



Jakkalsvlei Estuary: Estuarine Management Plan (2023 to 2027)

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I, Anton Bredell, Minister of Local Government, Environmental Affairs and Development Planning hereby approve the Jackalsvlei Estuary Estuarine Management Plan for implementation.

Disclaimer:

The Estuarine Functional Zone depicted in this estuarine management plan will be subject to change based on new data published from time to time.

EXECUTIVE SUMMARY

The National Environmental Management: Integrated Coastal Management Act (Act 24 of 2008) (ICMA) was developed to facilitate the sustainable use and management of South Africa's coastline and coastal and estuarine resources. The ICMA requires that estuaries within South Africa be managed in a co-ordinated and efficient manner, and in accordance with the National Estuarine Management Protocol (NEMP), the National Coastal Management Programme (CMP) and the Western Cape CMP, which lay out specific objectives for management of the South African coastline, including estuaries. This document represents the first-generation estuarine management plan (EMP) for the Jakkalsvlei estuary developed under the auspices of the Western Cape Estuarine Management Framework and Implementation Strategy (EMFIS), a strategic project emanating from the provincial CMP, specifically priority area 7.

The purpose of this EMP is to provide the Vision of the future desired state of the Jakkalsvlei estuary and guide the management of human activities in and around the system by setting out strategic objectives, management priorities and detailed management strategies with actions/activities. The co-ordination of the implementation of the EMP vests with the responsible management authority (RMA) as per the 2021 NEMP.

Geographical Boundaries

The Jakkalsvlei estuary is a large temporarily closed estuarine system, situated on the west coast of South Africa, in the Cederberg Local Municipality (LM), West Coast District. It is located on the outskirts of Lamberts Bay, 271 km north of Cape Town. The size of the estuary, as defined by estuarine Functional Zone (EFZ), is approximately 56.6 ha, extending over a length of 2 km from the mouth to 400 m above the railway bridge.

Vision and Objectives

The following vision for the Jakkalsvlei estuary was proposed at a public meeting held in Lamberts Bay in August 2017 and confirmed at a second meeting held in November 2018:

The Jakkalsvlei, adjoining Lamberts Bay, is clean, healthy, conserved and valued by all

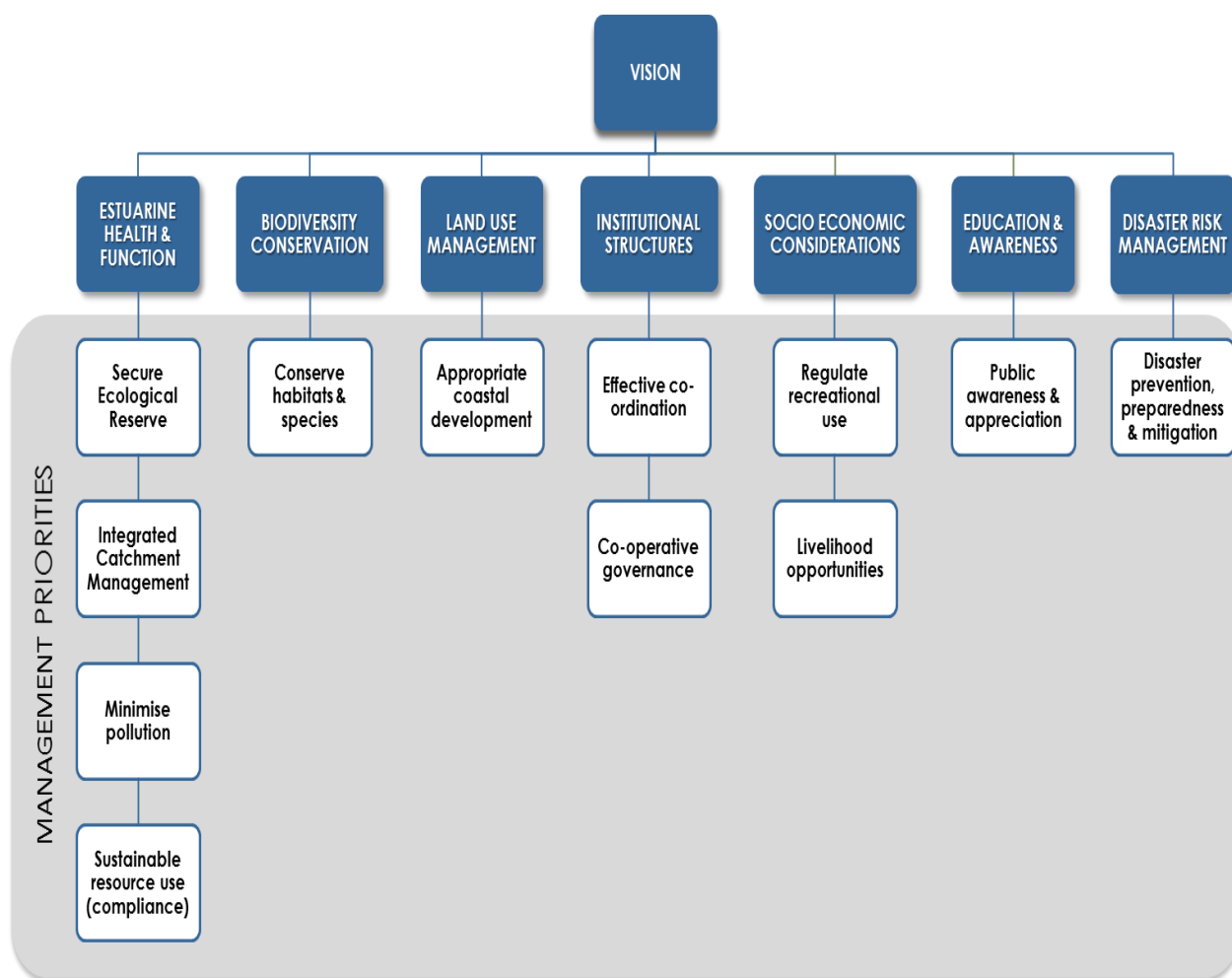
Strategic objectives, performance indicators and priorities for the Jakkalsvlei estuary are as follows:

	Sector / Category	Strategic Objective	Performance Indicator(s)	Priority
1	Estuarine Health and Functioning	The ecological health and functioning of the Jakkalsvlei estuary are improved, its negative ecological trajectory and catchment impacts reversed, living resources are sustainably managed and estuary nursery function protected, even as the climate gets hotter	<ul style="list-style-type: none"> • Maintain a D ecological condition • Baseflow to estuary is restored • Water abstractions are controlled • Ecological health of estuary is maintained as per the identified ecological condition goal, and as dictated by water availability in a hotter future climate • Projected future climate conditions and estuary requirements are integrated into catchment management processes • Water quality programme is in place • Best agricultural practice adopted & reduced agricultural return flows • Pollution is reduced, particularly solid waste • Monitoring programmes are in place • Resources utilised within legal limits 	HIGH
2	Biodiversity Conservation	The biodiversity of the Jakkalsvlei estuary is conserved	<ul style="list-style-type: none"> • Conservancy is established • Integrity of estuarine habitats is improved • EMP incorporated into the Cederberg Integrated Development Plan (IDP) and Spatial Development Framework (SDF) • Spatial zonation plan is adopted and enforced • Further transformation of estuary prevented 	MEDIUM
3	Land-use and Infrastructure Planning and Development	Impacts associated with developments and proposed changes in land-use, including infrastructure and agriculture, are minimised	<ul style="list-style-type: none"> • Coastal Management Line and controls implemented • Bylaws developed and published • Existing impacts reduced (through redesign) • Further transformation/ habitat degradation of estuary prevented 	MEDIUM
4	Institutional and Management Structures	The Jakkalsvlei estuary is managed well through effective co-operative governance	<ul style="list-style-type: none"> • EMP is seamlessly incorporated into the Cederberg IDP and SDF • RMA assigned & supported 	HIGH

			<ul style="list-style-type: none"> • An integrated catchment management process, involving the agricultural sector and RMA, is instituted • Regional estuary advisory forum is established and meets regularly • Estuarine bylaws are drafted • Mandated authorities and participating agencies are well capacitated, actions are fulfilled 	
5	Socio-economic considerations	Socio-economic benefits are regulated, and resilience in the face of climate change improved, to ensure sustainable use of the Jakkalsvlei estuary and its resources	<ul style="list-style-type: none"> • Integrity of estuarine habitats is improved • Illegal/damaging activities controlled • Early warning system for pollution established 	LOW
6	Education and Awareness	Members of society are sensitive to, and aware of, the value and importance of the Jakkalsvlei estuary	<ul style="list-style-type: none"> • Awareness programme developed and on on-going • Signage erected and information disseminated 	LOW
7	Disaster Risk Management	Potential risks that could impact the Jakkalsvlei estuary are reduced, inclusive of climate change impacts	<ul style="list-style-type: none"> • Rehabilitation programme developed • Key infrastructure is well defended • Contingency plans in place for high risk areas / activities • Disaster impacts are timeously and effectively mitigated 	MEDIUM

Priority management objectives and associated activities

An overview of the management objectives and management priorities is provided diagrammatically.



Proposed Zonation of activities

Spatial zonation of activities on an estuary is necessary to avoid user conflict and to guide sustainable utilization of resources without degradation of the estuarine environment. Informed by the intention of the Cederberg Local Municipality to conserve the estuary and the designation of a conservation servitude or special zone or rezoning to an Open Space 3 (Nature Reserve/Conservancy) is proposed. Rezoning to Open Space 3 will however require a land use application to be submitted (subdivision of land) in order to zone the whole estuary to Open Space 3.

Priority areas requiring rehabilitation area provided.

Integrated monitoring plan

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. Three broad categories of monitoring are incorporated into an integrated monitoring plan, namely resource monitoring, compliance monitoring and performance monitoring.

The recommended minimum monitoring requirements to ascertain impacts of current and future pressures on the estuary detailing ecological component, monitoring action, temporal scale as well as spatial scale of monitoring proposed.

Currently there is no compliance monitoring taking place on the Jakkalsvlei estuary. In respect to the implementation of this EMP, compliance monitoring will be the responsibility of the Cederberg LM in respect to land-use/town planning/illegal activities (e.g. dumping/littering), the Department of Agriculture, Land Reform and Rural Development (DALRRD) in respect to agricultural best practices; and DWS for water abstractions. Compliance monitoring and enforcement will be undertaken according to applicable legislation and policies and by means of law enforcement and compliance monitoring protocols.

The performance monitoring plan is proposed to be used by the RMA, and/or identified implementing agents, to assess the effectiveness with which planned management activities contained in the EMP are being performed and ultimately to gauge progress in achieving the vision and objectives. A monitoring plan relative to the proposed management priorities is included.

Institutional Capacity and Arrangements

This EMP should be regarded as a strategic plan that can guide the detailing of management actions and identification of implementing agents. While it does not specify the required resources (human and financial) required for effective management of the estuary, it does provide for their prioritisation. Co-management and effective governance have been identified as vital aspects to the efficient and effective management of the Jakkalsvlei estuarine system and key role players are identified.

The 2021 NEMP identifies the RMA to be CapeNature since Jakkalsvlei Estuary is listed in the Western Cape Protected Area Expansion Strategy.

The Jakkalsvlei estuary also falls within the Greater Cederberg Biodiversity Corridor, under the auspices of CapeNature. Thus, management of the Jakkalsvlei estuary may benefit from a joint agreement (or delegation).

While the establishment of an Estuary Advisory Forum (EAF) for each estuary is no longer a requirement in the NEMP, the Western Cape Government still support their establishment and recommend that private entities and non-government organisations continue to play a supporting role in the implementation of this EMP. While an individual EAF is not recommended, the establishment of a regional EAF is proposed, incorporating the Jakkalsvlei, Wadriest and Verlorenvlei estuarine systems. The EAF should be chaired by the RMA and should aim to meet on a quarterly basis.

Finally, key government departments and organs of state are identified, and a template provided for the conversion of the priority actions into detailed project plans, which must be prepared and adopted into the respective departmental implementation strategies.

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

-
- Measures must be instituted to prevent the continued deposition of solid waste into the estuary and the existing EPIP programme, Working for the Coast teams can be implemented to clean the estuary and its EFZ;
 - The EFZ should be rezoned to Open Space 3 and the area protected.
 - Every effort should be made to increase awareness of the value of the Jakkalsvlei estuary with residents of and visitors to Lamberts Bay; and
 - The DEA&DP to consider the appointment of a Regional estuarine management co-ordinator/champion within either DEA&DP or CapeNature, to support the RMA.

In preparation for the final EMP approval process, the draft EMP was published for public comment from 28 January to 04 March 2022 (see appendix C : stakeholder consultation report). This was followed by a formal “Comment and Response” process which reviewed and addressed all comments submitted. Minor edits were made to the EMP where appropriate. This document is the final Jackalsvlei Estuary Estuarine Management Plan.

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ACRONYMS AND ABBREVIATIONS

amsl	Above mean sea level
BOfCMA	Berg-Olifants Catchment Management Agency
CARA	Conservation of Agricultural Resources Act (Act No. 43 of 1983)
CBA	Critical Biodiversity Area
CFR	Cape Floristic Region
CMA	Catchment Management Agency
CML	Coastal Management Line
CMP	Coastal Management Plan
CPZ	Coastal Protection Zone
CSIR	Council for Scientific and Industrial Research
CWAC	Coordinated Waterbird Counts
DALRRD	Department of Agriculture, Land Reform and Rural Development (formerly DAFF)
DAFF	Department of Agriculture, Forestry and Fisheries (now DALRRD / DFFE)
DEA	Department of Environmental Affairs (now DFFE)
DEA&DP	Western Cape Government's Department of Environmental Affairs & Development Planning
DFFE	Department of Forestry, Fisheries and Environment (formerly DEA / DAFF)
DM	District Municipality
DMA	Disaster Management Act (Act No. 57 of 2002)
DoT&PW	Department of Transport and Public Works
DSL	Development Setback Line
DST	Department of Science and Technology
DWS	Department of Water and Sanitation
EAF	Estuary Advisory Forum
EFZ	Estuarine Functional Zone
EIA	Environmental Impact Assessment
EMC	Estuarine Management Coordinator/champion
EMFIS	Western Cape Estuarine Management Framework and Implementation Strategy
EMP	Estuarine Management Plan(s)
EPIP	Environmental Protection and infrastructure Programmes
GCBC	Greater Cederberg Biodiversity Corridor
GDP	Gross domestic product
HWM	High Water Mark
I&APs	Interested and affected Parties
IAPs	Invasive Alien Plants
ICM	Integrated Coastal Management
ICMA	National Environmental Management: Integrated Coastal Management Act (Act No. 24 of 2008)
ICMP	Integrated Coastal Management Plan
IDP	Integrated Development Plan
LED	Local Economic Development
LM	Local Municipality
LUPA	Land Use Planning Act (Act No. 3 of 2014)
LUPO	Land Use Planning Ordinance
MEC	Member of the Executive Council
MLRA	Marine Living Resources Act (Act No. 18 of 1998) as amended
MOU	Memorandum of Understanding
MRPDA	Mineral Resources and Petroleum Development Act (Act No. 28 of 2002)
MSA	Municipal Systems Act (Act No. 32 of 2000)
NBA	National Biodiversity Assessment
NEM: BA	National Environmental Management: Biodiversity Act (Act No. 10 of 2004)
NEM: PAA	National Environmental Management: Protected Areas Act (Act No. 57 of 2003)

NEMA	National Environmental Management Act (Act No. 107 of 1998)
NEMP	National Estuarine Management Protocol (2013)
NHA	National Health Act (Act No. 61 of 2004)
NWA	National Water Act (Act No. 36 of 1998)
PAES	Protected Area Expansion Strategy
PES	Present Ecological State
RDM	Resource Directed Measures
REC	Recommended Ecological Category
RMA	Responsible Management Authority
RQO(s)	Resource Quality Objectives
SAR	Situation Assessment Report
SDF	Spatial Development Framework
SUDS	Sustainable Urban Drainage Systems
SWOT	Strengths, Weaknesses, Opportunities and Threats analysis
WC	
DoT&PW	Western Cape Department of Transport: Public Works
WC TIA	Western Cape Transport Infrastructure Act (Act No. 1 of 2013)
WCDM	West Coast District Municipality
WfW	Working for Water
WQ	Water Quality
WRC	Water Resource Commission
WUA	Water Users Associations
WUL	Water Use Licence
WWTW	Waste Water Treatment Works

1 INTRODUCTION

1.1 Background

The National Environmental Management: Integrated Coastal Management Act (Act 24 of 2008) (ICMA) was developed to facilitate the sustainable use and management of South Africa's coastline and coastal and estuarine resources. The ICMA requires that estuaries within South Africa are managed in a co-ordinated and efficient manner, and in accordance with the National Estuarine Management Protocol 2021 (hereafter referred to as the 2021 NEMP) and the National Coastal Management Programme (CMP) and the Western Cape CMP which lay out specific objectives for management of the South African coastline, including estuaries.

In response to the directive issued under the ICMA and the 2021 NEMP, the Western Cape Government, and specifically the Provincial Department of Environmental Affairs and Development Planning (DEA&DP), commissioned the development of the Western Cape Estuarine Management Framework and Implementation Strategy (EMFIS), a strategic project emanating from the provincial CMP, specifically priority area 7, to facilitate the consistent development and implementation of Estuarine Management Plans (EMPs) in the Western Cape Province.

This document represents the first generation EMP for the Jakkalsvlei estuary (Figure 1) developed under the auspices of the Western Cape EMFIS.

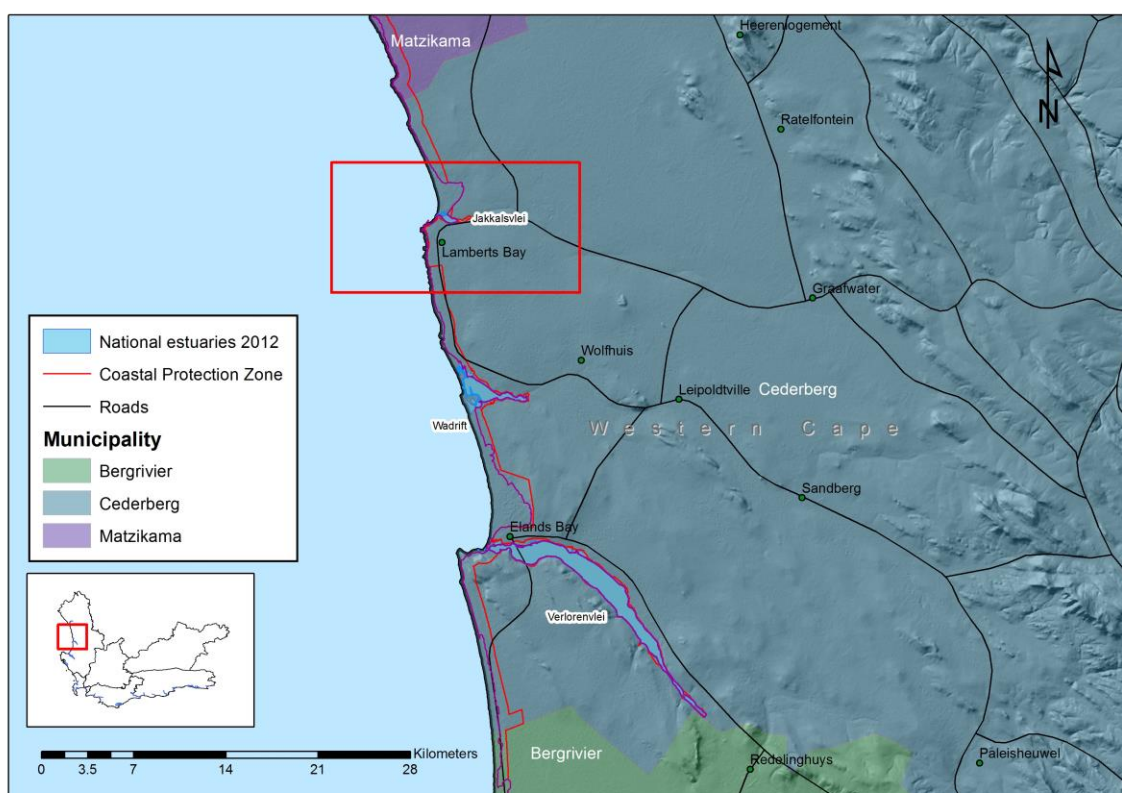


Figure 1: Location of the Jakkalsvlei estuary within the Cederberg Local Municipality

1.2 Purpose of the EMP

The development of an EMP is a three-phase process, as illustrated in Figure 2, comprising an initial scoping phase, followed by an objective setting phase, and finally an implementation phase. An adaptive management approach should be adopted during the latter phase with detailed reviews being conducted at five-yearly intervals.

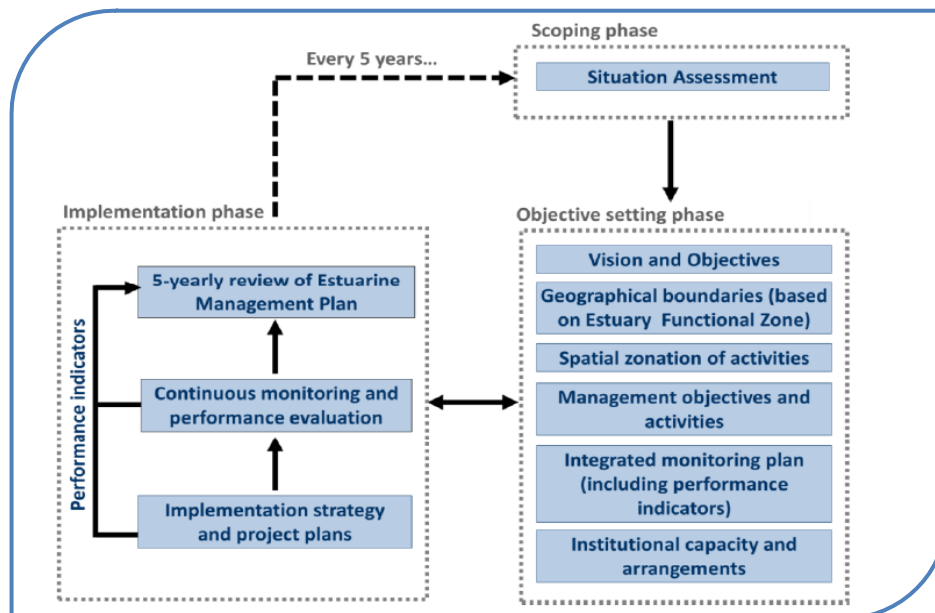


Figure 2: A framework for integrated estuarine management in South Africa

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 vision of the future desired state of the Jakkalsvlei estuary and guide the management of human activities in and around the system by setting out strategic objectives, management priorities and detailed management strategies with actions/activities.

Estuarine management is not only focused on the Estuarine Functional Zone (EFZ) but inclusive of coastal hinterland and marine influences, shoreline status, catchment management, climate change and human development impacts such as tourism, recreation and agriculture, amongst many others. This EMP is the primary document for use by the identified Responsible Management Authority (RMA) to facilitate coordination of the identified management interventions to ultimately ensure the longevity of the estuarine system concerned. This is also the critical reference document for the incorporation of estuarine management into the municipal Integrated Development Planning (IDP) and Spatial Development Framework (SDF) processes.

1.3 Mandate and responsibilities of the RMA

The co-ordination of the implementation of the EMP vests with the identified RMA as per the NEMP. One of the strategic objectives of this EMP is to promote and facilitate the

cooperative governance relationship between the RMA and potentially a new estuary advisory forum (EAF), or any other supporting structures or organisations with estuarine-related duties and functions.

The designated RMA is responsible for the development of the EMP¹ and the overall co-ordination of the actions of other implementing agencies, and not necessarily the implementation of all the actions themselves.

Specifically, the RMA responsibilities are described by the 2021 NEMP as:

- Section 5: “...authorities are **responsible for the development of EMPs and coordination of the implementation process...**”
- Section 5 (e): “The identified responsible management authority to develop the EMP needs to **budget accordingly for the development of these plans.**”
- Section 8(1): “The responsible management authority developing an EMP must **actively engage all the relevant stakeholders** including government departments, non-government organisations and civil society in the development and implementation of the EMP.”
- Section 9.1(1) and 9.2: “...it **must obtain formal approval** for the EMP...” and “Once approved...the EMP shall be... **Integrated..**” and “**incorporated** into the Provincial Coastal Management Programme”.

The responsible body contemplated in Section 33(3)(e) of the ICMA who develops an EMP must:

- a) follow a public participation process in accordance with Part 5 of Chapter 6 of the ICMA;
- b) ensure that the EMP and the process by which it is developed are consistent with:
 - i) the NEMP; and
 - ii) the National CMP and with the applicable provincial CMP and CMP referred to in Parts 1, 2 and 3 of Chapter 6 of the ICMA;
- c) if applicable, ensure that relevant legislation is enacted to implement the EMP; and
- d) submit an annual report to the Minister on the implementation of the EMP, the legislation and any other matter.

Coordination of the implementation actions by the RMA and its strategic partners can be supported by an EAF representing all key stakeholder groups on the estuary.

¹ In this instance, the EMP for the Jakkalsvlei estuary was developed under the auspices of the Western Cape EMFIS commissioned by the Western Cape Government.

1.4 Structure of Report

This report is structured as follows:

- **Section 2** introduces the estuary and details its **geographical boundaries**, i.e. the management area to which this EMP applies;
- **Section 3** provides a synopsis of the **situation assessment**, thereby providing context to the vision, strategic objectives and management objectives and management priorities;
- **Section 4** presents the **local vision and strategic objectives** as informed by the stakeholders, for the management of the Jakkalsvlei estuary. They collectively describe the desired future state and provide the overarching logical framework for the action plans;
- **Section 5** prescribes the **management priorities and associated activities**, i.e. the required actions to be undertaken within the next 5 years, captured as individual action plans. This EMP contains refined or detailed management objectives accompanied by action plans to facilitate implementation, and in this manner, serves to mobilise and co-ordinate all relevant government departments, institutions and other role players to undertake specific actions within their mandate or sphere of influence;
- **Section 6** describes the various components and zones included in the proposed **spatial zonation** of the estuary;
- **Section 7** set out the **integrated monitoring plan** encompassing resource monitoring, compliance monitoring, as well as performance monitoring in respect to achieving the objectives of the EMP;
- **Section 8** details the **institutional capacity and proposed arrangements** that are required to implement the actions contained in the plan, including identifying key role players and participating institutions, and the recommended projects provided for in the action plans; and
- **Section 9** details key **recommendations** and **concludes** the plan.

2 GEOGRAPHICAL BOUNDARIES

The Jakkalsvlei estuary is defined in the 2018 National Biodiversity Assessment (NBA) (SANBI, 2019) as a large temporarily closed estuarine system, situated on the west coast of South Africa, in the Cederberg Local Municipality (LM), West Coast District. It is located on the outskirts of Lamberts Bay, 271 km north of Cape Town (Figure 3). The size of the estuary, as defined by its estuarine functional zone (EFZ), is approximately 56.6 ha, extending over a length of 2 km from the mouth to 400 m upstream of the railway bridge. The geographical boundaries of the estuary, delineating the EFZ, are provided in Table 1 and illustrated in Figure 3.

Table 1: The Jakkalsvlei estuary estuarine functional zone

Downstream boundary:	-32.084554° S, 18.313463° E (estuary mouth)
Upstream boundary:	-32.091103° S, 18.333852° E (head of the estuary)
Lateral boundaries:	Approximated by the 5 m above Mean Sea Level (amsl) contour along each bank

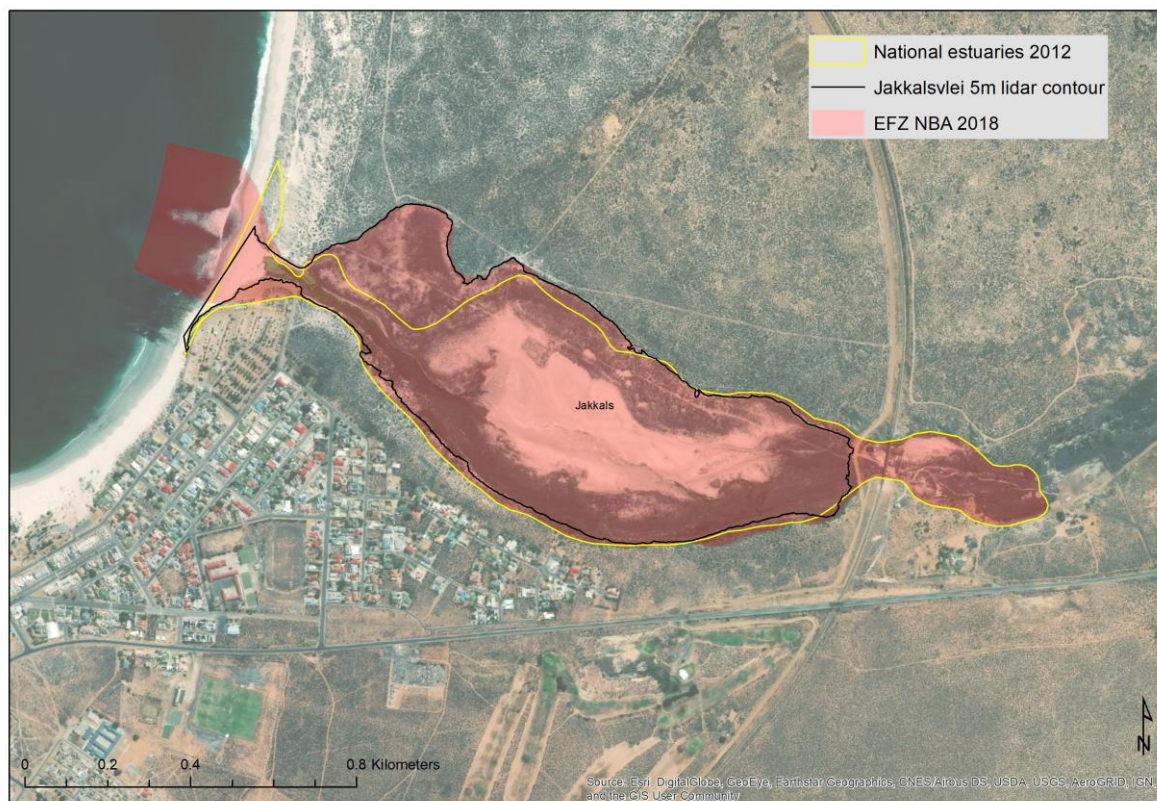


Figure 3: Geographical boundaries of the Jakkalsvlei estuary EFZ showing the 5 m topographical contour and the 2018 NBA (SANBI 2019) EFZ boundary

3 SYNOPSIS OF THE SITUATION ASSESSMENT

Introduction

The Jakkalsvlei estuary is defined in the 2018 National Biodiversity Assessment (NBA) (SANBI, 2019) as a large temporarily closed estuarine system. It falls within the Cederberg LM which experiences hot dry summers and cold wet winters with annual rainfall of as little as 170 mm per annum along the coastline (classified as semi-desert). Average daily temperatures along the coast range from 18°C in winter to 29°C in summer. The underlying geology of the Jakkalsvlei estuary comprises Malmesbury Group Shales with overlying sandstone of the Piekenierskloof, Graafwater and Peninsula Formations of the Table Mountain Group.

The landscape of the Cederberg LM is characterised by the Sandveld and the Cederberg Mountain range. The latter has contributed to the prevalence of natural landcover throughout the municipal area (74%). Production (agricultural) is relatively low (18%), resulting in a less extensive urban and infrastructure land cover. Water availability for irrigation is a major factor inhibiting agricultural intensification and thus irrigated crops are located along the Olifants River valley. Large portions of the coastal zone between the main coastal towns of Elands Bay (Verlorenvlei River estuary) and Lamberts Bay (Jakkalsvlei estuary), remain natural as it is relatively unsuited to agriculture. However, potato farming is placing increasing pressure on coastal biodiversity.

Abiotic Function

The catchment area of the Jakkalsvlei estuary falls within the Berg-Olifants Water Management Area, and the Jakkals River, which is approximately 60 km long, drains an estimated area of 750 km². The size of the estuary, as defined by the EFZ, is approximately 56.6 ha, extending over a length of 2 km from the mouth to 400 m upstream of the railway bridge. Depending on the state of the mouth and river flow, the water surface area varies between 3 and 10 ha. In general, very little is known about the abiotic aspects of the Jakkalsvlei estuarine system. Hydrological estimations suggest that the present day mean annual runoff (2.5 million m³/a) of the estuary is reduced from natural (reference) runoff (3.5 million m³/a), with significantly reduced baseflows as a result of abstraction.

The hydrodynamics of the Jakkalsvlei estuary has been significantly impacted by the construction of a causeway across the estuary channel just upstream of the estuary mouth shortly after 1970, which was demolished during flood events in 2008; the reduction in runoff from the catchment and from groundwater reaching the estuary, mainly because of agricultural demands; the construction of the Sishen-Saldanha railway bridge across the estuary channel, combined with the construction of a causeway next to this bridge, which only had some small culverts to allow some river flow to reach the lower estuary; and the development of the town of Lamberts Bay.

There is little information available on the water quality of this small system. Water quality is estimated to be “moderately modified” as a result of changes in the salinity regime,

to a lesser degree agricultural activity in the surrounding areas and catchment, as well as potential pollution from the currently being rehabilitated waste disposal site.

Biotic Function

No detailed studies have been conducted on most of the ecosystem aspects of this system following the flood-related breach in 2008, with the exception of the coordinated waterbird counts (CWAC) from 1997 to present. The vegetation of the Jakkalsvlei estuary is characterised by saltmarsh types, predominantly flood plain salt marsh (31.44.5 ha) and Arid Estuarine Salt Marshes (15.89 ha). Little to no information is available for invertebrates and fish. In respect to birds, a total of 51 different species of inter-seasonally and/ or inter-annually water birds have used the estuary over a period of 13 years. The number of bird species and the total number of birds present always peaked in years when the system was recorded as full or partially full at the time of the count. Southern African pan-coastal migrants, such as flamingos, derive the most benefit from ephemeral coastal pans such as Jakkalsvlei estuary. The seasonal pan is deemed complementary to the avifaunal habitat provided by the neighbouring Verlorenvlei and sustaining the environmental integrity of the aggregate area is of international importance.

Ecological Health Status, Importance, and Recommended Future State

The ecological health of the Jakkalsvlei estuary is in a D Category, that is, 'largely modified', having experienced a large loss of natural habitat, biota and basic ecosystem function. In terms of conservation importance, the estuary is not one of the national priority estuaries requiring formal protection and it is deemed to be of 'average importance' in respect to biodiversity value due to its small size. Based on the low/average ecological importance overall, the recommended ecological condition for the Jakkalsvlei estuary remains a Category D. While this is in agreement with the 2018 National Biodiversity Assessment (NBA)(SANBI, 2019), it is noted that the 2013 Reserve Determination study recommends a Category C (DWA, 2013).

Important Ecosystem Goods and Services

Estuaries typically provide a range of services that have economic or welfare value. However, it is evident that the Jakkalsvlei estuary provides very limited ecosystem services due to its largely modified state.

Impacts and Potential Impacts

The environmental processes, activities and developments that pose a threat to the Jakkalsvlei estuary include the following:

- *Environmental hazards* – drought, floods and climate change impacts;
- *Land-use and infrastructure development* - construction of the Sishen-Saldanha railway bridge and causeway, various access paths, and expansion of Lamberts Bay;
- *Water quality and quantity issues* - reduction in river inflow reaching the estuary, increased mouth closure, increased nutrient load, and solid waste pollution; and

- *Encroachment of invasive reeds* – as a result of territorialisation of the floodplain due to reduced freshwater inflow.

Socio-economic Context

The Cederberg LM is one of the least populated local municipalities within the West Coast District municipal area. While population density is relatively low the provision of basic services (namely water and lighting) is relatively high, such that 83% have access to piped water within their dwellings, and 96.6% have electricity for lighting (Stats SA, 2016). Approximately 57% of the population are economically active, and of these 6% are unemployed (Stats SA, 2016). The youth unemployment rate is slightly higher at 13.8% (Stats SA, 2011). Of all the municipalities in the district, the Cederberg LM had the lowest Human Development Index score of 0.6 and the highest poverty rate of 42.7%, compared to the district poverty rate of 30.4% (Cederberg IDP, 2017).

Jakkalsvlei estuary and its catchment falls within the very rural, and largely undeveloped, Ward 5 of the Cederberg LM, which has a total population of 9141. The population density (8 persons/km²) of the ward is greater than the overall municipal density (Stats SA, 2011). This is due to the urbanised coastal areas of Lamberts Bay and Elands Bay.

In terms of the municipal economy, the Cederberg economy grew by 2.2% per annum between 2000 and 2010 and contributed 9.2% to the West Coast District Gross Domestic Product (GDP) in 2010 (Cederberg IDP, 2017). The four main sectors contributing to this growth were construction; mining and quarrying; transport, storage and communication; and finance, insurance and business services (Cederberg IDP, 2017). The agriculture and fishing sector is by far the largest sector in the municipality, contributing 30% of the GDP (reflecting the largely rural nature of the municipal area) and providing the largest number of employment opportunities (35%) (Cederberg IDP, 2017). Tourism does not make a very large contribution to the local economy, and limited tourism growth opportunities exist (Cederberg IDP, 2017). Nonetheless, surfing at Elands Bay and fishing in Lamberts Bay make a small contribution to the local economy (Cederberg IDP, 2017).

The direct and indirect benefits derived from estuarine ecosystems services are manifested directly or indirectly in tangible income and employment. The main form of social dependency associated with the Jakkalsvlei estuary relates to recreational/aesthetic value from a tourism and landownership perspective. Above the estuary, the Jakkals River is vitally important in terms of regional water supply, particularly for irrigation. Local Economic Development (LED) projects related to the coast may exist in terms of clean-up operations for the Jakkals River.

Legislative Instruments and relevant Strategies, Plans and Policy Directives

The legislative framework specific to estuarine management is the Integrated Coastal Management Act (ICMA) and the accompanying 2021 National Estuarine Management Protocol (2021 NEMP). The Protocol provides national policy and ensures

alignment by providing a national vision and objectives for achieving effective integrated management of estuaries, amongst other things. The Protocol identifies the RMA per estuary and describes key legal instruments that are applicable to estuarine management.

Opportunities and Constraints

A Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis for the management of the Jakkalsvlei estuary was undertaken. One of the main strengths in terms of estuarine health is the removal of the causeway at the estuary mouth which had a significant impact on the functioning of the system for many years. Other strengths include the undeveloped, sparsely populated surrounding landscape, assistance from the West Coast District Municipality (DM) for environmental issues and the existence of potential for bird tourism and other LED opportunities. Weaknesses include the degradation and loss of biodiversity and ecosystem services, irreversible impacts on river inflow, current limited capacity and reliance on the West Coast DM, continued pollution and the apparent ineffectiveness of the waste disposal site rehabilitation. Opportunities for positive change are plentiful and include future protection, improved water quality and increased capacity. Threats to the successful implementation of this management process include the systems relative remoteness, the continued abstraction of water, climate change implications, limited LED opportunities and continued pollution.

Although the Jakkalsvlei estuary was not identified as a national priority estuary in need of formal protection at the national level, it has been flagged for the establishment of a protected area by the West Coast DM. Furthermore, the estuary falls outside of the Greater Cederberg Biodiversity Corridor, but the catchment area of the Jakkals River would benefit from the implementation of the agriculture best practise guidelines produced under the initiative. Various options for protection have been proposed including potential stewardship with CapeNature or the designation of conservation servitudes as part of the Cederberg Spatial Development Framework.

In respect to priority restoration activities, base flows to the estuary must be maintained/increased, no large dams or weirs and new licenses (during the summer low flow periods) must be permitted on the mainstream of the Jakkals River, catchment water quality must be improved, invasive alien vegetation must be removed, and no further development should be permitted in the estuarine functional zone in order to achieve the Recommended Ecological Category (REC).

Information Gaps and Recommendations

Very little to no quantitative data exists on all aspects of the Jakkalsvlei estuary ecosystem. Inferences can only be made on the state of the estuary based on expert opinion, information gathered during the site visits and anecdotal reports.

Thus, detailed studies are required on all biotic and abiotic aspects to improve our knowledge and understanding of the system. A minimum long-term monitoring programme is recommended for ascertaining the impacts of current and future

pressures on the condition on the estuary, in line with the methods for the determination of the ecological water requirements for estuaries.

4 VISION & OBJECTIVES

4.1 Vision

The Vision for an estuary should be inspirational, representing a higher level of strategic intent and aligned with the strategic objectives of the 2021 NEMP, Western Cape CMP and the greater Cape Floristic Region (CFR). The National Vision and Vision of the Estuaries of the CFR are as follows:

The estuaries of South Africa are managed in a sustainable way that benefits the current and future generations

The estuaries of the CFR will continue to function as viable systems which are beautiful, rich in plants and animals, attract visitors, sustain our livelihoods and uplift our spirits

The 2016 Western Cape Provincial Coastal Management Programme (PCMP), which identifies estuarine management as one of its nine priority areas and sets out the goal for the Western Cape as:

Co-ordinated and integrated estuarine management which optimises the ecological, social and economic value of these systems on an equitable and sustainable basis

The following vision for the Jakkalsvlei estuary was proposed at a public meeting held in Lamberts Bay in August 2017 and confirmed at a second meeting held in November 2018.

The Jakkalsvlei, adjoining Lamberts Bay, is clean, healthy, conserved and valued by all

The vision highlights the following aspects of the estuary that are valued and need to be preserved or enhanced:

- The sense of place and beauty of the estuary by virtue of its location is appreciated by the local community and transient visitors;
- The estuary and vlei is cleaned and actions have been taken to appropriately rehabilitate the dump site to prevent further pollution; and
- The estuary and vlei is appropriately protected and managed.

4.2 Strategic Objectives

Objectives are qualitative statements of the values derived from the vision and typically reflect the overarching issues. They should answer the following question, “How will you know when you have achieved the vision?”. The strategic objectives inform the development of the detailed management strategies that are carried forward as plans of action.

The strategic objectives for the Jakkalsvlei estuary were discussed at the stakeholder meeting. Based on the feedback received from the participants, the strategic objectives for the Jakkalsvlei estuary align with the following identified sectors or categories of issues (Figure 4):

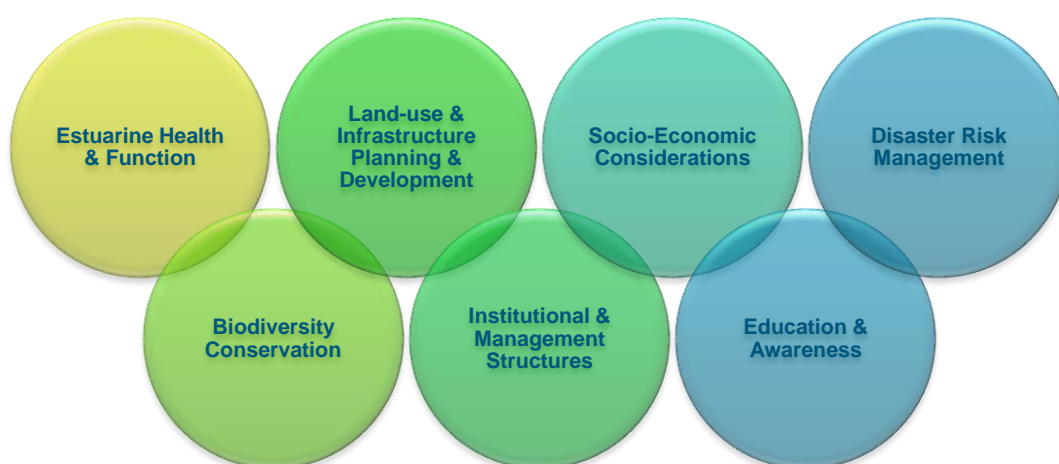


Figure 4: Sectors or categories of issues relevant to the management of the Jakkalsvlei estuary

According to these categories, the strategic objectives for the Jakkalsvlei estuary are as follows:

Table 2: Strategic Objectives for management of the Jakkalsvlei estuary, their indicators and level of priority

	Sector / Category	Strategic Objective	Performance Indicator(s)	Priority
1	Estuarine Health and Functioning	The ecological health and functioning of the Jakkalsvlei estuary are improved, its negative ecological trajectory and catchment impacts reversed, living resources are sustainably managed and estuary nursery function protected,	<ul style="list-style-type: none">• Maintain a D ecological condition• Baseflow to estuary is restored• Water abstractions are controlled• Ecological health of estuary is maintained as per the identified ecological condition goal, and as dictated by water availability in a hotter future climate	HIGH

		even as the climate gets hotter.	<ul style="list-style-type: none"> • Projected future climate conditions and estuary requirements are integrated into catchment management processes • Water quality programme is in place • Best agricultural practice adopted & reduced agricultural return flows • Pollution is reduced, particularly solid waste • Monitoring programmes are in place • Resources utilised within legal limits 	
2	Biodiversity Conservation	The biodiversity of the Jakkalsvlei estuary is conserved	<ul style="list-style-type: none"> • Conservancy is established • Integrity of estuarine habitats is improved • EMP incorporated into the Cederberg IDP and SDF • Spatial zonation plan is adopted and enforced • Further transformation of estuary prevented 	MEDIUM
3	Land-use and Infrastructure Planning and Development	Impacts associated with developments and proposed changes in land-use, including infrastructure and agriculture, are minimised	<ul style="list-style-type: none"> • Coastal Management Line and controls implemented • Bylaws developed and published • Existing impacts reduced (through redesign) • Further transformation/ habitat degradation of estuary prevented 	MEDIUM
4	Institutional and Management Structures	The Jakkalsvlei estuary is managed well through effective co-operative governance	<ul style="list-style-type: none"> • EMP is seamlessly incorporated into the Cederberg IDP and SDF • An integrated catchment management process, involving the agricultural sector and RMA, is instituted • RMA assigned & supported • Regional estuary advisory forum is established and meets regularly • Estuarine bylaws are drafted • Mandated authorities and participating agencies are well capacitated, actions are fulfilled 	HIGH
5	Socio-economic considerations	Socio-economic benefits are regulated, and resilience in the face of climate change improved, to ensure sustainable use	<ul style="list-style-type: none"> • Integrity of estuarine habitats is improved • Illegal/damaging activities controlled • Early warning system for pollution established 	LOW

		of the Jakkalsvlei estuary and its resources		
6	Education and Awareness	Members of society are sensitive to, and aware of, the value and importance of the Jakkalsvlei estuary	<ul style="list-style-type: none"> • Awareness programme developed and on on-going • Signage erected; information disseminated 	LOW
7	Disaster Risk Management	Potential risks that could impact the Jakkalsvlei estuary are reduced, inclusive of climate change impacts	<ul style="list-style-type: none"> • Rehabilitation programme developed • Key infrastructure is well defended • Contingency plans in place for high risk areas / activities • Disaster impacts are timeously and effectively mitigated 	MEDIUM

5 PRIORITY MANAGEMENT OBJECTIVES AND ASSOCIATED ACTIVITIES

After the review of the background information, as well as after conducting stakeholder engagement, a SWOT analysis of the Jakkalsvlei estuary under the current management practices was prepared.

Table 3: SWOT Analysis

STRENGTHS <i>(highlights, uniqueness?)</i>	WEAKNESSES <i>(what could you improve?)</i>
<ul style="list-style-type: none"> • Removal of major impact to estuarine functioning • Undeveloped, sparsely populated landscape • West Coast District Municipality (WCDM) Integrated Coastal management Plan (ICMP) has been developed to facilitate co-ordinated management • Shared service agreement between LM and WCDM for assistance with environmental studies and expertise • Bird Tourism and related LED opportunities 	<ul style="list-style-type: none"> • Degradation and loss of biodiversity • Degraded ecosystem services • There is a large dam on the system that impacts river inflow, this is irreversible • Lack of/limited capacity, resources (human and financial) and knowledge for Integrated Coastal Management (ICM) (SRK, 2013) • Heavy reliance of LM on WCDM and other associations for input and assistance (SRK, 2013) • Uncertainty regarding Roles and Responsibilities • Continued pollution (litter and debris) particularly during peak season • Effectiveness of rehabilitation of waste disposal site
OPPORTUNITIES <i>(opportunities for positive change)</i>	THREATS <i>(what could prevent the EMP from working?)</i>
<ul style="list-style-type: none"> • The estuary lends itself to protection for ecological reasons, and because the aesthetic value of the estuary is important to property owners and tourism • Declining water quality holds a major risk for recreation activities and property owners, this is a good time to arrest the slide through management interventions • Research opportunities to improve knowledge of this arid climate system • Increasing environmental awareness • Appointment of Cederberg Municipal environmental officer • Conservation Servitude or stewardship under CapeNature • Availability of Working for the Coast team to assist in clean-up operations 	<ul style="list-style-type: none"> • The system is relatively far from any managing authority, thus not the focus of management interventions • Unconstrained development in the EFZ is another major impact, but assuming most of this is approved and cannot be reversed • Further degradation due the abstraction of water • Limited alternative livelihood/LED opportunities • Climate change and loss of aquatic ecosystems • Continued pollution from waste disposal site

The management objectives detailed below were informed by the SWOT analysis and critical issues identified as part of the scoping phase. They represent the focus areas for the 5-year cycle of this EMP. An illustrative overview of the priority management objectives for the Jakkalsvlei estuary is provided in Figure 5 below.

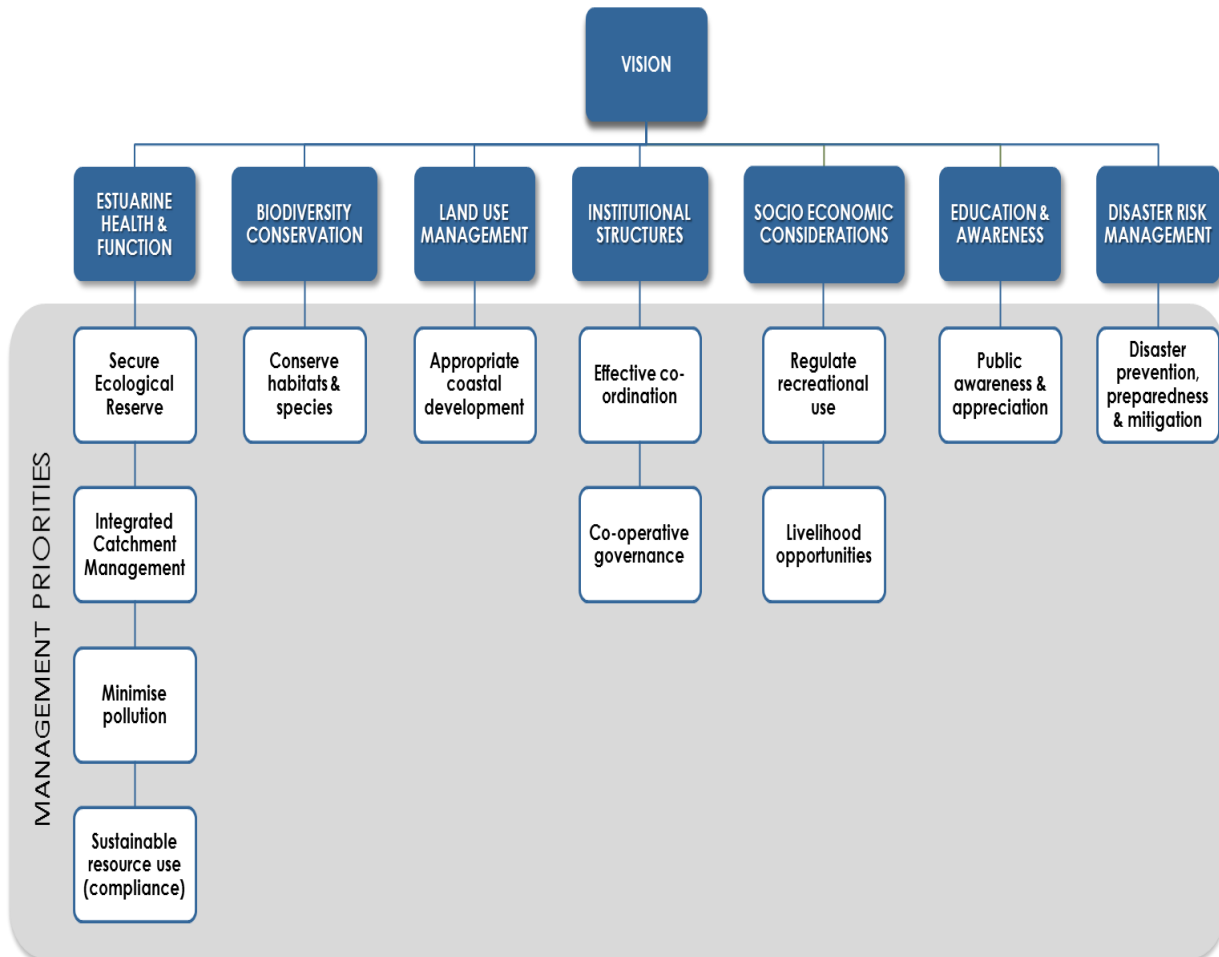


Figure 5: Summary of priority management objectives per management sector

5.1 Estuarine Health and Function

Strategic Objective 1: The ecological health and functioning of the Jakkalsvlei estuary is improved, its negative ecological trajectory and catchment impacts reversed, living resources are sustainably managed and estuary nursery function protected, even as the climate gets hotter.

Table 4: Management Objectives and Actions for Estuarine Health and Function (includes water quantity and quality as well as utilisation of living resources)

Action	Relevant Legislation	Performance Indicator	Priority	Responsibility
Management Objective 1.1: Recognising likely future climatic conditions, secure adequate quantity and quality of freshwater input to improve ecosystem health and functioning				
a. Lobby Department of Water and Sanitation (DWS) Minister to sign off the recommended freshwater reserves, ensuring that the minimum flow requirement (specifically baseflow) for the estuary is restored), including no dams or weirs on the Jakkalsvlei River and no new licenses for water abstraction in summer (low flow) period of the year	National Water Act (NWA)	<ul style="list-style-type: none"> • Meetings held and correspondence written • Recommended reserve(s) signed off • Baseflow is restored • Ecological health of estuary is maintained as D category or improved • Projections of reduced future water availability due to reduced overall rainfall, fewer rain days and higher average temperatures are taken into consideration in the water use allocations 	HIGH	Berg-Olifants catchment management agency (BOCMA), RMA
b. Once classification study signed off, follow up on implementation of water resource classification process	NWA	<ul style="list-style-type: none"> • Meetings held and correspondence written • Water resource classified • Baseflow is protected 	HIGH	BOCMA, RMA
c. Identify abstraction and discharge points – both legal and illegal – and implement compliance action against illegal operations	NWA	<ul style="list-style-type: none"> • Register of abstraction and discharge points compiled • Legal status determined • Illegal operations prosecuted 	HIGH	Department of Environment, Forestry and Fisheries (DFFE), BOCMA

d.	Develop and implement a water resource utilisation plan for surface and groundwater resources (including registration and licensing)	NWA	<ul style="list-style-type: none"> • Utilisation plan developed • Number of licensed users • Regulated water use/abstraction 	HIGH	DFFE, BOCMA
e.	Develop and implement an alien invasive vegetation eradication programme	Conservation of Agricultural Resources act (CARA), NWA	<ul style="list-style-type: none"> • Invasive Alien Plants (IAPs) eradication programme implemented • Increased area of IAPs removed (and kept clear) 	MEDIUM	RMA, Greater Cederberg Biodiversity Corridor (GCBC), DFFE: Working for Water (WfW)
f.	Monitor natural mouth dynamics (in partnership with neighbouring land owners and other Interested & Affected Parties (I&APs))	NWA (RDM)	<ul style="list-style-type: none"> • Mouth state documented • Photographic database generated 	HIGH	RMA,
g.	Undertake artificial breaching in accordance with an approved Mouth Maintenance Management Plan (MMP)	ICMA	<ul style="list-style-type: none"> • MMP approved • MMP developed and approved • Execution of science based artificial breaching / mouth manipulation 	HIGH	RMA, Cederberg LM, DEA&DP
h.	Monitor and report on the status of the estuary annually (inclusive of estuarine stresses and impacts)	NWA	<ul style="list-style-type: none"> • Estuary impacts identified • Mitigation measures established • Climatic records obtained and analysed • Annual report submitted to Department of Environment, Forestry and Fisheries (DFFE) and EAF • Data incorporated into EMP 5-year review 	MEDIUM	RMA (supported by e.g. Department of Science and Technology (DST), Council for Scientific and Industrial Research (CSIR))
i.	Catchment water quantity and quality monitoring to be summarised and reported on	NWA	<ul style="list-style-type: none"> • Catchment strategy implemented • Annual report submitted to RMA and EAF 	LOW	DWS, BOCMA, Cederberg LM
j.	Identify and monitor sensitive species/ habitats of concern to assess ecosystem	NWA (RDM)	<ul style="list-style-type: none"> • Sensitive species/ habitats identified • Status and trends of indicator species determined taking climate change 	LOW	GCBC

	functionality, and develop appropriate guidelines		projections into consideration when selecting indicator species • Guidelines developed and implemented • Annual report submitted to DFFE and EAF		
k.	Undertake seasonal (summer/winter) monitoring of fish and bird populations	NWA (RDM), National Environmental Management: Biodiversity Act (NEM:BA), Marine Living Resources Act (MLRA)	• Species list and abundance data produced • Databases developed • Monitoring reports compiled and submitted • Data incorporated into EMP 5-year review	HIGH	RMA (supported by e.g. GCBC, DST, CSIR, DFFE)
l.	Undertake full Resource Directed Measures (RDM) monitoring every 3 years	ICMA, NWA	• Required monitoring undertaken • Data produced and reported on • Data incorporated into EMP 5- year review	LOW	DWS, BOCMA, RMA (funding from Water research Commission (WRC), DST)
Management Objective 1.2: Ensure estuary requirements are integrated into catchment processes to ensure healthy water quality					
a.	EMP included in catchment management strategy, and catchment classification systems and processes	NWA	• EMP integrated into the Catchment Management Strategy (CMS) • Estuary acknowledged as sensitive endpoint	LOW	BOCMA
b.	Catchment land use map developed and updated annually	NWA, CARA	• Updated land use map produced every year • Potential sources of pollution identified	MEDIUM	DALRRD (Land Care)
c.	Land use and effluent management included in the CMS	NWA	• CMS reduces nutrient pollution from agricultural practices and identifies additional sources of pollution (land use and effluent) to the estuary and provides mitigation strategies	LOW	BOCMA

d.	Water use plan updated on an annual basis	NWA	<ul style="list-style-type: none"> Updated water use plan produced every year, with reference to any changes in water availability due to climatic changes 	LOW	DWS (Resource protection)
e.	Municipal SDF and environmental overlay updated as and when required	Municipal Systems Act (MSA)	<ul style="list-style-type: none"> Updated SDF and overlays produced 	MEDIUM	Cederberg LM
Management Objective 1.3: Minimise pollution by addressing activities that lead to poor water quality					
a.	Undertake quarterly basic WQ monitoring, taking Resource Quality Objectives (RQOs) into account	NWA	<ul style="list-style-type: none"> Estuary WQ database maintained to facilitate long term database Annual report compiled and provided to EAF EMP informed by monitoring results going forward 	HIGH	Cederberg LM
b.	Develop a waste collection and recycling programme linked to the Municipal landfill site (including parking area)	MSA	<ul style="list-style-type: none"> Waste collection programme developed Recycling opportunities identified and implemented No. of staff employed Weight of waste/bags of waste collected Community clean up drives initiated 	HIGH	Cederberg LM
c.	Identify monitor and control/mitigate other polluting activities, (discharges, i.e. stormwater, septic tank seepages, etc).	MSA, NWA, ICMA	<ul style="list-style-type: none"> Patrols undertaken by appropriate municipal dept. Blocked systems reported, inappropriate activities halt and reported Mitigation / clean-up undertaken Identify and prosecute offenders 	LOW	Cederberg LM
m.	Implement and document DFFE and DWS policy to not allow effluent discharge to the estuary (including Waste Water Treatment Works (WWTW), septic tanks, conservancy tanks, industrial & livestock effluent etc.)	NWA	<ul style="list-style-type: none"> Discharge of effluent strictly prohibited Upstream discharges monitored 		RMA, DWS, DFFE, Cederberg LM

d.	Enforce agricultural best practice, specifically to reduce the application of inorganic fertilisers and sediment erosion from surrounding farms and catchment	NWA, CARA	<ul style="list-style-type: none"> • Engagement with famers in catchment initiated • Best practice methods promoted and implemented • Improved water quality variables 	HIGH	DALRRD,
e.	Investigate sustainable urban drainage systems for stormwater runoff	MSA, NWA, ICMA	<ul style="list-style-type: none"> • 1-day training for municipal officials convened and attended • Sustainable Urban Drainage Systems (SUDS) applied by building control and technical services 	LOW	Cederberg LM
Management Objective 1.4: Ensure sustainable resource use through an effective level of compliance management					
a.	Determine status of fish and bait stocks in Jakkalsvlei estuary, including regular monitoring to determine recruitment patterns	MLRA	<ul style="list-style-type: none"> • Research undertaken • Data generated, and results reported on • Data incorporated into EMP 5- year review 	MEDIUM	DFFE (supported by e.g. CapeNature, DST, CSIR)
b.	Determine carrying capacity for fishing and bait harvesting	MLRA	<ul style="list-style-type: none"> • Carrying capacity determined for likely future climate states, and enforced 	LOW	DFFE
c.	Assess, quantify and regulate extractive resource use activities on the estuary through relevant monitoring programmes (e.g. compliance patrols)	MLRA	<ul style="list-style-type: none"> • Monitoring programme developed and implemented • Monthly counts of number of harvesters • Increased patrols and monitoring conducted • Research projects commissioned • Reports submitted to DFFE for information purposes 	MEDIUM	CapeNature/DFFE,
d.	Deploy human resources for compliance and enforcement in respect to MLRA	MLRA	<ul style="list-style-type: none"> • Monitoring programme developed and implemented • Monthly counts of number of harvesters • Increased patrols and monitoring conducted • Research projects commissioned 	LOW	CapeNature/DFFE

			<ul style="list-style-type: none"> • Reports submitted to DFFE for information purposes 		
e.	Informative signage, indicating zonation and allowable activities, to be placed at strategic points for all users/visitors	ICMA	<ul style="list-style-type: none"> • Key public spaces / access points identified • Signage created and erected 	LOW	RMA,

5.2 Biodiversity Conservation

Strategic Objective 2: The biodiversity of the Jakkalsvlei estuary is conserved.

Table 5: Management Objectives and Actions for Conservation

	Proposed Activity/Action	Relevant Legislation	Performance Indicator	Priority	Responsibility
Management Objective 2.1: Ensure the conservation of representative estuarine habitats and indigenous species in accordance with a long-term view that recognises projected climate change					
a.	Adopt, implement and enforce spatial zonation plan	ICMA, Land Use Planning Act (LUPA)	<ul style="list-style-type: none"> • EFZ controls enforced and offenders prosecuted • Reduced illegal activities • Reduced habitat loss/degradation and disturbance, and inappropriate behaviour • Improved fish and invertebrate populations • Provision is made in spatial and development plans for biodiversity to adapt to a hotter climate 	MEDIUM	Cederberg Bay LM, GCBC
b.	Engage with landowners and stakeholders to encourage conservation environmental custodianship on adjacent properties.	National Environmental Management Act (NEMA) (Duty of Care)	<ul style="list-style-type: none"> • Meeting with adjacent land owners convened • Signed agreements with land owners • Degraded areas rehabilitated • Degrading activities halted • Integrity of estuarine margin improved 	MEDIUM	RMA, GCBC

c.	Keep a watching brief over the estuary in respect to bird disturbance (e.g. less nests, mortalities)	NEM:BA	<ul style="list-style-type: none"> • Basic monitoring undertaken • Key disturbance factors identified and reported on 	LOW	GCBC, Cape Nature
d.	Regulate recreational use in and around the estuary to reduce habitat degradation and wildlife disturbance	ICMA, NWA, NEM:BA	<ul style="list-style-type: none"> • Recovery of vegetation • Persistence of breeding pairs • Duty of Care perception by public 	MEDIUM	RMA

5.3 Land-use and Infrastructure Planning and Development

Strategic Objective 3: Impacts associated with developments and proposed changes in land-use, including infrastructure and agriculture, are minimised.

Table 6: Management Objectives and Actions for Land-use and Infrastructure Planning and Development

	Action	Relevant Legislation	Performance Indicator	Priority	Responsibility
Objective 3.1: Ensure appropriate and sustainable land use and coastal development in and around the Jakkalsvlei River estuary, considering ecosystem services					
a.	Implement coastal management line and associated development controls	ICMA, LUPA, MSA	<ul style="list-style-type: none"> • No further permanent development, infilling or land transformation in the EFZ (e.g. only sacrificial infrastructure permitted) • Transgressors prosecuted • Corrective action undertaken • Reduced habitat loss/degradation and disturbance, and inappropriate behaviour 	HIGH	Cederberg LM, West Coast DM, DEA&DP
b.	Adopt and incorporate the EMP and the spatial zonation plan into the municipal planning (SDF, schemes environmental overlay) and zoning.	MSA, LUPA, NEMA, ICMA	<ul style="list-style-type: none"> • EMP included in all relevant planning documents • Estuary considered no-go for development 	HIGH	Cederberg LM

c.	Develop and publish estuarine bylaws or regulations to support spatial zonation	MSA, ICMA	<ul style="list-style-type: none"> Bylaws developed and gazetted 	MEDIUM	Cederberg LM
d.	EFZ to be incorporated into all relevant government department planning documents and processes (e.g. Water use licence (WUL) Applications)	MSA, LUPA, NEMA, ICMA	<ul style="list-style-type: none"> EMP included in all relevant planning documents 	HIGH	All authorities
e.	Use EAF as source of I&APs for Environmental Impact assessments (EIAs)	MSA, LUPA, ICMA, NEMA	<ul style="list-style-type: none"> EAF partakes in development planning affecting the estuary Impacts on the estuary are mitigated/prevented 	HIGH	RMA, Cederberg LM, West Coast DM, DEA&DP

5.4 Institutional and Management Structures

Strategic Objective 4: The Jakkalsvlei estuary is well managed through effective co-operative governance.

Table 7: Management Objectives and Actions for Institutional and Management Structures

	Action	Relevant Legislation	Performance Indicator	Priority	Responsibility
Management Objective 4.1: Ensure effective co-ordination of estuarine management responsibilities					
a.	RMA adopts and incorporates the EMP and the spatial zonation plan into planning documents	MSA, LUPA, NEMA, ICMA	<ul style="list-style-type: none"> EMP and zonation plan adopted by RMA EMP included in all relevant planning documents 	HIGH	RMA, Cederberg LM, West Coast DM
b.	Undertake needs analysis and identify skills required	ICMA	<ul style="list-style-type: none"> Needs and shortages identified Motivation for acquisition drafted and approved Equipment purchased and maintained 	LOW	RMA, DEA&DP
c.	Implement skills development, training or co-opt additional members / secondment for estuarine management	ICMA	<ul style="list-style-type: none"> Motivation for training drafted and approved Staff attend relevant accredited training courses 	LOW	RMA, DEA&DP

			<ul style="list-style-type: none"> • Memorandum of Understanding (MOU) to be developed for secondments 		
d.	Develop good communication protocols and processes with implementing agents (The RMA to develop working relationships with mandated department & agreements need to be developed to address each management action)	ICMA	<ul style="list-style-type: none"> • Project champions identified • Networks established, and contacts database compiled • Regular email correspondence 	MEDIUM	RMA
e.	Ensure that EMP is maintained, enforced and budgeted for annually	ICMA, MSA, LUPA, NWA	<ul style="list-style-type: none"> • An action plan for securing future funding drafted and approved • Funding secured for 5-year cycle 	HIGH	All authorities
f.	Maintain/support a fully functional, regional EAF (or utilise other applicable forum) to facilitate co-operative governance	ICMA, MSA, LUPA, NWA, NEM: PAA, Mineral Resource and Petroleum Development Act (MRPDA)	<ul style="list-style-type: none"> • EAF constituted (Membership includes representatives of government and stakeholders/civil society) • Regional EAF meets on a quarterly basis • Meetings with minutes 	HIGH	RMA
g.	Identify and invite missing stakeholders/ interest groups to partake in regional EAF	ICMA	<ul style="list-style-type: none"> • Networks established • Stakeholder database developed and regularly updated 	HIGH	RMA
h.	RMA present on critical forums to ensure that estuarine issues are tabled, e.g. Catchment Management agency (CMA), Water Users Association (WUA), Agriculture groups etc.	ICMA	<ul style="list-style-type: none"> • RMA attendance at critical forum meetings • Meetings with minutes 	HIGH	RMA
i.	Maintain, monitor, review and report on the progress of EMP actions and achievements on annual basis	ICMA	<ul style="list-style-type: none"> • Feedback received from participating agencies • Biannual and annual reporting to EAF, DEA&DP DEA and, undertaken by RMA 	MEDIUM	RMA

			<ul style="list-style-type: none"> • Action plans updated as and when required 		
j.	Undertake formal 5-year review as prescribed by the 2021 NEMP, with involvement of EAF	ICMA	<ul style="list-style-type: none"> • Motivation for updated drafted and approved • Funding confirmed • Terms of Reference drafted • Consultants appointed • Plan updated 	LOW	RMA
k.	Provincial authority to intervene if RMA incapacitated and ineffectual	ICMA	<ul style="list-style-type: none"> • Needs and shortages identified • Motivation for hand over • Meeting with EAF • MOU signed 		DEA&DP

Management Objective 4.2: Define co-operative governance arrangements

a.	Identify and implement procedures to ensure cooperative governance between all gov. depts. with a mandate to act	ICMA, Inter-Governmental Relations Act (Act 13 of 2005)	<ul style="list-style-type: none"> • Roles and responsibilities defined and accepted via MOUs signed between RMA and spheres of government and participating agencies • Regional EAF meets on a quarterly basis • Meetings with minutes • Active collaboration of various implementing agents 	HIGH	All authorities
b.	EAF to monitor performance of RMA in respect to implementation of plan	ICMA	<ul style="list-style-type: none"> • Authorities to provide formal feedback on mandated activities • Regional EAF meets on a quarterly basis 	MEDIUM	All authorities, All stake-holders
c.	Individual agencies to identify and address training needs, with possible secondment to address training and capacity shortfalls	ICMA	<ul style="list-style-type: none"> • Motivation for training drafted and approved • Staff attend relevant accredited training courses • MOU to be developed for secondments 	MEDIUM	All authorities
d.	Individual agencies to allocate resources, create and fill posts (including project champions), and acquire necessary infrastructure, resources and equipment of fulfil their mandates	MSA, NWA, ICMA, NEMA	<ul style="list-style-type: none"> • Need and Desirability investigation undertaken • Motivation for acquisition drafted and approved • Equipment purchased and maintained • Project champion(s) for allocated management actions • Staff appraisals in terms of management actions and projects (performance management system implemented) 	MEDIUM	All authorities
e.	Mandated authorities and participating agencies to confirm budget allocations for mandated activities/actions	MSA, NWA, ICMA, NEMA	<ul style="list-style-type: none"> • Formal feedback from authorities on mandated activities • Motivation for budget drafted and approved • Funding secured for 5-year cycle 	LOW	All authorities

5.5 Socio-economic Considerations

Strategic Objective 5: Socio-economic benefits are regulated, and resilience in the face of climate change improved, to ensure sustainable use of the Jakkalsvlei estuary and its resources.

Table 8: Management Objectives and Actions for Socio-economic Considerations

	Action	Relevant Legislation	Performance Indicator	Priority	Responsibility
Management Objective 5.1: Regulate recreational use of the estuary					
a.	Adopt, demarcate and enforce spatial zonation plan	ICMA	<ul style="list-style-type: none"> • EFZ controls enforced and offenders prosecuted • Reduced habitat loss/degradation and disturbance, and inappropriate behaviour 	MEDIUM	RMA
b.	Informative signage, indicating zonation and allowable activities, to be placed at strategic points for all users/visitors	ICMA	<ul style="list-style-type: none"> • Key public spaces / access points identified • Signage created and erected 	MEDIUM	RMA, GCBC
c.	Develop and implement an effective communication strategy for users, specifically an early warning system to alert users of possible health threats, linked to pollution identification and water quality monitoring	ICMA, National Health Act (NHA)	<ul style="list-style-type: none"> • Strategy developed • Effective network established • Cell phone link set up • Peaks season patrols • Investigative surveys/ questionnaires undertaken 	MEDIUM	RMA,
Management Objective 5.2: Develop and regulate local livelihoods associated with the estuary					
a.	Investigate and implement alternate livelihoods opportunities that promote non-consumptive enterprises involving previously disadvantaged communities,	NEMA, MSA	<ul style="list-style-type: none"> • Target groups/areas identified • Potential alternatives identified • Community projects initiated • Employment opportunities provided 	HIGH	RMA, Cederberg LM,

	which are compliant with all forms of legislation and planning frameworks				
b.	Assist people from local vulnerable communities through training programmes (e.g. guiding courses), and by creating links with Environmental Protection and Infrastructure Programmes (EPIP), Non-Governmental Organisations (NGOs), Community Based organisations (CBOs), donors and commercial operators.	ICMA, MSA	<ul style="list-style-type: none"> • Trained members of the local communities • Employment opportunities • EPIP programmes engaged 	HIGH	RMA, Cederberg LM, DFFE: WftC, WfW etc.
c.	Livelihood protection is planned for as part of a climate change adaptation response in the estuary management planning cycle	DMA, MSA	<ul style="list-style-type: none"> • Local and District economic planning and disaster management plans to address the socio-economic impacts of extreme climate-related events on employment opportunities in their adaptation planning 	LOW	RMA, West Coast DM, Cederberg LM

5.6 Education & Awareness

Strategic Objective 6: Members of society are sensitive to, and aware of, the value and importance of the Jakkalsvlei estuary.

Table 9: Management Objective and Actions for Education & Awareness

	Action	Relevant Legislation	Performance Indicator	Priority	Responsibility
Management Objective 6.1: Promote high levels of public awareness and appreciation of the value of estuaries					
a.	Develop and effective education and awareness programme for local farmers, residents and visitors	ICMA	<ul style="list-style-type: none"> • Education & awareness programme developed and implemented at schools and through interest groups • Increased educational opportunities at group gatherings, community meetings, conferences etc. 	MEDIUM	RMA, GCBC
b.	Source and/or commission educational and informative material including signage, posters, and pamphlets	ICMA	<ul style="list-style-type: none"> • Signage created, and erected Posters and pamphlets erected/ disseminated • Cederberg estuaries webpage operational 	MEDIUM	RMA, GCBC
c.	Engage and educate estuary users (namely, potential harvesters, fishers and livelihood users)	ICMA	<ul style="list-style-type: none"> • Reduction in illegal activities • Reduced habitat loss/degradation and disturbance, and inappropriate behaviour • Informative surveys/talks undertaken 	LOW	GCBC

5.7 Disaster Risk Management

Strategic Objective 7: Potential risks that could impact the Jakkalsvlei estuary are reduced, inclusive of climate change impacts.

Table 10: Management Objectives and Actions for Disaster Risk Management

Action	Relevant Legislation	Performance Indicator	Priority	Responsibility
Management Objective 7.1: Disaster prevention, preparedness and mitigation				
a. Ensure that all proposed developments adhere to the full suite of relevant environmental legislation, particularly the coastal management line and associated development controls	NEMA, ICMA, etc	<ul style="list-style-type: none"> • All developments comply with environmental legislation and environmental best practice / risk aversion approach • No permanent development, infilling or land transformation of EFZ • Transgressors prosecuted • Corrective action undertaken • Reduced risk of degradation, transformation and disturbance to the estuary 	HIGH	Cederberg LM, RMA, DEA&DP
b. Identify, prioritise, estimate costs, and rehabilitate vulnerable areas (e.g. bank erosion, disturbed riparian vegetation).	NEMA, Western Cape Transport Infrastructure Act (WC TIA)	<ul style="list-style-type: none"> • Priority areas needing rehabilitation identified • Degradation profiles compiled • Rehabilitation programme developed • Priority degraded areas restored 	MEDIUM	Western Cape Department of Transport: Public Works (WC DoT&PW), Cederberg LM, RMA
c. Install appropriate defence for critical infrastructure	ICMA, NEMA, WC TIA	<ul style="list-style-type: none"> • Appropriate defence methods identified • Infrastructure protected 	MEDIUM	WC DoT&PW

d.	Identify areas and infrastructure at risk of flooding and erosion, and include in relevant plans (specifically regional disaster management plan)	Disaster Management Act (Act 57 of 2002) (DMA), WC TIA	<ul style="list-style-type: none"> • High risks and risk areas identified • Relevant plans updated with early warning and monitoring systems, and contingency plans for high erosion and flood risk areas, as well as extreme heat and drought events. • Disaster management plan implemented 	MEDIUM	RMA, WC DoT&PW, Cederberg LM, WC Dept of Local Gov: Disaster Management
e.	Enforce the 'Polluter pays' principle and timeous and appropriate rehabilitation of damaged areas	NEMA	<ul style="list-style-type: none"> • Transgressors prosecuted • Corrective action undertaken; degraded areas rehabilitated 	MEDIUM	Cederberg LM, DEA&DP

6 PROPOSED SPATIAL ZONATION

6.1 Introduction

The spatial zonation of activities on an estuary is necessary to avoid user conflict and to guide sustainable utilisation without degradation of the estuarine environment. The spatial zonation plan provides a means of geographically transposing the aims of the management objectives, where applicable, and is typically informed by the following (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 (recreational, commercial, industrial, harvesting etc.) are permissible and others not permissible.

6.2 Habitat zones

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

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

The habitat map shown in Figure 6 is used as the baseline for the identification of sensitive estuarine habitats. Sand and mud flats as well as salt marsh are valuable habitat types and need to be appropriately protected.

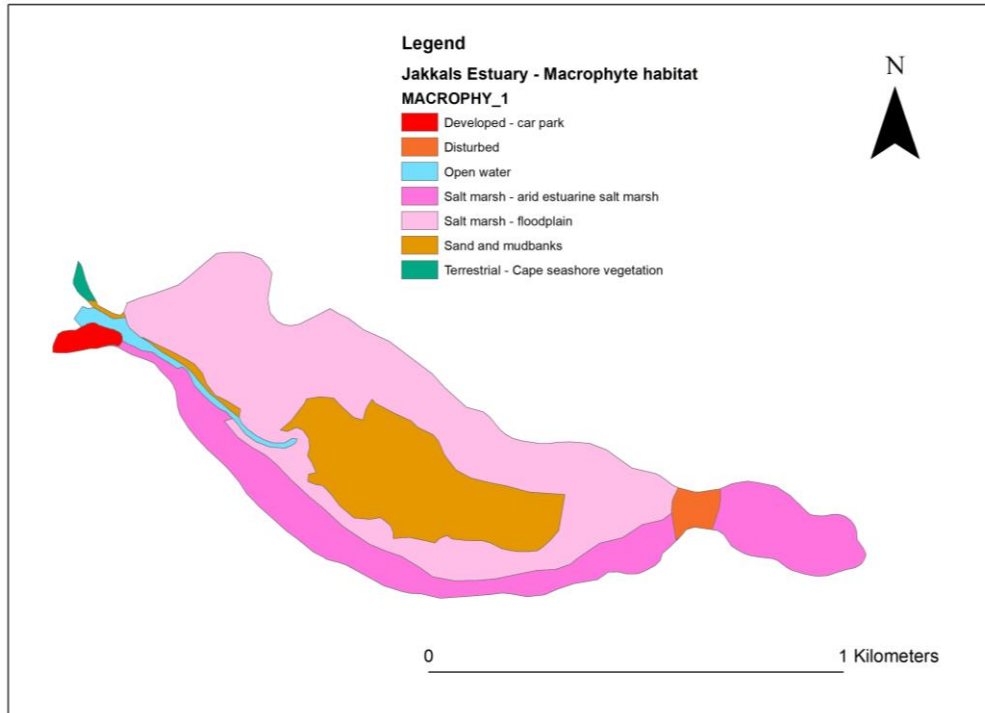


Figure 6: Habitats identified in the Jakkalsvlei estuary (based on 2016 aerial imagery)

6.3 Legislated Coastal Boundaries and Buffer Zones

6.3.1 Estuarine Functional Zone

The ICMA defines an estuary as “a body of surface water -

- a) that is permanently or periodically open to the sea;
- b) in which a rise and fall of the water level as a result of the tides is measurable at spring tides when the body of surface water is open to the sea; or
- c) in respect of which the salinity is higher than fresh water as a result of the influence of the sea, and where there is a salinity gradient between the tidal reach and the mouth of the body of surface water”.

Similarly, the National Water Act (NWA) defines an estuary as “a partially or fully enclosed water body that is open to the sea permanently or periodically, and within which the seawater can be diluted, to an extent that is measurable, with freshwater drained from land”.

However, the 2018 National Biodiversity Assessment provides a more detailed definition of an estuary, that is: “a partially enclosed permanent water body, either continuously or periodically open to the sea on decadal time scales, extending as far as the upper limit of tidal action, salinity penetration or back-flooding under closed mouth conditions. During floods an estuary can become a river mouth with no seawater entering the formerly estuarine area or, when there is little or no fluvial input, an estuary can be

isolated from the sea by a sandbar and become fresh or even hypersaline" (SANBI 2019).

The EFZ is defined by the 2014 Environmental Impact Assessment (EIA) Regulations (as amended in 2017) (GN 324) 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", as defined by the 5 m topographical contour (referenced from the indicative mean sea level)*. The 2021 NEMP acknowledges the EFZ as the geographical boundary of estuaries in South Africa. In practice, it is found that the 5 m topographic contour approximates the EFZ for most estuaries in South Africa. It is consequently commonly used to delineate the EFZ in the absence of specific biophysical assessments. Where biophysical information is available, the EFZ can be delineated according to the presence of estuarine vegetation or features such as wetlands that are directly supportive of the estuary. This approach informed the EFZ used in the 2018 NBA (SANBI, 2019) (refer to Figure 3).

6.3.2 Coastal Protection Zone and proposed Coastal Management Line

The ICM Act defines a default **Coastal Protection Zone (CPZ)** which, in essence, consists of a continuous strip of land, starting from the High Water Mark (HWM) and extending 100 m inland in developed urban areas zoned as residential, commercial, or public open space, or 1 000 m inland in areas that remain undeveloped or that are commonly referred to as rural areas. It also includes certain sensitive or at-risk land such as estuaries, littoral active zones and protected areas.

The Provincial Member of the Executive Council (MEC), in consultation with the Local Municipalities, is required to refine and formally adopt the CPZ. A process is currently underway to formally establish a CPZ for the Western Cape Coastline. In accordance with provisional delineation of the CPZ for estuaries in the West Coast, as per draft delineations recommended in the Coastal Set-back / Management Lines for the West Coast District project (WCG, 2015), the CPZ is informed by a coastal risks zone approximated by the **5 m amsl contour or 1:100yr floodline** around an estuary, whichever is wider.

The ICMA also provides for the establishment of a **Coastal Management Line (CML)**, designed to limit development in ecologically sensitive or vulnerable areas, or an area where dynamic natural processes pose a hazard or risk to humans. A CML, as envisaged by the amended ICM Act, is informed by the projections of risk emanating from dynamic coastal processes such as sea level rise or erosion, information on ecological or other sensitivities adjacent to the coast, as well as the location and extent of existing development and existing executable development rights. The CML is a continuous line, seawards of which lies:

- Areas of biophysical or social sensitivities such as sensitive coastal vegetation identified as priority conservation areas and formal protected areas.

- those areas that should be left undeveloped, or only be granted appropriately restricted development rights, due to a high risk from dynamic coastal processes;
or
- coastal public property.

In estuaries, the CML is delineated by the 5 m amsl contour or the 1:100yr floodline, whichever is wider, to differentiate a zone where formal development should be discouraged. The coastal boundaries for the Jakkalsvlei estuary are illustrated in Figure 7.

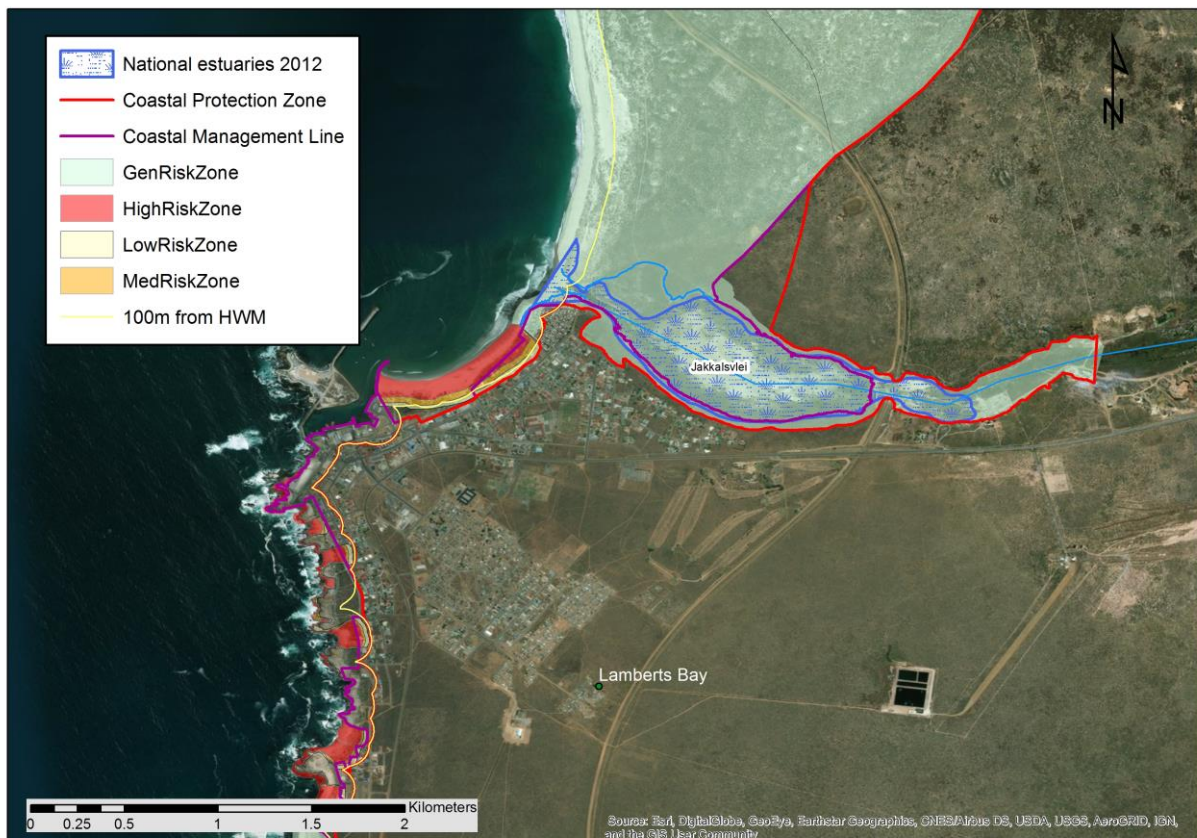


Figure 7: Coastal boundaries of the Jakkalsvlei River estuary and risk projections (WCG, 2015)

6.3.3 Environmental Impact Assessment regulatory line

In respect of the EIA regulatory scheme, an additional line called the Development Set-Back Line (DSL) needs to be differentiated as it relates to the 'development set-back' referred to in the EIA regulations² rather than the coastal management lines described in the ICM Act. However, as part of the on-going process of defining coastal

² The Environmental Impact Assessment Regulations, 2014 (as amended in 2017), published under Government Notice No. 326 in Gazette No. 40772 of 4 April 2017, in terms of sections 24(5) and 44 of the National Environmental Management Act, 1998 (Act No. 107 of 1998)

management lines for the Western Cape, it is currently **proposed that the CML, as defined under ICMA, also be used as the DSL.**

Reference to development setback lines is found in the EIA Listing Notices that list a range of activities that require different levels of environmental impact assessment and the issuing of an environmental authorisation prior to being undertaken.

Typically, an activity would be listed in the form of a range of thresholds which, if exceeded, trigger the need for an environmental impact assessment in the form of a Basic Assessment or EIA. In some cases, however, a development set-back line is used as spatial reference to include or exclude activities. The EIA regulations indicate that: *“development setback” means a setback line defined or adopted by the competent authority*. This implies that if such a setback is defined, the setback delineation replaces the default parameters for an activity, as read within the context of that activity. The competent authority in the Western Cape is DEA&DP or the National DFFE.

The EIA regulations also refer to whether a development is in front or behind the line – for a coastal development set-back this equates to any development seaward of the line being ‘in front of’, whilst landward of the line being ‘behind’.

An important further point to note is that the development setback lines are usually linked to the presence of urban built-up areas. The regulations indicate that *““urban areas” means areas situated within the urban edge (as defined or adopted by the competent authority), or in instances where no urban edge or boundary has been defined or adopted, it refers to areas situated within the edge of built-up areas”*. These exclusion areas create *de facto* islands in the area below the DSL, within which the specifically excluded EIA triggers don't apply.

The Western Cape Government, as designated competent authority, considers the area below/seaward of existing development as falling outside of the ‘built-up area’. Therefore, any exclusions based on a listed activity taking place within the built-up area would not apply to this strip of coastal land, and the prescriptions for environmental assessments related to the particular activity will apply. For example, the beach in front of seafront houses is not considered ‘built-up’ and environmental authorisations will be required to execute any listed activities on that beach.

6.4 Zonation of Activities

6.4.1 Current zonation and uses

The table below lists the surrounding land use types as per the Cederberg Municipal town planning scheme regulations (Cederberg LM, 1986) and activities occurring in and/or adjacent to the Jakkalsvlei estuary (Table 11) It is noted that the scheme is

currently being reviewed and updated and proposed to be implemented in mid-2019 (A Neethling³, pers. comm).

³ Adriaan Neethling, Town Planner, Cederberg Local Municipality, 1 November 2018

Table 11: Current zonation and activities occurring in and/or adjacent to the Jakkalsvlei estuary

LAND ZONE	DESCRIPTION
Residential Zone 1	The estuary/vlei abuts the town of Lamberts Bay and the properties adjacent the southern boundary is zoned as residential zone 1. A few vacant sites exist within the 1 st row of properties.
Resort Zone 1	A caravan park and parking area is located on the southern bank of the mouth of the Jakkalsvlei Estuary. This area is identified in the Cederberg SDF as an existing tourism facility and future tourism node. The parking area has been hardened restricting the natural movement of the mouth.
Agriculture Zone 1	The northern portion of the vlei is included on erf 174 and zoned as Agriculture Zone 1.
Undetermined	The reminder and southern portion of the vlei is located on erf 168 which is not currently zoned and deemed to be undetermined. As such no buildings may be erected in this zone and no specific use referred to.
ACTIVITIES	DESCRIPTION
Fishing	Assumed Limited fishing
Bait harvesting	Assumed Limited sand prawn pumping
Swimming	Peak season swimming within the estuary/vlei
Recreational activities	Sunbathing, birding, picnicking etc. on the beach / sand bar as well as on the extensive estuary/vlei margins. Canoeing when the vlei was full.

The Cederberg Spatial Development Framework (Cederberg LM, 2017), while not specifically zoning the EFZ, does reflect the proposed CML and excludes the EFZ from the urban edge (Figure 8). No additional development or urban expansion is therefore proposed adjacent to the system. The existing waste site is still noted on the land use proposals.

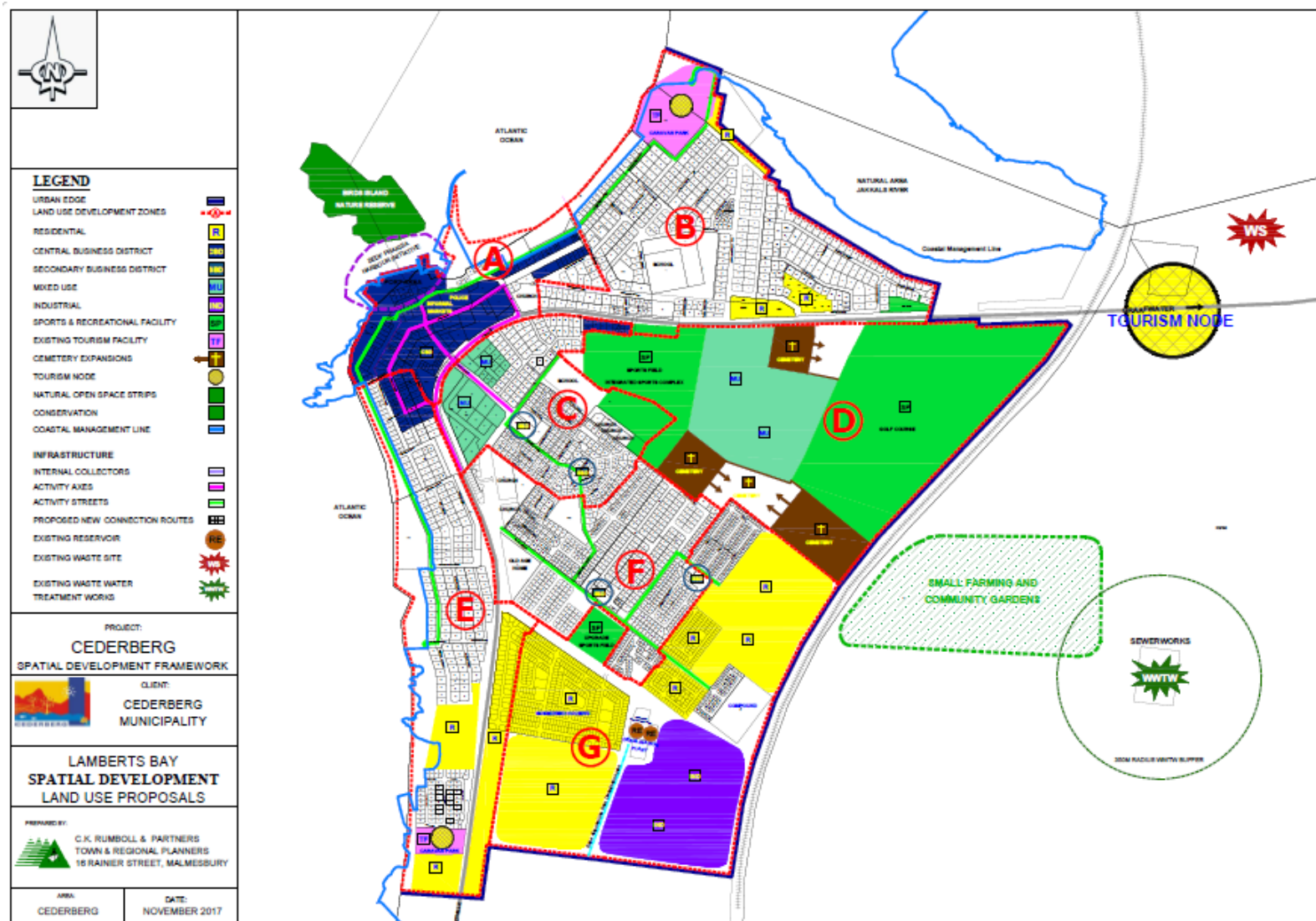


Figure 8: Cederberg Spatial Development Framework: Lamberts Bay Land Use Proposals (Cederberg LM, 2017)

6.4.2 Proposed spatial zonation

Zonation of the Jakkalsvlei estuary is informed by the intention of the Cederberg LM to conserve the estuary and the designation of a conservation servitude or special zone or rezoning to an Open Space 3 (Nature Reserve) is proposed. The designation as a special zone can consist of different portions of land provided the land use restrictions are the same (Cederberg LM, 1986). Rezoning to Open Space 3 will however require a land use application to be submitted (subdivision of land) in order to zone the whole vlei to Open Space 3 (A Neethling⁴, pers. comm).

Allowable activities in these zones are to be managed as per Table 12 below. Formal development or construction activities in either zone are to be regulated according to the EIA Regulations and any future controls emanating from the Provincial determination of coastal management lines.

Table 12: Zonation prescriptions for the Jakkalsvlei estuary

ZONE/USE	CONDITIONS OF USE	RELEVANT LEGISLATION	RESPONSIBLE AUTHORITY	ENFORCEMENT
Open Space 3 / special zone / conservation servitude	<ul style="list-style-type: none"> • Guided or unguided nature observation. • Day hiking trails and/or short trails. • Bird hides, canoeing, mountain biking & rock-climbing where appropriate and if there is enough water. • No special access control or permits required. • Pedestrian access from parking areas or adjacent development zones along designated routes. • No accommodation or camping. • Frequent interaction with other users. • On water – only non-motorised craft permitted (e.g. canoeing), unless specifically noted. • Fishing/ harvesting subject to approval by CapeNature and possession of an appropriate permit. 	LUPA / Land Use Planning Ordinance (LUPO) or NEM: PAA	Cederberg LM / CapeNature	Cederberg LM / CapeNature

6.4.3 Areas requiring rehabilitation

In order to maintain the present ecological state of the Jakkalsvlei estuary at a Present Ecological State (PES)/ REC of D, the following interventions are required:

⁴ Adriaan Neethling, Town Planner, Cederberg Local Municipality, 1 November 2018

-
- Maintaining good water quality conditions in the catchment through strict management of urban and agricultural return flows;
 - Management of abstraction of water and building of dams;
 - Solid waste removal and management;
 - Stormwater management from carpark at the mouth;
 - Mitigation of erosion at carpark;
 - Closure and rehabilitation of unnecessary access paths; and
 - Removal / management of invasive alien species.

A rehabilitation programme is proposed and should include the catchment area as the recommended ecological category of the Jakkalsvlei River feeding into the Jakkalsvlei estuary is category C.

7 INTEGRATED MONITORING PLAN

According to the standards for estuarine management, management actions should be based on sound scientific evidence. Thus, monitoring is a crucial aspect of the adaptive estuarine management 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 in the following sections.

7.1 Resource Monitoring

7.1.1 Current Resource Monitoring

The only known monitoring taking place on the Jakkalsvlei are the biannual counts of bird populations, undertaken by CapeNature as part of the CWAC. It is imperative that this monitoring continues.

7.1.2 Recommended Resource Monitoring Programmes

In the context of the Jakkalsvlei estuary, general baseline information is severely lacking. It is important that monitoring be undertaken on the river and groundwater flow reaching the estuary (flow gauging) and on the natural (and artificial) breaching occurring at the inlet. The minimum long-term monitoring recommended for ascertaining the impacts of current and future pressures on the condition on the estuary are provided in Table 13 (Appendix 1), which is in line with the methods for the determination of the ecological water requirements (EWR) for estuaries (DWA, 2011). In respect to improving baseline information, the proposed monitoring requirements must also be implemented in the event of a breaching event, and quarterly for 2 years thereafter (apart from those items identified as requiring continuous monitoring). Recommended baseline monitoring requirements to improve the confidence of future water EWR assessments are listed in Table 14 (Appendix 1).

A basic monitoring programme should be established by the RMA for the Jakkalsvlei estuary according to the Reserve Determination methods. The programme should seek to address the monitoring priorities as soon as possible and various components can potentially be monitored by Cape Nature.

7.1.3 Resource Quality Objectives

Resource Quality Objectives (RQOs) or Ecological Specifications (EcoSpecs) are clear and measurable specifications of ecological attributes (in the case of estuaries - hydrodynamics, sediment dynamics, water quality and different biotic components) that define a specific

ecological category. It is noted that this SAR and the 2018 National Biodiversity Assessment (SANBI, 2019) suggests a Category D.

However, according to the 2013 Reserve Determination study, the REC for the Jakkalsvlei River estuary is a Category C. The associated RQOs are presented in Table 15 (Appendix 2) for ease of reference.

7.2 Compliance Monitoring

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

Currently there is no compliance monitoring taking place on the Jakkalsvlei estuary.

In respect to the implementation of this EMP, compliance monitoring will be the responsibility of the:

- Cederberg LM in respect to land-use/town planning/illegal activities (e.g. dumping/littering);
- DALRRD in respect to agricultural best practices; and
- DWS for water abstractions.

Compliance monitoring and enforcement will be undertaken according to applicable legislation and policies and by means of law enforcement and compliance monitoring protocols.

7.3 Performance Monitoring (Review & Evaluation)

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

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 applicable IDP, SDF and/or CMP. This review is the responsibility of the RMA. According to the 2021 NEMP, this review should include an assessment of:

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

This review may involve revisiting the SAR to determine the progress or changes that have come about because of the EMP in terms of the objectives that were originally set. It may also require the EMP to be amended, including a revision of the objectives, amendments to the management actions, and/or monitoring protocols. Ideally, representatives and experts in the major sectors (e.g., water quantity and quality, land-use and infrastructure planning and development), 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.

A performance monitoring plan relative to the proposed management priorities is included as Table 16 at Appendix 3.

8 INSTITUTIONAL CAPACITY & ARRANGEMENTS

It is essential that this EMP is regarded as a strategic plan that can guide the detailing of management actions and the identification of implementing agents. Therefore, it does not specify the required resources (human and financial) required for effective management of the estuary. 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. It is crucial that champions/project leaders/teams are identified who will be responsible for the formulation of detailed project plans and the implementation thereof.

8.1 Key Role Players

Co-management and effective governance have been identified as vital aspects of efficient and effective estuarine management.

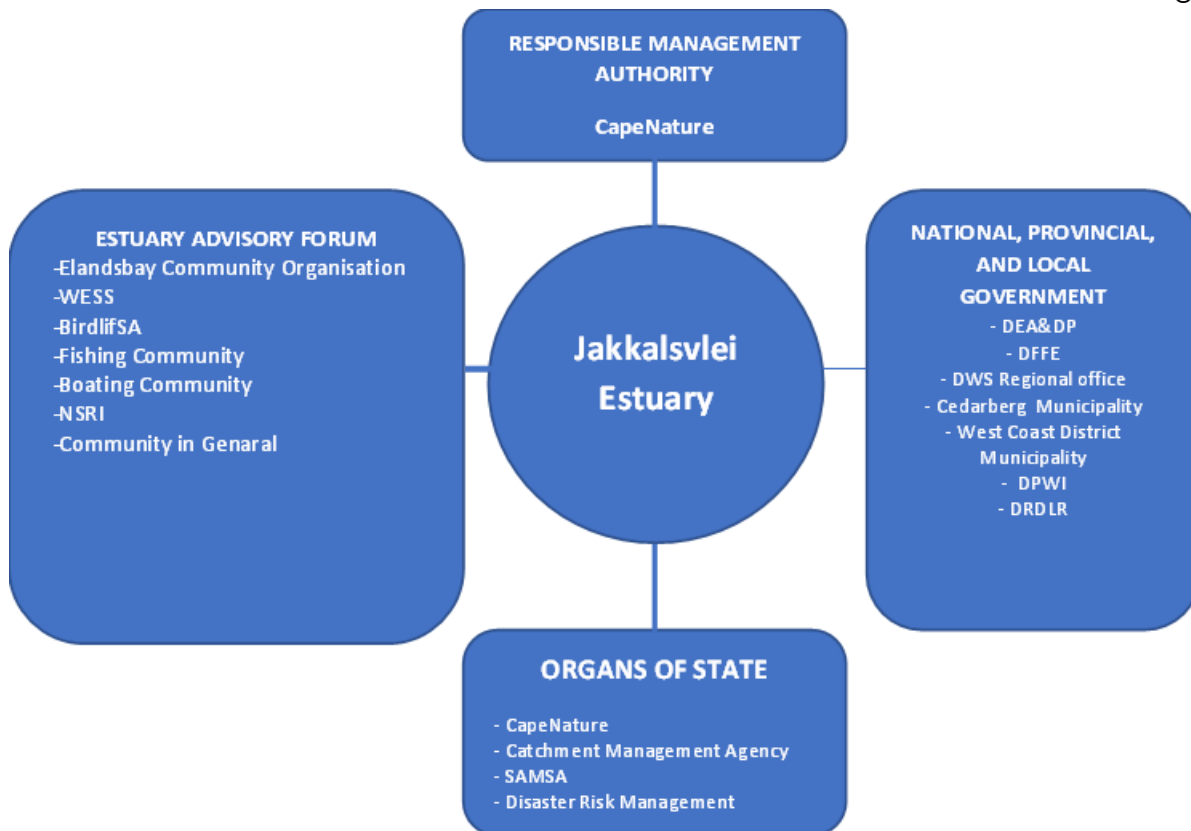


Figure 9 displays the key role players that should be included in its management.

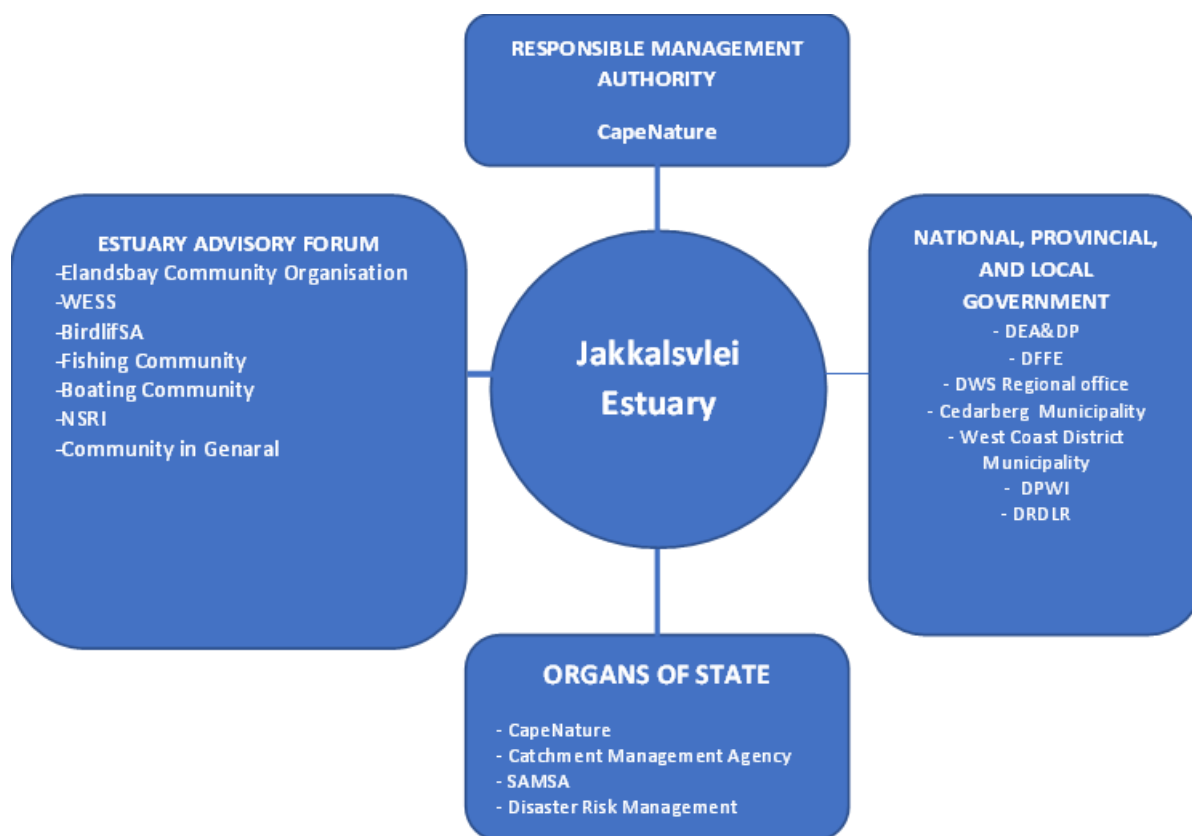


Figure 9: Key role players for the management of the Jakkalsvlei estuarine system

8.2 Responsible Management Authority

The 2021 NEMP identifies the RMA to be CapeNature since Jakkalsvlei Estuary is listed in the Western Cape Protected Area Expansion Strategy.

Specific implementation actions identified in this EMP remain the responsibility of mandated government agencies as well as respective departments within the RMA. As an example, the DWS will monitor water quality, while the DALRRD will be responsible for agriculture and fisheries related issues. It is crucial that champions/project leaders/teams are identified who will be responsible for the formulation of detailed project plans and the implementation thereof.

Effective implementation of this EMP requires the augmentation of capacity specifically within DEA&DP, with the recommended appointment of a District Estuarine Management Co-ordinator (EMC). This individual will play a critical co-ordinating role for all other implementing agencies.

Progress towards achieving the objectives set out in this EMP should be reviewed on an annual basis by the RMA and communicated to stakeholders and the DEA via an annual report. This EMP will need to be revisited and updated after five years to reflect goals that have been achieved and to accommodate changing priorities.

8.3 Estuary Advisory Forum

While the establishment of an EAF for each estuary is no longer a requirement in the 2021 NEMP, the Western Cape Government still supports their establishment and recommends that private entities and non-government organisations continue to play a supporting role in the implementation of this EMP. While an individual EAF is not recommended, the establishment of a regional EAF is proposed, incorporating the Jakkalsvlei, Wadriest and Verlorenvlei estuarine systems. The EAF should be chaired by the RMA and should aim to meet on a quarterly basis.

Government departments should be represented on this regional EAF by delegates mandated by the respective department to do so. Each government representative on the EAF will be tasked to convey recommendations to his/her department and report back to the EAF on behalf of the department. Moreover, representatives from the authority/ies who have executive powers within the specific sector should also be present. This ensures that recommendations are executed, and resources are made available for priority tasks or activities. This also streamlines the flow of information and decreases the turnaround time of required interventions.

The various local members of the EAF will play an invaluable role in providing on the ground, local insight and support to the various authorities as well as to the RMA. For example, the GCBC can potentially assist with ongoing basic monitoring of the system.

8.4 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:

- The identified RMA (DEA&DP, Cape Nature or the Cederberg Local Municipality);
- The Cederberg Local Municipality: responsible for providing key municipal services, as well as the provision of management, technical and legislative support;
- The West Coast District Municipality: Responsible for issues relating to water and sanitation, disaster management as well as the provision of management and technical support;
- Western Cape Government departments: Responsible for legislatively mandated responsibilities as well as support, including compliance, funding, research and monitoring (e.g. DEA&DP, DoT&PW);
- Relevant National government departments, especially DFFE, DWS (via the regional office), DALRRD, Department of Mineral Resources; Department of Transport, Department of Public Works (DPW) and the Department of Science and Technology (DST); and
- Organs of State: CapeNature, CSIR, BOCMA.

A crucial element towards achieving the vision and objectives of this plan, now and in future, is to ensure that the responsible authorities and their constituent departments, fulfil their roles and responsibilities as identified within the EMP. In terms of practical implementation of the EMP, each responsible government department is required to produce internal project plans linked the identified management actions, and in line with their legislative mandates. Funding and staff resources will need to be sourced within each respective sector department and/or institute. Alternatively, departments may fund other entities to undertake their necessary functions on their behalf.

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

- The West Coast Municipal Coastal Committee: Responsible for facilitating co-management, effective governance and district level co-ordination of coastal and estuarine management issues;
- Western Cape Provincial Coastal Committee: Responsible for facilitating co-management and effective governance and provincial co-ordination of estuarine management; and
- The Western Cape Estuaries Task Team: Responsible for facilitating provincial co-ordination of estuarine management.

8.4.1 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 as Appendix 4 for ease of reference. This template can also be utilised to facilitate the implementation of other projects proposed in the EMP.

9 RECOMMENDATIONS AND CONCLUSION

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

- Measures must be instituted to prevent the continued deposition of solid waste into the estuary and the existing EPIP programme, Working for the Coast, must be instructed to clean the estuary and its EFZ;
- The EFZ should be rezoned to Open Space 3 and the area protected;
- Every effort should be made to increase awareness of the value of the Jakkalsvlei estuary with residents of and visitors to Lamberts Bay; and
- The DEA&DP to consider the appointment of a Regional estuarine management co-ordinator/champion within either DEA&DP or CapeNature, to support the RMA.

In conclusion, this plan adopts the principle of adaptive management and presents an integrated and holistic approach to addressing not just the impacts but also the social and economic drivers that affect estuarine health. The actions proposed in this EMP reflect an ongoing process of implementation and should accommodate potential amendment due to changing circumstances. They are the first steps of a long-term process designed to secure ongoing and sustainable improvements to the current situation.

10 REFERENCES

- Cederberg LM (1986). Scheme Regulations in terms of Section 8 of the Land Use Planning Ordinance, 1985 (Ordinance 15 Of 1985).
- Cederberg LM (2018). Lamberts Bay Spatial Development Land Use Proposals.
- Cederberg Local Municipality (2017). Cederberg Local Municipality Integrated Development Plan 2012-2017.
- Department of Environmental Affairs (DEA), (2021). National Environmental Management Integrated Coastal Management Act 2008 (Act No. 24 of 2008): National Estuarine Management Protocol (NEMP).
- Department of Environmental Affairs (DEA) (2015). Guidelines for the Development and Implementation of Estuarine Management Plans in terms of the National Estuarine Management Protocol. Department of Environmental Affairs, Cape Town.
- Department of Water Affairs (2013). Determination of Resource Quality Objectives for the Olifants Doorn Water Management Area – Report No. 3 - RQO Determination Report. Prepared by Umvoto Africa (Pty) Ltd in association with Southern Water Ecological Research and Consulting cc. (Authors: K Riemann, A Joubert, C. Brown) on behalf of the Directorate: RDM Compliance. DWA Report No.
- Department of Water and Sanitation (DWS) (2017). Determination of Ecological Water Requirements for Surface water (river, estuaries and wetlands) and Groundwater in the Lower Orange WMA. Ecological Specifications and monitoring report. Prepared by: Rivers for Africa eFlows Consulting (Pty) Ltd. DWS Report No: RDM/WMA06/00/CON/COMP/0217.
- South African National Biodiversity Institute (SANBI) (2019). National Biodiversity Assessment 2018: The status of South Africa's ecosystems and biodiversity. Synthesis Report. South African National Biodiversity Institute, an entity of the Department of Environment, Forestry and Fisheries, Pretoria. pp. 1–214.
- SRK (2013). West Coast District Municipality Integrated Coastal Management Programme. Final Report. Prepared by SRK Consulting (South Africa) (Pty) Ltd, 332pp.
- StatsSA, (2011). Cederberg Municipality. Key Statistics from the 2011 National Census. Statistics South Africa. Accessed 12 November 2018. URL: http://www.statssa.gov.za/?page_id=993&id=cederberg-municipality
- StatsSA, (2016). Cederberg Municipality Community Survey data 2016. Accessed 12 November 2018. URL: <https://wazimap.co.za/profiles/ward-10102005-cederberg-ward-5-10102005/>

WCG (2015). Coastal Management (Set-back) Lines for the West Coast District, 31 March 2015. Western Cape Government Environmental Affairs and Development Planning.

WCG (2018). Jakkalsvlei Estuarine Management Plan: Situation Assessment Report. Western Cape Government Department of Environmental Affairs and Development Planning.

APPENDIX 1: RECOMMENDED MONITORING PROGRAMMES

Table 13: Recommended minimum requirements for long-term monitoring (Priority: Red = High; Orange = Medium, Yellow = Low) (based on DWS, 2017)

COMPONENT	MONITORING ACTION	TEMPORAL SCALE (FREQUENCY AND WHEN)	SPATIAL SCALE (NO. STATIONS)	PRIORITY
Hydro-dynamics	Record estuary water levels.	Continuous	In main water body	Red
	Observe mouth status	Daily or weekly	Mouth	Red
	Measure river inflow.	Continuous	Near head of estuary	Yellow
	Satellite photographs of estuary (30 x 30 m).	Every 3 years	Entire estuary	Red
Sediment dynamics	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	Yellow
	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	Yellow
Water quality	Water quality (e.g. system variables (e.g. pH, oxygen, turbidity), nutrients and toxic substances) measurements in freshwater entering the head of the estuary.	Monthly continuous	Close proximity to head of estuary	Orange
	<i>In situ</i> salinity and temperature observations.	Continuous	In main water body (1 to 3 stations)	Red
	Longitudinal salinity and temperature profiles (in situ) collected over a spring and neap tide during high and low tide at: End of low flow season (i.e. period of maximum seawater intrusion). Peak of high flow season (i.e. period of maximum flushing by river water).	Every year at end of dry season	Entire estuary (3-5 stations)	Orange
	Water quality measurements (i.e. system variables, and nutrients) taken along the length of the estuary (surface and bottom samples).	Seasonal surveys, every 3 years	Entire estuary (3-5 stations)	Orange
	Measurements of organic content and toxic substances (e.g. trace metals and hydrocarbons) in sediments along length of the estuary, where considered an issue.	Every 6 years	Focus on sheltered, depositional areas	Yellow
	Water quality (e.g. system variables, nutrients and toxic substances) measurements on near-shore seawater.	Use available literature	Seawater adjacent to estuary mouth at salinity 35	Yellow
Microalgae	Record relative abundance of dominant phytoplankton groups, i.e. flagellates, dinoflagellates, diatoms and blue-green algae.	Summer survey every 3 years	Entire estuary	Yellow

COMPONENT	MONITORING ACTION	TEMPORAL SCALE (FREQUENCY AND WHEN)	SPATIAL SCALE (NO. STATIONS)	PRIORITY
	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.	Summer survey every 3 years	Entire estuary	
	Intertidal and subtidal benthic chlorophyll-a measurements.	Summer survey every 3 years	Entire estuary	
Macrophytes	Ground-truthed 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	
	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.	Summer survey every 3 years	Entire estuary	
	Note extent of macroalgal blooms, floating aquatic macrophytes and area occupied by invasive vegetation.	Summer survey every 3 years	Entire estuary	
	Take measurements of depth to water table	Summer survey every 3 years	Upper reaches	
Invertebrates	Record species and abundance of zooplankton, based on samples collected across the estuary.	Summer survey every 3 years	Entire estuary (3-5 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.	Summer survey every 3 years	Entire estuary (3-5 stations)	
	Measures of sediment characteristics at each station.	Summer survey every 3 years	Entire estuary (3-5 stations)	
Fish	Record species and abundance of fish, based on seine net sampling.	Summer survey every 3 years	Entire estuary (3-5 stations)	
Birds	Undertake counts of all water associated birds, identified to species level.	Annual winter (Jul/Aug) and summer (Jan/Feb) surveys	Entire estuary	

Table 14: Recommended baseline monitoring requirements to improve the confidence of future EWR assessments (Priority: Red = High; Orange = Medium, Yellow = Low, White = Not relevant) (based on DWS, 2017)

COMPONENT	MONITORING ACTION	TEMPORAL SCALE (FREQUENCY AND WHEN)	SPATIAL SCALE (NO. STATIONS)	PRIORITY
Hydro-dynamics	Record estuary water levels.	Continuous	In main water body	Red
	Measure groundwater level.	Continuous	Near head of estuary	Red
	Measure river inflow.	Continuous	Near head of estuary	Yellow
	Satellite photographs of estuary (30x 30 m).	Once off	Entire estuary	Red
Sediment dynamics	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.	Once off (or in the case of a flood)	Entire estuary	Orange
	Set sediment grab samples (at cross section profiles) for analysis of Particle Size Distribution (PSD) and origin (i.e. using microscopic observations).	Once off (with invert sampling)	Entire estuary	Yellow
Water quality	Water quality (e.g. system variables (e.g. pH, oxygen, turbidity), nutrients and toxic substances) measurements in Groundwater entering the head of the estuary.	Breaching event, then quarterly for 2 years	Close proximity to head of estuary	Orange
	<i>In situ</i> salinity and temperature observations.	Continuous	In main water body (1 to 3 stations)	Red
	Longitudinal salinity and temperature profiles (in situ) collected over a spring and neap tide during high and low tide at: End of low flow season (i.e. period of maximum seawater intrusion). Peak of high flow season (i.e. period of maximum flushing by river water).	Breaching event, then quarterly for 2 years	Entire estuary (3-5 stations)	Yellow
	Water quality measurements (i.e. system variables, and nutrients) taken along the length of the estuary (surface and bottom samples).	Breaching event, then quarterly for 2 years	Entire estuary (3-5 stations)	Yellow
	Measurements of organic content and toxic substances (e.g. trace metals and hydrocarbons) in sediments along length of the estuary, where considered an issue.	Breaching event, then quarterly for 2 years	Focus on sheltered, depositional areas	Yellow
	Water quality (e.g. system variables, nutrients and toxic substances) measurements on near-shore seawater.	Use available literature	Seawater adjacent to estuary mouth at salinity 35	Yellow
Microalgae	Record relative abundance of dominant phytoplankton groups, i.e. flagellates, dinoflagellates, diatoms and blue-green algae.	Breaching event, then quarterly for 2 years	Entire estuary	Yellow

COMPONENT	MONITORING ACTION	TEMPORAL SCALE (FREQUENCY AND WHEN)	SPATIAL SCALE (NO. STATIONS)	PRIORITY
	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.	Breaching event, then quarterly for 2 years	Entire estuary	
	Intertidal and subtidal benthic chlorophyll-a measurements.	Breaching event, then quarterly for 2 years	Entire estuary	
Macrophytes	Ground-truthed maps to document changes in macrophyte habitats over time. Document area covered by sensitive habitats i.e. submedged macrophytes.	Breaching event, then quarterly for 2 years	Entire estuary	
	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.	Breaching event, then quarterly for 2 years	Entire estuary	
	Note extent of macroalgal blooms, floating aquatic macrophytes and area occupied by invasive vegetation.	Breaching event, then quarterly for 2 years	Entire estuary	
Invertebrates	Record species and abundance of zooplankton, based on samples collected across the estuary.	Breaching event, then quarterly for 2 years	Entire estuary (3-5 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.	Breaching event, then quarterly for 2 years	Entire estuary (3-5 stations)	
	Measures of sediment characteristics at each station.	Breaching event, then quarterly for 2 years	Entire estuary (3-5 stations)	
Fish	Record species and abundance of fish, based on seine net sampling.	Breaching event, then quarterly for 2 years	Entire estuary (3-5 stations)	
Birds	Undertake counts of all water associated birds, identified to species level.	Breaching event, then quarterly for 2 years	Entire estuary	

APPENDIX 2: RESOURCE QUALITY OBJECTIVES

Table 15: Water level and inundation RQOs for Jakkalsvlei Pan (estuary) (Category ≥C) (DWA, 2013)

COMPONENT	RQOS	
Hydrology and Hydrodynamics	<ul style="list-style-type: none"> Flows shall be sufficient to maintain the Jakkalsvlei Pan in an ecological condition that is equal to a C Category. 	
	Volume requirement	<ul style="list-style-type: none"> 0.5 MCM %nMAR = 19.2
	Flow	<ul style="list-style-type: none"> 0.03 m³/s mean of month with lowest flow (March)
	Period of inundation	<ul style="list-style-type: none"> July to November/December Floods: >60% of natural floods for July, August and September
	Depth	<ul style="list-style-type: none"> 1 m average depth
	Volume at average depth	<ul style="list-style-type: none"> 0.155 MCM
	Surface area at average depth	<ul style="list-style-type: none"> 25 ha
	Downward seepage losses	<ul style="list-style-type: none"> Negligible (estimated <0.001 m/d)
	Evaporation loss	<ul style="list-style-type: none"> 1.2 m/a
	Contribution from groundwater	<ul style="list-style-type: none"> Undetermined
	Frequency for meeting requirement	<ul style="list-style-type: none"> 1 or 2 years (provisional)
General conditions	<ul style="list-style-type: none"> There should be no expansion of agriculture or other landuses in to remaining intact wetland areas. 	

APPENDIX 3: RECOMMENDED PERFORMANCE MONITORING PLAN

Table 16: Recommended Performance Monitoring Plan for the management of Jakkalsvlei estuary

MANAGEMENT OUTPUT	PERFORMANCE INDICATOR	TEMPORAL SCALE (frequency)	RELEVANT LEGISLATION	RESPONSIBLE AUTHORITY
1. ESTUARINE HEALTH AND FUNCTION				
1.1 Secure adequate quantity and quality of freshwater input to improve and maintain ecosystem health and functioning	<ul style="list-style-type: none"> Recommended reserve(s) signed off and implemented Abstraction and discharge points identified and monitored Water resource utilisation plan developed Alien invasive vegetation programme developed and implemented Natural mouth dynamics monitored MMP and MaintMP developed, approved and implemented when necessary State of the estuary monitored Prioritised RDM monitoring activities undertaken Ecological health maintained as D category or improved 	<ul style="list-style-type: none"> Once a year 	NWA, CARA	DWS, DEA, BOfCMA, RMA, Cederberg LM, CapeNature
1.2 Ensure estuary requirements are integrated into catchment processes to ensure healthy water quality	<ul style="list-style-type: none"> EMP included into catchment management strategy Critical catchment and other maps updated Effective catchment management Good catchment water quality preserved Mapping updated 	<ul style="list-style-type: none"> Once a year 	NWA, NWA, MSA, CARA, NEM:BA, NEM:PAA	DWS, BOfCMA DFFE, Cederberg LM, CapeNature
1.3 Minimise pollution by addressing activities that lead to poor water quality	<ul style="list-style-type: none"> Water quality (WQ) monitoring programme implemented Effective waste collection and recycling programme developed and implemented Control of all polluting discharges/activities 	<ul style="list-style-type: none"> Quarterly for WQ monitoring programme Twice a year 	NWA, CARA	DFFE, Cederberg LM, CapeNature

MANAGEMENT OUTPUT	PERFORMANCE INDICATOR	TEMPORAL SCALE (frequency)	RELEVANT LEGISLATION	RESPONSIBLE AUTHORITY
	<ul style="list-style-type: none"> Effective functioning and sustainable discharge from waste water treatment works Environmental best practice in agriculture is implemented and enforced SUDS investigated 			
1.4 Ensure sustainable resource use through an effective level of compliance management	<ul style="list-style-type: none"> Status of fish and bait stocks determined. Level of extractive use established Carrying capacity established and enforced Signage installed, and compliance management undertaken 	<ul style="list-style-type: none"> Twice a year 	ICMA, MLRA	DFE, CapeNature, GCBC
2. BIODIVERSITY CONSERVATION				
2.1 Ensure the conservation of representative estuarine habitats and indigenous species	<ul style="list-style-type: none"> Custodianship on adjacent properties Spatial zonation plan implemented and enforced Ecological monitoring programme developed for birds and fish, particularly bird disturbance and species of concern Appropriate regulations and bylaws are gazetted and enforced to protect fauna and flora Reduced habitat degradation and inappropriate behaviour/activities 	<ul style="list-style-type: none"> Once a year 	ICMA, NEMA, MLRA, LUPA, NWA, MLRA NEM:BA	CapeNature, RMA, DFE, Cederberg LM, GCBC
3. LAND USE AND INFRASTRUCTURE DEVELOPMENT PLANNING				
3.1 Ensure appropriate and sustainable land use and coastal development in and around the Jakkalsvlei estuary	<ul style="list-style-type: none"> CML and its associated development controls implemented EMP included in IDP and SDF and EFZ and no-go areas incorporated to all relevant government department documents Bylaws developed and gazetted EAF used as a source of I&APs 	<ul style="list-style-type: none"> Annually 	ICMA, LUPA	Cederberg LM, West Coast DM, DEA&DP and applicable authorities
4. INSTITUTIONAL AND MANAGEMENT STRUCTURES				

4.1 Ensure effective co-ordination of estuarine management responsibilities	<ul style="list-style-type: none"> • EMP adopted and incorporated into Cederberg LM SDF • Regional Estuarine management function established in DEA&DP • Needs analysis and skills training etc. undertaken • Good communication and working relationship established with implementing agencies • Regional EAF supported and meets on quarterly basis • Stakeholder database maintained • Annual reporting undertaken by RMA • Funding secured for 5-year cycle 	• Quarterly	ICMA, NEMA, NWA	MSA, LUPA,	RMA, Cederberg LM, West Coast DM, applicable authorities
4.2 Define co-operative governance arrangements	<ul style="list-style-type: none"> • Active collaboration of various institutions, private and civil stakeholders • Individual agencies knowledgeable and with capacity and resources to carry out mandated actions 	• Annually	MSA, ICMA, WC, CARA	NWA, NEMA, BRA,	All applicable authorities
5. SOCIO-ECONOMIC CONSIDERATIONS					
5.1 Regulate recreational use of the estuary	<ul style="list-style-type: none"> • EFZ controls enforced and offenders prosecuted • Signage erected • Communication strategy developed for estuary users/landowners 	• Annually	ICMA, NEMA, NWA		RMA, Cederberg LM, West Coast DM, CapeNature, GCBC
5.2 Develop and regulate local livelihoods associated with the estuary	<ul style="list-style-type: none"> • Livelihood alternatives investigated • People assisted through training programmes • Livelihood protection planned 	• Annually	ICMA, NEMA, NWA		RMA, Cederberg LM, CapeNature, GCBC
6. EDUCATION AND AWARENESS					
6.1 Promote high levels of public awareness and appreciation of the value of estuaries	<ul style="list-style-type: none"> • Education & awareness programme developed and implemented • Educational and informative material indicating zonation and allowable activities (including signage, posters, and pamphlets) sourced 	• Every 3 years	ICMA		RMA, GCBC, CapeNature Cederberg LM, West Coast DM

	<ul style="list-style-type: none"> • Estuary users engaged 			
7. DISASTER RISK MANAGEMENT				
7.1 Reduce the potential risks within the estuary, inclusive of climate change impacts	<ul style="list-style-type: none"> • All developments and activities are legally compliant • Vulnerable areas rehabilitated • Key infrastructure defended • Pollution/spill contingency plan(s) developed and approved 	<ul style="list-style-type: none"> • Annually 	DMA, NEMA	RMA, WC DoT&PW, Cederberg LM, WC Dept of Local Gov: Disaster Management

APPENDIX 4: PROJECT PLAN TEMPLATE

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)																																																												
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Source: DEA (2015)