas¹; • any part of the littoral active zone that is not coastal public property; • any coastal protected area, or part of such an area, which is not coastal public property; • any rural land unit that is situated within 1 km (1000 m) of the HWM which is zoned as agricultural or undetermined; • any urban land unit that is situated completely or partly within 100 m of the HWM; • any coastal wetland, lake, lagoon, dam or river which is situated completely or partially within a land unit situated within 1000 m of the HWM that was zoned for agricultural or undetermined use, or is within 100 m of the HWM in urban areas; • any part of the seashore which is not coastal public property including all privately owned land below the HWM; • any Admiralty Reserve which is not coastal public property; and • any land adjacent to the above stated areas that would be inundated (submerged or covered) by a 1:100-year flood or storm event (this includes flooding caused by both rain storms and rough seas). The CPZ was established to manage and regulate the use of land that is adjacent to coastal public property (CPP), or that plays a significant role in coastal ecosystems. Current practice within South Africa is that the 10 m contour is the proxy for the CPZ extending inland and surrounding an estuary. Delineation of the CPZ provides for the protection of coastal properties and public safety, as well as for the protection of the coastal environment from dynamic coastal processes such as sea level rise, flooding and coastal erosion.
	Coastal Management Line (CML)	Coastal management lines (CML) are proposed to protect or preserve CPP such as beach amenities and other infrastructure such as parking; coastal private property such as private residences and business properties; public safety in the face of extreme weather and other natural events; the CPZ and the aesthetics or 'sense-of-place' of the coastal zone. The CML, once determined for KZN by EDTEA, must be incorporated into this spatial zonation. In the interim, the 5 m contour (i.e., the boundary of the current EFZ) is adopted as the proposed CML surrounding an estuary.
NEMA EIA Regs	5 m contour (Estuarine Functional Zone delineation)	The 5 m topographic contour encapsulates the current EFZ, which in turn is defined by the 2014 EIA Regulations (GNR 985) as "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...". The 2013 and updated 2021 Protocol acknowledge the EFZ as the geographical boundaries of an estuary in South Africa. No new development should be permitted below 5 m contour unless it has been assessed as having low/little to no impact on the health and functioning of the estuary.
	100 m from the High-Water Mark (HWM) of the sea and estuary	This area is a zone listed in terms of both the ICMA (in terms of the CPZ) and the EIA regulations (2014). In the EIA Regulations, this zone is identified and linked to various activities requiring prior environmental assessment and authorisation. A map of the estuary is provided indicating these contours in relation to the development cadastre. Imagery is sourced from CoastKZN (http://maps.coastkzn.co.za). (See Figure 1, pg. 17) (CoastKZN 2021).

¹ as defined by the Environment Conservation Act (Act No. 73 of 1989, section 21)

Legislation	Zone/Delineation	Description
	32 m River and Wetland Development Buffer	The 32 m buffer from the edge/bank of all rivers, water bodies and wetlands/salt marshes, is intended to protect the ecological functioning of the riparian system. Any activities proposed within this area are also controlled by the EIA Regulations and the construction or expansion of facilities, irrespective of the increase in capacity or physical footprint, within this buffer, trigger a requirement to undertake an environmental assessment and obtain environmental authorisation before continuing. It is noted that on adoption of a CML relevant to the estuary, these lines take precedence. The inclusion of this development buffer will facilitate the protection of the sensitive vegetation along river banks from a terrestrial perspective. It is also proposed as a rehabilitation priority area where current development and other activities should be controlled, and damage caused mitigated or reversed. In such areas the priority is to discourage and control such activities and rehabilitate existing disturbed or transformed.

6.4. Development Buffer Zone (10 m contour)

Recent studies indicate that the EFZ in many KZN estuaries extends beyond the current 5 m contour, and the 10 m contour is now being considered the new boundary of an estuary, as provided in the 2018 NBA. However, until this is formally approved, the 5 m contour remains the default legal estuarine boundary in respect to requiring Environmental Authorisation for listed activities in sensitive estuarine areas. The 2018 EFZ and the 5m contour are illustrated in the delineation of the estuary for comparative purposes (See Figure 1, pg. 17) (CoastKZN 2021).

In taking a precautionary approach, the 10 m contour has been adopted in consultation with the relevant authorities (Municipalities, EDTEA and Ezemvelo KZN Wildlife) as the Development Buffer Zone for the iZinkwazi Estuary. To this end, no new development (or activities) will be permitted below 10 m contour unless it has been assessed as having low/little to no (negative) impact on the health and functioning of the estuary.

The Development Buffer Zone provides for the following:

- Undeveloped estuary margin as recommended for national priority estuaries;
- Prevention of damage to future developments through climate change events, floods, storm events etc.;
- Ecological climate change adaptation; and
- Restoration, improved estuarine functioning and biodiversity support.

With support from the KDM, all septic tanks servicing the waterfront properties will need be phased out (removed) over time and replaced with a suitable environmentally-friendly alternative, or a conservancy tank, located preferably on the inland side of all properties, that will need to be serviced by the KDM. Any new developments within existing developed footprints will need to use ecologically sensitive sewerage systems.

6.5. Controlled Fishing/ High Impact Recreation Zone

The two main recreation zones are within the most productive area within the estuary, which needs to be protected to allow for sustained ecological functioning. It will be a highly contentious issue to aspire to classify these zones as Sanctuary Zones, i.e. no recreational activities, and to prevent removal of resources (i.e. no fishing) in areas along the current extent of the Zinkwazi urban edge. It is therefore proposed that High Impact Zone be designated as a Catch and Release zone,

with no extractive activities (i.e. any fish caught must be released back into the estuary).

The High Impact Zone allows for all wake causing activities, including all motorised watercraft i.e. the use of high-speed motorized watercraft is permitted. Importantly, such high impact recreational activities are not permitted in the estuary mouth channel adjacent to the sand bar. This is largely due to the shallow water depth in this area, and for the protection of bathers, canoeists, and visitors crossing the shallow area between the beach and waterfront properties.

The High Impact zone must be well managed, particularly during peak holiday seasons when tourism and recreational activities are highest. This management function is undertaken by ZSBC, as per the agreement with KDM, and relates specifically to the regulation of boating activities. However, any inappropriate behaviour and activities on the estuary must also be controlled, e.g. littering, overfishing, etc.

A general Code of Conduct in respect to various recreational activities of the waterbody should apply. This Code of Conduct should include the following:

- Bathers take priority (bathers have right of way) and must remain within 3 - 5 m of the banks;
- Bathers must avoid known boat launch areas, slipways, boat houses, quay-sides and skiing lanes;
- Vessels and paddlers/ canoeists must avoid bathers and must remain at least 3 - 5 m away from bathers as well as banks; and
- Vessels and paddlers/ canoeists must be considerate of fishermen's lines.

All beach launching and beach driving activities must continue to be controlled through the ZSBC, in close consultation with the KDM Beach Manager. The responsible authorities will be required to be present or active during peak holiday periods. For example, the KDM Beach Manager may need to appoint additional beach officials/managers to direct recreational activities, KDM may need to deploy teams to undertake effective waste collection/management, as well as additional life-guards to monitor this area as well as the lower estuary during these times.

6.6. Marine Zone – Thukela Inshore Controlled Zone

This zone incorporates the estuarine shore and encapsulates the estuarine-marine continuum, i.e. the connectivity between the estuarine and marine environment (Van Niekerk et al. 2019a). It is the main safe swimming beach for the Zinkwazi area, and also serves as the launching area of ZSBC. According to the uThukela MPA zonation regulations (GG. 42479, 23 May 2019, GN. 790), this area falls within the uThukela Inshore Controlled Zone (TICZ) (a seaward distance of 200 m from the HWM). All general conditions and restrictions of the use of the MPA will apply.

The following applies specifically to the TICZ adjacent to the iZinkwazi Estuary mouth:

- No littering or discharging of fishing waste including fishing gear, hooks, bait packing or fishing line;
- No fishing/ spearfishing / invertebrate harvesting without a valid permit;
- Only fishing/collection of species listed in Annexure 2 of the regulations is permitted (See Appendix);
- All fishing /collection is subject to the species restriction, quantity, size limits, allowable effort, closed seasons and bag limits authorised by the permit;
- No fishing for any shark species, except catch and release fishing from the shore within any controlled zone;
- No fishing competitions allowed without a permit;
- No fishing from a vessel in the MPA during night-time hours (sunset to sunrise);
- No collection of brood-stock for aquaculture without a permit;

- No chumming for or attracting in any shark species;
- No shark repelling / exclusion / protection devices; and
- No gillnetting in any estuary.

6.7. No-Take/ Medium Impact Recreation Zone

The Medium Impact Recreation Zone is much the same as the High Impact Zone, except it is a full no-take zone, i.e. no fishing, bait harvesting or harvesting of any other resources is permitted. It is important to have a full no-take area that allows the estuary to serve as a nursery area and will ensure that suitable functioning takes place as well as habitat maintenance.

As in the High Impact Zone, the Medium Impact Zone also allows for wake causing activities, and must similarly be well-managed. Even though motorized watercraft are allowed in this area, there has been little visible impact to the estuarine area and therefore should be allowed to continue. It is important to note that, within the current Municipal By-laws, only five watercraft are allowed on the estuary at any given time and therefore there is limited impact (see Appendix B: Water Craft Management). No new jetties or launch sites should be constructed within Medium Impact Recreation Zone.

6.8. Quiet/ Low Impact Zone

For many years, this region of the estuary has been an unofficial no-wake zone and most users abide by this. It is therefore a simple progressive step to formalise this region as a no-wake zone. From the starting point of this management zone, the estuary starts narrowing and there is a greater vegetation change from predominately reeds to predominantly reeds and coastal and riparian forest-type trees and plants making wakes more destructive as the estuary banks are more exposed. There are two natural rock weirs that significantly increase the risk of boats being damaged, especially when the water levels are low, making navigation difficult and dangerous, especially at higher speeds.

This Low Impact Zone allows for multiple uses in terms of extractive resource use (angling) and non-extractive use (canoeing/paddling/no wake motorboats). Furthermore, developments such as jetties and launch sites (slipways) along this section may be allowed as prescribed by legislation and feasibility. It is strongly suggested that number of private launch sites be restricted and that the communal public launch site be used to reduce impact and visual pollution.

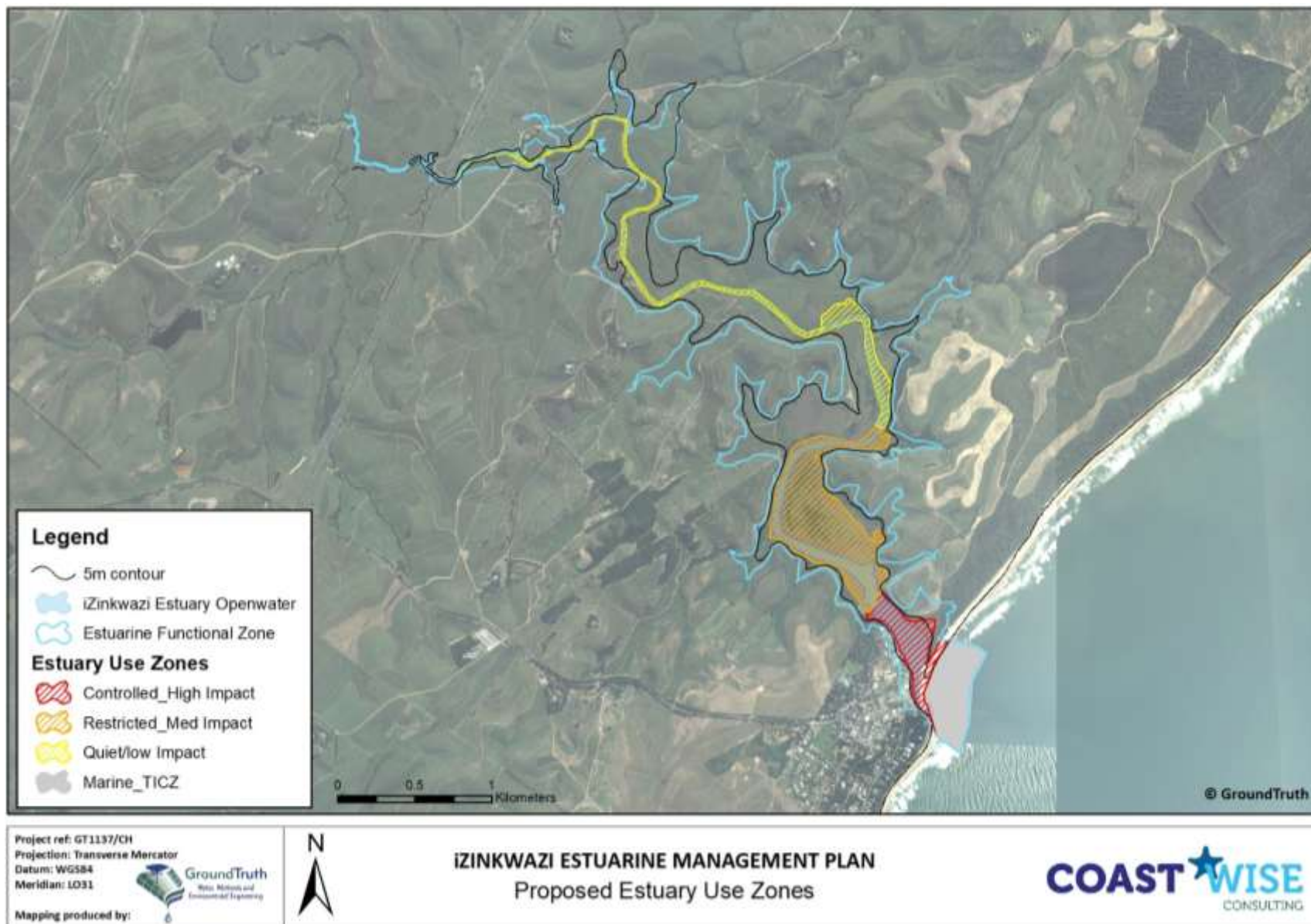


Figure 4: Spatial Zonation Plan showing the Marine Zone, Quiet/Low Impact Zone, Restricted/Medium Impact Zone, and Controlled/High Impact Zone

6.9. Land-based zones within the EFZ

6.9.1. Urban Zone

Urban development within the Zinkwazi EFZ is limited to the southern margin at the estuary mouth, constituting the northern boundary of Zinkwazi Village (Breetzke and Meyer 2021). Such development has resulted in noteworthy modification of the estuary margin along this stretch, through the removal of natural vegetation in favour of rolling lawns and sea views, and hard development (structures/dwellings, boathouses, quay walls, septic tanks, 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 septic tanks, as well as stormwater run-off containing pollution and sediment.

The zoning of the urban portion of the EFZ relates to land-based activities and developments (versus water-based activities of the recreation zones above) and reflects the existing land use, and municipal zonation and accompanying land use controls as per the KDM TPS (KDM 2018), and the CMO (RHDHV 2016).

To this end, no new development (or activities) will be permitted below 10 m contour unless it has been assessed as having low/little to no (negative) impact on the health and functioning of the estuary. Any new development below the 5 m contour will 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 to be able to construct new jetties or launch sites within the High Impact Zone.

6.9.2. Agricultural Zone (Remainder of the Estuarine Functional Zone)

There are large areas within and around the iZinkwazi Estuary that have been historically transformed by intensive agriculture, specifically sugar cane cultivation, which have impacted and continue to impact on the system through reduced flood buffering, sedimentation, and water quality impacts. The loss and transformation of estuarine habitat is the largest and most conspicuous impact on the estuary and reclaiming and restoring transformed areas is the ideal. However, there would be much resistance in prescribing the retreat or extraction of all agriculture from the EFZ and this would also impact negatively on the agricultural sector and contributions to the local economy for communities and the municipality in the region.

A strategic retreat of agriculture from specific areas of the EFZ is therefore proposed. This will entail engagement and focussed discussions between EDTEA and the landowner, Tongaat Hulett, to identify areas of high restoration potential and ecosystem linkages/biodiversity corridors. These would typically include wetland and drainage areas, which would help to filter agricultural return flows.

Apart from strategic retreat, key management interventions within this zone, include:

- Stringent implementation of agricultural best practices - reduced tilling, controlled use fertilizers, herbicides and pesticides, controlled surface run-off using vegetated strips to prevent nutrients, chemicals and excess organic material entering the system;
- Control of invasive alien vegetation;
- Strict avoidance of remaining natural vegetation, including reed beds, coastal and riparian forest, wetlands and drainage lines. Despite being zoned as Agriculture 1, remaining natural areas must be designated as No-go areas; and

- Rehabilitation of trampled/cleared areas of the riparian margin, including the coastal dune cordon on the northern bank that stretches northwards along the coastline.

These agricultural areas would also be subject to the Conservation and Rural Typology Controls prescribed in the KDM CMO (RHDHV 2016) (Appendix C, Table 23 and Table 24). The conditions of use of the various zones are indicated in Table 13 below.

Table 13: Conditions of use per zone in the iZinkwazi Estuary

CONDITIONS OF USE	High Impact	Medium Impact	Low Impact	Marine*	Urban	Agric.	RELEVANT LEGISLATION	RESPONSIBLE AUTHORITY	ENFORCEMENT
High-speed motorised boating activities (wake-causing activities) (Active use/sporting of jetskis is prohibited) (see Water Craft Management, pg.85)	✓	✓	X	✓	n/a	n/a	Bylaws, PBLs license, PAMP	EDTEA	KDM/ ZSBC
Low speed (no-wake) motorised boating/canoeing/paddling	✓	✓	✓	✓	n/a	n/a	Bylaws	EDTEA	KDM/ ZSBC
Fishing	✓	✓	X	✓	n/a	n/a	MLRA, PAMP	DFFE	DFFE, Ezemvelo
Bait harvesting	✓	X	X	✓	n/a	n/a	MLRA, PAMP	DFFE	DFFE, Ezemvelo
Removal of indigenous vegetation for access, estuary views or security purposes.	X	X	X	n/a	X	X	NFA, NEM:BA, TPS controls, Bylaws	DFFE, KDM	KDM, EDTEA
Removal/control of invasive alien vegetation	✓	✓	✓	n/a	✓	✓	NEM:BA, CARA	KDM	DALRRD, DFFE
Additional development or extension within the EFZ (Environmental Authorisation required)	n/a	n/a	n/a	n/a	TBD	TBD	ICMA, NEMA, KDM CMO	KDM	KDM
Discharge of clean, attenuated stormwater runoff	✓	X	X	X	✓	X	TPS controls, NWA	KDM	KDM
Construction of jetties or slip ways (Environmental Authorisation required)	X	X	✓	X	X	✓	NEMA	KDM, EDTEA	EDTEA
Erosion control or defence (Environmental Authorisation required)	✓	X	X	n/a	✓	X	NWA, NEMA, ICMA, KDM CMO	KDM, EDTEA	KDM
Artificial breaching	X	n/a	n/a	n/a	X	X	NEMA	KDM	EDTEA
Discharge of effluent/waste water into the estuary (no new discharges)	✓	X	X	X	✓	X	NWA, ICMA	DWS, EDTEA	DWS
Contingency plans developed for those properties at risk of predicted and unforeseen events	✓	n/a	n/a	n/a	✓	n/a	TPS controls, NEMA, KDM CMO	KDM, EDTEA	KDM, EDTEA

* In alignment with controls for the Thukela MPA

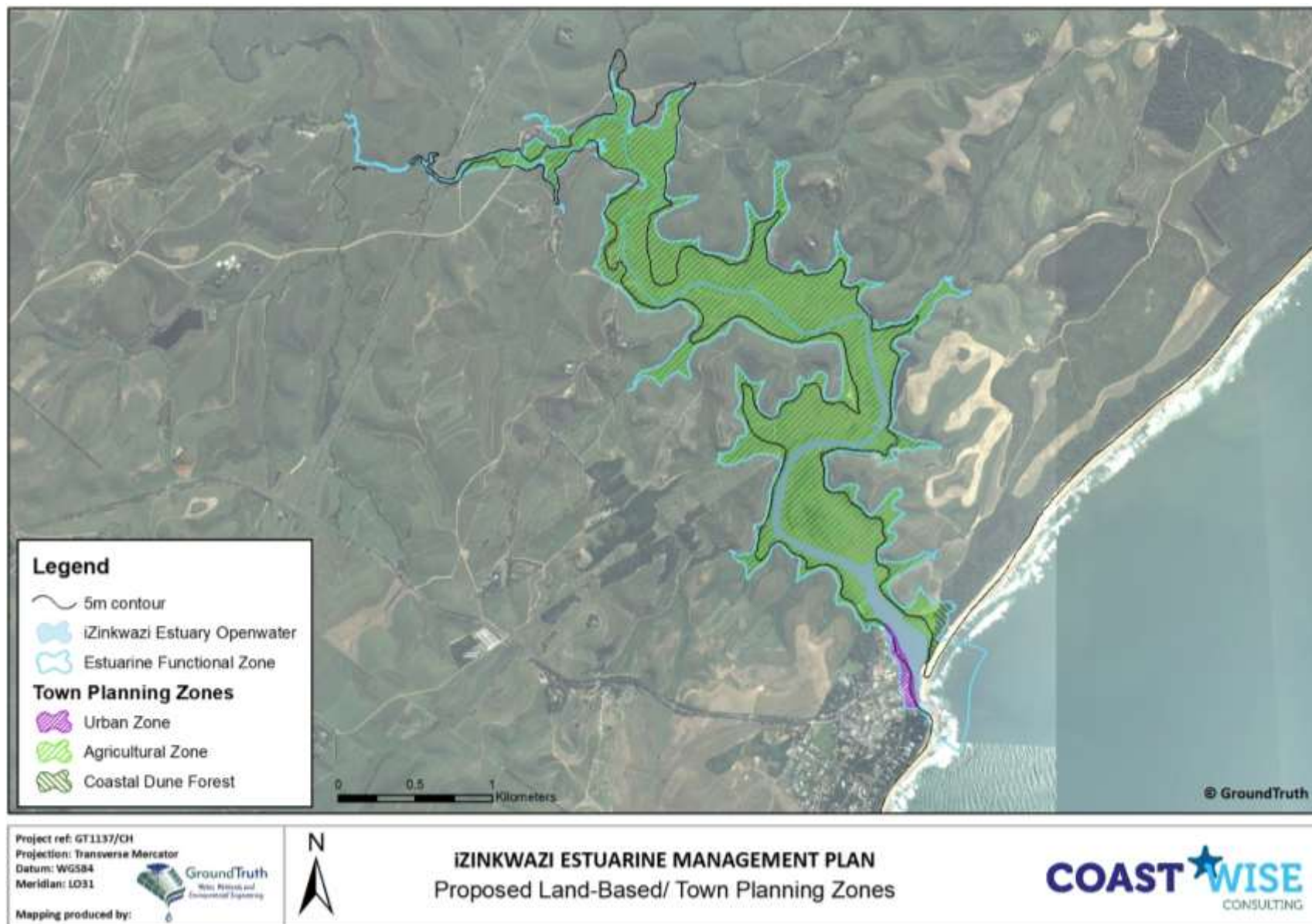


Figure 5: Spatial Zonation Plan showing the land-based zones, including the Urban Zone, Agricultural Zone and Coastal Dune Forest

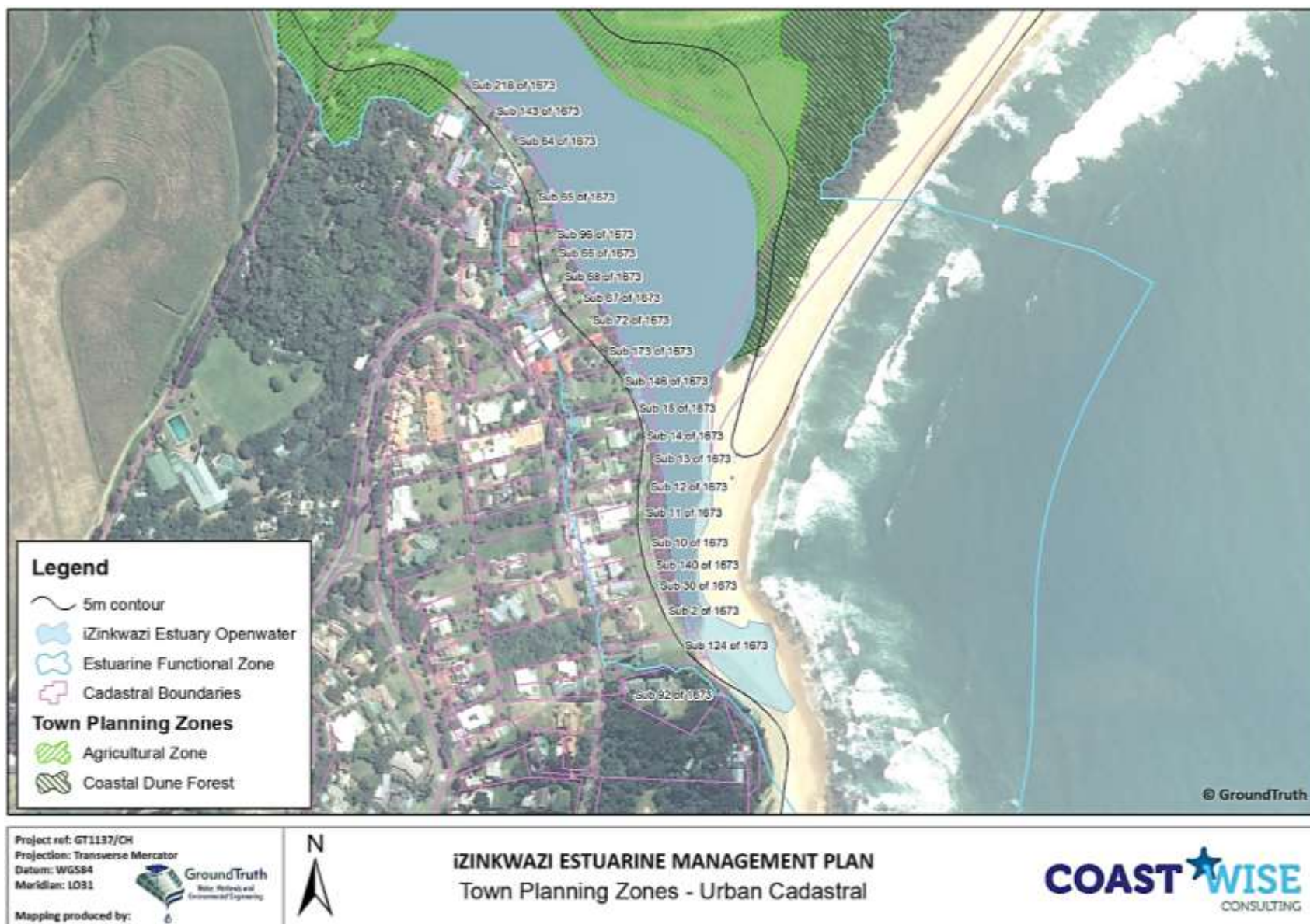


Figure 6: Spatial Zonation Plan showing details of the urban cadastre relative to the boundaries of the estuarine functional zone (10m contour) and the 5 m contour

6.10. Areas for Rehabilitation

Rehabilitation of the iZinkwazi Estuary relates primarily to areas of agriculture within the EFZ and the control of invasive alien vegetation along the estuary margins. The required activities are specifically addressed in the action plan under Management Priority 1.3 and 1.4. Specific areas identified for rehabilitation, are detailed as follows:

- Invasive alien vegetation removal is required along the estuary channel and at a broader catchment level within the adjacent farmlands. This must be undertaken by a registered service provider, with experience in the invasive species control around water bodies, specifically the application of appropriate herbicides (Figure 7A);
- Rehabilitation of the estuarine margin by private land owners must be encouraged where there has been active removal of marginal/riparian vegetation. Ground-truthing of these areas is required to advise on appropriate interventions, species for planting, etc (Figure 7B).
- Ad hoc access paths and seating areas created in the dune cordon to the north of the estuary mouth should be closed and signage erected to prevent damage to the vegetation. Open areas should be rehabilitated using known methods and revegetated to strengthen the integrity of the natural coastal defence (Figure 7C).



Figure 7: Area of estuary margin heavily infested with *Schinus terebinthifolia* (A), unknown informal access route cut through vegetated estuary margin (B), shaded seating area created in the dune cordon just north of beach boat launch site

7. INSTITUTIONAL CAPACITY AND ARRANGEMENTS²

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 required 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 accordance with the 2013 NEMP, the KDM together with the ZBC, initiated the development of the inaugural (draft) iZinkwazi EMP (Roberts and Mthuli 2015) in 2013, however it did not reach the adoption and implementation phase. Through a provincial prioritisation exercise, the iZinkwazi Estuary was identified as a priority system requiring an EMP and commissioned the update of the EMP. This is also in alignment with the amended 2021 NEMP, which prescribes the responsibility for developing an EMP and coordinating the implementation thereof, to the provincial environmental department in collaboration with affected municipalities, in this case the KDM and IDM.

The KDM has identified its role as the Responsible Management Authority (RMA) and accepted the responsibility for coordinating the implementation of the iZinkwazi EMP, with support from EDTEA. Specific implementation actions identified remain the responsibility of mandated government departments as well as respective departments within the KDM. As an example, the DWS will monitor water quality, while the DFFE should ensure compliance with matters related to fisheries.

Given that there are several estuaries within the KDM, it is recommended that a designated **estuarine management line function be established** within KDM, with an appointed **Estuarine Management Coordinator (EMC)** who will play a critical role in organising, liaising and monitoring activities by all other implementing agencies and KDM departments.

The KDM departments identified as important roleplayers include:

- Civil Engineering and Human Settlement (infrastructure development and maintenance of such infrastructure, including roads and storm water systems, public transport infrastructure, public facilities, maintenance of Council buildings, etc.);
- Community Services (waste management, maintenance of municipal parks, gardens and recreational facilities, and beaches etc.);
- Community Safety (aquatic safety, bylaws enforcement, crime prevention, disaster management, etc.);
- Corporate Governance (in respect to incorporation of the EMP into the IDP and SDF); and
- Economic Development and Planning (environmental management, town planning, building control and local economic development).

Monitoring forms an important part of ensuring the EMP remains valid and will help to address issues that may arise in due course. The different actions and activities must be monitored by the relevant governmental departments, organizations or elected groups/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 EDTEA and DFFE via an annual report. This EMP must be revisited and updated after five years to reflect goals that have been achieved and changing priorities.

² It should be noted that this section has been inserted prior to 'Management Priorities' to provide context

7.1.1. Zinkwazi Ski Boat Club

The KDM is the management authority for the Zinkwazi Public Boat Launch Site and has entrusted (delegated) management of boating activities both on the estuary and out to sea to the ZSBC (the Operator). These activities are managed in alignment with KDM Boating Bylaws and South African Maritime Safety Association (SAMSAs) Regulations (which includes the presence of a Safety Officer and a full-time Beach Manager [KDM] to co-ordinate safe beach launching, and also to control any inappropriate activities on the estuary), as well as the requisite Environmental Management Programme produced for the Public Boat Launch Site application. The Zinkwazi Deep Sea Angling and Boating Club further makes use of numerous operational procedures previously developed which includes sensitive areas, the 'lagoon', toilet facilities and waste removal, among others (cf. Breetzke and Meyer, 2021).

The co-management agreement between KDM and the ZSBC is proving effective and is set to continue. No formal written agreement could be produced at the time of developing this EMP and it is therefore recommended that an MOU or formal agreement be signed between the two parties and kept on record.

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:

- KwaDukuza Municipality: as the RMA;
- iLembe District Municipality: Responsible for issues relating to water and sanitation, disaster management, the provision of management and technical support;
- KwaZulu-Natal government departments: Responsible for legislatively mandated responsibilities as well as support, including compliance, funding, research and monitoring (e.g., EDTEA, Cooperative Governance and Traditional Affairs (COGTA), and Department of Agriculture and Rural Development (DARD);
- Relevant National government departments, especially DFFE, DWS via the regional office, Department of Rural Development and Land Reform (DRDLR), and Department of Science and Technology (DST); and
- Organs of State: Umgeni Water, Ezemvelo KZN Wildlife, Oceanographic Research Institute, Council for Scientific and Industrial Research, and KZN Sharks Board.

The DFFE is responsible for national standardisation of estuarine management and approval of provincially-compiled EMPs. Direct involvement in individual estuaries will occur via existing forums for intergovernmental coordination. These forums will have estuarine management on their agendas, and include:

- The iLembe MCC: Responsible for facilitating co-management, effective governance and district level co-ordination of coastal and estuarine management issues; and
- The KZN PCC: Estuaries sub-committee: Responsible for facilitating co-management, effective governance and provincial level co-ordination of coastal and estuarine management issues.

Both technical and management support should be provided by the KZN Environmental Department, the EDTEA, as well as the IDM, and Ezemvelo KZN Wildlife, in support of this process.

7.3. Estuary Advisory Forum

The establishment of an estuary advisory forum (EAF) is no longer a requirement of the NEMP. Private entities and non-government organisations can still play a supporting role in the implementation of this EMP through the iLembe Municipal Coastal Committee (MCC) Estuarine Sub-committee that would be established on an *ad hoc* basis to address critical estuarine matters as they arise³. This will serve as the Regional Estuary Advisory Forum. Estuarine issues should also be included as standard item on the agenda of the current Municipal Environmental Committee reported by the Municipal EMC.

7.4. Other Key Role Players

Both co-management and effective governance have already been identified as the keystones to the efficient and effective estuarine management. The following functional environmental structures/ forums should also be integrated into the EMP:

- iZinkwazi Blythedale Conservancy;
- Zinkwazi Beach Residents and Ratepayers Association;
- Tongaat Hulett Development;
- Darnall Farmers Association;
- Local business owners and tourism operators;
- Local developers and industries;
- NGOs, such as Coastwatch and WESSA;
- Working for the Coast Forum; and
- KZN Wildlife and Environment Working Group (requirement of the MPA).

7.5. Project Plans for Implementation

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)) and is attached in the Appendix D for ease of reference. This template can also be utilised to facilitate the implementation of other projects proposed in the EMP, e.g., the development of a consolidated monitoring programme.

³ Minutes of the first authorities meeting, held via Microsoft Teams virtual meeting platform on Thursday, 27th of May 2021, 10h00-12h00.

8. MANAGEMENT PRIORITIES

The following aspects were refined as the management priorities for the iZinkwazi Estuary.

8.1. Estuarine Health and Function

The iZinkwazi Estuary is currently in a moderately modified ecological state (Category C) (Breetzke and Meyer 2021). While in many KZN temporarily closed estuaries, the hydrology (amount and timing of flows reaching the estuary) has been considerably affected, with a resultant impact on the state of the mouth (frequency and duration of closure), these attributes and processes of the iZinkwazi Estuary remain close to the natural condition. This is fairly rare for a system of this size. Due to the limited development present only at the estuary mouth and the upgrade of the STP, the water quality of the system is considered good – although there are periodic incidents of sewage pollution related to flooding and overflow of the septic at the beach ablutions, and seasonal overflow of septic tanks at waterside holiday establishments. The deterioration in physical habitat is largely attributed to the impacts of agriculture and the extensive replacement of estuarine vegetation with sugar cane crops. Apart from the fish community, the other key biotic attributes are in good condition.

As one of the national priority estuaries requiring formal protection and by virtue of its link to the Thukela Bank MPA, preserving the health and natural functioning of the iZinkwazi Estuary is imperative. Ultimately, the health status of the estuary must be improved to a Category B ecological condition (i.e., largely natural with few modifications) (DWS 2015). Key interventions proposed, and included as management priorities, include protection of baseflow to the estuary, further improvement in water quality, and partial restoration of estuarine habitat (DWS 2015). These aspects are provided for in the action plan below, including consideration of sustainable urban drainage systems and reinstating ecological infrastructure (EI). Furthermore, it is important to maintain a healthy state for recreational use and overall socio-economic value of the system. Importantly, artificial breaching of the estuary is not supported in accordance with the KZN breaching protocols (EDTEA 2020a, 2020b).

Managing pollution is important aspect that must be urgently addressed. The KDM, together with the ZSBC, and ZBRRA, is currently planning to upgrade and revitalise the beach amenities, including the lifeguard tower, the ski boat club building and the ablutions⁴. This will alleviate the problem of effluent entering the estuary. The proposed upgrade is set to commence in 2025; however, the estuary remains at risk in the interim. Therefore, KDM must utilise and connect the existing infrastructure and secondary tank, making the system operational, to alleviate the pollution risk until the commencement of the renovations⁵. As for the beach amenities, many of the waterfront properties are serviced by aged septic tank systems, which reportedly overflow during peak holiday season. Installing alternative methods of processing with domestic sewage have received support from some of the property owners, and needs further investigation through establishment of a working group between waterfront property owners and KDM.

Controlling the spread and densification of invasive alien plant (IAP) species is important aspect to improving the overall state of the iZinkwazi Estuary. This can be achieved by lobbying THD, as the current landowner of the surrounding farmland, to control IAPs within the EFZ on their land in accordance with the CARA and NEM:BA. This one of the key aspects of, and links directly with, restoration of estuarine habitat. It is a key recommendation of this EMP, that the KDM as the RMA

⁴ Minutes of the second stakeholder meeting, held via Microsoft Teams virtual meeting platform on Wednesday, 1st of December 2021, 10h00-12h00.

⁵ Mr. A. Matsheke, KZN EDTEA: Coastal Management Unit, at the second stakeholder meeting

enters into engagements with THD as soon as possible regarding the strategic retreat and rehabilitation of agricultural land within the iZinkwazi EFZ. Using specialist assessments and input, and guidance from Ezemvelo KZN Wildlife, retreat and subsequent rehabilitation should focus on areas where restoring landscape linkages (e.g., between the estuary and wetland drainage lines) would be most easily attainable, whilst not incurring significant loss in terms of agricultural returns, and where the restoration would be most effective for the system in terms of improving ecosystem goods and services, and climate change resilience. Sustainable agricultural methods must be implemented on the remaining farmland to reduce the diffuse impacts on the estuary.

Additional areas of rehabilitation include ad hoc paths and hollows created in the coastal dune forest along the northern margin, and encouraging waterfront property owners to reinstate natural vegetation. Rehabilitation will help to restore estuarine habitat, and enhance the buffering capacity of the estuary to withstand and recover from environmental disturbances (e.g. flooding and climate change effects) and provide other important ecosystem goods and services.

Table 14: Management Priorities for Estuarine Health and Function

ACTION	RELEVANT LEGISLATION	PERFORMANCE INDICATOR	WORK PLAN	
			PRIORITY	RESPONSIBILITY
Management Priority 1.1: Secure adequate quantity and quality of freshwater input to maintain healthy ecosystem functioning				
i. Adopt and implement gazetted estuary and river Water Resource Classification outputs (REC, RQOs, etc.)	NWA	- Health Class of B and RQOs adopted - Outputs incorporated into District/Regional Water Services and Sanitation Master Plans	HIGH	DWS, IDM, KDM
Management Priority 1.2: Minimise pollution by identifying and addressing activities that lead to poor water quality				
i. Connect and ensure the operation of existing secondary tank system serving the beach ablutions with immediate effect (before next holiday period)	ICMA, NEMA	- Meeting convened between KDM and IDM - Project action plan compiled - Action plan implemented - Secondary tank operational - Regular evacuation of secondary tank and ongoing maintenance	HIGH	KDM, IDM
ii. Ensure that the Zinkwazi Lagoon Lodge STP is operating according to design specifications and an approved Water Use licence (WUL), with a maintenance and operations plan in place	NWA, ICMA	- Regular auditing undertaken - Operation is compliant with WUL - 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	DWS, DFFE, IDM
iii. Investigate opportunities for the instalment of SUDS and ecological infrastructure (EI) (e.g. vegetated strip or wetlands for trapping contaminants and sediment) within the urban area and potentially along the estuary to regulate stormwater inputs	MSA, NWA, ICMA	- SUDS/EI investigation included in KDM stormwater management plan for Zinkwazi Beach - Training for officials convened and attended - SUDS applied by building control and technical services - Increased vegetated margin and ‘natural’ habitat - Improved habitat integrity	MEDIUM	KDM

ACTION	RELEVANT LEGISLATION	PERFORMANCE INDICATOR	PRIORITY	WORK PLAN RESPONSIBILITY
Management Priority 1.3: Promote sustainable agriculture				
i. Lobby THD (and farmers leasing land) to implement agriculture best practice (e.g. reduced application of harmful fertilisers, reduced tillage practises, reduced clearing of natural vegetation)	CARA, NWA	- On-going relationship with farmers developed - Farmers made aware of best practise methods - Improved quality of agricultural return flow - Increased river input to estuary - Recovery of riparian margin and wetland areas - Use of inorganic fertilisers reduced	HIGH	KZN DARD, EDTEA
Management Priority 1.4: Control the spread and densification of invasive alien plant species				
i. Prioritise areas along the estuary followed by key areas in the catchment (e.g. adjacent to/in wetlands and CBA)	CARA, NEM:BA	- Level of infestation established - Priority species and areas identified	HIGH	KDM, DFFE, KZN DARD
ii. Lobby property owners (including THD and farm managers, residential and resort owners) to manage/control IAPs within the EFZ	CARA, NEM:BA	- Engagements with farmers - Training/education undertaken where required - Commitment obtained by farmers for IAP control	HIGH	KDM, DEA: WftC, WfW, DFFE
Management Priority 1.5: Rehabilitate degraded and transformed areas				
i. Convene formal engagements with THD to obtain buy-in for retreat and rehabilitation of strategic areas, and farming best practices (setback)	NEM:BA, NWA, CARA, NEMA	- Engagements with THD - Partnership formed and formalised through signed agreement	HIGH	KDM, THD, Ezemvelo, EDTEA
ii. Develop and implement strategic rehabilitation plan together with THD (with ongoing maintenance of rehabilitated areas) (Cross cutting with 2.1 ii)	NEM:BA, NWA, CARA, NFA	- Rehabilitation plan developed - Buffer zone established within the EFZ, to restore riparian margin - Priority degraded areas repaired/ restored (taking NEMA / NWA into account) - Annual review of rehabilitated areas for ongoing maintenance	HIGH	KDM
iii. Lobby for landowners to maintain/rectify damages/ degraded areas on their property, towards Biodiversity Stewardship (Cross cutting with 2.1 ii)	NEM:BA, NWA, CARA, NEMA	- On-going relationship with landowners developed - Degraded areas restored (e.g., planting of estuarine/coastal species and rehabilitation of estuarine margin) - Ongoing maintenance of all erosion defence interventions	MEDIUM	EDTEA, I&APs, identified landowners

8.2. Conservation

The iZinkwazi Estuary is among the priority estuaries identified as requiring formal protection in order to conserve South Africa estuarine biodiversity (Turpie et al. 2012, DWS 2015, Van Niekerk et al. 2019a). It is considered to be of extremely high regional importance in terms of the vegetation present (swamp forest habitat), moderately important in terms of fish populations, and of some importance for regional bird populations (DWA 2013). In accordance with the National Estuary Biodiversity Plan (Turpie et al. 2012), the estuary should be partially protected, namely, inclusion of a no-take zone and areas of controlled usage of natural resources. In light of the above, and the close proximity of the Thukela MPA abutting the estuary, the rationale for obtaining formal protected area status is strong. The inclusion of the iZinkwazi Estuary (or part thereof) within the MPA is therefore considered the most effective and streamlined method to obtain formal protection of the estuary, instead of the establishment of a separate protected area. This is likely to take several years to achieve. In the interim, protection of the iZinkwazi Estuary is limited to the prescriptions of the KDM CMP (RHDHV 2016). Two additional measures are recommended to increase protection. Firstly, at a municipal level, it is strongly recommended that the iZinkwazi Estuary receive formal zonation through the municipal TPS as this would provide a basic form of protection against development encroachment and inappropriate activities, and thus contribute to the conservation of estuarine habitats, including the estuary banks/margins, reedbeds, swamp forest, and coastal riparian and dune forest (explained under in the SZP, Section 6, pg. 41). Secondly, at the level of land owner, it is recommended that a formal Biodiversity Stewardship⁶ Agreement (SANBI 2018) is entered into with THD, the owner of all agricultural land within the EFZ, Ezemvelo KZN Wildlife and other participating institutions. While there are various options of biodiversity stewardship, a Biodiversity Agreement is formalised through a signed contract for a given time period.

Estuaries offer a variety of ecosystem goods and services that provide benefits to society and contribute to human well-being. The tangible goods, including living resources (e.g. fish, reeds) and non-living resources (e.g. sand/stone) are extracted for subsistence, recreational or commercial gain. Unchecked removal of these resources from estuaries has dire consequences for the ecosystem functioning, processes, biodiversity and ecological structure, and future viability of economically important resources. For the iZinkwazi Estuary, extraction of marine living resources (fish and bait organisms), especially illegal netting, must be controlled to maintain the nursery function of the estuary as a source area to the Thukela MPA and for the preservation of regional fish populations. Furthermore, the controls of the spatial zonation plan need to be enforced (catch and release zone, no-take zone, etc.). Means of increasing the presence of law enforcement need to be investigated. Ezemvelo KZN Wildlife could play a strong supporting role, given the proximity of the MPA.

⁶ “Biodiversity Stewardship is an approach to entering into agreements with private and communal landowners to protect and manage land in biodiversity priority areas, led by conservation authorities in South Africa. It recognises landowners as the custodians of biodiversity on their land. Biodiversity stewardship is based on voluntary commitments from landowners, with a range of different types of Biodiversity Stewardship Agreements available to support conservation and sustainable resource use”(SANBI, 2018).

Table 15: Management Priorities for Conservation

ACTION	RELEVANT LEGISLATION	PERFORMANCE INDICATOR	PRIORITY	WORK PLAN RESPONSIBILITY
Management Priority 2.1: Ensure the conservation of estuarine habitats				
i. Ensure the estuary is appropriately zoned within the municipal TPS to ensure the conservation of the estuarine ecosystem at a municipal level	NWA, MSA, SPLUMA	- Engagement with landowners regarding potential zonation - Environmental protection of the iZinkwazi Estuary provided for in the TPS (e.g. environmentally sensitive zonation is applied) - Management controls disseminated - Landowners notified of updated zonation (and associated restrictions contained in the management controls) - Admiralty Reserve included in TPS.	HIGH	KDM
ii. Engage with landowners and stakeholders i.t.o. Biodiversity Stewardship Agreements (and other mechanisms of conservation) (e.g. MPA inclusion, conservation servitude, Duty of Care, etc.)	NEM: PAA, MSA, SPLUMA	- Engagements with land-owners undertaken - Formal Biodiversity Stewardship Agreement signed with THD - Land set aside for the preservation of estuarine biodiversity - Participation of landowners and stakeholders in improvement and preservation of iZinkwazi Estuary - Increased vegetated margin and ‘natural’ habitat - Improved habitat integrity and general estuarine health and appearance	MEDIUM	KDM, Ezemvelo KZN Wildlife,
iii. Investigate the feasibility of the inclusion of the estuary within the Thukela MPA	NEM: PAA	- Feasibility investigated - Meetings/workshops convened with DFFE/Ezemvelo KZN Wildlife - Formal motivation submitted for consideration	MEDIUM	KDM, EDTEA, DFFE, Ezemvelo KZN Wildlife, ZBC, ZBRRA, ZSBC
iv. Adopt and implement estuary spatial zonation plan (SZP)	ICMA, NEMP	- Markers/ buoys/signage installed - Reduced habitat disturbance/degradation/loss - Improved habitat integrity and general estuarine health and appearance	HIGH	KDM, ZSBC
Management Priority 2.2: Ensure sustainable resource use through an effective level of compliance management				
i. Adopt and demarcate SZP using signage/ buoys/markers	MSA, ICMA, NEMP,	Designated preservation zones demarcated and enforced (in respect to boating and fishing controls)	MEDIUM	KDM, ZSBC, ZBC
ii. Enforce compliance with boating by-laws SZP and associated controls governing usage of the estuarine space (i.e., use of living resources (fishing, boating activities)	MLRA, NWA, Boating bylaws	- Monitoring by Ski Boat club and conservancy members (watch-dog/check your neighbour) - Increased compliance monitoring during peak holiday season - Development of Code of Conduct - Findings documented and reported on	HIGH	KDM, ZSBC, ZBC, Ezemvelo (MPA), EDTEA

8.3. Land-use and Infrastructure Planning and Development

The iZinkwazi Estuary is a moderately transformed system with some urban development located within the EFZ at the estuary mouth, and a significant portion of the EFZ under sugar cane cultivation along both banks. The system is negatively impacted upon by poorly sited historical development (beach amenities and ablutions at the estuary mouth), waterside property developments with low lying septic tanks, urban stormwater inputs, and agricultural activities (e.g., clearing of estuarine vegetation, removal of riparian margin/flood buffer). Agricultural land-use in particular invokes pressure to artificially breach the estuary, which has numerous ramifications for the integrity of the system. On the other hand, the estuary also exerts positive and negative impacts on neighbouring development through aesthetic appeal and recreational use, and risks of flooding and erosion, respectively.

Best international practice in the face of potential impacts of climate change (flooding, sea-level rise and changing coastal dynamics) is a managed retreat away from the shoreline and/or flood line. While it is not feasible to prescribe full extraction or retreat from the EFZ, especially for the urban area, there are various measures that can be employed.

In alignment with the National Estuary Biodiversity Plan (Turpie et al., 2012), at least 50% of the estuary margin must remain undeveloped or set back behind a 500m buffer zone. Any new development or change in existing development (redesign/reinstatement) should be sited and constructed to reduce risk and should preferably be located above the 1:100-year flood line. It should also be innovative in design (e.g., adaptable buildings, re-locatable buildings, flood-proofed buildings, flood resistant and resilient construction, etc.) and not increase risk elsewhere. Infrastructure currently located within the EFZ should have contingency plans developed, in anticipation of predicted and unforeseen events, and should include likely impacts and proposed responses, particularly with respect to damage to sewage infrastructure (i.e. septic tanks, conservancy tanks). Additional special planning regulations or coastal by-laws, in terms of style and sustainability, as provided in the KDM CMO (RHDHV 2016) (Appendix C: Table 25) must be implemented as a precautionary measure in reducing the potential impacts of climate change.

The current location of both the life-saving, ablution and beach café buildings within the high-risk zone, which continue to be undermined, need to be reconsidered with the ablution facilities, in particular, being relocated in the long term. While the proposed upgrade of the facilities, as previously noted, is acknowledged, KDM must utilise and connect the existing infrastructure and secondary tank, making the system operational, to alleviate the pollution risk until the commencement of the renovations⁷.

The ICMA provides for the KZN EDTEA, in consultation with KDM, to designate coastal management lines (CML). It is anticipated that such line(s) will relate closely to the EFZ and will formalise development control and set-back from these sensitive ecosystems and protect lives, property and future development from flooding, predicted sea level rise and other extreme weather events. Once established, the KDM should continue to engage with property owners on the estuary margin regarding the anticipated risks and appropriate interventions. Property owners should also be encouraged to investigate options of retreat for risky infrastructure, e.g., septic and develop a contingency plan for their property.

In respect to land within the EFZ under agriculture, it is in the best interest for farmers to retreat as backflooding under prolonged closed mouth conditions damages crops. Breaching of the estuary mouth to mitigate inundation of croplands will not be authorised according to the EDTEA breaching protocols (EDTEA 2020a, 2020b) (cross cutting to Estuarine Health and Function) and actions to do so illegally could have punitive consequences. The Coastal Conservation and Rural Typology controls prescribed in the KDM CMO (RHDHV 2016) (Appendix C: Table 23 and Table 24). Incorporation of the EMP and the SZP into the KDM Integrated Development

⁷ Mr. A. Matsheke, KZN EDTEA: Coastal Management Unit, at the second stakeholder meeting

Plan (IDP) and Spatial Development Framework (SDF) would ensure that the status of the EMP document is acknowledged and included into the municipal planning processes going forward, as well as factor into the key performance areas of the relevant departments.

Jetties and launch sites have a direct impact on the estuarine environment and may have an impact on estuary users in terms of obstruction. It is therefore important to limit their numbers and prevent excessive future developments. With these potential impacts in mind as well as legislative requirements for constructing these structures, all existing jetties and launch sites/slipways are to be registered and ratified as legal (The Zinkwazi Beach Public Boat Launch site is a registered launch). In not doing so, legislation may dictate that they need to be removed. All maintenance of jetties and slipways/launch sites will be to the cost of the land-owner.

Table 16: Management Priorities for Land-use and Infrastructure Planning and Development

ACTION	RELEVANT LEGISLATION	PERFORMANCE INDICATOR	WORK PLAN	
			PRIORITY	RESPONSIBILITY
Management Priority 3.1: Ensure the effective implementation of the EMP				
i. Ensure the incorporation of this EMP into the IDP and SDF	ICMA, NEMP, MSA, SPLUMA	• EMP approved • Objectives, management objectives and activities included in IDP as part of cyclical review	HIGH	KDM
ii. Ensure that estuary SZP and land use controls are reflected in SDF and LUMS (during review cycle)	ICMA, NEMP, MSA, SPLUMA	• EMP approved • Zonation included in SDF and LUMS as part of cyclical review	HIGH	KDM
Management Priority 3.2: Minimise the potential impacts of climate change				
i. Determine and designate Coastal Management Line (CML)	ICMA	• Sea level rise implications and coastal risk determined • Consultation undertaken • CML lines designated	MEDIUM	EDTEA, KDM
ii. Incorporate CML into SDF / LUMS	ICMA, MSA, SPLUMA	• CML reflected on SDF • Decisions influenced by CML	MEDIUM	KDM
iii. 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)	ICMA, MSA	• Sea level rise implications and coastal risk determined • Engagement with property owners regarding risks and appropriate interventions • Contingency plans developed for infrastructure at risk	MEDIUM	EDTEA, KDM
Management Priority 3.3: Facilitate and manage the sustainable utilisation and development of the areas within the Estuarine Functional Zone				
i. Ensure that all proposed developments (and modifications) adhere to the full suite of relevant environmental legislation	NEMA, NWA, NEM:BA NEM: PAA, NHA	• Contact details of where transgressions can be reported provided • Effective reporting channels in place to ensure enforcement of legal requirements • Inspections undertaken/ increased visibility of control • New developments and modifications are legally compliant	HIGH	EDTEA, KDM

ACTION	RELEVANT LEGISLATION	PERFORMANCE INDICATOR	WORK PLAN	
			PRIORITY	RESPONSIBILITY
		- Transgressors prosecuted - Corrective action undertaken / effective results of increased inspections		
ii. Encourage environmentally sensitive developments/developers and maintain sound / innovative building techniques	MSA, NWA, ICMA, SPLUMA, NEMA	- 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	MEDIUM	KDM, EDTEA
iii. Ensure that all jetties are authorised and licensed	MSA, ICMA	- Jetties and slipways database developed and maintained - Location and details of all structures is known - All jetties and slipways are compliant	MEDIUM	EDTEA

8.4. Institutional and Management Structures

Co-operative governance is the linchpin to realising the key objectives and thus ultimately achieving the vision for the iZinkwazi Estuary. Without well-structured and efficient institutional and management arrangements, actions taken could be no more than a series of uncoordinated reactions to immediate problems. Essential to the successful implementation of this EMP, is the coordination of the management responsibilities by the RMA.

Given that there are seven estuaries in the municipal area, this may best be achieved through a designated estuarine (and coastal) management function within the KDM, through which all estuarine management interventions are administered. Coordination is a pivotal role in rallying the participation and input of the relevant government departments and institutions to undertake their responsibilities, according to their legislated mandates. Facilitating and maintaining effective communication between these role players as well as civil society is thus essential. In addition, co-operative governance is required for identifying, lobbying, and promulgating appropriate by-laws and/or amendments to existing by-laws of the KDM in support of estuarine management (e.g., implementation of the estuary spatial zonation). Further to this, the ZSBC has played a pivotal role in the co-management of the iZinkwazi Estuary over the years in respect to boating, but also on an informal/general basis regarding inappropriate behaviour and general oversight of the system, with support from the ZBC. It is important that this role continues and that a formal agreement is signed between the relevant parties. Further co-management structures to assist the KDM, include the formation of the estuaries' subcommittee under the iLembe MCC, as reflected in Section 7 above. It is critically important that all co-management agreements are formalised to ensure accountability and successful implementation⁸.

The recommended management actions cannot be undertaken without appropriate funding. Each participating institution will be required to source funding for their respective mandated responsibilities from within their respective operational budgets. Additional means of obtaining funding does exist, for example, by motivating for funding via the Environmental Protection and Infrastructure Programme (EPIP).

⁸ Comment received on the draft EMP by M. Brook, representing the ZBRRA and ZBC, dated 7 March 2022.

Table 17: Management Priorities for Institutional and Management Structures

ACTION	RELEVANT LEGISLATION	PERFORMANCE INDICATOR	WORK PLAN	
			PRIORITY	RESPONSIBILITY
Management Priority 4.1: Ensure effective co-ordination of estuarine management responsibilities				
i. Establish an effective and sustainable organisational structure within KDM for coordinating management activities (Designate an estuarine management function, assigned to an Estuarine Management Co-ordinator, EMC)	ICMA, NEMP	- Estuarine management coordination function assigned/ established in KDM - EMC appointed in the long term	HIGH	KDM / IDM
ii. Monitor and report on the progress of EMP actions and achievements (and report back at iLembe Municipal Coastal Committee (MCC) meetings)	ICMA, NEMP	Biannual and annual reporting undertaken	HIGH	KDM / IDM
iii. Update environmental/river by-laws to include key estuarine issues (e.g., clearance of vegetation for views, preservation of estuarine habitat, interference with estuarine mouth, permissible/non permissible uses/activities i.r.t. to spatial zonation, e.g., boating)	MSA, ICMA, NEMP	- Bylaws updated and published/gazetted - Bylaws adopted - Limited impact on fish nursery function - Improvement in fish and invertebrate populations	MEDIUM	KDM
iv. Maintain a stakeholder database for the dissemination of information and engagements	ICMA, NEMP, MSA	Stakeholder database developed and regularly updated	MEDIUM	KDM
v. Establish and manage a voluntary community monitoring team (Citizen Science Programme) and manage the data collected	NWA, ICMA, NWA	- Voluntary champion/ team details captured - Regular communication with voluntary team - Results of monitoring collated and documented	MEDIUM	KDM and participating institutions (e.g., Zinkwazi Conservancy, Ezemvelo)
vi. Develop and maintain estuaries information repository and database	ICMA, NEMP	Critical data and information collected and managed	MEDIUM	KDM / IDM

ACTION	RELEVANT LEGISLATION	PERFORMANCE INDICATOR	WORK PLAN	
			PRIORITY	RESPONSIBILITY
vii. Individual agencies to identify and address training needs among staff involved in estuarine management (KDM, iLembe, DWS, DFFE (e.g., for monitoring, visitor regulation and assistance, etc)	ICMA, NEMP	Official(s) attend accredited estuarine management course	MEDIUM	KDM / IDM
viii. Individual agencies to acquire necessary equipment (e.g. office equip, water quality meter, boat, vehicle)	MSA, NWA, ICMA, NEMA	- Need and Desirability investigation undertaken - Motivation for acquisition drafted and approved - Equipment purchased and maintained	MEDIUM	Applicable agencies
Management Priority 4.2: Confirm co-operative governance arrangements for the iZinkwazi Estuary				
i. Maintain role of Zinkwazi Ski Boat Club (ZSBC) to enforce boating bylaws and boating regulations on the estuary and beach environment	ICMA, NEMP, MSA	- Signed MOU/agreement between ZSBC and KDM - ZSBC license is valid and up to date - EMPr is valid and regularly updated	HIGH	KDM, ZSBC
ii. KDM and IDM to obtain agreement from government departments and other participating agencies in respect of their roles and responsibilities in estuarine management	ICMA, NEMP, MSA, SPLUMA, NWA, NEM: PAA, NFA	MOUs signed (or applicable agreements reached) between RMA and spheres of government and participating agencies	HIGH	IDM / KDM
iii. Establish the terms for convening the iLembe MCC <i>ad hoc</i> estuarine sub-committee, chaired by the IDM	ICMA, NEMP, MSA	- iLembe ad hoc Estuarine Sub-committee convened as required - Membership includes representatives of government and stakeholders/civil society - Meetings are minuted - iZinkwazi Estuary included on the agenda of MCC	HIGH	IDM
iv. Convene regular (biannual) meetings to address estuarine matters and discuss progress on management actions	ICMA, NEMP, MSA	- iLembe Estuarine Sub-committee meets on a biannual basis - Additional meetings held as required to resolve issues - Meetings are minuted - Active collaboration of various institutions, private and civil stakeholders	HIGH	IDM / KDM and participating institutions & stakeholders
v. IDM to chair iLembe MCC ad hoc estuarine sub-committee meetings. iZinkwazi Estuary to be included on the agenda	ICMA, NEMP,	IDM Estuarine Sub-committee meetings chaired by IDM	MEDIUM	IDM

ACTION	RELEVANT LEGISLATION	PERFORMANCE INDICATOR	WORK PLAN	
			PRIORITY	RESPONSIBILITY
Management Priority 4.3: Secure financing for estuarine management initiatives				
i. 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 KDM estuaries	ICMA, NEMP, MSA, SPLUMA, NWA, MRPDA, MFMA, PFMA, NFA	- Funds secured for 5 years - An action plan for securing future funding drafted and approved	HIGH	KDM and Participating institutions
ii. Individual government agencies to develop long-term financing plans				

8.5. Socio-Economic Considerations

Rivers and estuaries have long since attracted human settlement not only because they once served as important trade routes for industry, but they also provided a source of food and remain places of recreational, aesthetic, and spiritual/cultural value. This is evident in the ever-increasing ribbon development present along the South African coastline, and the KDM is no exception with several resort and retirement towns.

Tourism is one of the main economic drivers for the KDM. Much of this is dependent on the coastline and around estuaries. The ancillary supporting services, including holiday accommodation, restaurants and food-outlets, recreational activities (e.g., canoe and beach umbrella hire, craft sales etc.) and even transport facilities, all provide employment to residents as well as poorer communities, particularly around peak holiday periods. These activities can therefore be viewed as both 'green and blue economy' activities. The economic value of the ecosystem goods and services provided by estuaries is receiving growing attention, and undertaking a study of this kind for the iZinkwazi Estuary would assist in formulating a business case for the system in favour of estuarine management.

All effort should be made to ensure the current ecotourism related activities taking place within the iZinkwazi EFZ continue to provide livelihood opportunities through supporting existing business opportunities, current work opportunities and potential job creation related to synergistic activities. Part of this entails the persistence and effective management of the Zinkwazi Beach public boat launch site, managed by the ZSBC. Additional opportunities should be investigated; these could include for example negotiations with THD for a coastal mountain biking trail around the estuary, education programmes for schools related to marine rocky shore ecology and estuarine ecology, among others. Heritage and cultural resources related to the estuary are not well known and these could add further socio-economic value to the system and the surrounding area, as well as potential offer livelihood or local economic development opportunities. To ensure the return of visitors to the KDM coastline as a whole and specifically the iZinkwazi EFZ, visitors must be assured of a safe, clean, and attractive coastal environment that is easily accessible to all who wish to enjoy its beauty and benefits. However, the health of the iZinkwazi Estuary should not be jeopardised by the influx of visitors, and thus recreational activities in and around the estuarine environment (e.g., boating, fishing) must be regulated to prevent the degradation and misuse of the system.

Table 18: Management Priorities for Socio-Economic Considerations

ACTION	RELEVANT LEGISLATION	PERFORMANCE INDICATOR	WORK PLAN	
			PRIORITY	RESPONSIBILITY
Management Priority 5.1: Maintain safe, clean, equitable and controlled access				
i. Maintain and control the current access to the iZinkwazi Beach and iZinkwazi Estuary margins	ICMA, MSA	• Budget allocated for on-going maintenance of beach amenities, including beach ablutions • Scheduled maintenance programme in place to maintain beach facilities and infrastructure • Specific issues related to the iZinkwazi Estuary included in any KDM Peak Season Planning (e.g., increased waste management, increase signage not to breach estuary etc.)	HIGH	KDM
Management Priority 5.2: Regulate recreational use in and around the iZinkwazi Estuary ⁹				
i. Adopt, demarcate and enforce the SZP (i.e., no wake, no-take)	ICMA, NEMP, MSA	• SZP incorporated into SDF and LUMS • SZP demarcated with markers/buoys/signage if necessary • SZP controls enforced according to bylaws and offenders prosecuted • Reduced habitat disturbance / degradation	HIGH	KDM
ii. Ensure that the Zinkwazi Beach Public Boat Launch Site is compliant and well managed	Bylaws, SAMSA Regs, ORV Regs Thukela MPA Regulations	• PBLS application renewed on an ongoing basis • PBLS compliant with EMPr and operating procedures • PBLS facilities well maintained • Reduced habitat disturbance/degradation	HIGH	KDM, ZSBC, EDTEA
iii. Enforce boating bylaws and boating regulations on the estuary and beach environment (maintain the role of ZSBC)		• Controlled boating activities • Compliance with SZP • Penalties/fines issued as required • Reduced habitat disturbance/degradation	HIGH	ZSBC, KDM, EDTEA (KZN BLSAG), ZBC, Ezemvelo
iv. Develop, adopt and enforce a code of conduct for activities in and around the iZinkwazi Estuary		• Controlled recreational activities • Penalties/fines issued as required • Reduced habitat disturbance/degradation • Reduced conflict	MEDIUM	KDM
v. Instate educational signage at strategic locations to promote environmental awareness, stewardship and preservation	ICMA, NEMP, MSA	• Approval and funding obtained • Signage created and erected in key public spaces and main access routes • Signage maintained	MEDIUM	KDM

⁹ Cross cutting with Conservation

ACTION	RELEVANT LEGISLATION	PERFORMANCE INDICATOR	WORK PLAN	
			PRIORITY	RESPONSIBILITY
Management Priority 5.3 Maintain economic benefits				
i. Undertake an economic evaluation of the ecosystem goods and services provided by the iZinkwazi Estuary to formulate a business case in favour of estuarine management.	ICMA, NEMP	• Specialists appointed and study undertaken • Findings are reported on • Findings incorporated into EMP • Findings incorporated into IDP	MEDIUM	KDM, EDTEA
ii. Identification, evaluation and protection of heritage and cultural resources (there is limited known heritage in this area associated with the estuary)	NHRA	• Heritage study undertaken • Findings of study publicised • LED/livelihood opportunities related to heritage/ cultural resources investigated	MEDIUM	SAHRA, ZBC, ZSBC
iii. Maintain the facilities provided in support of economic activities (maintain parking area, ablution, boat launch sites, local craft market etc.)	ICMA, MSA, MFMA	• Facilities maintained/ upgraded as necessary • LED budget allocated accordingly • Degraded/transformed areas rehabilitated	HIGH	KDM, EDTEA, IDM, COGTA, KZN DARD, DFFE

8.6. Education, Awareness, Monitoring and Research

iZinkwazi Estuary management priorities in respect to this management objective relate to improving levels of understanding and awareness of the value of the system by both residents and visitors to the area, as well as continuing to monitor the state or condition of the estuary.

Effective estuarine management is intimately influenced by stakeholder involvement, community buy-in and creating informed users as it is human activities that need to be managed to preserve estuarine ecosystems. The surrounding communities and visitors need to be engaged through effective channels of communication (e.g. signage, pamphlets, newsletters, publicised reports etc.) to raise awareness and appreciation of the value of the estuaries, the environmental goods and services they provide, and the management rules and regulations necessary to protect their resources. Signage and dissemination of information is considered to be of paramount importance to maintain constant public and community awareness¹⁰. The community should be informed all of projects contained in the EMP and the role that they can play in their implementation to achieve a positive outcome¹⁰ and to foster community pride and sense of ownership. Beach-based tourism is an important component of the KwaDukuza economy, and estuarine ecosystems, such as the iZinkwazi Estuary should feature in marketing material to inform local to international visitors of the sensitivity and importance of the system and the current vision and management approach adopted by KDM and the ZSBC. Similarly, it is important that farmers subcontracted to THD, and fishers (both rural/subsistence and recreational) are engaged and educated on these aspects.

Monitoring and research form the basis of increasing (and updating) our knowledge on estuaries and contribute to effective management through adaptive management processes. This knowledge should be disseminated through scientific publications and reports to various end users, ranging from schools and visitors to municipal officials and the greater scientific community. Monitoring of various components of the iZinkwazi Estuary should be undertaken and the results

¹⁰ Comment received on the draft EMP from M. Brook, representing the ZBRRA and ZBC, dated 7 March 2022.

assessed to check the progress of the EMP in achieving the management objectives set out. Of particular importance is undertaking an ongoing basic monitoring programme, which incorporates existing water quality monitoring to measure safety for human contact and other key biophysical parameters necessary for estuarine biota, to monitor the condition of the estuary against the prescribed Resource Quality Objectives (DWS 2015). There are several active community groups associated with the iZinkwazi Estuary, namely, the ZSBC, ZBC, and ZBRRA and these groups offer a valuable opportunity to initiate/continue Citizen Science activities to contribute to the monitoring of the system (see Appendix E for examples of monitoring sheets, Roberts and Mthuli, 2015). This in turn will foster further sense of owners and stewardship of the estuary.

The opportunity exists to engage with universities or research institutions to collect samples and measurements in a scientifically-sound manner to yield reliable data for monitoring purposes or to fill identified knowledge gaps (e.g. value of fish nursery area, control of the invasive snail, *Tarebia granifera*), and that these data are disseminated to the estuarine data repository at the South African Environmental Observation Network (SAEON).

Table 19: Management Priorities for Education, Awareness, Monitoring and Research

ACTION	RELEVANT LEGISLATION	PERFORMANCE INDICATOR	WORK PLAN	
			PRIORITY	RESPONSIBILITY
Management Priority 6.1: Promote high levels of public awareness and appreciation of the value of the iZinkwazi Estuary				
i. Source and/ or commission educational and informative material including signage, posters, pamphlets and webpage design	ICMA, NEMP	• Educational signage erected at strategic points • Posters and pamphlets erected/ disseminated • KDM estuaries webpage operational	MEDIUM	KDM, EDTEA, DWS
ii. Facilitate annual discussions with farmers on suitable resource use and best farming practices	CARA, ICMA,	• Annual farmer’s meetings convened and minuted • Improved farming practices	MEDIUM	DARD/DFFE, Ezemvelo, THD
iii. Facilitate regular discussions with fishers on sustainable resources use	MLRA, ICMA	• Improved angler compliance with catch & release, no-take zone • Reduced number of gillnets	MEDIUM	DFFE
Management Priority 6.2: Enhance scientific knowledge and understanding of the iZinkwazi Estuary through monitoring and research				
i. Monitor the number of users and quantify extractive resources use activities on the estuary to determine the level of use and carrying capacity (e.g. roving kreeel surveys)	ICMA, NEMP, MLRA,	• Monitoring programme developed • Monitoring programme implemented and maintained • Roving creel/bait surveys undertaken every 5 years • Number of subsistence users established • Resource use and carrying capacity informed by monitoring results going forward	MEDIUM	DFFE, DST
ii. Investigate and formalise the existing water quality monitoring activities by various	MSA, NWA, ICMA, NEMP	• Consolidated monitoring programme implemented and maintained • Long-term database maintained	MEDIUM	iLembe, KDM, DWS

ACTION	RELEVANT LEGISLATION	PERFORMANCE INDICATOR	WORK PLAN	
			PRIORITY	RESPONSIBILITY
institutions (IDM, KDM, DWS for STP), to monitor impacts and guide mitigation measures		- Data reported on against RQOs - EMP informed by monitoring results going forward		
iii. Monitor the condition of the estuary through the monitoring programme as outlined in section 9.1.2, against the RQOs		- Required basic monitoring undertaken - Data reported on against RQOs - EMP informed by monitoring results going forward	MEDIUM	KDM, IDM, DWS, DFFE
iv. Undertake training of community monitors to participate in estuarine monitoring (Citizen Science support e.g. state of mouth, pollution monitoring, usage, transgressions)	ICMA, NEMP, NWA	- Number of volunteer community monitors trained - Increased knowledge and awareness - Community support and custodianship - Timeous reporting and mitigation of incidents	MEDIUM	KDM, ZSBC, ZBC, community members

9. INTEGRATED MONITORING PLAN

According to the standards for estuarine management, management actions should be based on evidence. Thus, monitoring is a crucial aspect of the adaptive estuarine management planning 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 and 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 the sections below.

9.1. Resource Monitoring

9.1.1. Existing Resource Monitoring

- **National Department of Water and Sanitation** – The DWS established five basic water quality monitoring stations in the iZinkwazi Estuary as part of the National Estuary Monitoring Programme. These sites were actively monitored between 2012 and 2015 with support from the ZBC. Monitoring of some, if not all, of these sites should continue according to the resource monitoring programme included in Table 20 below.
- **Zinkwazi Lagoon Lodge** – Operation of the STP, which treats domestic effluent from the resort only, is subject to the conditions of the Environmental Authorisation and the Water Use License. It is understood that quarterly sampling of the STP is undertaken by the DWS, whilst sampling is undertaken every two months by an independent consultant on behalf of the owners of the resort (W. Joint, *pers. comm.*, 2021)¹¹. It is imperative that these monitoring activities, and any data collected for the estuary (e.g. upstream and downstream of the resort) be included in a central database for long-term monitoring,

¹¹ Mr. W. Joint, Manager of the Zinkwazi Lagoon Lodge, 30/08/2021

as means to detect trends in deteriorating water quality.

- **iLembe District Municipality** – Water quality samples are routinely collected close to the beach amenities on a quarterly basis by the IDM Environmental Health Department, and more frequently during the peak holiday season; testing for *E.coli* and total bacterial counts.
- **WESSA Blue Flag Beach Programme** – WESSA has been managing the Blue Flag Beach Programme in South Africa since 2001. The international programme focusses on the environmental management of the coastline and coastal waters to help tourism growth and development. Beaches awarded Blue Flag status meet a standard of excellence in the areas of safety, amenities, cleanliness, and environmental education. Zinkwazi Beach is listed as a Pilot Beach and thus monitoring is undertaken at least every 31 days, specifically for *E. coli* (faecal coli bacteria) and *Streptococci* (intestinal enterococci). These results would be particularly important with reference to detecting any problems associated with the beach ablutions and septic tank.
- The **Southern African Bird Atlas Project 2 (SABAP2)** is a citizen science project for mapping the distribution of birds across South Africa. Phase 1 took place from 1987-1991, and Phase 2 was initiated in 2007. The project allows for citizens to record bird sightings within specific pentads and the information is then uploaded to the SABAP2 database for research purposes. Pentad 2915_3125 encompasses the vast majority of the iZinkwazi Estuary, and several residents and members of the ZBC contribute to bird sightings for this area. It is recommended that this database is regularly consulted (especially in respect to waterbird/wader counts), and the bird species list currently available through the conservancy is updated annually.
- **Catches by Zinkwazi Ski Boat Club** – According to the Environmental Management Plan for the Ski Boat Club, the club is required to maintain a register of all catches made by craft launched from the site. However, this register pertains to marine catches only. Currently there is no register for fish catches within the estuary.

9.1.2. Recommended Resource Monitoring

Given the high tourism value of Zinkwazi Beach and the high level of human interaction with the iZinkwazi Estuary particularly during peak visitor periods, the estuary should be prioritised for regular monitoring of both abiotic and (some) biological aspects (DWA 2013).

The requirements and methodology for resource monitoring is prescribed by the *Methods for the Determination of the Ecological Water Requirements Reserve for estuaries* (DWA 2011). The EcoClassification of estuaries in the KDM was undertaken as part of the Mvoti-Umzimkulu WMA Classification Study (DWA 2013). While the specific flow requirements were not prescribed, the Ecological Specifications (or targets), against which to assess the ecological health of the iZinkwazi Estuary, were provided (DWS 2015, Breetzke and Meyer 2021).

The main priority is to establish a long-term monitoring plan to track the water quality in terms of environmental health, its suitability for human contact as well as to acquire the necessary data on an ongoing basis to increase our knowledge of the system, especially its response to management interventions, such as those proposed in this EMP. The minimum long-term monitoring recommended for ascertaining the impacts of current and future pressures on the iZinkwazi Estuary is listed in Table 20, [in bold and highlighted in grey] adapted from DWA (2011).

In comparison, baseline surveys are once-off, intensive assessments to collect data relating to a wide range of factors, primarily to gain key information on the composition and structure of estuarine communities and a better understanding of estuarine processes, patterns and functioning. The baseline information, which informed the development of this EMP, was provided through the inaugural EMP and specialist report by Mackay et al., (2013).

Table 20: Recommended minimum requirements for long-term monitoring (Priorities in grey)

COMPONENT	MONITORING ACTION	TEMPORAL SCALE (FREQUENCY AND WHEN)	SPATIAL SCALE (NO. STATIONS)
Hydrology	Measure river inflow	Simulated every 3 years	Near head of estuary
Hydro-dynamics	Observe mouth status	Daily or weekly	Mouth
	Record estuary water levels using small <i>in situ</i> probe	Continuous	Near mouth
	Aerial photography or satellite imagery of estuary (30x 30 m).	Every 3 years	Entire estuary
Sediment dynamics	Monitoring berm height using appropriate technologies	Quarterly	Mouth
	Bathymetric surveys: Series of cross-section profiles and a longitudinal profile collected at fixed 100-200 m intervals, but in more detail in the mouth. The vertical accuracy should be about 5 cm.	Every 3 years	Entire estuary
	Set sediment grab samples (at cross section profiles) for analysis of Particle Size Distribution (PSD) and origin (i.e., using microscopic observations).	Every 3 years (with invert sampling)	Entire estuary
Water quality	Water quality (e.g., system variables (e.g., pH, oxygen, turbidity), nutrients and toxic substances) measurements in the surface water entering the head of the estuary (supplemented by ongoing institutional monitoring indicated above)	Monthly continuous	Close proximity to head of estuary
	Salinity and temperature profiles, and any other in situ measurements possible (e.g. pH, Dissolved oxygen, turbidity etc.) taken along the length of the estuary (surface and bottom samples)	Seasonally, annually	Entire estuary (3-5 stations)
	Inorganic nutrient concentrations (together with above)	High flow/low flow surveys, every 3 years or when significant change in WQ expected	Entire estuary (3-5 stations)
	Measurements of organic content and toxic substances (e.g., trace metals, hydrocarbons, herbicides, pesticides) in sediments along length of the estuary, where considered an issue.	Once off, then every 3 – 6 years, if results show contamination	Entire estuary, including depositional areas (muddy areas)
	Water quality (e.g., system variables, nutrients, toxic substances, <i>E. coli.</i>) measurements on near-shore seawater.	Blue flag monitoring (or available literature)	Seawater adjacent to estuary mouth at salinity 35
Microalgae	Record relative abundance of dominant phytoplankton groups, i.e., flagellates, dinoflagellates, diatoms and blue-green algae.	Summer survey every 3 years	Entire estuary (2-5 stations)

COMPONENT	MONITORING ACTION	TEMPORAL SCALE (FREQUENCY AND WHEN)	SPATIAL SCALE (NO. STATIONS)
	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., HPLC.		
	Intertidal and subtidal benthic chlorophyll-a measurements.		
Macrophytes	Ground truth maps to document changes in macrophyte habitats over time. Document area covered by sensitive habitats i.e., submerged macrophytes.	Summer survey every 3 years	Entire estuary (2-5 stations)
	Record number of macrophyte habitats, identification and total number of macrophyte species, number of rare or endangered species or those with limited populations documented during a field visit.		
	Note extent of macroalgal blooms, floating aquatic macrophytes and area occupied by invasive vegetation.		
Invertebrates	Record species and abundance of zooplankton, based on samples collected across the estuary.	Summer survey every 3 years	Entire estuary (2-5 stations)
	Record benthic invertebrate species and abundance, based on subtidal and intertidal grab samples at a series of stations up the estuary, and counts of hole densities.		
	Measures of sediment characteristics at each station.		
Fish	Record species and abundance of fish, based on seine net and gill net sampling.	Twice annually Spring/ summer and autumn/ winter	Entire estuary (2-5 stations)
Birds	Undertake counts of all water associated birds, identified to species level.	Annual winter (Jul/Aug) and summer (Jan/Feb) surveys	Entire estuary

9.2. Compliance Monitoring

Compliance monitoring refers to the monitoring of the character and intensity of uses/activities and developments within an estuary, that is the 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 the resources.

Compliance monitoring in respect to the discharge of domestic effluent falls within the ambit of the Department of Water and Sanitation (DWS). Compliance can be assessed in terms of the Water Use License (WUL) for the Zinkwazi Lagoon Lodge STP, and the discharge standards therein, as well as the national guidelines for aquatic and coastal ecosystem health (DWAF 1995, 1996, DEA 2012). In respect to the beach ablutions, management of the sewage system is a joint responsibility between the KDM and the ZSBC and will similarly be held accountable in the event of sewage overflow incidents and pollution of the estuary.

Prospective developers and the KDM will be accountable to KZN EDTEA as well as the DWS when undertaking development activities within the EFZ. Legal due process must be consistently followed, monitored and enforced¹² in respect to any new development or development changes within the sensitive and vulnerable coastal space, especially land-use controls within the CPZ / EFZ. Special attention must be given to development encroachment, land reclamation / infilling, and erosion defence, particularly after severe weather events. It is also important to remember that activities within the catchment ultimately have an impact on the estuary and the coastal environment in various ways not limited to surface hardening, increased stormwater run-off, pollution, and sedimentation.

Compliance monitoring in the KDM in respect to estuarine/marine living resource use is essentially non-existent (apart from the Thukela MPA), with the disbandment of the Ezemvelo KZN Wildlife MLRA compliance officers and uptake of the compliance mandate to the DFFE (formerly DAFF). Compliance monitoring by the relevant authority will be most important during the peak holiday seasons when increased usage of the estuary and sand bar/beach for bait collection and shoreline angling and/or netting by holiday makers, is anticipated. This function is particularly relevant given that the iZinkwazi Estuary lies adjacent to the Thukela MPA. As the estuary plays an important role as a supporting nursery area to the MPA, compliance monitoring should be commissioned during holiday periods as minimum.

Table 21: Recommended compliance monitoring

USE / ACTIVITY	INDICATOR	TEMPORAL SCALE (frequency)	TARGET/LIMIT	RELEVANT LEGISLATION	RESPONSIBLE AUTHORITY
EFFLUENT DISCHARGE (including treated waste water, and stormwater and grey water outlets)	No. of discharge points, volume of effluent discharged, no. of system failures and/or spillages, water quality variables to monitored, reported contraventions	Peak and off-peak periods for wastewater, As per WUL conditions for STP, High and low-flow periods for stormwater	95% compliance	WUL conditions, NWA, Effluent disposal standards, MSA, NHA	DWS, KDM, IDM, DFFE
LAND-USE AND DEVELOPMENT ACTIVITIES	Nature, location and extent of activities, extent of degradation/habitat alteration	Continuous	Non-compliance reduced by 50%	NWA, SPLUMA, NEMA, EIA Regulations, ICMA, MSA, NEM:BA, NEM: PAA, NEM: WA	KDM, EDTEA
FISHING	No. of fishers, No. of permits, reported contraventions	Peak holiday season	Non-compliance reduced by 50%	MLRA	DFFE
BAIT HARVESTING	No. of harvesters, No. of permits, reported contraventions	Peak holiday season	Non-compliance reduced by 50%	MLRA	DFFE

¹² Reiterated by M. Brook, representing the ZBRRA and ZBC. Comment received on the draft EMP dated 7 March 2022.

9.3. Performance Monitoring

The performance monitoring plan is proposed to be used by the RMA, the KDM (and/or 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.

Ultimately the EMP must be holistically reviewed every 5 years from the date it was adopted, ideally in line with the review cycles of the IDP, SDF and/or CMP. This review is ultimately the responsibility of the RMA, the KDM, with support from EDTEA, IDM, the ZSBC, and ZBC. According to the NEMP, this review should include an assessment of:

- 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 EMP in terms of the objectives that were originally set, and 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), 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 22 below provides the performance monitoring plan relative to the proposed management priorities.

Table 22: Recommended Performance Monitoring Plan

MANAGEMENT OUTPUT	PERFORMANCE INDICATOR	TEMPORAL SCALE (frequency)	RELEVANT LEGISLATION	RESPONSIBLE AUTHORITY
1. ESTUARINE HEALTH AND FUNCTION				
i. Secure adequate quantity and quality of freshwater input to improve and maintain ecosystem health and functioning	• B Health Class and RQOs adopted and incorporated into Regional Water Services and Sanitation Master Plans	• Biannual for DWS	NWA	DWS, IDM, KDM
ii. Minimise pollution by identifying and addressing activities that lead to poor water quality	• Secondary conservation tank at beach ablutions connected and operational • iZinkwazi Lagoon Lodge sewage treatment plant operating to specification and well maintained • Appropriate SUDS/EI included in KDM stormwater management plan for Zinkwazi Beach	• Quarterly	MSA, NWA, ICMA, NEMA	KDM, IDM, DWS, DFFE

MANAGEMENT OUTPUT	PERFORMANCE INDICATOR	TEMPORAL SCALE (frequency)	RELEVANT LEGISLATION	RESPONSIBLE AUTHORITY
	- Improved estuarine water quality - Improved integrity of estuarine margins			
iii. Promote sustainable agriculture	- Agricultural best practice implemented by THD and subcontracted farmers - Improved estuarine water quality - Improved integrity of estuarine margins	Annually	CARA, NWA	KZN DARD, EDTEA
iv. Control the spread and densification of invasive alien plant species	- iZinkwazi Estuary include in KDM IAPs eradication programme, with buy-in from property owners - Increased area / tonnes of IAPs removed	Annually	CARA, NEM:BA	KDM, DEA: WftC, WfW, DFFE, KZN DARD
v. Rehabilitate degraded and transformed areas	- Strategic rehabilitation plan developed together with THD, and priority degraded areas restored - Damages/degraded areas on private property addressed	- Annually - Ad hoc visual monitoring	NEM:BA, NWA, CARA, NEMA, NFA	KDM, THD, EDTEA, Ezemvelo, landowners/I&APs
2. CONSERVATION				
i. Ensure the conservation of estuarine habitats	- iZinkwazi Estuary receives appropriate zonation within the municipal TPS - Biodiversity Stewardship Agreement signed with THD - Increased stewardship and sense of ownership by all landowners for improvement and preservation of iZinkwazi Estuary - Feasibility of the inclusion of the estuary within the Thukela MPA assessed - Spatial zonation plan adopted and adhered to	- Annually - Ecological monitoring every 3 years	ICMA, NEMP, SPLUMA, MSA	KDM, ZBC, ZBRRA, Ezemvelo, EDTEA, ZBSC
ii. Ensure sustainable resource use through an effective level of compliance management	- Spatial zonation plan demarcated and enforced using signage - Compliance monitoring / patrols undertaken by ZSBC and ZBC, findings documented and reported on	Annually	MSA, ICMA, NEMP, MLRA, NWA, NEMP, Boating bylaws	KDM, Ezemvelo, EDTEA,
3. LAND USE AND INFRASTRUCTURE PLANNING AND DEVELOPMENT				
i. Ensure the effective implementation of the EMP	- EMP approved and incorporated into IDP during cyclical review - Spatial zonation included in SDF and LUMS as part of cyclical review	5-year review cycle	ICMA, NEMP, MSA, SPLUMA	KDM

MANAGEMENT OUTPUT	PERFORMANCE INDICATOR	TEMPORAL SCALE (frequency)	RELEVANT LEGISLATION	RESPONSIBLE AUTHORITY
ii. Minimise the potential impacts of climate change	- CML determined, adopted and reflected on SDF and LUMS - Specific engagement with property owners held	Once-off (review after 5 years and extreme events)	MSA, NWA, ICMA, SPLUMA, NEMA	KDM, EDTEA
iii. Facilitate and manage the sustainable utilisation and development of the areas within the EFZ	- Inspections undertaken, transgressors prosecuted, and remedial actions implemented - Effective control of stormwater inputs - Indigenous vegetation and habitat are preserved and valued - Shift toward green/environmentally sensitive development and behaviour, ultimately leading to improved environmental quality - Jetty structures controlled to prevent environmental degradation - Effective and positive ongoing relationship with property owners	- Ad hoc - Annually	NEMA, NWA, NEM:BA, NHA, MSA, ICMA,	EDTEA, KDM, DWS
4. INSTITUTIONAL AND MANAGEMENT STRUCTURES				
i. Ensure effective co-ordination of estuarine management responsibilities	- Estuarine management coordination function established in KDM - EMC appointed in the long term - Bylaws developed/updated and published in local gazette - Relevant official(s) attend accredited estuarine management course - iLembe Estuarine Sub-committee meets regularly - Voluntary community monitoring team established, data collected on an ongoing basis and stored in a central repository with the EMC - Stakeholder database maintained - Municipal teams or assigned entities well equipped for estuarine management activities	Biannually	NWA, ICMA, NEMP, NWA, MSA	EDTEA, KDM, IDM and participating depts. and institutions
ii. Confirm co-operative governance arrangements for the iZinkwazi Estuary	- MOUs signed between KDM and ZSBC - iLembe Estuarine Sub-committee constituted and meets regularly (minimum biannually) and chaired by IDM - Active collaboration of various institutions, private and civil stakeholders - Formal review of EMP every 5 years	Annually	ICMA, NEMP, MSA, SPLUMA, NWA, NEM: PAA	KDM, IDM, and participating institutions & stakeholders (e.g. ZBCS, ZBC, etc)

MANAGEMENT OUTPUT	PERFORMANCE INDICATOR	TEMPORAL SCALE (frequency)	RELEVANT LEGISLATION	RESPONSIBLE AUTHORITY
iii. Secure financing for estuarine management initiatives	- Funds secured for 5 years - Long term funding plan developed, and reviewed on an ongoing basis	Annually	ICMA, NEMP, MSA, SPLUMA, NWA, MFMA, PFMA	KDM and participating depts. and institutions
5. SOCIO-ECONOMIC CONSIDERATIONS				
i. Maintain safe, clean, equitable and controlled access	- Current access well maintained through a scheduled maintenance programme - iZinkwazi Estuary included in any Peak Season Maintenance Plans to ensure estuary is well maintained/protected over peak season	Annually	ICMA, MSA	KDM, ZSBC, EDTEA
ii. Regulate recreational use in and around the iZinkwazi Estuary	- EMP and SZP approved, and incorporated into SDF and LUMS - Zinkwazi Beach Public Launch Site is compliant and well managed - Boating bylaws and EFZ controls enforced and offenders prosecuted - Code of Conduct for the iZinkwazi Estuary developed and monitored - Signage procured, installed and maintained - Increased environmental awareness and education via informative signage	Annually	ICMA, NEMP, MSA, SPLUMA, Bylaws, SAMSA Regs, ORV Regs, Thukela MPA Regulations	KDM, DFFE/Ezemvelo, ZSBC, ZBC
iii. Maintain economic benefits	- Economic evaluation undertaken and key benefits included in EMP and IDP - Heritage resources related to the estuary are identified and enhanced where possible - Beach/recreational amenities well maintained to ensure persistence of local economic activities and benefits	- Once-off - Annually	ICMA, MSA, NHRA, SPLUMA, MFMA	KDM, EDTEA, SAHRA, IDM, COGTA, KZN DARD, DFFE
6. EDUCATION, AWARENESS, MONITORING AND RESEARCH				
i. Promote high levels of public awareness and appreciation of the value of the iZinkwazi Estuary	- Increased environmental awareness and education via informative signage - Buy-in from landowners, farmers and fishermen achieved - Reduced negative impacts and activities	Every 3 years	ICMA, NEMP, CARA, MLRA	KDM, EDTEA, DWS, DARD / DFFE, THD, Ezemvelo

MANAGEMENT OUTPUT	PERFORMANCE INDICATOR	TEMPORAL SCALE (frequency)	RELEVANT LEGISLATION	RESPONSIBLE AUTHORITY
ii. Enhance scientific knowledge and understanding of the iZinkwazi Estuary through monitoring and research	- Intensity of extractive resource use determined and management controls adjusted as necessary - Monitoring programme formalised - EMP updated by data/monitoring results going forward - Volunteer community monitors trained, and ZBC engaged to facilitate on-going monitoring - Reduce number and severity/impacts of incidents	- Once-off - Annually	ICMA, NEMP, NWA, MFMA, MSA, MLRA	DWS (lead) IDM, KDM, EDTEA, I&APs, ZBC/ZSBC, DFFE/Ezemvelo

10. CONCLUDING REMARKS

Through this EMP development process, it is unambiguously apparent that the iZinkwazi Estuary has a long history of human modification which persists today. Despite transformation of large areas within the EFZ due to agriculture, as well as water edge development at the estuary mouth, the iZinkwazi Estuary maintains important biodiversity and socio-economic value. The system is among the country's most important estuaries and it has the potential to influence the functioning and success of the Thukela MPA.

It is for these reasons that further deterioration of the iZinkwazi Estuary must be prevented through effective and co-ordinated management by all relevant institutions. It is not the estuary itself that needs to be managed, but rather human activities which could negatively affect the integrity of the estuary and the ecosystem goods and services it provides, if such activities continue without a level of control. Overall, what is required is a stronger appreciation of the importance of this estuarine ecosystem as a valuable asset worthy of conservation and its conscientious use for the benefit of both the environment and coastal communities.

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. However, updates can also be made as and when critical information becomes available.

In conclusion, **priority actions** requiring immediate attention are summarised as:

- Begin process to lobby for inclusion of the iZinkwazi Estuary into the Thukela MPA;
- Enter engagements with THD for the strategic setback/retreat from the estuary margin and rehabilitation of degraded areas for biodiversity preservation purposes through a formal signed Biodiversity Stewardship Agreement;
- Update the KDM town planning scheme to include a zonation for the estuary;
- Connect the existing infrastructure (secondary conservancy tank in the parking area) to the beach ablution facilities to alleviate potential pollution risk to the estuary during peak holiday periods until the planned upgrades to the ablution facilities are initiated;
- Obtain (or update) a formal signed agreement or MOU for roles and responsibilities of the ZSBC in respect to managing boating activities on the estuary; and
- Determine the terms for establishment of the iLembe District Coastal Committee: Estuaries sub-committee.

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12. APPENDICES

12.1. Appendix A: Extract of Annexure 2 of the uThukela MPA Regulations

Only pelagic fish species from the following families may be caught or used as bait in the **uThukela Controlled – Pelagic Line fish zone**:

Atherinidae – silversides

Belonidae – garfish

Carangidae – kingfish, garrick, yellowtail, queenfish, etc.

Chirocentridae – wolf herring/slimy

Clupeidae – red-eyes, sardines, etc.

Coryphaenidae – Dorado

Engraulidae – anchovies, glass-noses/bonies, etc.

Exocoetidae – flying fishes

Hemiramphidae – halfbeaks

Istiophoridae – Sailfish and marlin

Pomatomidae – Shad/elf

Rachycentridae – Prodigal son/Cobia

Scomberesocidae - sauries

Scombridae – Tunas, mackerels, wahoo, etc.

Sphyraenidae – Barracudas

12.2. Appendix B: Water Craft Management

Water craft as per definition by KDM Boating Bylaws state that any floating craft whether powered by wind, person or motor is classified as a water craft. The Bylaws further state that only 5 water craft are allowed on an estuary at any one time.

Within this EMP it is proposed that the Municipal Bylaw be amended to all for an improved definition and reasonable limits going forward:

- A permit system to be implemented for all motorized and jet-propelled water craft to manage the numbers on the estuary (annually purchasable).
- All current land owners bordering the estuary to be granted one permit (more permits to be purchased for the prescribed annual fee)
- Any visitor wanting to launch will need to purchase a daily permit or a yearly permit at the prescribed fees
- Yearly permits to be limited to 50 annual permits (excluding bordering land owners) (fees payable to the Zinkwazi Ski Boat Club (ZSBC) to have joint management of the estuary with the Zinkwazi Blythedale Conservancy (ZBC))
 - The funds will be used to implement and manage the estuary
 - The ZSBC will be in charge of managing boat numbers and maintaining the public launch site
 - The ZBC can assist with ecological and water quality monitoring.
 - Daily permits to be purchased from the ZSBC
 - All daily users including annual permit holders are to book usage prior to launching
- Daily limit of motorized water craft be limited to 10 boats (this to be managed by the relevant authority being the Zinkwazi Ski Boat Club on behalf of the KwaDukuza Municipality)
- Active use/sporting use of jetskis within the estuary is prohibited, i.e. warming engines of fishing skis and use of the estuary to gain access to the beach for launching to sea through the Zinkwazi Ski Boat Club is permitted. No-wake speed is permitted only. Ramping of the estuary berm is strictly prohibited.
- All non-motorized need not have a permit system
- All non-motorized be excluded from number limits
- All boats are to be cleaned prior to launching to prevent contamination by pathogens and invasive species where possible

12.3. Appendix C: Coastal Land Use Typology Controls

Table 23: Coastal Conservation Typology Controls (RHDHV, 2016)

COASTAL TYPOLOGY	INTENTION	LISTED ACTIVITIES (2014 Regulations) ¹³
Coastal Conservation	- Protect Critical Biodiversity areas - Limit construction in the estuarine functional zone - Protect sensitive coastal ecosystems	<u>Listing notice 1:</u> 6,7,15 to 19, 41, 42, 49, 52 – 55, and 62 <u>Listing notice 2:</u> 10 and 25 <u>Listing notice 3:</u> all
Primary Use	With special consent	Not supported
As per base land use controls, except where BOSMaP CBAs, High Risk CVI areas or Coastal Access Land are present	- Temporary infrastructure or structures proposed to be removed within 6 weeks - Structures or activities that require a coastal location, such as desalination plants or aquaculture, subject to applicable coastal/environmental controls and authorisation processes	Transformation of natural habitats
Additional Controls		
- All structures constructed, if approval is granted by the EDTEA, require approval from a professionally registered engineer. - All structures, if approval is granted by the EDTEA, must preferably be elevated on pilings, posts, piers-and-joists, column or similar foundations. - All structures constructed, if approval is granted by the EDTEA, must be designed to allow for the entry and exit of flood waters with necessary design arrangements to ensure that coastal risk is addressed and reduced by implementing responsible mitigation measures to the satisfaction of the Municipality. - Any new development, if approval is granted by the EDTEA, must be designed and positioned within reason to limit potential flood damage and risk to human life, including but not limited to positioning buildings in suitably acceptable elevated portions of properties. - Any new development, if approval is granted by the EDTEA, must demonstrate reasonable risk reduction measures and should include innovative solutions (adaptable buildings, re-locatable buildings, flood-proofed buildings, flood resistant and resilient construction, etc.). - Storm water management plans must be submitted along with building plans. - Hardened surfaces must be minimised and suitable permeable alternative utilised to maximise natural infiltration and reduce overland flow and associated velocities with concomitant risk of erosion and damage. - Only fully enclosed / self-contained effluent storage and treatment systems will be permitted if links to sewer mains are not possible. These must be located either on the landward side of structures or either side of structures, and recommended by a Registered Engineer to ensure suitable sealing and safety. - Development should be sited to minimise the removal of trees and endemic vegetation. - Existing coastal processes, including dune migration and littoral drift, should not be impeded and indigenous vegetation must be maintained. - Fencing or other barriers must be permeable to accommodate storm events and limit structural damage and associated negative impacts on the environment.		

¹³ The most current and relevant National Environmental norms and standards, guidelines, applying Environmental Impact Assessments or Basic Assessments must be conducted for scheduled activities in the coastal zone.

Table 24: Coastal Rural Typology Controls (RHDHV, 2016)

COASTAL TYPOLOGY	INTENTION	LISTED ACTIVITIES (2014 Regulations)
Coastal Rural	- To maintain a balance between the rural and urban environment - Protect indigenous fauna and flora - Limit ribbon development and control sprawling urban development - Address uncontrolled subdivision - Avoid hazards - Retain aesthetic values	<u>Listing notice 1:</u> 6,7,15 to 19, 41, 42, 49, 52 – 55, and 62 <u>Listing notice 2:</u> 10 and 25 <u>Listing notice 3:</u> Potentially all
Primary Use	With special consent	Not supported
As per base land use controls except where BOSMaP CBAs, High Risk CVI areas or Coastal Access Land are present	- Temporary infrastructure or structures proposed to be removed within 6 weeks - Development of more than a single dwelling on properties zoned as agriculture (with the necessary authorisations) - Structures or activities that require a coastal location, such as desalination plants or aquaculture, subject to applicable coastal/environmental controls and authorisation processes	- Transformation of natural areas - Disruption of natural processes
Additional Controls		
- All structures constructed, if approval is granted by the EDTEA, should be outside any high-risk areas and set-back from the coast and littoral active zone. - Storm water management plans must be submitted along with building plans. - Hardened surfaces must be minimised and suitable permeable alternative utilised to maximise natural infiltration and reduce overland flow and associated velocities with concomitant risk of erosion and damage. - Only fully enclosed / self-contained effluent storage and treatment systems will be permitted if links to sewer mains are not possible. These must be located either on the landward side of structures or either side of structures, and recommended by a Registered Engineer to ensure suitable sealing and safety. - Development should be sited to minimise the removal of trees and endemic vegetation. - Existing coastal processes, including dune migration and littoral drift, should not be impeded and indigenous vegetation must be maintained. - After construction, any exposed ground area must be stabilised by the use of ground covering plants or mulches to minimise the risk of erosion. - Dunes must be protected and rehabilitated where necessary to reinforce and strengthen natural barriers - Exotic species of vegetation should be limited to feature trees or shrubs within an indigenous setting. - Fencing or other barriers must be permeable to accommodate storm events and limit structural damage and associated negative impacts on the environment.		

Table 25: Coastal Urban Typology Controls (RHDHV, 2016)

COASTAL TYPOLOGY	INTENTION	LISTED ACTIVITIES (2014 EIA Regulations)
Coastal Urban	• Limit public and private liability • Increase public awareness of the potential risks to property and human life • Maintain coastal quality • Prevent encroachment that will impact on the integrity of the shoreline ecology and exacerbate negative impacts • Enable safe evacuation in an emergency	<u>Listing notice 1:</u> 6,7,15 to 19, 41, 42, 49, 52 – 55, and 62 <u>Listing notice 2:</u> 10 and 25 <u>Listing notice 3:</u> all
Primary Use	With special consent	Not supported
As per base land use controls, except where BOSMaP CBAs, High Risk CVI areas or Coastal Access Land are present	• Temporary infrastructure or structures proposed to be removed within 6 weeks • Structures or activities that require a coastal location, such as desalination plants or aquaculture, subject to applicable coastal/environmental controls and authorisation processes	Transformation of BOSMaP Priority 1 areas
Additional Controls		
• All structures constructed, if approval is granted by the EDTEA, require approval from a professionally registered engineer. • All structures constructed, if approval is granted by the EDTEA, must preferably be elevated on pilings, posts, piers-and-joists, column or similar foundations with the lowest floor of habitable structures/buildings constructed above a pre-determined risk level. • Lower inhabitable floors (i.e. garages, basements) of structures/buildings must be permeable – i.e. have openings to allow for the entry and exist of flood waters – to allow effective interior and exterior hydrostatic pressure equalisation during and post inundation. • Habitable basements or rooms will only be permitted if an engineer has made the necessary design arrangements to ensure that coastal risk is addressed and reduced by implementing responsible mitigation measures to the satisfaction of the Municipality. • Consideration during conceptual building design must be given to issues of privacy, overshadowing and visual impact and the apportionment and positioning of higher risk site areas for parking, open space and recreational areas. • Any new development must be designed and positioned within reason to limit potential flood damage and risk to human life, including but not limited to positioning buildings in suitably acceptable elevated portions of properties. • Development must be designed and constructed, within the framework of applicable building controls, in such a way that buildings and structures are positioned furthest from the foreshore whether limited by rear space, side space or the building line (up to the maximum allowed in the applicable scheme). • Building design must demonstrate reasonable risk reduction measures and should include innovative solutions (adaptable buildings, re-locatable buildings, flood-proofed buildings, flood resistant and resilient construction, etc.) without increasing and transferring risks to adjacent properties. • Key mechanical and electrical services/structures (e.g. substations, transformers, generators, geysers and DB boards) must be located above a pre-determined risk level. • After construction, any exposed ground area must be stabilised by the use of ground covering plants or mulches to minimise the risk of erosion.		

- On request from the municipality, a storm water management plan might be required to be submitted along with building plans.
- Hardened surfaces to be minimised and suitable permeable alternative utilised to maximise natural infiltration and reduce overland flow and associated velocities with concomitant risk of erosion and damage.
- Only fully enclosed / self-contained effluent storage and treatment systems will be permitted if links to sewer mains are not possible. These must be located either on the landward side of structures or either side of structures, and recommended by a Registered Engineer to ensure suitable sealing and safety.
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- Fencing or other barriers must be permeable to accommodate storm events and limit structural damage and associated negative impacts on the environment.

12.4. Appendix D: Proposed template for project plans

Source: DEA 2015

ACTION	Describe the action to be undertaken																																																											
COMPLETION DATE	Provide date of expected completion																																																											
PERFORMANCE INDICATOR																																																												
Requirements stipulated in policy and legislation																																																												
Available methods, protocols and best practice-guides																																																												
Spatial zonation consideration (e.g. limits/targets)																																																												
Detailed work plan	Task 1: Task 2: Task 3: Task 4:																																																											
Scheduling	<table border="1"> <thead> <tr> <th rowspan="2">TASK</th><th colspan="9">TIME (months)</th></tr> <tr> <th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th></tr> </thead> <tbody> <tr> <td>1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr> <td>2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr> <td>3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr> <td>4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </tbody> </table>	TASK	TIME (months)									1	2	3	4	5	6	7	8	9	1										2										3										4									
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Responsibilities for different tasks	E.g. Identify specific departments, personnel and/or service providers responsible for execution of this action																																																											
Monitoring and reporting plan	E.g. - Define data and information to measure in order to monitor performance indicator/s - Specify frequency at which data/information should be collected/monitored - Where and when to report on progress																																																											
Human resource plan	<table border="1"> <thead> <tr> <th rowspan="2">HUMAN RESOURCE</th><th colspan="4">WEEKS PER TASK</th></tr> <tr> <th>1</th><th>2</th><th>4</th><th>4</th></tr> </thead> <tbody> <tr> <td>Staff member 1</td><td></td><td></td><td></td><td></td></tr> <tr> <td>Staff Member 2</td><td></td><td></td><td></td><td></td></tr> <tr> <td>Service provider</td><td></td><td></td><td></td><td></td></tr> </tbody> </table>	HUMAN RESOURCE	WEEKS PER TASK				1	2	4	4	Staff member 1					Staff Member 2					Service provider																																							
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12.5. Appendix E: Citizen Science monitoring sheets

Estuary Monitoring Sheet for long term comparisons

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Estuary		Date																														
Mouth	Open	Closed	Over Topping																													
Tide	High	Low																														
Rainfall (24hr)																																
Rainfall (7 days)																																
Weather																																
Wind																																
Picture 2	Picture 3																															

Condition Monitoring Sheet

Date			
Cloud cover			
Rain 24hrs	Yes	No	
Rain 7Days	Yes	No	
Wind Speed			
Wind Direction			
Mouth	Open	Closed	Over Top
Tide	High	Int	Low
River Flow	High	Med	Low
Water Level	High	Med	Low
Temp	Hot	Moderate	Cool