

Environmental Impact Assessment (EIA) for the  
Proposed Construction, Operation and  
Decommissioning of a Sea Water Reverse Osmosis  
Plant and Associated Infrastructure Proposed at  
Lovu on the KwaZulu-Natal South Coast

# FINAL EIA REPORT

## CHAPTER 3: DESCRIPTION OF THE AFFECTED ENVIRONMENT

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## 3. DESCRIPTION OF THE AFFECTED ENVIRONMENT

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### 3.1. INTRODUCTION

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This chapter provides an overview of the environment of the South Coast of the eThekweni Municipality, within which the Umgeni Water Desalination Project will take place (should an Environmental Authorisation be granted by the DEA). The receiving environment is understood to include biophysical, socio-economic and heritage aspects which could be affected by the proposed development or which in turn might impact on the proposed development. The majority of information used in this chapter has been sourced from studies and recent EIAs conducted in the eThekweni Municipality.

### 3.2. SITE LOCATION

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The Preferred and Alternative sites for the proposed Lovu SWRO plant are located approximately 3 km away from the ocean and are positioned on the left bank of Lovu Estuary which is located approximately 37 km from the city of Durban (Forbes and Demetriades, 2008). According to a study carried out in 2007 and 2008 of the estuaries in Durban, the Lovu Estuary is classified as a temporary open estuary situated in a semi-rural landscape, with residential settlement on the south bank and the floodplain being dominated by sugarcane fields (Forbes and Demetriades, 2008).

The Lovu Estuary has been modified by sugar cane cultivation and the construction of a rail bridge, road bridges (R102 regional road and the N2 National Road), causeways and levees (upstream of the road bridges) (Forbes and Demetriades, 2008).

Currently, the main access to the Preferred and Alternative sites for the proposed desalination plant is gained from the N2 via the R102 or the R603. A secondary road leads from the R102 and R603 to the Preferred and Alternative sites. The proposed project will entail the construction of access roads leading from the existing roads to the proposed desalination site, as well as a ring road surrounding the site and internal roads.

### 3.3. BIOPHYSICAL ENVIRONMENT

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#### 3.3.1. Climate

The region is characterized by a typical warm sub-tropical climate with an average winter temperature of 16°C between the months of May to July and an average summer temperature of 27°C between the much warmer months of January to March, coupled with an average annual rainfall of 1054 mm mainly during the summer months. Approximately 80% of the annual rainfall occurs in the warmer summer months. The average rainfall ranges from 28 mm in June to 134 mm in January (Royal HaskoningDHV, 2014).

In terms of temperature, average monthly minimum and maximum temperatures measured at the old Durban International Airport site from 1990 to 1999 is respectively shown in Figure 3.1 and Figure 3.2 below. The average monthly minimum temperatures (over the period of 1990 to 1999) range from 8.97°C to 22.59°C. The average monthly maximum temperatures (over the period of 1990 to 1999) range from 20.63°C to 29.60°C. As shown in Figure 3.1, the lowest average monthly minimum temperatures are generally achieved in the winter months.

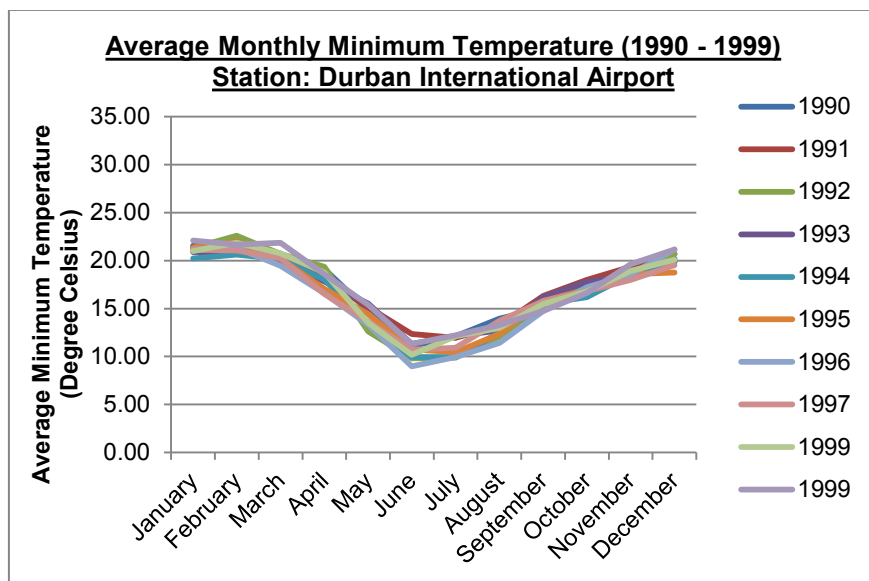


Figure 3.1 Average Monthly Minimum Temperatures in Durban (measured at the old Durban International Airport site in from 1990 to 1999). (Data Source: Climate System Analysis Group (CSAG), University of Cape Town), Accessed 8 September 2015).

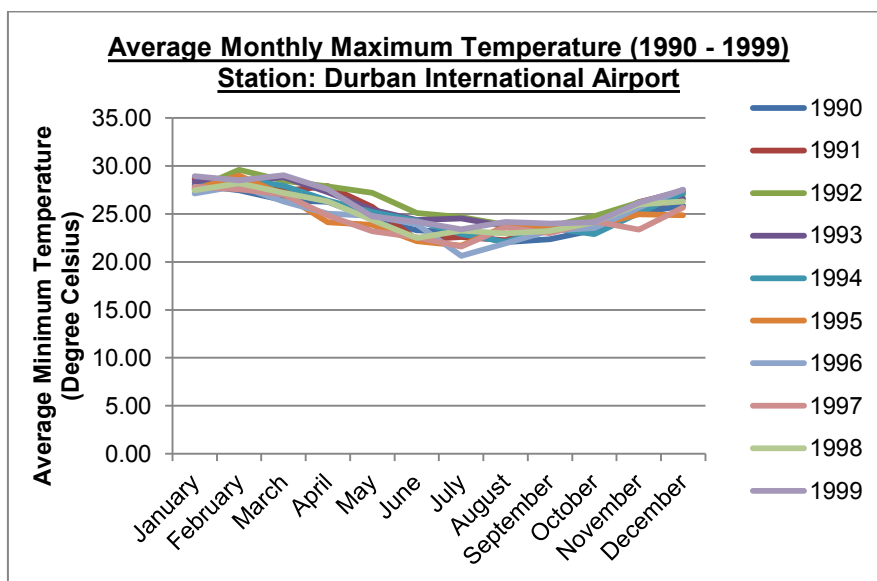


Figure 3.2 Average Monthly Maximum Temperatures in Durban (measured at the old Durban International Airport site in from 1990 to 1999). (Data Source: CSAG, University of Cape Town), Accessed 8 September 2015).

The total observed monthly rainfall measured at the old airport site from 1990 to 1999 was sourced from the CSAG. From this data, the average rainfall received each month over this 10 month period was calculated, as shown in Figure 3.3 below. Derived from Figure 3.3, it is clear that the majority of the rainfall is generally received in summer, whilst minimal rainfall is received in winter.

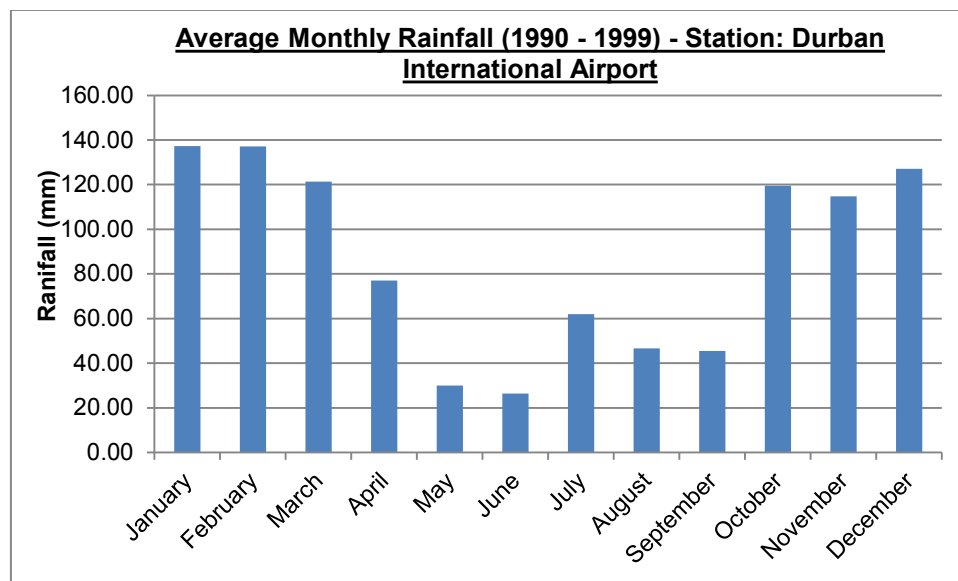


Figure 3.3 Average Monthly Maximum Temperatures in Durban (measured at the old Durban International Airport site in from 1990 to 1999). (Data Source: CSAG, University of Cape Town), Accessed 8 September 2015).

Meteorologically, the KZN coastline is affected by the position and seasonal movements of both the South Atlantic and Indian Ocean anti-cyclone cells, and mid-latitude cyclones that originate from the westerly wind belt. South-westerly winds result from the eastward moving mid-latitude cyclones (and their associated coastal low pressure systems) and prevail during both summer and winter, although the occurrence of north-east winds increases during summer. The basic weather cycle is related to the eastward movement of the coastal low-pressure systems generated along the southern African West Coast during pre-frontal conditions.

### 3.3.2. Coastline, Visual Landscape and Topography

The orientation of the coastline along the East Coast is relatively uniform, and north-northeast. The only significant topographical feature is the Natal Bight, a coastal indentation between Cape Vidal and Durban. The majority of the East Coast region has a narrow continental shelf and a steep continental slope. The KZN continental shelf is characterised by Cretaceous and Cenozoic marine sediments, with the uppermost Cretaceous sediments being predominantly a soft and muddy layer, rich in marine fossils. Stratified Quaternary marine deposits have also resulted in a series of prominent north-south oriented sandy dune ridges.

In terms of topography, the land rises relatively quickly towards the west of the proposed sites (i.e. the preferred and alternative sites) and the valleys are steeply incised. Major rivers in the surrounding area are the Lovu, Mbokodweni to the north and the Mkomazi River to the south, all of which account for the steeply incised valleys.

The proposed development site is located in the Southern Municipal Planning region of the eThekweni Municipality. As previously noted, the proposed desalination plant will be built on agricultural land in the Lovu River floodplain. Land to the south and east is mostly under sugar cane cultivation. West and south of the site are rural residential developments of Nsulwana and Umgababa, while to the north is mixed agricultural and residential land. Further north but within 5 km of the site are the urban settlements of Illovo (inland) and Kingsburgh (coast). East of the N2 is residential land all along the coastline. Many of these coastal towns are tourist and holiday destinations. The proposed site for the

pump station lies near the coastline and is across the road from The Boardwalk, an upmarket residential estate. The deeply buried intake and discharge pipelines will cross beneath the beach in front of this estate. The Lovu estuary and mouth is just south of these pipelines and the pump station. The N2 and R102 are major roads that will be crossed by the proposed pipeline corridors. A rail track running parallel to the coast passes next to the proposed pump station site. A tarred rural road passes between the two site options for the desalination plant.

The eThekweni Municipal Spatial Development Framework (SDF) as well as the South Spatial Development Plan (SDP) emphasise the importance of rivers and their estuaries in future development of tourism and recreation (eThekweni Municipality 2012; eThekweni Municipality 2014). There are some remaining pockets of indigenous KwaZulu-Natal Dune and Coastal Forest in the region. There are no protected areas within 5 km of the proposed development site.

Refer to Chapter 6 Marine specialist study for further details of the physical characteristics of the coastline and Chapter 11 Visual impact assessment for additional information regarding the visual baseline.

### **3.3.3. Soils and Geology**

The two possible sites for the proposed desalination plant are located approximately 3 km inland from the coast. The higher site is situated on a hillside and is underlain by Ecca Shales of the Pietermaritzburg Formation, which have been intruded by Dolerite intrusions. The soils at the Lower desalination plant site and along the pipeline routes across the floodplain are talus from the hillsides, as well as deep alluvial soils and also colluvial soils derived from the Berea red sands. These soils are underlain at depth by cobbles and boulders overlying Ecca Shales with Dolerite intrusions.

Most of the region surrounding the desalination plant site is underlain by a palaeo-dune system known as the Berea Formation, and is often covered in sugar cane plantations. West of the site are outcrops of older rock formations such as those of the Namakwa-Natal Metamorphic Province, and quartzites of the Natal Group (similar in age and composition to the Table Mountain sandstones). These are generally erosion resistant rock formations that form positive topography in the landscape.

### **3.3.4. Terrestrial Ecology**

The proposed desalination plant and its associated infrastructure fall extensively within the estuarine environment of the Lovu River and associated wetland systems. Most of the affected environments and habitats within the proposed development area can be summarised as:

- The supra tidal beach and dune cordon immediately north of the river mouth;
- Portions of mesic or dry, ancient dune form, lying inland of the dune cordon; and
- The estuarine functional zone of the Lovu River.

Mesic environments are those environments that are considered to be neither wetland or estuarine and receive a reasonable level of moisture, derived either from the ground or through precipitation. Much of the southern KZN habitat can be described as “mesic”.

By far the greatest extent of affected environment can be ascribed to the estuarine environment, through which the proposed pipelines will be established, although the desalination plant and the pump station will lie outside of this environment. Given this scenario, some consideration of the

riverine system's ecological significance has been undertaken. From previous historical assessments of both catchments and in particular estuaries, it has been noted that:

- The catchment of this system is dominated by “agriculture” with concomitant influences on water quality;
- Water quality (chemistry) is considered “moderate” with “high turbidity” being recorded (Diederichs et al 2002);
- The Lovu estuary is one of the most modified estuaries in the peri – urban / rural areas of eThekweni (Forbes et al 2008); and
- As an “open mouth” and tidal estuary and despite the above constraints, the estuary shows significant fish and avian diversity (Forbes 2008).

The proposed pipeline routes are envisaged to fall primarily within reclaimed portions of the estuary, which are now under the cultivation of sugar cane. A number of other servitudes and significant road / rail routes have also served to transform habitat and natural function within the system. Much of the flood plain is subject to regular anthropogenic or human induced perturbations through the regular draining of the south bank for farming activities, as well as burning and other cultivation practices. A small portion of wetland environment located to the east of the M4 incorporates areas of parkland which progressively show a more hygrophilous forest structure as elevation increases. Some areas of moderately significant hygrophilous forest are located at this point and require specific consideration at a further date.

The proposed pump station would be located within the beach and dune environment on the north bank of the Lovu estuary. This area comprises a highly dynamic portion of dune form that is subject to both marine erosion, as well as erosion from the tracking of the Lovu mouth in a northward direction under certain circumstances. As such the frontal dune can be considered to be subject to both accretion and erosion over time, with such dynamics having been altered by past human and natural factors.

The mesic or dryland components of the development footprint include the areas immediately landward of the dune, as well as the area identified for the placement of the desalination plant. The near coast, mesic areas are primarily relic forest forms, as located within the caravan park, with secondary forest forms located at the proposed pump house where exotic horticultural plantings and exotic invasive plant species are equally prevalent. The desalination plant, some 3 kilometres inland of the pump station, lies upon a low lying hillock, which is under sugar cane cultivation.

Additional information regarding terrestrial ecology is provided in Chapter 9 of this Final EIA Report (i.e. Terrestrial Ecology Assessment).

### **3.3.5. Freshwater Resources**

NFEPA data shows that the proposed project is located in the Mvoti to Umzimkulu Water Management Area (WMA 14), in the Mgeni Sub WMA. All of the proposed infrastructure and alternative desalination plants themselves under consideration in this study fall within the Lovu River catchment. NFEPA River data (Nel et al 2011) show that the Lovu River has been classified throughout its reaches as in a Present Ecological State (PES) Category C, indicative of rivers that have been Moderately Modified from their natural condition. NFEPA data also indicate that the upper reaches of the Lovu River are classified as a Fish Sanctuary for vulnerable or near threatened fish species. The species of concern is in fact *Amphilius natalensis* (Natal Mountain catfish), but its sanctuary area is well upstream of the reaches likely to be affected by the proposed desalination plant.



Significant existing disturbance from sand mining operations is already evident at two locations on the east bank of the estuary, just downstream of the existing road bridge (refer to Figure 3.4).



Figure 3.4 Disturbance from sand mining operations  
(Co-ords: 30°05'59"S, 30°49'46"E and Co-ords: 30°05'53"S, 30°49'34"E).

Ecoregions are groups of rivers that share similar physiography, climate, geology, soils and (under natural conditions) natural vegetation. The National Ecoregional Classification of Kleynhans (2005) classifies the Lovu River catchment as falling within Ecoregion 17 (North Eastern Coastal Belt). Rivers within this ecoregion are characteristically:

- Associated with a diversity of terrains, but usually occurring in closed hill and mountain terrain, at altitudes from sea level to 700 mamsl;
- Typically associated with Valley Thicket and a variety of Grassland and Bushveld types; and
- Usually in areas where mean annual precipitation and temperatures are both high (MAP = 700-1000 mm and mean annual temperature = 16-22°C).

Chapter 8 of this Final EIA Report provides a detailed description of the freshwater aquatic ecosystems that have been identified close enough to the proposed desalination plant and are likely to be impacted on.

### 3.3.6. Estuarine Ecology

The Lovu Estuary is one of 16 estuaries located within the eThekweni Municipality. The Lovu River is approximately 135 km in length with an annual mean flow of  $6.2 \text{ m}^3 \cdot \text{s}^{-1}$  (Begg 1978). Under these flow conditions the estuary mouth remains open for most of the year and the system is thus classified as a temporarily closed estuary.



As with most estuaries in KwaZulu-Natal the Lovu has a long history of anthropogenic influence and degradation. Impacts have arisen because of poor catchment management, wetland reclamation and development on the floodplain. Begg (1978) regarded siltation and pollution as the most serious problems in the system in the late 1970s. Based on surveys in the late 1990s Harrison assessed water quality in the estuary to be poor, but classified the fish fauna in the system, and the system's aesthetic quality, to be moderate (Harrison et al 2000). In a synthesis of available knowledge of South African estuaries Whitfield (2000) categorised the estuary as being in a fair condition overall.

Assessments above were acknowledged as being made on a generally poor state of information and knowledge on the estuary (Begg 1978, Whitfield 2000). However, a more detailed assessment of the system's condition has been undertaken in recent years. As part of an assessment of the ecological state of Durban's estuaries commissioned by the eThekweni Municipality, the Lovu estuary was sampled in August 2007 and February 2008. The system was assigned a health rating of "Fair" implying that core estuarine habitat and key estuarine process remained intact, but that water quality was impacted and that there was some loss of estuarine support habitats, and diversity (Forbes and Demetriades 2008).

Despite the clearly degraded nature of the Lovu estuary, the retention of core habitats and estuarine processes allows the system also to retain a valuable ecological function. In terms of conservation importance at a national scale the Lovu ranked 80<sup>th</sup> of 250 South African estuaries (Turpie et al 2002). In terms of biodiversity importance (one of the metrics used to derive conservation importance) the estuary ranked in the top 30 South African systems.

Chapter 7 of this Final EIA Report provides a detailed description of the Lovu Estuary and its ecological features.

### **3.3.7. Marine Biological Environment**

Biogeographically the coastline of the study area falls into the subtropical Natal bioregion, which extends from the Mbashe Mouth to Cape Vidal (Lombard *et al.* 2004). The coastline comprises primarily sandy beaches, punctuated by numerous rocky shores. Consequently, marine ecosystems along the coast comprise a limited range of habitats that include:

- Sandy intertidal and subtidal substrates;
- Intertidal rocky shores and subtidal reefs; and
- The water body.

The benthic communities within these habitats are generally ubiquitous throughout the southern African East Coast region, being particular only to substratum type, wave exposure and/or depth zone. They consist of many hundreds of species, often displaying considerable temporal and spatial variability. The following biological communities 'typical' of each of these habitats are described in detail in Chapter 6 of this Final EIA Report (i.e. Marine Ecology Assessment), focusing both on dominant, commercially important and conspicuous species, as well as potentially threatened or sensitive species, which may be affected by the proposed project:

- Plankton
- Soft-sediment Benthic Macro and Meiofauna
  - Intertidal beaches
  - Subtidal Macrobenthos
- Reef Communities

- Intertidal rocky shores
- Subtidal reefs
- Pelagic and Demersal Fish
- Turtles
- Seabirds
- Marine mammals
- Fisheries

#### **3.3.7.1. Conservation Planning**

KwaZulu-Natal boasts three Marine Protected Areas (MPAs). The Maputaland and St Lucia Marine Reserves form a continuous protected area stretching 150 km from the Mozambique border southwards to Cape Vidal, and 3 nautical miles out to sea. They are components of the iSimangaliso Wetland Park. The MPA protects a large number of turtle nesting sites; the migration of whales, dolphins and whale-sharks offshore; and a considerable number of waterfowl associated with the iSimangaliso Wetland Park, including large breeding colonies of pelicans, storks, herons and terns.

The Aliwal Shoal MPA is situated on the south coast between Umkomaas and Ocean View. The northern boundary of the reserve is located ~ 10 km southwest of the Lovu site. The Aliwal Shoal MPA is 125 km<sup>2</sup> in size, approximately 18 km long and stretches ~4 nautical miles offshore. The Aliwal Shoal is especially known for its abundance of Grey nurse sharks that congregate there to mate between August and November. Further south lies the small Trafalgar Marine Reserve, which stretches for only 6 km along the KwaZulu-Natal south coast adjacent to the Mpenjati Nature Reserve, and extends 500 m offshore. This reserve, which primarily protects a petrified forest that is exposed in the intertidal zone at low tide, may be incorporated into the proposed Pondoland Marine Protected Area which (although still in the concept phase) would extend from southern KwaZulu-Natal into the northern part of the Eastern Cape.

### **3.4. ARCHAEOLOGICAL HERITAGE**

The proposed Lovu River site is of low sensitivity from all aspects of archaeological heritage. The proposed desalination plant location within the river basin precludes the presence of archaeological sites as in the past people would not have chosen to reside within what would have been the periphery of a tidal marsh or at least, reedbeds. However, the access servitude for the pipeline through the coastal foreshore dunes and the immediate environments are red-flagged for the presence of shell middens. Anywhere along the coastal littoral zone where a rocky shoreline is present would have been exploited for marine resources. These practices invariably result in the formation of middens where shell fish was processed prior to being transported to homesteads located immediately to the hinterland. These heritage resources can be easily mitigated by sampling or rescue excavation, prior to construction activity, if necessary. In terms of old shipwrecks, due to very active and high energy wave action along the immediate coastline *in situ* shipwreck remains are rare and constitute a very low potential for impact.

Chapter 4 and Appendix E of this Final EIA Report include additional information regarding heritage resources.

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### 3.5. SOCIO-ECONOMIC BASELINE DESCRIPTION

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The significance of impacts is often highly dependent on the economic environment or context within which they occur. For example, job creation in a small local community with a stagnating economy and high unemployment will be far more significant than it would be in a larger community with a healthy economy. In order to offer such baseline information to the impact assessment this section describes the socio-economic environment.

Given the location and nature of the project, the economic context includes information primarily on eThekweni, Kingsburgh (which includes the smaller Illovo Beach and Winkelspruit areas along the coast) and Vulamehlo Local Municipality which includes the more rural area located adjacent and to the east of the proposed plant sites.

Refer to Chapter 12 for further details on the socio-economic baseline description.