



Verlorenvlei Estuary Estuarine Management Plan

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I, Anton Bredell, Minister of Local Government, Environmental Affairs and Development Planning hereby approve the Verlorenvlei 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.

DOCUMENT USE

The South African National Estuarine Management Protocol (the Protocol), promulgated in May 2013 and amended in 2021, under the National Environmental Management: Integrated Coastal Management Act (Act No. 24 of 2008, as amended by Act No. 36 of 2014), sets out the minimum requirements for individual Estuarine Management Plans (EMPs).

In 2014, a review was conducted by the National Department of Environmental Affairs: Oceans and Coasts (DEA, 2014) on existing estuarine management plans which were products of the C.A.P.E. Estuaries Management Programme, to ensure, *inter alia*, the alignment of these plans with the Protocol.

The first revision of the Verlorenvlei Estuary Estuarine Management Plan (EMP), consisting of a Situation Assessment Report and the Management Plan itself, was primarily a response to the DEA review process, to ensure compliance with the minimum requirements for estuarine management plans as per the Protocol. In summary, this entailed:

- Updating the preliminary assessment with NBA 2018 Desktop Assessment results;
- Including socio-economic information in the Situation Assessment Report;
- Updating the terminology as per the Protocol;
- Updating the summary of the Situation Assessment;
- Including map of geographical boundaries based on Estuarine Functional Zone;
- Provision of performance indicators for the management actions;
- Extending the monitoring plan to explicitly include a performance monitoring plan to gauge progress towards achieving EMP objectives (i.e. using performance indicators); and
- Including a description of institutional capacity and arrangements to manage elements of EMP provided as per the Protocol.
- Embedding the Ecological Reserve and Catchment Classification (2021-2023) processes and results into updated EMP

The work of the original authors and input received from stakeholders remains largely unchanged. Historical information and data remain relevant and critically important for estuarine management in the long term and must be updated when new information becomes available. This revision does not represent, or replace, the full five-year review process required to re-evaluate the applicability of the plan and to provide new information. This full review process is therefore still urgently required and should be part of a future revision. Nonetheless, this EMP must be considered a living document that should be regularly updated and amended as deemed necessary.

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 Verlorenvlei Estuary Estuarine Management Plan.

EXECUTIVE SUMMARY

Introduction

Estuaries are recognised as particularly sensitive and dynamic ecosystems, and therefore require above-average care in the planning and control of activities related to their use and management. For this reason, the National Environmental Management: Integrated Coastal Management Act (No. 24 of 2008, as amended by Act 36 of 2014) (ICM Act), via the prescriptions of the South African National Estuarine Management Protocol (the Protocol), require Estuary Management Plans (EMPs) to be prepared for estuaries in order to create informed platforms for efficient and coordinated estuarine management.

Designated as a Ramsar site in 1991, Verlorenvlei Estuary is regarded as one of the ten most important wetlands for wading birds in the South-Western Cape. The Verlorenvlei Estuary is a unique system with multiple conservation assets (ecological, social, historical, cultural, architectural and archaeological). It has been listed as one of the estuaries with minimal development and in a good state to be conserved so as to control further developments. Despite the importance of this estuary in South Africa, it has no official conservation status.

The Verlorenvlei estuary was one of the first estuaries in the country for which an EMP was compiled as part of a pilot study under the auspices of the C.A.P.E. Estuaries Management Programme. The process of compiling an EMP for the Verlorenvlei estuary commenced in 2009 when a Situation Assessment Report was commissioned as a platform for the development of the EMP (CSIR, 2009b). The Draft EMP was compiled in 2010, with a revised version dated November 2010 being publicly available.

The further revision of the Draft Verlorenvlei Estuary EMP, including the Situation Assessment and the Management Plan itself, was a response to a review conducted by the National Department of Environmental Affairs: Oceans and Coasts in 2014, to ensure compliance with the minimum requirements for estuary management plans as per the Protocol. The final revision that took place in 2022 included a formal public participation process published for comment on the 28 of January 2022 and concluded on 04 March 2022. As a result of this recent process further minor edits took place.

Situation Assessment

Verlorenvlei Estuary is a system that is subjected to fluctuating water levels linked to dry and wet weather cycles. The water flowing into the system affects the water quality and level which in turn impacts on available habitat and species. Management objectives need to adapt and respond appropriately to these changing water levels.

For the purpose of this planning process, Verlorenvlei Estuary is considered to extend between the West Coast villages of Elands Bay (Cederberg Local Municipality) and Redelinghuys (Bergrevier Local Municipality). It opens into Elands Bay approximately 25 km south of Lambert's Bay, the nearest coastal town. Verlorenvlei Estuary (32°24'S 018°26'E) is one of the largest estuarine lakes in South Africa but is also one of the country's few coastal freshwater lakes.

Verlorenvlei Estuary functions as a freshwater dominated estuarine system: the mouth is perched and only allows occasional seawater inflow during high spring tides and stormy conditions at sea. A small estuarine channel about 2.6 km long connects the lake to the sea. The entire channel is very shallow (about 0.5 m deep), tending to inhibit free water exchange. During the dry summer months, the mouth is usually closed by a sandbar overlying a rocky sill and the estuarine channel may be reduced to a series of stagnant saline pools. When good rains provide sufficient water, the lake and estuary fill, and the bar is overtopped. The outflowing water scours the sandbar away thus permitting some tidal interaction.

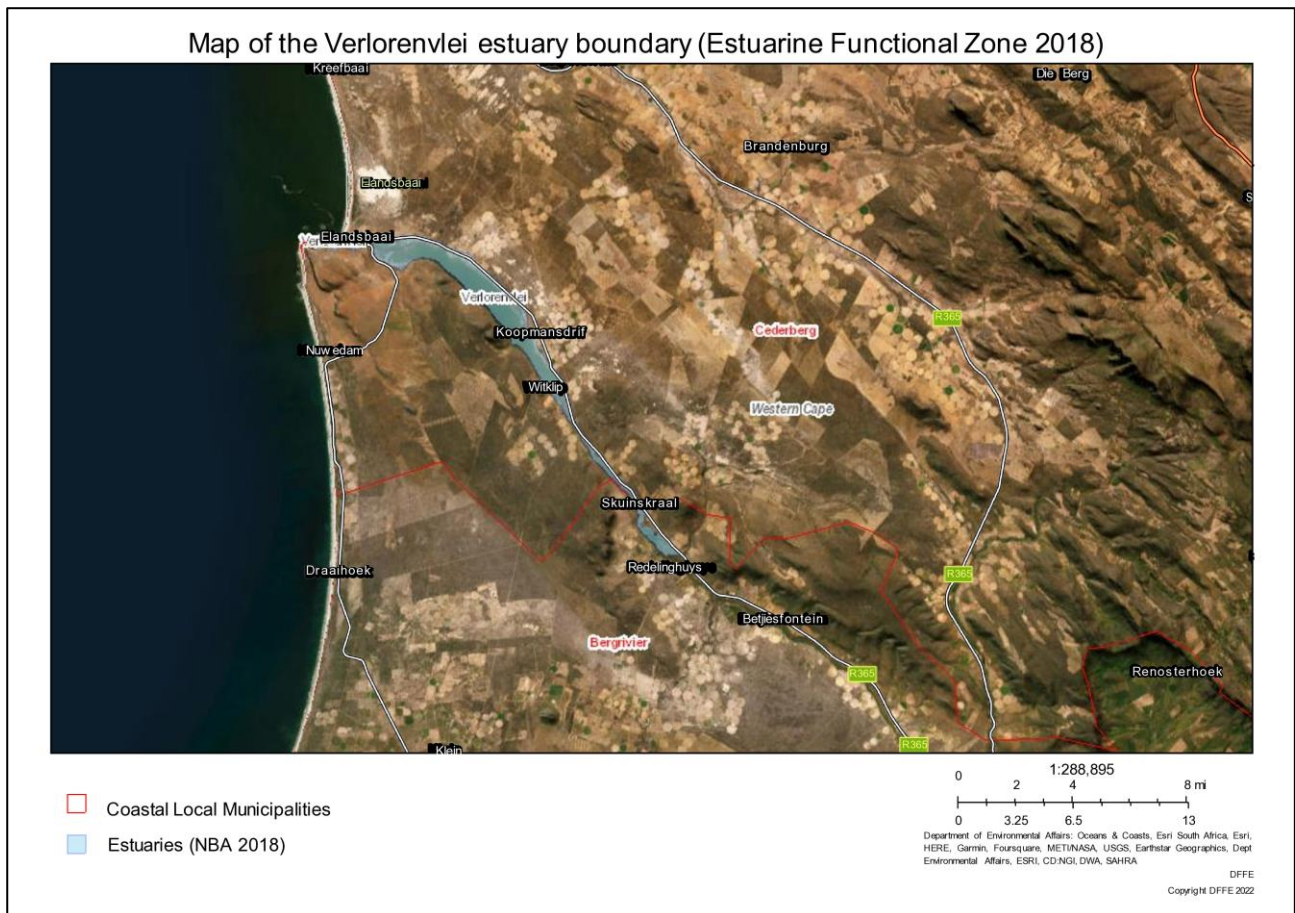


Figure 1: Locality map of Verlorenvlei Estuary

Tidal exchange continues until the velocity of the outflowing water decrease sufficiently to allow the accretion of sand to form a new bar at the mouth. During storms and high spring tides the sea washes over the sandbar. Sea water is reported to penetrate as far as Verloren Farm (Robertson 1980). High water levels in the estuarine lake area during wet periods will sustain the ecosystem during dry periods and periods of drought.

A desktop study to determine the Present Ecological Status (PES) for all estuaries in South Africa suggested a decline in the health of the estuary, mainly due large alterations to physical habitat, microalgae and fish which are currently in poor condition. The only ecological components considered to be presently in a good condition were water quality and the avifauna. Overall, the PES of the Verlorenvlei Estuary is now considered 'largely

modified', Category D. This indicates that a large loss of natural habitat, biota and basic ecosystem functions and processes has taken place.

The degradation of the system's health was largely attributed to:

- Significant reduction in the freshwater inflow (ground- and surface water) to the system;
- A decrease in open mouth conditions (i.e. frequency and duration);
- Increase in the nutrient and sediment load to the system;
- Possible increase in coverage by reeds and sedges; and
- Changes in the species composition and abundance of fish in the system.

Through stakeholder consultation, as part of the Situation Assessment (CSIR, 2009b), 16 key activities were identified as threatening (or potentially threatening) to the ecosystem services provided by Verlorenvlei Estuary:

- Veld fires in and around Verlorenvlei Estuary leading to soil erosion and increased sedimentation;
- Road infrastructure that stabilize the course of the vlei and the numerous crossings and culverts (e.g. road bridge to Elands Bay, crossings to Grootdrift and Redelinghuys, informal crossings near mouth and railway bridge) cutting across the system frequently restrict its flow, stabilizes its course and leads to increased reed growth;
- Riparian infrastructure especially the low-lying properties near the mouth of the system put pressure on local authorities to manage the water level in a system artificially;
- In-stream infrastructure like jetties and pumphouses could have a localized influence on circulation patterns in the vlei;
- Recreational activities such as boating and swimming may have a limited localized disturbance impact on the birdlife. Windsurfing, however, results in a high disturbance impact on the avifauna;
- Open-cast mining of tungsten and molybdenum is being proposed in the upper catchment of Verlorenvlei at Metonsoek;
- Artificial breaching of the mouth is rumoured to be undertaken to relieve back flooding of the floodplain (grazing land) in the upper vlei;
- Agriculture in the catchment - crop production and livestock grazing - results in increased soil erosion and related sedimentation, as well as agricultural return flow carrying leached fertilizer (nutrients) and agrochemicals;
- Water abstraction which causes a significant reduction in the inflow of freshwater to Verlorenvlei Estuary;
- Alien vegetation infestation in the catchment;
- Wastewater disposal which leads to nutrient enrichment and microbial contamination;
- Solid waste disposal especially leachate and litter from the municipal waste dump, which is situated within a few hundred metres of the vlei, can lead to microbial contamination, toxic substances entering the system or enrichment, whilst solid litter can lead to the entrapment of biota and reduction in the aesthetic value of the vlei.

Dumping of building rubble in unauthorized sites (e.g. on the “Island”) can lead to the loss of habitat and a decrease in aesthetic value;

- Harvesting of reeds and sedges can lead to reduction in the abundance of plant species, and the burning of reeds and sedges can lead to an increase in sedimentation and changes in the nutrient cycle of the vlei;
- Gill netting which leads to recruitment failure of estuarine associated species (including over-exploited species such as white steenbras) and results in a decrease of the system's nursery value; and
- Introduction of alien fish species has caused the displacement of indigenous species.

Vision and Objectives

The Vision Statement and related Objectives for Verlorenvlei Estuary were discussed at the Stakeholder Workshop held in September 2009 in Elands Bay.

Based on feed-back received from participants, the following Vision Statement is proposed for Verlorenvlei Estuary:

“From catchment-to-coast we are an integrated and empowered community, providing a fair standard of living to all, while protecting and proudly sharing the cultural, historical, archaeological and natural values of Verlorenvlei.”

The key Objectives for Verlorenvlei Estuary were discussed, and based on the feedback received from the participants the following main Objectives were proposed for Verlorenvlei Estuary:

KEY OBJECTIVES	
Ecological	The Verlorenvlei Estuarine ecosystem receives formal protection status under the Protected Areas Act, 2004 (by 2023)
	Further degradation (negative trajectory) of Verlorenvlei estuarine ecosystem is halted
	Ecological health of ecosystem is improved to Category C/B (moderately modified) (by year 2022) Ecological health of ecosystem is improved to Category A/B (near natural) (by year 2030)
Heritage	The cultural, historical and archaeological sites in and around Verlorenvlei Estuary receives official protection status (e.g. Protected Areas Act, National Heritage Act)
Socio-economic	The Estuary Forum is reconstituted (“integrated & empowered community”)
	The community (farmers, fishers, residents, commercial concerns, NGOs, authorities, etc.) functions in an integrated, cooperative manner through a trusting and fully representative Estuary Advisory Forum (“integrated & empowered community”)

A sustainable tourism market is established for the area, utilizing the diverse range of values offered by Verlorenvlei (“sharing values” and “valued visitors”)

Unemployment (and associated poverty) in the Verlorenvlei Estuary area is reduced through innovative job creation initiatives, e.g. tourism, fisheries, food security, ecological restoration, etc. (“fair standard of living”)

Spatial Zonation

The management objectives have been translated into an estuary zonation plan. The estuary zonation plan (and applicable management objectives) is consequently the blueprint against which all development, and any other activities which impact on the estuary, should be tested for compliance. **The inaccurate map in the draft EMP needs to be reviewed and edited to reflect the three zones accurately** as a priority action linked to the implementation of the EMP.

The current zonation, which was mainly derived from a habitat perspective, identifies only three broad zones:

ZONES	PROPOSED ACTIVITIES		RESPONSIBLE AGENT(S)
	ALLOWED	PROHIBITED OR CONTROLLED	
Primary Boundary (Red Zone Estuary Functional Zone 1)	Swimming Birding Canoeing Line fishing Light Grazing	Gillnetting Speed boating Driving through the flood plain Farming Sumps Discharges Solid waste dumping	DFFE Cederberg and Bergrevier LMs CapeNature DALRRD
Ecosystem Connectivity Zone 2 (Orange Zone)	Light grazing Development Recreational areas	Farming Solid waste dumping	DFFE Cederberg LM DALRRD
Ecosystem Connectivity Zone 3 (Yellow Zone)	Recreational areas Grazing Farming Development	Solid waste dumping	Cederberg and Bergrevier LMs DALRRD

Management Priorities

Nine project plans have been compiled for the efficient and effective management of the Verlorenvlei Estuary. Each plan corresponds to a key objective and contains applicable management actions, supporting regulations, responsible institution(s), required resources, allocated timeframe and level of priority if such information is available. These are arranged in general order of priority, but nevertheless recognize that the neglect of any leg will compromise overall success. These plans are:

- Conservation;
- Living Resource management;
- Water quantity and quality;
- Agriculture;
- Town and tourism development;
- Improved integration and collaboration among role players;
- Law enforcement and compliance;
- Funding sources and opportunities; and
- Innovative opportunities for job creation (e.g. including tourism opportunities).

Table 1: Summary of management action plans per Sector

		ACTION	INDICATORS	PRIORITY
Conservation	1.1	Reinforce Ramsar status of Verlorenvlei Estuary through promulgation as a formal Protected Area	The Verlorenvlei Estuary ecosystem is proclaimed a formal Protected Area	High
	1.2	Adopt a formal conservation zoning plan for Verlorenvlei Estuary (as part of the estuary zoning plan) and ensure that local IDP/SDF is aligned with this plan and that plan is incorporated in the IDP/SDF, and linked to other formal initiatives like Western Cape Protected Areas Expansion Strategy, updated Critical Biodiversity Area maps and Sandveld Environmental Management Framework, etc..	Estuary zoning plan and recommendations incorporated into IDP/SDF and acknowledged in formal initiatives Identification of extent of peat wetland in the EFZ	High
	1.3	Obtain formal protection of the heritage areas in and around Verlorenvlei Estuary	Heritage sites receive formal protection and heritage site database developed and maintained	Medium
	1.4	Prepare and implement a rehabilitation and restoration programme for Verlorenvlei Estuary	<ul style="list-style-type: none"> • Fine scale GIS map developed indicating areas requiring priority rehabilitation and restoration identified • Long term budget estimated and funding sourced • Rehabilitation and restoration programme implemented 	High
	1.5	Develop and implement a climate change adaptation plan for Verlorenvlei Estuary (in response to changes in freshwater flow, sea level rise, etc.)	Estuary-specific climate change adaptation plan developed, in line with the Provincial climate change adaptation plan	Medium
Living resources management	2.1	Eradicate alien fish in Verlorenvlei Estuary	Alien fish species and abundance decreased on annual basis	High
	2.2	Eradicate alien vegetation in Verlorenvlei Estuary through Working for Wetlands programme	<ul style="list-style-type: none"> • Alien vegetation eradication programme developed and implemented • Deployment of staff to the area, but preferential employment of locals • Alien vegetation cover greatly reduced 	High

ACTION		INDICATORS	PRIORITY
Water quantity and quality		<ul style="list-style-type: none"> On-going maintenance in terms of vegetation removal 	
	2.3 Investigate deterioration of fish health in Verlorenvlei Estuary	<ul style="list-style-type: none"> Research project devised and executed Results and recommendations published Mitigation measures implemented 	High
	2.4 Investigate the occurrence of avian botulism in wading bird population of Verlorenvlei Estuary	<ul style="list-style-type: none"> Research project devised and executed Results and recommendations published Mitigation measures implemented 	High
		•	
	3.1 Determine the Ecological water requirements of Verlorenvlei Estuary at a comprehensive level	Ecological water requirements determined, implemented and monitored to ensure compliance	High
	3.2 Develop and implement a water resource utilization plan (including registration & licensing)	<ul style="list-style-type: none"> Water resource utilisation plan developed and implemented (including monitoring and compliance) Catchment Classification process is completed in consideration of climate change, and all water resources are classified and reserves are secured Catchment Management Plan and Strategy is developed Database developed and maintained All water uses and users are registered and licensed 	High
	3.3 Prepare and implement a mouth management plan (to improve connection with the sea)	<ul style="list-style-type: none"> Mouth management plan developed and implemented Optimal functioning of estuary mouth maintained 	High
	3.4 Address sanitation and sewage treatment facilities in Redelinghuys & Elands Bay	<ul style="list-style-type: none"> Current maintenance plans reviewed and priorities identified Budget secured for priority maintenance activities/upgrades Sanitation and sewage treatment facilities upgraded and functioning optimally Improved water quality and reduced pollution into Verlorenvlei Estuary 	High
	3.5 Appropriately manage solid waste dump sites along Verlorenvlei Estuary	<ul style="list-style-type: none"> Environmental management plans developed for each dump site, and necessary permitting obtained Environmental best practice and appropriate management actions implemented Sites monitored for compliance with approved environmental management plans Illegal sites closed 	High
	3.6 Investigate impact of water abstraction on groundwater in Verlorenvlei Estuary	<ul style="list-style-type: none"> Research project devised and executed Results published Mitigation measures implemented Sandveld Area-wide Plan developed 	High

	ACTION	INDICATORS	PRIORITY
	3.7 Investigate the link between nutrient dynamics and algal blooms in Verlorenvlei Estuary	<ul style="list-style-type: none"> • Research project devised and executed • Results published • Mitigation measures implemented • Occurrence of algal blooms reduced 	High
	3.8 Design and implement a water quality monitoring programme for Verlorenvlei Estuary	<ul style="list-style-type: none"> • Water quality programme developed and implemented • Regular, documented monitoring undertaken • Database of results maintained • Regular reports produced, inclusive of recommendations • Recommendations implemented 	Medium
Agriculture	4.1 Develop and implement agricultural best practice specifically to reduce nutrient enriched return flow and sediment erosion (e.g. through Biodiversity and Potatoes/ Rooibos Initiatives)	<ul style="list-style-type: none"> • Agricultural best practice guidelines developed and published • Farmers and local communities made aware of such guidelines • Agricultural best practice implemented 	High
	4.2 Develop and implement a protocol for reed management in Verlorenvlei Estuary (addressing excessive growth, harvesting e.g. for thatching and burning)	<ul style="list-style-type: none"> • Protocol for reed management developed, implemented, monitored and enforced, with due consideration of natural processes of reed control (e.g. regular saline inundation etc.) • Areas, volumes and seasonality for reed harvesting and burning determined 	High
	4.3 Manage and control salt marsh grazing in Verlorenvlei Estuary	<ul style="list-style-type: none"> • Areas and grazing capacity determined • Grazing protocol developed • Cattle farmers /local communities involved in the development or made aware of such protocol • Grazing protocol implemented, with compliance monitoring and enforcement 	High
Town and tourism development	5.1 Remove or upgrade of road crossings through Working for Wetlands programme	<ul style="list-style-type: none"> • Priority road crossings and type of action identified • Project plan developed and implemented • All road crossings addressed (removal or upgrade) 	High
	5.2 Ensure appropriate development in and around Verlorenvlei Estuary through IDP/SDF	<ul style="list-style-type: none"> • Developed coastal management lines gazetted • Coastal management lines incorporated into IDP & SDF • Development excluded from sensitive areas, including EFZ • Applicable building controls applied to high risk areas 	High
	5.3 Increase and improve access (e.g. for birding) in Verlorenvlei Estuary	<ul style="list-style-type: none"> • Prime access points and appropriate type of access and facilities identified • Access needs for Verlorenvlei Estuary incorporated in municipal coastal access roll-out process 	High

	ACTION	INDICATORS	PRIORITY
Institutional arrangements & empowerment		<ul style="list-style-type: none"> Controlled access provided and maintained within Verlorenvlei Estuary 	
	6.1 Establish the Verlorenvlei Estuary Advisory Forum, comprising broader representation from relevant government authorities and the community. To give formal status to the forum a Terms of Reference must be drafted and approved by the RMA and stakeholders and will be a sub-committee of the Protected Area Advisory Committee in terms of NEM:PA..	<ul style="list-style-type: none"> Former Estuary Management Forum reconstituted into Estuary Advisory Forum and ToR agreed with CapeNature Members formally nominated and confirmed Quarterly EAF meetings convened integrated into the Provincial Coastal meeting cycle, Minutes of meeting compiled 	High
	6.2 Develop and deploy a human resource plan for implementation of Verlorenvlei Estuary EMP	<ul style="list-style-type: none"> ToR agreed to by various government departments and other institutions Project champions assigned Departmental project plans developed and implemented 	High
Law enforcement and compliance	6.3 Develop and deploy an education and awareness programme for Verlorenvlei Estuary	<ul style="list-style-type: none"> Education and awareness programme developed and implemented Strategically placed signage in and around Verlorenvlei Estuary Dissemination of information via website, newsletters, pamphlets relating to both environmental education and compliance awareness 	High
	7.1 Sign an MoU (CapeNature and DFFE Enforcement Operational Plan) to increase compliance capacity and formalize agreement on the removal of gillnetting	<ul style="list-style-type: none"> MoU signed Deployment of additional compliance officers/conservancy rangers Additional patrols undertaken Database of offenders developed and maintained Gillnetting (legal and illegal) phased out entirely 	High
	7.2 Increase environmental law enforcement and compliance capacity with respect to pollution (e.g. from waste and wastewater and agricultural return flows)	<ul style="list-style-type: none"> Appropriate waste management facilities/infrastructure established and maintained (e.g. rubbish bins) Designated pollution compliance and enforcement units deployed to Verlorenvlei Estuary and surrounding areas Improved compliance with applicable standards (e.g. water quality standards) and municipal by-laws 	High
	7.3 Increase environmental law enforcement and compliance capacity with respect to water quantity (abstractions)	<ul style="list-style-type: none"> Ecological flow requirements (EFR) determined for Verlorenvlei Estuary Verlorenvlei Estuary EFR considered in issuing of abstraction permits Database of licensed and illegal users maintained Illegal users/uses convicted and appropriately penalised 	High

	ACTION	INDICATORS	PRIORITY
Funding	7.4 Increase environmental law enforcement and compliance with respect to infrastructure development and land-use	<ul style="list-style-type: none"> Verlorenvlei EAF registered as an Interested & Affected Party for all developments and rezoning applications surrounding the estuary Increased monitoring of compliance with Environmental Authorisations Increased monitoring of compliance with building controls 	High
	7.5 Develop a safety and security plan for the Verlorenvlei Estuary area (e.g. "Buurtwag")	<ul style="list-style-type: none"> Safety and security plan developed and implemented Deployment of additional security officers Additional patrols undertaken Database of offenders developed and maintained Offenders convicted and appropriately penalised 	Medium
	8.1 Prepare a financial plan for the implementation of the Verlorenvlei Estuary EMP	<ul style="list-style-type: none"> Financial plan developed MoUs signed with relevant responsible departments and institutions Sufficient and effect use of funding Project plans implemented 	High
Innovative opportunities for job creation	9.1 Investigate and deploy job opportunities for communities in the Verlorenvlei Estuary area linked to tourism (e.g. guides for hiking trails/boat trip)	<ul style="list-style-type: none"> Enhanced local economic development (e.g. through SMMEs) Increase in employment rate surrounding Verlorenvlei Estuary Reduction in poverty index 	High
	9.2 Investigate and deploy projects the area to increase food security, e.g. hydroponics programme or ecological restoration/rehabilitation	<ul style="list-style-type: none"> Feasibility study conducted Results published and funding secured Job creation programme initiated Increase in employment rate surrounding Verlorenvlei Estuary Improved food security for Verlorenvlei Estuary communities Access EPWP programme 	High
	9.3 Develop a suitable venue for a range of activities, including a museum of the area, a wetlands museum and interpretive centre and a training centre for supporting the establishment of work opportunities in the community	<ul style="list-style-type: none"> Development options investigated and approved Funding secured Project plan developed and implemented Information centre developed Increase in number of visitors Increase in number of school tours / events 	Medium

Institutional Arrangements

In line with the Protocol (2021), the development and co-ordination of the implementation of the EMP, and thus overall responsibility in terms of effecting estuarine management of the Verlorenvlei estuarine system, lies with **CapeNature, i.e. the designated Responsible Management Authority (RMA)**.

In addition, an Estuary Advisory Forum (previously Estuary Management Forum) exists to assist the RMA. **It is recommended that the RMA considers the continuation of the existing stakeholder communication platform (the estuary forum) so as to provide an advisory service to the RMA on issues specific to the management and implementation of the EMP.**

Further to this, the forum will also serve as the hub that links all stakeholders, which in turn will serve to foster stakeholder engagement and cooperative governance. Nonetheless, the future role of the existing Verlorenvlei Estuary EAF will need to be confirmed by CapeNature.

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ACRONYMS AND ABBREVIATIONS

amsl	Above mean sea level
C.A.P.E.	Cape Action for People and the Environment
CapeNature	Western Cape Nature Conservation Board
CARA	Conservation of Agricultural Resources Act (Act No. 43 of 1983)
CFR	Cape Floristic Region
CSIR	Council for Scientific and Industrial Research
CWAC	Coordinated Waterbird Counts
DFFE	Department of Forestry, Fisheries and Environment
DEA	Department of Environmental Affairs
DALRRD	Department of Agriculture, Land Reform and Rural Development
DEA: O&C	Department of Environmental Affairs: Oceans & Coasts Branch (formerly MCM)
DEA&DP	Western Cape Government's Department of Environmental Affairs & Development Planning
DIN	Dissolved Inorganic Nitrogen
DIP	Dissolved Inorganic Phosphorous
DM	District Municipality
DO	Dissolved Oxygen
DoT	Department of Tourism
DWS	Department of Water and Sanitation (previously DWA/F)
EAF	Estuary Advisory Forum
EFZ	Estuarine Functional Zone
EIA	Environmental Impact Assessment
EMP	Estuary Management Plan
EPWP	Expanded Public Works Programme
EZP	Estuary Zonation Plan
ha	hectares
HWM	High-Water Mark
I&AP	Interested and Affected Party
ICM Act	National Environmental Management: Integrated Coastal Management Act (Act No. 24 of 2008)
IDP	Integrated Development Plan
LM	Local Municipality
NBA	National Biodiversity Assessment
MAP	Management Action Plan
MCM	Directorate Marine and Coastal Management (DEA)
MLRA	Marine Living Resources Act (Act No. 18 of 1998) as amended
MSA	Municipal Systems Act (Act No. 32 of 2000)
NEM:BA	National Environmental Management: Biodiversity Act (Act No. 10 of 2004) as amended
NEM:PAA	National Environmental Management: Protected Areas Act (Act No.57 of 2003)
NEM:WA	National Environmental Management: Waste Act (Act No. 59 of 2008) as amended
NEMA	National Environmental Management Act (Act No. 107 of 1998) as amended
NGO	Non-governmental Organisation
NWA	National Water Act (Act No. 36 of 1998) as amended
PAR	Photosynthetically Active Radiation
PSU	Practical Salinity Units
RDM	Resource Directed Measures
RMA	Responsible Management Authority
SDF	Spatial Development Framework
TDS	Total Dissolved Salts
The Protocol	National Estuarine Management Protocol
TPC	Threshold of Potential Concern

1 INTRODUCTION

1.1 Background

Estuaries are recognised as particularly sensitive and dynamic ecosystems, and therefore require above-average care in the planning and control of activities related to their use and management. For this reason, the National Environmental Management: Integrated Coastal Management Act (No. 24 of 2008, as amended by Act 36 of 2014) (ICM Act), via the prescriptions of the South African National Estuarine Management Protocol (the Protocol), require Estuary Management Plans (EMPs) to be prepared for estuaries in order to create informed platforms for efficient and coordinated estuarine management.

Designated as a Ramsar site in 1991, Verlorenvlei Estuary is regarded as one of the ten most important wetlands for wading birds in the South-Western Cape. The estuary is a unique system with multiple conservation assets (ecological, social, historical, cultural, architectural and archaeological). It has been listed as one of the estuaries with minimal development and in a good state to be conserved so as to control further developments. Despite the importance of this estuary in South Africa, it has no official conservation status.

The Verlorenvlei Estuary was one of the first estuaries in the country for which an EMP was compiled as part of a pilot study under the auspices of the C.A.P.E. Estuaries Management Programme. The process of compiling an EMP for the Verlorenvlei Estuary commenced in 2009 when a Situation Assessment Report was commissioned as a platform for the development of the EMP (CSIR, 2009b). The Draft EMP was compiled in 2010, with a revised version dated November 2010 being publicly available.

The first revision of the Verlorenvlei Estuary EMP, including the Situation Assessment and the Management Plan itself, was a response to a review conducted by the National Department of Environmental Affairs: Oceans and Coasts in 2014, to ensure compliance with the minimum requirements for estuary management plans as per the Protocol.

In preparation for the final EMP approval process, the draft EMP was published for public comment from 28 January to 04 March 2022. 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 Verlorenvlei Estuary Estuarine Management Plan.

1.2 Purpose and scope of Verlorenvlei Estuary Estuarine Management Plan

Drawing on the Situation Assessment prepared for the Verlorenvlei Estuary (CSIR, 2009), inputs from key stakeholders and other supporting documents prepared, the Verlorenvlei Estuary Estuarine Management Plan (EMP) sets out the Vision and Objectives for the Verlorenvlei Estuary. It also identifies the management objectives required to meet these key objectives, which correspond to sectors of governance (e.g. conservation, water regulation, etc.), and indicates the main strategic activities required in the five years

following adoption in order to achieve the overall vision. A plan of implementation is provided for each key objective and will result in a number of deliverables. While planning for some emergencies (e.g. floods) is part of the Verlorenvlei Estuary EMP, it remains possible that unforeseen disasters could disrupt the prioritisation set out here.

This EMP is a strategic planning document, and as such does not provide detailed, routine planning for the management of the estuary. This detail should be captured by the Responsible Management Authority (RMA), or its assigned representative, in its Governance Tool, annual budget, Plan of Operations, Integrated Development Plan (IDP), Annual Performance Plan (APP) etc. (as applicable) with the management plan forming the basis for more fine-scale planning. Furthermore, the ICM Act provides for a report to be submitted to National DFFE every two years in respect to implementation once an EMP has been signed off and approved. The EMP should also be recognized as a dynamic document, whereby certain components could be revised as important new information becomes available and management priorities change. Adaptive management should be continually pursued through a process of annually reviewing the progress made in achieving the management objectives. Finally, the management plan should be subject to a comprehensive revision on a five-year cycle, as required by the Protocol.

The flow diagram in Figure 2 below shows how the EMP for the Verlorenvlei Estuary (this document) links with other documentation (e.g. the Situation Assessment Report) and Stakeholder consultation processes, and how it is embedded within annual and longer-term management and review processes.

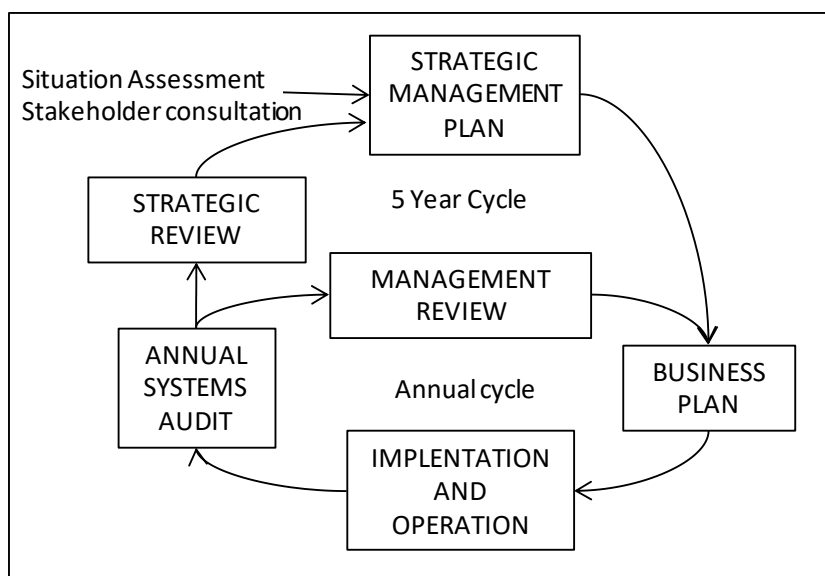


Figure 2: Process of Review and Implementation

1.3 Legal framework and mandates

Chapter 4 of the National Environmental Management: Integrated Coastal Management Act (No. 24 of 2008, as amended by Act 36 of 2014) (ICM Act), aims to facilitate the efficient and coordinated management of all estuaries, in accordance with:

- a) The Protocol (Section 33) approved by the Ministers responsible for the environment and water affairs; and
- b) Estuarine management plans for individual estuaries (Section 34).

The Protocol itself, promulgated in 2013 and amended in 2021, provides a national policy for estuarine management and guides the development of individual EMPs. It must be ensured that the EMPs are aligned with the Protocol and the National Coastal Management Programme (CMP) (DEA 2014). The Protocol lays out the following:

- a) The strategic vision and objectives for achieving effective integrated management of estuaries in South Africa;
- b) The standards for the management of estuaries;
- c) The procedures regarding how estuaries must be managed and how the management responsibilities are to be exercised by different organs of state and other parties;
- d) The minimum requirements for EMPs;
- e) Who must prepare EMPs and the process to be followed in doing so; and
- f) The process for reviewing EMPs to ensure that they comply with the requirements of the ICM Act.

One of the pillars of successful integrated coastal (including estuarine) management is the establishment of effective institutional arrangements to underpin both cooperative government and cooperative governance. Cooperative governance is a system that allows government and civil society to communicate and contribute to shared responsibility in respect of coastal management objectives and must be well-organized and widely representative of all coastal stakeholders. The ICM Act details the institutional arrangements that will contribute to cooperative coastal management in South Africa. These arrangements are made at national, provincial and municipal government levels, and the embodiment of cooperative coastal governance is vested in what will be known as coastal committees. The ICM Act provides for the permissive, i.e. if so required, establishment of municipal coastal committees, but at a national and provincial level however, the Minister and Members of the Executive Council (MECs) of coastal provinces are directed to establish national and provincial coastal committees, respectively. Provincial coastal committees must be established within one year of the commencement of the ICM Act.

The National Coastal Committee (linked to the MINTEC Working Group 7) is established by the Minister, and its powers determined by notice in the Government Gazette. It is supported administratively by the National Department of Environmental Affairs (DFFE). The Premier of each coastal province must identify a lead agency (organ of state) that is responsible for the coordination, monitoring and implementation of the provincial coastal management programme, monitoring the state of the environment in the coastal zone, and identifying

relevant trends and priority issues. The lead agency for coastal management is directly responsible to the MEC. Each metropolitan, district or local municipality which has jurisdiction over the coastal zone may establish a municipal coastal committee. The establishment of Municipal Coastal Committees is discretionary.

The lowest tier of institutional arrangements for estuarine management comprises the RMA and the estuary advisory forums. The role of the estuary advisory forum is to act as the hub which links all stakeholders, including both organs of state and civil society, so as to facilitate cooperative management and effective governance in terms of the EMPs, as well as facilitate and monitor implementation of an EMP. The role of RMA is for developing and co-ordinating implementation of EMPs. **The CapeNature Governance Tool will be used to track and report on the implementation of the management objectives.**

1.4 Mandate and responsibilities of the RMA

The Protocol identifies the **CapeNature** as the management authority responsible for developing and co-ordinating implementation of the Verlorenvlei Estuary Estuarine Management Plan, as the entire estuary is identified as a priority estuary in the Western Cape Protected Area Expansion Strategy.

The RMA is responsible for overall co-ordination of the actions of other implementing agencies, and not the implementation actions themselves. Section 7.3 of the Protocol indicates that:

“...management actions...shall be translated into project plans by the responsible government department that is responsible for certain aspects of estuary management (as per legislative mandates)...”

Specifically, the RMA responsibilities are described by the Protocol as:

Section 5: *“...authorities are **responsible for the development of EMPs and coordination of the implementation process...**”*

Section 5(7)(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 that protected area's management plan as contemplated in section 39 of NEMPAA.”*

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

- a) follow a public participation process in accordance with Part 5 of Chapter 6 of the ICM Act; and
- b) ensure that the EMP and the process by which it is developed are consistent with:
 - i) the Protocol; 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 ICM Act;
- 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, CapeNature, and its strategic partners (Cederberg Local Municipality, West Coast District Municipality (WCDM), Western Cape Provincial Government, Department of Water and Sanitation (DWS), Department of Forestry, Fisheries and Environment (DFFE) Department of Agriculture, Land Reform and Rural Development (DALRRD), will be supported by the Verlorenvlei Estuary Advisory Forum (VEAF) representing key stakeholders on the estuary. CapeNature will be implementing the EMP through the use of a governance tool.

2 SUMMARY OF SITUATION ASSESSMENT

2.1 Summary of Problems and Impacts

Verlorenvlei Estuary is a system that is subjected to fluctuating water levels linked to dry and wet weather cycles. The water flowing into the system affects the water quality and level which in turn impacts on available habitat and species. Management objectives need to adapt and respond appropriately to these changing water levels. Through stakeholder consultation, as part of the Situation Assessment (CSIR, 2009b), 16 key activities have been identified as threatening (or potentially threatening) to the ecosystem services provided by Verlorenvlei Estuary. The following section provides a brief description of these key activities:

- Veld fires in and around Verlorenvlei Estuary lead to soil erosion and increased sedimentation. This can be particularly problematic at Verlorenvlei Estuary as it has a constricted outlet that prevents sediment scouring during floods leading to an accumulation of sediments in the system.
- Road Infrastructure refers to the roads and embankments in the floodplain and the crossings and culverts that transverse it. The roads and embankments stabilize the course of the Verlorenvlei and often create a different substrate character compared with the natural situation. The numerous crossings and culverts (e.g. road bridge to Elandsbay, crossings to Grootdrift and Redelinghuys, informal crossings near mouth and railway bridge) cutting across the system frequently restrict its flow, stabilizes its course and leads to increased reed growth. The construction of informal crossings near the mouth and at the railway bridge has led to the destruction of habitat and disturbance of bird life.
- Riparian Infrastructure refers to all infrastructure in the floodplain of the system. Of particular concern are the low-lying properties near the mouth of the system, i.e. along the estuarine channel. There are numerous examples along the coast where this type of urban creep starts putting pressure on local authorities to manage the water level in a system artificially. An additional concern is the many fences that span the floodplain that restrict access and result in overgrazing in the areas where animals are kept. This causes changes in the species composition of the floodplain vegetation.
- In-stream infrastructure refers to jetties and pumphouses that could have a localized influence on circulation patterns in the Verlorenvlei Estuary.
- Recreational activities include non-consumptive activities such as boating and swimming that may have a limited localized disturbance impact on the birdlife. Windsurfing, however, results in a high disturbance impact on the avifauna.
- Open-cast mining of tungsten and molybdenum is being proposed in the upper catchment of Verlorenvlei at Metonshoek. This mining development is likely to need significant freshwater supplies, hold significant risk for the sense of place in the area and can potentially cause pollution of the freshwater supplies flowing into Verlorenvlei Estuary.
- Artificial breaching of the mouth is rumoured to be undertaken as a result of the back flooding of the floodplain (grazing land) in the upper Verlorenvlei Estuary. Artificial

breaching can lead to loss of water column habitat and a reduction in estuarine productivity.

- Crop production and livestock grazing in the catchment results in increased soil erosion and related sedimentation. This in turn is linked to increased reed growth in the upper reaches and a decrease in water clarity. Crop production is also linked to agricultural return flow carrying leached fertilizer (nutrients) and agrochemicals, a decrease in freshwater input and loss of riparian habitat.
- Water abstraction, specifically sumps, river, groundwater and direct abstraction which collectively cause a significant reduction in the inflow of freshwater to Verlorenvlei Estuary. This decreases the average water level in the Verlorenvlei Estuary, prevents regular natural breaching of the mouth and increases isolation of the system from the sea. Reduced water levels and flushing in turn has led to increased reed growth and blooms (blue green algae or parrot's feather).
- Alien vegetation infestation in the catchment of Verlorenvlei Estuary has contributed significantly to a decrease in surface and groundwater flow to the system.
- Wastewater disposal includes the disposal of non-reticulated sewage, washings from fishing boat and discharging of wastewater from a local pig farm. In appropriate disposal of waste water leads to nutrient enrichment and microbial contamination.
- Solid waste disposal especially leachate and litter from the municipal waste dump, which is situated within a few hundred metres of the Verlorenvlei Estuary, can lead to microbial contamination, toxic substances entering the system or enrichment. Solid litter can lead to the entrapment of biota and reduction in the aesthetic value of the Verlorenvlei Estuary. Dumping of building rubble in unauthorized sites (e.g. on the "Island") can lead to the loss of habitat and a decrease in aesthetic value.
- Agricultural return flow carrying leached fertilizers causes nutrient enrichment, which in turn leads to the blue-green algal blooms or extensive growth of parrot's feather. A relatively recent phenomenon is the occurrence of avian botulism in wading birds, also linked to poor water quality.
- Harvesting of reeds and sedges can lead to reduction in the abundance of plant species. While the burning of reeds and sedges can lead to an increase in sedimentation and changes in the nutrient cycle of the Verlorenvlei Estuary.
- Gill netting refers to the targeting of indigenous estuarine dependant and associated fish species for local consumption. Gillnetting leads to recruitment failure of estuarine associated species (including over-exploited species such as white steenbras) and results in a decrease of the system's nursery value. It also may enable alien fish species to become established.
- Introduction of alien fish species has caused the displacement of indigenous species.
- Livestock grazing in the riparian zone reduces the vegetation cover which, in turn, allows greater amounts of sediment to be washed into the Verlorenvlei Estuary during heavy rains. In addition, overgrazing will also lead to changes in the species composition/abundance of the vegetation around the system.
- Alien vegetation infestation in the floodplain leads to changes in the species composition (biodiversity loss) and reduction in water level.

The different activities contribute to an array of problems and associated environmental impacts and socio-economic consequences, when managed inappropriately, as illustrated in

Table 2 and

Table 3.

From these tables, it is clear that there are no one-to-one linkages between the activities, problems and impacts – several activities can contribute to one or more problems which, in turn, can contribute to more than one impact, and vice versa.

Table 2: An overview of key activities and linkages to potential environmental problems if managed inappropriately

CATEGORY	ACTIVITY	PROBLEM							
		Siltation	Physical habitat alteration/ destruction	Alteration of salinity regime	Eutrophication	Toxic chemical pollution	Microbial contamination	Littering	Suspended solids Direct Alteration of biomass/species
Land-use & Infrastructure Development	Alien vegetation infestation in flood plain	X	X	X					X
	Veld fires	X	X						X X
	Road Infrastructure (including roads, crossings, culverts)	X	X	X					X
	Riparian Infrastructure (including fences, bird hides, low-lying developments)	X	X	X					X
	In-stream infrastructure (e.g. jetties, pumphouses)	X	X						
	Recreational activities (boating, windsurfing, swimming)		X					X	X
	Mining (Tungsten/Molybdenum)	X	X			X			X
	Artificial breaching		X						X
	Agriculture: Crop production & Livestock in catchment	X	X		X	X	X		X
Water Quantity & Quality	Water abstraction (river, groundwater, direct abstraction, sumps)		X	X	X				
	Alien vegetation infestation in catchment causing flow reduction		X	X	X				X
	Wastewater disposal (non-reticulated sewage, boat washing, effluent from farms)				X	X	X		
	Solid waste disposal (building rubble, leaches and litter from municipal dump)		X			X	X	X	X
	Agricultural return flow			X	X	X	X		X
Living Resources	Harvesting and burning of reeds and sedges		X		X				X X
	Gill netting of indigenous fish species							X	X
	Introduction of alien fish species								X X
	Agriculture: Livestock grazing of riparian zone	X	X						X

Table 3: Environmental impacts and socio-economic consequences potentially associated with specific problems

ENVIRONMENTAL IMPACTS AND SOCIO-ECONOMIC CONSEQUENCES	PROBLEM								
	Siltation	Physical habitat alteration/destruction	Alteration of salinity regime	Eutrophication	Toxic chemical pollution	Microbial contamination	Littering	High Suspended solids	Direct Alteration of biomass/species
<u>ENVIRONMENTAL IMPACTS</u>									
Modification/loss in species composition	X	X	X	X	X	X		X	X
Smothering of benthic communities	X	X		X			X	X	
Entanglement of organisms (e.g. birds)							X		
Chronic effects on biota			X	X	X	X		X	
Mortality (acute effects) on biota			X	X	X	X		X	
Opportunistic/Nuisance/Harmful algal blooms			X	X					
Anoxic conditions		X		X					
Pathogenic infections in biota				X	X	X			
<u>PUBLIC HEALTH & SAFETY</u>									
Human health and safety risks through recreational activities		X		X	X	X			
Human health risk through ingestion of contaminated seafood				X	X	X			
<u>FOOD SECURITY & POVERTY</u>									
Loss in quality of seafood products				X	X	X		X	X
Loss of fisheries resources and revenue		X	X	X	X	X		X	X
<u>OTHER SOCIO-ECONOMIC IMPACT</u>									
Loss of aesthetic value (e.g. for tourism)	X	X		X			X	X	X
Loss of coastal real estate, public facilities and recreational potential		X		X		X	X	X	X

2.2 Summary of Legislation and Responsibilities

As part of the Situation Assessment (CSIR, 2009b), an array of existing Acts (both national and provincial) governs the activities were identified as posing threats to the ecosystems services provided by Verlorenvlei Estuary. A summary of relevant Acts and responsible departments/authorities pertaining to the different activities is provided in Table 4.

Table 4: Summary of relevant legislation and responsible departments/authorities pertaining to identified activities in Verlorenvlei Estuary

CATEGORY	ACTIVITY	RELEVANT LEGISLATION	RESPONSIBLE DEPARTMENT/ AUTHORITY
Land-use & Infrastructure Development	Alien infestation	National Water Act (NWA) 1998 Conservation of Agricultural Resources Act (CARA) 1983 Biodiversity Act 2004	Dept of Water and Sanitation (DWS) Dept of Environmental Affairs, Forestry and Fisheries (DFFE) Dept of Environmental Affairs (DEA) Government landowners
	Veld fires	CARA 1983 Biodiversity Act 2004 Veld & Forest Fires Act 1998	DFFE Fire Departments and (FPAs) associations
	Road Infrastructure	Municipal Systems Act 2000 Integrated Development Plans (IDPs)	Dept. Provincial and Local Government Local Authorities
	Riparian Infrastructure	Municipal Systems Act 2000 IDPs	Dept. Provincial and Local Government Local Authorities
	In-stream infrastructure	NWA 1998 Integrated Coastal Management Act (ICM Act) 2008 Municipal Systems Act 2000	DWS DFFE Dept. Provincial and Local Government/ Local Authorities
	Recreational activities	NWA 1998 Marine Living Resources Act (MLRA) 1998 Western Cape Biodiversity Act: 6 of 2021 Provincial Conservation Ordinances ORV Regulations	DWS DFFE CapeNature
	Mining	Mineral and Petroleum Resources Development Act 2002	Dept of Mining (DM)
	Artificial breaching	NWA 1998/ICM Act 2008	DEA&DP DWS/DFFE
	Agriculture: Crop production and livestock	NWA 1998 CARA 1983	DWS DALRRD
	Water abstraction	NWA 1998 Water Services Act IDP	DWS Local Authorities
Water Quantity & Quality	Wastewater disposal	NWA 1998/ Water Services Act ICM Act 2008 IDP	DWS DFFE Local authority

CATEGORY	ACTIVITY	RELEVANT LEGISLATION	RESPONSIBLE DEPARTMENT/ AUTHORITY
	Solid waste disposal	ICM Act 2008/ NEMA 1998 National Environmental Management: Waste Act, 2008 Solid Waste Management By- laws	DWS Local Authorities
	Agricultural return flow	NWA 1998 CARA 1983	DWS DALRRD
Living Resources	Harvesting and burning of reeds and sedges	CARA 1983 MLRA 1998	DALRRD DFFE: O&C
	Gill netting	MLRA 1998 Provincial Conservation Ordinances Western Cape Biodiversity Act: 6 of 2021	DFFE: O&C CapeNature
	Introduction of alien fish species	MLRA 1998 Western Cape Biodiversity Act: 6 of 2021 Provincial Conservation Ordinances	DFFE CapeNature
	Agriculture: Livestock grazing in flood plain	CARA 1983 MLRA 1998	DALRRD DFFE: O&C

2.3 Summary of Existing Responses

As part of the Situation Assessment (CSIR, 2009b), it was identified that many instances activities that pose a threat to the ecological and socio-economic ecosystem services provided by Verlorenvlei Estuary are governed by specific legislation. Also, there are a number of existing management actions or responses aimed at mitigating or minimising such threats. A summary of the estimated severity of the impacts, as well as the status of existing legislation and management initiatives pertaining to specific activities is provided in Table 5. Note that this is not an absolute rating but rather a qualitative evaluation to enable prioritization of management actions.

Table 5: Summary of (negative) impacts on Verlorenvlei Estuary (depicted as H= high; M = medium; L = low) and the status of existing legislation and management initiatives (G = good; F = fair; P = poor) pertaining to identified activities

CATEGORY	ACTIVITY	"IMPACT"		"RESPONSE"	
		Ecological Impact Severity	Socio-Economic Impact Severity	Legislation	Management Responses
Land-use & Infrastructure Development	Agriculture: Crop production	H	L	F	F
	Alien infestation	M	L	F	G
	Veld fires	L	L	G	F
	Road Infrastructure	L	L	F	F
	Riparian Infrastructure	M	L	G	F
	In-stream infrastructure	L	L	F	F
	Recreational activities	L	L	F	G
	Mining (proposed)	H	H	P	F/P
	Artificial breaching	H	L	F	P
	Solid waste disposal	L	L	G	P
Water Quantity & Quality	Water abstraction	H	H	G	P
	Wastewater disposal (non-reticulated sewage & wash water from boats)	M	M	F	P
Living Resources	Harvesting and burning of reeds and sedges	M	L	F	P
	Gill netting	H	M	G	F/P
	Introduction of alien fish species	H	M	G	P
	Agriculture: Livestock	H	L	F	P

2.4 Future Situation Assessment

Once the EMP is being implemented, the Situation Assessment will constitute the review and auditing process during which the outcomes of the EMP (and associated monitoring programmes) are used to prepare Annual Assessment Reports, or five-yearly State-of-the-Estuary Reports, to inform management on the consequences and effectiveness of the process.

3 VISION AND KEY OBJECTIVES

3.1 Vision Statement

The Vision statement for Verlorenvlei Estuary was discussed at the Stakeholder Workshop held in September 2009 in Elands Bay. Participants were asked to propose vision statements for the area. Based on the feed-back received from the participants, the following Vision Statement is proposed for Verlorenvlei Estuary:

"From catchment-to-coast we are an integrated and empowered community, providing a fair standard of living to all, while protecting and proudly sharing the cultural, historical, archaeological and natural values of Verlorenvlei."

3.2 Key Objectives for Verlorenvlei Estuary

While the vision is an inspirational, higher-level statement of strategic intent, strategic objectives answer the question: "How will you know when you have achieved the Vision and by when?" Key objectives can typically be grouped into three broad categories, namely those addressing (a) Ecological, (b) Heritage and (c) Socio-economic values. Distilling from the Verlorenvlei Estuary EMP Vision, Objectives are required for the following:

Ecological:	"protecting natural value"
Heritage:	"protecting cultural, historical, archaeological values"
Socio-economic	"Integrated and empowered community" "Fair standard of living for all"; and "Sharing values"

The key Objectives for Verlorenvlei Estuary were a discussion point at the Stakeholder Workshop held in September 2009 in Elands Bay. Based on the feedback received from the participants the following main Objectives are proposed for Verlorenvlei Estuary:

Table 6: Key Objectives proposed for the Verlorenvlei Estuary

OBJECTIVES	
Ecological	The Verlorenvlei ecosystem receives formal protection status under the Protected Areas Act 2004
	Further degradation (negative trajectory) of Verlorenvlei estuarine ecosystem is halted
	Ecological health of ecosystem is improved to Category C/B (moderately modified) by 2022
	Ecological health of ecosystem is improved to Category A/B (near natural) by 2030

Heritage	The cultural, historical and archaeological sites in and around Verlorenvlei Estuary receives official protection status (e.g. Protected Areas Act, National Heritage Act)
Socio-economic	The Estuary Forum is reconstituted (“integrated & empowered community”)
	The community (farmers, fishers, residents, commercial concerns, NGOs, authorities, etc.) functions in an integrated, cooperative manner through a trusting and fully representative Estuary Advisory Forum (“integrated & empowered community”)
	A sustainable tourism market is established for the area, utilizing the diverse range of values offered by Verlorenvlei Estuary (“sharing values” and “valued visitors”)
	Unemployment (and associated poverty) in the Verlorenvlei Estuary area is reduced through innovative job creation initiatives, e.g. tourism, fisheries, food security, ecological restoration etc. (“fair standard of living”)

4 OVERVIEW OF MANAGEMENT OBJECTIVES AND ACTIONS

4.1 Management objectives

When setting Management Objectives, the following question should be answered “What do we need to do to achieve or maintain the key objectives?” or “What is preventing us from achieving the vision and key objectives?”

Based on the feedback received from participants at the Stakeholder Workshop held in Elands Bay (September 2009), the following “issue packages” (or key sectors) for which management objectives had to be defined were apparent:

- Conservation;
- Living Resource management;
- Water quantity and quality (including waste and wastewater management);
- Agriculture;
- Town and tourism development;
- Improved integration and collaboration among role players (institutional arrangements & empowerment);
- Law enforcement and compliance;
- Funding sources and opportunities; and
- Innovative opportunities for job creation (e.g. including tourism opportunities).

In the following sections, Management Objectives for the listed issues are proposed, partly based on the feedback received from participants at the Stakeholder Workshop held in September 2009 in Elands Bay. However, these objectives need to be revisited and refined in subsequent updates of the EMP.

A range of actions are proposed and categorised into nine issues packages, or sectors. A summary of these actions is provided below.

Table 7: Summary of Management Actions per Issue Package/ Sector

ISSUE PACKAGE/SECTOR		ACTION	PRIORITY
1	Conservation	ACTION 1.1: Reinforce Ramsar status of Verlorenvlei Estuary through promulgation as a Formally Protected Area	High
		ACTION 1.2: Adopt a formal conservation zoning plan for Verlorenvlei Estuary (as part of the estuary zoning plan) and ensure that local IDP/SDF is aligned with this plan and that plan is incorporated in IDP/SDF, linked to other formal initiatives	High
		ACTION 1.3: Obtain formal protection of the heritage areas in and around Verlorenvlei	Medium
		ACTION 1.4: Prepare and implement a rehabilitation and restoration programme for Verlorenvlei Estuary	High
		ACTION 1.5: Develop and implement a climate change adaptation plan for Verlorenvlei Estuary (in response to changes in freshwater flow, sea level rise, etc.)	Medium

ISSUE PACKAGE/SECTOR		ACTION	PRIORITY
2	Living resources management	ACTION 2.1: Eradicate alien fish in Verlorenvlei Estuary	High
		ACTION 2.2: Eradicate alien vegetation in Verlorenvlei Estuary through the Working for Wetlands programme	High
		ACTION 2.3: Investigate deterioration of fish health in Verlorenvlei Estuary	High
		ACTION 2.4: Investigate the occurrence of avian botulism in wading bird population of Verlorenvlei Estuary	High
		ACTION 2.5: Investigate the viability of fishing competitions (for alien fish) in Verlorenvlei Estuary	Medium
3	Water quantity and quality (including waste and wastewater management)	ACTION 3.1: Determine the Ecological water requirements of Verlorenvlei at a comprehensive level	High
		ACTION 3.2: Develop and implement a water resource utilization plan (including registration & licensing)	High
		ACTION 3.3: Prepare and implement a mouth management plan (to improve connection with the sea)	High
		ACTION 3.4: Address sanitation and sewage treatment facilities in Redelinghuys & Elands Bay	High
		ACTION 3.5: Appropriately manage solid waste dump sites along Verlorenvlei Estuary	High
		ACTION 3.6: Investigate the impact of water abstraction on groundwater in Verlorenvlei Estuary	High
		ACTION 3.7: Investigate the link between nutrient dynamics and algal blooms in Verlorenvlei	High
		ACTION 3.8: Design and implement a water quality monitoring programme for Verlorenvlei Estuary	Medium
4	Agriculture	ACTION 4.1: Develop and implement agricultural best practice specifically to reduce nutrient enriched return flow and sediment erosion (e.g. through Biodiversity and Potatoes/Rooibos Initiatives)	High
		ACTION 4.2: Develop and implement a protocol for reed management in Verlorenvlei Estuary (addressing excessive growth, harvesting e.g. for thatching and burning)	High
		ACTION 4.3: Manage and control salt marsh grazing in Verlorenvlei Estuary	High
5	Town and tourism development	ACTION 5.1: Remove or upgrade of road crossings through Working for Wetlands programme	High
		ACTION 5.2: Ensure appropriate development in and around Verlorenvlei Estuary through IDP/SDF	High
		ACTION 5.3: Increase and improve access (e.g. for birding) in Verlorenvlei Estuary	High
6	Institutional arrangements & empowerment	ACTION 6.1: Establish the Verlorenvlei Estuary Advisory Forum, comprising broader representation from relevant government authorities and the community. To give formal status to the forum a constitution must be drafted and approved.	High
		ACTION 6.2: Develop and deploy a human resource plan for implementation of the Verlorenvlei Estuary EMP	High
		ACTION 6.3: Develop and deploy an education and awareness programme for Verlorenvlei Estuary	High

ISSUE PACKAGE/SECTOR		ACTION	PRIORITY
7 Law enforcement and compliance		ACTION 7.1: Sign an MoU (CapeNature and DFFE) to increase compliance capacity and formalize agreement on the removal of gillnetting	High
		ACTION 7.2: Increase environmental law enforcement and compliance capacity with respect to pollution (e.g. from waste and wastewater and agricultural return flows)	High
		ACTION 7.3: Increase environmental law enforcement and compliance capacity with respect to water quantity (abstractions)	High
		ACTION 7.4: Increase environmental law enforcement and compliance with respect to infrastructure development and land-use	High
		ACTION 7.5: Develop a safety and security plan for the Verlorenvlei Estuary area (e.g. "Buurtwag")	Medium
8 Funding sources & opportunities		ACTION 8.1: Prepare a financial plan for the implementation of the Verlorenvlei Estuary EMP	High
9 Innovative opportunities for job creation		ACTION 9.1: Investigate and deploy job opportunities for communities in the Verlorenvlei Estuary area linked to tourism (e.g. guides for hiking trails/boat trip)	High
		ACTION 9.2: Investigate and deploy projects the area to increase food security, e.g. hydroponics programme or ecological restoration/ rehabilitation	High
		ACTION 9.3: Develop unused primary school as a suitable venue for a range of activities, including a museum of the area, a wetlands museum and interpretive centre and a training centre for supporting the establishment of work opportunities in the community	Medium

The prioritisation of actions needs to be undertaken by the Responsible Management Authority, the **CapeNature**, together with the Estuary Advisory Forum, in consultation with stakeholders. Factors to consider in the selection of priority actions are, for example:

- Severity of ecological or socio-economic impact in relation to the vision and strategic objectives; and
- Availability of resources, both financial and human resources.

Detailed implementation plans for each for the issue packages or key sectors, including the Management Action Plans (MAPs) for priority actions are contained in Section 6 – Management Priorities.

4.2 Operational Objectives (Targets) for Verlorenvlei Estuary

Operational objectives, or specifications, include the measurable targets (or thresholds of potential concern) applicable to areas of ecological, heritage and socio-economic value of the estuarine environment (as highlighted in the Objectives). These are addressed in this section as follows:

- Ecological targets for Verlorenvlei Estuary;
- Heritage targets for Verlorenvlei Estuary; and
- Socio-economic targets for Verlorenvlei Estuary.

Thresholds of potential concern (TPC) are defined as measurable end points related to specific abiotic or biotic indicators that if reached, prompt management action. In essence, thresholds of potential concern should be defined such that they provide early warning signals of potential non-compliance to ecological specifications. This concept implies that the indicators (or monitoring activities) selected as part of a long-term monitoring programme need to include biotic and abiotic components that are particularly sensitive to ecological changes associated with changes in river inflow into the system.

The spatial zoning of the estuary (through an Estuary Zonation Plan (EZP)), together with the Operational Specifications, is the “blueprint” against which any existing or future initiative, development or activity in the estuary is measured. MAPs and environmental impact assessment (EIA) studies are required to use the “Blueprint” to derive targets and limits, rather than each developing their own, which may be inconsistent or conflicting.

While the overarching EZP provide comprehensive geographical information covering all the aspects, it may be more appropriate to extract the relevant information from the comprehensive plan and to produce “customised EZP” for the different MAPs. For example, compliance officers in municipalities may be more interested in a map that highlights the zones where certain types of activities/developments will be allowed/not allowed (e.g. the traditional EZP), while tourism concerns may be more interested in the demarcation of areas of ecological and heritage value.

4.2.1 Ecological Targets for Verlorenvlei Estuary

The following ecological specifications for Verlorenvlei Estuary, and the associated thresholds of potential concerns (TPCs), are representative of an Ecological Category B/C. **The specifications and the associated TPCs are based on a desktop health assessment of Verlorenvlei Estuary that needs to be refined during an intermediate ecological water requirement (EWR) study executed by an estuarine specialist consultant team.** Such teams are usually appointed by the DWS Resource Directed Measures Directorate.

Table 8: Provisional Ecological Specifications and Thresholds of Potential Concern for Verlorenvlei Estuary

COMPONENT	ECOLOGICAL SPECIFICATION	THRESHOLD OF POTENTIAL CONCERN (TPCs)
Water Quality	Salinity distribution not to exceed TPCs for fish, invertebrates, macrophytes and microalgae (see below)	<ul style="list-style-type: none"> • Salinity concentrations in the estuary exceed 35 PSU • Salinity concentrations in the Verlorenvlei Estuary exceed 10 PSU
	Dissolved oxygen not to exceed TPCs for biota (see below)	Dissolved oxygen concentrations in Verlorenvlei Estuary decrease below 4 mg/l

COMPONENT	ECOLOGICAL SPECIFICATION	THRESHOLD OF POTENTIAL CONCERN (TPCs)
	Turbidity levels in Verlorenvlei Estuary should not detrimentally impact biota i.t.o. reduced visibility or smother of benthic communities	Average suspended solid concentrations in river inflow increase by more than 10% of present concentrations (to be determined asap)
	Inorganic nutrient concentrations in Verlorenvlei Estuary should result in excessive algal or reed growth	<ul style="list-style-type: none"> Average DIN concentrations in river inflow exceed 300 ug/l Average DIP concentrations in river inflow exceed 50 ug/l
	Toxic substance concentrations in Verlorenvlei Estuary not to cause detrimental impact on biota	Toxic substance concentrations (e.g. trace metals) in river inflow and the water column of Verlorenvlei Estuary exceed South African Water Quality guidelines for coastal marine waters (DEA 2012)
Hydro-dynamics	Maintain a flow regime to create the required habitat for birds, fish, macrophytes, microalgae and water quality (see below)	To be determined by intermediate EWR study
Sediment dynamics	Flood regime to maintain the sediment distribution patterns and aquatic habitat (instream physical habitat) so as not to exceed TPCs for biota (see below)	To be determined by intermediate EWR study
	Changes in sediment grain size distribution patterns not to exceed TPCs in benthic invertebrates (see below)	To be determined by intermediate EWR study
Phytoplankton	Maintain low phytoplankton biomass.	To be determined by intermediate EWR study
	Maintain microalgal group diversity as measured for the baseline survey.	To be determined by intermediate EWR study
Benthic microalgae	Maintain high subtidal benthic microalgal biomass during the closed mouth phase.	To be determined by intermediate EWR study
Macrophytes	Maintain the distribution of plant community types.	To be determined by intermediate EWR study
	Prevent excessive filamentous macroalgal growth.	Area covered should be less than 50 % of the open water surface area.
	Ensure the long-term persistence of salt marsh species.	Decline in salt marsh species - To be determined by intermediate EWR study
	Prevent hypersaline sediment and groundwater conditions in the salt marsh.	Sediment electrical conductivity should be approximately 30 mS and similar to groundwater values.

COMPONENT	ECOLOGICAL SPECIFICATION	THRESHOLD OF POTENTIAL CONCERN (TPCs)
Fish	<p>Retain the following fish assemblages in the estuary (based on abundance):</p> <ul style="list-style-type: none"> • Estuarine species (10-20 %); • Estuarine associated marine species (80-90 %); and • Indigenous freshwater species (1 %). • All numerically dominant species are represented by 0+ juveniles. 	<ul style="list-style-type: none"> • Level of estuarine species increases above 60 % of total abundance. • Level of estuary associated marine species drops below 60 % of total abundance. • Alien <i>Lepomis macrochirus</i> and <i>Micropterus spp.</i> dominate in the upper reaches. • Absence of 0+ juveniles of any of the dominant fish species.
Birds	Retain regular representation of waders, gulls, and terns, and overall waterbird species richness of seven or more species.	Waders or terns are absent from the estuary for five consecutive CWAC counts.

4.2.2 Heritage Targets for Verlorenvlei Estuary

To be included in the next version of EMP once zoning plan has been approved by the Western Cape Department of Environmental Affairs & Development Planning (DEA&DP).

4.2.3 Socio-economic Targets for Verlorenvlei Estuary

To be included in next version of EMP once zoning plan has been approved by the Western Cape DEA&DP.

5 SPATIAL ZONATION

The Estuary Zonation Plan (EZIP) provides a means of geographically transposing the aims of the Management Objectives for a particular estuary, where applicable.

The following needs to be demarcated on an EZIP:

- **Geographical boundaries (e.g. estuary functional zone according to the 5m amsl contour)** of the estuary also indicating important habitat (e.g. open water, main channel and flood plains);
- **Areas of ecological** (Ramsar boundaries; sensitive ecosystems), **heritage** (archaeological, historical and cultural sites) and **socio-economic** (fisheries; recreation areas; bird watching sites) **value**;
- **Zones depicting the areas where certain types of activities/developments** will be allowed or where certain activities/developments will not be allowed (i.e. the traditional estuary zonation map); and
- Approved existing and future **developments/activities**, where feasible.

The ICM Act 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”.*

Figure demarcates geographical features of the Verlorenvlei Estuary for the purposes of this EMP. The main estuary body, as demarcated by the national estuaries database maintained by SANBI, is indicated in light blue. This is supplemented by the 5m amsl contour as extracted from lidar imagery available for the area. The municipal boundary is added for reference.

Areas of ecological value, specifically the Redelinghuys wetlands upstream of the estuary system, are indicated by the red ‘estuary floodplain’ boundary on Figure . These wetland areas are not specifically estuarine in nature but provide an important function as a biological filter for removing some of the excess nutrients from the watercourse. Also indicated in orange and yellow are connectivity zones directly connected to the estuarine area that should be managed with estuarine considerations in mind. The orange and yellow zones need to be considered in the Western Cape Protected Areas Expansion Strategy and in the Critical Biodiversity Area maps.



Figure 3: Main geographical boundaries around the Verlorenvlei estuary

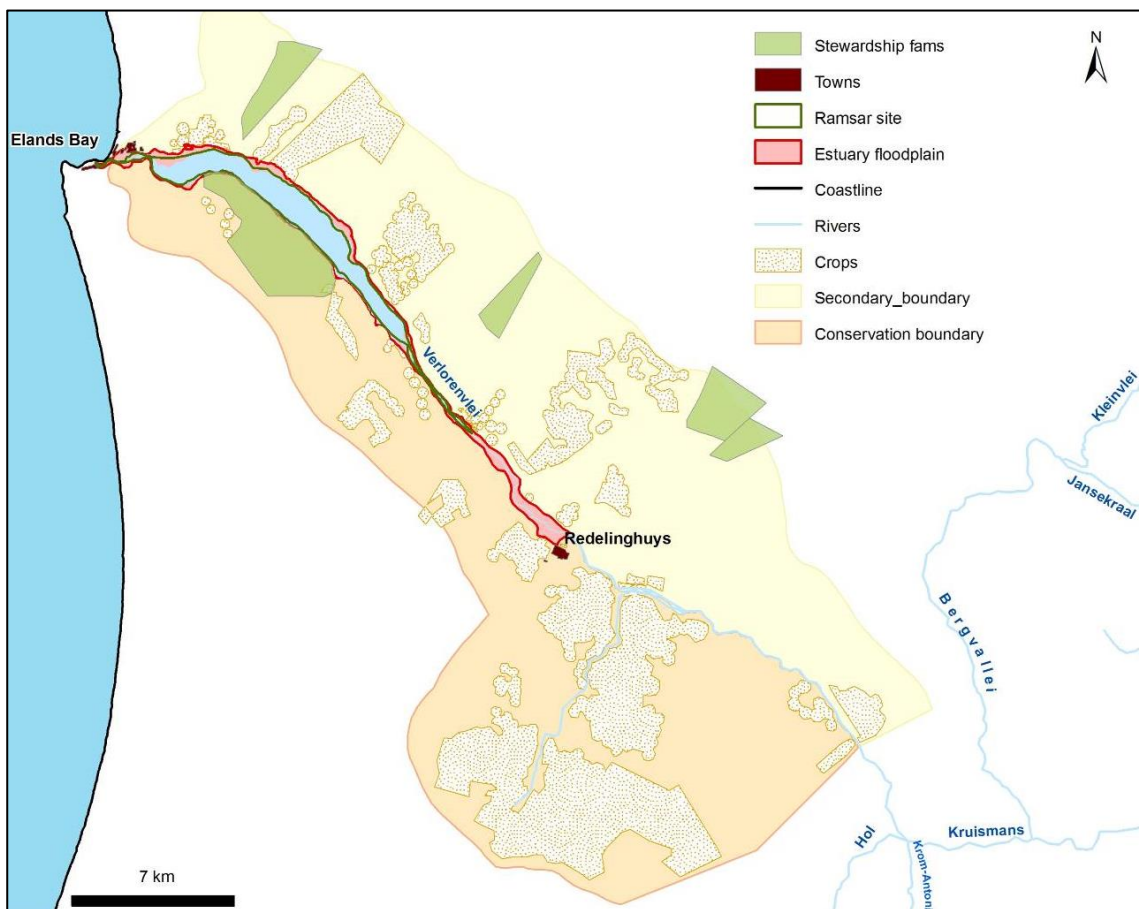


Figure 4: Important supportive features around the Verlorenvlei estuary

In Figure 4 (Section 2 - summary of Situation Assessment), the location of existing activities within the Verlorenvlei Estuary and broader functional and support zones have been mapped. However, several of the existing activities are incompatible with the zoning proposed above. It is therefore important that the Responsible Management Authority, CapeNature, together with the Estuary Advisory Forum re-assess this situation to produce a map that will depict approved existing and future developments/activities within the secondary boundary (Orange and Yellow). Engagement with landowners regarding existing activities to develop possible measures to mitigate the possible negative impact of these on the estuary, will also need to take place. Catchment related impacts will also need to be identified and addressed. Within the estuary the following proposed zoning as detailed in Table 9 applies:

Table 9: Verlorenvlei Estuary EMP proposed zoning

ZONES (Figure)	PROPOSED ACTIVITIES		
	ALLOWED	PROHIBITED OR CONTROLLED	RESPONSIBLE AGENT
Primary Boundary (Red line 1 –Estuary Functional Zone)	<ul style="list-style-type: none"> Swimming Birding Canoeing Line fishing Light Grazing 	<ul style="list-style-type: none"> Gillnetting Speed boating Driving through the flood plain Farming Sumps Discharges Solid waste dumping 	<ul style="list-style-type: none"> DFFE Cederberg LM CapeNature DWS
Ecosystem Connectivity Zone 2 – Orange Zone	<ul style="list-style-type: none"> Light grazing Development Recreational areas 	<ul style="list-style-type: none"> Farming Solid waste dumping 	<ul style="list-style-type: none"> DALRRD Cederberg LM RMA
Ecosystem Connectivity Zone 3– Yellow Zone	<ul style="list-style-type: none"> Recreational areas Grazing Farming Development 	<ul style="list-style-type: none"> Solid waste dumping 	<ul style="list-style-type: none"> Cederberg LM RMA

6 MANAGEMENT PRIORITIES

This section contains the detailed plans to carry out the priority Management Objectives, for the different sectors. These sectors are:

1. Conservation;
2. Living Resource management;
3. Water quantity and quality;
4. Agriculture;
5. Town and tourism development;
6. Improved integration and collaboration among role players;
7. Law enforcement and compliance;
8. Funding sources and opportunities; and
9. Innovative opportunities for job creation (e.g. including tourism opportunities).

6.1 Conservation (linking to Ramsar Convention)

6.1.1 Targets & Critical limits

Operational specifications refer to the measurable targets or critical limits applicable to activities/developments or activity/development zones in and around the estuary.

As part of the development of a regional conservation plan for the cool and warm temperate estuaries, Turpie and Clark (2007) recommended that the Verlorenvlei Estuary form part of the set of estuaries that needs to be protected to meet biodiversity targets in South Africa. The conservation plan stipulates that 50% of the terrestrial marginal area be included as a no-development area and that the Recommended Ecological Water Requirement Category be a B or C, summarized as follows:

RECOMMENDATION	VALUE
Extent of sanctuary protection	Half
Extent of undeveloped margin	50%
Minimum water requirement (ecological category)	B or C

6.1.2 Management Actions

The following actions or issues, specifically related to conservation, were identified at the Situation Assessment and Stakeholder Workshop held in Elands Bay (September 2009):

- Conservation of biodiversity through the declaration of a **formal Protected Area** (under National Environmental Management: Protected Areas Act, No 57 of 2003) continued compliance to **Ramsar status requirements** and bringing the importance of Ramsar to the fore, and contributing to the **Western Cape Protected Areas Expansion Strategy**;
- Increased protection through **zoning and formal planning** in and around Verlorenvlei Estuary and link this with other formal initiatives, e.g. IDP, SDF, Western Cape

Protected Area Expansion Strategy, updated Critical Biodiversity Area maps and Sandveld Environmental Management Framework, etc.

- **Conserve and formally protect the cultural heritage of the area;**
- **Halt further degradation** of the Verlorenvlei Estuary system and **institute restoration/rehabilitation** measures were appropriate; and
- **Adaptation to climate change** needs to be ensured through better water resources planning and agricultural best practice.

ACTION 1.1: Reinforce Ramsar status of Verlorenvlei through promulgation as a Formally Protected Area	
Related Main Objective(s)	The Verlorenvlei Estuary ecosystem receives formal protection status
Indicator(s)	The Verlorenvlei Estuary ecosystem is proclaimed a formal Protected Area
Relevant legislation	National Environmental Management: Protected Areas Act (No 57 of 2003)
Responsible agent	Department of Forestry, Fisheries and Environment CapeNature (WCPAES implementation plan) Department of Public Works
Timeframe	Within 2- 5 years
Priority	High

ACTION 1.2: Adopt a formal conservation zoning plan for Verlorenvlei (as part of the estuary zoning plan) and ensure that local IDP/SDF is aligned with this plan and that plan is incorporated in IDP/SDF, linked to other formal initiatives	
Related Main Objective(s)	The Verlorenvlei ecosystem receives formal protection status
Indicator(s)	Estuary zoning plan, including ecological connectivity zones and recommendations incorporated into IDP/SDF and acknowledged in formal initiatives Identification of extent of peat wetland in the EFZ
Relevant legislation	National Environmental Management: Protected Areas Act (No 57 of 2003)
Responsible agent	Department of Environmental Affairs CapeNature (including Western Cape Protected Area Expansion Strategy , and Sandveld Environmental Management Framework, etc Conservancy)
Timeframe	1 – 2 years
Priority	High

ACTION 1.3: Obtain formal protection of the heritage areas in and around Verlorenvlei	
Related Main Objective(s)	The cultural, historical and archaeological site in and around Verlorenvlei receives official protection status
Indicator(s)	Heritage sites receive formal protection Heritage site database developed and maintained
Relevant legislation	National Heritage Resources Act (No 25 of 1999) National Environmental Management: Protected Areas Act (No 57 of 2003)

Responsible agent	Department of Environmental Affairs South African Heritage Resources Agency / Western Cape Heritage Resources Agency (with input from University of Cape Town)
Timeframe	2 – 5 years
Priority	Medium

ACTION 1.4: Prepare and implement a rehabilitation and restoration programme for Verlorenvlei	
Related Main Objective(s)	Ecological health of ecosystem is improved Further degradation (negative trajectory) of Verlorenvlei ecosystem is halted
Indicator(s)	Fine-scale GIS map developed indicating areas requiring priority rehabilitation and restoration identified Long term budget estimated and funding sourced Rehabilitation and restoration programme implemented
Relevant legislation	National Water Act (No 36 of 1998) Conservation of Agricultural Resources Act (No 43 of 1983) National Environmental Management: Protected Areas Act (No 57 of 2003)
Responsible agent	Department of Water and Sanitation Department of Agriculture, Land Reform and Rural Development Department of Environmental Affairs Department of Public Works
Timeframe	On-going
Priority	High

ACTION 1.5: Develop and implement a climate change adaptation plan for Verlorenvlei (in response to changes in freshwater flow, sea level rise, etc.)	
Related Main Objective(s)	Further degradation (negative trajectory) of Verlorenvlei Estuary ecosystem is halted Ecological health of ecosystem is improved
Indicator(s)	Estuary-specific climate change adaptation plan developed, in line with the Provincial climate change adaptation plan
Relevant legislation	National Water Act (No 36 of 1998) Conservation of Agricultural Resources Act (No 43 of 1983) National Environmental Management: Protected Areas Act (No 57 of 2003)
Responsible agent	Department of Water and Sanitation Department of Agriculture, Land Reform and Rural Development Department of Environmental Affairs CapeNature
Timeframe	2 – 5 years
Priority	Medium

6.1.3 Detailed Project Plans for implementation

Once the priority actions have been confirmed, the Responsible agent(s) will be required to prepare **detailed project plans** for these actions. A template for the preparation of the project plans is provided in Appendix 2, inclusive of a monitoring and reporting plan.

6.2 Living Resources Management

6.2.1 Targets & Critical Limits

Operational specifications refer to the measurable targets or critical limits applicable to activities/developments or activity/development zones in and around the estuary.

To be included in later version of EMP by the relevant government departments.

6.2.2 Management Actions

The following actions or issues, specifically related to living resources were identified in the Situation Assessment and at the Stakeholder Workshop held in Elands Bay (September 2009):

- **Need to eradicate/control alien fish** (through the initiation of a small-scale fishery using large mesh nets that target introduced species while collapsed stock are protected);
- **Removal of alien vegetation** (from water and land);
- General concern for **fish health** as some fish have large lesions on them at the end of summer (could be parasites or blue green algae);
- Need to understand the extent and severity of the **occurrence of avian related infections** in the wading bird population of Verlorenvlei. A better understanding is required of the vectors that are causing it - enriched sediment, low water levels, poor water quality, climate change;
- Need to know if it is viable to have **fishing competitions (for alien fish)** in Verlorenvlei; and

ACTION 2.1: Eradicate alien fish in Verlorenvlei Estuary	
Related Main Objective(s)	Ecological health of ecosystem is improved Further degradation (negative trajectory) of Verlorenvlei estuary ecosystem is halted
Indicator(s)	Alien fish species and abundance decreased on annual basis
Relevant legislation	Marine Living Resource Act (No 18 of 1998)
Responsible agent	Department of Forestry, Fisheries and Environment CapeNature WWF - SA Private parties
Timeframe	Within 3 Years
Priority	High

ACTION 2.2: Eradicate alien vegetation in Verlorenvlei Estuary through Working for Wetlands programme	
Related Main Objective(s)	Ecological health of ecosystem is improved Further degradation (negative trajectory) of Verlorenvlei Estuary ecosystem is halted
Indicator(s)	Alien vegetation eradication programme developed and implemented

	Deployment of staff to the area, but with preferential employment of local labour Alien vegetation cover greatly reduced Ongoing maintenance in terms of vegetation removal
Relevant legislation	Conservation of Agricultural Resources Act (No 43 of 1983)
Responsible agent	Department of Forestry, Fisheries and Environment Department of Agriculture, Land Reform and Rural Development Department of Water and Sanitation CapeNature
Timeframe	On going
Priority	High

ACTION 2.3: Investigate deterioration of fish health in Verlorenvlei Estuary	
Related Main Objective(s)	Ecological health of ecosystem is improved Further degradation (negative trajectory) of Verlorenvlei Estuary ecosystem is halted
Indicator(s)	Research project devised and executed Results and recommendations published Mitigation measures implemented
Relevant legislation	Marine Living Resources Act (No 18 of 1998)
Responsible agent	Department of Forestry, Fisheries and Environment
Timeframe	1 – 2 years
Priority	Medium

ACTION 2.4: Investigate the occurrence of avian botulism in wading bird population of Verlorenvlei Estuary	
Related Main Objective(s)	Ecological health of ecosystem is improved Further degradation (negative trajectory) of Verlorenvlei ecosystem is halted
Indicator(s)	Research project devised and executed Results and recommendations published Mitigation measures implemented
Relevant legislation	Marine Living Resources Act (No 17 of 1998) Conservation of Agricultural Resources Act (No 43 of 1983)
Responsible agent	Department of Forestry, Fisheries and the Environment Department of Agriculture, Land Reform and Rural Development CapeNature Department of Water and Sanitation
Timeframe	1 – 2 years
Priority	High

6.2.3 Detailed Project Plans for implementation

Once the priority actions have been confirmed, the Responsible agent(s) will be required to prepare **detailed project plans** for these actions including budgets. A template for the preparation of the project plans is provided in Appendix 1, inclusive of a monitoring and reporting plan.

6.3 Water Quantity & Quality (including waste & wastewater management)

6.3.1 Targets & Critical Limits

Operational specifications refer to the measurable targets or critical limits applicable to activities/developments or activity/development zones in and around the estuary.

To be included in later version of EMP by the relevant government departments.

6.3.2 Management Actions

The following actions or issues, specifically related to water quantity and quality were identified at the Stakeholder Workshop held in Elands Bay (September 2009):

- Determination of the **Ecological Water Requirements** and associated ecological specifications (including funding & capacity to implement this "Reserve" of freshwater) at an intermediate/comprehensive level;
- There is limited water in the region, there is thus a need to **manage water resource demand and utilization**;
- Mouth management is required to enhance nursery value through **improved connection with the marine environment**, i.e. more open mouth conditions and removal of obstructions and to prevent **artificial breaching of mouth** when high water levels cause inundation of grazing land or properties;
- **Inadequate sewage treatment** (Redelinghuys & Elands Bay) needs to be addressed;
- **Solid waste** (e.g. municipal dump site) needs to be well managed;
- Need to **understand impact of abstraction** (over abstraction/inappropriate use) on **groundwater**;
- Understand the **link between pollution (i.e. nutrients) and blooms** (e.g. blue green algae or parrot grass blooms); and
- Need to instigate a **baseline water quality monitoring programme** (in line with the Reserve Determination methodologies and taking the ecological specifications into account).

ACTION 3.1: Determine the Ecological water requirements of Verlorenvlei at a comprehensive level

Related Main Objective(s)

Further degradation (negative trajectory) of Verlorenvlei ecosystem is halted
Ecological health of ecosystem is improved

Indicator(s)	Ecological water requirements determined, implemented and monitored to ensure compliance
Relevant legislation	National Water Act (No 36 of 1998)
Responsible agent	Department of Water and Sanitation
Timeframe	Within 3 years
Priority	High

ACTION 3.2: Develop and implement a water resource utilisation plan (including registration & licensing)

Related Main Objective(s)	Further degradation (negative trajectory) of Verlorenvlei ecosystem is halted Ecological health of ecosystem is improved
Indicator(s)	Water resource utilisation plan developed and implemented (including monitoring and compliance) Database developed and maintained All water uses and users are registered and licensed Catchment Classification process is completed and all water resources are classified and reserves are secured Catchment Management Plan and Strategy is developed
Relevant legislation	National Water Act (No 36 of 1998)
Responsible agent	Department of Water and Sanitation
Timeframe	10 years
Priority	High

ACTION 3.3: Prepare and implement a mouth maintenance management plan (to improve connection with the sea)

Related Main Objective(s)	Ecological health of ecosystem is improved Further degradation (negative trajectory) of Verlorenvlei Estuary ecosystem is halted
Indicator(s)	Mouth maintenance management plan developed and implemented (MMP) Optimal functioning of estuary mouth maintained
Relevant legislation	National Environmental Management: ICM Act (No 24 of 2008) Marine Living Resources Act (No 18 of 1998) National Water Act (No 36 of 1998)
Responsible agent	Department of Forestry, Fisheries and Environment Department of Water and Sanitation CapeNature Municipalities
Timeframe	Within 2 years
Priority	High

ACTION 3.4: Address sanitation and sewage treatment facilities in Redelinghuys & Elands Bay

Related Main Objective(s)	Further degradation (negative trajectory) of Verlorenvlei ecosystem is halted Ecological health of ecosystem is improved
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Indicator(s)	Current maintenance plans reviewed and priorities identified Budget secured for priority maintenance activities/upgrades Sanitation and sewage treatment facilities upgraded and functioning optimally Improved water quality and reduced pollution into Verlorenvlei
Relevant legislation	National Water Act (No 36 of 1998)
Responsible agent	Department of Water and Sanitation Cederberg and Berg River Municipalities
Timeframe	Within 5 years
Priority	High

ACTION 3.5: Appropriately manage solid waste disposal sites along Verlorenvlei Estuary

Related Main Objective(s)	Further degradation (negative trajectory) of Verlorenvlei ecosystem is halted Ecological health of ecosystem is improved
Indicator(s)	Environmental management plans developed for each dump site, and necessary permitting obtained Environmental best practice and appropriate management actions implemented Sites monitored for compliance with approved environmental management plans Illegal sites closed
Relevant legislation	National Environmental Management: Waste Act (No 59 of 2008)
Responsible agent	Department of Forestry, Fisheries and Environmental Affairs Local municipality
Timeframe	1 year
Priority	High

ACTION 3.6: Investigate impact of water abstraction on groundwater in Verlorenvlei Estuary

Related Main Objective(s)	Further degradation (negative trajectory) of Verlorenvlei Estuary ecosystem is halted Ecological health of ecosystem is improved
Indicator(s)	Research project devised and executed Results published Mitigation measures implemented Sandveld Area-wide Plan developed
Relevant legislation	National Water Act (No 36 of 1998)
Responsible agent	Department of Water and Sanitation
Timeframe	2 - 3 years
Priority	High

ACTION 3.7: Investigate the link between nutrient dynamics and algal blooms in Verlorenvlei Estuary	
Related Main Objective(s)	Further degradation (negative trajectory) of Verlorenvlei Estuary ecosystem is halted Ecological health of ecosystem is improved
Indicator(s)	Research project devised and executed Results published Mitigation measures implemented Occurrence of algal blooms reduced
Relevant legislation	National Water Act (No 36 of 1998)
Responsible agent	Department of Water and Sanitation
Timeframe	1 – 2 years
Priority	High

ACTION 3.8: Design and implement a water quality monitoring programme for Verlorenvlei Estuary	
Related Main Objective(s)	Further degradation (negative trajectory) of Verlorenvlei Estuary ecosystem is halted Ecological health of ecosystem is improved
Indicator(s)	Water quality programme developed and implemented Regular, documented monitoring undertaken Database of results maintained Regular reports produced, inclusive of recommendations Recommendations implemented
Relevant legislation	National Water Act (No 36 of 1998)
Responsible agent	Department of Water and Sanitation
Timeframe	Within 5 years
Priority	Medium

6.3.3 Detailed Project Plans for implementation

Once the priority actions have been confirmed, the Responsible agent(s) will be required to prepare **detailed project plans** for these actions. A template for the preparation of the project plans is provided in Appendix 2, inclusive of a monitoring and reporting plan.



Figure 5: Unauthorised trenching at river mouth (Photo: C Malherbe)

6.4 Agriculture

6.4.1 Targets & Critical Limits

Operational specifications refer to the measurable targets or critical limits applicable to activities/developments or activity/development zones in and around the estuary.

To be included in later version of EMP by the relevant government departments.

6.4.2 Management Actions

The following actions or issues, specifically related to land- and water use were identified at the Stakeholder Workshop held in Elands Bay (September 2009):

- **Agricultural Best Practice** (e.g. Biodiversity and Potato and Rooibos Initiatives) needs to be supported by all farmers in region. Agricultural return flow (enriched through application of fertilizers) and increased turbidity in Verlorenvlei as a result of siltation, should be addressed through agricultural best practice. Overgrazing of natural areas in and around the system (e.g. goats, pigs and cattle) causing siltation should be addressed through agricultural best practice. Lack of cover crops causing increased sediment input into the vlei – water and wind erosion should be addressed through agricultural best practice;
- Harvesting and burning of **reeds and sedges** needs to be controlled. The burning of reeds reduces buffer capacity and disturbs nutrient processes. Increased reed growth (result of sedimentation, pollution, lower water levels and obstruction to flow) needs to be halted and if possible, reversed. The harvesting of reeds could potentially

help control reed growth, but it needs to be investigated as reeds are also acting as nutrient “traps” that help control blue-green algal blooms; and

- **Grazing** of salt marshes which leads to reduction in detritus (food) to Verlorenvlei and a loss of riparian buffer capacity against sedimentation needs to be addressed.

ACTION 4.1: Develop and implement agricultural best practice specifically to reduce nutrient enriched return flow and sediment erosion (e.g. through Biodiversity and Potatoes/Rooibos Initiatives)	
Related Main Objective(s)	Further degradation (negative trajectory) of Verlorenvlei Estuary ecosystem is halted Ecological health of ecosystem is improved
Indicator(s)	Agricultural best practice guidelines developed and published Farmers and local communities made aware of such guidelines Agricultural best practice implemented
Relevant legislation	Conservation of Agricultural Resources Act (No 43 of 1983) National Water Act (No 36 of 1998)
Responsible agent	Department of Agriculture, Land Reform and Rural Development Department of Water and Sanitation
Timeframe	On-going
Priority	High

ACTION 4.2: Develop and implement protocol for reed management in Verlorenvlei Estuary (addressing excessive growth, harvesting (e.g. for thatching) and burning)	
Related Main Objective(s)	Ecological health of ecosystem is improved Further degradation (negative trajectory) of Verlorenvlei Estuary ecosystem is halted
Indicator(s)	Areas, volumes and seasonality for reed harvesting and burning determined Protocol for reed management developed, implemented, monitored and enforced – with a series of micro plans for different species of reed e.g. <i>Phragmites australis</i> and <i>Typha</i> should be developed given the variety of concentrations of different species and the number of independently owned land units contiguous with Verlorenvlei Estuary.
Relevant legislation	National Water Act (No 36 of 1998) Conservation of Agricultural Resources Act (No 43 of 1983)
Responsible agent	Department of Water and Sanitation Department of Agriculture, Land Reform and Rural Development
Timeframe	Initiate within next 5 years, then on-going
Priority	High

ACTION 4.3: Manage and control salt marsh grazing in Verlorenvlei Estuary	
Related Main Objective(s)	Ecological health of ecosystem is improved Further degradation (negative trajectory) of Verlorenvlei Estuary ecosystem is halted
Indicator(s)	Areas and grazing capacity determined

	Grazing protocol developed Cattle farmers /local communities involved in the development or made aware of such protocol Grazing protocol developed implemented, including compliance monitoring and enforcement
Relevant legislation	National Water Act (No 36 of 1998) Conservation of Agricultural Resources Act (No 43 of 1983)
Responsible agent	Department of Water and Sanitation Department of Agriculture, Land Reform and Rural Development
Timeframe	On going
Priority	High/medium/low

6.4.3 Detailed Project Plans for implementation

Once the priority actions have been confirmed, the Responsible agent(s) will be required to prepare **detailed project plans** for these actions. A template for the preparation of the project plans is provided in Appendix 2, inclusive of a monitoring and reporting plan.



Figure 6: Desiccated salt marsh (photo: C Malherbe)

6.5 Town and Tourism Development

6.5.1 Targets & Critical Limits

Operational specifications refer to the measurable targets or critical limits applicable to activities/developments or activity/development zones in and around the estuary.

To be included in later version of EMP by the relevant government departments.

6.5.2 Management Actions

The following actions or issues, specifically related to land- and water use were identified at the Stakeholder Workshop held in Elands Bay (September 2009):

- Removal or upgrading of numerous **crossings** (e.g. road bridge – more pipelines & road access at Grootdrift);
- **Inappropriate development** (e.g. unsustainable development within the 5m contour too close to estuary and lake) needs to be managed through the IDP and SDF of District and Local municipality. Detailed short-, medium- & long-term development planning for area for inclusion in IDPs, SDFs, Water Resources Plans, Living Resource Plans and Agricultural resource plans; and Greater Cederberg Biodiversity Corridor (GCBC) Planning, including appropriate infrastructure for tourism and hospitality industry; and
- **Access to the wetland** (e.g. for birding) needs to be improved – access limited/prevented through fencing.

ACTION 5.1: Remove or upgrade of road crossings through Working for Wetlands programme	
Related Main Objective(s)	Further degradation (negative trajectory) of Verlorenvlei Estuary ecosystem is halted Ecological health of ecosystem is improved
Indicator(s)	Priority road crossings and type of action identified Project plan developed and implemented All road crossings addressed (removal or upgrade)
Relevant legislation	National Land Transport Act, 2009 (Act 5 of 2009) National Environmental Management: ICM Act (No 24 of 2008) Local Government: Municipal Systems Act (No 32 of 2000)
Responsible agent	Western Cape Department of Transport and Public Works Department of Forestry, Fisheries and Environment Municipality
Timeframe	3 years
Priority	High

ACTION 5.2: Ensure appropriate development in and around Verlorenvlei through IDP/SDF	
Related Main Objective(s)	Further degradation (negative trajectory) of Verlorenvlei Estuary ecosystem is halted Ecological health of ecosystem is improved A sustainable tourism market is established for the area based on a sound tourism marketing plan, utilizing the diverse range of values offered by Verlorenvlei Estuary
Indicator(s)	Developed coastal management lines gazetted Coastal management lines incorporated into IDP & SDF Development excluded from sensitive areas, including EFZ Applicable building controls applied to high risk areas
Relevant legislation	National Environmental Management: Integrated Coastal Management Act (No 24 of 2008)

	Local Government: Municipal Systems Act (No 32 of 2000)
Responsible agent	Municipality
Timeframe	5 years
Priority	High

ACTION 5.3: Increase and improve access (e.g. for birding) in Verlorenvlei Estuary	
Related Main Objective(s)	Further degradation (negative trajectory) of Verlorenvlei Estuary ecosystem is halted A sustainable tourism market is established for the area based on a sound tourism marketing plan, utilizing the diverse range of values offered by Verlorenvlei
Indicator(s)	Prime access points and appropriate type of access and facilities identified Access needs for Verlorenvlei Estuary incorporated in municipal coastal access roll out process Controlled access provided and maintained within Verlorenvlei Estuary
Relevant legislation	National Environmental Management: Integrated Coastal Management Act (No 24 of 2008)
Responsible agent	Cederberg Local Municipality /CapeNature
Timeframe	1 – 3 years
Priority	High

6.5.3 Detailed Project Plans for implementation

Once the priority actions have been confirmed, the Responsible agent(s) will be required to prepare **detailed project plans** for these actions. A template for the preparation of the project plans is provided in Appendix 2, inclusive of a monitoring and reporting plan.



Figure 7: Road crossing creating an obstruction to free-flowing water (Photo: C Malherbe)

6.6 Institutional Arrangements and Empowerment

6.6.1 Targets & Critical limits

Operational specifications refer to the measurable targets or critical limits applicable to activities/developments or activity/development zones in and around the estuary.

To be included in later version of EMP by the relevant government departments.

6.6.2 Management Actions

The following actions or issues, specifically related to integration and collaboration among role players were identified at the Stakeholder Workshop held in Elands Bay (September 2009):

- Need to develop capacity to **implement the EMP** among the role players, including assigning human resources to manage the estuary;
- Need to identify a **Champion**;
- Foster **continuity in implementation and refinement** of EMP, i.e. efficiently, effectively, continuously;
- Need **buy-in** from all levels of government departments/authorities;
- **Fragmented and overlapping management roles/responsibilities/mandates** need clarification;
- **Need to overcome geographical isolation**: Verlorenvlei Estuary is far from decision-making centres and central business districts;
- **The EMP must link with IDPs** of local and district municipality, e.g. in terms of tourism;

- The EMP needs to **balance ecological concerns with community and social development**; and
- The community is **fragmented and uninformed** – The entire community needs to be involved as this will generate buy-in from locals. This will require good coordination of the Estuary Advisory Forum. Education of the fragmented community (all parties) in respect of the urgency of the EMP is needed to save the Verlorenvlei Estuary.

ACTION 6.1: Establish the Verlorenvlei Estuary Advisory Forum, comprising representation from relevant government authorities and the community. To give formal status to the forum a constitution must be drafted and approved.	
Related Main Objective(s)	The Estuary Advisory Forum (EAF) is constituted. The community (farmers, fishers, residents, commercial concerns, NGOs, authorities, etc.) functions in an integrated, cooperative manner through a trusting and fully representative Estuary Advisory Forum
Indicator(s)	Former Estuary Management Forum reconstituted into Estuary Advisory Forum and ToR agreed on with CapeNature Members confirmed EAF meetings convened (quarterly, bi-annually, or as formally agreed) Minutes of meeting compiled
Relevant legislation	National Environmental Management: ICM Act (No 24 of 2008)
Responsible agent	CapeNature
Timeframe	1 year
Priority	High

ACTION 6.2: Develop and deploy a human resource plan for implementation of Verlorenvlei Estuary EMP	
Related Main Objective(s)	The Estuary Advisory Forum is constituted. The community (farmers, fishers, residents, commercial concerns, NGOs, authorities, etc.) functions in an integrated, cooperative manner through a trusting and fully representative Estuary Advisory Forum.
Indicator(s)	ToR for various government departments and other institutions agreed to Project champions assigned Departmental project plans developed and implemented
Relevant legislation	National Environmental Management: ICM Act (No 24 of 2008)
Responsible agent	Estuary Advisory Forum lead by CapeNature, together with government departments (DWS, DFFE, District and Local municipality), other institutions and community of the area.
Timeframe	1 – 2 years
Priority	High

ACTION 6.3: Develop and deploy an education and awareness programme for Verlorenvlei Estuary	
Related Main Objective(s)	The community (farmers, fishers, residents, commercial concerns, NGOs, authorities, etc.) functions in an integrated, cooperative manner through a trusting and fully representative Estuary Advisory Forum
Indicator(s)	Education and awareness programme developed and implemented Strategically placed signage in and around Verlorenvlei Estuary Dissemination of information via website, newsletters, pamphlets relating to both environmental education and compliance awareness
Relevant legislation	National Environmental Management: ICM Act (No 24 of 2008)
Responsible agent	Estuary Advisory Forum lead by CapeNature, together with government departments (DWS, DFFE, District and Local municipality), other institutions and community of the area
Timeframe	1 – 2 years
Priority	Medium

6.6.3 Detailed Project Plans for implementation

Once the priority actions have been confirmed, the Responsible agent(s) will be required to prepare **detailed project plans** for these actions. A template for the preparation of the project plans is provided in Appendix 2, inclusive of a monitoring and reporting plan.

6.7 Law Enforcement and Compliance

6.7.1 Targets & Critical Limits

Operational specifications refer to the measurable targets or critical limits applicable to activities/developments or activity/development zones in and around the estuary.

To be included in later version of EMP by the relevant government departments.

6.7.2 Management Actions

The following actions or issues, specifically related to law enforcement and compliance were identified in the Situation Assessment and at the Stakeholder Workshop held in Elands Bay (September 2009):

- Increase capacity for law enforcement/compliance to **manage and control fishing pressure** and illegal fishing (i.e. removal of gill netting) in Verlorenvlei Estuary. Gill netting compromises the nursery function and relevant authorities (CapeNature and DFFE) have agreed to not renew licenses to riparian owners in future;
- Increase capacity law enforcement/compliance with respect to **pollution** from agricultural activities in the catchment (e.g. polluted agricultural return flows) and town and tourism development (waste and wastewater);
- Increase capacity law enforcement/compliance with respect to **water abstraction**; and

- Increase capacity law enforcement/compliance with respect to **infrastructure development and land-use** adjacent to estuary; and
- Need to address **safety and security** in the area as crime is on the increase (related to lack of jobs as farming only provides livelihoods for 6 months of the year).

ACTION 7.1: No renewal of gillnetting licenses and sign a MoU (CapeNature and DFFE) to increase compliance capacity	
Related Main Objective(s)	Ecological health of ecosystem is improved Further degradation (negative trajectory) of Verlorenvlei ecosystem is halted
Indicator(s)	MoU signed or operational plans developed (Warning Order) Deployment of additional compliance officers/conservancy rangers Additional patrols undertaken Database of offenders developed and maintained Gillnetting (legal and illegal) phased out in entirety
Relevant legislation	Marine Living Resources Act (No 18 of 1998)
Responsible agent	Department of Forestry, Fisheries and Environment CapeNature & appointed rangers
Timeframe	Within 1 year
Priority	High

ACTION 7.2: Increase environmental law enforcement and compliance capacity with respect to pollution (e.g. from waste and wastewater and agricultural return flows)	
Related Main Objective(s)	Further degradation (negative trajectory) of Verlorenvlei Estuary ecosystem is halted Ecological health of ecosystem is improved
Indicator(s)	Appropriate waste management facilities/infrastructure established and maintained (e.g. rubbish bins) Designated pollution compliance and enforcement units deployed to Verlorenvlei Estuary and surrounding areas Improved compliance with applicable standards (e.g. water quality standards) and municipal by-laws
Relevant legislation	National Water Act (No 36 of 1998) Conservation of Agricultural Resources Act (No 43 of 1983)
Responsible agent	Department of Water and Sanitation Department of Agriculture, Land Reform and Rural Development Cederberg Local Municipality CapeNature
Timeframe	1 year
Priority	High

ACTION 7.3: Increase environmental law enforcement and compliance capacity with respect to water quantity (abstractions)

Related Main Objective(s)	Further degradation (negative trajectory) of Verlorenvlei Estuary ecosystem is halted Ecological health of ecosystem is improved
Indicator(s)	Ecological flow requirements (EFR) determined for Verlorenvlei Estuary Verlorenvlei Estuary EFR considered in issuing of abstraction permits Database of licensed and illegal users maintained Illegal users/uses convicted and appropriately penalised
Relevant legislation	National Water Act (No 36 of 1998)
Responsible agent	Department of Water and Sanitation Ramsar site combined operations (CapeNature)
Timeframe	1 year
Priority	High

ACTION 7.4: Increase environmental law enforcement and compliance with respect to infrastructure development and land-use

Related Main Objective(s)	Further degradation (negative trajectory) of Verlorenvlei Estuary ecosystem is halted Ecological health of ecosystem is improved
Indicator(s)	Verlorenvlei Estuary EAF registered as an Interested & Affected Party for all developments and rezoning applications surrounding the estuary Increased monitoring of compliance with Environmental Authorisations Increased monitoring of compliance with building controls
Relevant legislation	Local Government: Municipal Systems Act (No 32 of 2000) Integrated Coastal Management Act (No 24 of 2008) Conservation of Agricultural Resources Act (No 43 of 1983) National Environmental Management Act (No 107 of 1998)
Responsible agent	Cederberg Local Municipality Department of Environment Affairs DEA&DP/CapeNature Department of Agriculture, Land Reform and Rural Development Verlorenvlei Estuary Advisory Forum
Timeframe	On-going
Priority	High

ACTION 7.5: Develop a safety and security plan for the Verlorenvlei Estuary area (e.g. "Buurtwag")

Related Main Objective(s)	The community (farmers, fishers, residents, commercial concerns, NGOs, authorities, etc.) functions in an integrated, cooperative manner through a trusting and fully representative Estuary Advisory Forum
Indicator(s)	Safety and security plan developed and implemented

	Deployment of additional security officers Additional patrols undertaken Database of offenders developed and maintained Offenders convicted and appropriately penalised
Relevant legislation	All relevant laws
Responsible agent	South African Police Service and community
Timeframe	1 – 2 years
Priority	High

6.7.3 Detailed Project Plans for implementation

Once the priority actions have been confirmed, the Responsible agent(s) will be required to prepare **detailed project plans** for these actions. A template for the preparation of the project plans is provided in Appendix 2, inclusive of a monitoring and reporting plan.



Figure 8: Fish caught in illegal net (Photo: N. Taylor)

6.8 Funding Sources and Opportunities

6.8.1 Targets & Critical Limits

Operational specifications refer to the measurable targets or critical limits applicable to activities/developments or activity/development zones in and around the estuary.

To be included in later version of EMP by the relevant government departments.

6.8.2 Management Actions

The following actions or issues, specifically related to funding sources and opportunities were identified at the Stakeholder Workshop held in Elands Bay (September 2009):

- **Generate/source funding to implement the EMP.** Financing (funding and budgets) need to be in the short- and the long-term, e.g. Biosphere funded local community projects.

In order to address the above issue, the following actions are proposed:

ACTION 8.1: Prepare a financial plan for the implementation of the Verlorenvlei Estuary EMP	
Related Main Objective(s)	Cross-cutting to all objectives
Indicator(s)	Financial plan developed MoUs signed with relevant responsible departments and institutions Sufficient and effect use of funding Project plans implemented
Relevant legislation	Integrated Coastal Management Act (No 24 of 2008) Local Government: Municipal Systems Act (No 32 of 2000) National Water Act (No 36 of 1998) Conservation of Agricultural Resources Act (No 43 of 1983)
Responsible agent	Estuary Advisory Forum together with government departments (DWS, DFFE, District and Cederberg local municipality) and other institutions (e.g. CapeNature) and business in the area
Timeframe	1 year
Priority	High

6.8.3 Detailed Project Plans for implementation

Once the priority actions have been confirmed, the Responsible agent(s) will be required to prepare **detailed project plans** for these actions. A template for the preparation of the project plans is provided in Appendix 2, inclusive of a monitoring and reporting plan.

6.9 Innovative Opportunities for Job Creation

6.9.1 Targets & Critical Limits

Operational specifications refer to the measurable targets or critical limits applicable to activities/developments or activity/development zones in and around the estuary.

To be included in later version of EMP by the relevant government departments.

6.9.2 Management Actions

the following actions or issues, specifically related to land- and water use were identified in the Situation Assessment and at the Stakeholder Workshop held in Elands Bay (September 2009):

- Investigate **job creation** associated with the management of the system, for example, **enhance tourism** as an avenue for job creation (an IDP objective) and that ensures equity for all local communities in Verlorenvlei region; and
- Investigate **poverty alleviation initiatives** and **local community projects**, e.g. hydroponics for increase food security, or ecological restoration/rehabilitation, possibly via Expanded Public Works Programme (EPWP) or similar programmes.

Tourism opportunities include guides for canoeing, hiking trail, bird trail, horse-riding, fishing, surfing and donkey-cart rides.) Job creation initiatives include catering (in a house in the community, take-aways); processing and selling of living resources (alien fish, licensed crayfish-selling to licensed buyers), creation of contemporary crafts (sewing, clothes-making, artworks) and reviving and demonstrating old skills (heritage values) (e.g. hand-axe making to weaving).

ACTION 9.1: Investigate and develop job opportunities for communities in the Verlorenvlei Estuary area linked to tourism	
Related Main Objective(s)	Unemployment in the Verlorenvlei Estuary area is reduced through innovative job creation initiatives
Indicator(s)	Enhanced local economic development (e.g. through SMMEs and EMWP projects) Increase in employment rate surrounding Verlorenvlei Estuary Reduction in poverty index
Relevant legislation	Local Government: Municipal Systems Act (No 32 of 2000) Tourism Act (No 72 of 1993, as amended in 1996 & 2000)
Responsible agent	CapeNature, Cederberg Local Municipality and West Coast District Municipality Western Cape Department of Economic Development and Tourism Department of Tourism
Timeframe	1 year
Priority	High

ACTION 9.2: Investigate and deploy projects the area to increase food security, e.g. hydroponics programme or ecological restoration/ rehabilitation	
Related Main Objective(s)	Unemployment in the Verlorenvlei Estuary area is reduced through innovative job creation initiatives that involve partner NGOs and other organisations or government programmes (such as the Environmental Protection and Infrastructure Programmes) to increase food security and ecological restoration/rehabilitation
Indicator(s)	Access to Environmental Protection and Infrastructure Programmes in terms of funding or job creation Hydroponics feasibility study conducted Results published and funding secured Hydroponics programme initiated Increase in employment rate surrounding Verlorenvlei Estuary Improved food security for Verlorenvlei Estuary communities
Relevant legislation	Conservation of Agricultural Resources Act (No 43 of 1983)
Responsible agent	Department of Agriculture, Land Reform and Rural Development
Timeframe	5 years
Priority	High

ACTION 9.3: Develop a suitable venue for a range of activities, including a museum of the area, a wetlands museum and interpretive centre and a training centre for supporting the establishment of work opportunities in the community.	
Related Main Objective(s)	Unemployment in the Verlorenvlei Estuary area is reduced through innovative job creation initiatives
Indicator(s)	Development options investigated and approved Funding secured Project plan developed and implemented Information centre developed Increase in number of visitors Increase in number of school / events
Relevant legislation	N/A
Responsible agent	Local community Cederberg Local Municipality Heritage Western Cape Cape Nature Department of Forestry, Fisheries and the Environment
Timeframe	2 - 3 years
Priority	Medium

6.9.3 Detailed Project Plans for implementation

Once the priority actions have been confirmed, the Responsible agent(s) will be required to prepare **detailed project plans** for these actions. A template for the preparation of the project plans is provided in Appendix 2, inclusive of a monitoring and reporting plan.

7 INSTITUTIONAL ARRANGEMENTS

7.1 Key Role Players

It is essential that this EMP is regarded as a strategic plan that can guide the detailing of implementation actions and identification of implementing agents. Therefore, it does not specify the required resources (human and financial) required for proper management of the estuary. However, it does 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 action plans and the implementation thereof. Ways of empowering historically disadvantaged individuals with regards to the local management of the Verlorenvlei Estuary must be explored and implemented.

Co-management and effective governance have already been identified as the keystone to the efficient and effective management of the Verlorenvlei Estuary.

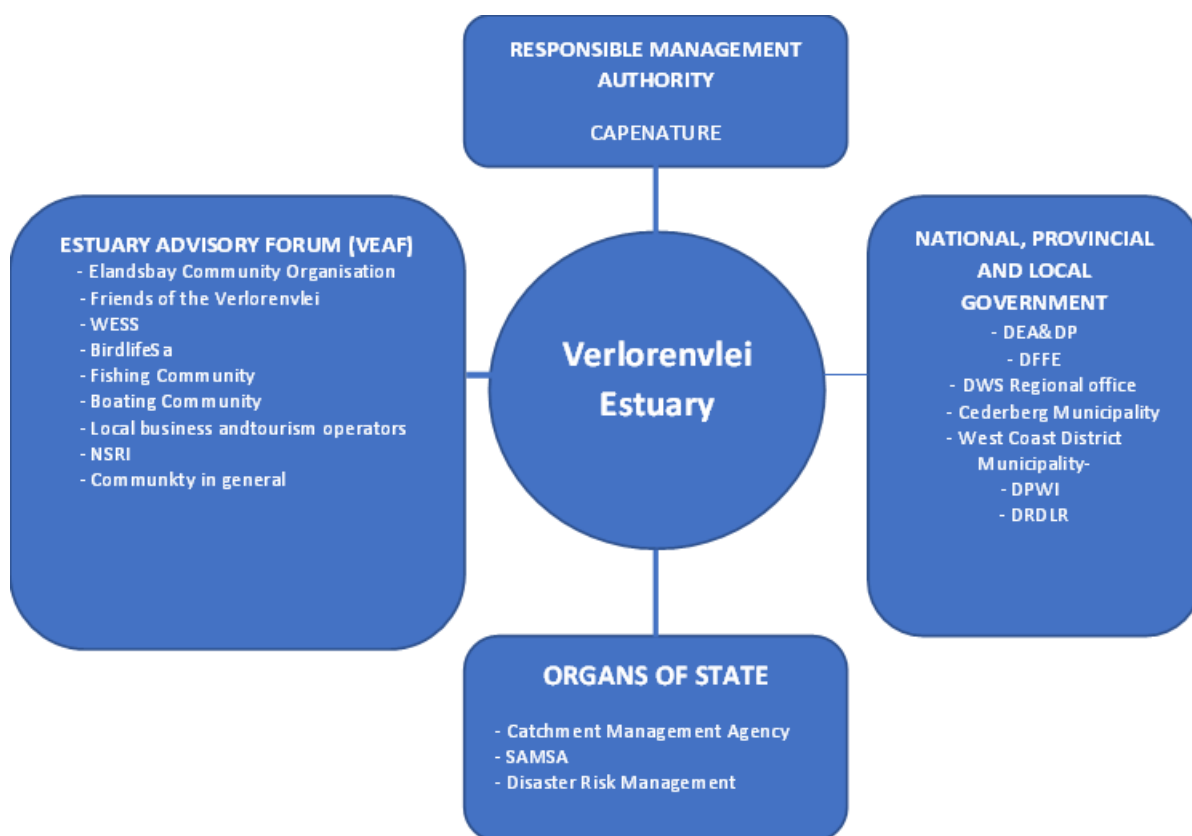


Figure 9: Key role players for the management of the Verlorenvlei Estuary with CapeNature acting as RMA

7.1.1 Estuary Management Authority

As detailed earlier, the Protocol identifies the **CapeNature**, or its assigned representative, as the **Responsible Management Authority** responsible for the development of the Verlorenvlei

Estuary EMP as well as being responsible for the co-ordination of its implementation. This implementation function can be affected through a range of different forums and actors.

7.1.2 Verlorenvlei Estuary Advisory Forum (VEAF, currently VEMF)

According to the Protocol, the **role of VEAF** is interpreted as providing an advisory service to the RMA on issues specific to the management and implementation of the EMP, as well as being the hub that links all stakeholders, which serves to foster stakeholder engagement and to facilitate the implementation of the project plans identified. The broader **community** will be able to voice concerns and raise issues via the VEAF. This includes Ratepayers' Associations, NGO's, community groups, conservancies, etc., as well as representatives from surrounding industry and agriculture. Any representatives are obliged to raise issues identified by their constituents and to provide feedback to the constituents. Importantly, the VEAF will not represent or supplant the individual positions of its members unless specifically mandated to do so.

7.1.3 Government Departments and organs of state

The successful implementation of the EMP may be seen as also dependent on the contribution of a number of governmental role players, including:

- **Western Cape Government departments:** Responsible for legislative support, including compliance, funding, research and monitoring;
- **West Coast District Municipality:** Responsible for legislative support and funding;
- **Cederberg Local Municipality:** Responsible management of land use activities, as well as water quality and quantity in the catchment;
- Relevant **National government departments**, especially DWS, DFFE, Department of Public Works and Infrastructure (as key landowner) or the Department of Agriculture, Land Reform and Rural Development
- **Organs of State** (SANparks, CapeNature, BOCMA).

The DFFE is generally responsible for national standardisation of estuarine management and approval of EMPs compiled by Provincial Government. Direct involvement in individual estuaries, such as the Verlorenvlei, Estuary will occur via existing forums for intergovernmental coordination. These forums will have the management of the Verlorenvlei estuary on their agendas from time to time, and include:

- **Western Cape Provincial Coastal Committee:** Responsible for facilitating co-management, effective governance and provincial co-ordination of estuarine management; and
- **West Coast District Municipal Coastal Committee:** Responsible for facilitating co-management and effective governance.

7.2 Review and Evaluation

This EMP should be reviewed and updated on a five-yearly basis from the date it was approved and adopted to ensure that objectives and targets are being achieved (**CapeNature Governance Tool**). An audit should be undertaken alongside the review and

evaluation to determine and grade the success and failures with the implementation of the management plan according to the specified performance indicators (Appendix 2). The audit should ultimately be the responsibility of CapeNature or its assigned representative and the VEAF.

The review will involve revisiting the Situation Assessment Report to determine the progress or changes that have come about as a result of the EMP in terms of the objectives that were originally set as well as any changes in legislation or policies, and followed by revisions or refinement of the objectives and where necessary, aspects of the management actions plans or monitoring protocol.

8 MONITORING REQUIREMENTS FOR THE VERLORENVLEI

There is very little baseline ecological information available on the Verlorenvlei Estuary. It is of the utmost importance to develop an in-depth understanding of how the ecology functions. The following abiotic and biotic components need to be surveyed and monitored.

Abiotic components that need to be addressed are:

- Hydrology;
- Sediment dynamics;
- Hydrodynamics; and
- Water Quality.

Biotic components that need to be addressed are:

- Microalgae;
- Macrophytes;
- Invertebrates (including zooplankton, benthic invertebrates and macrocrustaceans);
- Fish (ichthyofauna); and
- Birds (avifauna).

Current monitoring initiatives underway are described in Section 8.1 below and future monitoring requirements for Verlorenvlei Estuary, as identified in the initial Situation Assessment (CSIR, 2009b), are summarised in Section 8.2. Specific monitoring plans linked to each of the issue packages or sectors are contained in Section 6 - Management Priorities.

8.1 Current Monitoring Initiatives

8.1.1 DWS Water –level Recorder

The DWS has a permanent water level recorder in Verlorenvlei Estuary that monitors its water levels continuously (every 2 hours). It is of the utmost importance that this monitoring continues.

The DWS (under the National Estuary Monitoring Programme), in association with the District Municipality, also carries out monthly basic water quality sampling (e.g. salinity, dissolved oxygen and water temperature) at 6 monitoring points.

8.1.2 Co-ordinated Waterbird Counts (CWAC)

The Coordinated Waterbird Counts (CWAC) was launched in 1992. The objective of CWAC is to monitor South Africa's waterbird populations and the conditions of the wetlands which are important for waterbirds. This is being done by means of a programme of regular mid-summer and mid-winter censuses at a large number of South African wetlands and

estuaries, at regular six-monthly intervals. CWAC currently monitors over 350 wetlands around the country.

This project was initiated by the then Ramsar Working Group of the Department of Environmental Affairs in part-fulfilment of South Africa's commitment to the Ramsar Convention. CWAC also contributes its data to the African Waterbird Census, a programme coordinated by Wetlands International and based at the African headquarters of Wetlands International in Senegal.

Sites registered with CWAC have their waterbirds census every six months, in midsummer and midwinter. The permissible periods are mid-January to mid-February, and July, respectively. Where ideally all counts should be carried out on the same day, in practice it is necessary to provide a wider time period to accommodate volunteers and organizations. Methods of counting are standardized for a site in terms of area covered and manner in which counters are deployed. Counters are provided with information sheets, which advise on how to count efficiently and avoid double-counting and misidentification. Observers are also requested to monitor their sites by fixed-point photography at two-year intervals. This is to establish long-term variability in physical changes at wetlands.

Counts are submitted on a standard form, which also requests details on weather and threats currently having an impact on the wetland and birds. This is then directly entered into the computer. Feedback on each seasonal count are provided by means of a newsletter which is distributed shortly before the next count, together with a computer output of previous count and a blank form.

8.2 Future Monitoring Requirements

The Situation Assessment Report highlighted significant uncertainties regarding the interaction between water chemistry and plants (both microalgae and macrophytes). These components should be investigated in detail and monitoring initiated as speedily as possible. Monitoring must be undertaken in line with the Resource Quality Objectives identified during the Reserve Determination process.

8.2.1 Water Geochemistry (especially nutrients)

The following samples should be collected in the Verlorenvlei Estuary:

- Salinity and temperature profiles (also required for hydrodynamics);
- System variables (pH, DO, turbidity, suspended solids); and
- Inorganic nutrients (nitrate/nitrite, ammonia, reactive phosphate and reactive silicate).

Salinity and temperature data must be collected at 0.5 m depth intervals, while other water quality parameters are collected in surface and bottom waters.

In addition, the following water quality parameters should also be collected from the inflowing river water and measured:

- System variables (pH, DO, turbidity, suspended solids, TDS and temperature);
- Nutrients (inorganic nitrogen (nitrite, nitrate and ammonia),
- reactive phosphate and silicate; and
- toxic substances.

The water quality of the near-shore marine waters should be obtained from available literature.

Sampling should be conducted at stations distributed geographically along the entire estuary at fixed intervals. A rough estimate for setting the distance between stations is to divide the length of the estuary by 10 (i.e. if an estuary is 12 km long, the distance between stations should be about 1-2 km). Typically, a representative number of stations for large estuaries are between 10 and 15. Sampling stations should also be selected along cross sections. During each sampling survey, water quality samples must also be taken in the river and in the near-shore marine waters (i.e. the water sources).

8.2.2 Vegetation

The following information needs to be captured from recent and any available historical aerial photographs and ortho-photographs covering the entire estuary as defined by the geographical boundaries:

- Number of different habitats (plant community types;
- Area covered by each plant habitat;
- Historical change in area covered by plant habitat; and
- Extent of anthropogenic impacts (agriculture, flood plain development).

Field data need to be collected for ground truthing of aerial photographs:

- Number of different plant habitats (plant community types;
- Area covered by each plant habitat;
- Species list for each plant habitat; and
- Extent of anthropogenic impacts such as grazing, trampling, alien vegetation, boating, bait digging.

Permanent transects (sampling stations) need to be set up for long-term monitoring of changes in plant habitats:

- Transects set up along an elevation gradient; and
- Record percentage cover of each plant species in duplicate quadrats (1m²) along transect.

Along each transect (minimum of 4) the following data need to be collected:

- Elevation profile and water level;
- Water column salinity and turbidity; and
- Sediment salinity, moisture content and sediment composition.

It is also recommended that shallow boreholes be augured in to measure depth to water table and ground water salinity. The surveys should be conducted during summer and repeated every two years after implementation, followed by a summer survey every three years thereafter (where aerial photographs are available for intermediate years these should also be analysed).

8.2.3 Microalgae

Phytoplankton: To estimate phytoplankton biomass, collect duplicate samples for chlorophyll a at the surface and 0.5 m depth intervals. Use a spectrophotometer for sample analysis before and after acidification. Do cell counts (at 400 x magnification) on dominant phytoplankton species to establish species distribution and composition, i.e. green algae, flagellates, dinoflagellates, diatoms and blue-green algae.

Benthic microalgae: Collect intertidal and subtidal benthic samples for chlorophyll-a (biomass) analysis. Collect five samples at each station. Analyse samples using a recognised technique, e.g. High-Performance Liquid Chromatography (HPLC).

Record the relative abundance of dominant algal groups, i.e. green algae, dinoflagellates, diatoms and blue-green algae and identify the dominant species. At each station also measure:

- Water salinity and inorganic nutrients;
- Sediment particle size distribution and organic content; and
- Light penetration PAR or Secchi disk).

Sampling should be conducted at 10 to 15 stations selected geographically along the entire length of the estuary, covering the different salinity zone. Stations should preferably be set at fixed intervals. A rough estimate for setting the distance between stations is to divide the length of the estuary by 10 (i.e. if an estuary is 30 km long, the distance between stations should be about 3 km).

8.2.4 Invertebrates

Zooplankton: Collect quantitative samples after dark. Sampling should be done at mid-water level, i.e. not at the surface. Two net trawls (WP 2 – 200 micron mesh) representing two replicate samples should be taken at each station. The net should be pulled for three minutes per station (10.0 -12.0 m³ of water) at 0.5 knots diagonally across the estuary at each site. Record the abundance (density per volume) of each species in each trawl and average the results over the two replicates for each station. At each station phytoplankton samples (i.e. water column sample) and benthic microalgae samples need to be collected for chlorophyll-a analyses.

Benthic invertebrates: Collect (subtidal) samples using a Zabalocki-type Eckman grab sampler with six to nine randomly placed grabs (replicates) at each station. Collect intertidal samples at spring low tide using a core sampler with a minimum diameter of 150 mm and depth of 250 mm, with six to nine replicates at each site along the transect. Grab/core sample should then be placed in a 500- micron sieve bag and the contents gently sifted so as to remove fine particles. Animals and any other relatively coarse material

are then stored in formalin for identification in the laboratory. At least six replicates are required per station. For intertidal benthic invertebrates (in estuary) that are not well quantified by core sampling (e.g. mud prawns, sand prawns, some crabs), count overall density for each species in 0.25 m² minimum quadrat areas, with five replicates at each station.

The following must be completed at each site:

- Identify fauna to the lowest taxon possible.
- Record animal density and species abundance (animals per m²).
- Record the presence of *Zostera* or other macrophytes at the site.

At each station, sediment samples need to be collected for particle size analysis (250 ml) and organic content (250 ml) using standard techniques. Other parameters that must be measured at each site are temperature, salinity, oxygen, conductivity, turbidity, chlorophyll-a and pH. Measurements should be taken at the surface, 0.5 m, 1.0 m from the surface and thereafter at 1.0 m depth intervals.

Macrocrustaceans: Quantitative sampling for macrocrustaceans should be conducted during neap tides (mid to high tide), at the same stations used for zooplankton. Use a benthic sled (80 cm x 80 cm, with a 500 micron mesh) attached to a flow meter to collect the sample; tow for 30 metres diagonally across the estuary. Take two samples at each station. Set two prawn/crab traps per station overnight (more applicable to sub-tropical areas). Identify fauna to the lowest taxon possible. Record the number of species and determine densities for each species.

A sampling station is defined as a specific location in the system (at a specific 'distance from the mouth') from where a number of replicates are collected. Sampling stations (when the mouth is open) must take into account the salinity zones characteristic of a particular estuary, which typically include:

- Fresh (river water);
- 0 – 10 ppt;
- 10 – 20 ppt; and
- 20 – 35 ppt.

These zones should be indicated on a map and within each of the salinity zones, the following habitat representatives need to be sampled:

- Submerged macrophytes;
- Soft sediments (sand, muddy sand and fine mud), hard (rocky areas) and organic rich areas; and
- Benthic invertebrate stations must also include intertidal bird feeding areas.

As a guideline, ten to 15 stations should be selected. These should be located geographically along the entire length of the estuary, covering the salinity zones and habitat types as described above. This may vary depending on the diversity of habitats in

the estuary. Stations should preferably be set at fixed intervals or positions. A rough estimate for setting the distance between stations is to divide the length of the estuary by 10.

Subtidal invertebrates. Seasonal surveys over a period of two years. Sampling must incorporate an open mouth phase.

Zooplankton, benthic invertebrates and macrocrustaceans. Seasonal surveys over a period of two years. It is important that samples be taken during a state of the estuary (determined by the extent of saline intrusion and the state of the mouth) that is representative of the particular season that sampling is taking place. Sampling must incorporate an open mouth phase.

8.2.5 Fish

Seine nets: A suitable net would be a 30 m X 2.0 m X 15 mm multifilament bar mesh in the wings and a 5 mm bar mesh in the purse. Seine nets should be 30 m long and 2.0 m in depth. The cod end (bag and purse) and the wings 5.0 m to either side should be 5.0 mm bar mesh, whereas the remaining 15 m of each wing may be 15 mm bar mesh. This is required to adequately sample 'faster moving' species. The net should be weighted such that it sinks below the surface when set in water deeper than 2.0 m (i.e. the distance between the lead and cork lines). A light net makes it more difficult to obtain a representative sample from weed and sandy areas, e.g. flatfish species tend to burrow in the sand and escape under a light seine.

Gill nets: Monofilament gill nets should comprise at least three different mesh sizes between 40 - 150 mm stretch mesh. Monofilament gill nets should comprise at least four nets (or panels) of which one net comprises 44, 48, 51 and 54 mm mesh, and an additional three nets made in the range 75 - 150 mm stretched mesh (e.g. 75, 100 and 145 mm stretched mesh). If time permits either fyke nets or longlines should be used to sample eels in the upper reaches of the estuary and Dam.

At each sampling station the following data need to be recorded:

- Species present;
- Number of each species; and
- Size frequency distributions in total length.

The system needs to be sampled from the mouth to the Redelinghuys wetlands approximately 11 km upstream. Stations (seine samples) should be spaced at 500 m intervals for the first two kilometres and thereafter at one kilometre intervals. A standard practice could be to divide the estuary length by 10.

If possible, especially if Verlorenvlei mouth is open, sampling stations must be representative of the salinity zones, including:

- Fresh (lake water);
- 0 – 10 ppt.;
- 10 – 20 ppt.;

- 20 – 30 ppt.; and
- 30 –35 ppt. (at least one station should be in this range). It has been found that this salinity range supports a substantially different species composition than that found, for example in the range 20-30 ppt.

Within each salinity zone, the following habitat representatives should be sampled:

- Submerged macrophytes (e.g. *Zostera* beds);
- Sandy/muddy/rocky areas (representing different food sources); and
- Near or in saltmarsh area.

9 RECOMMENDATIONS

The following recommendations are made to assist/ improve management of the Verlorenvlei estuarine system:

- The **Sandveld Reserve Study, which provided a very cursory estimate of the present health of the Verlorenvlei Estuary, was procedurally flawed as it did not consider the estuarine requirements of the Verlorenvlei Estuary. It is critical that this study be updated, taking these requirements into account. The EMP should therefore be amended accordingly.**
- It is recommended that the RMA considers the continuation of the existing stakeholder body (the estuary forum) so as to provide an advisory service to the RMA on issues specific to the management and implementation of the project plans, but more specifically to undertake day-to-day management actions on behalf of the RMA (to be formally delegated by means of municipal by-laws. Funding for the day-to-day activities of the forum need to be secured, and this must include provision for travel assistance to disadvantaged persons. **The CapeNature Governance Tool will be used to identify, monitor, track, and report on the implementation of management objectives.**
- There is pressure for general reed harvesting throughout the system. It is imperative that a Maintenance Management Plan for reed harvesting be compiled to facilitate sustainable use of this resource where appropriate. It is imperative that this activity does not compromise the filtration and ecological function performed by the reedbeds, wetlands and Peat wetlands.
- Redesigning and upgrading of poorly constructed road crossings must be undertaken with urgency. In the case of the Redelinghuys wetlands, insufficient through-flow caused by the under designed road bridge culverts results in back flooding.
- The Verlorenvlei Estuary system is also subject to substantial water abstraction, both legal and illegal, and it is strongly recommended that compulsory licensing be undertaken with individual inspections, and that the planning take future climate change into consideration.

- Heavy mining traffic using the causeways crossing the Verlorenvlei Estuary must be managed to prevent degradation of sensitive habitats.
- The Verlorenvlei Estuary is a heavily utilised system and it is strongly recommended that a suitably qualified and knowledgeable candidate is appointed, and seconded to the Cederberg Municipality, to co-ordinate management actions.
- Future revisions of this EMP must take into account any changes in Verlorenvlei Estuary Mouth Maintenance Management Plan (MMP), and therefore amended accordingly.
- Future revisions of the zonation plan should also consider flexible recreational use areas as well as peak user days regulations.

10 REFERENCES

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- CSIR 2009. C.A.P.E. Estuaries Programme. Proposed generic framework for estuary management plans. Version 1.1. Report submitted to the C.A.P.E. Estuaries Programme. CSIR Report No. CSIR/NRE/CO/ER/2009/0128/A. Stellenbosch. 46 pp.
- CSIR 2009b. Development of the Verlorenvlei estuarine management plan: Situation assessment. Report prepared for the C.A.P.E. Estuaries Programme. CSIR Report No (to be allocated). 117 pp. Stellenbosch.
- Department of Water Affairs and Forestry (DWAF) 1995. South African water quality guidelines for coastal marine waters. Volume 1. Natural Environment. Pretoria.
- Turpie, JK and Clark, BM 2007. Development of a conservation plan for temperate South African estuaries on the basis of biodiversity importance, ecosystem health and economic costs and benefits. Anchor Environmental Consulting report prepared for C.A.P.E. Regional Estuarine Management Programme.

APPENDIX 1: PROPOSED TEMPLATE FOR PROJECT PLANS

Source: DEA (2015)

ACTION	Describe the action to be undertaken																																																											
COMPLETION DATE	Provide date of expected completion																																																											
PERFORMANCE INDICATOR																																																												
Requirements stipulated in policy and legislation																																																												
Available methods, protocols and best practice-guides																																																												
Spatial zonation consideration (e.g. limits/targets)																																																												
Detailed work plan	Task 1: Task 2: Task 3: Task 4:																																																											
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APPENDIX 2: RECOMMEND PERFORMANCE MONITORING PROTOCOL

OBJECTIVES	BY WHEN	PERFORMANCE INDICATOR	LEGISLATION	RESPONSIBLE AGENT
<u>Ecological</u>				
The Verlorenvlei ecosystem receives formal protection status	2024	<ul style="list-style-type: none"> The Verlorenvlei ecosystem is proclaimed a Formal Protected Area Estuary zoning plan and recommendations incorporated into IDP/SDF and acknowledged in formal initiatives 	Protected Areas Act Municipal Systems Act	DFFE DEA&DP DPWI CapeNature Cederberg LM
Further degradation (negative trajectory) of Verlorenvlei ecosystem is halted	2023	<ul style="list-style-type: none"> Fine scale GIS map developed indicating areas requiring priority rehabilitation and restoration identified Rehabilitation and restoration programme implemented Estuary-specific climate change adaptation plan developed and adopted Mouth management plan developed and implemented Agricultural best practice guidelines developed, published and implemented Protocol for reed management developed and implemented Grazing protocol developed and implemented Appropriate waste management facilities/infrastructure established and maintained (e.g. rubbish bins) Designated pollution compliance and enforcement units deployed to Verlorenvlei and surrounding areas Illegal users/uses convicted and appropriately penalised Verlorenvlei EAF registered as an Interested & Affected Party for all developments and rezoning applications surrounding the estuary Increased monitoring of compliance with Environmental Authorisations Increased monitoring of compliance with building controls 	Conservation of Agricultural Resources Act National Water Act Protected Areas Act	DFFE DEA&DP DWS CapeNature Cederberg LM Verlorenvlei EAF Bergvriër LM DALRRD

OBJECTIVES	BY WHEN	PERFORMANCE INDICATOR	LEGISLATION	RESPONSIBLE AGENT
<p>Ecological health of ecosystem is improved to Category C/B (moderately modified)</p> <p>Ecological health of ecosystem is improved to Category A/B (near natural)</p>	<p>2023</p> <p>2030</p>	<ul style="list-style-type: none"> Water resource utilisation plan developed and implemented Ecological flow requirements (EFR) determined for Verlorenvlei Estuary Catchment Classification process is completed and all water resources are classified and reserves are secured Catchment Management Plan and Strategy is developed Verlorenvlei Estuary EFR considered in issuing of abstraction permits Gillnetting (legal & illegal) phased out in entirety Alien fish species and abundance decreased on annual basis Alien vegetation eradication programme developed and implemented Research projects investigating fish health, avian botulism undertaken Sanitation and sewage treatment facilities at Redelinghuys and Elands Bay upgraded and functioning optimally Environmental best practice and appropriate management actions implemented at solid waste dump sites Research projects on groundwater and nutrient dynamics undertaken All road crossings addressed (removed or upgraded) 	<p>National Water Act</p> <p>Conservation of Agricultural Resources Act</p> <p>Marine Living Resources Act</p> <p>ICM Act</p> <p>Municipal Systems Act</p>	<p>DFFE</p> <p>DWS</p> <p>CapeNature</p> <p>DFFE (incl. WfW)</p> <p>CapeNature</p> <p>Cederberg LM</p> <p>Bergivier LM</p>
<u>Heritage</u>				
The cultural, historical and archaeological sites in and around Verlorenvlei Estuary receives official protection status	2024	<ul style="list-style-type: none"> Heritage sites receive formal protection Heritage site database developed and maintained 	<p>Protected Areas Act</p> <p>National Heritage Act</p>	<p>DFFE</p> <p>SAHA</p>
<u>Socio-economic</u>				
The Estuary Advisory Forum is constituted ("integrated & empowered community")	2023	<ul style="list-style-type: none"> Former Estuary Management Forum reconstituted into EAF, ToR agreed with RMA, and bi-annual meetings convened ToR agreed for various government department and other institutions Departmental project plans developed and implemented 	ICM Act / he Protocol	All parties

OBJECTIVES	BY WHEN	PERFORMANCE INDICATOR	LEGISLATION	RESPONSIBLE AGENT
The community (farmers, fishers, residents, commercial concerns, NGOs, authorities, etc.) functions in an integrated, cooperative manner through a trusting and fully representative Estuary Advisory Forum ("integrated & empowered community")	2023	<ul style="list-style-type: none"> Education and awareness programme developed and implemented Safety and security plan developed Deployment of additional security officers Offenders convicted and appropriately penalised 	ICM Act All relevant laws	All relevant government departments CapeNature Verlorenvlei EAF Cederberg LM Bergrivier LM West Coast DM SAPS Local community DALRRD
A sustainable tourism market is established for the area, utilizing the diverse range of values offered by Verlorenvlei Estuary ("sharing values" and "valued visitors")	2024	<ul style="list-style-type: none"> Developed coastal management lines and gazetted Applicable building controls applied to high risk areas Access needs for Verlorenvlei incorporated in municipal coastal access roll out process Controlled access provided and maintained within Verlorenvlei 	ICM Act Municipal Systems Act	Cederberg LM DEA&DP DFFE CapeNature
Unemployment (and associated poverty) in the Verlorenvlei Estuary area is reduced through innovative job creation initiatives, e.g. tourism, fisheries, food security, etc. ("fair standard of living")	2024	<ul style="list-style-type: none"> Feasibility study for fishing competitions conducted Feasibility study for hydroponics conducted and programme implemented Development options for Community Tourism/Information Centre investigated, approved and executed Enhanced local economic development (e.g. through SMMEs) Increase in employment rate surrounding Verlorenvlei Reduction in poverty index Improved food security for Verlorenvlei communities 	Conservation of Agricultural Resources Act Marine Living Resources Act Municipal Systems Act Tourism Act	Cederberg LM West Coast DM DoT DFFE DALRRD

