# UPDATE OF THE ORANGE RIVER MOUTH ESTUARY MANAGEMENT PLAN

# ESTUARINE MANAGEMENT PLAN

**DRAFT REPORT**

forestry, fisheries & the environment

Department:
Forestry, Fisheries and the Environment
REPUBLIC OF SOUTH AFRICA

**FEBRUARY 2025**

# Report Details

| Report Title | Development of an Estuarine Management Plan for the Orange River Mouth Estuary: Draft Estuarine Management Plan |
|---|---|
| **Report Status** | Draft Report |
| **Report Date** | February 2025 |
| **Purpose of this Report** | The Estuarine Management Plan (EMP) addresses the requirements as set out in the 2021 National Estuarine Management Protocol (NEMP) and is ultimately intended to improve the state of the coastal, and specifically the estuarine environment, for the Orange River Mouth Estuary, whilst ensuring the on-going provision of benefits to society. |
| **Acknowledgements** | The following main contributors to the development of this report are acknowledged for their input into and compilation of the report:<br>• National Department of Forestry, Fisheries and the Environment (DFFE)<br>• Orange-Senqu River Commission (ORASECOM)<br>• Habitat Link Consulting: appointed service provider and project leaders<br>• Coastwise Consulting: estuarine and ecological specialists<br>• GroundTruth: estuarine and ecological specialists<br>• Ms Wilna Oppel: stakeholder liaison and local contact |

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## Indemnity

Certain information included in this document has been sourced from the original Orange River Mouth Estuarine Management Plan (and associated reports) compiled by Eco-Pulse and the CSIR. The information in the original reports has stayed the same in many respects with additional work added where necessary. The original content in previous reports still remains applicable as historical information and, where necessary, more updated maps and information has been incorporated into these documents. This revised document has been prepared in accordance with the scope of Habitat Link Consulting's appointment and contains intellectual property and proprietary information that is protected by copyright in favour of Habitat Link Consulting (Pty) Ltd and its associates. The document has been prepared exclusively for use by the Orange-Senqu Commission (ORASECOM) on behalf of the National Department of Forestry, Fisheries and the Environment (DFFE), and Habitat Link Consulting accepts no liability for any use of this document other than by ORASECOM and/or DFFE and only for the purposes for which it was prepared. No person/entity other than the ORASECOM and/or DFFE may copy, use or rely on the content of this document without the prior written consent of the author or relevant officials. This report was compiled using the best available information, knowledge, technology and experience. However, Habitat Link Consulting (Pty) Ltd, its associates and/or any individual or any other company who have contributed towards the compilation of this information cannot be held responsible for any loss or damage incurred as a direct or indirect result of the use thereof. All recommendations were made in good will, but the risks associated with the implementation thereof, resides with the implementer.

# Foreword

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

The Orange-Senqu Commission (ORASECOM) commissioned the review and update of the 2013 EMP, which was previously aligned for the management of the Ramsar site (Macfarlane, 2013).

The purpose of this revision, which includes the Situation Assessment Report (SAR) and the Estuarine Management Plan (EMP) itself, is to ensure that the documents remain relevant as "living documents" and embody the adaptive management approach as per the cyclical review process prescribed in the NEMP and the accompanying guideline document (DFFE, 2023).

The work of the original authors (CSIR, 2011; MacFarlane, 2013; DFFE, 2017) and input received from stakeholders during the inaugural EMP development process remains foundational to this revised EMP. 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. Relevant sections have been replaced and/or updated with more recent information as deemed necessary, whilst other sections remain unchanged.

To note, the earlier editions of the SAR and EMP were drafted referring to the government departments in existence at the time (e.g. National Department of Environmental Affairs, Northern Cape Department of Environment and Nature Conservation). Where feasible, the necessary updates have been made or indicated otherwise.

Note: Information from earlier editions of the SAR and EMP (2011, 2013 and 2017) are included in information boxes in order to provide context to this Updated EMP.

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# List of Abbreviations

| | |
|---|---|
| msl | (Above) Mean Sea Level |
| BAS | Best Attainable State |
| BCLME | Benguela Current Large Marine Ecosystem |
| CARA | Conservation of Agricultural Resources Act |
| CBD | Central Business District |
| Cd | Cadmium |
| CMA | Catchment Management Agency |
| CMP | Coastal Management Programme |
| Co | Cobalt |
| CPA | Communal Property Association |
| CPUE | Catch per unit effort |
| Cu | Copper |
| CWAC | Co-ordinated Waterbird Counts |
| DAERL | Northern Cape Department of Agriculture, Environmental Affairs, Rural Development and Land Reform |
| DALRRD | National Department of Agriculture, Land Reform and Rural Development |
| DEA | Department of Environmental Affairs |
| DECT | Department of Environmental Conservation and Tourism |
| DENC | Department of Environment and Conservation |
| DFFE | Department of Forestry, Fisheries and the Environment |
| DIN | Dissolved Inorganic Nitrogen |
| DIP | Dissolved Inorganic Phosphorous |
| DMRE | Department of Mineral Resources |
| DOT | Department of Tourism |
| DWA | Department of Water Affairs |
| DWAF | Department of Water Affairs and Forestry |
| DWS | Department of Water and Sanitation |
| EA | Environmental Authorisation |
| EBSA | Ecologically or Biologically Significant Marine Area |
| EDC | Estuarine Dependence Category |
| EFR | Environmental Flow Requirements |
| EFZ | Estuarine Functional Zone |
| EHI | Estuary Health Index |
| EIA | Environmental Impact Assessment |
| EIS | Ecological Importance and Sensitivity |
| EMP | Estuarine Management Plan |
| EMPr | Environmental Management Programme |
| EPWP | Expanded Public Works Programme |
| EWR | Environmental Water Requirements |
| FAO | Food and Agriculture Organization of the United Nations |
| Fe | Iron |
| GIS | Geographic Information System |
| Ha | Hectares |
| ICM Act/ICMA | National Environmental Management: Integrated Coastal Management Act |
| IDP | Integrated Development Plan |
| MAP | Mean annual precipitation |
| MAR | Mean annual runoff |
| MEFT/MET | Namibian Ministry of Environment, Forestry and Tourism |
| MLRA | Marine Living Resources Act |
| MMP | Maintenance Management Plan |
| MOU | Memorandum of Understanding |

| | |
|---|---|
| MPA | Marine Protected Area |
| MPRDA | Minerals and Petroleum Resources Development Act |
| MSA | Marine Shipping Act |
| N/A | Not Applicable |
| NBA | National Biodiversity Assessment |
| NC DAERL | Northern Cape Department of Agriculture, Environmental Affairs, Rural Development and Land Reform |
| NEMA | National Environmental Management Act |
| NEMBA | National Environmental Management: Biodiversity Act |
| NEMP | National Estuarine Management Protocol |
| NEMPAA | National Environmental Management: Protected Areas Act |
| NEMWA | National Environmental Management: Waste Act |
| NFA | National Forests Act |
| NHA | National Health Act |
| NHRA | National Heritage Resources Act |
| Ni | Nickel |
| NMU | Nelson Mandela University |
| NSRI | National Sea Rescue Institute |
| NTU | Nephelometric Turbidity Unit |
| NWA | National Water Act |
| NWMS | National Waste Management Strategy |
| ORASECOM | The Orange-Senqu Commission |
| ORM | Orange River Mouth |
| ORM PSC | Orange River Mouth Public Service Commission |
| Pb | Lead |
| PES | Present Ecological State |
| PERC | Preliminary Ecological Reserve Category |
| PFMA | Public Finance Management Act |
| psu | Practical salinity unit |
| REC | Recommended Ecological Category |
| REI | River-Estuarine Interface |
| RMA | Responsible Management Authority |
| RQO | Resource Quality Objectives |
| SANBI | South African National Biodiversity Institute |
| SAR | Situation Assessment Report |
| SAWCP | South Africa Wetland Conservation Programme |
| SAWQG | South African Water Quality Guidelines |
| SD | Standard Deviation |
| SDF | Spatial Development Framework |
| SE | Standard Error |
| SPLUMA | Spatial Planning and Land Use Management Act |
| TBC | To be confirmed |
| TIN | Total inorganic nitrogen |
| TP | Total phosphorus |
| TPC | Thresholds of Potential Concern |
| UNDP-GEF | United Nations Development Programme - Global Environment Facility |
| WMA | Water Management Area |
| WWTW | Wastewater Treatment Works |
| Zn | Zinc |

# 1. Introduction

## 1.1. Background

The Orange-Senqu River flows westwards from the Lesotho Highlands to Alexander Bay / Oranjemund on the Atlantic West Coast for about 2 432 km (Figure 1.1). The catchment of the Orange-Senqu River is shared by Botswana, Lesotho, Namibia and South Africa, with the river basin covering a total area of 0.9 million km$^2$. The management of the Orange-Senqu River Basin is particularly complex, but is vital to the economy of the region. Irrigation demands from Namibia and South Africa impact largely on environmental flows to the Orange River Mouth (ORM) Estuary (also known as the Gariep Estuary), whilst water resource quality is affected by the heavily developed basin. Periodic flooding in the middle and lower reaches of the river can often be devastating and mining along the estuary has had several negative environmental implications, although the ORM Estuary is ranked as one of the most important wetland systems in southern Africa.

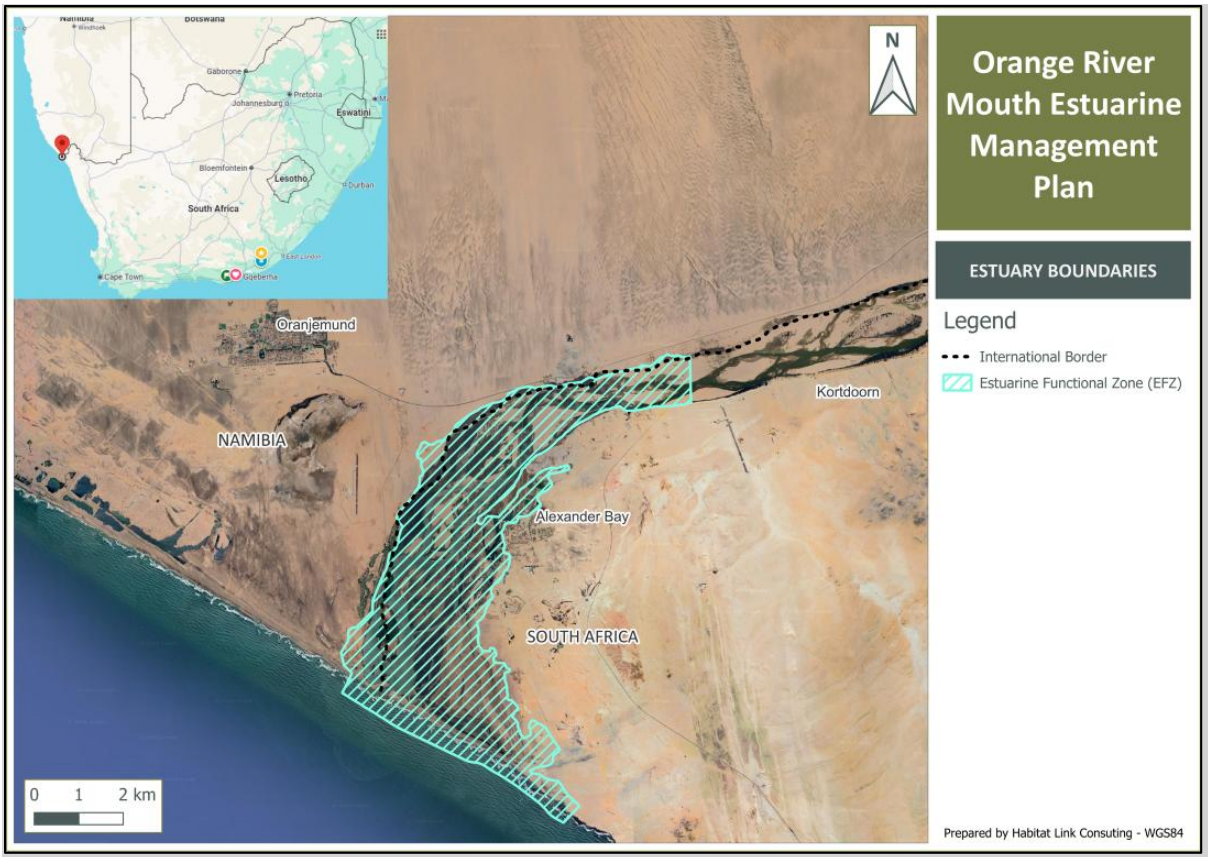


**Figure 1.1: Locality and boundaries of the Orange River Mouth estuary, Northern Cape).**

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 National Estuarine Management Protocol (NEMP), require Estuary Management Plans to be prepared for estuaries in order to create informed platforms for efficient and coordinated estuarine management. Chapter 4 of the ICM Act (Act No. 24 of 2008, as amended), aims to facilitate the efficient and coordinated management of all estuaries, in accordance with:

a) The NEMP (or 'the Protocol') (Section 33) approved by the Ministers responsible for the environment and water affairs; and
b) EMPs for individual estuaries (Section 34).

The purpose of the Estuarine Management Plan (EMP) is to coordinate activities undertaken by organs of state, private sector and communities in relation to the estuary. The aim is to improve the ecological and management status of the estuarine system and prevent degradation of the area.

Ultimately, the EMP must be reviewed at least every five years from the date it was adopted. The Orange-Senqu Commission (ORASECOM) commissioned the review and update of the current EMP, which was originally drafted by Eco-Pulse Environmental Consulting Services in 2013.

## History of the Orange River Estuary

*(Adapted from DEA, 2017, Orange River Mouth Estuarine Management Plan)*

Archaeological evidence shows that early man frequented the shores of the Orange River from about 1.5 million years ago onwards. As a linear oasis, the Orange River served as a route from inland to the coast during the Early Stone Age (ESA, 1.5 million to 200 000 years ago), the Middle Stone Age (MSA, about 200 000 to 40 000 years ago) and the Later Stone Age (LSA, 40 000 years ago to the present).

The first written historical account of the lower Orange River was made in 1486, when three ships sent by the King of Portugal called at the ORM (or Angra das Voltas, as it was then called) under the command of Barthlomew Dias. The first prospecting operations in the area are recorded as early as 1685. An increase in activity took place during the Namibian copper rush in the 1850s. During this period, Mr James Alexander operating the Kodos copper mine (approximately 10km from Sendelingsdrift) from 1854 transported copper on barges during high flows to Alexander Bay for shipment to the sea (Alexkor, 2009). The colonial boundary of the Cape Colony was extended to the Orange River in 1847; however it was only in the early 1900s when diamonds were discovered that the government showed any interest in utilizing the area.

The ORM also served as an access point to the open sea when on 22 October 1886 Adolf Luderitz and his companion, Steingroewer, set off for Luderitz via the river mouth. After the discovery of diamonds in 1908, the lower Orange River was subject to intense prospecting activities.

Until this time the area was inhabited by the Nama people who were semi-nomadic pastoralists. They have used the area for purposes of habitation, cultural and religious practices, grazing, cultivation, hunting, fishing, water "trekking" and harvesting, and exploitation of natural resources.

In 1908 the first diamonds were discovered along the west coast of southern Africa at Kolmanskop near Lüderitz. This led to the subsequent prospecting at the Orange River Mouth where rich deposits were discovered at Alexander Bay in 1926. These deposits proved so rich that in 1927 the Government prohibited all further diamond prospecting on state owned land in Namaqualand and started mining operations at Alexander Bay. Later diamonds were also discovered and mined elsewhere along the vast coastline, including areas in Namibia just north of the Orange River Mouth (Alexkor, 2009).

In order to limit access to the area, the Nama people were dispossessed of their right of ownership and their beneficial occupation of the Namaqualand coastal area by a series of legislative and executive actions. Amongst others these included the Precious Stones Amendment Act (Act 27 of 1907 (Cape)) and the Precious Stones Act (Act 44 of 1927). Under these Acts during the 1930s, members of the Nama people who lived in the village of Dunvlei were forced to move their homes off this land. In 1957 the Nama people also lost the right to exercise their rights of access, seasonal grazing and watering of stock on Farm 1 (the present-day Alexander Bay and the ORM). Some others were forcibly removed from a settlement at Kortdoorn in 1961, and were moved to Arries inside the Richtersveld reserve. The community was denied access to the mining area and a corridor of farms was created around the declared mining reserve and along the riverbank. The State alluvial Diggings was taken over from the Government and transformed into the Alexander Bay Development Corporation (Alexkor) in 1989.

On the Namibian front, the German government created the Sperrgebiet in 1908 in its colony of German South West Africa, giving sole rights for mining to the Deutsche Diamantengesellschaft ("German Diamond Company"). Access to this stretch of the coast was prohibited through an exclusion policy with access strictly limited to mining operations.

Following South Africa's accession to the Ramsar convention the Orange River Mouth was designated as a Ramsar site by South Africa in 1991. After Namibia ratified the Ramsar Convention in 1995, the designated area was enlarged and the Namibian part of the wetland was immediately designated as well. This was not the result of a formal international agreement between Namibia and South Africa; both countries simply proposed their respective parts of the area under the Ramsar Convention (Verschuuren, 2007).

In the same year, the area was put on the Montreux record because part of it had been seriously degraded. The Orange River Mouth Interim Management Committee (ORMIMC) was established in 1995 and has served as an advisory body to the respective competent authorities. The ORMIMC has been the driving force behind current initiatives at the central government level in South Africa to rehabilitate the area, to remove it from the Montreux record, to get the area protected under South African law, and to draft a management plan for the Ramsar site. Despite these initiatives however, active management of the Ramsar site has been limited and has resided largely in the hands of the mining companies Alexkor and NAMDEB (jointly owned by De Beers and Namibian Government) located on the South African and Namibian sides of the estuary respectively. This situation has recently changed with the proclamation of the Sperrgebiet National Park in Namibia that includes the Namibian section of the Orange River Mouth and the settlement of a land claim on the South African section which has now been handed over to the Richtersveld community.

## 1.2. Estuary Management Process

Based largely on the initial Generic EMP planning framework (CSIR 2009) developed under the C.A.P.E. Estuaries Programme, the NEMP identifies a set of minimum requirements that must be included in the process of developing and implementing an EMP, and these are further detailed in the supporting EMP Guidelines (DEA, 2023) (Figure 1.2).

The minimum requirements of an EMP include:

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

The original EMP assessment was initiated early in 2011 and was captured as a separate document (CSIR, 2011) and the original EMP was then refined through subsequent interactions with stakeholders and then adopted and gazetted by the DFFE (formerly the DEA) on 30 June 2017.

The revision of the ORM EMP will proceed through the two (2) main phases as prescribed in the 2021 NEMP and EMP Guideline document (DEA, 2023). Phase 1 entailed the review and update of the SAR, while Phase 2 has focused on the review of the EMP.

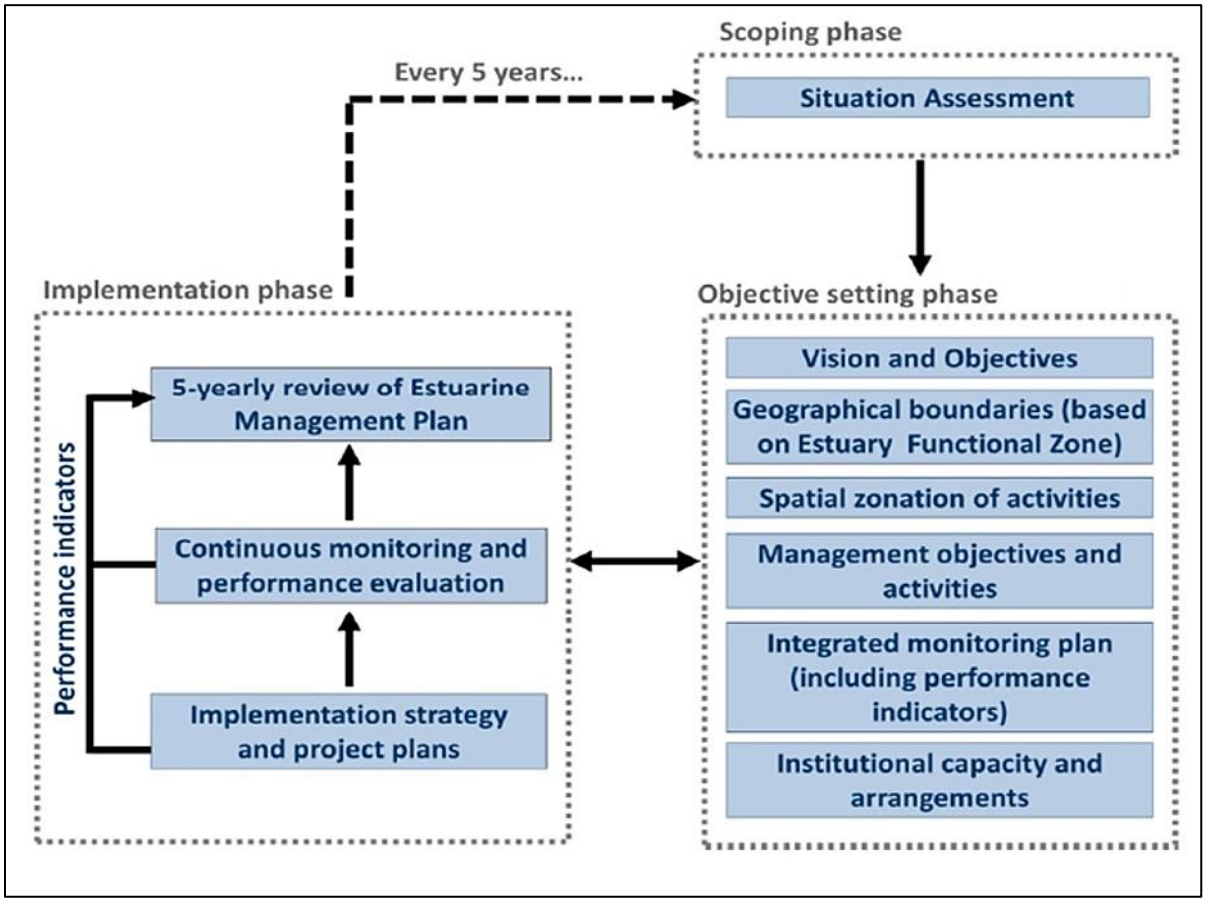


**Figure 1.2: A framework for integrated estuarine management in South Africa (DEA, 2023).**

## 1.3. Purpose of the Estuarine Management Plan

This report constitutes the second phase and core component of the estuarine management planning process, namely the EMP. The purpose of the plan is to provide the overarching 'Vision' for the future desired state of the estuary, and thereby guide the management of human activities in and around the Orange River EFZ by setting out essential management objectives with related actions and activities to be undertaken. It is the primary document for use by the responsible authority (in this case, the DFFE) to facilitate coordination of management interventions, in alignment with existing legislative and institutional mandates, identified during the planning process to ultimately ensure the longevity of the estuarine system.

It is also the critical reference document for the incorporation of estuarine management into local, regional and international management strategies. At a local level, this will include the municipal Integrated Development Planning (IDP) and spatial planning processes (e.g. spatial development framework (SDF), land use management system (LUMS) / town planning scheme (TPS), etc.). At the regional level, this plan needs to be integrated into and aligned with conservation and land-use planning such as regional Land Use Management Plans in South Africa and the Sperrgebiet National Park Management Plan in Namibia. At an international level, consideration should be given to existing institutional structures and plans, such as the Orange River Integrated Water Resources Management Plan of the Orange-Senqu River Commission (ORASECOM).

This EMP comprises the following critical elements, as prescribed in the 2021 NEMP and EMP Guidelines:

- A geographical description and map of the estuary, based on the EFZ;
- A succinct Executive Summary of the SAR, highlighting key information;
- The local vision and overarching or key objectives (confirmed via stakeholder engagement);

- A priority list of management objectives and activities, established largely through stakeholder engagement, in the form of specific action plans;
- Spatial zonation of the system that indicates permissible and non-permissible activities within various proposed zones of the system, to be governed by specific organs of state and respective legislation;
- A description of the institutional capacity and arrangements required for undertaking the identified actions, taking cognisance of the mandates of the implicated departments and institutions, and the existence of local forums;
- A detailed integrated monitoring plan with specific management actions, accompanied by a list of performance indicators for gauging the progress of achieving the objectives of the EMP; and
- A summary of critical issues and recommendations.

This plan is intended to be a high-level, strategic five-year document that provides the direction for the management of the ORM estuary, portion of which is a Ramsar Site. Further to the above, and as per the 2017 EMP, the purpose of the document includes the following:

- To facilitate cooperative management of the Ramsar site amongst stakeholders through the development of a shared vision and strategic objectives for future management of the site;
- To provide for the formal establishment of a governance structure that will oversee the implementation of the plan;
- To provide the primary strategic tool for management of the Orange River Ramsar site, informing the need for specific programmes and operational procedures;
- To enable stakeholders to manage and use the Orange River Mouth Ramsar Site in such a way that its values and the purpose for which it was declared are protected;
- To provide a basis for integrating site management into broad-scale landscape and ecosystem planning;
- To provide motivations for budgets and future funding and providing indicators that available funds are spent correctly;
- To build accountability into the management of the Orange River Mouth Ramsar Site; and
- To provide for capacity building, future thinking and continuity of management.

## 1.4. Structure of the Report

The structure of this EMP is detailed as follows:

- **Chapter 2** delineates the geographical boundaries of the ORM Estuary;
- **Chapter 3** provides a summary of the current state of affairs of the ORM Estuary;
- **Chapter 4** sets out the Vision and Key Objectives for the management of the ORM Estuary. It describes the desired future state for the system and provides the overarching logical framework for the action plans that have been developed and/or updated;
- **Chapter 5** sets out the Management Objectives for the ORM Estuary and includes a list of actions from which management priorities were selected;
- **Chapter 6** details the Spatial Zonation and associated operational specification for the ORM Estuary;
- **Chapter 7** describes the recommended Management Priorities, i.e., the required actions and activities to be undertaken in terms of implementing the EMP, captured as sectoral action plans;
- **Chapter 8** provides the priority rehabilitation measures to restore the degraded salt marsh;
- **Chapter 9** describes the institutional arrangements for implementation of the EMP;
- **Chapter 10** sets out the Integrated Monitoring Plan required in respect to assessing the implementation and the performance of the EMP in respect to achieving the stipulated objectives; and
- **Chapter 11** provides a summary of key recommendations made and the conclusion to the document.

# 2. Geographical Boundaries

## 2.1. The Orange River Catchment

The ORM estuary forms part of the Orange-Senqu River Basin (or catchment), the largest river basin in Africa south of the Zambezi, covering an area of approximately 0.9 million km$^2$ (ORASECOM, 2014). The basin stretches over four countries - South Africa, Lesotho, Botswana and Namibia, with the Orange River itself forming part of the border between South Africa and Namibia (Figure 2.1). The two main tributaries are the Senqu and the Vaal rivers. The headwaters of the Senqu rise in the Maluti mountain range in the Lesotho Highlands, while the other main tributary, the Vaal River, rises on the eastern highveld escarpment in the north-east of South Africa (Earle *et al*. 2005). At the confluence of the Senqu and Vaal rivers, the Orange River flows in a westerly direction to the west coast entering the Atlantic Ocean through the ORM estuary. Smaller ephemeral systems, namely the Molopo (South Africa) and Fish (Namibia), join the Orange River in the lower catchment.

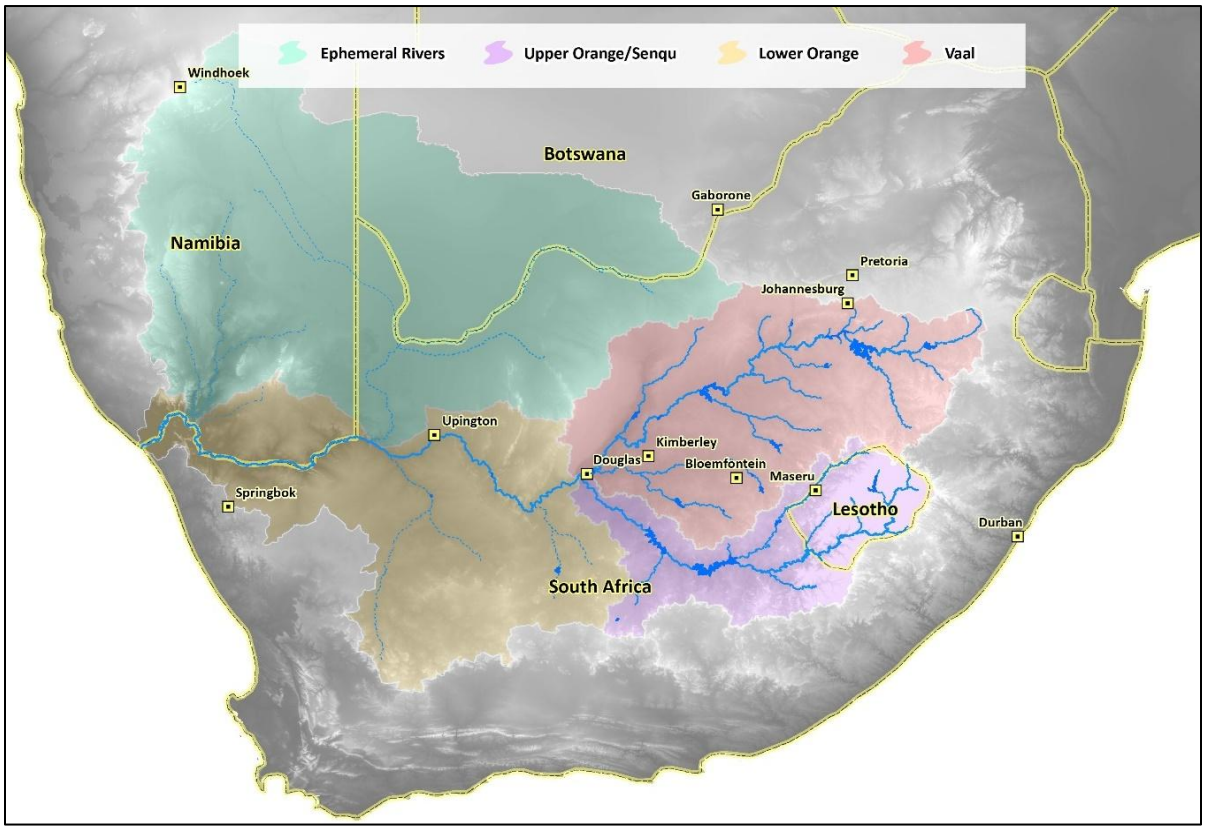


**Figure 2.1: Overview of the sub-catchments making up the greater Orange-Senqu River basin (GroundTruth, 2021).**

## 2.2. The Orange River Mouth Estuarine Functional Zone

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

According to the 2014 EIA Regulations, the 'estuarine functional zone' (EFZ) means "*the area in and around an estuary which includes the open water area, estuarine habitat (such as sand and mudflats, rock and plant communities) and the surrounding floodplain area, as defined by the area below the 5 m topographical contour (referenced from the indicative mean sea level)*". The NEMP acknowledges the EFZ as the geographical boundary of an estuary in South Africa, with provisions for modifications. As prescribed by the 2018 South African National Biodiversity Assessment (NBA; Van Niekerk *et al.*, 2019), the EFZ has since been refined and extended, where necessary, to include estuarine habitat and processes that what were previously excluded by default application of the 5 m contour in certain estuaries. The extended boundaries also include part of the adjacent marine environment (see Figure 2.2).

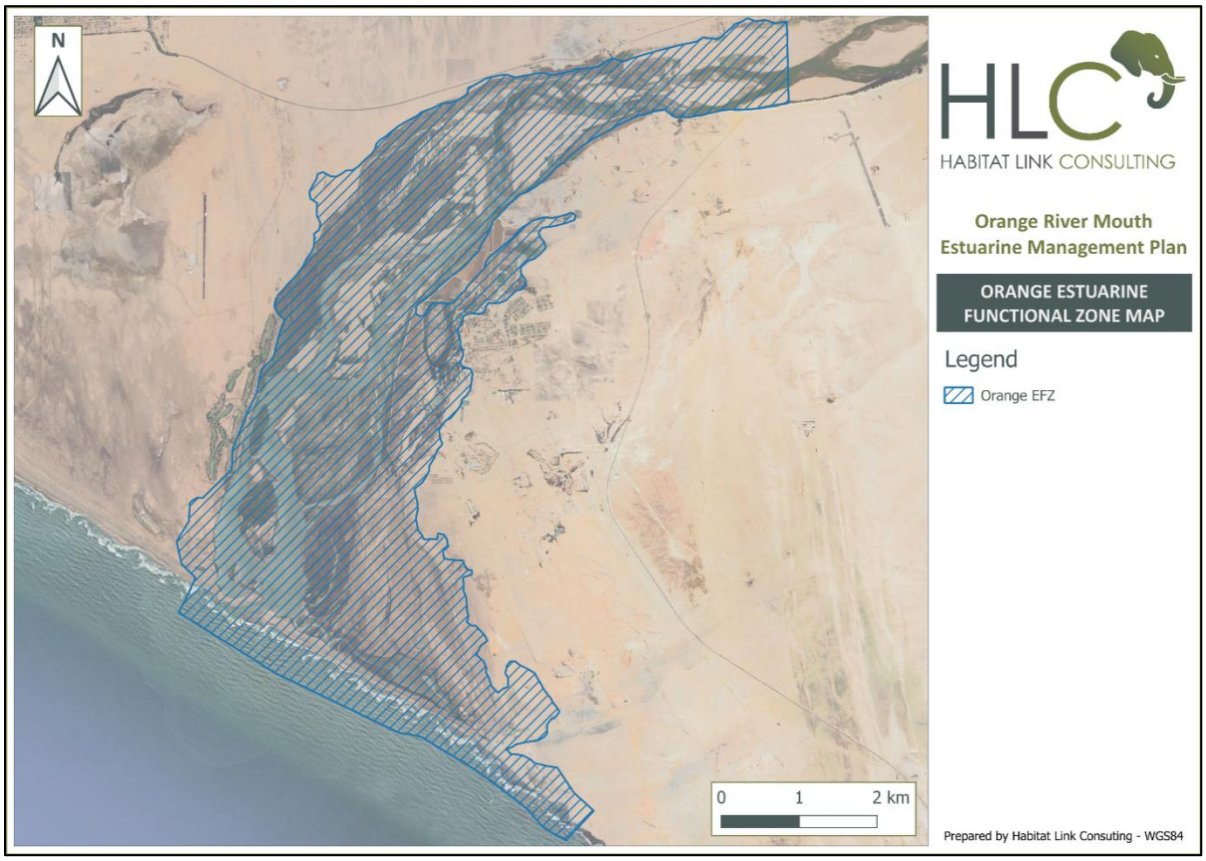


**Figure 2.2: Geographical boundaries of the Orange River Mouth Estuary as captured in the 2018 National Biodiversity Assessment (Van Niekerk et al., 2019).**

The ORM Estuary (28°38' S; 16°27' E) is situated just north of the coastal town of Port Nolloth in the Northern Cape province and forms the border between South Africa and Namibia, on the west coast of southern Africa. The system falls within the Cool Temperate biogeographic region, which extends from the Uilkraals Estuary to the ORM Estuary (and beyond into Namibia). The boundaries of the EFZ encompass the extent of tidal influence, which is approximately 3 km above the Sir Ernest Oppenheimer Bridge, approximately 14 km from the mouth (Table 2.1). Tidal variations of a few centimetres are observed at springtide at this bridge. The estuary has an area of about 3 000 ha.

**Table 2.1: Geographical boundaries of the Orange River Mouth estuary.**

| | |
|---|---|
| **Downstream boundary*** | 28°38'30" S; 16°27'45" E |
| **Upstream boundary** | 28°33'38.46" S; 16°31'24.19" E |
| **Lateral boundaries** | 5 m contour above Mean Sea Level (MSL) along each bank |

*The exact location of the mouth is variable

The ORM Estuary is classified as a cold-temperate, large, fluvially-dominated system (Van Niekerk *et al.*, 2019). It is a delta type river mouth, comprising a channel system between sand banks, a tidal

basin, the river mouth and the salt marsh on the south bank. The tidal basin is separated from the Atlantic Ocean by a sand bar, through which a mouth, a few hundred metres wide, is usually present. At times the mouth is located towards the northern bank and sometimes towards the southern bank, which is driven by the interplay between fluvial and marine (longshore transport) processes. The location of the mouth has a major influence on the volume of seawater entering the estuary which in turn affects various physio-chemical and biological attributes of the system.

## Boundaries of the Ramsar Site

*(Adapted from DEA, 2017, Orange River Mouth Estuarine Management Plan)*

In managing a site of this nature, it is important that the site boundaries adequately incorporate important wetland and estuarine features and that such boundaries are clearly established and communicated between relevant parties. In the case of the ORM Ramsar site, several important sections of the Orange River, floodplain and mouth have not been incorporated into the Namibian side of the Ramsar site. This is a concern, given that management of such areas (together with an appropriate buffer zone) should be addressed as part of the management plan. This also has implications for zoning and management of the adjoining Oranjemund town lands that extend up to the Ramsar boundary.

There are also substantial differences between the Ramsar boundaries as defined by each country. In terms of South Africa the lateral boundaries of an estuary are defined based on the 5m contour, suggesting that it would be preferable to extend the boundaries of the Ramsar site accordingly. This consideration has been incorporated into the proposed boundary of the protected area on the South African Side which also extends upstream to include close to 25 km of riparian habitat. The Ministry of Environment and Tourism in Namibia have also previously expressed a desire to expand the Ramsar boundary to include Pink Pan and to extend further up the river.

Given existing differences in Ramsar boundaries, the desire to extend the Ramsar site on the Namibian side and the need to align this management plan with the proposed management plan for the protected area on the South African side, there is a clear need to collaboratively review and refine the boundary of the Ramsar site.

Further to the above, the ORM Estuary is a designated Ecologically or Biologically Significant Marine Area (EBSA) (Sink *et al*., 2019; NMU, 2023), known as the Orange Cone EBSA. The Orange Cone EBSA is transboundary spanning coastal portions of both Namibia and South Africa marine waters (50km north and south of the estuary mouth, and approximately 150km offshore), and it extends up the ORM estuary to the 5m contour (approximately 30 km from the mouth). The figure below (Figure 2.3) illustrates the discrepancy between the described boundaries.

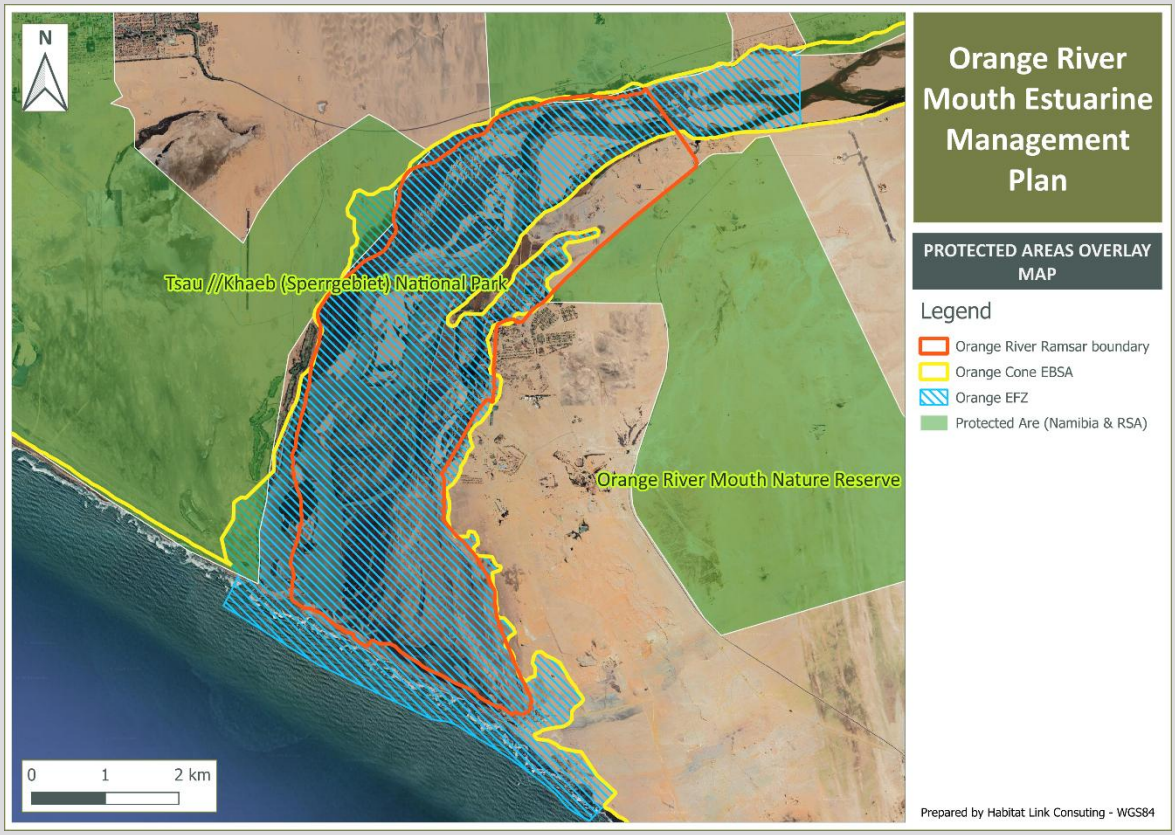


**Figure 2.3: Overview of Orange River Mouth estuary EFZ, relative to Ramsar boundaries, protected area boundaries, and EBSA boundaries.**

# 3. Summary of Situation Assessment

## 3.1. Overview

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

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

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

## 3.2. Legislative Instruments

The legislative framework specific to estuarine management is the Integrated Coastal Management Act and the accompanying National Estuarine Management Protocol. The Protocol provides national policy and ensures alignment by providing a national vision and objectives for achieving effective integrated management of estuaries. The Protocol identifies the responsible management authority per estuary, in this instance the Department of Forestry, Fisheries and the Environment (DFFE).

**Integrated Coastal Management Act (ICM Act)**

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

**National Environmental Management Act (NEMA)**

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

**National Water Act (NWA)**

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

**Marine Living Resources Act (MLRA)**

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

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

## 3.3. Ecological Function: Abiotic Function

Water resource development in the Orange-Senqu River basin has markedly reduced river inflows to the estuary from reference (natural), with only an estimated 40% of natural flows still reaching the system (4 515 million $m^3$/a) (Louw, *et al.*, 2013a). Despite the drastic reduction in flows and flow regulations, the estuary is still river-dominated with marine interchange limited to the middle and lower section of the estuary. Following the first generation EMP for the ORM Estuary, a co-ordinated water quality monitoring programme was established to collate the results of several monitoring activities undertaken by different institutions. This SAR includes relevant information and data regarding monitoring of water quality parameters including salinity, temperature, pH, dissolved oxygen, turbidity, nutrients, toxic substances and bacterial load. The mouth of the ORM Estuary is maintained by fluvial discharges and additional fluvial sediment passing through the estuary and deposited in the sea, where it is dispersed. During major resetting river floods, large volumes of sediment are flushed from the entire estuary, removing many of the islands between the braided channels, scouring out the basin area and removing large parts of the sand bar across the mouth. Although no data are available on sediment concentrations of other toxic substances (e.g. persistent organic pollutants) it is possible that extensive urban development and agricultural practices in the catchment could have resulted in some contamination.

## 3.4. Ecological Function: Biotic Function

There is very little information available on the microalgae in the ORM Estuary. The CSIR (Harrison, unpublished data) completed a once-off survey of the estuary in January 1994. The estuary was clearly flowing strongly and any phytoplankton in the water column must have been imported in the river water with little production due to the short residence time. The ORM Estuary has a wide range of habitats that consists of a series of braided troughs interspersed with sandbanks, channel bars and small islands, with a tidal basin and a severely degraded salt marsh on the southern bank (Bornman, Adams and Bezuidenhout 2004; Bornman 2008; Louw, *et al.*, 2013b). The estuarine vegetation includes submerged macrophytes, reeds and sedges, sand and mud banks, macroalgae, intertidal salt marsh and supratidal salt marsh. Brown (1959) described the estuarine fauna of the lower Orange River near the mouth as ‘extremely poor’ and ascribed this to extreme changes in salinity between summer and winter. Comprehensive sampling of the ORM Estuary was undertaken in August 2004 (winter) and February 2005 (summer), and September 2012 (spring) (Louw, *et al.*, 2013b) from nine stations along the estuary, moving from the mouth to approximately 5 km downstream of the Oppenheimer Bridge. The SAR contains information regarding invertebrates (including zooplankton, hyperbenthos and macrozoobenthos), as well as fish and birds.

## 3.5. Ecological Health Status, Estuary Importance and Recommended Condition

While abiotic modifications to the systems were significant, modification in the biotic functioning of the estuary was most significant, specifically in respect to birds. The outcomes of the EFR study (Louw, *et al.*,

2013a) shows a decline in some attributes, such as water quality, and microalgae, with microalgae and birds showing deterioration towards a poorer condition. Other attributes have seen some improvement, such as hydrodynamics and invertebrate fauna. The PES of the ORM Estuary remains as a Category D (largely modified). Despite the highly modified state of the ORM Estuary, the system received a score of 98.5 (out of 100). It was nationally ranked as the 2nd most important estuary in South Africa in terms of conservation importance after the Knysna Estuary (Turpie and Clark, 2007). The importance rating was given as 'Highly Important'. Considering the high importance of the ORM Estuary, as well as its proclamation as a Ramsar site (i.e. protected area of international importance), the REC should be a Category A - or Best Attainable State (BAS).

## 3.6. Ecosystem Services

The ORM estuary was proclaimed a Ramsar site in 1991 in South Africa (Ramsar site 526) and in 1995 in Namibia (Ramsar site 744). The estuary and surrounding floodplain provide a sizeable area of sheltered shallow water suitable for concentrations of wetland birds. The estuary is unique in that it is situated in a trans-border position between Namibia and South Africa, and is one of a limited number of wetlands along the arid Atlantic coastline of southern Africa. Turpie and Clark 2007 estimates that the nursery value of the ORM Estuary between R1 000 000 and R5 000 000 per year. The ORM Estuary offers valuable tourism opportunities for communities in the area (e.g. Richtersveld). Turpie and Clark (2007) estimated the recreational value of the ORM Estuary as between R50 000 and R500 000 per year. Due to the arid nature of the surrounding landscape the flood plain provides an important source of grazing for both domestic and wild stock. The value of estuarine fisheries and estuary contribution to marine fisheries on the west coast is in the region of R 18 million per annum of which R 3 million (17 %) can be attributed to the ORM Estuary (Lamberth and Turpie 2003).

## 3.7. Socio-Economic Context

The ORM estuary and immediate upstream areas extend over Wards 1, 2 and 5 of the Richtersveld Local Municipality, which is seated within the Namakwa District Municipality of the Northern Cape Province in South Africa. Locally, estuaries are recognised to play an important role in the management of water quality and quantity, controlling erosion and providing wildlife habitat within the Richtersveld Local Municipality as well as within the greater Trans Frontier Conservation Area. There is however potential conflict 1) between community (pastoralism) and conservation land use objectives, requiring a necessity for refinement and review of the zonation plan for managing activities of the area and 2) in harmonizing management and use of the area across borders of South Africa and Namibia (Richtersveld IDP, 2015). Potential future developments in relation to the estuary include several tourism developments, property developments and other infrastructure such as dams.

## 3.8. Impacts, Associated Problems and Threats to the Estuary

The major human induced threats and associated problems, as well as the potential impacts arising from these problems, were first identified in the inaugural ORM Estuary EMP. These remain largely unchanged in the present day and include siltation, physical habitat alteration / destruction, alteration of salinity regime, eutrophication, toxic chemical pollution, microbial contamination, littering, suspended solids and direct alteration of biomass/species. These impacts are a result of several activities falling under the broad categories of land-use and infrastructure development, water quantity and quality variations and living marine resources impacts. Several other environmental impacts, public health and safety aspects, food security and poverty topics as well as other socio-economic impacts are listed in the SAR.

## 3.9. Opportunities and Constraints

A number of strengths, weaknesses, opportunities and threats (SWOT) have been identified. These mostly pertain to aspects associated with implementation of legislation, institutional functions, estuary and basin size, tourism topics, protected status, transboundary considerations, mining activities and community buy-in. The SAR lists the specific topics in more detail.

## 3.10. Recommendations, Information Gaps and Research

The listing of the ORM estuary on the Montreux Record obligates the relevant conservation authorities in South Africa to put measures in place, where possible, to restore and maintain the site's ecological character. Several recommendations were proposed in the first SAR (CSIR, 2011), for consideration in the future development and implementation of the ORM estuary management plan. Based on these recommendations, the original Orange River Mouth Estuary Management Plan (2013 EMP) was developed and included several management activities to address the outcomes of the 2011 SAR. In order to inform this update of the EMP, the status of the management activities in the 2013 EMP have been assessed. Similarly, key information gaps or research needs were identified and the status of these have been updated in the updated SAR.

# 4. Vision and Objectives

## 4.1. Proposed Revised Vision

During the stakeholder consultation meetings held in Alexander Bay and Oranjemund in July 2024, the communities were given the opportunity to review the exiting vision for the ORM Estuary and to provide key words and phrases to inform an updated or new vision. The following draft visions have been prepared and will be presented during subsequent community engagement sessions (note that community members suggested that it is provided in both Afrikaans and English):

Vision Option 1:

***'n Riviermonding wat staan as 'n lewende simbool van naasbestaan, waar menslike lewe en natuurlike prosesse naatloos verweef is, die beskerming van natuurlike hulpbronne prioritiseer word, en terselfdertyd die gesondheid en lewenskragtigheid daarvan, vir die komende geslagte verseker.***

***An estuary that stands as a living symbol of coexistence, where human life and natural processes intertwine seamlessly, prioritizing the protection of natural resources while simultaneously ensuring its health and vitality for generations to come.***

Vision Option 2:

***Die Oranjeriviermond 'n model moet word van gebalanseerde ontwikkeling, waar ekologiese gesondheid, ekonomiese lewenskragtigheid en gemeenskapswelstand wedersyds versterk word sonder om die geïntegreerde benadering vir langtermyn volhoubaarheid en veerkragtigheid van hierdie kosbare natuurlike bate, prys te gee***

***The Orange River Mouth is to be a model of balanced development, where ecological health, economic vitality, and community well-being are mutually reinforced ensuring the integrated approach for long-term sustainability and resilience of this precious natural asset.***

Vision Option 3:

***'n Riviermonding waar omgewingsbeskerming, ekonomiese ontwikkeling en gemeenskapsbetrokkenheid, mekaar balanseer***

***An Estuary Orange that balances environmental protection, economic development, and community engagement.***

Vision Option 4:

***'n Riviermonding waar mense die ongeëwenaarde waarde van die riviermonding erken, volhoubare lewensbestaanspraktyke beoefen word, en die ekologiese integriteit daarvan respekteer, verbeter en onderhou word.***

***An Estuary where humans, recognize the estuary's unparalleled value, engage in sustainable livelihood practices, and respect, improve and enhance its ecological integrity.***

A final revised vision will be included in the Final EMP document.

## Other Visions Supporting or Informing Management of the Orange River Mouth

*(Adapted from DEA, 2017, Orange River Mouth Estuarine Management Plan)*

**Ramsar**: In terms of the Ramsar Convention, Contracting Parties are expected to "*formulate and implement their planning so as to promote the conservation of the wetlands included in the List and as for as possible the wise use of wetlands in their territory*". Wise use is defined as "*the maintenance of their ecological character, achieved through the implementation of ecosystem approaches within the context of sustainable development*". Contracting parties are therefore expected to manage the Ramsar Sites so as to maintain the ecological character of each site and, in so doing, retain the ecological and hydrological functions which ultimately provide its products, functions and attributes.

**Sperrgebiet National Park**: The objectives of the park are aligned with the Mission of the Ministry of Environment and Tourism which is, "*To promote biodiversity conservation in the Namibian environment through the sustainable utilization of natural resources and tourism development for the maximum social and economic benefit of its citizens*". This is fleshed out in the management plan through a range of specific objectives ranging from conserving and wisely managing the landscapes, ecosystems, character and biological diversity of the Sperrgebiet National Park to promoting and supporting appropriate land and natural resource uses that are compatible with park objectives (MET, 2012a).

**ORASECOM**: The Parties to the agreement agree to, inter alia: "*…utilise the resources of the River System in an equitable and reasonable manner with a view to attaining optimal and sustainable utilisation thereof, and benefits there from, consistent with adequate protection of the River System," "...take all appropriate measures to prevent the causing of significant harm to any other Party," and "...individually and jointly take all measures that are necessary to protect and preserve the River System from its sources and headwaters to its common terminus*.". This includes the "*...estuary of the River System, including the marine environment, taking into account generally accepted international rules and standards*,". This commitment provides a useful basis from which to engage around catchment management issues that could have a negative impact on the Orange River Mouth.

**Lower Orange River TFCA**: The overall aim of LOR TFCA is, '*to promote a culture of peace and cooperation between Republics of Namibia and South Africa, focussed on the local communities residing in the target area, by unlocking ecotourism potential through the active co-management of shored unique biodiversity, cultural and tourism resources in a suitable manner*".

## 4.2. Key Objectives

The 2017 EMP included three 'thematic areas' (i.e. Institutional, Ecological and Socio-economic). The NEMP makes provision for additional sectors to facilitate grouping of actions for ease of execution. The structure was amended accordingly and there are now several categories for 'key objectives' as prescribed by the EMP Guidelines (Figure 4.1). The key objectives have been informed by the issues identified in the most recent Situation Assessment.

### Estuarine Health and Functioning

- The functional integrity of the ORM Estuary is restored and maintained (C+ Ecological category) to support key ecosystem processes and thriving plant and animal communities

### Conservation

- The biodiversity of the ORM Estuary is formally and effectively conserved as a unique system of global significance

### Land-use and Development Planning

- Impacts associated with developments and proposed changes in land-use, including infrastructure, are minimised

### Institutional and Management Structures

- The ORM Estuary is managed through effective institutional arrangements that promote collaboration and accountability among all relevant stakeholders

### Socio-economic considerations

- Local social and economic benefits are enhanced through the promotion of nature-based recreation and tourism, and sustainable resource use

**Figure 4.1: Key objectives relevant to the management of the Orange River Mouth Estuary**

# 5. Management Objectives and Actions

In order to inform the selection of management priorities for the next 5-year cycle of this EMP, a comprehensive list of management objectives and actions was compiled based on the Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis undertaken during the Situation Assessment, a review of the management activities from the 2017 EMP that still need to be addressed, as well as input from members of the ORM project steering committee (PSC) who review the implementation of the EMP. Additional objectives or actions were added as deemed necessary. Management objectives are grouped according to the key objectives (see Chapter 4 above) (Figure 5.1). The proposed activities, unpacked per management objective, are included in the tables that follow, and detail the ecological and socio-economic consequences of no action, expected availability of human resources, estimated cost and expected duration of activity.

In some cases, the management action has been aligned with the priorities as per the rehabilitation measures detailed in Chapter 8 of this report. These are indicated in the tables below with three asterixis (***).

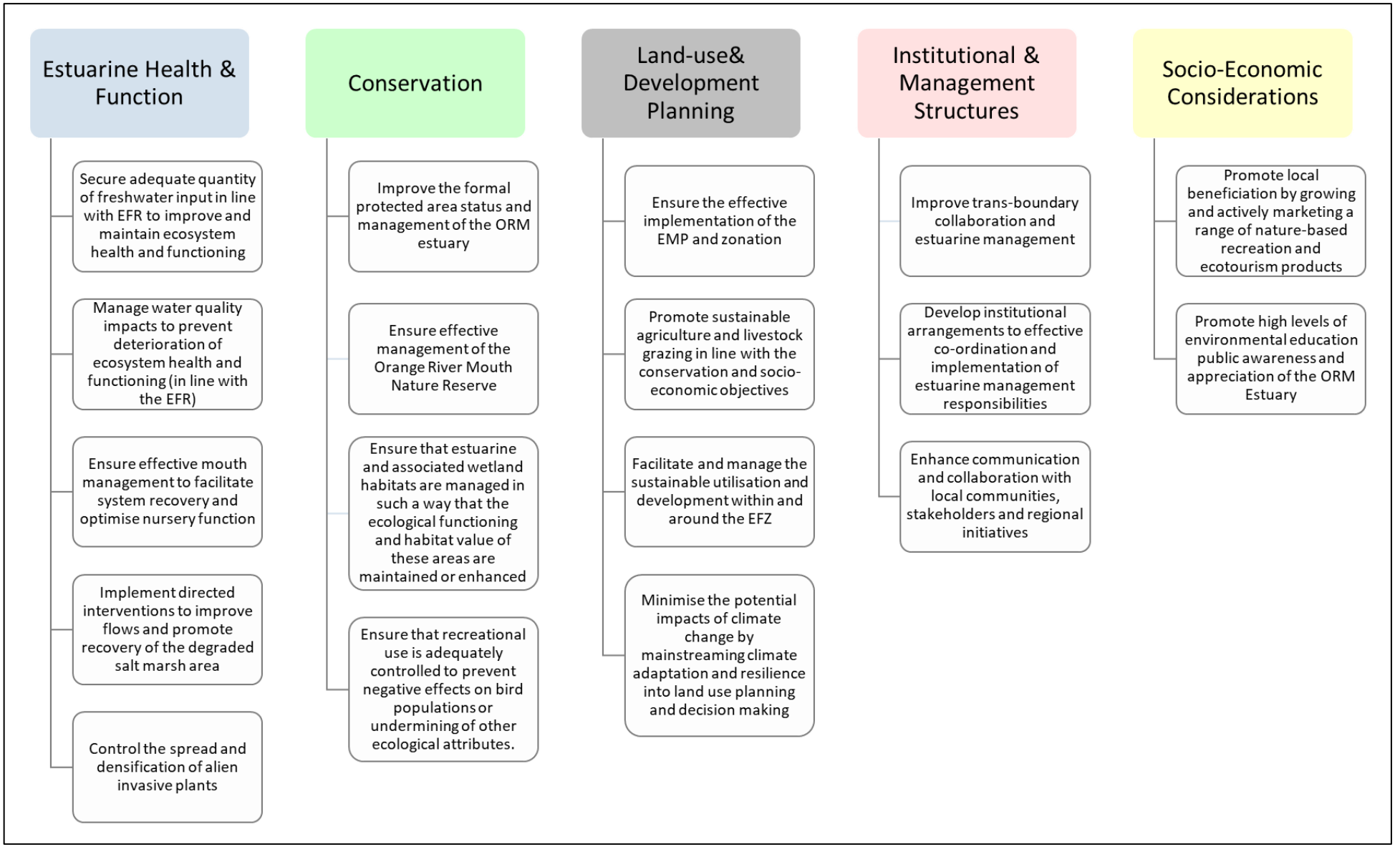


**Figure 5.1: Management Objectives for the Orange River Mouth Estuary**

## 5.1. Estuarine Health & Function

*(inclusive of research and monitoring)*

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

1. Secure adequate quantity and quality of freshwater input in line with EFR to improve and maintain ecosystem health and functioning;
2. Manage water quality impacts to prevent deterioration of ecosystem health and functioning (in line with the EFR);
3. Ensure effective mouth management to facilitate system recovery and optimise nursery function;
4. Implement directed interventions to improve flows and promote recovery of the degraded salt marsh area; and
5. Control the spread and densification of alien invasive plants.

| | Management Activities | Ecological impact/socio-economic consequences of no action | Expected availability of human resources | Estimated cost | Expected duration |
|---|---|---|---|---|---|
| **Management Objective 1.1 Secure adequate quantity and quality of freshwater input in line with EFR to improve and maintain ecosystem health and functioning** | | | | | |
| i. | Ensure operating rules of dams in the catchment[1] are implemented to better serve ecological flow requirements (EFR) of the estuary | Potential unsustainable abstraction and loss of functioning, resulting in further degradation of the estuary, insufficient flows to protect the water resource, and nursery function/links to the EBSA and offshore MPA | Resources available in DWS | Part of mandate | Ongoing |
| ii. | Implement and maintain the EFR for the ORM Estuary and nearshore marine environment *** | Potential unsustainable abstraction and loss of functioning, resulting in further degradation of the estuary, insufficient flows to protect the water resource, and nursery function/links to the EBSA and offshore MPA. Loss of value as tourism asset | Resources available in DWS and DFFE | Part of mandate | Ongoing |
| iii. | Re-instate ORM gauging site to improve information and monitor flows in the LOR in terms of the EFR requirements for the estuary and nearshore marine environment | Lack of information to understand and make informed decisions regarding the water resource, achieving required flow (EFR) and nursery function/links to the EBSA and offshore MPA | Resources available in DFFE | <R1M | Once off capital expenditure |

[1] A Water Resource Classification Study is in progress following reserve determination which will influence aspects of the proposed Vioolsdrift Dam and various operating scenarios. Feasibility studies are ongoing with regards to the Vioolsdrift Dam.

| | Management Activities | Ecological impact/socio-economic consequences of no action | Expected availability of human resources | Estimated cost | Expected duration |
|---|---|---|---|---|---|
| iv. | Participate in biannual engagements with ORASECOM, and Vioolsdrift and Noordoewer Joint Irrigation Authority for water resource development in the Orange-Senqu Basin | Potential unsustainable abstraction and loss of functioning, resulting in further degradation of the estuary, insufficient flows to protect the water resource, and nursery function/links to the EBSA and offshore MPA. Reduced potential economic cross-boundary opportunities | Resources available in DFFE | Part of mandate | Ongoing |
| v. | Ensure that ORASECOM / CPA register as I&APs for any projects to ensure that risks and opportunities pertaining to the ORM are adequately addressed/ considered | Possible developments approved in contravention to EMP objectives. Possible exclusion of local contractors from development processes | Resources should be provided to the CPA management<br>Resources available in ORASECOM | <R500 000 | Ongoing |
| **Management Objective 1.2: Manage water quality impacts to prevent deterioration of ecosystem health and functioning (in line with the EFR)** | | | | | |
| i. | Undertake routine water and sediment quality monitoring to detect emerging pollution risks | Continued degradation of the estuarine habitat and biodiversity within the EFZ. Potential loss of value as tourism asset | Resources available in DWS and DFFE | Part of mandate | Ongoing |
| ii. | Develop a pollution action plan in response to the outcomes of the routine monitoring, which includes identification of point and non-point pollution sources, and appropriate strategies to curtail pollution in its various forms from the different sources | Continued degradation of the estuarine habitat and biodiversity within the EFZ<br>Continued pollution of system and resultant negative impacts on biodiversity, tourism and human health. Potential loss of value as tourism asset | Resources available in DWS and DFFE | Part of mandate | Ongoing |
| **Management Objective 1.3: Ensure effective mouth management to facilitate system recovery and optimise nursery function** | | | | | |
| i. | Enter into agreement with Namibia regarding terms and conditions for mouth management/ breaching. (i.e. mouth intervention may not proceed without bilateral engagement prior to any intervention) | Lack of understanding of impact and lack of ability to engage with Namibia. Potential loss of value as tourism asset | Resources available in DFFE | Part of mandate | Within 2 years |
| ii. | Develop a mouth management plan (MMP) in line with National Guidelines and Namibian MOU, in the event of emergency | Lack of understanding of impact. Detrimental mouth manipulation resulting in knock on effects to estuarine health and | Resources available in DFFE | Part of mandate | Within 1 year |

| | Management Activities | Ecological impact/socio-economic consequences of no action | Expected availability of human resources | Estimated cost | Expected duration |
|---|---|---|---|---|---|
| | breaching/closure to safeguard estuarine health and function | function, further degradation of salt marsh and estuary. Potential loss of value as tourism asset. Loss of opportunity to launch to sea | | | |
| **Management Objective 1.4: Implement directed interventions to improve flows and promote recovery of the degraded salt marsh area** | | | | | |
| i. | Consolidate recommended rehabilitation interventions into a single integrated plan, including those specified in this EMP and Alexkor mining rehabilitation plan and considering national rehabilitation guidelines, to harmonise rehabilitation interventions | Poorly planned rehabilitation interventions resulting in duplication of efforts, wasted expenditure and additional negative environmental impacts. Potential loss of value as tourism asset | Resources available in DFFE | Part of mandate | Within 1 year |
| ii. | Remove/redesign causeway as a critical rehabilitation intervention to restore hydrological connectivity and promote restoration, whilst still providing access to the coast*** | Ongoing decline in estuarine health and function, loss of critical salt marsh habitat and threatened bird species, with knock on effects to socio-economic benefits. Potential loss of assumed access rights to the coast. Potential loss of value as tourism asset | Consultants will need to be appointed to support government and obtain the necessary approvals | <R1M | <2year |
| iii. | Establish the volume of buried scrap metal underlying the causeway (or parts thereof) and the potential negative impact on estuarine soils (e.g. metal leachate etc.) and water quality through lateral flows | Poorly planned rehabilitation interventions resulting in unplanned expenditure and additional negative environmental impacts | Consultants/Contractors would need to be appointed | <R1M | Within 5 years |
| iv. | Obtain relevant authorisations to proceed with rehabilitation activities (e.g. EA for listed activities) | Stagnated processes, discontinuity/hiatus, lapsed authorisations, ongoing degradation of estuarine health and function. Loss of earnings and reduced economic opportunities | Resources available in DFFE | Part of mandate | Within 2 years |
| v. | Lobby funding from various sources (e.g. the Green Climate fund, GIZ, EU) for salt marsh / habitat restoration (cf. Target 2 of the Global Biodiversity Framework (30x30)) | Insufficient resources to undertake effective interventions. Potential loss of value as tourism asset | Resources available in DFFE | Part of mandate | Within 2 years |

| | Management Activities | Ecological impact/socio-economic consequences of no action | Expected availability of human resources | Estimated cost | Expected duration |
|---|---|---|---|---|---|
| vi. | Implement effective strategies as per EMPr and Mining Rehabilitation Plan to control windblown sediments/ dust from mining operations and seepage of saline water from slimes *** | Cumulative negative impacts from ongoing mining activities. Potential loss of value as tourism asset | Contractors would need to be appointed | Dependant on strategies | Implementation ongoing |
| vii. | Ensure compliance with EMPr, rehabilitation strategies, and environmental best practice of all mining operations to minimise impacts from mining operations in/ adjacent to the ORM estuary (including Alexkor and contractors) | Cumulative negative impacts from ongoing mining activities. Potential loss of value as tourism asset | Contractors would need to be appointed | Dependant on strategies | Implementation ongoing |
| viii. | Document and report on appropriate actions being implemented to improve the ecological health and functioning of the ORM estuary | Progress and outcomes of monitoring unknown, inability to apply adaptive management | Resources available in DFFE | Part of mandate | Within 2 years |
| ix. | Based on demonstrable recovery of ORM Estuary, motivate for the withdrawal of the site from the Montreux Record | Persistence of status quo, loss of critical wetland habitat and related bird species Potential loss of value as tourism asset | Resources available in DFFE | Part of mandate | After 5-year cycle |
| **Management Objective 1.5: Control the spread and densification of alien invasive plants** | | | | | |
| i. | Assess the current distribution and density of alien invasive plants in the EFZ and determine priority areas for removal of alien vegetation | Continued spread of invasive species, loss of native biodiversity | Once off assessment to be undertaken by appointed consultants | <R500 000 | 6 months |
| ii. | Implement alien vegetation removal programmes for priority species and priority areas | Continued spread of invasive species, loss of native biodiversity. Loss of potential job opportunities via EPWP | Part of Working for Water/ Wetlands Programme | >R5M | Within 3 years |
| iii. | Undertake regular monitoring of alien plant infestations to inform planning and management | Continued spread of invasive species, ineffective management. Potential loss of value as tourism asset | Collaborative resources available in government departments | Part of mandate | Ongoing |

## 5.2. Conservation

*(inclusive of living and non-living resource use, compliance and enforcement, and research and monitoring)*

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

1. Improve the formal protected area status and management of the ORM estuary;
2. Ensure effective management of the ORM Nature Reserve;
3. Ensure that estuarine and associated wetland habitats are managed in such a way that the ecological functioning and habitat value of these areas are maintained or enhanced; and
4. Ensure that recreational and resource use are adequately controlled to prevent negative effects on wildlife or undermining of other ecological attributes.

| | Management Activities | Ecological impact/socio-economic consequences of no action | Expected availability of human resources | Estimated cost | Expected duration |
|---|---|---|---|---|---|
| **Management Objective 2.1: Improve the formal protected area status and management of the ORM estuary** | | | | | |
| i. | Review and refine the Ramsar boundary to include the full EFZ and required buffer zones | Continued ineffective Ramsar boundary which excludes key areas in EFZ | Resources available in DFFE | Part of mandate | 3 years |
| ii. | Investigate various options[2] for formal protected area status for the Orange EFZ (ergo the South African Ramsar site), inclusive of the water body and islands | Continued lack of protection of EFZ (holistic ecosystem approach). Potential loss of value as tourism asset | Availability of resources in SANParks needing to be investigated | >R2M | 5 years |
| **Management Objective 2.2: Ensure effective management of the Orange River Mouth Nature Reserve** | | | | | |
| i. | Second / appoint an Operational Manager and adequate human resources to implement effective operational management of the ORM Nature Reserve (NR) | Continued lack of management of the ORM NR as well as little to no implementation of any of the NRs objectives. Potential loss of value as tourism asset as well as loss of potential earnings by residents in the NR | Position funded, appointment needing to be made | Within already approved budget | 1 year |
| ii. | Ensure that adequate funding is obtained to acquire necessary equipment and undertake the necessary training and management actions for the NR | No implementation of the NRs management actions / objectives and deterioration of the state of the NR. Potential loss of value as tourism asset | Position funded, appointment needing to be made | Within already approved budget | 1 year |

[2] E.g. Marine Protected Area (MPA), Special Management Area (SMA), Other Effective area-based Conservation Measures (OECMs), Transfrontier Conservation Area (TCA)

| | Management Activities | Ecological impact/socio-economic consequences of no action | Expected availability of human resources | Estimated cost | Expected duration |
|---|---|---|---|---|---|
| iii. | Quarterly reporting to confirm that the site is being managed in accordance with the requirements of the EMP | No implementation of the NRs management actions/objectives and no understanding of the state of management of the NR | Position funded, appointment needing to be made | Within already approved budget | Ongoing |
| iv. | Erect a fence around strategic areas of the ORM NR in line with management objectives (e.g. rehab areas, livestock exclusion etc.) | No implementation of the NRs management actions/objectives and no means of excluding livestock or human interference | Fencing materials already purchased | >R1M | 1 year |
| v. | Ensure that access and use restrictions are communicated through appropriate demarcations, signage and informative materials | No means of implementing access and use restrictions and potential degradation of the NR | | >R1M | 3 years |
| **Management Objective 2.3: Ensure that estuarine and associated wetland habitats are managed in such a way that the ecological functioning and habitat value of these areas are maintained or enhanced (including control of alien invasive plants** | | | | | |
| i. | Compile, maintain and expand waterbird species lists, including species of special concern | Lack of understanding of habitat importance, loss of species | Collaborative resources available (government and non-government) | Part of mandate | Ongoing |
| ii. | Develop and implement bird monitoring programmes for focal species / species of special concern | Lack of understanding of habitat importance, loss of species | Consultant team would need to be appointed | <R500 000 per species | 5 years |
| iii. | Develop and implement management prescriptions for focal species[3] together with Ramsar contact to inform habitat enhancement interventions | Degradation / loss of habitats which support critical species, loss of species. Potential loss of economic opportunities associated with birding | Collaborative resources available (government and non-government) | Dependant on prescriptions | Once Ramsar issues resolved |
| iv. | Ensure that dust bins are provided at appropriate localities | Littering, Continued pollution of the EFZ with resultant negative impacts on biodiversity, tourism, property and human health | In the absence of the Municipality rendering services, the Landowners to fulfil that duty or appoint a Service Provider | R500 000 | 5 years |

[3] Focal species include Great White Pelicans, terns and Cape cormorants, which were previously present in high numbers at the ORM estuary

| | Management Activities | Ecological impact/socio-economic consequences of no action | Expected availability of human resources | Estimated cost | Expected duration |
|---|---|---|---|---|---|
| v. | Ensure that waste is regularly removed from the site | Continued pollution of the EFZ with resultant negative impacts on biodiversity, tourism, property and human health | In the absence of the Municipality rendering services, the Landowners to fulfil that duty or Appoint a Service provider | R500 000 | 5 years |
| vi. | Implement a reward-based litter collection and/or recycling programme and address/mitigate illegal dumping and/or wind-blown litter | Potential damage to EFZ with resultant negative impacts on biodiversity, tourism, property and human health | In the absence of the Municipality rendering services, the Landowners to fulfil that duty or appoint a Service Provider | R500 000 | 5 years |
| vii. | Report any aircraft activities that are not in line with the relevant restrictions (e.g. nature reserve restrictions) to the aviation authorities to limit disturbance to birds and wildlife | Negative impact on species, abandonment of habitat, reduced breeding | Collaborative resources available (government and non-government) | As part of government reporting lines | Ongoing |
| **Management Objective 2.4: Ensure that recreational and resource use are adequately controlled to prevent negative effects on wildlife or undermining of other ecological attributes.** | | | | | |
| i. | Adopt and implement revised zonation plan to reduce disturbance by recreational use (boating, off-road driving) *** | Unsustainable resource use and potential continued degradation of the EFZ | Limited on the ground resources | Part of mandate | Within 1 year |
| ii. | Undertake a needs and desirability (N&D) study to establish a public launch site, taking into account ecological, aesthetic and socio-economic perspectives (including future tourism opportunities) | Continued illegal/ uncontrolled boat launching and boating activities | Resources available to assess need but should need exist then consultants need to be appointed to submit application on behalf of Municipality | Dependant on assessment | When and if needed |
| iii. | Based on the outcome of the N&D study, design and implement a permitting and monitoring system to control boating activities | Continued illegal/ uncontrolled boat launching and boating activities | Best practice permitting system exists and will need to be adapted if | Dependant on assessment | When and if needed |

| | Management Activities | Ecological impact/socio-economic consequences of no action | Expected availability of human resources | Estimated cost | Expected duration |
|---|---|---|---|---|---|
| | | | needed (dependant on study) | | |
| iv. | Engage with Namibian enforcement agencies to combine efforts of implementing zonation plan and boating regulations | Continued illegal/ uncontrolled boat launching and boating activities, negative impacts on habitats and species | Limited on the ground resources | Part of mandate | After 5 years |
| v. | Enforce compliance with ORV regulations to reduce impacts on coastal dunes and floodplain vegetation by off-road driving[4] | Unsustainable resource use and potential continued degradation of the EFZ | Resources available within DFFE | Part of mandate | After 5 years |
| vi. | Establish the level of fishing effort on the estuary through a dedicated monitoring programme | Unsustainable resource use in the EFZ and negative impacts on the nursery function | Resources available within DFFE | Part of mandate | After 5 years |
| vii. | Review and align fishing quotas based on an improved understanding of the importance of the mouth as a fish nursery area | Unsustainable resource use in the EFZ and negative impacts on the nursery function | Resources available within DFFE | Part of mandate | After 5 years |
| viii. | Examine the need for a no-take area in the ORM EFZ | Unsustainable resource use in the EFZ and negative impacts on the nursery function | Resources available within DFFE | Part of mandate | Within 5 years |
| ix. | Deploy additional staff to undertake additional patrols to better control fishing activities, particularly during peak fishing and holiday periods | Unsustainable resource use in the EFZ and negative impacts on the nursery function. Loss of economic earning opportunities for locals | Currently limited | >R1M | During peak seasons only |
| x. | Monitor the type and intensity of recreational use of estuary | Unsustainable resource use in the EFZ and Lack of appropriate planning and management of visitors and awareness to inform tourism opportunities | Resources available within NC-DEDT | Part of mandate | Ongoing Peak periods |

[4] On the South African side, off-road driving will only be allowed where it is authorised in terms of the ORV Regulations.

## 5.3. Land-Use, Planning and Development

*(inclusive of climate change considerations and research and monitoring)*

The Land-use, planning and development key objective is subdivided into the following specific management objectives:

1. Ensure the effective implementation of the EMP;
2. Promote sustainable agriculture and livestock grazing in line with the conservation and socio-economic objectives;
3. Facilitate and manage the sustainable utilisation and development within and around the Estuarine Functional Zone; and
4. Minimise the potential impacts of climate change by mainstreaming climate adaptation and resilience into land use planning and decision making.

| | Management Activities | Ecological impact/socio-economic consequences of no action | Expected availability of human resources | Estimated cost | Expected duration |
|---|---|---|---|---|---|
| **Management Objective 3.1: Ensure the effective implementation of the EMP** | | | | | |
| i. | Ensure the incorporation of this EMP and zonation into IDPs and SDFs for the relevant municipalities and future EIA/WUL decisions | No uptake of EMP, wasted expenditure and uncoordinated estuarine management, ongoing degradation and misuse of EFZ | Resources available | Part of mandate | By next review |
| ii. | Ensure that estuary zonation and land use controls are reflected in SDF and LUMS (during review cycle) | Continued degradation of EFZ, including habitat loss/destruction<br>Wasted expenditure | Resources available | Part of mandate | By next review |
| **Management Objective 3.2: Promote sustainable agriculture and livestock grazing in line with the conservation and socio-economic objectives** | | | | | |
| i. | Harmonise policies on cross-border livestock access and control | Continued degradation of EFZ including habitat destruction and potential transfer of disease (foot and mouth), loss of biodiversity | Resources available in government | Part of mandate | By next review |
| ii. | Actively manage domestic livestock in line with access and control policies | Continued degradation of EFZ including habitat destruction, loss of biodiversity | Limited resources available | Unknown | On-going |
| iii. | Livestock to be assessed for potential diseases and necessary action taken where diseases are identified | Continued degradation of EFZ including habitat destruction and potential transfer of disease (foot and mouth), biodiversity loss, human health considerations | Limited resources available | Unknown | When needed |
| iv. | Establish a mechanism for lost/found livestock to be reported and returned to the owners and/or appropriate areas | Unchecked multiplication of feral livestock, continued degradation of EFZ including habitat destruction and potential transfer of disease (foot and mouth), loss | Limited resources available | Unknown | Year 2 |

| | Management Activities | Ecological impact/socio-economic consequences of no action | Expected availability of human resources | Estimated cost | Expected duration |
|---|---|---|---|---|---|
| | | of biodiversity, loss of income from lost livestock | | | |
| v. | Lobby local growers/ farmers to implement agriculture best practice[5] | Ongoing catchment water quality issues, sedimentation, with knock on for estuarine health and functioning. continued degradation of EFZ including habitat destruction | Resources available in government | Part of mandate | By next review |
| **Management Objective 3.3: Facilitate and manage the sustainable utilisation and development within and around the Estuarine Functional Zone** | | | | | |
| i. | Continue to engage with the CPA to formally discuss the implications of the EMP, specifically with regards to rehabilitation and associated implications for the CPA activities | Uninformed CPA, potential conflict resulting in lack of implementation of management interventions, continued degradation of EFZ including habitat destruction | Resources available in government | Part of mandate | Year 1 |
| ii. | Adopt, implement and enforce the spatial zonation plan to manage activities within the EFZ | Lack of estuarine management considerations, ongoing degradation and misuse of EFZ | Resources available in government | Part of mandate | By Year 3 |
| iii. | Undertake social study to understand the access needs of the community, constraints, and potential alternatives | Ineffectual management interventions, Infringements on access rights and livelihoods Continued degradation of EFZ including habitat destruction | Funding would need to be motivated for | >R500 000 | Within 1 year |
| iv. | Review existing road network and identify necessary changes to improve the ecological status quo while providing adequate accessibility for recreational and tourism activities | Continued degradation of EFZ including habitat destruction, loss of biodiversity, continued use of informal roads | Funding would need to be motivated for | <R1M | By next review |

[5] E.g. reduced application of harmful fertilisers, reduced tillage practises, reduced clearing of natural vegetation, land rehabilitation and planting of indigenous vegetation, keeping livestock out of sensitive habitat (salt marsh)

| | Management Activities | Ecological impact/socio-economic consequences of no action | Expected availability of human resources | Estimated cost | Expected duration |
|---|---|---|---|---|---|
| v. | Implement road network concept, rehabilitating abandoned roads and stabilising banks to prevent collapse *** | Continued degradation of EFZ including habitat destruction, loss of biodiversity, Continued use of informal roads, and perceived loss of coastal access | Funding would need to be motivated for | >R5M | After next review |
| vi. | Strictly enforce 'low negative impact' of any new proposed developments and/or activities within the EFZ, with stringent mitigation and rehabilitation measures | New and growing cumulative negative impacts on estuarine health and function. Continued degradation of EFZ including habitat destruction, continued funding constraints with the management of the EFZ | Resources available in government | Part of mandate | Ongoing |
| vii. | Review the effectiveness of current compliance monitoring of activities undertaken within the EFZ (especially mining activities) | Unsustainable and insensitive development resulting in further degradation, potential pollution, depreciation of tourism value and loss of socio-economic value | Resources available in government | Part of mandate | Biannually |
| viii. | Ensure the incorporation of this EMP and zonation into progressing Tourism Master Plan to ensure sustainable tourism development that supports improvement and preservation of the ORM estuary | Unsustainable and insensitive development resulting in further degradation, potential pollution, depreciation of tourism value and loss of socio-economic value | Current appointment | Part of mandate | Project-specific |
| **Management Objective 3.4: Minimise the potential impacts of climate change by mainstreaming climate adaptation and resilience into land use planning and decision making** | | | | | |
| i. | Determine and implement coastal management line / flood line delineation and associated development controls | Continued degradation of EFZ and negative impacts on biodiversity, tourism and human health<br>Inappropriate development and potential damage to property and loss of human life | Resources available in government | Part of mandate | Ongoing |
| ii. | Specific engagement with property owners / occupants (e.g. CPA, Alexkor, Richtersveld LM) within the EFZ / seaward of the CML in respect to potential risk and responses/ interventions (e.g. innovative building techniques) | Continued degradation of EFZ and negative impacts on biodiversity, tourism and human health<br>Inappropriate development and potential damage to property and loss of human life | Resources available in government | Part of mandate | Within 3 years |

| | Management Activities | Ecological impact/socio-economic consequences of no action | Expected availability of human resources | Estimated cost | Expected duration |
|---|---|---|---|---|---|
| iii. | Update building restrictions & develop construction guideline for properties at risk | Continued degradation of EFZ and negative impacts on biodiversity, tourism and human health. Depreciation of tourism value and loss of socio-economic value | Resources available in government | Part of mandate | Within 2 years |
| iv. | Undertake a study to inform a long-term solution to relocate flood defence (dykes)/ infrastructure protection at a more suitable position closer to the edge of Alexander Bay | Continued degradation of EFZ and negative impacts on biodiversity, tourism and human health<br>Inappropriate development and potential damage to property and loss of human life | Funding would need to be motivated for | >R5M | After next review |

## 5.4. Institutional and Management Structures

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

1. Improve trans-boundary collaboration and estuarine management;
2. Develop institutional arrangements to effective co-ordination and implementation of estuarine management responsibilities; and
3. Enhance communication and collaboration with local communities, stakeholders and regional initiatives.

| | Management Activities | Ecological impact/socio-economic consequences of no action | Expected availability of human resources | Estimated cost | Expected duration |
|---|---|---|---|---|---|
| **Management Objective 4.1: Improve trans-boundary collaboration and estuarine management** | | | | | |
| i. | Formal discussions to be held between Namibia and South Africa to better collaborate in estuarine management and transboundary issues (e.g. erosion control, beach driving, access, fishing regulations) | Uncoordinated and ineffective implementation of management of entire EFZ, Potential damage to EFZ with resultant negative impacts on biodiversity, tourism, property and human health | Resources available in government | Part of mandate | Within 1 year |
| ii. | Engage with Ramsar Secretariat to discuss feasibility and processes of designating a transboundary site | No extension or harmonization of RAMSAR site | Resources available in government | Part of mandate | Unknown |
| iii. | Review and if necessary, revise institutional structures to cater for better trans-boundary collaboration | Uncoordinated and ineffective implementation of management of whole EFZ | Resources available in government | Part of mandate | Ongoing |

| | Management Activities | Ecological impact/socio-economic consequences of no action | Expected availability of human resources | Estimated cost | Expected duration |
|---|---|---|---|---|---|
| **Management Objective 4.2: Develop institutional arrangements for effective co-ordination and implementation of estuarine management responsibilities** | | | | | |
| i. | Obtain agreement from government departments and other participating agencies with respect to their roles and responsibilities in estuarine management (and the implementation of this EMP) | Uncoordinated and ineffective implementation of EMP, unfunded actions proposed Capacity constraints | Enter into a Memorandum of Understanding (MOU) with Government Departments | R2 000 000 | Within 2 years |
| ii. | Identify human resource and infrastructure needs for estuarine management | Uncoordinated and ineffective implementation of EMP | Assistance from Mining sector as well as Government institutions | R2 000 000 | 2 years |
| iii. | Address training needs and equipment requirements of the various role-players (e.g. water quality monitoring equipment, patrol boats etc.) | Uncoordinated and ineffective implementation of EMP Unsupported / ineffective institutional structures | Assistance from Mining sector as well as Government institutions | R1 000 000 | Within 3 years |
| iv. | Establish and manage a voluntary community monitoring team to monitor site-specific EMP compliance and manage the data collected | Uncoordinated and ineffective implementation of EMP | Government to play a leading role supported by CPA | R2 000 000 | Within 3 years |
| v. | Maintain the ORM PSC to coordinate, monitor and report on the progress of EMP actions and achievements | Uncoordinated and ineffective implementation of EMP | Resources available in government | Part of mandate | Ongoing |
| **Management Objective 4.3: Enhance communication and collaboration with local communities, stakeholders and regional initiatives** | | | | | |
| i. | Through Provincial Coastal Committee meetings, ORM PSC to table issues relating to the ORM estuary | Uncoordinated and ineffective implementation of EMP, unsupported / ineffective institutional structures | Part of mandate | Part of mandate | Ongoing |
| ii. | Foster good working relationships with ARTP JMB[6] and SANParks (LOR TFCA) to pursue opportunities for support related to progressing Tourism Master Plan | The growth of potential tourism opportunities will be hampered in the absence of good working relationships | Part of mandate | Part of mandate | Within 5 years |

[6] Ais! Ais! Richtersveld Transfrontier Park Joint Management Board and Lower Orange River Transfrontier Conservation Area

| | Management Activities | Ecological impact/socio-economic consequences of no action | Expected availability of human resources | Estimated cost | Expected duration |
|---|---|---|---|---|---|
| iii. | Implement appropriate institutional arrangements to actively involve landowners in management decisions | Uncoordinated and ineffective implementation of EMP. Potential conflict and misunderstanding, hindrances to implementation of EMP, potential damage to EFZ with resultant negative impacts on biodiversity, tourism, property and human health | Resources available in government | Part of mandate | Within 1 year |
| iv. | Implement supporting institutional arrangements to facilitate active involvement with landowners, local stakeholders, the private sector, NGOs and governmental departments | Uncoordinated and ineffective implementation of EMP. Unsupported / ineffective institutional structures | Source Donor Funding | R1 000 000 | Unknown |
| v. | Regularly liaise with the Ramsar contact point regarding management of the site | Continuation of status quo and inconsistency with Ramsar boundary | Part of Mandate | Part of mandate | Ongoing |
| vi. | Provide an online / social media platform for public comment and grievances (on municipal website) | Uncoordinated and ineffective implementation of EMP<br>Uninformed public/stakeholders | Richtersveld Local Municipality | 500 000 | Within 2 years |

## 5.5. Socio-Economic Considerations

*(inclusive of research and monitoring, education and awareness)*

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

1. Promote local beneficiation by growing and actively marketing a range of nature-based recreation and ecotourism products;
2. Control the influx and distribution of solid waste (litter) pollution within the system; and
3. Promote high levels of environmental education, public awareness, and appreciation of the ORM Estuary.

| | Management Activities | Ecological impact/socio-economic consequences of no action | Expected availability of human resources | Estimated cost | Expected duration |
|---|---|---|---|---|---|
| **Management Objective 5.1: Promote local beneficiation by growing and actively marketing a range of nature-based recreation and ecotourism products** | | | | | |
| i. | Identify key items/ actions from the progressing Tourism Master Plan that can be implemented systematically in the short-, | Uncoordinated and ineffective implementation of EMP. | Provincial Government - Economic Development | Part of Mandate | Within 4 Years |

| | Management Activities | Ecological impact/socio-economic consequences of no action | Expected availability of human resources | Estimated cost | Expected duration |
|---|---|---|---|---|---|
| | medium- and long-term and implement these accordingly. | Ineffective uptake /loss of take up of tourism opportunities | and Tourism mandate to boost Tourism | | |
| ii. | Link closely with existing initiatives that can complement the Tourism Master Plan, aimed at growing the tourism market in the area, e.g. LORTFCA initiative | Uncoordinated and ineffective implementation of EMP, ineffective uptake /loss of tourism opportunities | All role-players involved in existing Tourism activities to join forces with District and Local Government to draft Tourism Plan for the area | R500 000 | Within 2 years |
| iii. | Develop and implement a marketing strategy for the ORM Protected Area to promote the area and tourism products and services | Uncoordinated and ineffective implementation of EMP. Ineffective uptake /loss of tourism opportunities/ potential | Appoint a Service Provider to develop a Marketing Strategy | R500 000 | Within 2 years |
| iv. | Ensure that procurement policies favouring local communities and HDIs are implemented for the provision of tourism and recreation products and services related to the ORM estuary | Loss of local employment opportunities Influx of project specific labour force | Government to provide an Oversight and Monitoring service ensuring effective capacity -and community building services are rendered | Within mandate | Within 3 years |
| **Management Objective 5.2: Promote high levels of environmental education, public awareness, and appreciation of the ORM Estuary** | | | | | |
| i. | Identify, prioritise and implement initiatives / programmes necessary to support education and awareness | Uninformed public/stakeholders Potential damage to EFZ with resultant negative impacts on biodiversity, tourism, property and human health | Provincial Government mandate- Environmental Education | Part of Mandate | 5 Years |

# 6. Spatial Zonation

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

- The geographical boundary of the estuary and important habitats;
- The surrounding land uses and existing infrastructure;
- Areas designated for the conservation and protection of biodiversity;
- Appropriate buffers in which land use and development are strictly controlled and monitored; and
- Zones where certain types of activities (recreational, mining, agricultural, etc.) are permissible and others not permissible.

## 6.1. 2017 Preliminary Zonation

As part of the original EMP, a fine-scale zonation plan integrating the requirements of relevant stakeholders was drafted for the site. A key informant to this process was the delineation of key areas identified as sensitive to human disturbance and included the following aspects:

- Important bird areas and habitats, including salt marsh on the South African side, and the northern bank, adjacent islands and beach on the Namibian side;
- Fish populations; and
- General wildlife.

Sensitive areas are illustrated in Figure 6.1.

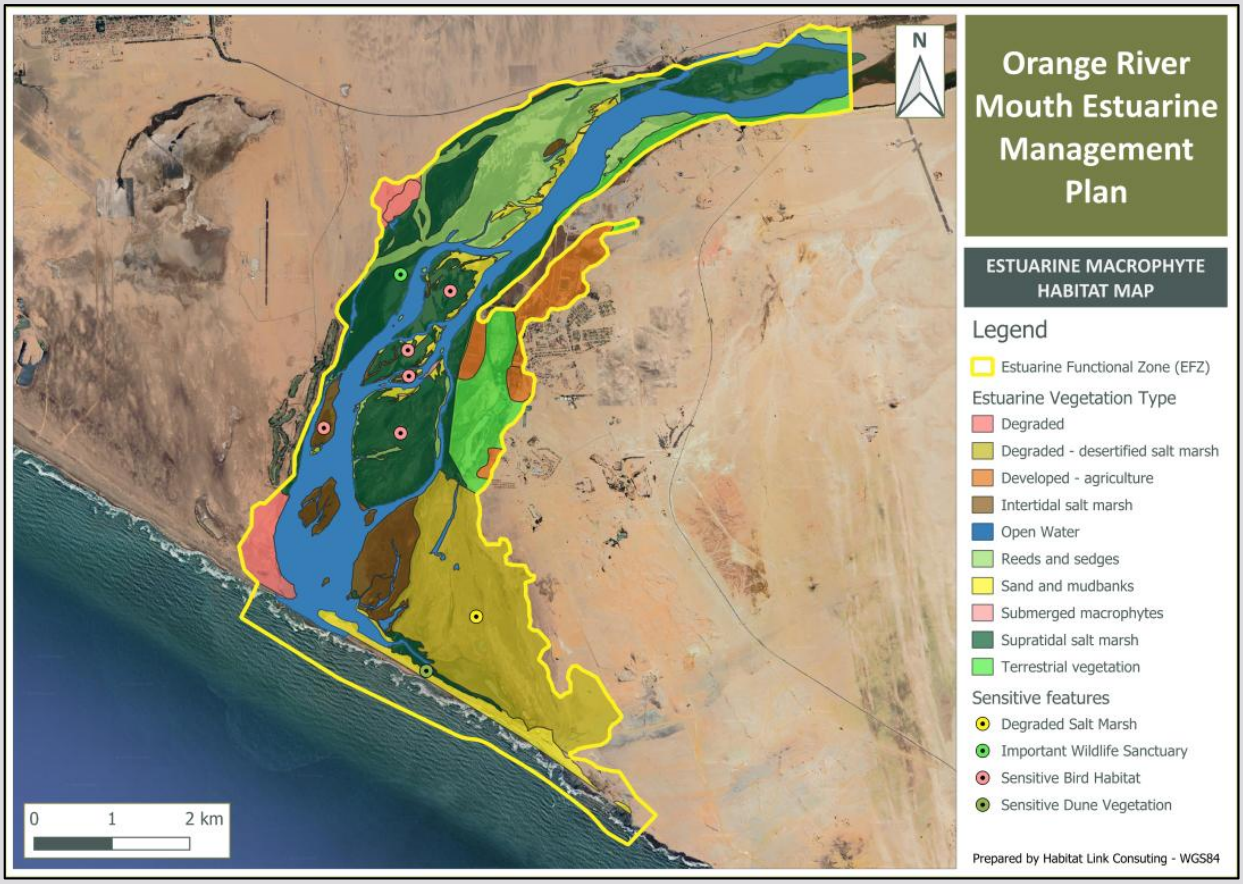


**Figure 6.1: Estuarine habitat map and location of sensitive features considered during previous zonation process (adapted from Eco-pulse map in DEA, 2017, Orange River Mouth Estuarine Management Plan).**

Another informant was an assessment of the existing and potential future types of human uses of the estuary and its resources. The concerns and potential impacts of these uses were considered and suitable control measures were proposed. The uses remain applicable for this revision of the ORM EMP and are provided below.

**Table 6.1: Range of human uses and control measures considered in development of the zonation plan**

| Use | Concerns / Potential Impacts | Control measures to be implemented |
|---|---|---|
| Recreational shore angling | • Over-fishing can negatively affect nursery functions provided by the estuary<br>• Disturbance of roosting terns and cormorants (on berm and islands)<br>• Pollution associated with litter and sanitation | • Permits are required for recreational angling<br>• No access / fishing from sensitive islands or salt marsh habitats is permitted<br>• Monitoring and enforcement of angling regulations including bag limits<br>• Provision and regular clearing of waste bins in common fishing points |
| Recreational boating | • Disturbance of birds and wildlife<br>• Noise (motorised craft)<br>• Damage to aquatic vegetation<br>• Boat engine emissions<br>• Decreased human safety<br>• Shoreline erosion | • Motorised boating is restricted to specific zones<br>• No motorised boating within 50m of islands<br>• No jet skis are permitted<br>• No skiing is permitted<br>• All motorised boats to be registered with local conservation office (MET/DENC) |
| Gill netting | • Uncontrolled gill netting can have a negative impact on fish stocks | • No gill netting is permitted |
| Bait collection[7] | • Over-exploiting of bait stocks including harders<br>• Disturbance of sensitive areas | • Permits are required for all bait collection activities (including use of cast nets)<br>• Monitoring and enforcement of bait collection regulations including catch limits. |
| Off-road driving | • Disturbance of roosting terns and cormorants on berm<br>• Damage to vegetation<br>• Disturbance of birds and wildlife; Disturbance to other recreational users | • Off-road driving will be allowed in accordance with the ORV (Off-Road Vehicle) Regulations. Those persons who are eligible to apply for permits to drive in the coastal area will be informed and required to apply for a permit to drive in the coastal area. |
| Livestock grazing | • Competition for limited grazing areas<br>• Negative impact on wilderness character of the area | • No livestock grazing is permitted within the estuary functional zone<br>• Any livestock may be forcibly removed from the site |
| Pets (cats and dogs) | • Disturbance of wildlife<br>• Predation on wildlife, birds and eggs | • No pets are permitted within the estuary functional zone |
| Hunting of ducks and geese | • Direct impact on bird populations<br>• Disturbance of birds and wildlife<br>• Safety risk to other recreational users | • No hunting is permitted |
| Camping and picnicking | • Pollution (litter and noise)<br>• Disturbance of wildlife<br>• Habitat trampling | • Camping is restricted to designated areas |
| Development of tourism infrastructure | • Direct disturbance to vegetation<br>• Access to and disturbance of birds and wildlife populations | • Infrastructure must be aligned with any endorsed tourism development plan |

[7] Note: no information exists as to the species or extent of bait collection in the estuary

| | | |
|---|---|---|
| | • Effect on sense of place<br>• Management of waste (including effluent) | • Environmental impact assessment / screening must be undertaken prior to construction of any new infrastructure<br>• **No new permanent infrastructure must be permitted in the estuary except for rehabilitation purposes**<br>• **All development must ensure low impact on the estuary and avoid further degradation** |
| Agricultural activities | • Direct impact on vegetation and biodiversity<br>• Impact on water quality | • Agricultural use is restricted to designated zones outside the estuary functional zone<br>• Rehabilitate old agricultural lands |

## 6.2. Delineation of Management Zones

The delineated management zones of the 2017 EMP remain largely unchanged and form the basis for the zonation in this EMP update. The ORM Estuary was subdivided into several zones based on an understanding of the sensitivity of estuarine attributes and use by local stakeholders (Figure 6.2).

The following section summarises the delineated management zones (as per DEA, 2017, Orange River Mouth Estuarine Management Plan) and proposed revisions are indicated below.

**Zone A: Coastal dunes and frontal estuary**

*Boundaries*: This zone extends from the beach in front of the parking area on the Namibian side to east of the parking area on the South African side. The zone also extends inland from the coastal dunes up until the start of the golf course on the Namibian side.
*Description*: This is a high intensity use zone for angling and recreational activities including motorised boating[8]. Restrictions are aimed at preventing undue impacts on birds and sensitive habitats without unduly constraining existing recreational activities.

**Zone B: Sensitive islands and salt marsh habitats**

*Boundaries*: This zone encompasses islands located within the main channel which are important for birds together with associated open water areas and fringing sensitive salt marsh habitat. It also includes sensitive salt marsh habitat on the South African side known to provide important habitat for bird populations.
*Description*: Activities are restricted to in this zone to ensure that impacts and disturbance to sensitive bird roosting / nesting areas and sensitive salt marsh habitats are minimised.

**Zone C: Fringing estuarine zones:**

*Boundaries:* This zone extends from the parking area on the Namibian side, north along the river banks up to the edge of the estuary functional zone upstream of the Oppenheimer Bridge. It then extends south along the South African side up until the start of the degraded salt marsh habitat. This zone includes open water areas upstream of the last main island which is located between the off-road club in the west and sports grounds to the east.

[8] Currently there are no provisions for a boat launching site on the South African side, although motorised boating is permitted, and future tourism opportunities are exploring non-motorised boat use (i.e. canoeing/kayaking) and will thus require a suitable area for embarking/disembarking.

*Description:* This zone includes largely intact estuarine vegetation and provides important habitat for wildlife. While access and low-intensity recreational usage is permitted, off-road driving is not permitted unless it is authorised in terms of the ORV Regulations.

**Zone D: Rehabilitation zone:**

*Boundaries:* This zone includes old lands and degraded salt marsh associated with the South African section of the estuary.
*Description:* This zone is the focus of rehabilitation efforts which includes removal and/or redesign of causeways, rationalisation of road infrastructure and removal of waste water infrastructure. Activities within this zone need to be managed so as not to undermine rehabilitation efforts.

**Zone E: Riparian zone**

*Boundaries:* This zone encompasses riparian habitat upstream of the estuary and is defined based on the extent of the revised Ramsar Boundary for South Africa[9]. Areas of active cultivation have been explicitly excluded.
*Description:* This zone incorporates the river banks, riparian and instream habitat of the Orange River. It is characterised by largely natural vegetation although some areas have been impacted by historic farming and operations and encroachment by alien invasive plants.

**Zone F: Terrestrial rehabilitation zone**

*Boundaries:* This zone includes terrestrial areas on the South African side which are located outside of the estuarine zone but within the revised Ramsar Boundary for South Africa.
*Description:* This area has been disturbed by historic mining and farming operations with low ecological value. This zone could potentially be used for ecotourism development as per Zone H.

**Zone G: Off-road driving club:**

*Boundaries:* This zone is limited to the extent of the existing off-road club and motor-cross track on the Namibian side.
*Description:* This area is substantially disturbed and has been used historically for a range of off-road driving activities. Ongoing use for these activities is permitted but is not permitted in adjoining areas. For the South African side of the estuary, off-road driving will only be allowed where it has been authorised in terms of the ORV Regulations.

[9] Note that the boundary is poorly aligned with the edge of the riparian zone on the Namibian side and should ideally be re-drawn to reflect a more ecologically meaningful delineation.

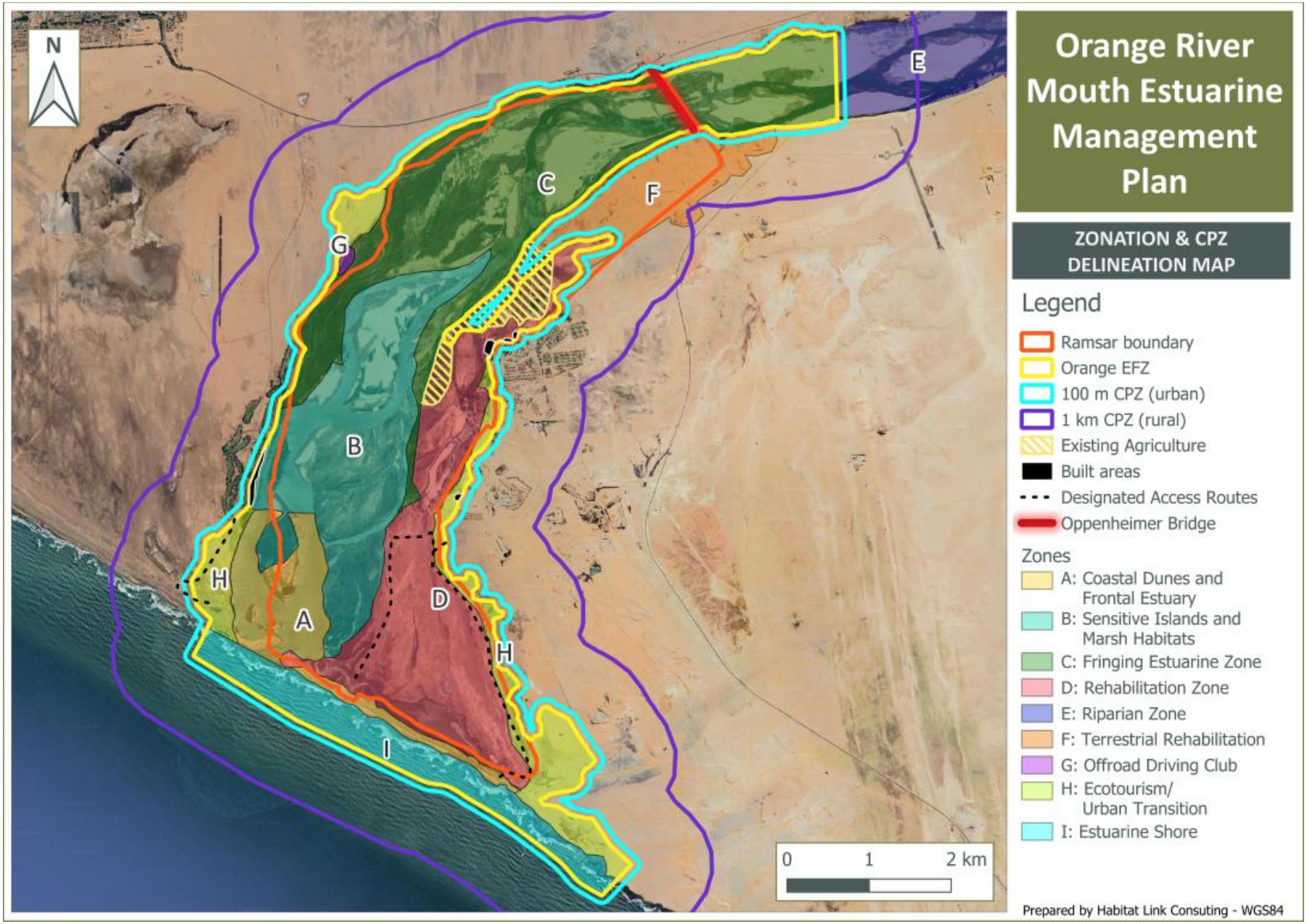


**Figure 6.2: Updated preliminary zonation plan for the Orange River Estuary (adapted from Eco-pulse map in DEA, 2017, Orange River Mouth Estuarine Management Plan).**

The following changes and additional zones are included in the revised zonation plan:

**Additional Zone H: Ecotourism/Urban transition zone:**

*Boundaries:* This zone includes estuarine areas (within the 5m contour), specifically along the southern margin adjacent to Alexander Bay extending to the coast and including active mining lands.
*Description:* This zone includes a range of features which have divergent characteristics, but which are degraded due to historical development and mining operations with low ecological value. These features/areas should be individually assessed in respect to rehabilitation opportunities and/or use as ecotourism transitional areas.

**Additional Zone I: Estuarine shore:**

*Boundaries:* As per the 2019 NBA, this zone spans the entire width of the estuary front, from the toe of the foredune, extending into the nearshore marine environment to the back of the surface zone.
*Description:* The zone reflects the continuum in estuarine-marine connectivity through estuarine inputs to the surf zone/marine environment. This zone encompasses the estuarine-marine mixing zone, eco-physiological cues, and fish accumulations and migrations through the estuary mouth.

## 6.3. Operational Specifications and Restrictions

The operational specifications aim to describe the various management zones of the estuary, the management requirements of the zones and the restricted activities within these zones. The operational specifications have been revised in line with the updated spatial zonation.

## 6.4. Recreational Use

***Living Resource Use***

**Shore Angling**

Permitted zones: A, C, E, I
Unpermitted zones: B and D

*Rationale*: Restrictions on shore angling have been imposed on this zone due to the importance of islands for bird roosting and nesting. This follows reports of at least 831 pairs of Cape Cormorants aborting their breeding attempt after people disturbed the birds on the islands (Williams 1986 in Anderson *et.al*., 2003). No fishing is permitted without the necessary permit.

*Related activities*:
- Bait collection – invertebrates: No spatial restrictions other than access restrictions to sensitive areas. No bait collecting permitted without the necessary permit;
- Bait collection— cast nets: No spatial restrictions other than access restrictions to sensitive areas. No line fish species to be kept. No limit on mullet;
- Spear fishing, gill netting: Not permitted throughout the EFZ; and
- Hunting: Not permitted throughout the EFZ.

### *Non-Living Resource Use*

**Motorised Boating**

Permitted zones: A
Unpermitted zones: Remainder of EFZ

*Rationale*: Current motorised boating activities are largely confined to the frontal estuary (Zone A). Noise and disturbance associated with motorised boating poses a threat to birds and may reduce breeding success. Boating may also cause bank erosion. As such, access for boating is restricted to the lower reaches of the estuary.

*Related activities*:
- Jet skis: Not permitted throughout the EFZ.

**Non-motorised boating**

Permitted zones: A-E, I

*Rationale*: No restrictions although cognisance must be taken not to unduly disturb wildlife, particularly roosting or nesting birds.

*Related activities*:
- Swimming: No restrictions;
- Wind-driven watercraft (e.g. sailing boats): Not permitted due to disturbance to birds; and
- Camping: Not permitted except in designated camping sites in Zone C.

**Off-road Driving**

Permitted zones: G (A and C with a permit)
Unpermitted zones: Remainder of EFZ

*Rationale*: Off-road vehicle driving on the South African side will only be allowed where it is authorised in terms of the ORV Regulations. On the Namibian side, although off-road vehicle driving is strictly not permitted, the area indicated can be permitted for off-road driving subject to approval by the Namibian authorities.

*Related activities*:
- Motorbikes or quad bikes: As per above restrictions.

**Public Access (Walking/Hiking)**

Unpermitted zones: Sensitive islands in Zones A and B, active mining areas in Zone A and F, Zone D (except for designated access routes)

*Rationale*: Access should not be permitted on the sensitive islands in Zones A and B, which are important roosting and/or nesting habitat for sensitive bird species. Access through the rehabilitation zone is strictly restricted to the designated access route. There are no other restrictions although cognisance must be taken not to unduly disturb wildlife, particularly roosting or nesting birds throughout the system. Note: public access is not permitted through private/closed mining areas, except with permission of the landowner/operator.

## 6.5. Land Use Activities

**Future Mining and Prospecting**

Permitted zones: None
Regulated use zones: F, H and I

*Rationale*: Mining activities have, over the years, had the largest impact on the Orange EFZ. While certain areas are earmarked for rehabilitation, the zonation must contemplate plans for future mining activities in and around the estuary. Thus, future mining and prospecting should not be permitted within the EFZ. Currently mining is regulated in zones, F, H, under existing mining rights issued by the DMRE.

*Related activities*:
- Stockpiles and slimes heaps: As per above restrictions ; and
- Materials from rehabilitation of historical mining: As per above restrictions.

**Agricultural Activities (cultivation and livestock grazing)**

Permitted zones: None

*Rationale*: Agricultural activities, including crop cultivation and livestock grazing have contributed to estuarine habitat loss and degradation, and competition and disturbance to native wildlife. Such activities are in conflict with conservation objectives of restoring, preserving and enhancing biodiversity and ecosystem processes and function of the Ramsar site and broader EFZ. As with mining, the zonation must contemplate plans for ongoing/future agricultural activities in and around the estuary. Future agriculture and livestock grazing should not be permitted within the EFZ.

**Future Tourism Infrastructure Development**

Permitted zones: D (beach access), E, F, G
Unpermitted zones: Remainder of EFZ

*Rationale*: The ORM estuary is earmarked for future tourism development through a developing tourism master plan. Promoting tourism, particularly ecotourism and cultural tourism is means to enhance the much-needed socio-economic development of Alexander Bay. However, such development must take place in accordance with an endorsed tourism master plan, which is founded on the environmental/conservation principles and objectives to restore the ORM estuary. Development must be

environmentally sensitive and avoid designated rehabilitation zones, i.e. Zone D, and should rather focus on other disturbed areas of low ecological value, or areas beyond the estuary.

*Related activities*:

- Residential housing: As per above restrictions;
- Services infrastructure (e.g. pipelines, electricity): As per above restrictions, but relaxations permitted in circumstances where alternative routes are required; and
- Recreational facilities/activities: As per above restrictions.

## 6.6. Biodiversity Areas

**Zone A: Vegetation along frontal dunes**

Vegetation established along the frontal dunes on the South African side serves to stabilise the dunes and prevent erosion. An access road passes along the back of the dune and through this area of sensitive vegetation. Vehicles must stay on the existing track to avoid impacting on sensitive vegetation. No off-road driving is therefore permitted in this area. No hunting and no pets or livestock allowed.

**Zone B & C: Sensitive salt marsh habitat**

This includes areas of intertidal and supratidal salt marsh that are sensitive to disturbance. Access to these areas is prohibited apart from via formal paths that exist in these areas. No hunting and no pets or livestock allowed.

**Zone B & D: Sensitive bird habitat**

The islands and salt marsh on the South African side are known to provide important habitat for birds, with highest counts typically associated with these areas. Zonation has been developed to limit disturbance to these areas and includes no-go areas for motorised boating and prohibition of shoreline angling from islands where roosting and nesting is known to occur. No hunting and no pets or livestock allowed.

**Zone D: Rehabilitation zone**

This zone includes areas of recovering natural vegetation, old lands and degraded salt marsh habitat. Given management aims to rehabilitate this area, activities must be managed so as not to compromise rehabilitation efforts. Rehabilitation efforts must also be undertaken in such a manner as to limit impacts on already recovering areas and to maximise rehabilitation potential. No hunting and no pets or livestock allowed.

The abovementioned operational specifications and restrictions are summarised in Table 6.2, below, which corresponds to the updated zonation plan presented in Figure 6.2.

**Table 6.2: Summary of operational restricted activities in zones A-I**

| Zone | A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|---|
| **Zone Name** | ***Coastal dunes and frontal estuary*** | ***Sensitive islands and salt marsh habitats*** | ***Fringing estuarine zone*** | ***Rehabilitation zone*** | ***Riparian zone*** | ***Terrestrial rehabilitation zone*** | ***Off-road driving zone*** | ***Ecotourism transition zone*** | ***Estuarine Shore*** |
| **Shore Angling** | YES | NO | YES | NO | YES | YES | N/A | | YES |
| **Motorised Boating** | YES | NO | NO | NO | YES | N/A | N/A | | NO (permit required) * |
| **Off-road driving (incl. bikes and quads)** | NO (permit required) ** | NO | NO | NO | NO | NO | YES | NO | NO (permit required) * |
| **Non-motorised boating / swimming** | YES | YES | YES | YES | YES | N/A | N/A | N/A | YES |
| **Public Access (Walking/ hiking)** | YES | NO | YES | YES (via designated routes only) | YES | YES | YES | YES | YES |
| **Agriculture / Livestock grazing** | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| **Mining** | NO | NO | NO | NO | NO | NO (permit required) * | NO | NO (permit required) * | NO (permit required) * |
| **Ecotourism Development** | NO | NO | NO | NO | TBD*** | TBD*** | YES | TBD*** | NO |

*Mining lease area – permits and permissions required for new/future mining activities.
**Off-road vehicle driving on the South African side is only permissible where it is authorised in terms of the ORV Regulations.
***TBD – to be determined. Suitable, environmentally sensitive tourism would be permissible in these zones pending a rigorous approval process.

# 7. Management Priorities

During this EMP update, a list of management priorities was identified in accordance with the EMP Guidelines to address the key issues facing the ORM estuary and management thereof. The process of prioritisation entailed cross-checking the key issues identified in the 2017 EMP with progress made to date; whilst new management activities were prioritised as deemed necessary. Progress was determined through input received from the ORM PSC implementation meeting, and members thereof, and/or insights gained during the course of this EMP review. The prioritisation scale is provided in Table 7.1 below. Items rated as desirable / low do not feature on this priority list but remain in the full list of objectives in Section 5.

**Table 7.1: Rating scale used to prioritize issues identified for management action.**

| Rating | Description |
|---|---|
| 1. Critical / High | Critical issue where little to no progress has been achieved.<br>A critical issue which if not addressed would prevent effective management of the site or have negative consequences in the short term (<1 year). |
| 2. Important / Medium | A critical issue which has seen some progress, or an important issue which has seen no progress.<br>An important issue which needs to be addressed to improve management of the site in the medium term (2 – 5 years) and which if delayed could result in negative impacts or prevent progress being made. |
| 3. Desirable / Low | An issue which would be worth pursuing if resources are available, but which is not essential for effective management of the site in the medium term. Addressing the issue is however regarded as desirable in the longer term (5 – 10 years). |

Effective implementation of this EMP requires the conversion of the priority actions into detailed project plans, which must be prepared and adopted into the respective departmental implementation strategies. A template for such project plans is provided in the 2015 EMP Development Guideline (DEA, 2015)[10]. This template can also be utilised to facilitate the implementation of other projects proposed in the EMP. Furthermore, a comprehensive and properly structured Regulatory Impact Assessment (RIA) must be commissioned to determine the details of the resources required by all organisations that will be involved in the implementation of the EMP.

[10] Document currently under review. Any updated EMP Development Guidelines would subsequently apply.

**Table 7.2: Management priorities for Estuarine Health and Function**

| | Management Activities | Relevant Legislation | Indicators | Leading Institutions | Priority |
|---|---|---|---|---|---|
| **Management Objective 1.1 Secure adequate quantity and quality of freshwater input in line with EFR to improve and maintain ecosystem health and functioning** | | | | | |
| i. | Implement and maintain the EFR for the ORM Estuary and nearshore marine environment *** | NWA | • MOU signed by water resource users (dams, Irrigation board, ORASECOM, etc.)<br>• System flows and patterns mimic historical flow regime<br>• Floods as well as natural mouth closure experienced<br>• Restoration of freshwater flows (and inundation) through degraded salt marsh<br>• Regrowth of salt marsh | ORASECOM<br>DWS | |
| ii. | Ensure that ORASECOM register as I&APs for any projects to ensure that risks and opportunities pertaining to the ORM are adequately addressed/ considered | NWA | • Focussed input into project design to ensure that risks to the ORM Estuary are adequately addressed<br>• EFR of the ORM Estuary are upheld/ensured | ORESECOM<br>CPA<br>DFFE<br>NC-DAERL | |
| **Management Objective 1.2: Manage water quality impacts to prevent deterioration of ecosystem health and functioning (in line with the EFR)** | | | | | |
| i. | Undertake routine water and sediment quality monitoring to detect emerging pollution risks | NWA, NEMA, ICMA | • Routine water and sediment quality monitoring programme in place<br>• Managed inventory of monitoring data housed at DWS<br>• Pollution risks identified | DWS<br>DFFE | |
| ii. | Develop a pollution action plan in response to the outcomes of the routine monitoring, which includes identification of point and non-point pollution sources, and appropriate strategies to curtail pollution in its various forms from the different sources | NWA, NEMA, ICMA | • Pollution action plan compiled<br>• Sources of pollution investigated<br>• Action items recorded in departmental budgets and project programmes<br>• Water quality risks are reduced through appropriate actions | DWS | |
| **Management Objective 1.3: Ensure effective mouth management to facilitate system recovery and optimise nursery function** | | | | | |
| i. | Enter into agreement with Namibia regarding terms and conditions for mouth management/ breaching. (i.e. mouth intervention may not proceed without bilateral engagement prior to any intervention) | NEMA, ICMA | • MOU signed with Namibia for joint agreement for mouth management<br>• Mouth management guidelines agreed by both countries | ORASECOM<br>DFFE | |

| | Management Activities | Relevant Legislation | Indicators | Leading Institutions | Priority |
|---|---|---|---|---|---|
| ii. | Develop a mouth management plan[11] (MMP) in line with National Guidelines and Namibian MOU, in the event of emergency breaching/closure[12] to safeguard estuarine health and function | NEMA, ICMA, NEMP | • Estuary mouth is managed collaboratively with Namibia in accordance with MM guidelines and objectives<br>• Estuary health and function is maintained at optimum with regards to mouth dynamics | DFFE<br>NC-DAERL | |
| **Management Objective 1.4: Implement directed interventions to improve flows and promote recovery of the degraded salt marsh area** | | | | | |
| i. | Consolidate recommended rehabilitation interventions into a single integrated plan, including those specified in this EMP and Alexkor mining EMPr/rehabilitation plan and considering national rehabilitation guidelines, to harmonise rehabilitation interventions | NEMA, ICMA | • Critical information, reports and databases are gathered and reviewed<br>• Integrated Rehab Plan drafted and signed off<br>• Integrated Rehab Plan distributed to key government departments | DFFE | |
| ii. | Remove/redesign of causeway as a critical rehabilitation intervention to restore hydrological connectivity and promote restoration, whilst still providing access to the coast*** | NEMA, ICMA, MPRDA | • Consultants/Engineers appointed to develop design concept which enables optimal through-flow<br>• Options reviewed / impact assessments completed<br>• Optimal design adopted<br>• Restoration of flows through salt marsh | DFFE<br>NC-DAERL<br>Alexkor | |
| iii. | Obtain relevant authorisations to proceed with rehabilitation activities (e.g. EA for listed activities) | NEMA<br>MPRDA | • Authorisation for proposed rehabilitation activities obtained | Alexkor<br>DFFE<br>NC-DAERL | |
| iv. | Lobby funding from various sources (e.g. the Green Climate fund, GIZ, EU) for salt marsh / habitat restoration (cf. Target 2 of the Global Biodiversity Framework (30x30)) | | • Application submitted<br>• Funding approved<br>• Financial plan compiled | DFFE | |
| v. | Implement effective strategies as per Mining EMPr /Rehabilitation Plan to control windblown sediments/ dust from mining | NEMA, MPRDA | • Effective implementation and maintenance of rehab interventions<br>• control of windblown dust and saline waters<br>• Revitalisation of degraded salt marsh | Alexkor (as per EMPr and rehab plan) | |

[11] Template provided in Appendix A

[12] Administrative Procedure for an Oral Request to Artificial Breach an Estuary is provided in Appendix B

| | Management Activities | Relevant Legislation | Indicators | Leading Institutions | Priority |
|---|---|---|---|---|---|
| | operations and seepage of saline water from slimes *** | | | | |
| vi. | Ensure compliance with EMPr, rehabilitation strategies, and environmental best practice of all mining operations to minimise impacts from mining operations in/ adjacent to the ORM estuary (including Alexkor and contractors) | NEMA, MPRDA, | • Independent audit of Alexkor rehab performance/ maintenance goals and milestones<br>• Independent monitoring programme in place<br>• Management actions successfully implemented and refined as necessary | DMRE<br>Alexkor | |
| vii. | Document and report on appropriate actions being implemented to improve the ecological health and functioning of the ORM estuary | ICMA | • Monitoring programmes in place for rehabilitation interventions<br>• Annual reports submitted to South African Ramsar contact point<br>• Ongoing liaison with South African Ramsar contact point | ORASECOM<br>DWS<br>DFFE | |
| **Management Objective 1.5: Control the spread and densification of alien invasive plants** | | | | | |
| i. | Assess the current distribution and density of alien invasive plants in the EFZ and determine priority areas for removal of alien vegetation | CARA, NEMBA | • Total area (ha) of infestation<br>• Critical/worst alien species<br>• Priority areas of infestation<br>• Maps and supporting reports produced<br>• Annual Plan of Operations (APOs) produced to implement alien plant control | DFFE (WfW)<br>NC-DAERL | |
| ii. | Implement alien vegetation removal programmes for priority species and priority areas | CARA, NEMBA | • Funding obtained<br>• Service provider appointed<br>• Progress assessed against APO<br>• Area and biomass of AIPs cleared per annum<br>• No. of staff employed per annum<br>• Methods and volume of chemicals used per annum | DFFE (WfW)<br>NC-DAERL | |

**Table 7.3: Management priorities for Conservation**

| | Management Activities | Relevant Legislation | Indicators | Leading Institutions | Priority |
|---|---|---|---|---|---|
| **Management Objective 2.1: Improve the formal protected area status and management of the ORM estuary** | | | | | |
| i. | Review and refine the Ramsar boundary to include the full EFZ and required buffer zones | NEMBA | • Boundary revised by South Africa<br>• Ramsar Secretariat notified of any changes to the boundary of the site | DFFE | |
| ii. | Investigate various options[13] for formal protected area status for the Orange EFZ (ergo the South African Ramsar site), inclusive of the water body and islands | NEMPAA, ICMA | • Various options discussed and evaluated<br>• Relevant authorities' meetings convened and minutes distributed<br>• Process initiated for most feasible option<br>• Management/ conservation authority appointed | DFFE<br>NC-DAERL (Legal Services)<br>SANParks | |
| **Management Objective 2.2: Ensure effective management of the Orange River Mouth Nature Reserve** | | | | | |
| i. | Second / appoint an Operational Manager and adequate human resources to implement effective operational management of the ORM NR | NEMPAA | • Operational Manager appointed<br>• Staffing structure approved<br>• Office secured<br>• Staff members appointed and retained with appropriate responsibilities for the Protected area | NC-DAERL | |
| ii. | Ensure that adequate funding is obtained to acquire necessary equipment and undertake the necessary training and management actions for the site | NEMPAA | • Funding secured<br>• Operational budget for the management of the site<br>• Annual plan of operation approved | NC-DAERL | |
| iii. | Quarterly reporting to confirm that the site is being managed in accordance with the requirements of the EMP | NEMPAA | • Quarterly reports submitted<br>• Annual assessment of management effectiveness of protected area (including use of METT) tabled and presented to stakeholders | NC-DAERL (Co-management body) | |
| iv. | Erect a fence around the ORM NR in line with management objectives (e.g. protecting sensitive areas, livestock exclusion etc.) | NEMPAA | • Main access gate constructed at the Alexander Bay Tourism Info Centre<br>• Site adequately fenced | NC-DEDT<br>NC-DAERL | |
| v. | Ensure that access and use restrictions are communicated through appropriate | NEMPAA | • Zones of the NR well demarcated<br>• Signage erected at strategic locations | NC-DEDT<br>NC-DAERL | |

[13] E.g. Marine Protected Area (MPA), Special Management Area (SMA), Other Effective area-based Conservation Measures (OECMs), Transfrontier Conservation Area (TCA)

| | Management Activities | Relevant Legislation | Indicators | Leading Institutions | Priority |
|---|---|---|---|---|---|
| | demarcations, signage and informative materials | | • Flyers/ pamphlets printed | | |
| **Management Objective 2.3: Ensure that estuarine and associated wetland habitats are managed in such a way that the ecological functioning and habitat value of these areas are maintained or enhanced** | | | | | |
| i. | Compile, maintain and expand waterbird species lists, including species of special concern | NEMBA | • Seasonal surveys undertaken<br>• Updated species list compiled<br>• Species list maintained (e.g. ADU/SABAP2 or CWAC) | NC-DAERL<br>DFFE | |
| ii. | Develop and implement bird monitoring programmes for focal species / species of special concern | NEMBA | • Surveys undertaken<br>• Monitoring plans developed<br>• Monitoring results produced and reported on quarterly basis | NC-DAERL | |
| iii. | Establish an effective waste management programme | NEMA, ICMA, NEMWA, MSA | • Waste management plan developed<br>• No of people employed<br>• No of bins located at strategic locations<br>• Education and awareness regarding the impacts of litter/solid waste | Richtersveld LM, Alexkor | |
| iv. | Ensure that waste is regularly removed from the site | NEMA, ICMA, NEMWA, MSA | • Bi-weekly removal of waste<br>• Number of waste bags or tonnes of waste removed per month<br>• Waste is well managed | Richtersveld LM, Alexkor | |
| v. | Report any aircraft activities that are not in line with the relevant restrictions (e.g. nature reserve restrictions) to the aviation authorities to limit disturbance to birds and wildlife | Civil Aviation Act | • Engagement with aviation companies via local airports (Alexander Bay, Oranjemund)<br>• No. of offenses reported<br>• Penalties issued | DFFE<br>NC-DAERL<br>Richtersveld LM<br>Namakwa DM | |
| **Management Objective 2.4: Ensure that recreational and resource use are adequately controlled to prevent negative effects on wildlife or undermining of other ecological attributes.** | | | | | |
| i. | Adopt and implement revised zonation plan to reduce disturbance by recreational use (boating, off-road driving) *** | ICMA, NEMP, MSA, SPLUMA | • Areas demarcated with buoys or land beacons/ markers<br>• Sign boards erected<br>• Flyers/notices printed<br>• Reduced habitat disturbance/degradation | DFFE<br>NC-DAERL<br>Richtersveld LM | |

| | Management Activities | Relevant Legislation | Indicators | Leading Institutions | Priority |
|---|---|---|---|---|---|
| | | | • Improved bird diversity and population numbers | Namakwa DM | |
| ii. | Enforce compliance with ORV regulations to reduce impacts on coastal dunes and floodplain vegetation by off-road driving[14] | ICMA | • Law enforcement officials and EMI's appointed<br>• Beach driving activities controlled<br>• No. of patrols<br>• No. of penalties/fines issued | DFFE<br>NC-DAERL | |
| iii. | Establish the level of fishing effort on the estuary through a dedicated monitoring programme (e.g. roving kreel survey) | MLRA | • Monitoring programme developed and implemented<br>• Seasonal counts of number of fishers taken<br>• No. of ad hoc patrols undertaken<br>• No of permit holders<br>• Investigative surveys / questionnaires undertaken.<br>• Data produced and reported on<br>• Data incorporated into EMP 5-year review | DFFE | |
| iv. | Review and align fishing quotas with Namibia based on an improved understanding of the importance of the mouth as a fish nursery area | MLRA | • Ongoing fish community monitoring (inclusive of recruitment and resource needs)<br>• Transboundary fish offtake quotas established, published and implemented | DFFE | |
| v. | Examine the need for a no-take area in the ORM EFZ | MLRA | • Expert opinion obtained from fisheries expert<br>• No-take areas declared, if and where necessary<br>• Recommendations implemented | DFFE | |
| vi. | Deploy additional staff to undertake additional patrols to better control fishing activities, particularly during peak fishing and holiday periods | MLRA | • Increased presence and visibility of enforcement staff (additional staff deployed as necessary)<br>• No. of patrols<br>• No. of people inspected / engaged<br>• No. of offences and penalties issued | NC-DAERL<br>DFFE<br>Richtersveld LM | |
| vii. | Monitor the type and intensity of recreational use of estuary | ICMA, NEMP | • No. of visitors<br>• Types of activities<br>• No. of vehicles and boats | NC-DEDT<br>NC-DAERL | |

[14] On the South African side, off-road driving will only be allowed where it is authorised in terms of the ORV Regulations.)

**Table 7.4: Management priorities for Land use, Planning and Development**

| | Management Activities | Relevant Legislation | Indicators | Leading Institutions | Priority |
|---|---|---|---|---|---|
| **Management Objective 3.1: Ensure the effective implementation of the EMP** | | | | | |
| i. | Ensure the incorporation of this EMP and zonation into IDPs and SDFs for the relevant municipalities and future EIA/WUL decisions | ICMA, NEMP, MSA, SPLUMA | • EMP approved<br>• Presentation to provincial authorities and municipal town planning officials, and other relevant authorities<br>• Incorporation of vision, objective and management objective into IDPs and SDFs of Local/District Municipalities<br>• Integration of estuarine priorities into EIA/WUL considerations | DFFE<br>NC-DAERL<br>Richtersveld LM<br>Namakwa DM | |
| ii. | Ensure that estuary zonation and land use controls are reflected in SDF and LUMS (during review cycle) | ICMA, SPLUMA | • EMP approved<br>• Zonation included in SDF and LUMS as part of cyclical review | Richtersveld LM<br>Namakwa DM<br>NC-DAERL | |
| **Management Objective 3.2: Promote sustainable agriculture and livestock grazing in line with the conservation and socio-economic objectives** | | | | | |
| i. | Harmonise policies on cross-border livestock access and control | CARA | • Meeting convened with SA and Namibia<br>• Minutes of meetings captured<br>• MOU signed | DALRRD<br>DFFE<br>NC-DAERL | |
| ii. | Actively manage domestic livestock in line with access and control policies | CARA | • Established livestock exclusion zones<br>• Signage and fencing erected where applicable<br>• Domestic livestock appropriately managed | DALRRD<br>NC-DAERL | |
| iii. | Livestock to be assessed for potential diseases and necessary action taken where diseases are identified | CARA | • Monitoring plan compiled<br>• Regular inspections of livestock health undertaken<br>• No. of inspections, diseases, and treatment reported<br>• No. of fatalities and causes | DALRRD<br>NC-DAERL | |
| iv. | Lobby local growers/ farmers to implement agriculture best practice[15] | CARA, NEMBA, | • On-going relationship with farmers developed<br>• Farmers made aware of best practise methods<br>• Improved quality of agricultural return flow | NC-DAERL | |

[15] E.g. reduced application of harmful fertilisers, reduced tillage practises, reduced clearing of natural vegetation, land rehabilitation and planting of indigenous vegetation, keeping livestock out of sensitive habitat (salt marsh)

| | Management Activities | Relevant Legislation | Indicators | Leading Institutions | Priority |
|---|---|---|---|---|---|
| | | NWA, NEMA | • Recovery of riparian margin and wetland areas<br>• Reduced use of inorganic fertilisers | | |
| **Management Objective 3.3: Facilitate and manage the sustainable utilisation and development within and around the Estuarine Functional Zone** | | | | | |
| i. | Continue to engage with the CPA to formally discuss the implications of the EMP, specifically with regards to rehabilitation and associated implications for the CPA activities | ICMA, | • No. of engagements convened<br>• Conflicts documented and resolved<br>• Record of mitigation measures<br>• Support for rehabilitation and the management plan<br>• MOU signed with CPA for improved estuarine management | DFFE<br>NC-DAERL<br>Richtersveld LM<br>CPA | |
| ii. | Adopt, implement and enforce the spatial zonation plan to manage activities within the EFZ | ICMA, MSA, NEMA, CARA, SPLUMA | • No further permanent development in the EFZ (e.g. only low impact development and sacrificial infrastructure within EFZ permitted)<br>• No infilling of EFZ or Coastal Protection Zone (CPZ)<br>• Recommended degree of undeveloped margin implemented (as per NBA)<br>• Reduced habitat loss/degradation and disturbance<br>• Reduced impact of livestock<br>• Reduced inappropriate behaviour / activities<br>• EFZ controls enforced and offenders prosecuted | DFFE<br>NC-DAERL<br>Richtersveld LM<br>Namakwa DM | |
| iii. | Undertake social study to understand the access needs of the community, constraints, and potential alternatives | ICMA, SPLUMA | • Appointment of consultant to undertake social study<br>• Community meetings/interviews convened<br>• Report produced<br>• Outcomes considered in planning of road network | NC-DAERL<br>Richtersveld LM<br>CPA | |
| iv. | Review existing road network and identify necessary changes to improve the ecological status quo while providing adequate accessibility for recreational and tourism activities | NEMA | • Road network reviewed<br>• Priority areas identified<br>• Rationalised/amicable road network determined<br>• Stakeholder meetings convened<br>• Final concept approved | DFFE<br>NC-DEDT<br>NC-DAERL<br>Richtersveld LM<br>Namakwa DM | |
| v. | Implement road network concept, rehabilitating abandoned roads and stabilising banks to prevent collapse. *** | NEMA | • Key areas identified<br>• Site specific rehab and erosion prevention techniques identified | Richtersveld LM<br>Namakwa DM | |

| | Management Activities | Relevant Legislation | Indicators | Leading Institutions | Priority |
|---|---|---|---|---|---|
| | | | • Rehab interventions implemented | | |
| vi. | Strictly enforce 'low negative impact' of any new proposed developments and/or activities within the EFZ, with stringent mitigation and rehabilitation measures | NEMA, NEMBA | • Effective implementation of EA/BA processes<br>• Low impact developments/activities permitted<br>• Effective rehabilitation of impacted areas to improve estuarine habitat | DFFE<br>DWS<br>DMRE<br>NC-DEDT<br>NC-DAERL | |
| vii. | Review the effectiveness of current compliance monitoring of activities undertaken within the EFZ (especially mining activities) | NEMA, MLRA, MPRDA | • Inventory compiled of activities within EFZ<br>• Meetings convened with applicable departments<br>• Compliance monitoring programmes revised if required<br>• Penalties / fines issued if required | NC-DAERL<br>DFFE<br>DMRE | |
| viii. | Ensure the incorporation of this EMP and zonation into the Tourism Master Plan to ensure sustainable tourism development that supports improvement and preservation of the ORM estuary | NEMA, ICMA, SPLUMA | • Incorporation of vision, objective and management objectives into Tourism Master Plan<br>• Integration of estuarine priorities into development concept<br>• Estuarine habitat- and process-sensitive development proposed | DoT<br>NC-DEDT | |
| **Management Objective 3.4: Minimise the potential impacts of climate change by mainstreaming climate adaptation and resilience into land use planning and decision making** | | | | | |
| i. | Determine and implement coastal management line / flood line delineation and associated development controls | ICMA, MSA, SPLUMA, Climate Change Act (CCA) | • Consultation undertaken<br>• CML lines designated and incorporated into SDF/LUMS<br>• No further permanent development, infilling or land transformation of EFZ in the EFZ (e.g. only new sacrificial infrastructure permitted).<br>• Transgressors prosecuted<br>• Corrective action undertaken<br>• Reduced habitat loss/degradation and disturbance, and inappropriate behaviour | DFFE<br>NC-DAERL<br>Richtersveld LM<br>Namakwa DM | |
| ii. | Specific engagement with property owners / occupants (e.g. CPA, Alexkor, Richtersveld LM) within the EFZ / seaward of the CML in respect to potential risk and responses/ | ICMA, CCA, SPLUMA | • Meetings convened with property owners<br>• Material made available to landowners | DFFE<br>NC-DAERL<br>Richtersveld LM<br>CPA | |

| | Management Activities | Relevant Legislation | Indicators | Leading Institutions | Priority |
|---|---|---|---|---|---|
| | interventions (e.g. innovative building techniques) | | | Alexkor | |

**Table 7.5: Management priorities for Institutional and Management Structures**

| | Management Activities | Relevant Legislation | Indicators | Leading Institutions | PRIORITY |
|---|---|---|---|---|---|
| **Management Objective 4.1: Improve trans-boundary collaboration and estuarine management** | | | | | |
| i. | Formal discussions to be held between Namibia and South Africa to better collaborate in estuarine management and transboundary issues (e.g. erosion control, beach driving, access, fishing regulations, livestock control) | NEMA, NEMBA, NEMPAA, MLRA, CARA | • Bilateral agreement on structures including defined role for ORASECOM to collaborate in managing the ORM<br>• Annual meetings convened with Namibian environmental management stakeholders<br>• Meeting minutes captured<br>• Roles and actions defined and agreed upon<br>• Engaged with Namibian authorities regarding best practice erosion defence and rehabilitation along the northern bank<br>• Engaged with Namibian authorities to restrict and/or limit vehicle access to the estuary mouth on the northern bank | DFFE ORASECOM Namibia | |
| ii. | Engage with Ramsar Secretariat to discuss feasibility and processes of designating a transboundary site | NEMPAA, NEMBA | • Discussions held with Ramsar Secretariat<br>• Minutes of meetings captured | DFFE | |
| iii. | Review and, if necessary, revise institutional structures to cater for better trans-boundary collaboration | NEMPAA, NEMBA | • Formal institutional arrangements for trans-boundary collaboration agreed to and recognised by both countries | DFFE | |
| **Management Objective 4.2: Develop institutional arrangements for effective co-ordination and implementation of estuarine management responsibilities** | | | | | |
| i. | Obtain agreement from government departments and other participating agencies with respect to their roles and responsibilities in estuarine management (and the implementation of this EMP) | ICMA | • Workshop held<br>• Agreement reached on roles and responsibilities<br>• Appropriate contacts with relevant institutions identified<br>• Authorities/ officials database updated on a biannual basis | DFFE | |

| | Management Activities | Relevant Legislation | Indicators | Leading Institutions | PRIORITY |
|---|---|---|---|---|---|
| | | | • Budget secured | | |
| ii. | Identify human resource and infrastructure needs for estuarine management | ICMA, NEMP | • Regulatory Impact Assessment commissioned<br>• Resource requirements identified<br>• Funding requested | NC-DAERL<br>DFFE<br>DWS | |
| iii. | Address training needs and equipment requirements of the various role-players (e.g. water quality monitoring equipment, patrol boats etc.) | ICMA, NEMP, MSA, MFMA, PFMA | • Training / equipment needs identified<br>• Funding requested | NC-DAERL<br>Richtersveld LM<br>Namakwa DM | |
| iv. | Establish and manage a voluntary community monitoring team to monitor site-specific EMP compliance and manage the data collected | ICMA, NEMA, NWA | • Request for volunteers distributed<br>• List of volunteers established<br>• Volunteer roles assigned | NC-DAERL<br>Richtersveld LM<br>Namakwa DM | |
| v. | Maintain the ORM PSC to coordinate, monitor and report on the progress of EMP actions and achievements | ICMA | • Quarterly PSC meetings convened<br>• Minutes of meetings captured<br>• Annual reporting undertaken<br>• Develop and maintain information repository and database | DFFE | |
| **Management Objective 4.3: Enhance communication and collaboration with local communities and stakeholders** | | | | | |
| i. | Through Provincial Coastal Committee meetings, ORM PSC to table issues relating to the ORM estuary | ICMA | • Quarterly meetings of PCC attended<br>• Presentation of ORM matters | DFFE<br>DWS | |
| ii. | Implement appropriate institutional arrangements to actively involve landowners in management decisions | ICMA, MSA, SPLUMA | • Institutional arrangements and supporting agreements formalised with landowners<br>• Biannual engagements with the landowners on management aspects | NC-DAERL<br>Richtersveld LM | |
| iii. | Implement supporting institutional arrangements to facilitate active involvement with landowners, local stakeholders, the private sector, NGOs and governmental departments | ICMA, MSA | • Biannual engagement with stakeholders<br>• Annual open invitation for public stakeholders to engage with the PSC | NC-DAERL<br>Richtersveld LM<br>Namakwa DM | |

| | Management Activities | Relevant Legislation | Indicators | Leading Institutions | PRIORITY |
|---|---|---|---|---|---|
| iv. | Regularly liaise with the Ramsar contact point regarding management of the site | NEMBA | • National Ramsar contact point included in the quarterly PSC implementation meetings<br>• Good working relationship maintained with National Ramsar Contact Point regarding management of the ORM | ORASECOM<br>DFFE<br>DWS | |

**Table 7.6: Management priorities for Socio-economic Considerations**

| | Management Activities | Relevant Legislation | Indicators | Leading Institutions | Priority |
|---|---|---|---|---|---|
| **Management Objective 5.1: Promote local beneficiation by growing and actively marketing a range of nature-based recreation and ecotourism products** | | | | | |
| i. | Identify key items/ actions from the Tourism Master Plan that can be implemented systematically in the short-, medium- and long-term and implement these accordingly | NEMA, MSA, SPLUMA | • Strategy and support programme for tourism development and income generation in the Protected Area<br>• No of local employment opportunities created | DoT<br>NC-DEDT<br>NC-DRPW<br>Richtersveld LM<br>Namakwa DM | |
| ii. | Ensure that procurement policies favouring local communities and HDIs are implemented for the provision of tourism & recreation products and services related to the ORM estuary | NEMA, MSA, SPLUMA | • Local community members are actively involved in tourism initiatives | DoT<br>NC-DEDT<br>NC-DAERL<br>Richtersveld LM<br>Namakwa DM | |
| **Management Objective 5.2: Promote high levels of environmental education, public awareness and appreciation of the ORM estuary** | | | | | |
| i. | Identify, prioritise and implement initiatives / programmes necessary to support education and awareness. | MSA, ICMA, NEMP | • Education and awareness programs successfully implemented<br>• Educational material (e.g. posters, pamphlets and webpages) to be developed and published | NC-DAERL<br>DFFE<br>Richtersveld LM | |

# 8. Priority Rehabilitation Measures to Restore Degraded Salt Marsh

The impact of mining related activities and the resultant degraded state of the salt marsh of the ORM estuary has been a critical environmental issue for several decades. In response, several rehabilitation projects, interventions and recommendations have been produced and/or implemented by various institutions with the main objective being to restore the water flow through the desiccated salt marsh thus improving the ecological integrity of this valuable habitat and the broader estuarine environment, particularly as a Ramsar site. Important interventions in 1995 (Bornman et al., 2004) saw a breach in the causeway at its most distal extent allowing for the influx of estuary water into the lowermost end of the salt marsh, and the installation of culverts in the causeway. Additional breaches were implemented further eastward to allow inflow to the southwestern corner of the salt marsh (Bornman et al., 2004). The effectiveness of these breaches is most evident during high flows/flood conditions (e.g. December 2022), resulting in inundation and refreshment of the middle portions of the salt marsh. This was followed by several smaller breaches of the causeway in 2005 east of the main breach allowing for additional inundation of the salt marsh (DEA, 2017); although these have been less effective than the breach closer to the mouth. These breaches have since become filled with dust over time, and reportedly infilled by the community to enable ease of access to the coast. Another important rehabilitation intervention was the decommissioning and subsequent relocation of the old Alexkor sewage oxidation ponds in 2001 to outside of the EFZ. However, the walls of the old ponds still remain along with some infrastructure, and thus flow through this arm of the ORM system to the wetland cannot be reinstated.

Following the baseline studies for the development of the EFR for the ORM in 2012, a list of priority interventions to improve the condition of the estuary was compiled (Van Niekerk et al., 2013). These were as follows:

- Remove the remnant causeway that still transects the salt marshes to improve circulation during high flow and floods events. This will also assist with increasing the water circulation into the intertidal and lower marsh areas;
- Remove of old earth-moving equipment buried in the sand berm near the mouth of the Orange. They were buried to prevent southwards migration of the mouth, but the further south the mouth moves, the more friction the inlet channel develops, which ultimately would assist with closure under low flow conditions;
- Control wind-blown dust and wastewater from mining activities to reduce smothering of salt marshes (in progress);
- Decrease the winter baseflows sufficiently to allow for mouth closure and related back-flooding of the salt marshes with brackish water to reduce soil salinities;
- The existing dirt-road network crossing the ORM floodplain needs to be rationalised to limit impacts on estuarine habitat and provide access to the Ramsar sites in an ecological sensitive manner while enhancing tourism in the area;
- Livestock grazing by domestic (and feral) cattle needs to be appropriately managed as it further degrades the salt marshes; and
- A Lidar survey of the ORM estuary shall be conducted, to assist with identifying elevated areas that obstruct tidal intrusion and drainage of flood plain after high flow events. The same data would also assist in determining the maximum water level (relative to mean sea level) at which critical infrastructure and developments will be inundated and at which artificial breaching needs to be conducted (completed 2022).

In honouring their commitment to restoring the environment impacted by past and current mining activities, Alexkor[16] as holder of Marine Diamond Mining Licence for the area, commissioned an assessment of the

[16] Alexkor RMC Pooling and Sharing JV

activities assigned to Alexkor in the 2017 EMP (Morant, 2017). These included: removal of historic scrap material from the beach berm; removal of the road embankment (causeway) through the salt marsh; and the rehabilitation of the former oxidation pond site and dust/sediment control. The assessment concluded that such interventions would contribute significantly to the rehabilitation of the ORM estuary, but that full recovery would be dependent on successful implementation of the activities within the ambit of other national and provincial departments.

In the most recent research regarding the *Prioritisation of blue carbon[17] ecosystems for implementation of restoration measures* (Adams et al. 2023), the ORM estuary was listed as one of nine estuarine systems prioritised for the restoration of salt marsh habitat. Each priority system is accompanied by a detailed restoration plan. The restoration measures for the degraded salt marsh of the ORM estuary are provided in Table 8.1 below. It is important to note that these interventions have remained unchanged (cf. Bornman et al., 2004; Van Niekerk et al., 2013) and must be implemented to see renewal of this critically important estuarine system.

**Table 8.1: Detailed information on the proposed restoration measures for the ORM estuary (Adams et al. 2023)**

| Intervention | Source | Area | Priority | Type | Timeframe | Cost Estimation | Implementer |
|---|---|---|---|---|---|---|---|
| 1. Remove causeway to restore hydrological activity | Mining | 311 | H | Active | Medium term | 5 000 – 10 000 k | EPWP, NGOs, ORASECOM, Mining companies |
| 2. Control dust input from mining | Mining | 311 | H | Passive but mining interventions required | Short term | <1 000 k | Mining companies |
| 3. Implement environmental flow requirement to mimic historical flow regimes | Continuous releases | 311 | M | Active | Long term | 1 000 – 2000 k | DWS, ORASECOM |
| 4. Rehabilitate abandoned roads and stabilise banks to prevent collapse | Off-road driving | 100 | H | Active | Short term | 1 000 – 2000 k | Local Municipality, EPWP |
| 5. Removal and restoration ponds of oxidation ponds | Mining | 50 | M | Active | Short term | 1 000 – 2000 k | Local Municipality, |

These interventions are in varying stages of implementation, some with varying supporting processes and activities in progress or completed (e.g. Lidar study is complete), and others facing complications resulting in stagnation. As such, these activities should remain embedded in updated versions of the ORM EMP as priority interventions until they are realised. Each activity should be guided by a detailed project plan developed by the applicable institutions (See Appendix C for template).

[17] Blue carbon ecosystems, namely salt marshes, seagrasses and mangrove forests, are highly effective at storing carbon naturally and are thus a valuable natural mechanism to reducing climate emissions and combating climate change (Adams et al., 2023)

# 9. Institutional Capacity and Arrangements

## 9.1. Responsible Management Authority

In alignment with the 2021 NEMP, the responsibility for developing the Orange River EMP and coordinating the implementation thereof falls to the national environmental department, in this case, the DFFE, due to the international transboundary nature of the estuary. The implementation, however, needs to be undertaken in collaboration with a number of other organs of state and stakeholders including national and provincial departments, district and local municipalities, mining houses, landowners (specifically the CPA) supported by non-governmental organisations (NGOs), wherever possible.

Specific implementation actions identified remain the responsibility of mandated organs of state. As an example, the DWS will monitor water quality, while the Fisheries Management Branch of DFFE should ensure compliance with matters related to fisheries. The Oceans and Coasts Branch of DFFE need to be supported by the national Department of Mineral Resources and Energy (DMRE), the national and provincial departments of Tourism, and specifically the Northern Cape provincial department of Agriculture, Environmental Affairs, Rural Development and Land Reform (DAERL) with support from both the Namakwa District Municipality and the Richtersveld Local Municipality. Support should also be expected from SANParks, with the nearby !Ai-!Ais Richtersveld Transfrontier Park as well as the Orange Shelf Edge Offshore Marine Protected Area, as well as from the Namibian government. Support is also provided by the Orange-Senqu River Commission (ORASECOM).

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

## 9.2. Government Departments and Organs of State

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

- The Oceans and Coasts Branch of DFFE as the proposed RMA;
- The Fisheries Management Branch of DFFE (compliance and enforcement);
- The Biodiversity and Conservation Branch of DFFE (in respect to the Ramsar site);
- The Environmental Programmes Branch of DFFE (in respect to EPWP and Working for programmes);
- The DWS (Hydrology, Planning as well as Classification);
- The DMRE (Mine health and safety inspectorate; and compliance and enforcement);
- The DOT (Tourism research, policy and international relations; Destination development and Tourism sector support services);
- The Northern Cape provincial department of Agriculture, Environmental Affairs, Rural Development and Land Reform (DAERL);
- Richtersveld Local Municipality: Infrastructure Development; and Community Services/Development Planning (Building Approvals, Spatial Planning, LED and IDP); and
- Namakwa District Municipality: Provision of management and technical support; Municipal Planning and Development Services.

Other agencies that impact the Orange River Mouth include:

- SANParks, with responsibility for the !Ai-!Ais Richtersveld Transfrontier Park as well as the Orange Shelf Edge Offshore Marine Protected Area;

- The Vioolsdrift and Noordoewer Joint Irrigation Authority which administers a joint irrigation scheme which allows both countries to divert water from the Orange River for irrigation purposes; and
- ORASECOM, who acts as a technical advisor for the competent authorities in both South Africa and Namibia on transfrontier water-related issues.

## 9.3. Institutional Arrangements

It is important to note that this EMP is a strategic plan that guides the implementation of actions in respect to each management priority. The management priorities do not specify the human resources required for the execution of the specific actions. It does, however, offer a schedule or phased planning approach that incorporates capacity building and implementation at the local, provincial and national level over, a five-year period. Numerous institutions have existed and continue to exist which are of relevance to the Orange River:

- **The Orange-Senqu River Commission (ORASECOM)**, who serves as a technical advisor to the authorities of the states involved on matters relating to the development, utilization, and conservation of the water resources of the river system. The Orange River riparian states include Botswana, Lesotho, Namibia, and South Africa. As previously reported, the importance of developing a common understanding of how the freshwater Orange River system and marine Benguela Current interact and influence each other was also recognized. This prompted further cooperation between two United Nations Development Programme—Global Environment Fund (UNDPGEF) projects on environmental concerns — the Orange-Senqu Strategic Action Programme supporting ORASECOM and the Benguela Current Large Marine Ecosystem Strategic Action Programme Implementation . Project supporting the Benguela Current Commission;
- **The Northern Cape Provincial Coastal Committee (PCC)**, established in terms of Section 40 of the ICM Act. The PCC is chaired by MEC of the NC DAERL, currently Ms Mase Manopole, and meets quarterly to deal with matters relating to coast and marine resource policy and management, coordinate effective implementation of the integrated coastal management Act as well as the application of other legislation relevant to the Northern Cape coastal, marine and estuarine environment in the Namakwa District. The Northern Cape PCC consists of 28 members and represents a broad sectoral/organizational composition with representation by organs of state and community groups or bodies which have a material and direct interest in the conservation and management of the coast and the use of coastal resources including representatives of government who play a significant role in undertaking or regulating activities that may have an adverse impact on the coastal environment. Representation includes:
    - NC DAERL;
    - NC office of the Premier;
    - DFFE;
    - SANParks;
    - South African Local Government Association (SALGA);
    - Namakwa DM;
    - Richtersveld LM;
    - Conservation South Africa;
    - Endangered Wildlife Trust;
    - Worldwide Fund for Nature;
    - Wildlife Foundation Africa;
    - Hondeklipbaai Fishing Primary Co-operative;
    - Aukotowa Fisheries Primary Co-Operative;
    - Sol Plaatje University;
    - Council for Scientific and Industrial Research (CSIR);
    - Alexkor Richtersveld Mining Company Joint Venture;
    - De Beers Group of Companies;
    - Namaqualand Mines;
    - South African Maritime Safety Association (SAMSA);

  - South African Police Service (SAPS);
  - Department of Economic Development and Tourism;
  - DMRE;
  - Department of Public Works and Infrastructure;
  - DWS; and
  - Northern Cape Economic Development Agency.

- **The DFFE ORM EMP Steering Committee (PSC) or Working Group,** was established to oversee the implementation of the inaugural EMP and continues to support the EMPs update [this document]. This PSC is chaired by DFFE and includes representation from various government departments and other agencies namely:
  - ORASECOM
  - DFFE;
  - DWS;
  - DOT;
  - DMRE;
  - DOA;
  - DPW;
  - SAPS;
  - NC DAERL;
  - NC Department of Economic Development and Tourism (DEDT) linked to the NC Tourism Authority;
  - Namakwa DM;
  - Richtersveld LM;
  - SANParks;
  - DWA (Namibia);
  - Alexcor;
  - Transhex;
  - SALGA;
  - NAMDEV;
  - CSIR; and
  - Conservation South Africa.

While a community representative from the Richtersveld community as well as Richtersveld environmental care, attended the last meeting held, it is unclear if community groups are represented on this committee.
As detailed in the 2021 updated NEMP, 'effective institutional structures and arrangements are crucial support elements for the successful implementation and co-ordination of actions in terms of the Protocol and the subsequent estuary management plans' (NEMP, 2021).

Chapter 5 of the ICM Act details the institutional arrangements that would, once implemented, contribute to co-operative coastal governance in South Africa. These arrangements are made at national, provincial and municipal levels and the embodiment of cooperative coastal governance is vested in coastal committees. No new institutional arrangements are proposed by the updated 2021 Protocol. The Provincial and Municipal coastal committees are required to serve as the forums for monitoring the implementation of EMPs and reporting of progress and achievements related to estuarine management. It is noted that in the NC, the NC PCC fulfils the function of the Namakwa municipal coastal committee (MCC).

It is noted that the current DFFE ORM Steering Committee / Working Group (detailed above) which oversees the implementation of the inaugural EMP developed currently fulfils the role of the proposed Estuarine Advisory Forum (EAF), which is no longer a requirement of the 2021 NEMP. It is considered appropriate that this committee continue functioning and performs the requirements of an EAF, however, an annual report back on progress made needs to be presented to the NC PCC.
In keeping with institutional best practice, organs of state should be represented by delegates mandated by the respective departments and each government representative will be required to convey

recommendations to his/her department and report back to the Committee on behalf of the department. Moreover, representatives from the authorities who have executive powers within the specific sector should also be present. This ensures that recommendations are executed and resources are made available for priority tasks or activities. This also streamlines the flow of information and decreases the turnaround time of required interventions. The various local members of the committee will play an invaluable role in providing on the ground, local insight and support to the various authorities as well as to the RMA, DFFE.

Effective implementation of this EMP requires the conversion of the priority actions into detailed project plans, which must be prepared and adopted into the respective departmental implementation strategies. A template for such project plans is provided in the EMP Development Guideline (DEA, 2015)[18]. This template can also be utilised to facilitate the implementation of other projects proposed in the EMP. Furthermore, a comprehensive and properly structured Regulatory Impact Assessment (RIA) must be commissioned to determine the details of the resources required by all organisations that will be involved in the implementation of the EMP.

## 9.4. Ramsar specific issues

As reported on in the situational assessment report, the ORM estuary was proclaimed a Ramsar site in 1991 in South Africa (Ramsar site 526) and in 1995 in Namibia (Ramsar site 744). In 1995, the site was placed on the Montreux Record of the Ramsar Convention following the collapse of the salt marsh component of the system, which was the result of a combination of impacts, both at and upstream of the wetland (CSIR 2001). Efforts have been ongoing to resolve ownership and management arrangements for the South African site, in order to institute a comprehensive rehabilitation and management programme.

The Namibian side of the Ramsar site is now included within the Sperrgebiet National Park, with future management of this area being undertaken by the Namibian Ministry of Environment and Tourism (MET) and their associated management committee. Unsuccessful effort has been made to afford the South African side formal protection status. Trans-boundary collaboration is an important provision in the Ramsar Convention which states that for trans-boundary wetlands, parties must consult with one another about implementing obligations arising out of the agreement (Ramsar, 2010a). As such, there is still a need for a mechanism for trans-boundary collaboration and feedback to ensure cooperation and alignment with respect to the management of the Ramsar site. Existing institutional arrangements therefore need to be refined to make way for more effective engagement and collaboration in future.

The inaugural ORM EMP (2017 EMP) reported on a twinning agreement between the Northern Cape Government and the Karas Region, signed in 1999 which could have been a useful vehicle to promote collaborative management. The purpose of the agreement was to promote and strengthen cooperation between the province and South Africa and the Karas region of Namibia. In 2006, provincial government and the Karas regional council agreed on specific areas of cooperation which included aspects relating to tourism and conservation (Northern Cape Provincial Government, 2006). This included the development of a joint management strategy for the Orange River mouth. While challenges with implementation hampered progress being made however, this could still provide a potential vehicle to facilitate further cooperative governance.

The inclusion of relevant departments of the Namibian government, Namibian conservation authorities and the Karas region in the DFFE ORM EMP Steering Committee (PSC) or Working Group could be the necessary stepping stone required to facilitate the necessary cooperation and collaboration.

[18] Document currently under review. Any updated EMP Development Guidelines would subsequently apply.

# 10. Integrated Monitoring Plan

According to the standards for estuarine management, management actions should be based on sound scientific evidence. Thus, monitoring is a crucial aspect of the adaptive estuarine management process as the generated data will be used to inform and update management decisions. However, the collection, processing and interpretation of such data, particularly ecological data, are generally costly, time-consuming and often require considerable scientific expertise. It is thus useful to drawn upon relevant institutional expertise, working within existing mandates as well as engaging with key research programmes with support from academic institutions to undertake necessary monitoring and research.

## 10.1. Resource Monitoring

In the context of estuarine management, there are three broad categories of monitoring which should be incorporated into an integrated monitoring plan, namely resource monitoring, compliance monitoring and performance monitoring (DEA, 2023). The primary aim of resource monitoring is to collect and evaluate data which will inform management on the ecological health of an estuary, as well as the intensity and nature of uses/activities that potentially influence its health (DEA, 2023). A summary of the current monitoring activities is provided below. Resource monitoring is closely linked to the reserve determination process and the adopted resource quality objectives and ecological specifications (EcoSpecs).

## 10.2. Current Resource Monitoring


**Figure 10.1: Water quality monitoring sites at the ORM estuary (DFFE, 2021).**

A coordinated monitoring plan is currently in place for the ORM Estuary, and includes water quality monitoring, bird monitoring, invertebrate and fish monitoring (DFFE, 2021). Participating institutions include DFFE, DWS, NC DAERL and Alexkor who conduct monitoring according to their legislative mandates and interests. The activities captured in the coordinated monitoring plan serve the key purpose of long-term monitoring of the system to detect emerging issues and inform adaptive management decisions, as well as

promote intersectoral collaboration (DFFE, 2021). It is therefore imperative that this monitoring programme continues. Resource monitoring activities are indicated through maps and tables of the sampling programmes below.

**Table 10.1: Summary of water quality monitoring activities at the ORM Estuary (DFFE, 2021)**

| Department of Forestry, Fisheries & the Environment | | | | | |
|---|---|---|---|---|---|
| **Site/Location** | **Coordinates** | **Component** | **Method** | **Parameters** | **Frequency** |
| Upper reaches | S28˚33.891 E16˚30.057 | Physico-chemical | In-situ using a Hydro-Lab multiparameter probe | Temp, pH, ORP, DO, EC, TDS, Sal | Quarterly: 3 Samples are taken from each of the Reaches (Left, Middle and Right) |
| Middle reaches | S28˚35.907 E16˚28.184 | | | | |
| Lower reaches | S28˚37.814 E16˚27.482 | | | | |
| Sandy beach | S28˚38.896 E16˚28.821 | Heavy metals | OVA 7000-Equitrol or HQ411d and HQ440 multiprobe | Al, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Ga, As, Se, Ag, Cd, In, Cs, Pb, Rb, Sr, Pd, Bi, Th, U, Ba, Tl. | |
| | | Bacterial load | Deltatox II Photometer | ATP | |
| | | Toxicity | Deltatox II Photometer | ATP | |
| **Alexkor** | | | | | |
| **Site/Location** | **Coordinates** | **Component** | **Method** | **Parameters** | **Frequency** |
| Patchvlei | 16°34'19.781"E 28°33'12.086"S | Physico-chemical | | pH, EC, NTU, TDS, nitrate, nitrite, Ca, CaCO3, Mg, Cl, Fl, Na, K, Zn, Ammonia, SO4 | Quarterly |
| Oppenheimer | 16°30'15.664"E 28°33'56.542"S | Potability | | | |
| Estuary | 16°27'47.219"E 28°38'8.473"S | | | | |
| **Department of Water and Sanitation** | | | | | |
| **Site Number** | **Location of site** | **Coordinates** | **Priority level** | **Parameters** | **Frequency** |
| 18 monitoring sites within the Lower Orange Water Management Area, including the Orange River estuary | | | | | |
| D8H012Q01* | Orange River at Alexander Bay/ Ernst Oppenheimer | -28.566111 S 16.508056 E | Level 2b | | |

* Last available data: 12 October 2010

**Table 10.2: Summary of bird monitoring activities at the ORM Estuary (DFFE, 2021)**

| NC-DAERL Bird Monitoring (CWAC method) | | | |
|---|---|---|---|
| **Site/Location** | **Coordinates** | **Method** | **Frequency** |
| B1 Dunvlei pan | 28.585338° S<br>16.488706° E | Count water birds on pan with binoculars | Twice a year |
| B2 Dunvlei fields | 28.587386° S<br>16.482438° E | Count water birds on fields (sometimes planted with Lucerne or maize, around estuary) | Twice a year |
| B3-B4 River channels Including islands and sandbars | River between Oppenheimer Bridge<br>28.565113° S<br>16.503644° E<br>and<br>Estuary mouth<br>28.628505° S<br>16.451793° E | Count water birds on river from boat, between the Oppenheimer Bridge and the mouth. | Twice a year |
| B5 Alexander Bay oxidation ponds (old) | 28.604579° S<br>16.476843° E | Count any water birds that may be present at the site of the old oxidation ponds with binoculars from the road. | Twice a year |
| B6 Alexander Bay oxidation ponds (new) | 28.605504° S<br>16.480327° E | Drive around back of oxidation ponds and count birds through the fence with binoculars | Twice a year |
| B7 Wetlands south of Alexkor security fence (opposite saltmarsh) | 28.647928° S<br>16.482224° E | Count any birds present from road through fence (no birds present past few years) | Twice a year |
| B8 Saltmarsh | 28.634244° S<br>16.463753° E | Drive on berm through saltmarsh and count water birds in saltmarsh | Twice a year |
| B9 Wetlands at mouth (backwater) | 28.640003° S<br>16.473383° E | Walk on sand spit and count birds on backwater | Twice a year |
| B10 Beach area (southern side of mouth) | 28.642269° S<br>16.470765° E | Walk beach and count birds on beach | Twice a year |

**Table 10.3: Summary of fish and invertebrate monitoring activities at the ORM Estuary (DFFE, 2021)**

| DFFE Fish and invertebrate monitoring | | | | |
|---|---|---|---|---|
| **Site/Location** | **Coordinates** | **Method** | **Parameters** | **Frequency** |
| S1 | -28.628024°S<br>16.451090°E | <u>Fish: Seine netting</u><br><br>30 m long, 2 m deep seine-net, with 10 m of 10 mm stretched mesh in the centre including the cod-end (bag) and 10 m of 15 mm stretched-mesh in each of the wings and hauling ropes of 30 m long<br><br><u>Benthic invertebrates: Grabs</u><br>Five replicates collected per site using a 250 $cm^2$ Van Veen grab and sieved through and 500 µm mesh sieve.<br><br>Samples are sorted and identified to lowest taxonomic level in the laboratory. | Fish<br>Invertebrates<br><br>Water quality: Salinity, turbidity, pH, temperature, dissolved oxygen<br><br>Sediment grain size and organic content | Biannually |
| S2 | -28.635973°S<br>16.464344°E | | | Biannually |
| S3 | -28.630058°S<br>16.457467°E | | | Biannually |
| S4 | -28.622164°S<br>16.448796°E | | | Biannually |
| S5 | -28.615675°S<br>16.451094°E | | | Biannually |
| S6 | -28.610401°S<br>16.456587°E | | | Biannually |
| S7 | -28.601189°S<br>16.458162°E | | | Biannually |
| S8 | -28.595084°S<br>16.463820°E | | | Biannually |
| S9 | -28.586314°S<br>16.466412°E | | | Biannually |
| S10 | -28.587108°S<br>16.476725°S | | | Biannually |
| S11 | -28.576940°S<br>16.487407°E | | | Biannually |

| | | | | |
|---|---|---|---|---|
| S12 | -28.566770°S 16.489868°E | Additional sediment sample is collected for particle size and organic content. | | Biannually |
| S13 | -28.566244°S 16.505617°E | | | Biannually |
| S14 | -28.55619°S 16.538164°E | | | Biannually |
| S15 | -28.553070°S 16.568280°E | | | Biannually |
| S16 | -28.532878°S 16.607794°E | | | Biannually |
| S17 | -28.507154°S 16.617927°E | | | Biannually |
| S18 | -28.471576°S 16.678578°E | | | Biannually |


**Figure 10.2: Bird (yellow) and fish-invertebrate monitoring (blue) site at the ORM estuary (DFFE, 2021).**

A long-term monitoring programme also provides the means to assess the abiotic and biotic attributes against the Resource Quality Objectives (RQOs) and EcoSpecs that have been determined for the estuary. RQOs are the specific environmental flows and goals that are set to preserve the quality of a water resource. EcoSpecs are clear and measurable specifications of ecological attributes (in the case of estuaries - hydrodynamics, sediment dynamics, water quality and different biotic components) that define a specific ecological category, in the case of the ORM Estuary, a Category C/D.

Thresholds of Potential Concern (TPCs) indicate the numerical values around the EcoSpecs that, if approached, would initiate more detailed investigations or even management actions. TPCs are therefore upper and lower levels along a continuum of change. These EcoSpecs and TPCs have been included in the most recent transboundary RQOs developed for the entire Orange-Senqu River Basin (ORASECOM, 2023) and are provided in Appendix D.

## 10.3. Recommendations for resource monitoring

- More information is needed on the monitoring efforts for macrophytes, invertebrates, and fish. These should be urgently addressed.
- An updated assessment of the macrophytes of the estuary, specifically the saltmarsh, is needed.
- The findings of the fisheries compliance monitoring should be included in the resource monitoring, terms of catch statistics (species, seasonality, sizes, etc.).
- Water quality data were found to be inconsistent, with variations in number and locations of sample sites, and sampling parameters, which created difficulties for data analyses and interpretation. This is likely attributed to fluctuating human and financial resources ahead of each sampling period. It is recommended that a minimum set of sampling sites and parameters are made mandatory (non-negotiable) to ensure a level of baseline consistency for comparable data.
- Optimum sampling techniques and laboratory analyses and protocols must be followed to ensure that samples do not degrade and the best quality results are obtained (e.g. calibrated sampling equipment, correct collection, handling and storage of samples, SANAS accredited laboratory, prompt analyses, etc.).
- Reporting must take into account the RQOs and TPCs for direct comparisons to be able to evaluate progress or achievement of the RQOs.

**Table 10.4: ORM Estuary: EcoSpecs and TPCs for abiotic components (DWS, 2017)**

| Component | Sub-component | EcoSpec | TPC |
|---|---|---|---|
| **Hydrology** | **Flow scenarios** | Maintain a flow regime to create the required habitat for birds, fish, macrophytes, microalgae and water quality.<br><br>PERC: D category (2017) | **Low flow requirement for mouth closure (D8H015 Sendelingsdrif):**<br>• Range: < 2 $m^3/s$ (currently achieved 1.6% of time at D8H015).<br>• Duration: 1 month at a time during the low flow period.<br>**Low flow requirement to maintain water column (instream) habitat:**<br>• 10% <5 $m^3/s$ (currently achieved 3.4% of time at D8H015).<br>• 20% <20 $m^3/s$ (currently achieved at D8H015) |
| **Hydrology** | **Flow scenarios (Post dam construction)** | Maintain a flow regime to create the required habitat for birds, fish, macrophytes, microalgae and water quality.<br><br>PERC: D category (2017) | **Low flow requirement for mouth closure (D8H015 Sendelingsdrif):**<br>• Range: < 2 $m^3/s$ (currently achieved 1.6% of time at D8H015).<br>• Duration: 2 - 3 months at a time during the low flow period.<br>• Frequency: 2 - 4 years out of 10.<br>**Low flow requirement to maintain water column (instream) habitat:**<br>• 10% <5 $m^3/s$ (currently achieved 3.4% of time at D8H015).<br>• 20% <20 $m^3/s$ (currently achieved at D8H015) |
| **Hydrodynamics** | | Maintain a mouth state to create the required habitat for birds, fish, macrophytes, microalgae and water quality.<br><br>PERC: C category (2017) | **In-stream habitat:**<br>• The water column (in stream) habitat not to be severely constricted/reduced for longer than 3 months at a time.<br>**Mouth Closure:**<br>• Aperiodical mouth closure for less than 3 months in duration.<br>**Water level during closed state:**<br>• >2.5 m mean sea level. |
| **Hydrodynamics** | **(Post dam construction)** | Maintain a mouth state to create the required habitat for birds, fish, macrophytes, microalgae and water quality.<br><br>PERC: C category (2017) | **In-stream habitat:**<br>• The water column (in stream) habitat not to be severely constricted/reduced for longer than 3 months at a time.<br>**Mouth Closure:**<br>• 2 months < closure > 4 months in 10 years<br>**Water level during closed state:**<br>>2.5 m mean sea level. |

| | | | |
|---|---|---|---|
| **Sediment dynamics** | | Flood regime to maintain the sediment distribution patterns and aquatic habitat (instream physical habitat) so as not to exceed TPCs for biota. | Average clay content of suspended sediments in river upstream of estuary >65%. |
| **Water quality** | **Salinity** | Salinity intrusion should not cause exceedance of TPCs for fish, invertebrates, macrophytes and microalgae.<br><br>PERC: Water quality C category (2017) | **River inflow (drought flows = 10% of the time):**<br>• 25 < salinity > 40 lower reaches (0 - 6 km).<br>• 10 < salinity > 40 upper reaches (6 - 12 km).<br>**River inflow (low flows):**<br>• 20 < salinity > 30 lower reaches for 5 < months > 7 of the year.<br>• 0 < salinity > 5 upper reaches for 5 < months > 7 of the year.<br>**River inflow (high flows):**<br>• Salinity <1 for >7 months of the year. |
| | **Nutrients** | Inorganic nutrient concentrations not to cause in exceedance of TPCs for macrophytes and microalgae<br><br>PERC: Water quality C category (2017)<br>$PO_4$, $NO_3$, $NO_2$, TN, TP, $NH_3$ currently monitored by DWA - Namibia | **River inflow (low flows):**<br>• DIN >100 µg/l; DRP >30 µg/l.<br>**River inflow (high flows):**<br>• DIN >150 µg/l; DRP >30 µg/l.<br>**Estuary (low flows):**<br>• DIN >100 µg/l; DRP >30 µg/l (except during upwelling when concentrations in saline areas can be higher).<br>**Estuary (high flows):**<br>• DIN >150 µg/l; DRP >30 µg/l. |
| | **System variables** | System variables (pH, DO, Turbidity) not to exceed TPCs for biota<br><br>PERC: Water quality C category (2017)<br>ORP currently monitored in-situ by DWA - Namibia | **River inflow (low flows):**<br>• 6.5< pH >8.5.<br>• DO <4 mg/l.<br>• Turbidity: Naturally turbid (can range between 10 - 100 NTU).<br>**River inflow (high flows):**<br>• 6.5< pH >8.5.<br>• DO <4 mg/l.<br>• Turbidity: Naturally turbid (can be >200 NTU).<br>**Estuary (low flows):**<br>• 6.5< pH >8.5.<br>• DO <4 mg/l.<br>**Estuary (high flows):**<br>• 6.5< pH >8.5.<br>• DO <4 mg/l. |

| | | | |
|---|---|---|---|
| | **Toxic substances** | Presence of toxic substances not to cause exceedance of TPCs for biota (see biotic components above)<br><br>PERC: Water quality C category (2017)<br>As, Ba, Pb, Se, Ti, U, V and Zn currently monitored by DWA - Namibia | **River inflow:**<br>• Trace metals (apply Freshwater Quality Guidelines (DWAF, 1996).<br>• Pesticides/herbicides (to be determined).<br>**Estuary:**<br>• Trace metals: Concentrations in estuary waters exceed target values as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995). Baseline studies to be undertaken before TPCs can be set for trace metals in sediments.<br>• Pesticides/herbicides: Baseline studies to be undertaken before TPCs can be set (preliminary TPC = when detected). |
| | **Solid waste/macroplastics** | Solid waste accumulation at the estuary requires monitoring to better understand the extent of the problem. The River-Ospar method should be undertaken following high flows to assess and characterise macroplastics to then establish numerical limits. | TBC |
| **Physical habitat alteration** | | PERC: B category (2017) | No action needed (B PERC). |

## 10.4. Compliance Monitoring

Compliance monitoring refers to the monitoring of the type and intensity of uses, activities and developments within an estuary/EFZ. Such monitoring is usually prescribed in relevant legislation, regulations, policies, standards, guidelines and or permits and license agreements (DFFE, 2023). The purpose of this form of monitoring is to assess whether activities are compliant with the established limits and objectives as well as to detect growing pressures on resources.

## 10.5. Current Compliance Monitoring

Compliance monitoring is currently undertaken according to the Operation Phakisa initiative. Meetings are held twice every quarter to discuss compliance related issues and to adjust monitoring accordingly. Compliance monitoring activities are summarised below.

**Table 10.5: Summary of compliance monitoring activities at the ORM Estuary**

| Sector/ Activity | Legislation | Authority | Type of Compliance Monitoring | Location/Frequency |
|---|---|---|---|---|
| Mining | MPRDA | DMRE | Permit conditions / EMPr | Annual audits |
| Fisheries | MLRA | DFFE: Fisheries (based at Port Nolloth) | MRLA regulations (species, quotas, size, gear), shore angling and vessels, illegal gillnets | Mouth, weekly basis during peak seasons |
| | | NC-DAERL | | River banks, monthly |
| Beach Driving | ICMA ORV Regulations | NC-DAERL | ORV Regulations. (Illegal beach driving) | Beach, ad hoc |

## 10.6. Recommendations for compliance monitoring

Once the spatial zonation plan is fully adopted and enforced, compliance monitoring will need to involve the Department of Agriculture in respect to monitoring of livestock infringements within the EFZ.

## 10.7. Tourism Monitoring

Given the importance of tourism as a vehicle for social upliftment in the region, monitoring of tourism activities and revenue generated by such activities is recommended. Some possible measures that should be considered include:

- **Visitor statistics**: Compiling statistics of visitor usage to available facilities would help to better understand the range of tourists using the estuary and Ramsar site. This would provide a useful measure for any marketing measures taken and, if correct information is collated, could help to inform future development planning in the area; and
- **Recreational activities:** It would be useful to monitor the number of people making use of the estuary / Ramsar site for various activities. In particular, the presence of motorised vessels should be monitored (e.g. numbers, duration of activity, location in the estuary).

While there are currently no means of compiling such statistics, this is suggested as an activity in the management plan.

## 10.8. Performance Monitoring Plan (Review and Evaluation)

A performance monitoring plan is used by the RMA, and/or identified implementing agents, to assess the effectiveness with which planned management activities contained in the EMP are being performed and ultimately to gauge progress in achieving the vision and objectives. This component utilises the performance indicators included for the various actions, specifically the management priorities, and includes a temporal scale or the frequency of the collection of the performance data and the targets that should be achieved (Table 10.6).

- Annual Review: Currently, the PSC undertakes quarterly meetings to monitor the progress of implementing the ORM EMP. This is an effective method for keeping informed regarding emerging issues, trouble-shooting, and new developments. It is proposed that this forum is periodically opened to the public/citizens to discuss and find solutions to ground-level issues. Issues identified at this forum need to be reported back to the PCC.

- 5-year Review: Ultimately, the EMP must be reviewed at least every five years from the date it was adopted, ideally in line with the review cycles of the applicable IDP, SDF and/or Coastal Management Programme (CMP). This review is the responsibility of the RMA and should include an assessment of:
  - The effectiveness of the EMP and success with meeting the objectives (i.e. the performance monitoring plan);
  - Environmental changes at a local or a wider scale that could affect the estuarine resources or the implementation of the EMP; and
  - Changes (if any) to legislation, land-use planning, goals or policies that may require the EMP to be amended.

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

**Table 10.6: Performance monitoring for implementation of the ORM EMP.**

| MANAGEMENT OUTPUT | PERFORMANCE INDICATOR | TEMPORAL SCALE (frequency) | RELEVANT LEGISLATION | RESPONSIBLE AUTHORITY |
|---|---|---|---|---|
| **1. ESTUARINE HEALTH AND FUNCTION** | | | | |
| **1.1 Secure adequate quantity and quality of freshwater input in line with EFR to improve and maintain ecosystem health and functioning** | • EFR and RQO fully adopted and enforced<br>  ○ Dam operating rules adjusted and implemented<br>  ○ Historical flow regime instated<br>  ○ Water use adequately regulated<br>• Improvement in flows through the system, C+ Ecological category attained<br>• ORASECOM privy to all water resource development project affecting the estuary | • Biannual for DWS | NWA | ORASECOM, DWS, DFFE |
| **1.2 Manage water quality impacts to prevent deterioration of ecosystem health and functioning (in line with the EFR)** | • Ongoing routine water and sediment quality monitoring<br>• Pollution action plan developed and implemented<br>• Improved estuarine water quality<br>• Improved sediment quality | • Quarterly | NWA, ICMA, NEMA | DFFE, DWS, DAERL, DMRE (Alexkor) |
| **1.3 Ensure effective mouth management to facilitate system recovery and optimise nursery function** | • MOU signed with Namibia for joint mouth management<br>• Mouth management plan developed<br>• Estuary health and function is maintained at optimum irt mouth dynamics | • Annually | NEMA, ICMA | DFFE |
| **1.4 Implement directed interventions to improve flows and promote recovery of the degraded salt marsh area** | • Consolidate/integrated plan for rehabilitation developed and adopted<br>• Project plans developed by respective departments and agencies<br>• Funding partners secured and sustainable financing sourced<br>• Rehabilitation interventions authorised and implemented<br>• Hydrological connectivity restored to degraded saltmarsh<br>• Coastal access provided<br>• Monitoring and enforcement of environmental best practice for all mining operations<br>• Adequate reporting of all rehabilitation interventions and impacts | • Biannual | NWA, ICMA, NEMA, NEM:BA, Ramsar Convention | DFFE, DMRE |
| **1.5 Control the spread and densification of alien invasive plants** | • Priority areas for AIP removal identified and mapped<br>• AIP eradication programme developed and implemented<br>• Increased area and biomass (tonnes) of IAPs removed per annum<br>• Reduction in AIP coverage within the ORM EFZ | • Annually | CARA, NEM:BA | DFFE, DAERL, landowners/I&APs |

| MANAGEMENT OUTPUT | PERFORMANCE INDICATOR | TEMPORAL SCALE (frequency) | RELEVANT LEGISLATION | RESPONSIBLE AUTHORITY |
|---|---|---|---|---|
| **2. CONSERVATION** | | | | |
| **2.1 Improve the formal protected area status and management of the ORM estuary** | • Ramsar boundary revised and in alignment with the EFZ<br>• Revised boundary adopted for Namibia Ramsar site<br>• Suitable formal conservation/protection mechanism established for EFZ | • Annually<br>• Ecological monitoring every 3 years | ICMA, Ramsar Convention, NEMPA | DFFE, DAERL |
| **2.2 Ensure effective management of the Orange River Mouth Nature Reserve** | • ORM NR manager appointed<br>• Sustainable funding stream secured<br>• Fencing erected<br>• Adequate communication of access and restrictions (signage, demarcations, informative materials)<br>• Quarter reporting of ORM NR operations | • Biannually | NEMPA | DAERL |
| **2.3 Ensure that estuarine and associated wetland habitats are managed in such a way that the ecological functioning and habitat value of these areas are maintained or enhanced** | • Waterbird surveys and species lists maintained<br>• Focus species monitoring programmes in place<br>• Habitat management plans developed for improvement of critical bird sites<br>• Effective removal and ongoing management of waste<br>• Community sensitization to impacts of littering<br>• Increase no. of breeding birds and general bird populations<br>• Contact person identified within local aviation authority<br>• Communication (ad hoc) with aviation authority regarding flight infringements over EFZ | • Biannually<br>• Annually | NEMBA<br>Ramsar Convention<br>NWMA, MSA, NEMA<br>CAA | DFFE, DAERL<br>Richtersveld LM, DMRE (Alexkor)<br>DFFE, DAERL |
| **2.4 Ensure that recreational and resource use are adequately controlled to prevent negative effects on wildlife or undermining of other ecological attributes** | • Spatial zonation plan demarcated and enforced<br>• Monitoring of ORV activities and infringements<br>• Compliance monitoring / patrols undertaken, findings documented and reported on<br>• Level of fishing effort established<br>• Need for no-take area investigated<br>• Alignment of SA/Namibia fishing quotas<br>• Recreational activities monitored and reported on | • Monthly compliance monitoring (or as per monitoring plan)<br>• Biannual<br>• Monthly | ICMA. NEMP, ORV Regs, MLRA | DFFE. DAERL. DoT |
| **3. LAND USE, PLANNING AND DEVELOPMENT** | | | | |
| **3.1 Ensure the effective implementation of the EMP** | • EMP approved and incorporated into IDP during cyclical review<br>• Spatial zonation included in SDF and LUMS as part of cyclical review | • 5-year review cycle | ICMA, NEMP, MSA, SPLUMA | NC DAERL, Namakwa DM, Richersveld LM |
| **3.2 Promote sustainable agriculture and livestock grazing in line with** | • SA/Namibia collaboration for cross-border livestock control<br>• Effective control of domestic and feral livestock | • Annually | CARA, NEM:BA | DALRRD, DAERL |

| MANAGEMENT OUTPUT | PERFORMANCE INDICATOR | TEMPORAL SCALE (frequency) | RELEVANT LEGISLATION | RESPONSIBLE AUTHORITY |
|---|---|---|---|---|
| **the conservation and socio-economic objectives** | • Effective control of livestock diseases<br>• Agricultural best practice implemented by local growers and larger corporations throughout the catchment<br>• Improved estuarine water quality<br>• Improved integrity of estuarine margins | | | |
| **3.3 Facilitate and manage the sustainable utilisation and development within and around the Estuarine Functional Zone** | • SPZ adopted and enforced<br>• Effective and positive collaborative relationship CPA<br>• Community access needs established through social study for consideration in revision of road network<br>• Implementation of rationalised road network<br>• Degraded habitats rehabilitated and stabilised as required<br>• Suitable, environmentally sensitive development concepts considered<br>• Shift toward green/environmentally sensitive development and behaviour, ultimately leading to improved environmental quality<br>• Harmonisation between Tourism Master Plan and EMP principles and objectives | • Biannually<br>• Ad hoc | NEMA, NWA, NEM:BA, MSA, ICMA, SPLUMA | DFFE, DAERL, DoT |
| **3.4 Minimise the potential impacts of climate change by mainstreaming climate adaptation and resilience into land use planning and decision making** | • CML determined, adopted and reflected in SDF and LUMS<br>• Specific engagement with property owners held<br>• Risk averse approach adopted for upgrades and new developments<br>• Reduced habitat loss/degradation and disturbance, and infrastructure loss and damage, risks to human lives | • Once-off (review after 5 years and extreme events) | MSA, NWA, ICMA, SPLUMA, NEMA, CCA | DAERL |
| **4. INSTITUTIONAL AND MANAGEMENT STRUCTURES** | | | | |
| **4.1 Improve trans-boundary collaboration and estuarine management** | • Regular formal discussion for collaboration between SA and Namibia<br>• Transboundary Ramsar site investigated<br>• Institutional structures established (e.g. champion/liaison) for effective transboundary relations | • Biannually | ICMA, NWA | DFFE<br>ORASECOM |

| MANAGEMENT OUTPUT | PERFORMANCE INDICATOR | TEMPORAL SCALE (frequency) | RELEVANT LEGISLATION | RESPONSIBLE AUTHORITY |
|---|---|---|---|---|
| **4.2 Develop institutional arrangements for effective co-ordination and implementation of estuarine management responsibilities** | • MOUs signed between various government departments and other agencies for estuarine management<br>• Departments are well resourced with knowledgeable / trained personnel and adequate equipment<br>• Institutional structures established (e.g. champion/liaison) for effective relations with landowners/CPA<br>• Active collaboration of various institutions, private and civil stakeholders<br>• Voluntary community monitoring team instated<br>• Ongoing oversight by ORM PSC to monitor implementation of estuarine management initiatives and actions<br>• Annual reporting and formal review of EMP every 5 years | • Annually | ICMA | DFFE, ORASECOM |
| **4.3 Enhance communication and collaboration with local communities and stakeholders** | • PSC attendance at PCC meetings<br>• Community engagements at scheduled PSC meetings<br>• Ongoing liaison with Ramsar contact | • Annually | ICMA, NEMBA, MSA | DFFE |
| **5. SOCIO-ECONOMIC CONSIDERATIONS** | | | | |
| **5.1 Promote local beneficiation by growing and actively marketing a range of nature-based recreation and ecotourism products** | • Key tourism and recreation products and services established managed and/or implemented by local communities<br>• Community members secure sustainable income generation | • Annually | ICMA, MSA, SPLUMA | DAERL, DoT, Richtersveld LM |
| **5.2 Promote high levels of environmental education, public awareness, and appreciation of the ORM Estuary** | • Increased environmental awareness and education via informative signage<br>• Buy-in from landowners, farmers and fishermen achieved<br>• Reduced negative impacts and activities | • Annually | ICMA, NEMP, MSA | DAERL, Richtersveld LM |

# 11. Conclusion and Recommendations

In conclusion, this plan adopts the principle of adaptive management and presents an integrated approach to addressing the environmental, social and economic impacts that affect the integrity of the ORM Estuary. The actions proposed in this EMP reflect an ongoing cyclical process of implementation designed to secure ongoing and sustainable improvements to the current situation.

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

- Implement environmental flow requirements to mimic historical flow regimes, i.e. decrease the winter baseflows sufficiently to allow for mouth closure and related back-flooding of the salt marshes to reduce soil salinities and improve moisture levels;
- Unlock discussions with the local community/CPA to resolve issues and work collaboratively regarding the disjuncture in community land-use activities and estuarine management objectives;
- Urgently address the impacts of mining activities, past, present and future. This includes but is not limited to:
    - Removal/redesign of the causeway to improve circulation during high flow and floods events, and increase water circulation into the intertidal and lower marsh areas;
    - Controlling wind-blown dust / sand from mining activities to reduce smothering of salt marshes;
    - Removal and rehabilitation of the former oxidation ponds to reinstate flow through this arm of the estuary;
    - Avoiding the estuarine functional zone (prospecting) and rehabilitate degraded estuarine habitat;
- Reconceptualise the existing dirt-road network to limit impacts on estuarine habitat whilst providing access to the estuary in an ecological sensitive manner while enhancing tourism in the area;
- Ensure that future development proposals are designed in harmony with the vision and objectives of the ORM EMP, contributing to overall ecosystem improvement and community upliftment;
- Improve institutional and departmental organisation and transboundary collaboration to enable effective and efficient estuarine management; and
- Improve consolidation and management of research and monitoring data to accurately and effectively inform decision-making and adaptive management.

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# Appendix A: Summary Guide for preparing a Mouth Management Plan (MMP)

(extracted directly from Van Niekerk *et al.*, 2023)

**1. Introduction**

In the absence of specific approval and a dedicated, system-specific implementation plan, the breaching of an estuary mouth remains an unlawful activity in terms of the National Environmental Management Act (NEMA) (No 107 of 1998) (KZN EDTEA 2020). Furthermore, according to EIA Regulations (2014), the movement of more than 5 cubic metres of material is a listed activity (Listing Notice 1, Activity 19A), unless it is undertaken in accordance with a maintenance management plan or in response to an emergency as contemplated in section 30A of the NEMA.

In line with management objectives and improved knowledge of the negative effects of artificial breaching, decision-making around this activity cannot continue as it has done in the past. There is a need to move on from ad-hoc approval to formal Estuarine Management Plans (EMPs) and only address breaching needs in accordance with a National Estuarine Management Protocol (KZN EDTEA 2020).

Artificial breaching should be a last resort that is only implemented if the following criteria are met (DEADP 2019; KZN EDTEA 2020):

- There is an imminent risk to human safety or life by back-flooding;
- Breaching requests may be considered in the short term for protecting historically located infrastructure (e.g. housing, pump stations etc.) with a fair leeway period to retreat/adapt in the medium term. Infrastructure and amenities, such as parking areas, picnic sites and caravan parks are excluded; or
- In estuaries where important ecological functions will be compromised, e.g. loss of annual fish recruitment, prolonged inundation of important salt marsh, mangrove or bird habitats.
- To mitigate emergency pollution incidents (not to be confused with ongoing problems, for example, water quality problems caused by wastewater treatment works and agricultural pollution).

Only emergency breaching or mouth closure under extremely rare conditions is considered appropriate for the ORM estuary.

## *Key Principles*

Where this practice needs to be considered, the following key principles must be considered:

- Natural breaching at high water levels remains the preferred option;
- Consider important ecological functions and processes;
- Consider key ecosystem services such as estuarine nursery function to maximise recruitment and support recovery of fish stock;
- Consider marine-estuary connectivity;
- Breaching can negate the impacts of alien invasive species or pathogens;
- Breaching is not a panacea for water quality problems;
- Water levels as high as possible prior to breaching;
- Breaching location should be the route of least resistance and consider hydrodynamic connectivity
- Excavate as deep and wide a trench before breaching to maximise outflow;

- Breach in late in winter and/or spring;
- Breach a few days before springtide;
- Breach at high tide to maximise outflow; and
- Consider public safety and animal mobility during breaching.

## *Contents*

An MMP should include the following to inform the decision-making process and to facilitate effective future implementation:

1. Objective;
2. Description of the estuary;
3. Motivation for artificial breaching;
4. Relevant authorities;
5. Breaching specifications;
6. Operational procedures;
7. Monitoring programme; and
8. Reporting.

A template for a MMP is included below for ease of use, as taken from Van Niekerk et al (2023), followed by the administrative process to be followed in the event of a proposed emergency breach (Appendix B).

## *2.* Objective of the Mouth Management Plan

**STATEMENT OF THE PROBLEM**

| |
|---|
| Text |

**OBJECTIVE OF THE ORANGE RIVER MOUTH MANAGEMENT PLAN**

| |
|---|
| **Text** |

| **IS ARTIFICIAL BREACHING TO BE CONSIDERED AT THE ORM ESTUARY? (Substantiation to be provided in section 3)** | **No** | **Yes** |
|---|---|---|
| High water levels | **X** | |
| Floods (emergency) | **X** | |
| Water quality (emergency such as spills) | | **X** |
| Fish kills (at DEFF; Branch Fisheries discretion as regarding nursery importance) | **X** | |
| **IS A MAINTENANCE MANAGEMENT PLAN REQUIRED?** | **No** | |

**KEY DATA /INFORMATION SOURCES**

| |
|---|
| The information presented below has largely been drawn from the ORM Estuary Management Plan (EMP) that focused on the operational management of the ORM estuary; the 2012/2013 ORM Estuary Ecological Water Requirement Study. |

**KEY RECOMMENDATIONS IN SUPPORT OF THE ORM ESTUARY MOUTH MANAGEMENT PLAN**

| |
|---|
| Key recommendations are as follows:<br>• Text |

**KEY LEGISLATION RELEVANT TO THIS MOUTH MANAGEMENT PLAN**

| |
|---|
| According to the 2014 Environmental Impact Assessment (EIA) Regulations (as amended) of the National Environmental Management Act 1998, the following activity may not commence without an environmental authorisation from the competent authority:<br>The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from—<br>I. the seashore;<br>II. the littoral active zone, an estuary or a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever distance is the greater; or<br>III. the sea<br><br>but excluding where such infilling, depositing, dredging, excavation, removal or moving<br>i. will occur behind a development setback;<br>ii. is for maintenance purposes undertaken in accordance with a maintenance management plan;<br>iii. …<br>[Listing Notice 1, Activity Number 19A] |

## 3. Description of the ORM Estuary

**Table A.1: Description of the estuary and its importance**

| Threat | Discussion |
|---|---|
| **Location and feature** | |
| **Estuary Importance** | |
| **Conservation status** | |
| **Important vegetation** | |
| **Important fish nursery** | |
| **Important Invertebrates** | |
| **Important Bird site** | |
| **Estuary Condition w.r.t breaching** | |
| **Recommended Ecological Condition** | |

## 4. Motivation for Artificial Breaching

Description of hydrology, hydrodynamics and mouth state

A summary of the relevance of motivations for potential artificial breaching is provided below in Table A.2.

**Table A.2: Summary of artificial breaching motivation**

| | Potential Threat | Relevance | |
|---|---|---|---|
| **Human wellbeing and safety** | Threat to human life (as a result of high-water levels) | No threat to human life. | |
| | Threat to immoveable property and infrastructure (as a result of high-water levels) | No threats to immoveable property, but will inundate low water bridge over estuary. | |
| | Human health impact (e.g. flooding of sewage pump station, septic tanks, chemical storage yards, etc.) | Not relevant. | |
| | Potential loss of agricultural resources (as a result of high-water levels) | Not relevant. | |
| | Potential impact on nearshore environment if breached (e.g. aquaculture facilities) | Not relevant. | |
| | Loss/impaired access (e.g. roads, footpaths, cattle crossings) | Higher water levels will inundate the low water bridge over estuary, similar to flood levels naturally achieved in the estuary. | |
| | Harmful / Noxious algal blooms | Not relevant. | |
| | | Impact of artificial breaching | Boating:<br>Recreational fishing:<br>Swimming: |
| | | Impact of NOT breaching | Boating:<br>Access:<br>Recreational Fishing:<br>Swimming: |
| **Ecosvs** | | Important bird habitat | |

| | Potential Threat | Relevance | |
|---|---|---|---|
| | Impact on avifauna abundance, species richness/ community composition | Impact of artificial breaching | |
| | | Impact of NOT breaching | |
| | | Occurrence of avian botulism | |
| | Impact on estuarine fish abundance, species richness/ community composition | Important fish nursery | |
| | | Impact of artificial breaching | |
| | | Impact of NOT breaching | |
| | | Occurrence of fish kills | |
| | Impact on estuarine invertebrate abundance, species richness/ community composition | Importance for invertebrates | |
| | | Impact of artificial breaching | |
| | | Impact of NOT breaching | |
| | | Occurrence of invertebrate kills | |
| | Estuarine Macrophytes (plants) | Impact of artificial breaching | |
| | | Impact of NOT breaching (i.e. die back of saltmarsh) | |
| | Water quality (Thresholds of concern that would compromise estuarine ecosystem or ecosystem services | Salinity thresholds of concern (high or low) that would compromise ecosystem or ecosystem services | |
| | | Dissolved Oxygen levels | |
| | | Ammonia levels | |
| | | Toxic substance in the context of breaching | |
| | | Pollution sources include: | |
| | Eutrophication | Excessive reed growth | |
| | | Macrophyte blooms | |
| | | Harmful algal blooms | |
| | Sedimentation | Ongoing sedimentation | |
| Emergencies | **Type** | **Yes/No** | **Motivation** |
| | Major flood events associated with severe (river) flood damage | Yes | |
| | High flood levels because of influx of water through the mouth or over the berm because of very high waves in the sea. | No | |
| | Poor water quality | No | |
| | Fish kills | No | |
| | Hazardous spill | Yes | |

## 5. Relevant Authorities

Table A.3 lists the Key lead authorities involved in artificial breaching at the ORM estuary.

**Table A.3: Key lead authority involved in artificial breaching**

| | |
|---|---|
| **Management authority** | DFFE |
| **Advisory Committee** | DFFE: PSC |
| **Authorisation (breaching / emergency)** | DFFE |
| **Lead authority** | **Minimum consultation in case of Emergency** |
| Department of Forestry, Fisheries and the Environment | ✓ |
| Namibia Ministry of Environment, Forestry and Tourism | ✓ |
| Department of Water and Sanitation | |
| NC DAERL | ✓ |
| Richtersveld Municipality (including Disaster Management) | ✓ |
| Namakwa District Municipality | ✓ |
| The decision to artificially breach in an emergency will be made by a Breaching sub-committee comprising at a minimum of DFFE Oceans and Coast, DFFE: Fisheries, Namibia-MEFT, NC DAERL and Richtersveld Municipality.<br><br>Data on water level, berm height, salinity, as well as water quality parameters (where feasible), will be collated by (…) and representatives of the local community. | |

| Disaster Management | Authority/Organisation | Status |
|---|---|---|
| **Early warning system** | South African Weather Services (weather) | Yes |
| | DWS warning system (flow/water levels/dam safety) | No |
| **Disaster Management Plan** | Municipality | Yes |
| **Approved Maintenance Management Plan** | Municipality | No |

## 6. Breaching Specifications

The ORM estuary mouth is, like almost every estuary mouth, highly dynamic. Mouth conditions and configuration of channel and sand banks upstream of the mouth are ever changing. In principle, interference to rectify perceived problems, such as sedimentation, should thus be avoided or undertaken as little as possible.

Breaching specifications that need to be met before artificial breaching of the ORM estuary can be considered are detailed in Table A.4 below.

**Table A.4: ORM Estuary Breaching Specifications**

| Breaching considerations | Details | | |
|---|---|---|---|
| Minimum breaching level (water level should be as high as possible before breaching) | XXX | No | Level still to be determined at site. |
| | Natural breaching at water levels XXX above MSL is preferred with no or minimal interference.<br><br>Owners of low-lying properties should flood-proof their dwellings to reduce risk (e.g. raise floor levels, construct retaining walls (subjected to municipal and/or EIA approvals)). In most cases this has been done at the ORM estuary.<br><br>In the absence of "crisis" conditions (defined below), artificial breaching must not be contemplated. | | |
| Optimum breaching period (if applicable) | Not relevant. | | |
| Water releases | Not relevant. | | |
| Neap-spring breaching considerations | Preferably 3-4 days before spring tide, but priority should be given to wave conditions and water levels. | | |
| Timing of breaching | Breach at or shortly after high tide, provided waves will not be interfering. (At 3-4 days before springtide this will normally be by mid-afternoon.) | | |
| Consider safety of public during breaching | Care should be taken with the general public to ensure their safety during emergencies. | | |
| Breaching trench to maximize outflow | Excavate a deep and wide trench before breaching to maximize outflow. A large bulldozer would be ideal to achieve this. A backactor or even a small bulldozer is far less sufficient for this. | | |
| Location of the breaching position. | At an emergency breaching the mouth should be breached where the berm is the lowest and narrowest. | | |
| Disposal of sediment removed during excavation | The sand excavated from the trench should be pushed out into the sea where wave action will take it away and not be stored on the banks next to the trench. Otherwise the sand stored on these banks will drop back into the excavated channel reducing the effectiveness of the outflow and the wider and deeper scouring of this trench. | | |
| Estimate amount of sediment to be moved during breaching | Not applicable, as volume varies significantly between breachings. This can therefore not be determined in advance. | | |
| Mobilizing machinery and equipment on site during breaching | Equipment and machinery to be utilised in a breaching must be in a good state. Oil leaks are not to cause additional pollution.<br><br>Care should be taken to ensure that earth moving equipment does not disturb indigenous vegetation of conservation worthiness on route to the excavation site. Bird nesting areas are to be avoided. Where possible an existing access road / track should be used.<br><br>Allow DFFE/ NC DAERL officials access to the designated area for the purpose of assessing and/or monitoring compliance with the conditions contained in the MMP, at all reasonable times.<br><br>Be responsible for all costs necessary to comply with these conditions unless otherwise specified<br><br>The DFFE retains the management responsibility of the designated area, even though the applicant may grant permission for the designated area to be managed, on their behalf, by a competent contractor /service provider. | | |

| | |
|---|---|
| | Ensure that all users adhere to the local authority By-Laws relating to the designated areas at all times.<br><br>The legal requirements associated with the use of the designated area must be brought to the attention of all persons that are granted access to the designated area by the applicant (licensee) in terms of the conditions of this licence and the applicant shall take measures necessary to bind such persons to these requirements. |
| Noise & light pollution | Noise during a breaching should be kept to a minimum and within the relevant noise control by-laws/regulations of the municipality. |
| Water Quality considerations (Thresholds of Concern) | Salinity: |
| | Oxygen: |
| | Toxins: |
| Ecological considerations | Vegetation: Breaching per natural conditions in early spring. |
| | Fish: Breaching per natural conditions in early spring. |
| | Invertebrates: Breaching per natural conditions in early spring. |
| | Birds: Breaching per natural conditions |

## 7. Operational Procedures

Articulate clear operational procedures as per the proposed flow charts for normal and emergency breaching events.

Two types of breachings are generally distinguished, namely:

- Planned artificial breaching undertaken according to an approved mouth Maintenance Management Plan (MMP); and
- Emergency breaching (e.g. to avoid danger of flooding).

**Emergency breaching of the ORM estuary is only considered appropriate under extremely rare conditions.**

The managing authority (in consultation with NC DAERL) is responsible for the operational aspects of the breaching. They can delegate this function, but ultimately, they have oversight. The managing authority is required to co-ordinate the breaching activities, which include:

- Convening emergency breaching meetings;
- Recording the minutes of the meetings;
- Distributing relevant information to the committee members; and
- Sharing the post-breaching incident report;

The managing authority is also responsible for continuous monitoring of the conditions in the estuary. Once the emergency breaching criteria (see Section 5) are met, the decision to artificially breach will be made by the DFFE (supported by a Breaching Sub-committee if there is time). Note, that an estuary mouth is highly dynamic and unforeseen events may require special management actions. In such an event, verbal (followed by written) authorisation may be required from the authorising authority (i.e. DFFE).

A flow chart for undertaking of mouth breaching under emergency conditions is included in Figure A.1. Emergency breaching should be undertaken in the swiftest manner possible. While breaching should be conducted according to the Estuary Mouth Management Plan, some of the general breaching principals (e.g. state of the tide, maximum water level) may be waivered under emergency conditions to ensure an expedient breaching.

Emergency conditions could develop when an estuary mouth is closed and severe rainfall occurs in the catchment causing a large flood. Constant monitoring of the conditions in the catchment is required when emergency conditions develop. Communication between the different role players, i.e.

the municipality and key authorities involved, should take place, if time is available, to monitor the situation. Included in the monitoring are:

- The actual and expected rainfall in the catchment;
- The water level in the estuary and its rate of increase;
- The height and width of the sand berm at the mouth;
- The actual and predicted wave conditions; and
- The availability of equipment to breach the mouth on short notice.

Section 3 lists some additional events that can constitute an emergency at the ORM estuary.

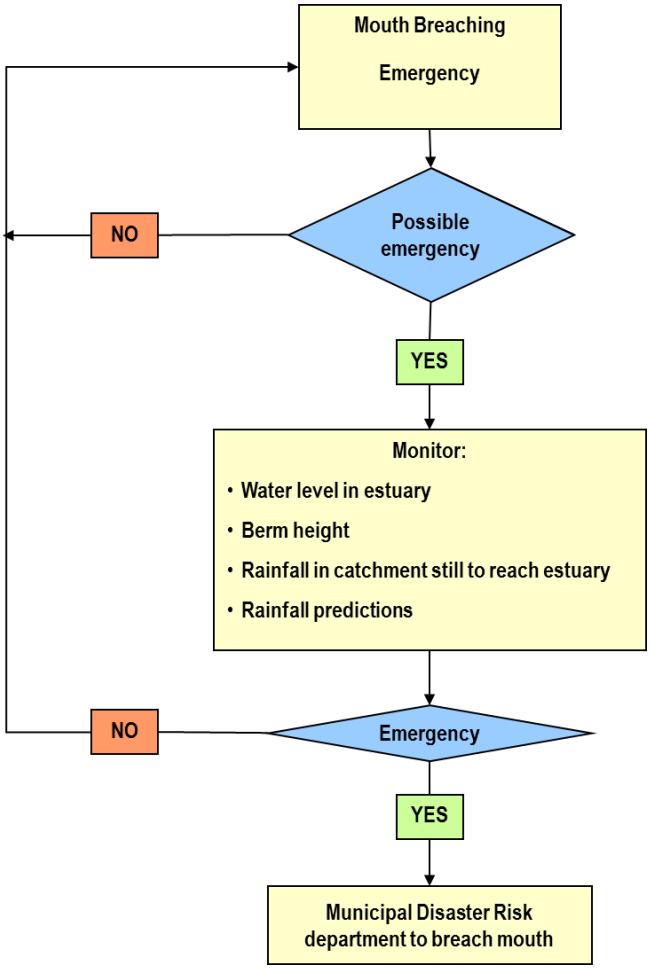


**Figure A.1: A flow chart illustrating the breaching plan for emergency conditions**

Once the relevant criteria have been met and that artificial breach must occur, they shall be responsible for overseeing the following:

- Ensuring the availability and deployment of earth moving equipment on the day of breaching;
- Establishing the exact location of the breaching channel;
- Verifying that the sand berm at the mouth is high enough above the water line to ensure that there is no risk of "fluidization" of berm sediment (i.e. turns to quicksand) and associated risk to operator and equipment;
- Deployment of flags and signage to warm the public of the risks to their safety; and
- Breaching of the estuary mouth.

Finally, the managing authority is responsible for the compilation of a Breaching Incident Report to be provided to DFFE within 14 days of the actual breaching (see Section 8 for more detail on the report).

## 8. Monitoring Programme

The following monitoring programme supports the responsible management of artificial breaching (Table A.5):

**Table A.5: Monitoring programme for ORM estuary**

| MONITORING ACTIONS | FREQUENCY | LOCAL REQUIREMENT - YES/NO | AGENCY RESPONSIBLE |
|---|---|---|---|
| Weather forecast (projected rainfall and waves) | Period leading up to breaching | Yes | SA Weather Services |
| Water levels | Continuous | Yes | DFFE / DWS |
| River inflow data | Daily | No | DWS |
| Bathymetric surveys | Every 3 years | Yes | DFFE |
| Salinity | Monthly (and day before and after 5 to 10 days after a breaching) | Yes | DFFE, DWS |
| *In situ* water quality measurements (e.g. oxygen) | Monthly | Yes | DFFE |
| Berm levels | Monthly (and just before breaching if breaching is planned) | Yes | DFFE |
| Observations on estuarine vegetation (e.g. inundation of salt marsh, reeds & sedges, occurrence of algal blooms) | Quarterly (and just before breaching) | Yes | DFFE |
| Observations on Invertebrate behaviour (e.g. invertebrate kills) | Quarterly (and just before breaching) | Yes | DFFE |
| Fish surveys<br>Distribution, abundance, movement and behaviour (e.g. recruitment, aggregations, fish kills) | Bi-annually | Yes | DFFE |
| Co-ordinated Water bird Counts (CWAC) | Bi-annually | Yes | NC DAERL |

## 9. Reporting

Following an estuary mouth opening a Breaching Incidence Report needs to be compiled and provided to DFFE within 2 weeks of breaching. This report should contain as much information on the breaching motivation as possible and the process followed during the breaching.

In addition to the Breaching Incidence Report, the Managing Authority needs to compile an Annual Mouth Breaching Report that summarises information on all mouth manipulation activities, ecological responses and consequences to human well-being and safety. The Annual Breaching Report needs to be presented to all Interested and Affected Parties (I&AP) (relevant authorities and civil society) to communicate progress with the implementation of the MMP. Such feedback sessions provide the opportunity for a critical review of current breaching practises and discussions on possible improvements to future MMPs. The Annual Mouth Breaching Report will also serve as a national reporting document.

**Breaching Report**

Table A.6: Content of ORM estuary breaching report below summarises the minimum content of a ORM estuary Breaching Report. The initial report should be complied within about two weeks of breaching, with data gaps (e.g. duration open) addressed after mouth closure.

**Table A.6: Content of ORM estuary breaching report**

| ACTIONS | LOCAL REQUIREMENT - YES/NO | AGENCY RESPONSIBLE |
|---|---|---|
| Met-ocean information<br>• State of the tide (spring-neap/ high-low tide)<br>• Sea conditions (waves calm/stormy) | Yes | DFFE/ NC DAERL |
| Estuary Information<br>• Water level before breaching<br>• Did flooding problems arise before or during the breaching? If so, quantify these problems.<br>• Could measures be taken to prevent such problems in the future? Distinguish between short-term and long-term measures.<br>• Could further problems arise by approval of new developments at too low levels?<br>• Were there problems with septic tanks before the breaching? If so quantify.<br>• Photographs | Yes | DFFE / NC DAERL |
| Location of channel<br>• Align with historical position of channels<br>• Reduce channel length | No | DFFE / NC DAERL |
| Period the mouth stayed open | No | DFFE / Alexkor |
| Do bathymetric surveys result show ongoing sedimentation? | Yes | DFFE |
| Salinity measurement before and after breaching | Yes | DFFE /Alexkor |
| Macrophyte conditions | No | DFFE |
| Fish recruitment survey | No | DFFE |
| Avifauna counts (CWAC) | No | NC DAERL |
| Other | | |
| Assessment record compiled by:<br>Name:<br>Organization:<br>Date:<br>Contact details: | | |

## Feedback on breaching activities

Table A.7: Minimum information required on breaching feedback sessions below summarises the minimum information required as evidence of breaching feedback reporting. Such report back sessions should be held at least once a year to ensure that the correct breaching procedures are being followed and that additional interventions are not required.

**Table A.7: Minimum information required on breaching feedback sessions**

| ACTIONS | LOCAL REQUIREMENT - YES/NO |
|---|---|
| Responsible agency /authority | DFFE |
| Place & Workshop venue | |
| Date | |
| Meeting/committee/workshop participants (attached attendance register) | |
| Workshop chaired by | |
| Key lessons learned that could assist with future breaching | |
| Material presented at meeting (including copies of presentations) | |

# Appendix B: Administrative Procedure for an Oral Request to Artificial Breach an Estuary

(Source: National Guideline, Van Niekerk *et al*., 2023)

The following procedures should be followed by any persons/entities wish to undertake artificial breaching of the ORM Estuary:

- An oral or written request for a verbal directive to breach an estuary mouth, in terms of NEMA section 30A, is directed to the national authority (DFFE) given that the ORM Estuary is a transboundary system.
- National and provincial authorities, in turn, will be assisted by district offices with verifying breach requests and advising of the status quo on-the-ground (e.g. providing photographs).
- The competent authority after receiving all information required in terms of Regulation 5(1) will assess the information and inform relevant directorates and managers.
- The competent authority may acknowledge the receipt of an oral or written request by email/SMS.
- Before making a decision regarding the commencement of the requested listed activities, the competent authority may, as soon as reasonably possible, consult with other affected organs of the state. For example, if an estuary is an important fish nursery for collapsed stock.
- Within six (6) hours after receipt of all required information required in terms of regulation 5(1) and / or 5(2), the competent authority must issue or refuse the verbal directive to the applicant. The competent authority must consider all the factors in regulation 6(1) in decision-making. The competent authority must instruct the applicant to submit a written request in terms of regulation 7.
- Within 24 hours the competent authority must receive written confirmation of the oral/verbal request from the applicant and compare it with the initial oral request for a verbal directive.
- The competent authority must confirm the verbal directive, in writing, within seven (7) days of the issuance of the verbal directive.
- Where reasonably possible, a site inspection must be undertaken to verify the information received. The site inspection may consist of a team coordinated by the competent authority which involves all the affected authorities.
- If the competent authority does not receive written confirmation of the oral request for a verbal directive within 24 hours or is of the opinion that there is incorrect or misleading information orally or in writing then it may amend, suspend or revoke the verbal directive.
- Should the intention of the competent authority be to amend, suspend or revoke the verbal directive, it shall first provide a written notice of intention to amend, suspend or revoke the verbal directive to the entity in whose favour the verbal directive was issued and shall give the said entity 48 hours in which to object to the amendment, suspension or revocation.
- Should the competent authority decide to amend, suspend or revoke the verbal directive, he/she shall provide written reasons for the decision to the entity in whose favour the verbal directive was issued.
- The competent authority shall, as soon as reasonably possible and in writing, inform all other relevant authorities that may be responsible for the management thereof of the amendment, suspension or revocation of an issued verbal directive.
- Confirmation of the oral request for a verbal directive shall be issued within 7 days in writing by the competent authority.
- The competent authority shall within 7 days from the date of issue of the verbal directive, report the emergency situation, in writing, to all other relevant authorities that may be responsible for the management thereof and inform the relevant authorities of any verbal directive issued.
- Post issuance of a directive, site inspections need to be conducted by the department or the relevant competent authority to assess compliance with the conditions of the verbal directive

issued and there shall be a report thereon in writing. The site inspection may consist of a team coordinated by the competent authority which involves all the affected authorities.

- Should any non-compliances be detected, the competent authority may take the necessary administrative enforcement action against the person or entity in whose favour the verbal directive was issued to ensure that compliance is achieved.

# Appendix C: Proposed template for project plans

(Source: DEA, 2015)

<table>
<tr><td>ACTION</td><td>Describe the action to be undertaken</td></tr>
<tr><td>COMPLETION DATE</td><td>Provide date of expected completion</td></tr>
<tr><td>PERFORMANCE INDICATOR</td><td></td></tr>
<tr><td>Requirements stipulated in policy and legislation</td><td></td></tr>
<tr><td>Available methods, protocols and best practice guides</td><td></td></tr>
<tr><td>Spatial zonation considerations (e.g. controls, limits or targets)</td><td></td></tr>
<tr><td>Detailed work plan</td><td>Task 1:<br>Task 2:<br>Task 3:<br>Task 4:</td></tr>
<tr><td>Scheduling</td><td>
<table>
<tr><td></td><td colspan="8">Months</td></tr>
<tr><td>Task</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr>
<tr><td>1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
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<tr><td>Milestones/ Interim Performance Indicator</td><td>
<table>
<tr><td>Milestone</td><td>Interim Performance Indicator</td><td>Due date</td></tr>
<tr><td>1</td><td></td><td></td></tr>
<tr><td>2</td><td></td><td></td></tr>
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<tr><td>Responsibilities for different tasks</td><td>Identify specific departments, personnel and/or service providers responsible for the execution of this action</td></tr>
<tr><td>Monitoring and reporting plan</td><td>- Define data and information to measure in order to monitor performance indicators<br>- Specify frequency at which data/ information should be collected/monitored<br>- Where and when to report on progress</td></tr>
<tr><td>Human resource plan</td><td>
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<tr><td></td><td colspan="4">Weeks per task</td></tr>
<tr><td>Human Resource</td><td>1</td><td>2</td><td>3</td><td>4</td></tr>
<tr><td>Staff 1</td><td></td><td></td><td></td><td></td></tr>
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# Appendix D: Ecological Specifications and Thresholds of Potential Concern for the Orange River Estuary

(Source: ORASECOM, 2023)

**Table D.1: EcoSpecs and TPCs for abiotic components of the ORM Estuary (after DWS, 2017)**

| Component | Sub-component | EcoSpec | TPC |
|---|---|---|---|
| **Hydrology** | **Flow scenarios** | Maintain a flow regime to create the required habitat for birds, fish, macrophytes, microalgae and water quality.<br><br>PERC: D category (2017) | **Low flow requirement for mouth closure (D8H015 Sendelingsdrif):**<br>• Range: < 2 $m^3/s$ (currently achieved 1.6% of time at D8H015).<br>• Duration: 1 month at a time during the low flow period.<br>**Low flow requirement to maintain water column (instream) habitat:**<br>• 10% <5 $m^3/s$ (currently achieved 3.4% of time at D8H015).<br>• 20% <20 $m^3/s$ (currently achieved at D8H015) |
| **Hydrology** | **Flow scenarios (Post dam construction)** | Maintain a flow regime to create the required habitat for birds, fish, macrophytes, microalgae and water quality.<br><br>PERC: D category (2017) | **Low flow requirement for mouth closure (D8H015 Sendelingsdrif):**<br>• Range: < 2 $m^3/s$ (currently achieved 1.6% of time at D8H015).<br>• Duration: 2 - 3 months at a time during the low flow period.<br>• Frequency: 2 - 4 years out of 10.<br>**Low flow requirement to maintain water column (instream) habitat:**<br>• 10% <5 $m^3/s$ (currently achieved 3.4% of time at D8H015).<br>• 20% <20 $m^3/s$ (currently achieved at D8H015) |
| **Hydrodynamics** | | Maintain a mouth state to create the required habitat for birds, fish, macrophytes, microalgae and water quality.<br><br>PERC: C category (2017) | **In-stream habitat:**<br>• The water column (in stream) habitat not to be severely constricted/reduced for longer than 3 months at a time.<br>**Mouth Closure:**<br>• Aperiodical mouth closure for less than 3 months in duration.<br>**Water level during closed state:**<br>• >2.5 m mean sea level. |
| **Hydrodynamics** | **(Post dam construction)** | Maintain a mouth state to create the required habitat for birds, fish, macrophytes, microalgae and water quality.<br><br>PERC: C category (2017) | **In-stream habitat:**<br>• The water column (in stream) habitat not to be severely constricted/reduced for longer than 3 months at a time.<br>**Mouth Closure:**<br>• 2 months < closure > 4 months in 10 years<br>**Water level during closed state:**<br>>2.5 m mean sea level. |

| | | | |
|---|---|---|---|
| **Sediment dynamics** | | Flood regime to maintain the sediment distribution patterns and aquatic habitat (instream physical habitat) so as not to exceed TPCs for biota. | Average clay content of suspended sediments in river upstream of estuary >65%. |
| **Water quality** | **Salinity** | Salinity intrusion should not cause exceedance of TPCs for fish, invertebrates, macrophytes and microalgae.<br><br>PERC: Water quality C category (2017) | **River inflow (drought flows = 10% of the time):**<br>• 25 < salinity > 40 lower reaches (0 - 6 km).<br>• 10 < salinity > 40 upper reaches (6 - 12 km).<br>**River inflow (low flows):**<br>• 20 < salinity > 30 lower reaches for 5 < months > 7 of the year.<br>• 0 < salinity > 5 upper reaches for 5 < months > 7 of the year.<br>**River inflow (high flows):**<br>• Salinity <1 for >7 months of the year. |
| | **Nutrients** | Inorganic nutrient concentrations not to cause in exceedance of TPCs for macrophytes and microalgae<br>PERC: Water quality C category (2017)<br>PO4, NO3, NO2, TN, TP, NH3 currently monitored by DWA - Namibia | **River inflow (low flows):**<br>• DIN >100 µg/l; DRP >30 µg/l.<br>**River inflow (high flows):**<br>• DIN >150 µg/l; DRP >30 µg/l.<br>**Estuary (low flows):**<br>• DIN >100 µg/l; DRP >30 µg/l (except during upwelling when concentrations in saline areas can be higher).<br>**Estuary (high flows):**<br>• DIN >150 µg/l; DRP >30 µg/l. |
| | **System variables** | System variables (pH, DO, Turbidity) not to exceed TPCs for biota<br><br>PERC: Water quality C category (2017)<br>ORP currently monitored in-situ by DWA - Namibia | **River inflow (low flows):**<br>• 6.5< pH >8.5.<br>• DO <4 mg/l.<br>• Turbidity: Naturally turbid (can range between 10 - 100 NTU).<br>**River inflow (high flows):**<br>• 6.5< pH >8.5.<br>• DO <4 mg/l.<br>• Turbidity: Naturally turbid (can be >200 NTU).<br>**Estuary (low flows):**<br>• 6.5< pH >8.5.<br>• DO <4 mg/l.<br>**Estuary (high flows):**<br>• 6.5< pH >8.5.<br>• DO <4 mg/l. |
| | **Toxic substances** | Presence of toxic substances not to cause exceedance of TPCs for biota (see biotic components above)<br>PERC: Water quality C category (2017)<br>As, Ba, Pb, Se, Ti, U, V and Zn currently monitored by DWA - Namibia | **River inflow:**<br>• Trace metals (apply Freshwater Quality Guidelines (DWAF, 1996).<br>• Pesticides/herbicides (to be determined).<br>**Estuary:**<br>• Trace metals: Concentrations in estuary waters exceed target values as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995). Baseline studies to be |

| | | | |
|---|---|---|---|
| | | | undertaken before TPCs can be set for trace metals in sediments.<br>• Pesticides/herbicides: Baseline studies to be undertaken before TPCs can be set (preliminary TPC = when detected). |
| | **Solid waste/macroplastics** | Solid waste accumulation at the estuary requires monitoring to better understand the extent of the problem. The River-Ospar method should be undertaken following high flows to assess and characterise macroplastics to then establish numerical limits. | TBC |
| **Physical habitat alteration** | | PERC: B category (2017) | No action needed (B PERC). |

**Table D.2: EcoSpecs and TPCs for abiotic components of the ORM Estuary (after DWS, 2017)**

| Component | Sub-component | EcoSpec | TPC |
|---|---|---|---|
| **Microalgae (phytoplankton and microphyto-benthos)** | | Phytoplankton biomass and cell density should not exceed 20 µg/l 1 and 10 000 cells/ml (typical of blooms) respectively.<br>Median phytoplankton and microphytobenthos (MPB) biomasses should not exceed 8 µg/l and 42 mg/m$^2$ (TPC of 'very high' biomass).<br>A 5% decrease in phytoplankton chl-a will relate to a 5% increase in microalgal score. This is mostly related to flow (low flow = higher residence time) and nutrients.<br>Median biomass in August 2012 (flow 20 - 50 m$^3$/s) exceeded these TPCs; Phytoplankton 13.1 µg/l and MPB 48.5 mg/m$^2$, and cell density was >31 000 cells/ml.<br><br>PERC: D category (2017) | • Median phytoplankton chl-a should be <8 µg/l under 'normal flows'.<br>• Phytoplankton cell density should be >10 000 cells/ml 'normal flows'.<br>• Median MPB biomass should not be >42 mg/m$^2$ under 'normal flows'. |
| **Macrophytes** | | Maintain the diversity of macrophyte habitats in the estuary.<br>Reeds and sedges covering approx. 300 ha, submerged macrophyte *Stuckenia pectinate* (pondweed) occurs in sheltered areas (approx. 1 ha). Macroalgae cover less than 1 ha.<br>Vegetation cover increases in desertified marsh area due to removal of causeway and improvement of tidal and flood channels.<br>More than 50% of this area vegetated (approx. 250 ha).<br>PERC: C category (2017) | Further sedimentation in main channel and colonisation by vegetation.<br>50% loss of reed and sedge habitats in non-flood year due to salinity changes.<br>No pondweed in non-flood years due to high turbidity.<br>Macroalgae cover more than 1 ha due to low flow conditions and increase in nutrients.<br>Less than 200 ha vegetation cover in the desertified marsh area due to limited rehabilitation efforts. |

| Component | Sub-component | EcoSpec | TPC |
|---|---|---|---|
| **Invertebrates** | **Zooplankton, hyperbenthos and benthos** | Retain present state species richness and mix (low species abundance, high dominance). However, under the present state one or two species are always present at high densities compared to others (e.g. *Pseudodiaptomus hessei* and *Ceratonereis keiskama*). This translates into high dominance of one or two species, both in the plankton and in the benthic community.<br>For a C/D Category the higher densities need to be highly variable in terms of abundance within and between years. Aperiodically mouth closure would the highly beneficial to the restoration of this system, but any variability in low flows would facilitate recovery of invertebrate community.<br>Indicator species such as *Capitella capitata*, should not dominate benthic species abundance at the majority of sampling sites since their presence indicates anoxia conditions in the sediment. However, *Capitella* will naturally occur in high abundance in stagnant or poorly drained backwater areas.<br><br>PERC: C category (2017) | Species richness is >20 for zooplankton and macroinvertebrates respectively (70% increase).<br>*C. capitata* numerically dominates benthic species abundance at more than five sites currently sampled (nine in total).<br><br>Not currently monitored by Namibia DWA |
| **Fish** | **Estuarine dependent/marine/freshwater fish** | Maintain species composition at<br>• 35 - 40% estuary associated marine species<br>• 20% non-dependent marine species<br>• 45 - 50% indigenous freshwater species.<br>All numerically dominant species are represented by 0+ juveniles.<br>The overall dominant species *Liza richardsonii* should not drop below 90% biomass.<br><br>PERC: C category (2017) | • Non-estuary associated marine or freshwater species become proportionally dominant.<br>• 0+ juveniles do not recruit,<br>• L. richardsonii <90% biomass. |
| **Birds** | **14 Red listed species** | The estuary should contain a rich avifaunal community that includes representatives of all the original groups, significant numbers of migratory waders and terns, as well as a healthy breeding population of resident waders. | The five-year average numbers of the 14 species for which the estuary supports more than 1% of the southern African or global population should not fall to below half of the average numbers reported by Anderson *et al*. (2003): |

| Component | Sub-component | EcoSpec | TPC | |
|---|---|---|---|---|
| | | The estuary should support over 8000 waterbirds in summer and over 6000 birds in winter.<br><br>PERC: C category (2017) | Blacknecked Grebe | 125 |
| | | | Great White Pelican | 473 |
| | | | Cape Cormorant | 984 |
| | | | Lesser Flamingo | 1031 |
| | | | Greater Flamingo | 700 |
| | | | South African Shelduck | 516 |
| | | | Cape Shoveller | 373 |
| | | | Chestnutbanded Plover | 97 |
| | | | Pied Avocet | 891 |
| | | | Curlew Sandpiper | 1666 |
| | | | Kelp Gull | 1098 |
| | | | Hartlaub's Gull | 707 |
| | | | Caspian Tern | 165 |
| | | | Swift Tern | 344 |