NAMWATER
Namibia Water Corporation Ltd

Environmental Impact Assessment for the Proposed Desalination Project at Mile 6, Swakopmund, Namibia

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FINAL SCOPING REPORT

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Summary

The Namibia Water Corporation Ltd (referred to as "NamWater") is currently challenged by a situation where, due to an anticipated unprecedented growth in the uranium mining industry adjacent to Namibia's central coastal area, large volumes of potable water will be required in the medium term to meet the growing demand of NamWater's existing and prospective new mining clients. This additional water can no longer be supplied from the current groundwater sources in the area. NamWater is therefore proposing to construct and operate a desalination plant and associated infrastructure near Mile 6 north of the Swakopmund municipal area. The project is planned to produce 25 million cubic metres of potable water per year and have a minimum lifespan of 20 years.

In order for the Namibian Ministry of Environment and Tourism (MET) to make an informed decision as to whether or not the project should receive an environmental clearance certificate and be allowed to proceed, it is essential that potentially significant environmental and social impacts (both negative and positive) are investigated and well understood. It is therefore necessary to conduct an Environmental Impact Assessment (EIA) process. This led to the CSIR being appointed by NamWater to undertake the EIA for the proposed project, with Enviro Dynamics conducting the public participation component.

The EIA is currently in the Scoping Phase. The findings of the Scoping Phase were presented in the Draft Scoping Report, which was made available to Interested and Affected Parties (I&APs) for comment.

The purpose of the Final Scoping Report is to:

- Provide a description of the proposed project, including a sufficient level of detail to inform the Ministry of Environment and Tourism;
- Describe the local environment and planning context within which the project is proposed, to assist further in identifying issues and concerns;
- Provide an overview of the process being followed in the Scoping Phase, in particular the public participation process, as well as present the draft Plan of Study for EIA that would be followed in the subsequent EIA phase;
- Present the issues and concerns identified to date by specialists and stakeholders, together with an explanation of how these issues will be addressed through the EIA process.

I&APs (including organs of state) were invited to submit comments on the Draft Scoping Report, to Stephanie van Zyl at Enviro Dynamics by 20 March 2009. Issues raised in response to the Draft Scoping Report were included in the Issues Trail (Appendix C) of the Final Scoping Report. The Final Scoping Report is now being submitted to the competent authority, the Ministry of Environment and Tourism.

The following specialist studies are proposed to address the issues identified in the Scoping Phase:

- Coastal physical characteristics and shoreline dynamics
- Marine modelling and impacts of intake and discharge structures
- Marine ecology
- Terrestrial and shoreline ecology
- Avifauna (birds)
- Heritage (archaeology)
- Visual impacts
- Socio-Economic (incl. tourism, planning & land use)
- Water and waste-water management
- Noise.

All information on the EIA process, including I&AP inputs, is being placed on the following website: **http://www.namwater.com.na/data/Projects_Desalination.htm**

Glossary of Terminology and Abbreviations

Algal blooms	An abundant growth of phytoplankton, typically triggered by sudden favourable environmental conditions e.g. excess nutrients.
Benthos	The sum total of organisms living in, or on, the sediments of aquatic habitats.
BID	Background Information Document
Biofouling	The undesirable accumulation of micro-organisms, plants, algae, and animals on submerged structures
CSIR	Council for Scientific and Industrial Research
DEA	Directorate of Environmental Affairs
Desalination	The process of removing salts and other minerals from seawater
Dissolved oxygen (DO)	Oxygen dissolved in a liquid, the solubility depending upon temperature, partial pressure and salinity, expressed in milligrams/litre or millilitres/litre
DSR	Draft Scoping Report
EA	Environmental Assessment
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EMA	Environmental Management Act (No. 7 of 2007)
EMP	Environmental Management Plan
FSR	Final Scoping Report
HIA	Heritage Impact Assessment
I&AP	Interested and Affected Party
IFC	International Finance Corporation
Macrofauna	Animals >1 mm.
MAWF	Ministry of Agriculture, Water and Forestry
Meiofauna	Animals <1 mm
MET	Ministry of Environment and Tourism
MW	Megawatt

PSEIA	Plan of Study for EIA
RO	Reverse Osmosis, a filtration process that removes dissolved salts and metallic ions from water by forcing it through a semi-permeable membrane
Surf zone	Also referred to as the 'breaker zone' where water depths are less than half the wavelength of the incoming waves with the result that the orbital pattern of the waves collapses and breakers are formed
Suspended material	Total mass of material suspended in a given volume of water, measured in mg/l.
Suspended sediment	Unconsolidated mineral and organic particulate material that is suspended in a given volume of water, measured in mg/l
SWRO	Sea Water Reverse Osmosis
TDS	Total dissolved solids
ToR	Terms of Reference
Toxicity	The inherent potential or capacity of a material to cause adverse effects in a living organism.
TSP	Total Suspended Particulates
Turbidity	Measure of the light-scattering properties of a volume of water, usually measured in nephelometric turbidity units.
WRMA	Water Resources Management Act (No. 24 of 2004)

Chapter 1: Introduction

INTRODUCTION

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1. INTRODUCTION

The Namibia Water Corporation Ltd (referred to as "NamWater") is currently challenged by a situation where, due to an anticipated unprecedented growth in the uranium mining industry adjacent to Namibia's central coastal area, large volumes of potable water will be required in the medium term to meet the growing demand of NamWater's existing and prospective new mining clients. This additional water can no longer be supplied from the current groundwater sources in the area.

The Erongo Region on the central coastal area of Namibia currently consumes about 12 million cubic metres of water annually, with Walvis Bay accounting for 4.3 million cubic metres of this total, Rio Tinto's Rössing Uranium mine 3.3 million cubic metres, and Swakopmund 3 million cubic metres. Most of the water is sourced from alluvial aquifers in the Kuiseb and Omaruru Rivers.

NamWater is proposing to construct and operate a desalination plant near Mile 6 north of the Swakopmund municipal area (Figure 1.1). The facility (including the infrastructure required to convey the water to the NamWater Swakopmond Reservoir) will be built on Namibia's Atlantic coastline at a cost of approximately 1.8 billion Namibian dollars. The plant is expected to be commissioned in 2011 and will have the capacity to produce 25 million cubic metres of potable water per year. It will have a minimum lifespan of 20 years.

1.1 NEED AND JUSTIFICATION FOR THE PROJECT

Due to a worldwide increase in the demand for uranium in the early 2000's and a resultant unprecedented rise in the uranium price, the Langer Heinrich Uranium Mine was developed and commissioned by the end of 2006. Although NamWater could meet the water demand of the mine by increasing its abstraction rate of water from the Omdel aquifer, the Ministry of Agriculture, Water and Forestry (MWAF) in its permit conditions for the additional abstraction only allowed a five year period for such abstraction. MWAF required that NamWater should develop a desalination facility during that time to supply potable water to meet the demands of the Langer Heinrich Mine as well as that of other existing and prospective industrial water users at the central west coast of Namibia.

In February 2007, UraMin Namibia (Pty) Ltd (referred to below as "UraMin", and which forms part of the French company, Areva) informed NamWater of their decision to proceed on their own with the development of a seawater intake and desalination plant near Wlotzkasbaken, approximately 30 km north of Swakopmund. This plant is intended to provide desalinated water to their planned Trekkopje Mine.

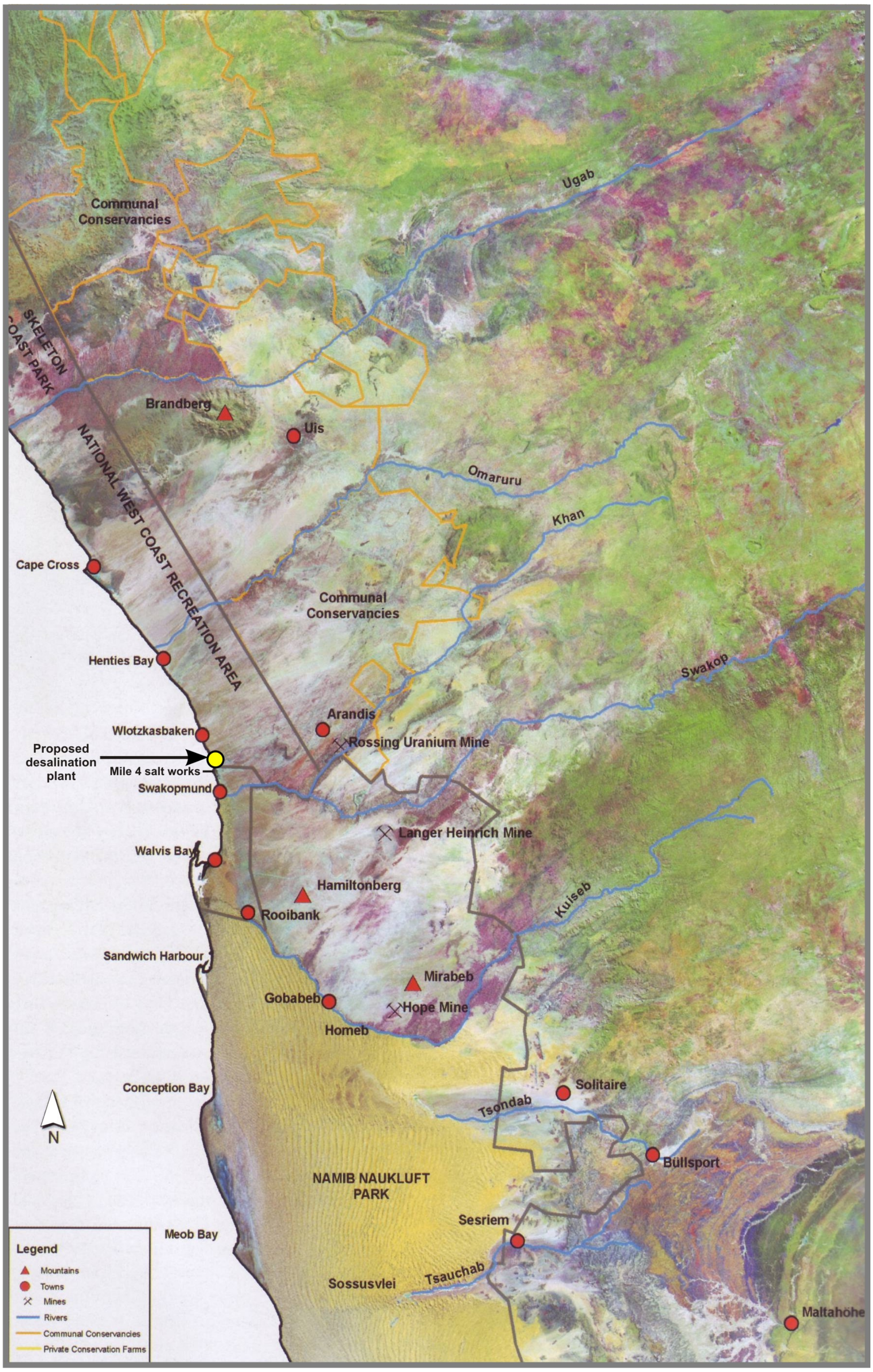

Figure 1.1: Location of the proposed NamWater Desalination Project on the central coast of Namibia, north of Swakopmund (Map source: Seely and Pallett, 2008)

In June 2007, NamWater obtained confirmation from the representatives of the Rössing and Langer Heinrich Mines, as well as the Valencia, Goanikontes, Ida Dome, Marenica and Tubas / Tumas uranium deposits, that they were willing to sign agreements with NamWater for the supply of desalinated seawater to their projects. In addition to the requirements of the Trekkopje Mine that will be supplied from the UraMin desalination project at Wlotzskasbaken, additional desalination capacity will have to be developed to supply 13 Mm^3/year of desalinated water to the Rössing Phase 1, Langer Heinrich and Valencia Uranium Mines by approximately April 2011; and a further 11 Mm^3/year to Rössing Phase 2, Goanikontes and Ida Dome from mid 2012.

This led to the NamWater Board of Directors, in July 2007, giving approval to NamWater's Management to proceed to plan the development of a 25 Mm^3/year desalination plant with a sea water intake and water transfer and storage infrastructure, to meet these demands. Subsequently, NamWater has conducted an extensive market analysis into the future demand for potable water in the central west coast area, established the willingness of the existing and emerging uranium mines to commit themselves to NamWater as their preferred bulk water supplier. NamWater also appointed an expert desalination consultant and conducted preliminary engineering work to obtain firm development offers and to make reliable cost and profitability estimates for the proposed desalination project. It is anticipated that the current slowdown in global economic growth may in the short-term lead to a reduction in the growth rate of the Namibian uranium industry. However, in the medium to long-term the predicted growth in water demand is unchanged and the need for the project remains unchanged.

Against this background, on 27 June 2008, the CEO of NamWater and the Permanent Secretary of the Ministry of Agriculture, Water and Forestry made a presentation to the Ad-hoc Cabinet Committee on High Level Priorities, chaired by His Excellency, the President of the Republic of Namibia, on the need for the development of seawater desalination capability on the central Namibian coast in order to be able to meet the anticipated increased demand for bulk water by the uranium mining companies. The concept of a desalination project was then approved by Cabinet in July 2008.

1.2 REQUIREMENTS FOR AN ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

In order for the Namibian Ministry of Environment and Tourism (MET) to make an informed decision as to whether or not the project should receive an environmental clearance certificate and be allowed to proceed, it is essential that potentially significant environmental and social impacts (both negative and positive) are investigated and well understood. It is therefore necessary to conduct an Environmental Impact Assessment (EIA) process and compile an Environmental Management Plan (EMP), to ensure that the project complies with the goals of the Namibian Environmental Management Act (No. 7 of 2007). The objectives of the Act are that:

- the developer consider the impact of the proposed activities on the environment carefully and in good time;
- all interested and/or affected people are encouraged to participate in environmental assessments; and

- the findings of environmental assessments are considered before any decisions are made about activities which might affect the environment.

The objectives of the Environmental Management Act of 2007 are underpinned by the previously existing Namibia Water Corporation Act (No. 12 of 1997), which provided for the establishment of The Namibia Water Corporation Ltd ("NamWater") on 1 April 1998. This Act of 1997 (commonly referred to as "NamWater Act") presents that the objects, functions and powers of NamWater are to (Government Gazette, 1997, emphasis added):

Carry out efficiently, and in the best interest of the Republic of Namibia –

(a) the primary business of bulk water supply to customers, in sufficient quantities, of a quality suitable for the customers purpose, and by cost-effective, environmentally sound and sustainable means; and

(b) the secondary business of rendering water-related services, supplying facilities and granting rights to customers upon request.

1.3 EIA TEAM

In November 2008, the CSIR was appointed by NamWater to undertake the EIA for the proposed desalination project. Enviro Dynamics, a Windhoek-based consultancy, has been sub-contracted by CSIR to manage the public participation component of the EIA. The full EIA team, included specialists, is listed in Table 1.1.

1.4 EXPERTISE OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONER (EAP)

The EIA Project Team is being led by Paul Lochner, who has 15 years experience in environmental assessment and management studies, primarily in the leadership and integration functions (refer to Appendix A for his CV). This has included Strategic Environmental Assessments (SEA), EIAs and EMPs. He has been a certified Environmental Assessment Practitioner for South Africa (EAPSA) since July 2003; and has conducted several EIA processes both in South Africa and internationally. Examples of EIAs include the Coega Aluminium Smelter EIA, EIA for the expansion of the container terminal and construction of an administration craft harbour at the Port of Ngqura near Port Elizabeth, Thesen Island EIA at Knysna, Century City Wetlands EIA in Cape Town, EIA for a resort development on Fregate Island in the Seychelles, and ESIA for a proposed alumina refinery at Sosnogorsk in the Komi Republic of Russia. He has also prepared various EMPs, such as the EMP for the Rietvlei Wetland Reserve (Cape Town), EMP for Century City wetlands, EMP for Eskom Wind Energy Project (Klipheuwel) and the EMP for the Coega Aluminium Smelter. He has authored several Guidelines, such as the "Overview of Integrated Environmental Management" information document for the South African Department of Environmental Affairs and Tourism (DEAT) in 2004; and the "Guideline for EMPs" published in 2005 by the Western Cape government. Paul will be supported by a CSIR Project Manager, Stephanie Dippenaar, who also has substantive experience in veld management and a track record in management and integration of environmental assessments.

Table 1.1: EIA Team

EIA Management Team		
Paul Lochner	*CSIR*	*Project Leader (EAPSA)*
Stephanie Dippenaar	*CSIR*	*Project Manager*
Annick Walsdorff	*CSIR*	*Report Writing*
Christabel Geland	*CSIR*	*Legal & Policy Review*
Specialist Team		
André Theron	*CSIR*	*Coastal physical characteristics and shoreline dynamics*
Dr Gerhardus Diedericks	*CSIR*	*Marine modelling and impacts of intake and discharge structures*
Dr Andrea Pulfrich & Dr Nina Steffani	*Pisces Environmental Services*	*Marine ecology*
Dr Juliane Zeidler & Reagan Chunga	*Integrated Environmental Consultants Namibia*	*Terrestrial and shoreline ecology*
Chris van Rooyen	*Chris van Rooyen Consultants*	*Avifauna (birds)*
Philip de Souza	*Emanti Management*	*Water and wastewater management*
Henry Holland	*Mapthis*	*Visual impacts*
Brett Williams	*Safetech*	*Noise*
Dr John Kinihan	*Quaternary Research Services*	*Heritage (archaeology)*
Ernst Simon & Stephanie van Zyl	*Enviro Dynamics*	*Socio-Economic (incl. tourism, planning & land use)*
Prof Jan Glazewski	*University of Cape Town*	*Legal Review*
Johan van Rensburg	*Geo Business Solutions*	*GIS specialist*
Public Participation Process		
Stephanie van Zyl	*Enviro Dynamics*	*Public consultation*

1.5 OBJECTIVES OF THE SCOPING PHASE

The Scoping Phase of the EIA refers to the process of determining the spatial and temporal boundaries for the EIA. In broad terms, this involves three important activities:

- Confirming the process to be followed and opportunities for stakeholder engagement;
- Clarifying the project scope and alternatives to be covered; and
- Identifying the key issues to be addressed in the impact assessment phase and the approach to be followed in addressing these issues.

This is done through parallel initiatives of consulting with the lead authorities involved in the decision-making for this EIA application; consulting with the public to ensure that local issues are well understood; and consulting with the EIA specialist team to ensure that their scientific and professional expertise informs the identification of issues. The scoping process is supported by a review of relevant background literature on the local area. Through this comprehensive process, the environmental assessment can identify and focus on key issues requiring assessment and identify reasonable alternatives.

The primary objective of the Scoping Report is to present key stakeholders (including affected organs of state) with an overview of the project and key issues that require assessment in the EIA Phase; and allow the opportunity for the identification of additional issues that may require assessment. The Draft Scoping Report has been released in the public domain and the closing date for comments was 20 March 2009. Issues raised in response to this document were added to the Issues Trail and included in the Final Scoping Report (Appendix C). The Final Scoping Report is now submitted to the competent authority, the Ministry of Environment and Tourism, for approval. This approval is planned to mark the end of the Scoping phase, after which the EIA process moves into the impact assessment and reporting phase.

1.6 STRUCTURE OF THIS REPORT

Chapter 1 of this Final Scoping Report presents the need for the project and the requirement for an EIA to be conducted. Chapter 2 provides an overview of the proposed project. Chapter 3 outlines the relevant environmental legislation that applies to this project. The affected environment of the central Namibian coastal region is described in Chapter 4, in order to assist stakeholders in identifying potential impacts that could arise from the project. Thereafter, the approach and methods used in the EIA and public participation are presented in Chapter 5, including a discussion on alternatives included in this EIA. A summary of the issues identified to date from the Scoping process is provided in Chapter 6. Chapter 7 presents the plan of study for the subsequent EIA phase, listing the issues that are to be addressed in the specialist studies. Lastly, references used in compiling the report are provided in Chapter 8.

Appendices at the end of the report provide the project leader's CV, copies of newspapers advertisements regarding the EIA process, a comprehensive issues trail together with responses from the client or the CSIR team to the issues raised to date, records of correspondence sent to I&APs, notes from meetings with stakeholders, and records of correspondence received from I&APs to date.

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2. PROJECT DESCRIPTION

This chapter is based on information provided by the project proponent (i.e. NamWater), as well as relevant information contained in the EIA conducted for the UraMin[1] Trekkopje Desalination Project at Wlotzkasbaken (Turgis, 2008). Inputs on the power line component of the project (section 2.3.5) are provided by NamPower.

With the higher price of uranium, the uranium deposits of the Erongo region have become increasingly economically viable. At present, the existing mine at Rössing is expanding, while new mines have been or are being developed at Trekkopje, Valencia and Langer Heinrich, with several others at the exploration phase. Large volumes of potable water which can no longer be supplied from the current groundwater sources in the area will be required in the medium term to provide for the growing demand of existing and prospective new mines.

As such, NamWater is proposing the establishment of a Sea Water Reverse Osmosis (SWRO) desalination plant near Mile 6, north of the Swakopmund municipal area, on the Atlantic coastline. The plant is planned to produce approximately 25 million cubic metres of potable water per year and will have a minimum lifespan of 20 years. The proposed project comprises a desalination plant located near Mile 6 (including a sea water intake structure and a brine disposal system), a 20 000 m^3 storage reservoir on site, a treated water pipeline to the boundary of the Swakopmund Municipal area and a new 132 kV power transmission line (including a new substation) extending for a distance of approximately 44 km inland to connect with an existing power line.

2.1 OBJECTIVES OF THE PROJECT

The Erongo Region on the central coastal area of Namibia currently consumes about 12 million cubic metres of water annually, with the main users being Walvis Bay accounting for 4.3 Mm^3, the Rössing Uranium mine using 3.3 Mm^3 and Swakopmund using 3 Mm^3. Most of the water is sourced from alluvial aquifers in the Kuiseb and Omaruru Rivers.

Due to a worldwide increase in the demand for uranium in the early 2000's and a resultant unprecedented rise in the uranium price, the Langer Heinrich Uranium Mine was developed and commissioned by the end of 2006. *Figure 2.1* indicates the forecast for uranium demand from 2008. Although NamWater could meet the water demand of the mine by increasing its abstraction rate of water from the Omdel aquifer, the Ministry Agriculture, Water and Forestry (MWAF) in its permit conditions for the additional abstraction only allowed a five year period for such additional abstraction. MWAF required that NamWater should develop a desalination facility during that time to supply potable water to meet the demands of the Langer Heinrich Mine as well as that of other existing and prospective industrial water users at the central west coast of Namibia. At present, the existing mines at Rössing and Langer Heinrich plan expansion, while new mines have been or are being developed in the surrounding areas, with several others at

[1] Recently taken over by "Areva Resources Southern Africa".

the exploration phase. All these mines will require water and the current groundwater supplies are insufficient to meet the anticipated demand. Table 2.1 details the predicted water requirements of the various new mines, illustrating the need for the development of seawater desalination capability on the central Namibian coast. This Table excludes the Trekkopje mine that is being developed by Areva Resources Southern Africa and which has its own dedicated desalination plant at Wlotzkasbaken. In the current global economic recession it is likely that the rate of water demand will be reduced in the short-term, as a result of the slowdown in the demand for uranium. However, in the medium to long-term the predicted growth in water demand is unchanged and the need for the project remains unchanged.

The implementation of the desalination project will enable NamWater to supply desalinated water to its current and prospective new mining clients and to significantly reduce the abstraction rate from the Omdel aquifer. Reduced abstraction will have a major positive effect on the preservation of the sustainability of future water supplies from this national asset. The desalination project is therefore of strategic importance to Namibia, since it will facilitate substantial growth in the uranium mining industry in the Central Namib Area with benefits to the central-west coast area and Namibia in terms of economic growth, job opportunities and income to the State in the form of taxes and royalties.

The first phase of the project is to produce approximately 15 Mm^3/year of water, with an expansion of the plant capacity to approximately 25 Mm^3/year of water during the second phase of the project as water demand from the mines increases. This EIA covers the full plant capacity of 25 Mm^3/year. The time period between the expansion from 15 to 25 Mm^3/year is uncertain at present, and will depend on the growth in water demand in the region.

Figure 2.1/…

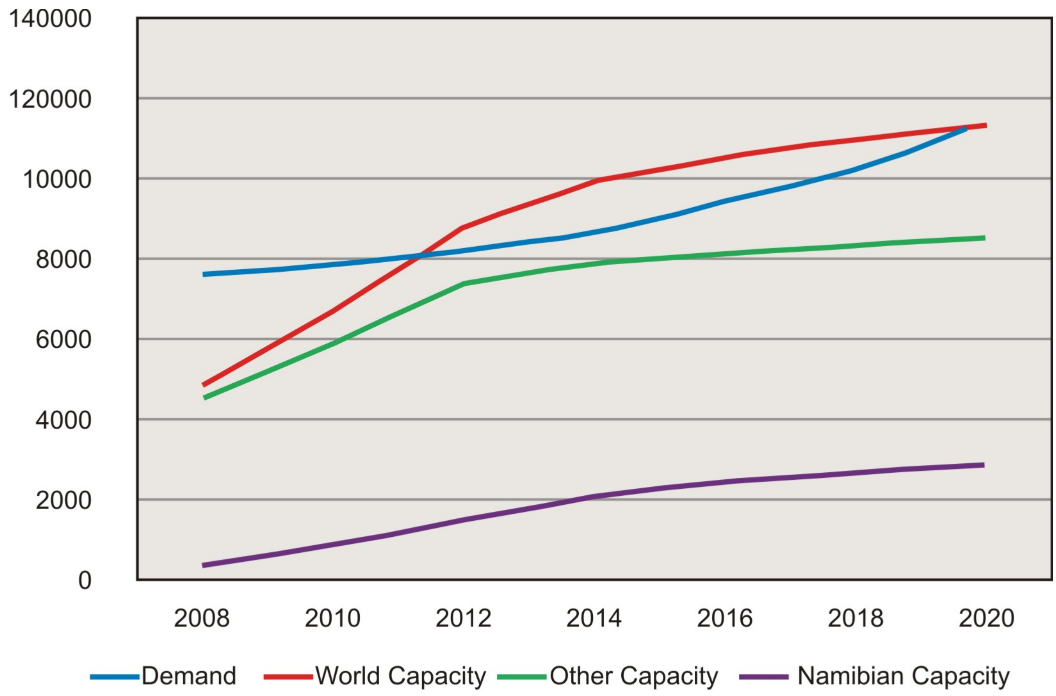

Chart 1: World uranium oxide demand and supply capacity

Figure 2.1: World uranium oxide demand and supply capacity forecast (Source: www.world-nuclear.org August 2008)

Table 2.1: Predicted water demands of municipalities and mines (Mm^3/year) on the central Namibian coast (Source: Dr Wotan Swiegers, Chamber of Mines in Namibia, 24 February 2009)

	Current	2010	2011	2012
Demand				
Municipalities	9	9	10	11
Rossing	3	5	8	8
Langer Heinrich	2	2	4	4
Valencia	0	0	3	3
Other Mines	0	0	0	10
Total	14	16	25	35
Supply				
Omdel Aquifer	9	5	5	5
Kuiseb Aquifer	5	5	5	5
Shortfall	0	6	15	25
Total	14	16	25	35

2.2 PROJECT CONCEPTUALISATION AND SITE SELECTION

During the conceptualisation phase of the project, NamWater investigated a range of options for supplying potable water to the central coastal area of Namibia to meet the anticipated growth in demand. As part of the "Water supply to the central Namib area" feasibility study undertaken in August 1996, a diversity of alternative water supply sources were investigated to assess their potential as a supplement to the presently utilized groundwater resources. The potential sources investigated were Antarctic iceberg harvesting, solar distillation, utilisation of coastal fog, tankering of water from the mouth of the Zaire (Congo-) River, wastewater reclamation, water supply from the eastern national water carrier, extended exploitation of existing surface water resources (dams) and seawater desalination.

These investigations identified desalination as the only viable option to provide a reliable supply of bulk water to meet the anticipated growth in the water demand in the Erongo Region. From June 2007, NamWater therefore undertook preliminary engineering design, technical investigations and a pilot study for a proposed reverse osmosis desalination plant near Swakopmund. The concept of a desalination project was approved by Cabinet in July 2008.

The next step was to conduct a site selection study. The following factors influenced the selection of the site for the proposed desalination project:

- The mines requiring water from NamWater are located further south than Trekkopje, therefore rendering the Wlotzkasbaken site unsuitable for the location of a desalination plant to serve these mines. Locating a desalination plant close to the mines that are in need of water has strategic advantages. For example, the cost of the infrastructure associated with the building of two desalination plants is not much different than that for building one large combined plant. This makes it financially justifiable to build two separate plants, while gaining the strategic advantage of having two plants at different geographic locations which then reduces the risk of zero supply of desalinated water in the Erongo Region. Moreover, the pipeline leading from Wlotzkasbaken to Trekkopje cannot be used to supply the other mines further south due to the carrying capacity being too small. The same constraint applies to the existing power line to Trekkopje.
- An inland site is restricted by the high costs associated with the length and associated costs of the intake and discharge pipelines that connect the plant to the marine environment. In order to obtain seawater with reduced sediment content, the intake pipeline(s) for the desalination plant needs to reach a water depth of approximately 10 metres. The plant therefore needs to be as close to the coast as possible.
- For cost efficiency, the plant should be as close as possible to Swakopmund which is currently the hub of the water distribution network for the Erongo Region. This would allow use of existing water supply and storage infrastructure at Swakopmund, thus reducing costs associated with the construction of new infrastructure as well as avoiding additional operational and maintenance costs. The proposed desalination plant and associated infrastructures should preferably be in an area used for industrial purposes (such as the proposed site close to the salt works) and away from pristine areas with high tourism potential and sense of place. The coast north of Swakopmund is part of the National West Coast Recreation Area, and it is preferable from a planning perspective to

locate the plant at the southernmost end of this area to reduce the impact on tourism potential.

- Locating the desalination project south of the Swakop River is considered technically unfavourable, as the water pipeline from the plant would then have to cross the Swakop River to connect with existing infrastructure and reach the mines located north of the Swakop River. There are currently two pipe bridges crossing the Swakop River, supporting the pipeline to Langer Heinrich and from Swartzekuppe to Swakopmund respectively. These bridges are currently used at their maximum load capacity and have not been designed to carry an additional 25 Mm^3/year of water planned to be transferred from the desalination plant. Moreover, the Swakop-Walvis area is of great conservation, tourism and development importance, thus making it unsuitable for a desalination plant.
- From a land use planning perspective, locating the desalination plant south of the Mile 4 salt works within the Swakopmund residential areas was not considered appropriate, in particular because the noise impact will be higher for sensitive receptors (i.e. neighbouring residential areas). In addition, during operations the trucks required for removal of chemicals and solids could potentially be a significant cause of concern. Locating the proposed plant on the northern side of the existing industrial area (i.e. Mile 4 Salt works) was considered appropriate, as the salt works already create an industrial ambience.
- The offshore bathymetry also influences the site selection, in that a site is required where the intake pipeline can reach a sea water depth of approximately 10 m as rapidly as possible. The shallow bathymetry around Walvis Bay therefore does not lend itself to the development of a desalination plant.

The above factors led to the identification of a study area for the desalination project of approximately 4 km of shoreline in the vicinity of Mile 6. Within this 4 km study area, bathymetric studies conducted by CSIR in October 2008 show that the central portion of this study area offers the steepest offshore gradient, resulting in the opportunity to construct the sea water intake most cost effectively in this portion. This survey led to the identification of two potential locations for the intake and brine disposal structures, in the central portion of the study area in the vicinity of Mile 6 (*Figure 2.2*). Depending on the total area needed for the plant, the northern option might spread to the east of the C34 road.

Factors affecting the site selection and route planning for <u>supporting infrastructure</u> for the desalination plant are discussed below:

- The desalination plant requires a power line connection to the power grid. Given the importance of the Mile 4 salt works for flamingos and other birds, it was not considered ideal to locate the plant immediately adjacent to the salt works, because of the potential impact of the new power lines on birds using the salt works.
- The influence of the proposed Swakopmund sewage works east of the proposed bypass road and north of the Mile 4 salt works on the downstream pipeline and power line routes needs to be considered. The new 1200 mm pipeline from the desalination plant to the existing Swakopmund Reservoir located within the existing NamWater water storage facility in Swakopmund (over a distance of approximately 15km) should be routed as to avoid potential impacts on the proposed sewage works and bypass road.

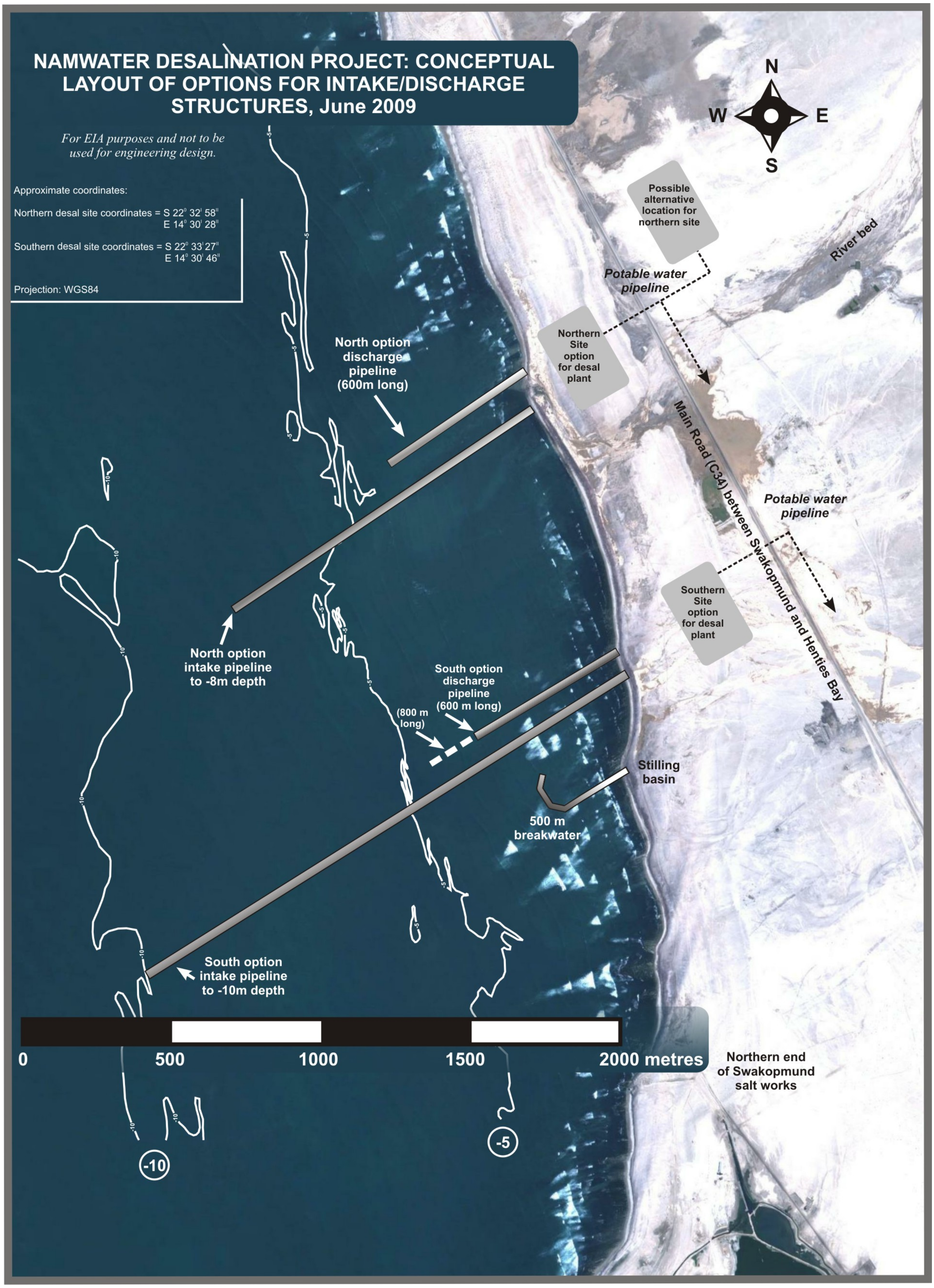

Figure 2.2: Conceptual layout of the proposed desalination project

2.3 PROJECT DESCRIPTION

The proposed Sea Water Reverse Osmosis (SWRO) Desalination Plant is designed for a maximum of 110 Mm^3/year seawater intake, with an installed abstraction capacity of 63 Mm^3/year, of which approximately 25 Mm^3/year will constitute the output (treated water) and 38 Mm^3/year the brine to be discharged back into the sea. The planned capacity of the intake pipes (or an alternative intake structure, such as a stilling basin) is 110 Mm^3/year to make provision for future extension and for the potential impact of biofouling (i.e. growth in the pipes). A minimum water recovery of approximately 40% will be achieved, meaning that at least 40% of the sea water is converted into treated water, while the remaining 60% constitutes the brine which is returned to the sea. *Figure 2.3* represents a conceptual design of the SWRO desalination plant and associated infrastructure.

An area of approximately 400 m x 250 m is required for construction and lay-down (i.e. temporary storage of equipment and construction materials). During operation, the project footprint will be approximately 250 m x 250 m, which includes the on-site water reservoir but excludes the marine infrastructure and new sub-station at Mile 6.

The project requires approximately 20 MW of power. A new 132 kV transmission line (*Figure 2.4*) will therefore be routed over approximately 44 km from Dolerite on the existing power line to Wlotzkasbaken, to the desalination plant at Mile 6. A new substation is required at Mile 6.

The processed water will be transported to NamWater's distribution facilities in Swakopmund via a common pipeline that will also carry groundwater supplied from NamWater's Omdel Borehole Scheme near Henties Bay for residential and industrial consumption in the Town of Swakopmund. Therefore, the treated water must comply in all respects with Namibian Water Quality Guidelines Class A (requirements for potable water), with the exception of boron (see *Table 2.4*). Boron is not specified in the Class A Guidelines and quality specifications were taken from the World Health Organisation (WHO) criteria.

The plant shall be designed, and the process equipment selected, for continuous operation 24 hours per day, for 350 days per year, with approximately 15 days per year allowed for maintenance. The actual operational time may vary, depending on the maintenance requirements. This could result in the plant operating for 20 hours per day, with a higher hourly through-put, to reach the required annual water production.

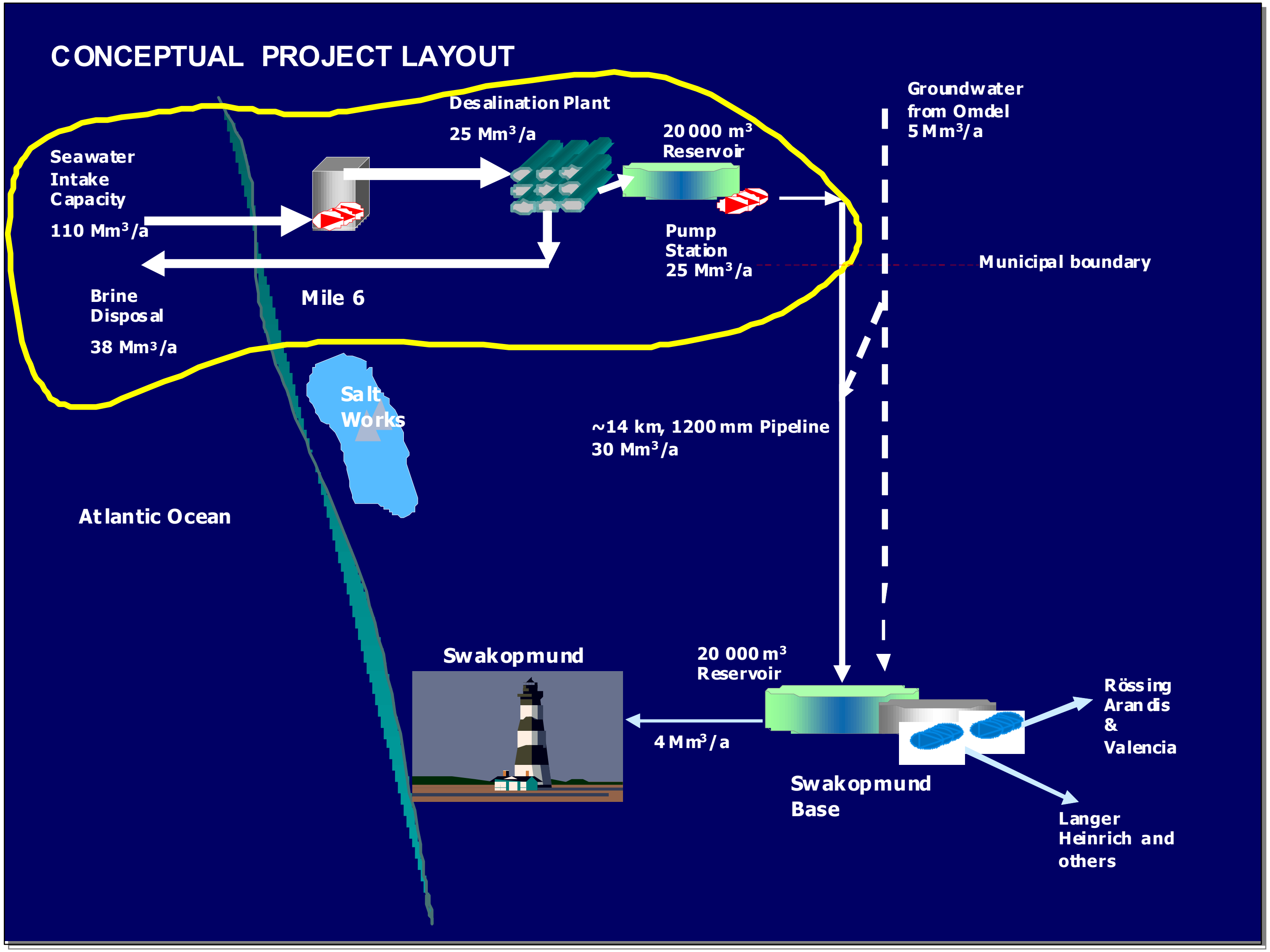

Figure 2.3: Conceptual design of the desalination project showing the link with existing water supply infrastructure

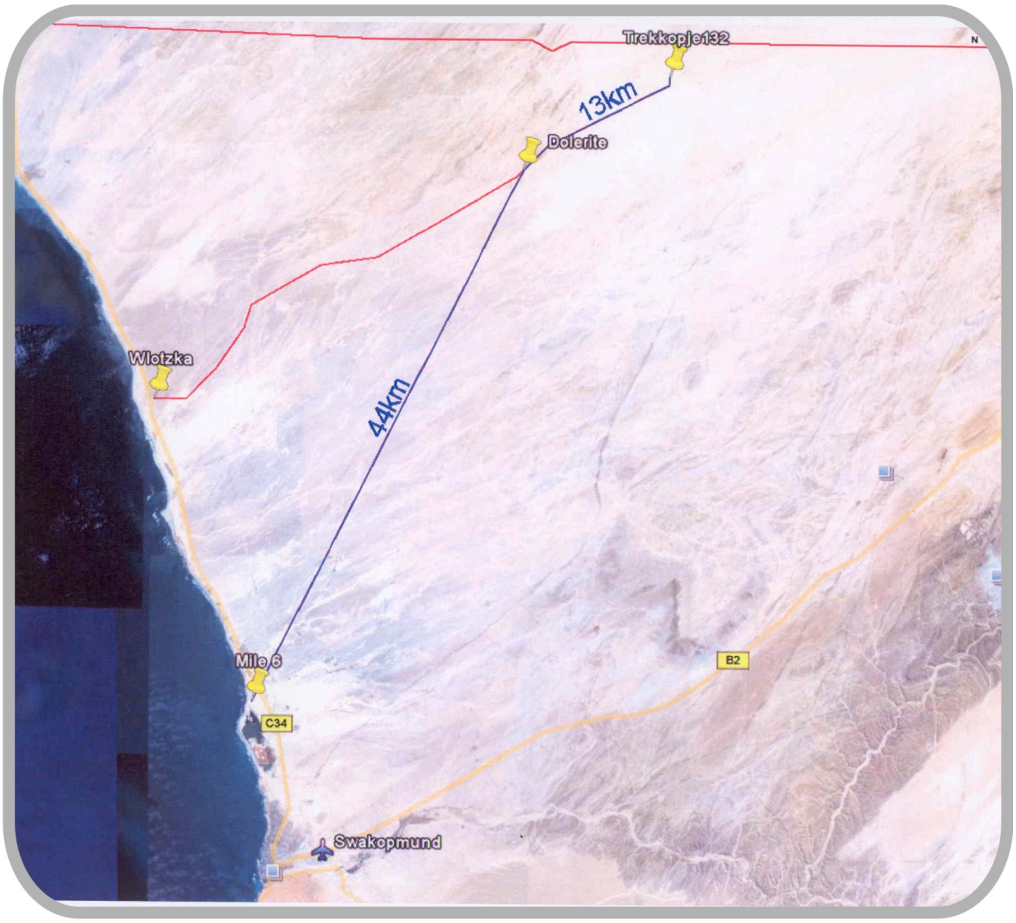

Figure 2.4: Proposed route for a new 132 kV transmission line of 44 km from the existing Dolerite line to the new substation at the Mile 6 site

The proposed project consists of the following principle components:

- seawater abstraction infrastructure (i.e. intake pipe system or possibly a stilling basin, connected to an inlet sump and a transfer pump station and pipeline to the SWRO plant);
- a SWRO desalination plant located on land;
- intermediate water storage reservoir located at the desalination plant and pipeline to link with the existing reservoir located at the NamWater water storage facility in Swakopmund (only the section of the pipeline up to the Swakopmund Municipal boundary will be assessed as part of this EIA);
- infrastructure for disposal of brine into the sea; and
- 132 kV transmission line of approximately 44 km from the existing Dolerite line to the desalination plant (including a new substation located near the desalination plant).

The following sections provide a more detailed description of the project components.

2.3.1 Sea water intake and discharge

The maximum capacity of the water intake would be 110 Mm^3/year with an actual seawater abstraction of 63 Mm^3/year, in order to produce 25 Mm^3/year of treated water. In the conceptual design for the project, the following two alternative design options for intake structures were proposed and are being considered in this EIA:

- ***Alternative 1*** is to use **pipelines** for seawater intake at 8 to 10 metre water depth. There are two location alternatives for the pipelines, a North option with a marine pipeline to approximately 8 m water depth approximately 1 200 m offshore; or a South option with a marine pipeline of approximately 1 900 m length and an inlet structure in approximately 10 m depth. The 10 m water depth is considered preferable in order to source cleaner water (e.g. less suspended sediment). However, the shorter pipeline to 8 m depth does provide cost savings. Two submerged anchored HDPE pipes (alternatively two cement coated and cathodic protected steel pipes) will connect the inlet structure to the onshore sump from where the intake pump station will transfer water to the SWRO plant. The pipelines will be trenched through the surf zone. The option of locating the pipeline in a sandy gully was considered, but seems unlikely as the shoreline and offshore areas are very rocky. Beyond the surf zone the pipeline will be placed on the seabed and secured/anchored. On the shore, the pipeline will run underground into the sump. It is envisaged that a caisson would be placed offshore at the inlet with the top of the caisson protruding about 5 m above the seabed so that sea water will be abstracted from approximately mid-depth between the surface and the seabed to minimize the amount of sediment in the intake water (also called 'feed water'). The intake will have fixed screens, with travelling screens located on the onshore structure. The fixed screen opening has been specified to 100 mm with a maximum intake velocity of 0.15 m/sec to minimize impingement/entrainment.
- ***Alternative 2*** would involve the construction of a J-shaped breakwater extending approximately 500 m out to sea to a water depth of approximately 3 to 4 m below mean seawater level (MSL), thus creating a **stilling basin**. A dredged open channel would connect the stilling basin with the intake pump station (*Figure 2.6*). The intake pump station will be equipped with trash racks, and fixed and travelling screens prior to the transfer pumps to reduce the effect of entrainment and the intake of sediments.

Both are open water intakes, necessitating the need for extensive pre-treatment of intake water. Pre-treatment and screen maintenance is likely to be higher for Alternative 2 (breakwater and stilling basin) as this is a surface water intake.

For both options, the intake lift pump station will be located close to the shore, with the pumps being protected by a screen system. The feed water will be transferred from the pump station to the desalination plant through a transfer pipeline. A pipe 'pigging' system for regular maintenance and cleaning of the seawater supply lines (only intake) will be installed. This involves the use of a 'pig' (bullet-shaped device with bristles), which is introduced into the pipeline to mechanically clean out the structure.

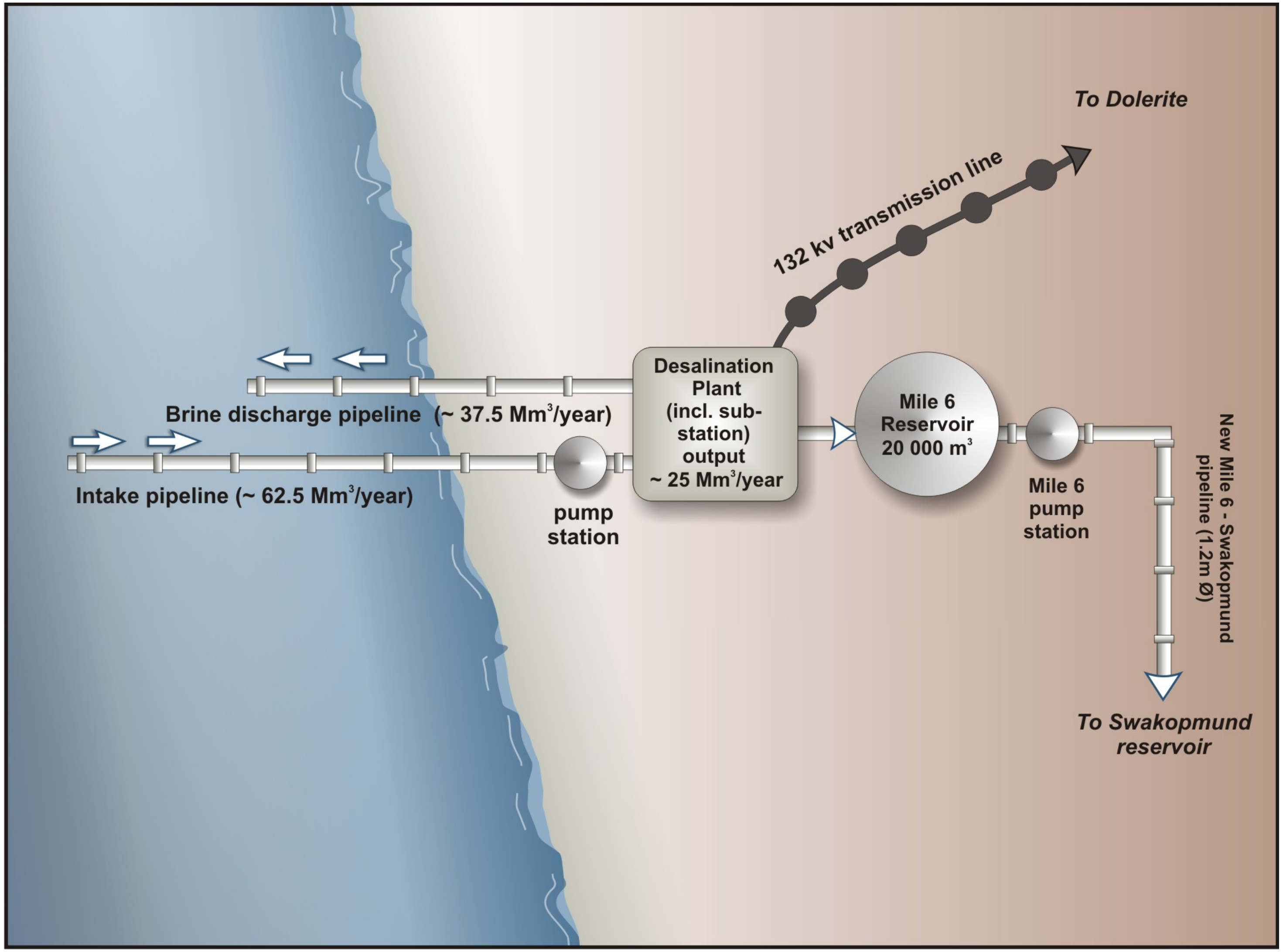

Figure 2.5: Conceptual layout of key components of the desalination plant (for the pipeline intake alternative)

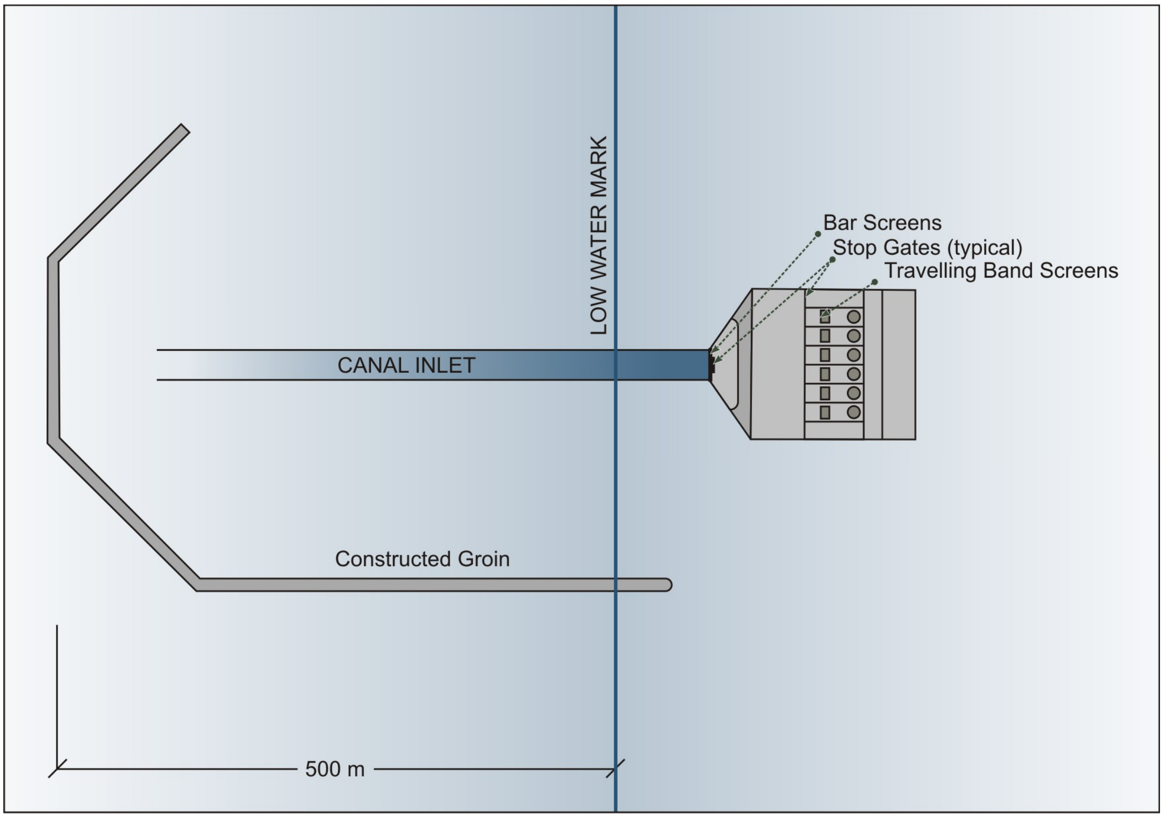

Figure 2.6: Conceptual design of the intake onshore channel with breakwater, stilling basin, and onshore pump station (Alternative 2)

2.3.2 Reverse Osmosis Plant

Reverse Osmosis (RO) is a membrane filtration process utilised to reduce the salinity of the feed (source) water. The process essentially works by applying pressure to overcome the natural osmotic pressure of seawater, forcing the feedwater through a membrane, from a region of high salinity (i.e. seawater side) to a region of low salinity (treated water). This process retains the brine (high salinity) on one side and allowing the water containing very low salinity to pass to the other side.

Table 2.2 summarizes typical raw/feed water quality data which has been collected by NamWater at the pilot facility at the Swakopmund pier during 1998 and 2006 to 2007. "Red tides" associated with algal blooms and sulphur eruptions are common occurrences all along the coast, leading to seawater being both nutrient rich and of highly variable quality. Pre-treatment processes to provide water suitable as feed to RO membranes must be designed to accommodate the full range of physical and biological quality expected.

Table 2.2: Typical raw seawater quality from the NamWater pilot studies at Swakopmund

Parameter	*Minimum (mg/L, unless otherwise stated)*	*Average (mg/L, unless otherwise stated)*	*Maximum (mg/L, unless otherwise stated)*
Calcium	750 as $CaCO_3$	991 as $CaCO_3$	1085 as $CaCO_3$
Magnesium	1292 as $CaCO_3$ *	4648 as $CaCO_3$	5667 as $CaCO_3$
Sodium	7000	10221	11 100
Potassium	340	359	400
Strontium	4.09	4.6	4.74
Barium	0.01	0.01	0.01
Iron	0.015	0.028	0.043
Total Alkalinity	106 as $CaCO_3$	118 as $CaCO_3$	122 as $CaCO_3$
Chloride	11 500 *	17 549	21 066
Sulphate	1750	3084	9480
Fluoride	0.8	0.9	1.0
Silica as SiO2	1	2.1	3
Boron	4.3	4.8	5.3
pH	7.27	7.69	8.33
TSS	113	301	396
TOC	1.1	2.3	3.8
Temperature, °C	13.90	17.18	23.50
TDS	32 428	34 173.7	35 711

** Singular anomalies both associated with high sulphates.*

Samples analysed at the Swakopmund jetty in 1998 (approximately 100 m around the end of the jetty) showed an average TSS of 301 mg/l (refer to Table 2.2). This is not representative of the raw sea water in the vicinity of the Mile 6 intake given high wave actions and associated sediment movements at the jetty. In 2008, 60 samples were taken at two locations in the vicinity of Wlotzkasbaken (approximately 1.2 km off shore, therefore minimising sediment movements due to wave actions). Total Suspended Solids were measured to be of maximum 30 mg/l, which is the value that will be used in this EIA. This was confirmed by a third sampling point (at Mile 6 - approximately 20 km south of the abovementioned sampling points) where the maximum TSS was measured to be about 30 mg/l. During events such as red tides or sulphuric eruptions, the total suspended solids may however increase for a maximum of approximately 2 to 3 days.

Given potential high variations in water quality, the design of the treatment processes will incorporate the range of raw water quality conditions as shown in Table 2.3 below.

Table 2.3: Range of raw seawater quality to be considered for design of the pre-treatment processes

Parameter	***Low***	***Average***	***High***
Temperature, C	*13.90*	*17.20*	*23.50*
TDS, mg/l	*32.000*	*34.200*	*36.000*
TOC, mg/l	*1.1*	*2.3*	*3.8*
TSS, mg/l	*2*	*11*	*30*
Turbidity, NTU	*1.56*	*8.48*	*34.50*

The engineering technologies to be applied at the desalination plant will be flocculation, Dissolved Air Flotation (DAF), pre-treatment membrane filtration (with a minimum recovery of 90%), cartridge filtration, reverse osmosis and post treatment (refer to *Figure 2.7*). A maximum of 60% of the sea water abstracted will be returned to the sea as brine. The selected design temperature of the water in the plant is 15 ºC. The plant will perform over the range of temperatures noted, with the RO feed pressure decreasing if the temperature is above 15 ºC and the required feed pressure increasing when the water temperature is below 15 ºC.

Figure 2.7/…

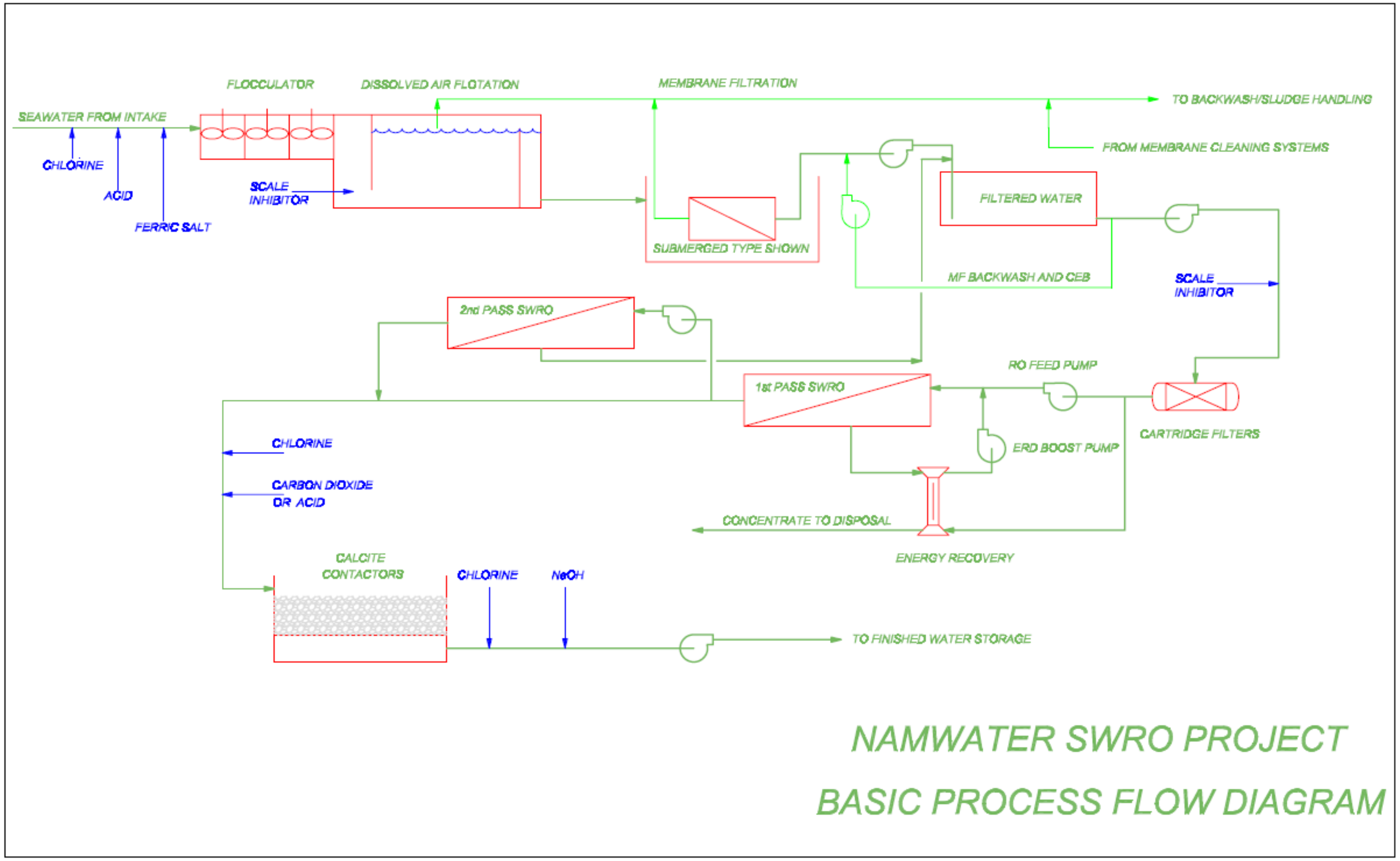

Figure 2.7: Basic process flow diagram for the RO Desalination Plant

The table below shows the expected RO feed water quality after pre-treatment, together with a summary of the required finished water quality.

Table 2.4: Pre-treated water quality and Namibian Water Quality Guidelines Class A (requirements for potable water)

Parameter	Pretreated Seawater mg/l	Required Finished Water Quality mg/l
Calcium	398	<80
Magnesium	1135	<30
Sodium	10221	<100
Potassium	359	<25
Strontium	4.6	<1
Barium	0.04	<0.01
Iron	0.027	<0.03
Total alkalinity as $CaCO_3$	118	>50
Chloride	17550	<100
Sulphate	3084	<100
Fluoride	1.0	<0.7
Si, as SiO_2	2.1	N/A
Boron	5.0	<0.5
pH	Determined by pretreatment	7.5-8.5
Temperature (deg. C)	13-23	N/A
Design temp, deg C	15	N/A
SDI (15 min)	<3.0	N/A
Turbidity, NTU	<0.2	<0.5
TSS, mg/l	<0.5	<1.0
DOC, mg/l	Determined by pretreatment	<5.0
CCPP mg/l		4-6
TDS (as sum of ions)	34173	<500

Of particular importance is the boron concentration in the finished product water. The proposed acceptable Namibian standard, consistent with the World Health Organisation, is <0.5 mg/l, with a Namibian ideal guideline of <0.3 mg/l. It is recognized that in a single pass seawater RO system, the boron concentration in the final treated water will in all probability be greater than 0.5 mg/l. It is NamWater's intent to achieve the best possible potable water quality while minimizing plant capital and operating cost. Therefore, the SWRO desalination plant will be designed to comply with the WHO requirements for boron.

It is likely that the use of a biocide is required to inhibit biological growth in the pipelines and on the screens. If sodium hypochlorite is used, this needs to be neutralised with sodium metabisulfite (SMBS) before the feed water enters the RO membranes as the chlorine damages the membranes. In addition, the RO membranes need to be cleaned at certain intervals. Depending on the quality of the feed water, this is typically undertaken at intervals of three to six months. The chemicals used are mainly weak acids, bases and detergents. Further chemicals are often added to improve the cleaning process, such as complexing agents or non-oxidising biocides for membrane disinfection. It is proposed that the used cleaning solutions (i.e. water and chemicals used for cleaning membranes) will be kept combined with the other residual streams from the DAF and ultra-filtration systems, treated in the sludge handling facilities, and the solids disposed of to an accredited landfill site. The quantity of organic and inorganic matters (i.e. nutrient rich solids) generated by the SWRO plant is anticipated to be approximately 6.4 tonnes dried sludge/day, with the sludge containing approximately 20% solids (i.e. approximately 31 m^3 wet sludge per day). As part of the EIA, potential recycling/re-use alternatives will be assessed depending on the sludge quality, with the disposal of these matters being the last resort. The identification of suitable waste disposal facilities, if required, will also form part of the ongoing EIA investigations.

2.3.3 Brine Effluent

During the operational life time of the plant, brine (which is approximately 1.7 times the salinity of seawater) will be returned into the sea at a maximum rate of 60% of the seawater abstracted. At the maximum production capacity of the proposed facility, this volume will be approximately 37.5 Mm^3/year. A brine return system conveys brine from the desalination plant back to the sea at approximately 3 to 4 m water depth (below Mean Sea Level) via a pipeline of approximately 600 to 800 m in length, either at the North or the South option (refer to *Figure 2.2*). The discharge system will be designed in such a manner as to avoid re-circulation of the brine back into the intake system. Diffusers will be located along the final 200 metres of the discharge pipeline in order to facilitate dispersed release of brine and minimise impacts on marine ecology. The diffusers are to be designed so that the effect of the brine is only detectable within a maximum of 100 m from the discharge pipeline, i.e. ambient background seawater concentrations are reached within 100 m.

Chemicals utilised in the process streams will be required to meet quality and purity standards necessary for drinking water production processes. The brine may contain an organic scale inhibitor which will be an approved chemical for potable water systems (certified by NSF International) and will be bio-degradable. Other chemicals utilised in the pre-treatment and feed water conditioning process become disassociated, such as acid for pH conditioning and, possibly, sodium metabisulfite to scavenge available chlorine.

Table 2.5 lists the expected composition of the brine effluent and the typical cleaning reagents and pre-treatment chemicals to be used. The brine effluent at build-out capacity is anticipated to have a temperature of approximately 16.5ºC (i.e. projected 1.5 degree Celsius temperature elevation above the ambient average seawater temperature of 15ºC), a salinity of 60 708 mg/l (based on the maximum feedwater salinity) and a density of 1 046 kg/m^3 with an effluent flow of a maximum of 38 Mm^3/year.

The brine is negatively buoyant and will tend to sink towards the seabed; however the brine temperature will increase slightly over the feed water temperatures. To ensure optimum dilution in the near-field, it is envisaged that the port would be configured to discharge at an angle of 60º above horizontal, at a depth of approximately 3 to 4 m below MSL. Further investigation with regard to the application of potential depth standards in Namibia will be undertaken during the EIA. The brine will be dispersed into the ambient seawater in a fast moving current and at a rate which will depend on the diffuser design and the current velocity.

The cleaning of each RO train (8 trains) is expected to be undertaken 3 times per year and will generate approximately 100 m^3 of cleaning solution and rinse water per train. Therefore, the maximum expected volume of cleaning solution and rinse water for the RO unit will be approximately 2 400 m^3/year, with an estimated recovery of 45%. The maximum expected volume of backwash, chemically enhanced backwash, cleaning solutions and rinse water for the pre-treatment membrane filtration system is expected to average 2.5 Mm^3/year (7 150 m^3/day) on a continuous basis. These streams will be mixed with the DAF sludge and treated in the sludge handling facilities where they will be neutralized, solids removed, prior to the wastewater being discharged/blended into the RO concentrate volume of 90 216 m^3/day.

Table 2.5: Expected composition and flow of the brine discharge from the proposed desalination plant

Description	***Units***	***Quantity***
Feed-water Intake for 80 000 m^3/day production	*m^3/h (m^3/day)**	*8 333 (~200 000)*
Average brine discharge for 80 000 m^3/day production	*m^3/h (m^3/day)**	*5 000 (120 000)*
SWRO concentrate at 80 000 m^3/day production	*m^3/h (m^3/day)**	*3 759 (90 216)*
Co-discharges (Pre-treatment Membrane Filtration Backwash and CIP rinse water)	*m^3/h (m^3/day)**	*298 (7 152)*
Supernatant from DAF sludge treatment	*m^3/h (m^3/day)**	*943 (22 632)*
Discharge velocity	*m/s*	*To be determined as part of engineering design, to meet UNEP 100m criteria*
Salinity	*mg/ℓ psu*	*60 071 60.1*
ΔT	*°C*	*1-1.5*
pH		*7.3 – 8.2*
Antiscalant (manufacturer TBD)	*mg/ℓ*	*4.0*
Chlorine	*µg/ℓ*	*<3*
Ethylenediaminetetraacetic Acid (EDTA) Intermittent	*mg/ℓ*	*0.013*
Coagulant: Ferric Chloride ($FeCl_3$) will precipitate into Ferric Hydroxide which will be removed in the sludge handling facility as a solid.	*mg/ℓ*	*<0.1*

Note: (*) Based on 24 hours production per day.
The above estimated brine composition is based on an 80 000 m^3/day water production to make provision for a reduced number of operational days/hours of the plant, while still reaching the same annual water production (i.e. 25 Mm^3/year).

2.3.4 Water storage and reticulation infrastructure

The processed water will be supplied at a rate of 25 Mm3/a from the desalination plant to a 20 000 m3 capacity above ground reservoir at Mile 6. From the reservoir, a pump station and a 1200 mm diameter pipeline will be built to transfer desalinated water to the existing NamWater reservoir at the Swakopmund Base Station. It is proposed that the new pipeline be aboveground on the eastern side of the new Swakopmund Eastern Bypass. It is proposed to have an aboveground pipeline (for a total of approximately 11 km) with a few sections being underground providing for road and railway line crossings.

The existing Omdel-Swakopmund pipeline (which currently follows the C34 main road) will either remain as is and both pipelines will be in operation or will be linked to the new pipeline when crossing the new bypass road. In the event of the existing Omdel-Swakopmund pipeline being linked to the new pipeline to Swakopmund, the section of the existing pipeline from the C34 to Swakopmund would be decommissioned. Only the section of the new pipeline from Mile 6 to the Swakopmund Municipal boundary forms part of this EIA.

2.3.5 Transmission power lines and power supply

NamPower has assessed various options to supply power to the desalination plant. The option described below is considered the ideal solution based on technical, economic and operational criteria. A key operational criterion is the impact of the saline weather conditions (especially coastal fog) on power lines, which leads to maintenance outages and high costs.

The plant will be connected to the national grid via a new 44 km long 132 kV transmission line from the existing Trekkopje-Wlotzkasbaken power line. The new line will tee off at Dolerite and run in a south-westerly direction to the proposed desalination plant, providing approximately 20 MW of power for the operational phase.

NamPower must align the power line route along existing infrastructure corridors, particularly roads which could provide the required access, instead of creating a new road that would increase access into the desert and detract from the wilderness nature of this area.

In terms of impacts on birds, it is important to ensure that the proposed route moves inland from the coast as rapidly as possible, to avoid the main bird migration paths along the coast.

The pylon design which supports the electrical conductors will be the standard timber H-pole configuration (using 5 poles), with twin copper conductors for each phase and a single earth wire on top of the structure. The timber is used to limit the risk of failure due to corrosion in this specific atmospheric environment. The tower structure of the power line is 13.5 m high, with towers spaced approximately 180 m apart depending on the terrain. An example of a similar pylon is shown in *Figure 2.8*. The transmission line will also require a 44 m servitude within which a service road (a two-track road) will be constructed. No other activities are permitted within the servitude.

A new 132/11 kV step-down enclosed substation will be constructed in close proximity to the desalination plant. From a technical perspective, this substation should be as close as possible to the desalination plant and could be either west or east of the C34 road. The substation will be comprised of a large shed to ensure all equipment contained within the substation is isolated from the adverse and corrosive weather conditions prevalent along the Namibian coast, thus ensuring long life of equipment and improved quality of supply to the desalination plant. The estimated dimensions of the shed are 55 m x 35 m and 14 m high.

Figure 2.8: Typical 132 kV power line from Keetmanshoop to Luderitz

Chapter 3: Legislative Requirements

LEGISLATIVE REQUIREMENTS

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3. LEGISLATIVE REQUIREMENTS

The environmental assessment policy adopted by the Namibian Government in 1995 aims to ensure that the aims and objectives of sustainable development concerning the natural resources and the biophysical environment is achieved and maintained. To realise this, the Government has developed and adopted policies, promulgated Acts, and set up structures within Ministries, such as the Directorate of Environmental Affairs in the Ministry of the Environment and Tourism, to deal with various environmental issues. Included in these policies is the Namibian Coastal Management Green Paper which sets the overall framework for coastal projects such as this.

Any proposed project, such as the desalination plant, with potentially significant environmental effects would therefore have to comply with the legislative requirements before the project can commence.

The following sections summarise the relevant national and international legal requirements for the desalination plant project. This chapter is divided as follows: i) the first section considers the framework for environmental management in Namibia; ii) the second section presents the national sectoral legislative requirements for the different components of the desalination plant; iii) the third section considers the relevant international obligations which Namibia is obliged to adhere to; and iv) the fourth section discusses the permitting requirements for the desalination plant.

3.1 NAMIBIAN LEGAL FRAMEWORK REGIME

3.1.1 The Constitution of the Republic of Namibia (1990)

Namibia's environmental policies are based on the requirements of the Namibian Constitution to endorse the concept of sustainable development. Article 95 (1) of the Constitution states that "…the State shall actively promote and maintain the welfare of the people by adopting, *inter alia*, policies aimed at.... maintenance of ecosystems, essential ecological processes and biological diversity of Namibia and utilization of natural resources on a sustainable basis for the benefit of all Namibians both present and future; in particular the Government shall provide measures against dumping or recycling of foreign nuclear and toxic waste on Namibian Territory."

Article 101 of the Namibian Constitution further states that the principles embodied within the constitution "shall not of and by themselves be legally enforceable by any court, but shall nevertheless guide the Government in making and applying laws .... The courts are entitled to have regard to the said principles in interpreting any laws based on them."

3.1.2 Environmental Assessment Policy, 1995

The Environmental Assessment Policy prescribes that all listed policies, programmes and projects, which could have an impact on the environment, whether initiated by the government or the private sector, should be subjected to the established Environmental Assessment (EA) procedure.

The Policy provides that once a project has been approved, the proponent (both Government and Private Enterprise) shall enter into a binding agreement based on the procedures and recommendations contained in the EA report. This will help ensure that the mitigatory and other measures recommended in the EA, and accepted by all parties, are complied with. This agreement should address the construction, operational and decommissioning phases as applicable, as well as monitoring and auditing.

This policy contains two appendices: 1. Appendix A explains the EA procedure that should be followed; and Appendix B contains the listed activities that require an EA. The relevant listed activities as they appear in Appendix B for this project, include, but not limited to, the following:

12	Power generation facilities with an output of 1 megawatt or more.
13	Electrical substations and transmission lines having equipment with an operating voltage in excess of 30 000 volts rms phase-to-phase.
25	Major pipelines;
34	Small scale (formal) water supply schemes; and
38	Desalination plants.

Legislation has finally been passed to support this policy in the form of the Environmental Management Act (No. 7 of 2007), which is discussed below.

3.1.3 Coastal Policy for Namibia (the Green Paper, Feb 2009)

The Coastal Policy Green Paper is a background document which sets the overall framework for development in the coastal area. As such its sets out, firstly, the coastal policy process. This will be followed by a White Paper and presumably an Integrated Coastal Area act which will replace the outdated Sea Shore Ordinance (1958) referred to elsewhere in this report. As the coastal policy process has still some time to go it does not impact on the project but the spirit and general tenor of the Green Paper should be followed. In particular the project should conform with Namibia's existing planning and environmental polices as well as legislation dealing with these topics.

3.1.4 Environmental Management Act 7 of 2007 – EMA

The Environmental Management Act (2007) (EMA) was promulgated in December 2007 and is administered by the Directorate of Environmental Affairs (DEA), under the auspices of the Ministry of the Environment and Tourism. It has as its main objectives: 1. to ensure that the significant effects of activities on the environment are considered carefully and timeously; 2. to ensure that there are opportunities for timeous participation by interested and affected parties throughout the assessment process; and 3. to ensure that findings are taken into account before any decision is made in respect of activities (section 2).

The EMA, in section 3(2), establishes a set of principles which give effect to the provisions of the Constitution for integrated environmental management. Although these principles are not enforceable, it is incumbent upon decision makers to take them into account when deciding on the approval of a project. Although the Act is promulgated, it is not yet implemented.

The EMA stipulates that no party, whether private or Governmental, can conduct a listed activity without an environmental clearance certificate obtained from the Environmental Commissioner[1]. Dependent on the type of project activity being applied for, the Commissioner may request that an environmental impact assessment (EIA) should be conducted. In the case of the desalination plant, an EIA is required as there may be impacts on the environment, as purported by the published listed activities. In any event, an EIA is required under the Water Resources Management Act described below.

3.2 NAMIBIAN SECTORAL LEGISLATIVE REQUIREMENTS

This section reviews the legislation as they are applicable to the different components of the proposed development.

MARINE ENVIRONMENT

3.2.1 Water Resources Management Act 24 of 2004 (the 'WRMA')

The WRMA is central to the proposal in question. This is because the essence of the project will be to abstract seawater, pipe it on-shore, and convert it to (semi) freshwater. While the Act does not specifically define water to include seawater it is implicit that it does include seawater. This is evident from the definition of both "water resource," and "water source" in section 1 which include a reference to the sea. More specifically "water source" is defined as " …water from a watercourse, an aquifer or the sea, and includes meteoric water" while "water resource" includes a "watercourse, an aquifer and the sea and meteoric water".

The consequence is that NamWater will have to obtain a licence to abstract and use sea water and will have to comply with the various provisions of the Act set out in Part VIII of the Act (sections 32 to 45). Section 32 prohibits the abstraction or use of water without a licence and significantly specifically states that the term "abstract water" includes the abstraction of marine water for any purpose (section 32(1)).

Section 33, titled "Application for licence to abstract and use water" goes on to list a number of requirements which must accompany the application to abstract water. Of particular importance is section 33(3) which stipulates that an application for a licence to abstract and use water must be accompanied by a number of requirements including "an environmental impact analysis of the proposed abstraction of water upon the environment and existing water users and water resources" (section 33(3)(c)). This phrase sets the template for the current exercise.

The remainder of Part VIII goes on to detail a number of considerations which may or may not apply to the application in question. These have been drafted with freshwater abstraction in mind but nevertheless should be consulted by the proponent as these provide for matters such

[1] The Environmental Commissioner is appointed by the Environmental Minister (according to section 16) to perform the duties described in section 17.

the contents of the licence (section 36), the terms and conditions of licence to abstract water (section 37), the duration and renewal of the licence (sections 39 & 40) and so forth.

Also of potential relevance is Part XI of the Act (sections 56 to 71) which deals with Water Pollution Control. The opening section stipulates that a person may not discharge effluent directly or indirectly to any 'water resource' (defined to include the sea as seen above) unless such person is in compliance with a permit issued in terms of section 60. The tem 'effluent' is defined to mean "…any liquid discharged as a result of domestic, commercial, industrial or agricultural activities". On the face of it a desalination plant appears to include the discharge of effluent but clarity about this has to be obtained from NamWater as to whether effluent will indeed be discharged in the operation of the plant.

Environmental impact analysis is required under Chapter 33(3) of the Water Resources Act 24 of 2004, for the abstraction and use of water and sections 34 and 35 explain what factors the Minister must take into account when considering issuing a license and what the license should contain, respectively. Section 59 gives details on what information is required for an effluent discharge permit and 60 describes the duties of the Minister when considering the issuing of a permit for the discharge of effluent, including brine.

This Act replaces the Water Act 54 of 1956.

3.2.2 Territorial Sea and Exclusive Economic Zone of Namibia Act 3 of 1990

The objective of this Act is to determine and define the territorial sea, internal waters, contiguous zone, exclusive economic zone and continental shelf of Namibia; and to provide for matters incidental thereto. It is only of passing relevance here.

3.2.3 Nature Conservation Ordinance 4 of 1975

This Ordinance covers game parks and nature reserves, the hunting and protection of wild animals (including game birds), problem animals, fish, and the protection of indigenous plants. It is administered by the Ministry of Environment and Tourism and establishes a Nature Conservation Board. The Ordinance includes a number of schedules listing threatened and endangered species of plants and wild animals. If any of these are identified as being affected by the proposal, a permit may have to be obtained.

3.2.4 Marine Resources Act 27 of 2000 (and accompanying regulations)

This Act provides for the conservation of the marine ecosystem; the responsible utilisation, conservation, protection, promotion of marine resources in a sustainable manner and for the control of marine resources for these purposes.

The Minister of Fisheries is empowered to make regulations under section 61 on a broad number of topics including "regulating or prohibiting the discharge in the sea or discarding on the seashore and land of specified substances or materials, or substances or materials not complying with specified requirements or having specified properties" (61(1)(r)). At time of writing it is not known whether regulations have indeed been promulgated under this subsection. If so they may well be relevant to the operations in question as pipelines will be deployed for the intake of sea water and the discharge of brine, out of and into the marine environment.

This Act replaces the *Sea Fisheries Act 29 of 1992*, the *Sea Birds and Seals Protection Act 46 of 1973,* and the Fishing Boat and Factory Owners' Committee Ordinance 16 of 1968. The Act came into force on 1 August 2001.

The stated objective of this Ordinance is to provide for the determination of the position of the highwater mark. As such it is not directly relevant to the project in question. More generally it can be stated that the Ordinance is outdated and a vestige of the pre-independence position. Namibia is in the process of developing a coastal area policy which will probably eventually result in a new coastal area act.

3.2.5 Hazardous Substances Ordinance 14 of 1974, and amendments

This ordinance provides for the control of toxic substances. It covers manufacture, sale, use, disposal and dumping as well as import and export.

3.2.6 Atmospheric Pollution Prevention Ordinance 11 of 1976

This Ordinance provides for the prevention of air pollution. Part 4 deals with control of dust and provides for the proclamation of dust control areas. We have not ascertained whether the area has been proclaimed a dust control area but if so the proponent will have to comply with section 24 which provides:

(1) Any person who in a dust control area-

(a) carries on any industrial process the operation of which in the opinion of the Director causes or is liable to cause a nuisance to persons residing or present in the vicinity on account of dust originating from such process becoming dispersed in the atmosphere; or

(b) has at any time or from time to time, whether before or after the commencement of this Ordinance, deposited or caused or permitted to be deposited on any land a quantity of matter which exceeds, or two or more quantities of matter which together exceed, twenty thousand cubic metres in volume, or such lesser volume as may be prescribed, and which in the opinion of the Director causes or is liable to cause a nuisance to persons residing or present in the vicinity of such land on account of dust originating from such matter becoming dispersed in the atmosphere,

We are in any event of the view that even if the area is not a declared dust control area the spirit of this section should be complied with as it could be categorised as causing a public nuisance under common law

3.2.7 Draft Pollution Control and Waste Management Bill (1999)

The Pollution Control and Waste Management Bill (1999) amalgamate a variety of Acts and Ordinances that provide protection for particular species, resources or components of the environment. These include, but are not limited to, the *Nature Conservation Ordinance No.4 of 1975, the Sea Fisheries Act 29 of 1992, the Sea Birds and Seals Protection Act 46 of 1973,* *Seashore Ordinance No. 37 of 1958, Hazardous Substances Ordinance No. 14 of 1974* and amendments, the *Namibia Ports Authority Act 2 of 1994*, and the *Atmospheric Pollution Prevention Ordinance No. 11 of 1976*.

3.2.8 National Monuments Act 28 of 1969

This Act establishes a National Monuments Council and provides for the preservation of certain property as National Monuments and the maintenance of certain burial grounds.

TERRESTRIAL ENVIRONMENT

For the terrestrial environment, the following Acts, Ordinances and Bills apply:

- Nature Conservation Ordinance 4 of 1975;
- Hazardous Substances Ordinance 14 of 1974, and its amendments;
- Atmospheric Pollution Prevention Ordinance 11 of 1976
- Draft Pollution Control and Waste Management Bill (1999);
- National Monuments Act 28 of 1969;
- Water Resources Act 24 of 2004

Note: These Legislative texts have all been discussed above for the marine environment and therefore no further discussion is required here.

3.2.9 Other Legislation

Other legislation which may be relevant to this project includes, but may not be limited to the following:

- **Electricity Act 2 of 2000**

This Act provides for the establishment and functions of the Electricity Control Board. It replaces the Electric Power Proclamation 4 of 1922.

The table below presents the applicability of the Acts, Ordinances and Bills, discussed above, to the NamWater Desalination Project:

Table 3.1: Applicability of the relevant Acts and Regulations for industrial activities adjacent to Namibian waters

Law/Ordinance	*Applicability*
Article 95 (1) of the Constitution of the Republic of Namibia (1990)	▪ *Preservation of Namibia's ecosystems, essential ecological processes and biological diversity* ▪ *Sustainable use of natural resources*
Environmental Assessment Policy of 1995	▪ *Prescribes Environmental Impact Assessments for any developments with potential negative impacts on the environment.*
Water Resources Management Act 24 of 2004	▪ *Seawater abstraction permit required under section 32;* ▪ *Effluent discharge permit required under sect 56* ▪ *Water related pollution and abstraction*
Environmental Management Act 7 of 2007	▪ *Establishes principles for EA* ▪ *Ensures that the significant effects of activities are considered timeously and carefully* ▪ *Allows for opportunities for participation by I&AP's throughout the assessment process*
Sea Birds and Seals Protection Act 46 of 1973 (Replaced by the Marine Resources Act, 27 of 2000)	▪ *No disturbance of seabirds and seals*
Seashore Ordinance 37 of 1958	▪ *Removal of living and non-living resources from seashore or seabed and depositing of rubbish within 3 nautical miles of the shore*
Sea Fisheries Act 29 of 1992 *(Replaced by the Marine Resources Act, 27 of 2000)*	▪ *Dumping at sea* ▪ *Discharge of wastes in marine reserves* ▪ *Disturbance of rock lobsters, marine invertebrates or aquatic plants* ▪ *Prohibited areas for catching/disturbing fish, aquatic plants or disturbing/damaging seabed*
Nature Conservation Ordinance 4 of 1975	▪ *Protection of various species*
Marine Resources Act 27 of 2000 (and accompanying regulations)	▪ *Discharges into the sea*
Convention of Biological Diversity	▪ *Protection of various species*
Atmospheric Pollution Prevention Ordinance No. 11 of 1976	▪ *Pollution prevention*
Hazardous Substances Ordinance 14 of 1974, and amendments	▪ *Pollution prevention*
Petroleum Products and Energy amendment Act of 2000	▪ *Disposal of used oil*
Territorial Sea and Exclusive Economic Zone of Namibia Act 3 of 1990	▪ *Exploitation of natural resources in the EEZ*
Inland Fisheries Resources Act 1 of 2003	▪ *Conservation and protection of aquatic ecosystems*

Law/Ordinance	*Applicability*
Draft Pollution Control and Waste Management Bill (1999)	▪ *Protection for particular species, resources or components of the environment*
SADC Protocol on Shared Water Systems	▪ *Water related pollution and abstraction*
National Monuments Act 28 of 1969	▪ *Disturbance of shipwrecks, archaeological and cultural sites*
United Nations Law of the Sea Convention of 1982	▪ *Marine pollution from seabed activities and land-based sources*
Convention on Biological Diversity of 1992	▪ *Conservation and protection of biological diversity*
Convention on Desertification of 1994	▪ *Combating desertification and mitigation of the effects of drought*

3.3 INTERNATIONAL REQUIREMENTS

3.3.1 SADC Protocol on Shared Water Systems

This Protocol came into force in 1998. It provides for institutions to be established for the different basins in the Region, known as Permanent River Basin Water Commissions or Operating Authorities to manage the shared water resources in a sustainable way.

This protocol provides for water related pollution and abstraction.

3.3.2 UN Law of the Sea Convention, 1982 (UNCLOS)

To govern the seas and oceans of the world, the UNCLOS presents a comprehensive international legal framework. A central feature of the Convention is the descriptions of the various maritime zones, i.e. internal waters, territorial sea, contiguous zone, exclusive economic zone, continental shelf, and high seas.

Part XII, titled "Protection and Preservation of the Marine Environment" deals more specifically with marine pollution. Article 192 states that: 'States have an obligation to protect and preserve the marine environment'. Article 194(2) requires States to take necessary measures to ensure that activities under their jurisdiction or control do not "cause damage by pollution to other States and their environment" and to take measures to minimise "the release of toxic, harmful or noxious substances, especially those that are persistent, from land based sources, from or through the atmosphere, or by dumping" (Article 194(3)(a)), as well as "pollution from vessels, installations and devices used in exploration or exploitation of the natural resources of the seabed and subsoil" and "pollution from other installations and devices operating in the marine environment" (Article 194(3)(b)).

Article 196 requires states to take necessary measures to "prevent, reduce and control pollution of the marine environment resulting from the use of technologies under their jurisdiction or control, or the intentional or accidental introduction of species, alien or new, to a particular area of the marine environment, which may cause significant and harmful changes thereto".

3.3.3 Convention on Biological Diversity, 1992

The overall objective of the Convention is the "…conservation of biological diversity and the sustainable use of its components and the fair and equitable sharing of the benefits…".

3.3.4 Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, particularly in Africa, 1994

The Convention aims to "…combat desertification and mitigate the effects of drought in countries experiencing drought and / or desertification, particularly in Africa, through effective action at all levels…in the framework of an integrated approach which is consistent with Agenda 21, with a view to contributing to the achievement of sustainable development in affected areas…" As this Convention is directly relevant to Namibia given its water-stressed nature Namibia's action plans under this convention should be taken into consideration. This is is line with the Convention's objective namely "to achieve "…long term integrated strategies that focus simultaneously, in affected areas, on improved productivity of land and the rehabilitation, conservation and sustainable management of land and water resources, leading to improved living conditions, in particular at the community level" should be employed.

This Convention further obligates parties to take effective action by developing action programmes, scientific and technical co-operation and supporting measures, and also invokes the principle of common but differentiated responsibilities, thus having different obligations for affected developing countries versus developed countries.

3.4 LEGISLATIVE AND PERMITTING REQUIREMENTS

3.4.1 Permits Required

Following the Environmental Assessment Policy of 1995 and the Environmental Management Act (No. 7 of 2007), an environmental clearance certificate is required from the Directorate of Environmental Affairs (DEA) prior to commencement of operations for the desalination plant project. This Policy and Act stipulate that an Environmental Impact Assessment is required for any policy, programme or project with potential negative impacts on the environment, whether initiated by Government or private sector.

Under Namibian legislation, both the abstraction from and discharge into the sea requires a permit under Sections 32 and 56 of the Water Resources Management Act (No. 24 of 2004), respectively. This Act is based on the National Water Policy (Ministry of Agriculture, Water and Rural Development 2000). The effluent water discharged (and potential associated co-discharges) from the proposed RO plant is classified as "industrial effluent" and thus requires a license under the Act. A combined licence to abstract and use water and to discharge effluent is covered under Section 38 of the Act. Licenses are provided through the Ministry of Agriculture, Water and Forestry (MAWF).

The Ministry of Environment and Tourism (MET) is the custodian of Namibia's natural environment and discharges this duty via environmental regulations. The MET is thus the lead agent for EIAs; however licensing of water abstraction, use and disposal is only considered once an EIA acceptable to MAWF has been submitted and a Record of Decision has been handed down.

3.4.2 International Standards and Guidelines

In addition to the regional, national and international legislative requirements, there are international standards, protocols and guidelines that are applicable for a desalination plant project:

- In August 2007, the Department of Water Affairs & Forestry (DWAF 2007) of South Africa published the *"Guidelines for the evaluation of possible environmental impacts during the development of seawater desalination processes".* This document gives general guidance on the assessment procedure, lists possible environmental impacts which can be expected during implementation of seawater desalination, and provides recommendations for specialist and monitoring studies.
- The International Finance Corporation, a member of the World Bank Group, has developed operational policies (IFC 1998) that, *inter alia*, require that an impact assessment is undertaken within the country's overall policy framework and national legislation, as well as international treaties, and that natural and social aspects are to be considered in an integrated way. IFC has further published Environmental, Health, and Safety Guidelines (known as the 'EHS Guidelines') containing guidelines and standards applicable to projects discharging industrial wastewater (IFC 2007). The EHS Guidelines contain the performance levels and measures that are normally acceptable to IFC and are generally considered to be achievable in new facilities at reasonable costs by existing technology. The EHS Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP), as defined in IFC's Performance Standard 3 on Pollution Prevention and Abatement (IFC 2006). This Performance Standard has the objective to avoid and minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities. It outlines a project approach to pollution prevention and abatement in line with internationally disseminated pollution prevention and control technologies and practices. In addition, Performance Standard 3 promotes the private sector's ability to integrate such technologies and practices as far as their use is technically and financially feasible and cost-effective in the context of a project that relies on commercially available skills and resources.
- Other guidance documents are those by the California Coastal Commission (Seawater Desalination and the California Coastal Act, 2004), the United Nations Environmental Programme (UNEP 2008) and the World Health Organisation (WHO, 2008) that include international best practices and principles such as the precautionary approach and describe how design and construction approaches can mitigate likely impacts.
- The Rio Declaration on Environment and Development (1992), which calls for use of EIA as an instrument of national decision making (Principle 17). Moreover, it establishes important principles for sustainable development that should be reflected in EIAs, such as the application of the precautionary principle (Principle 15, whereby, where there is uncertainty in the nature and severity of a potential impact, conservative assumptions are made with respect to the significance and potential severity of the impact being assessed).

As signatory to the Convention of Biological Diversity and Convention to Combat Desertification, Namibia is committed to the preservation of rare and endemic species, and to provide protection for ecosystems and natural life-support processes within the country's boundaries. As a signatory of the United Nations Law of the Sea Convention of 1982, Namibia is required to adopt legislation to reduce marine pollution from seabed activities in the Exclusive Economic Zone (EEZ) and on the continental shelf, and from land-based sources.

3.4.3 Water Quality Guidelines

The Water Resources Management Act does not contain any target values for water quality. These will form part of the regulations associated with the new Water Act and will be implemented at a future date. As far as can be established, South Africa is the only southern African country that currently has an official set of water quality guidelines for coastal marine waters. In terms of policy, legislation and practice South Africa's operational policy for the disposal of land-derived wastewater to the marine environment (DWAF 2004 a-c) is thus of relevance. Specifically, environmental quality objectives need to be set for the marine environment, based on the requirements of the site-specific marine ecosystems, as well as other designated beneficial uses (both existing and future) of the receiving environment. The identification and mapping of marine ecosystems and the beneficial uses of the receiving marine environment provide a sound basis from which to derive site-specific environmental quality objectives (Taljaard *et al.*, 2006). To ensure that environmental quality objectives are practical and effective management tools, they need to be set in terms of measurable target values, or ranges for specific water column and sediment parameters, or in terms of the abundance and diversity of biotic components. The South African Water Quality Guidelines for Coastal Marine Waters (DWAF, 1995) provide recommended target values (as opposed to standards) for a range of substances, but these are not exhaustive. Therefore, in setting site-specific environmental quality objectives, the information contained in the DWAF guideline document is supported by additional information obtained from published literature and best available international guidelines (e.g. ANZECC, 2000; World Bank, 1998). Recommended target values are also reviewed and summarized in the Benguela Current Large Marine Ecosystem (BCLME) document on water quality guidelines for the BCLME region (CSIR 2006). Recommended target values are provided in Table 3.2 below.

Table 3.2/...

Table 3.2: Water quality guidelines for the discharge of a high-salinity brine into the marine environment

VARIABLE	SOUTH AFRICA (DWAF 1995)	AUSTRALIA/NEW ZEALAND (ANZECC 2000)	WORLD BANK [a] (World Bank 1998)
Zone of impact / mixing zone	To be kept to a minimum, the acceptable dimensions of this zone informed by the EIA and requirements of licensing authorities, based on scientific evidence.		100 m radius from point of discharge for temperature
Temperature	The maximum acceptable variation in ambient temperature is ± 1°C	Where an appropriate reference system is available, and there are sufficient resources to collect the necessary information for the reference system, the median (or mean) temperature should lie within the range defined by the 20%ile and 80%ile of the seasonal distribution of the ambient temperature for the reference system.	< 3°C above ambient at the edge of the zone where initial mixing and dilution take place. Where the zone is not defined, use 100 meters from the point of discharge when there are no sensitive aquatic ecosystems within this distance.
Salinity [b]	33 – 36 psu	Low-risk trigger concentrations for salinity are that the median (or mean) salinity should lie within the 20%ile and 80%ile of the ambient salinity distribution in the reference system(s). The old salinity guideline (ANZECC 1992) was that the salinity change should be <5% of the ambient salinity.	-
Total residual Chlorine	No guideline, however deleterious effects recorded for concentrations as low as 2 – 20 µg. ℓ^{-1}. A conservative trigger value is <2 µg.ℓ^{-1}.	3 µg Cl. ℓ^{-1} measured as total residual chlorine (low reliability trigger value at 95% protection level, to be used only as an indicative interim working level) (ANZECC 2000)[c]	0.2 mg. ℓ^{-1} at the point of discharge prior to dilution
Dissolved oxygen	For the west coast, the dissolved oxygen should not fall below 10 % of the established natural variation. For the south and east coasts the dissolved oxygen should not fall below 5 mg/ℓ (99 % of the time) and below 6 mg/ℓ (95 % of the time)	Where an appropriate reference system is available, and there are sufficient resources to collect the necessary information for the reference system, the median lowest diurnal DO concentration for the period for DO should be >20%ile of the ambient dissolved oxygen concentration in the reference system(s) distribution. The trigger value should be obtained during low flow and high temperature periods when DO concentrations are likely to be at their lowest.	-

VARIABLE	SOUTH AFRICA (DWAF 1995)	AUSTRALIA/NEW ZEALAND (ANZECC 2000)	WORLD BANK [a] (World Bank 1998)
Nutrients	Waters should not contain concentrations of dissolved nutrients that are capable of causing excessive or nuisance growth of algae or other aquatic plants or reducing dissolved oxygen concentrations below the target range indicated for dissolved oxygen (see above)	Default trigger values of PO_4-P: 100 µg. ℓ^{-1} NO_x-N: 50 µg. ℓ^{-1} NH_4^+-N: 50 µg. ℓ^{-1} for the low rainfall southern Australian region (Table 3.3.8 in ANZECC 2000)	
Chromium	8 µg. ℓ^{-1} (as total Cr)	Marine moderate reliability trigger value for chromium (III) of 10 µg. ℓ^{-1} with 95% protection Marine high reliability trigger value for chromium (VI) of 4.4 µg. ℓ^{-1} at 95% protection.	0.5 mg. ℓ^{-1} (total Cr) for effluents from thermal power plants
Iron		Insufficient data to derive a reliable trigger value. The current Canadian guideline level is 300 µg. ℓ^{-1}	1.0 mg. ℓ^{-1} for effluents from thermal power plants
Molybdenum		Insufficient data to derive a marine trigger value for molybdenum. A low reliability trigger value of 23 µg. ℓ^{-1} was adopted to be used as indicative interim working levels.	
Nickel	25 µg. ℓ^{-1} (as total Ni)	7 µg. ℓ^{-1} at a 99% protection level is recommended for slightly-moderately disturbed marine systems.	

[a] The World Bank guidelines are based on maximum permissible concentrations at the point of discharge and do not explicitly take into account the receiving environment, *i.e.* no cognisance is taken of the fact of the differences in transport and fate of pollutants between, for example, a surf-zone, estuary or coastal embayment with poor flushing characteristics and an open and exposed coastline. It is for this reason that we include in this study other generally accepted Water Quality guidelines that take the nature of the receiving environment into account.

[b] The ANZECC (2000) Water Quality guideline for salinity is less stringent than, but roughly approximates, the South African Water Quality guideline that requires that salinity should remain within the range of 33 psu to 36 psu.

[c] In case of chlorine "shocking", which involves using high chlorine levels for a few seconds rather than a continuous low-level release, the target value is a maximum value of 2 mg. ℓ^{-1} for up to 2 hours, not to be repeated more frequently than once in 24 hours, with a 24-hour average of 0.2 mg. ℓ^{-1} (The same limits would apply to bromine and fluorine.).

Chapter 4: Description of the Affected Environment

DESCRIPTION OF THE AFFECTED ENVIRONMENT

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4. DESCRIPTION OF THE AFFECTED ENVIRONMENT

This chapter provides an overview of the affected environment and local planning context (including surrounding land uses) for the proposed desalination plant at Mile 6, near Swakopmund, Namibia. A broad understanding is given to the term 'environment', which includes the biophysical, socio-economic and heritage environment. This chapter therefore assists the reader in identifying potential impacts on the environment (positive or negative); and opportunities or constraints which the affected environment may present for the development.

The environmental baseline description is based on information extracted from the following sources: Atlas of Namibia (Mendelsohn, Jarvis, Roberts and Robertson, 2002), Namibia's marine environment (Molloy and Reinikainen, 2003), Namibia. Secrets of a desert uncovered (Seely and Pallett, 2008), Biological Diversity in Namibia (Barnard, 1998), Preliminary baseline study prior to exploration activities by Sasol on the Namibian continental shelf in licence area 2012 (CSIR, 1992) and the Marine Baseline study on the Potential Impacts of a Seawater Intake Structure and a Brine Disposal System for a Proposed Desalination Plant North of Swakopmund (Pisces, 2008).

4.1 SITE LOCALITY

The proposed desalination plant will be located in the coastal zone of the Erongo Region (Region in Namibia equates to a province in South Africa i.e. an governmental administrative area), on the coast approximately 14km north-northwest of Swakopmund and is also situated within the National West Coast Recreation Area (NWCRA) which stretches from Swakopmund 200 km northwards to the Ugab River. This area is expected to be incorporated within the Central Coast Area (CCA) of the Namib-Skeleton Coast National Park in the near future. It is foreseen that the Namib-Skeleton Coast National Park would include the Skeleton Coast Park, the National West Coast Recreational Area, the Namib Naukluft Park and the Sperrgebiet Park (MET, 2008). The area between Swakopmund and Walvis Bay is expected to achieve conservation status soon and is intended to form part of the Namib-Skeleton Coast National Park.

The coordinates of the northern site option are S 22^{o} 32'58.01" and E 14^{o} 30'28.37" and those of the southern site option are S 22^{o} 33'17.92" and E 14^{o} 30'40.89".

The closest residential area is the town of Swakopmund. The closest major road, located approximately 200m to the east of the proposed facility, is the C34 which connects all major towns along the coast of Namibia. *Figure 4.1* shows the locality of the proposed desalination plant.

A new 132 kV power line is being built from Trekkopje Mine to the Uramin Desalination Plant near Wlotzkasbaken and has already received environmental authorisation. For the NamWater desalination plant, a new 132 kV line is planned from the proposed substation at Mile 6, extending over 44 km to join the Trekkopje-Wlotzkasbaken line at a place called Dolerite, located about 13 km south-west of the new Trekkopje Uranium Mine.

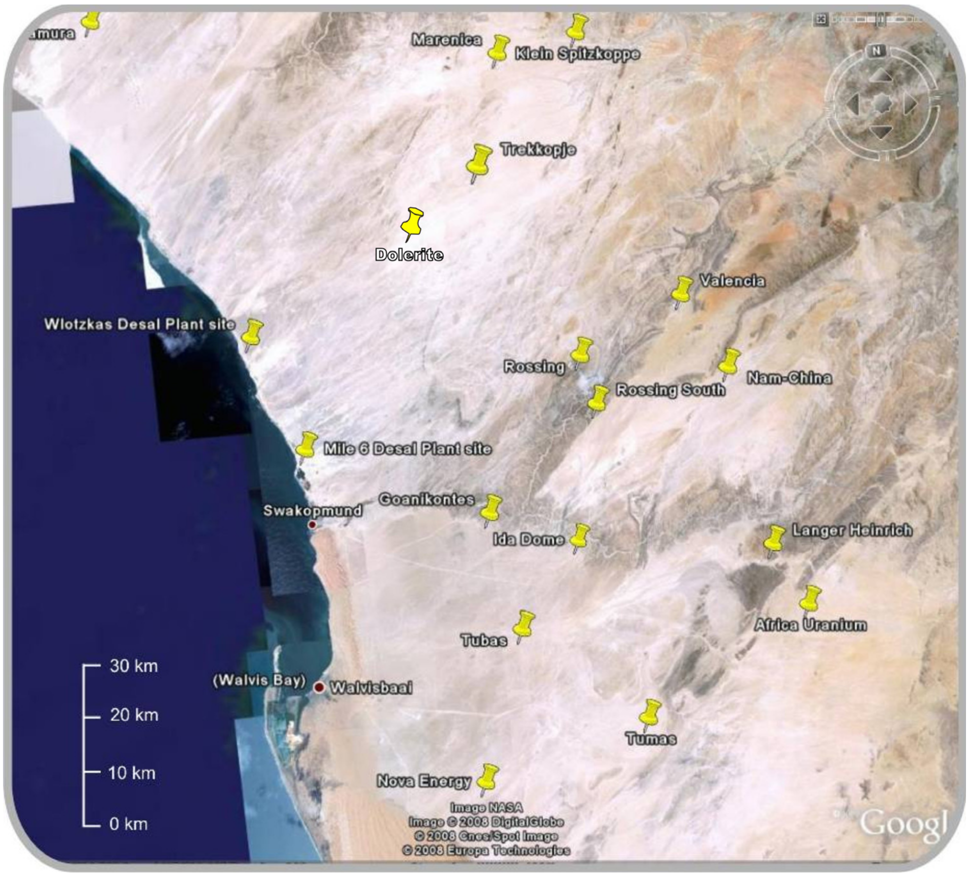

Figure 4.1: Location map for the proposed desalination plant at Mile 6, near Swakopmund, Namibia

Figure 4.2: The proposed location for the desalination plant, from top left to bottom right: South end of study area looking north, middle of study area showing beach berm, car tracks on beach, north end of study area and gravel beds at northern end.

4.2 BIOPHYSICAL ENVIRONMENT

4.2.1 Climate

The meteorological conditions along the Namibian coast are controlled by the ever-present South Atlantic anticyclone, the northward-flowing Benguela Current (with associated upwelling) and the divergence of the south-east trade winds along the coast.

Climatic conditions in the region vary from cool, foggy, windy and hyper-arid conditions along the coast to dry and hot weather towards the inland areas from which it is separated by the Great Escarpment.

a) Temperature

Namibia is considered to be a hot country, however, temperatures are highly variable daily and seasonally. Therefore, animals and plants have evolved to tolerate a broad range of temperatures. In the coastal area, temperatures are relatively constant, only exhibiting a slight decrease from north to south. The average annual temperature in the study area for the proposed desalination plant ranges between 16°C and 18°C, with an average maximum temperature of 23°C during the hottest month of February and an average minimum temperature of 11°C during the coldest month of August.

Average annual temperature along the proposed new transmission line will slightly increase towards inland and will range from about 17°C at the coast to about 19°C in the proximity of the Dolerite Tee-off from the UraMin line. The average maximum temperature will range from 23°C at the coast to 27°C inland during the hottest month (February) and the average minimum temperature of 11°C (during the coldest month of August) will remain relatively constant along the proposed line.

It is interesting to note that highest temperatures are recorded during the winter months and always during Berg Wind episodes when cold air from the interior flows towards the coast and is heated by compression (catabatic wind).

b) Rainfall and evaporation

The very low rainfall in the targeted area (mean annual rainfall of less than 15 mm in the vicinity of Swakopmund) means that many plants and animals rely on fog to provide water. Most rain falls in summer between January and April, with the wettest month being March for the

Swakopmund area. Heavy rainfall in the interior of the country rarely reaches the sea, although water trapped underground in large aquifers may reach the coastline. Together with low rainfall, evaporation rates in Namibia are generally high with southern and north-western areas losing much more water through evaporation than the north-eastern and coastal areas. Lower rates of evaporation at the coast are mainly due to cooler and more humid coastal conditions. The whole country however loses more water through evaporation than it receives in rain.

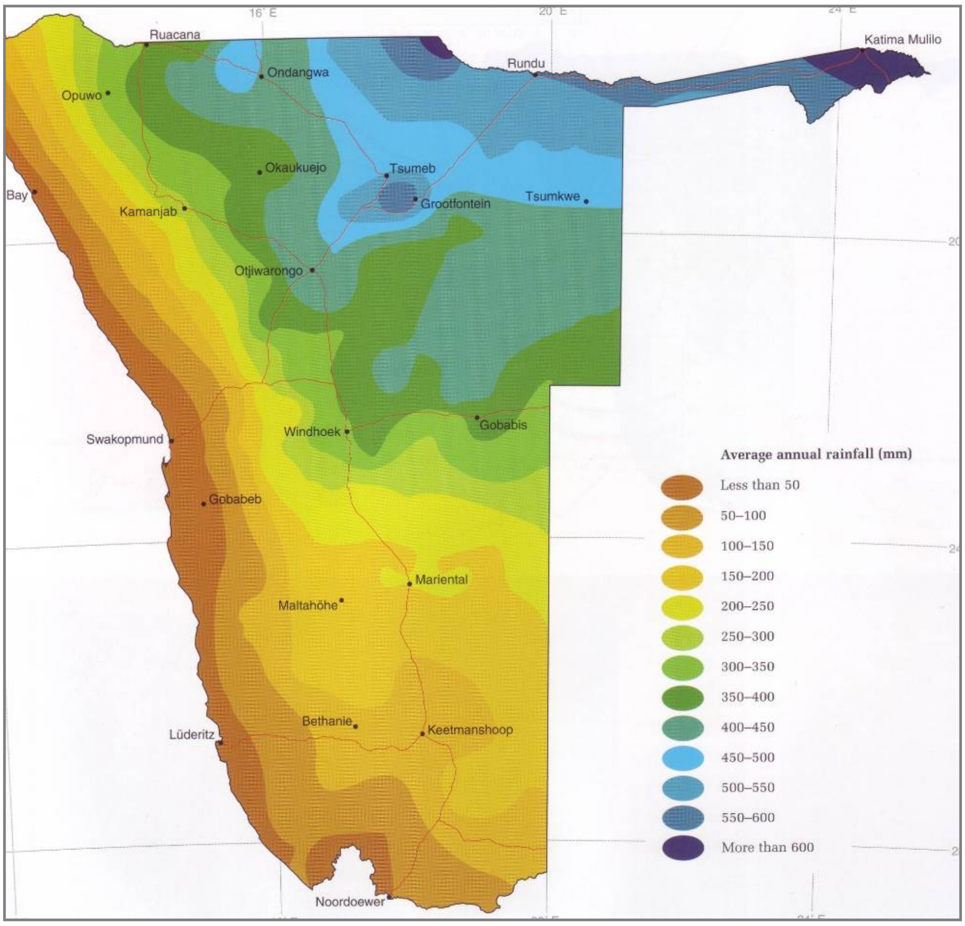

Figure 4.3: Average annual rainfall in Namibia
(Source: Mendelsohn, Jarvis, Roberts and Robertson, 2002).

c) Relative humidity

Climatic conditions in Namibia are also influenced by a steep humidity gradient from about 55% humidity at the coast to less than 10% inland during the least humid month and from more than 90% humidity at the coast to 50% inland during the most humid month.

Relative humidity along the new proposed transmission line will range from about 55% humidity at the coast to about 40% humidity at the Dolorite Tee-off during the least humid month. The relative humidity during the most humid month will remain relatively constant along the proposed line, ranging from about 90% humidity at the coast to 85% at the Dolorite Tee-off.

d) Surface Wind

The presence of the subtropical South Atlantic Anticylcone (SAA) off the coast of Namibia strongly influences the wind pattern, generating gale force winds along the coast in all seasons, but being most frequent during mid-summer and spring. Although their strength decreases inland, their effect is noticeable for distances of up to 200 km from the coast. These strong coastal south-westerly winds carry sand inshore from the coast to the Namib Sand Sea and create upwelling cells which allow nutrient-rich water to be brought to the surface, therefore increasing fish resources.

Occasional hot, dry and powerful easterly wind during winter (or *Berg Wind*) causes large quantities of dust and sand to be blown offshore, affecting sediment input into the coastal marine environment. These powerful offshore winds can exceed 50 km/h, producing sandstorms that considerably reduce visibility at sea and on land (*Figure 4.6*). Although they occur intermittently for about a week at a time, they have a strong effect on the coastal temperatures, which often exceed 30°C during 'berg' wind periods.

At the coast, the prevailing wind is southerly to south south-westerly[1] with speeds reaching 10m/s, while the predominant wind inland is north-easterly to easterly with speeds reaching approximately 3 m/s (refer to *Figure 4.5*). The coastal south-westerly winds bring cool, moist air into the coastal region, and play an important role in the loss of sediment from beaches.

[1] Direction from which wind blows

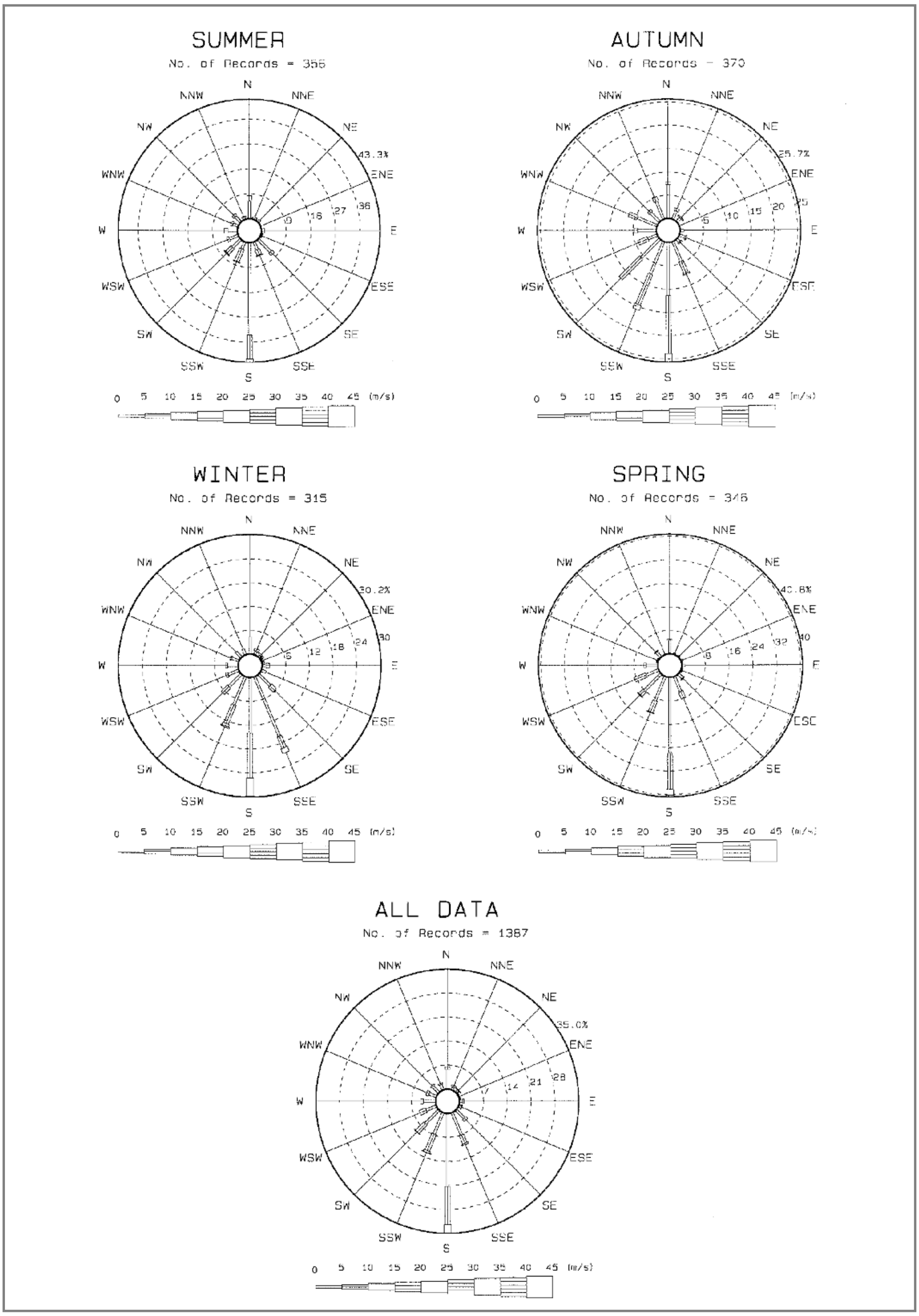

Figure 4.4: Seasonal wind roses for the offshore area near Swakopmund (22°-22.9°S; 14°-14.7°E recorded from 21 March 1960 to 27 December 2008).
(Source: Voluntary Observing Ship (VOS) data from the Southern Africa Data Centre for Oceanography (SADCO)).

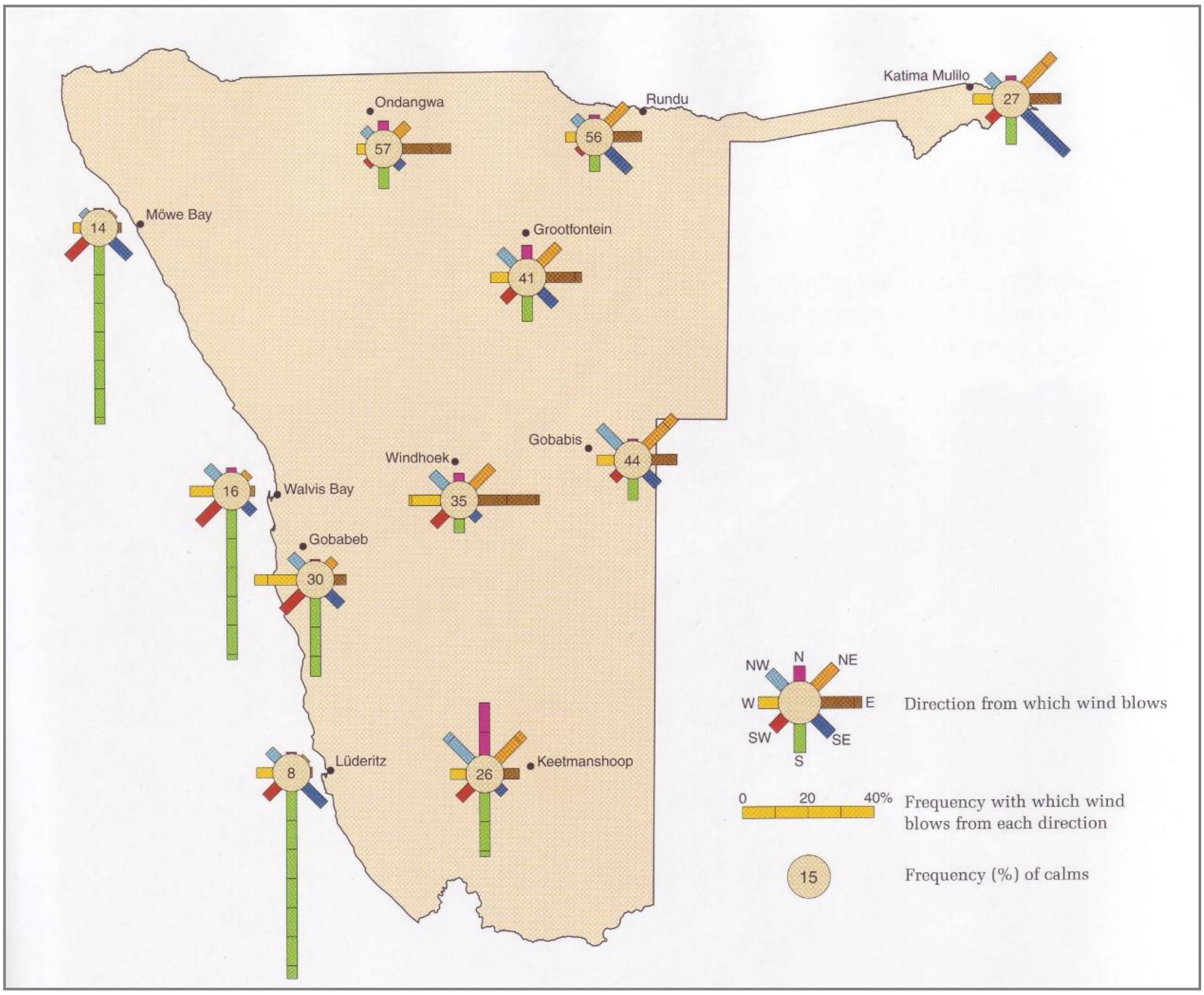

Figure 4.5: Wind directions and associated frequencies
(Source: Mendelsohn, Jarvis, Roberts and Robertson, 2002).

Figure 4.6: Berg winds along the west coast of Namibia carrying aerosol plumes of sand far offshore
(Source: Mendelsohn, Jarvis, Roberts and Robertson, 2002).

e) Fog

Fog is the most distinct feature of the coastal climate in Namibia, with an average of more than 125 days of fog per year in the vicinity of Swakopmund (*Figure 4.7*). Fog usually forms when moist maritime air is advected over cold upwelled water adjacent to the coast. It is therefore more frequent at the coast, but its effect can be felt for distances of more than 100 km to the interior. Fog precipitation often exceeds rainfall and is considerably more reliable, with an average of about 34 mm/year at the coast, in the Central Namib. The amount of fog precipitation rises from the coast to about 40 km inland, from where it decreases further inland.

Within 15 to 20 nautical mile zone offshore, fog frequency may be as high or even higher than at the coastal stations. This fog is usually quite dense and appears as a thick bank hugging the shore. However, it is often patchy further seawards, with clear areas indicating warmer water. The presence of sea fog is influenced by the spatial extent of the upwelling filaments and plumes. These may be extensive, often exceeding 200 km in length.

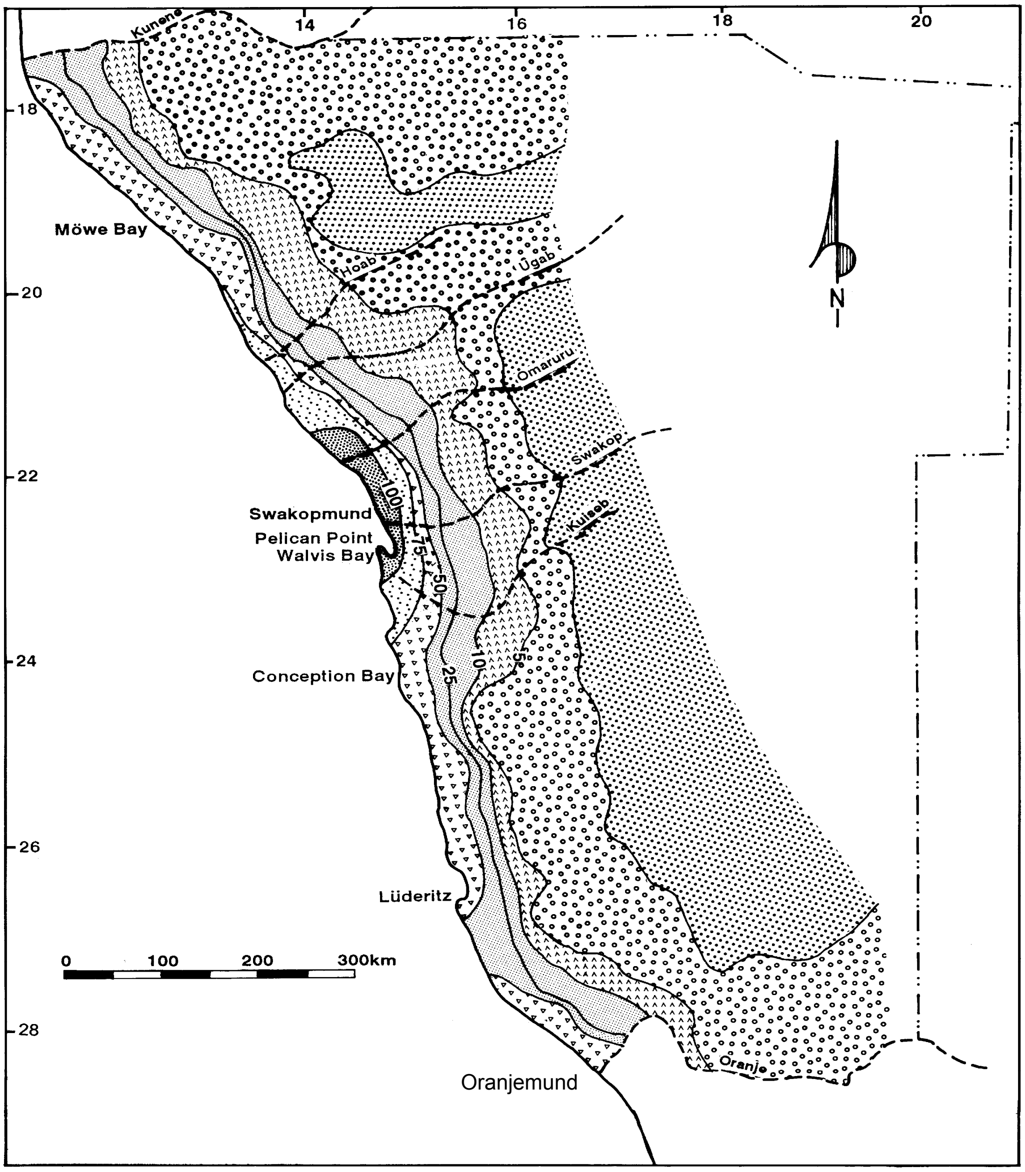

Figure 4.7: 1984 Fog day frequency using Meteosat Images
(Source: Olivier, 1992 and 1995).
Note: Contours indicate iso-lines (days) of fog occurrence.

f) Sunshine and cloudiness

Low stratus and stratocumulus clouds are often formed during the early morning hours when onshore breezes blow over the upwelling zone. These clouds may be advected inland, intersecting the rising land to produce fog. The amount of cloud cover is thus highest at night but decreases consistently throughout the day.

Given the greater level of cloud-cover and fog along the coast, the amount of sunshine is generally lower than inland regions which receive more sunshine than anywhere else. Since the rainy season is confined to the summer months, the amount of cloudiness peaks during that season, i.e. from September to April.

4.2.2 Landscape

The study area is located on the Namib Central-western plains (*Figure 4.8*) which stretch from the coast inland for about 450 km in places. The plains were largely formed by erosion cutting back into higher ground and carving out the catchment areas of several major rivers. The peneplain is dissected by numerous dry riverbeds, draining towards the coast.

The relief at the coast is very gentle, and the land slopes gradually upwards towards the east, with dolerite ridges along the transmission line route providing some positive relief. The area in the vicinity of the proposed desalination plant is generally flat, with few topographic features as depicted in *Figure 4.9*.

The coastline of central Namibia is dominated by sandy beaches, with rocky habitats being represented only by occasional small rocky outcrops. The largest dune seas occur in the central Namib south of Walvis Bay, but for approximately 250 km north of Swakopmund, the coastal area is relatively free of dunes. The coastal strip around Swakopmund is covered by a 2-3 m thick layer of very loose, medium to fine grained sea sand, which stretches for approximately 200 m inland. Only in the vicinity of Henties Bay is the shore backed by low sandy cliffs. The seabed at the northern end of the proposed location for the desalination plant is characterised by an extensive area of gravel. In the intertidal and low-shore areas, sediments become coarser and are generally dominated by moderately to well-sorted gravelly sand and fine sandy gravels with mean particle sizes of 600-1700 μm.

Namibia is a hyper-arid country, with only 4 km^3 of surface water produced internally, and a groundwater recharge of 2 km^3 (World Resources Institute). There are no perennial westward-flowing rivers in the study area. The central portion of Namibia is drained by a number of westward flowing ephemeral rivers that occasionally reach the sea when they flood after heavy rains in the interior. The main rivers draining the surroundings of the study area are the Omaruru, Swakop (of which the Khan River is a tributary) and the Kuiseb River (*Figure 4.10*). These rivers, though only flowing occasionally, are very important ecologically as they support a diverse biota that depends on the groundwater associated with the river course.

The closest major, non perennial river to the proposed desalination plant, is the Swakop River, located directly south of the Swakopmund municipal boundaries. A dried-up catchment run-off channel was observed reaching down to the coast in the middle of the proposed location for the desalination plant. Anecdotal evidence suggest that during flash floods the river can swell to 100 m wide, but that such floods only happen every 20 to 30 years (J. de Kock, Civil Construction Division, NamWater). A number of minor, non-perennial drainage channels are located in the vicinity of the proposed site and power line.

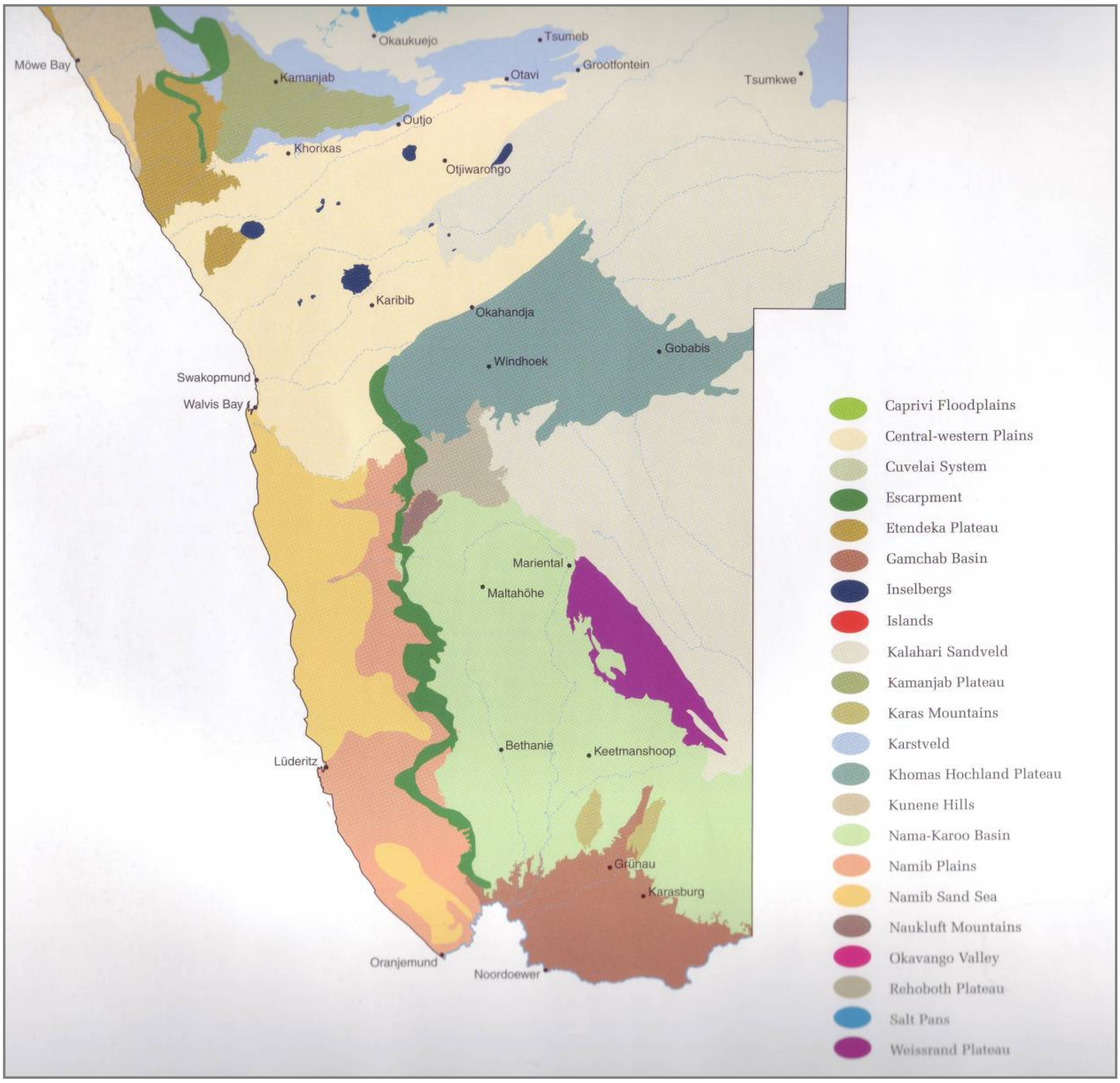

Figure 4.8: Landscape in Namibia
(Source: Mendelsohn, Jarvis, Roberts and Robertson, 2002).

Figure 4.9: Topography at desalination site (left) and the dolerite ridges (right)

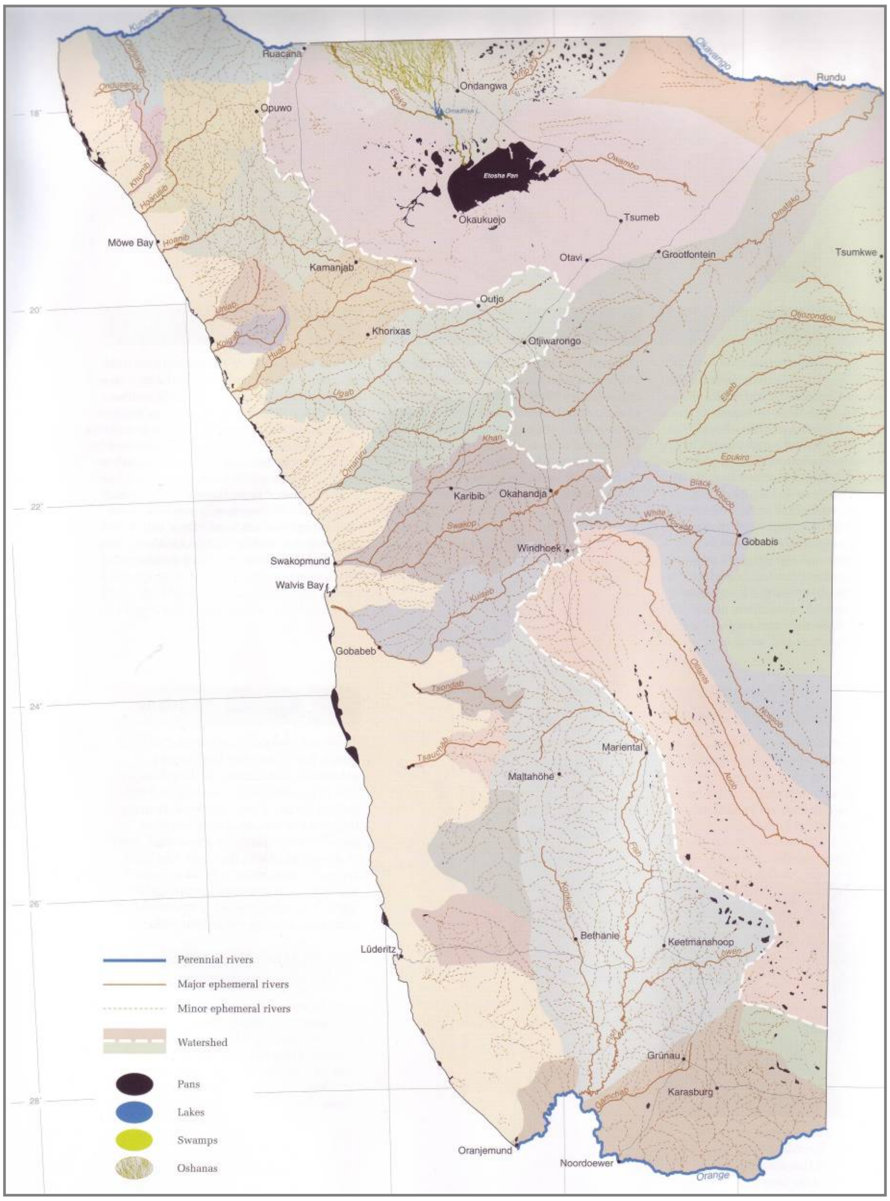

Figure 4.10: Perspective of all surface waters in Namibia (*Source: Mendelsohn, Jarvis, Roberts and Robertson, 2002*).

4.2.3 Geology

The study area is underlain by schist (with granitic intrusions) of the Swakop group which forms part of the Damara Supergroup and Gariep Complex, a group of rocks laid down approximately 850-600 millions years ago. In this area, much of the geology is exposed, because the harsh climate limits soil development and vegetation growth. Extensive gypsum and calcrete deposits have developed where the relief is low. Gypsum plains are found within 60 km of the coast, coinciding with the zone of regular occurrence of fog. Calcrete crusts are a feature of the soils further inland in the eastern part of the central Namib and pro-Namib and represent a moister period of *in situ* formation of calcrete and calcareous soil.

Groundwater reserves in the vicinity of the study area are limited to the Kuiseb and Omaruru alluvial bed aquifers, which supply Henties Bay, Swakopmund and Walvis Bay as well as Arandis, Rössing and Langer Heinrich Mines. These aquifers are situated within the alluvial beds of the Kuiseb and Omaruru rivers (*Figure 4.11*). A groundwater study undertaken for another proposed desalination plant project at Wlotzkasbaken, ca. 30 km north of Swakopmund, detected no freshwater table at the beach, although seawater penetrated inland to at least 500 m from the high water mark at a depth of 1.5 m.

4.2.4 Physical and Biological Oceanography

Along much of the coastline, there is a prominent berm on the upper beach. From the berm, the beach slopes steeply to the low water mark. At 1-2 m depth the slope flattens and the sand is replaced by gently sloping, low-relief rocky seabed. This extends approximately 400 m offshore to about the 5 m isobath (depth contour). Between the 5 m and 10 m depth contours, the seabed is characterised by low-relief rock outcrops interspersed by depressions of fine to medium sand. The sandy areas, which have a maximum thickness of 2.6 m, are underlain by bedrock. Seaward of the 10 m depth contour, the seabed is dominated by a gently sloping flat featureless sandy area.

Figure 4.11/...

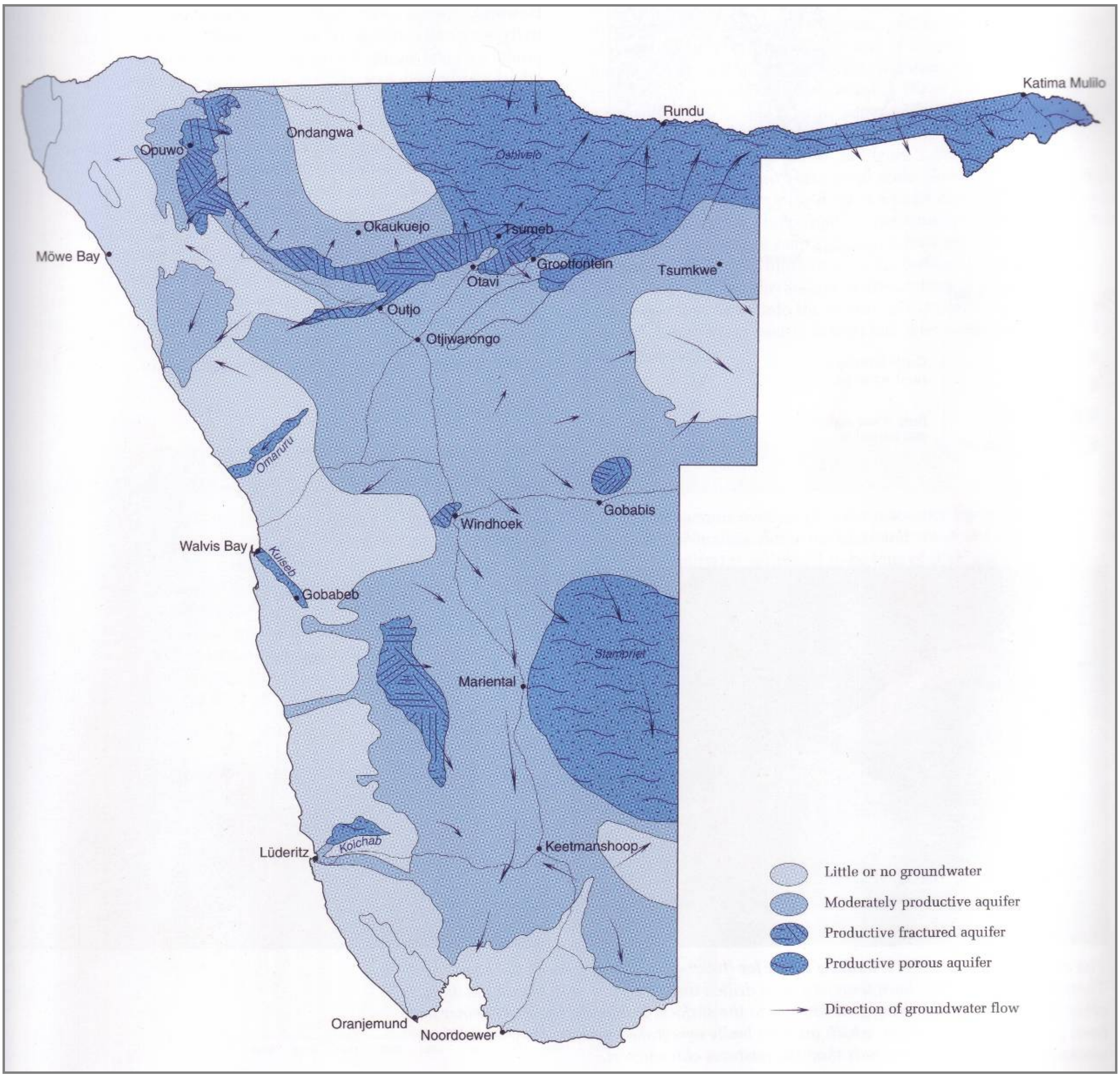

Figure 4.11: Perspective of all surface waters in Namibia
(Source: Mendelsohn, Jarvis, Roberts and Robertson, 2002).

Further offshore to beyond the 100-m depth contour, the seabed is dominated by a tongue of sandy mud, which extends from south of Sandwich Harbour to the north past Henties Bay (*Figure 4.12*).

Red tides (dinoflagellate and/or ciliate blooms), also referred to as Harmful Algal Blooms (HABs), low oxygen events and sulphur eruptions occur periodically in the Benguela system, with potentially catastrophic effects on the ecology of the system. The sulphur eruption events (*Figure 4.13*) are associated with the generation of toxic hydrogen sulphide and methane within the organically-rich, anoxic muds (biogenic muds) following decay of extensive algal blooms.

The major feature of the Benguela system is upwelling and the consequent high nutrient supply to surface waters leading to high biological production and large fish stocks. *Figure 4.14* shows a small upwelling cell in the vicinity of Swakopmund.

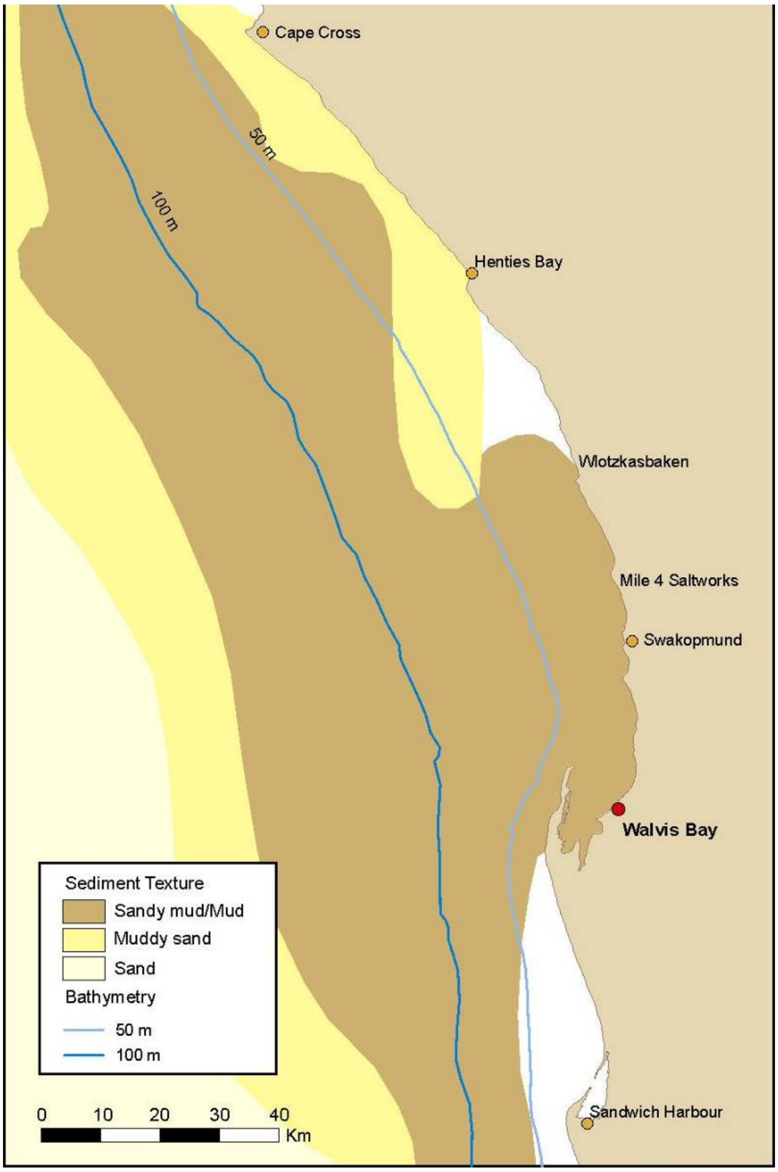

Figure 4.12: Seabed sediments in the study area.

Figure 4.13: Satellite image showing discoloured water offshore the Namib Desert resulting from a nearshore sulphur eruption (satellite image source: www.intute.ac.uk). Inset shows a photograph taken from shore at Sylvia Hill, north of Lüderitz, during such an event in March 2002 (photograph by J. Kemper, MFMR, Lüderitz).

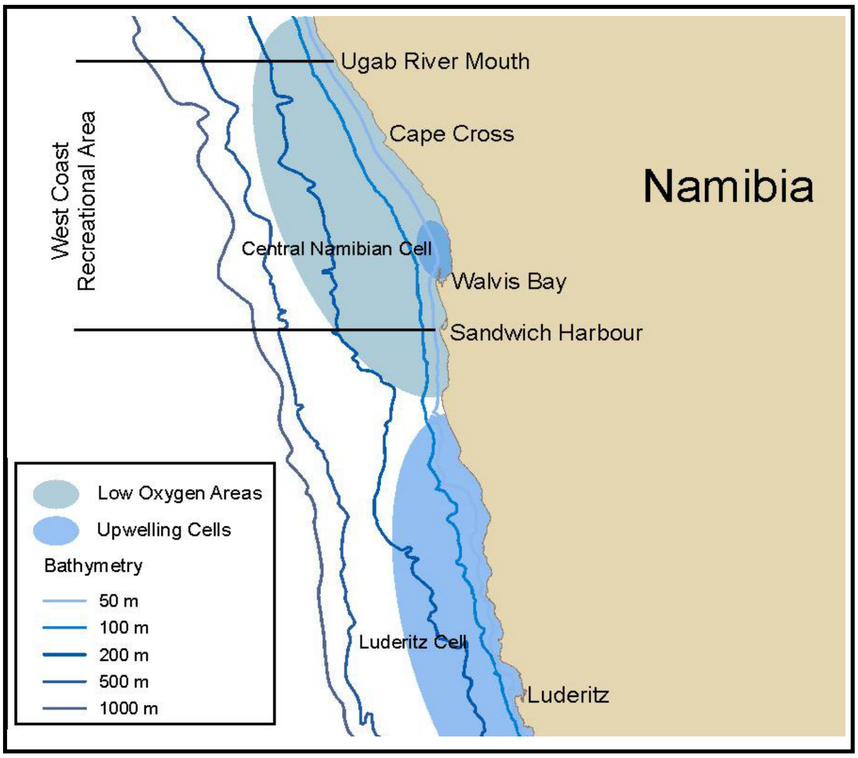

Figure 4.14: Map of the Namibian coastline showing the positions of the upwelling cells and the formation zones of low oxygen water *(Source: Shannon, 1985).*

a) Waves

The central Namibian coastline is influenced by major swells generated in the Roaring Forties, as well as significant sea waves generated locally by the persistent south-westerly winds. Apart from Walvis Bay and Swakopmund wave shelter, in the form of west to north-facing embayments and coasts lying in the lee of headlands, is extremely limited.

No measured wave data are available for the Swakopmund - Henties Bay area. However, data collected by Voluntary Observing Ships (*Figure 4.15*) indicate that wave heights in the range of 1.5 m to 2.5 m occur most frequently, with a mean wave height of 2.14 m and mean wave periods in the range of 8 s to 13 s. Longer period swells with mean periods of 11 s to 15 s generated by mid-latitude cyclones occur about 30% of the time. Wind-induced waves on the other hand have shorter periods (~8 seconds) and are generally steeper than the swells. Storms occur frequently with significant wave heights over 3 m occurring 10% of the time.

The annual distribution indicates that 43% of the waves come from the south with 30% and 12% coming from the SSW and SW respectively. These values are based on a fairly limited number of observations (583) but it is well accepted that the majority of waves are coming from the SW to S sectors.

b) Tides

In common with the rest of the southern African coast, tides in the study area are regular and semi-diurnal. The maximum tidal range is approximately 2 m, with a typical tidal range of approximately 1 m. Variations in the absolute water level as a result of meteorological conditions such as wind and waves can, however, occur adjacent to the shoreline and differences of up to 0.5 m in level from the tidal predictions are not uncommon. Tidal currents are minimal with measurements of 0.1 m/s reported at Walvis Bay. *Table 4.1* lists mean tidal levels for Walvis Bay.

Table 4.1: Tide statistics for Walvis Bay from the SA Tide Tables (SAN 2007). All levels are referenced to Chart Datum.

Description		***Level in m***
Highest Astronomical Tide	*HAT*	*+1.97*
Mean High Water of Spring Tide	*MHWS*	*+1.69*
Mean High Water of Neap Tide	*MHWN*	*+1.29*
Mean Level	*ML*	*+0.98*
Mean Sea Level	*MSL*	*+0.966*
Mean Low Water of Neap Tide	*MLWN*	*+0.67*
Mean Low Water of Spring Tide	*MLWS*	*+0.27*
Lowest Astronomical Tide	*LAT*	*0.00*

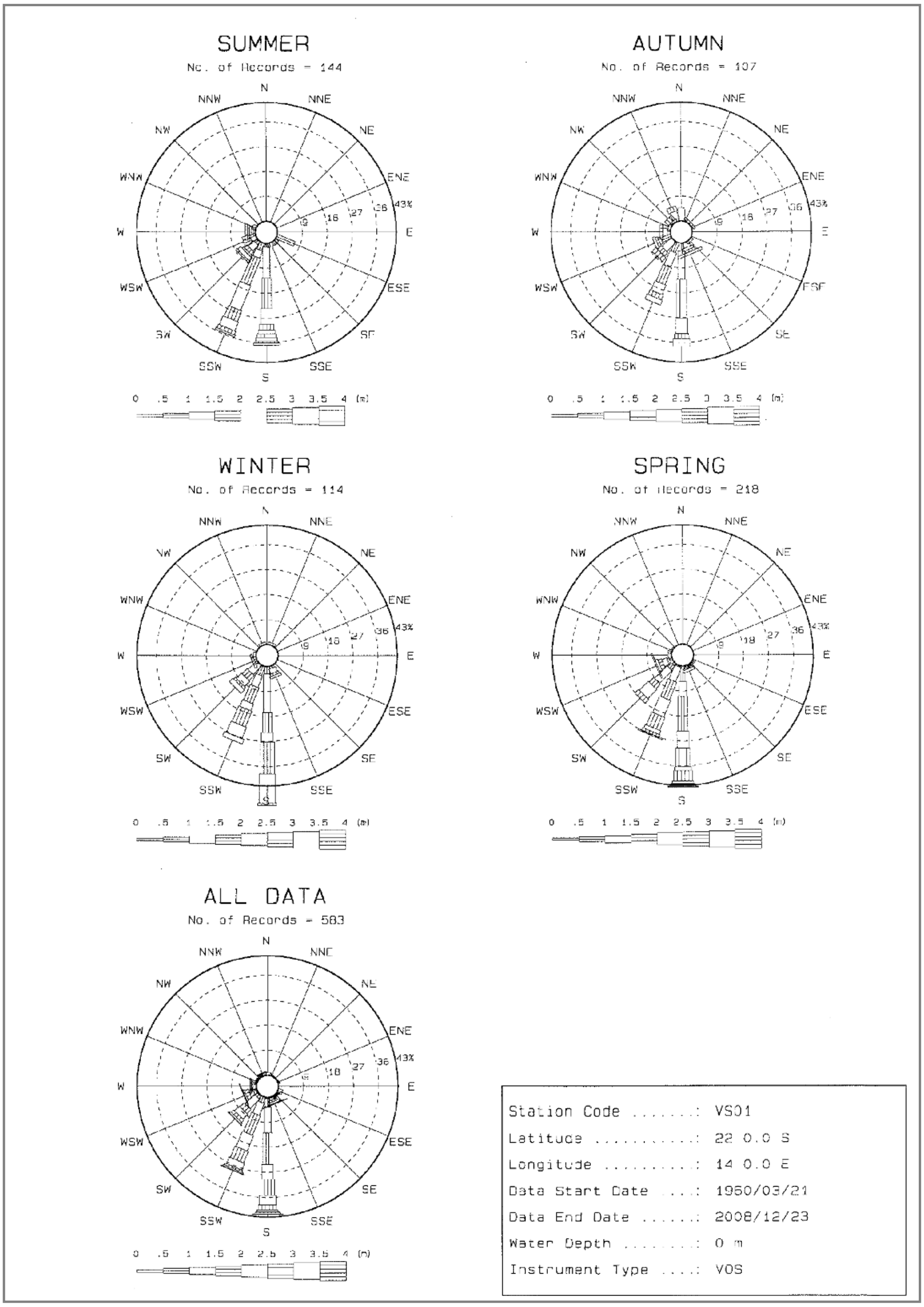

Figure 4.15: Seasonal wave roses for the Swakopmund Area (22°-23°S; 14°-15°E recorded during the period 21 March 1960 and 23 December 2008).

(Source: Voluntary Observing Ship (VOS) data from the Southern Africa Data Centre for Oceanography (SADCO))

c) Coastal Currents

Current velocities in continental shelf areas of the Benguela region range generally between 10 and 30 cm/s. The flows are predominantly wind-forced, barotropic and fluctuate between poleward and equatorward flow. Fluctuation periods of these flows are 3 to 10 days, although the long-term mean current residual, i.e. net flow, is in an approximate NW (alongshore) direction. Currents in the nearshore environment along the coastline of the study area have not been well studied, but some surface-current measurements were done at Swakopmund between 1971 and 1972. Surface currents in the area appear to be quite variable, with flows primarily <30 cm/s and an average velocity of 14 cm/s. Current speeds in reverse flows observed between Walvis Bay and Henties Bay range between 2 and 17 cm/s. Near bottom, shelf flow is mainly poleward with low velocities of typically 5 cm/s.

d) Surf-zone Currents

Typically wave-driven flows dominate in the surf-zone (characteristically 150 m to 250 m wide), with the influence of waves on currents extending out to the base of the wave effect (~40 m). The influence of wave-driven flows extends beyond the surf-zone in the form of rip currents. Longshore currents are driven by the momentum flux of shoaling waves approaching the shoreline at an angle, while cross-shelf currents are driven by the shoaling waves. The magnitude of these currents is determined primarily by wave height, wave period, angle of incidence of the wave at the coast and the bathymetry. Surf-zone currents have the ability to transport unconsolidated sediments along the coast in the littoral drift which, in the study area, flows northwards.

Nearshore velocities have not been reported and are difficult to estimate because of acceleration features such as surf-zone rips and sandbanks. However, computational model estimates using nearshore profiles and wave conditions representative of this coastal region suggest time-averaged northerly longshore flows with a cross-shore mean of between 0.2 to 0.5 m/s. Instantaneous measurements of cross-shore averaged longshore velocities are often much larger. Surf-zone-averaged longshore velocities in other exposed coastal regions commonly peak at between 1.0 m/s to 1.5 m/s, with extremes exceeding 2 m/s for high wave conditions. The southerly longshore flows are considered to remain below 0.5 m/s.

4.2.5 Marine Ecology

This section provides a brief overview of the marine and coastal environment in the vicinity of the proposed Desalination plant. The reader is referred to the Marine Specialist Study (to be included in the EIA report) for a detailed discussion of the area.

Biogeographically the central Namibian marine and coastal environment falls into the warm-temperate Namib Province, which extends northwards from Lüderitz into southern Angola. The wind-induced upwelling characterising the Namibian coastline is the principal physical process which shapes the marine ecology of the central Benguela region. The harsh aridity of the Namib coastline contrasts with the rich productive marine environment offshore.

The coastline of central Namibia is dominated by sandy beaches, with rocky habitats being represented only by occasional small rocky outcrops. 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 West 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 biological communities 'typical' of each of these habitats are described briefly below, focussing both on dominant, commercially important and conspicuous species, as well as potentially threatened or sensitive species, which may be affected by the proposed project.

a) Sandy Substrate Habitats and Biota

Intertidal Sandy Beaches

Sandy beaches are one of the most dynamic coastal environments. The composition of their faunal communities is largely dependent on the interaction of wave energy, beach slope and sand particle size.

Most beaches on the central Namibian coastline, i.e. between Swakopmund and Henties Bay, are open ocean beaches receiving continuous wave action. The beaches tend to be characterised by well-developed berms, and are well-drained and oxygenated.

The surf-zone in the study area is rich in phytoplankton (primarily dinoflagellates and diatoms) and zooplankton, and particulate organic matter is commonly deposited on the beaches as foam and scum. The organic matter, both in suspension and deposited on the sand, is thought to represent the main food input into these beaches, thereby accounting for the dominance of filter-feeders, such as mussels, in the macrofaunal biomass.

Most of the macrofaunal species recorded from beaches in central Namibia are ubiquitous throughout the biogeographic province, and no rare or endangered species are known. The beaches are characterised by a relatively depauparate invertebrate fauna, both with regard to species diversity and biomass, which is typical of high-energy west coast beaches.

Subtidal Sandy Habitats

The structure and composition of benthic soft bottom communities is primarily a function of water depth and sediment grain size, but other factors such as current velocity, organic content, and food abundance also play a role.

b) Rocky Habitats and Biota

Intertidal Rocky Shores

In common with most semi-exposed to exposed coastlines on the southern African west coast, the rocky shores in the region are strongly influenced by sediments, and include considerable amounts of sand intermixed with the benthic biota which is characterised by seaweeds, mussels and limpets (*Figure 4.16*). In the study area, mixed shores are limited to very few small low-shore outcrops that are exposed only at low water spring, which alternate with long stretches of sandy beaches.

The intertidal area of rocky shores can be divided into different zones according to height on the shore. Each zone is distinguishable by its different biological communities, which is largely a result of the different exposure times to air. The degree of wave action is particularly important on the low shore. Generally, biomass is greater on exposed shores, which are dominated by filter-feeders. Sheltered shores support a lower biomass, and algae form a large portion of this biomass.

Mixed shores incorporate elements of the trophic structures of both rocky and sandy shores. As fluctuations in the degree of sand coverage are common, the fauna and flora of mixed shores are generally impoverished when compared with more homogenous shores. The macrobenthos is characterized by sand-tolerant species whose lower limits on the shore are determined by their abilities to withstand physical smothering by sand. As part of a natural sedimentary cycle, these outcrops are subject to gradual accumulation of sand deposits during summer, and subsequent erosion during winter.

Although not directly harbouring any rare faunal or floral species, the rocky intertidal shores are food-rich habitats for seabirds and shorebirds, attracting higher numbers of birds than the surrounding sandy beaches.

Rocky Subtidal Reefs

Information on the rocky subtidal habitats in central Namibia is lacking. No scientific surveys have been undertaken of rocky subtidal habitats in the study area, and no information exists on the faunal and floral communities.

Figure 4.16: Rocky outcrop in the study area backed by sandy beach (top), and large *Perna perna* (bottom left) and a diversity of red foliose algae (bottom right) low at the shore.

c) Pelagic Communities

Besides the plankton, pelagic communities comprise large invertebrates (squid), fishes, mammals (seals, dolphins and whales) and turtles. Pelagic seabirds also form an important component of the Benguela Current Pelagic ecosystem.

Plankton

Plankton is particularly abundant in the shelf waters off Namibia, being associated with the upwelling characteristic of the area. Plankton range from single-celled bacteria to jellyfish of 2-m diameter, and include bacterio-plankton, phytoplankton, zooplankton, and ichthyoplankton. Off the Namibian coastline, the phytoplankton is dominated by diatoms, which are adapted to the turbulent sea conditions. Diatom blooms occur after upwelling events, whereas dinoflagellates are more common in blooms that occur during quiescent periods, since they can grow rapidly at low nutrient concentrations.

Namibian zooplankton has a relatively low diversity. The mesozooplankton (<2 mm body width) includs egg, larval, juvenile and adult stages of copepods, cladocerans, euphausiids, decapods, chaetognaths, hydromedusae and salps, as well as protozoans and meroplankton larvae. Copepods are the most dominant group making up 70–85% of the zooplankton. The zooplankton biomass appears to closely follow the changes in upwelling intensity and phytoplankton standing crop.

Ichthyoplankton constitutes the eggs and larvae of fish. As the preferred spawning grounds of numerous commercially exploited fish species are located off central and northern Namibia, their eggs and larvae form an important contribution to the ichthyoplankton in the region.

Fish

Small pelagic species that may occur in the area include the sardine/pilchard (*Sardinops sagax*), juvenile horse mackerel (*Sadinops ocellatus*), anchovy (*Engraulis capensis*), and round herring (*Etrumeus whiteheadi*). Linefish species common off the central Namibian coastline include snoek (*Thyrsites atun*), silver kob (*Argyrosomus inodorus*), West Coast Steenbras (*Lithognathus aureti*), blacktail (*Diplodus sargus*), white stumpnose (*Rhabdosargus globiceps*), Hottentot (*Pachymetopon blochii*) and galjoen (*Dichistius capensis*). Dusky kob (*Argyrosomus coronus*) also occurs off northern Namibia.

Marine Mammals

Marine mammals occurring off the central Namibian coastline include 35 species of whales and dolphins, including the endemic Heaviside's Dolphin (*Cephalorhynchus heavisidii*), and the Cape fur seal (*Arctocephalus pusillus pusillus*). On the central Namibian coast, Cape fur seals occur at two main breeding sites on the mainland and on nearshore islands and reefs. The mainland colony at Cape Cross is currently the largest in Namibia with an estimated 247 277. A further colony of approximately 16 454 individuals exists on Hollam's Bird Island south of Sandwich Harbour (Kirkman SP, Oosthuizen WH, 2007). The Pelican Point (Walvis Bay) colony was a non-breeding haul-out locality, but co-incident with the northwards shift in the Namibian seal population in the past decade, Pelican Point has become a breeding colony with an estimated 6 392 individuals.

Turtles

Five of the eight species of turtle worldwide occur off Namibia. Turtles that are occasionally sighted in the study area, include the Leatherback Turtle (*Dermochelys coriacea*), the largest living marine reptile. Leatherback Turtles are known to frequent the cold southern ocean and are often recorded off the southern African west coast. Although they tend to avoid nearshore areas, they may be encountered in Walvis Bay and off Swakopmund between October and April when prevailing north wind conditions result in elevated seawater temperatures. Observations of Green (*Chelonia mydas*), Loggerhead (*Caretta caretta*), Hawksbill (*Eretmochelys imbricata*) and Olive Ridley (*Lepidochelys olivacea*) turtles in the area are rare.

4.2.6 Terrestrial Ecology

The biodiversity of the Namibian coastline, specifically the Erongo and Kunene regions, is recognised to be of global significance with unique landscapes, fauna and flora. The coastline contains many endemic animals, breeding bird colonies, specialised fog-dependent lichens & vegetation and succulent flora. The priority areas of significance close to the proposed desalination plant development zone are:

a) The Lichen fields of the Central Namib.
b) South of Wlotzkasbaken is an important breeding zone for the Damara Tern, spreading southward to approximately Mile 8. The small number of birds (up to 14 pairs) breeding in the vicinity of Mile 6 do so mainly to the east of the C34 highway, up to 4 km inland.
c) Mile 4 salt works is a wetland of global importance and a recognized Important Bird Area. IBAs are sites that provide essential habitat for one or more species of bird and include sites for breeding, wintering, and/or migrating birds. To qualify as an IBA, sites must support at least one of the following:

   - Species of conservation concern (e.g. threatened and endangered species)
   - Restricted-ranges species (species vulnerable because they are not widely distributed)
   - Species that are vulnerable because their populations are concentrated in one general habitat type or biome
   - Species, or groups of similar species (such as waterfowl or shorebirds), that are vulnerable because they occur at high densities due to their congregatory behaviour.

a) Terrestrial fauna and flora

The proposed site of the desalination plant has been highly disturbed by developments, such as the salt works to the south and also by off road driving which is evident on the site. The site is dominated by sandy soils which are highly vulnerable to disturbance. A small percentage of the site is covered by plants.

The 44 m wide power line servitude will be located within a 1.4 km wide strip which is being assessed and which is mainly dominated by low lying areas with low biodiversity and dolerite ridges with relevant high biodiversity. This area consists of sporadic lichens (depicted in *Figure 4.17*) and succulents such as *Hoodia* (*Hoodia* is currently listed in Appendix II to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), which includes species not currently considered endangered, but are at risk if trade is not controlled). The lichen fields (*Figure 4.18*) between Wlotzkasbaken and Mile 8 are of global biodiversity significance and will not be impacted by the proposed power line route.

Along the transmission line route, gemsbok (*Oryx gazelle*) and springbok (*Antidorcas marsupialis*) are evident.

Most of the macrofaunal species recorded from beaches in Central Namibia are ubiquitous throughout the biogeographic province, and no rare or endangered species are known.

Figure 4.17: Photo to the left: dolerites in the vicinity of the proposed power route line (photo taken in the direction of Wlotzkasbaken) and photo to the right: Lichens on the dolerites.

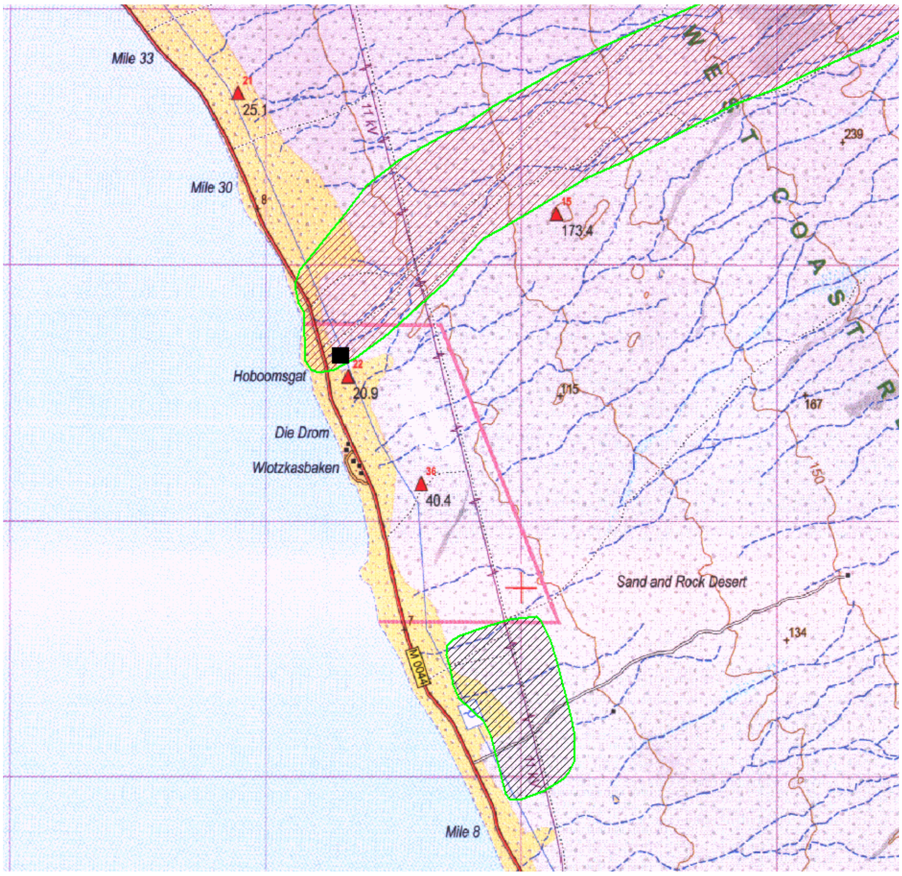

Figure 4.18: Lichen Fields near Wlotzkasbaken (Source: Extract from Walvis Bay 2246 Topographic Map).

b) Avifauna

Around 1.6 million birds, belonging to 73 species, regularly occur along the coastline of Namibia. Up to 770 birds per km of beach occur on the coastline between Swakopmund and Walvis Bay. The coast north of the saltworks (Mile 4) supports a number of resident and migrant sea- and shore-birds, but is much less important than the coast between Walvis Bay and Swakopmund (NA012), the Swakopmund Saltworks (NA011) and Cape Cross (NA009), which are recognized as Important Bird Areas (IBAs).

Cape Cormorants breed on the guano platform at Walvis Bay and in the saltworks at Swakopmund and Cape Cross. At times groups of non-breeding, Cape Cormorants roost on the beaches north of the Swakopmund Saltworks. Similarly migrant Common, Arctic, Sandwich and Black terns may roost on the beach, particularly when the sea is too rough for foraging. Of greatest concern are the nesting sites of the Southern African endemic Damara Tern (*Figure 4.19*), although the area around the proposed Desalination Plant currently holds only a few breeding pairs. Palaearctic migrant shorebirds (waders) such as Grey Plovers, Whimbrels and Sanderlings feed opportunistically in the swash zone and Turnstones forage on the limited areas of rocky shore.

The study area is subject to intense recreational activity and the backshore area is a maze of vehicle tracks. The proposed desalination plant site is therefore highly degraded due to off road driving. Consequently roosting and feeding birds are frequently disturbed, thus limiting its value to sea- and shore-birds in the area. The Great White Pelican has adapted to human activity in the area, particularly angling, and individuals often attend anglers in the expectation of being fed the offal from gutted fish.

Figure 4.19: Damara Tern

4.3 HERITAGE RESOURCES

No information and palaeontological and historical site in the study area could be obtained. Dr John Kinahan presented a letter indicating that the desalination site does not warrant an archaeological investigation. However, an archaeological investigation will be done for the proposed power line route. Should middens or other historical artefacts be discovered during construction, appropriate specialists will investigate and record them before construction proceeds further.

4.4 SOCIO-ECONOMIC

This section provides a brief introduction on the socio-economic characteristics of the Erongo Region for scoping purposes. Substantial desk studies and information gathering for the detailed review of the receiving socio-economic environment for the desalination plant is in progress. The aim is to identify social and economic trends and anticipate the potential impacts of the proposed project on the overall well-being of the region's population in general and the coastal towns in particular.

The Erongo Region is one of the most affluent regions in Namibia. Based on the food consumption ratio, which uses the share of food consumption in a household as a proportion of total consumption as a crude poverty measure, only 0.4% of households in the Erongo Region spend more than 80% of their income on food while 5.3% of households spend 60 – 79% of their income on food. Comparatively, 0.6% of households in the Khomas Region spend more than 80% of their income on food while 3% of households spend between 60 and 79% of their income from food. In the neighbouring Kunene Region, 11.2% of households spend more than 80% of income on food while 25.7% spend between 60 and 79% on food.

The adjusted per capita income (adjusted for household composition) in the Khomas Region is the highest in the country and set at N$ 25 427 per annum, while Erongo has the second highest per capita income of N$ 16 819 per annum. (NPC, 2006:105)

4.4.1 Demographic Characteristics

In 1991 the Erongo region accommodated a population of 55 470 people. This increased to 107 663 in 2001, partly due to the inclusion of Walvis Bay into Namibia and to migration to the coastal towns. Excluding the figures for Walvis Bay, the regional population grew from 55 470 to 79 722, at an annual rate of some 3.7%. If this is compared to the national growth rate of 2.6%, and a fertility rate that is lower than the national average, the high rate of population growth in the region should clearly be contributed to in-migration to the main coastal towns. The mining development in the Region resulted in an increased in-migration to the coastal towns.

57 616 of the total population are males and 50 040 are female, with a resultant sex ratio of 115 males for every 100 females. The region accommodates a total of 27 496 households with an average household size of 3.8. The average number of children per woman declined from 5.1 in 1991 to 3.2 in 2001. The mortality index declined from 51 per 1000 live births in 1991 to 42 in 2001. Males head 65% of all households in the Erongo region (NPC, 2005:4).

The literacy rate for 15 years and older is 92%, 7% more than the 85% recorded in 1991 and higher than the national average of 81%. (PHC, 2001:4).

In 1991, 63% of the population lived in urban areas and 37 % in rural areas. In 2001, 80% of the population lived in urban settings with only 29% living in the rural area. (PHC, 2001: 4). The Walvis Bay Urban constituency is the most populous with 26% of the total regional population. Arandis and Omaruru constituencies are the least populous. 20% of the population living in the Erongo region was born in other regions. 65% of those are males, indicating the migration of mainly male workers from the other regions to the coast in search of employment (NPC, 2005: 4).

4.4.2 Employment Rates and Poverty

The economy of the region is mainly based on natural resources and is slowly becoming more diversified due to expansion in the mining industry. The largest industry in the region is the fishing industry, mostly based at Walvis Bay. This is also the industry which is least likely to expand due to declining fish stocks and the resultant limitations on the fishing quotas issued by the Ministry of Fisheries and Marine Resources. The second biggest industry is the mining and exploration industry. This industry is in the process of expanding rapidly through the development of a number of uranium mines driven by the demand for uranium on the global market. There are currently two working mines, namely Rössing Uranium and Langer Heinrich with the Trekkopje mine due to become fully functional in 2009. The third biggest income generating activity of the Erongo Region is tourism. In 1998 a total of 45 986 foreign tourists visited the Erongo region while 14 517 Namibians paid a visit to the coastal areas (CZMP, 1999:121). Corresponding figures for 2008 are not yet available.

In 2001, 71% of the population of the region was regarded as "in the labour force", up from 64% in 1991. The 2001 labour force, in turn, is made up of 66% employed and 34% unemployed people. In 1991, 76% was employed and 24% unemployed. This indicates an increase in the proportion of the population inside the labour force who is unemployed and further suggests that not all migrants to the region succeed in finding gainful employment. The proportion of employed females is 58 % compared to 72% for males (NPC, 2005: 6).

Table 4.2: Main source of income for the Erongo Region1991-2001

Main source of income	***% of population for 1991***	***% of population for 2001***
Farming	*3*	*4*
Wages and Salaries	*73*	*67*
Business	*3*	*8*
Other	*21*	*18*

Table 4.2 shows that there was a 6% decrease in wages and salaries as the main source of income, yet a 5% increase in business activities from 1991 to 2001. This indicates that more people in the region are establishing own businesses and that the economy is slowly becoming more diversified (NPC, 2001: 4).

4.4.3 Access to Services

Access to safe water and proper sanitation are two indicators for development and poverty within a region. From 1991 to 2001 there was no increase or decrease of access to safe drinking water (PHC, 2001:4). However, the Regional Poverty profile of the Erongo region of 2005 indicates that 3% of the population has to cover 1 km or more to get water. There are however great disparities between urban and rural areas. One out of 5 households in the rural areas relies on unsafe water for drinking and cooking. From 1991 to 2001, the proportion of the population that did not have access to toilet facilities increased by 11%, showing that access to proper sanitation in the Erongo region is decreasing instead of improving (NPC, 2005: 7). This is most likely due to the inability of local authorities to provide sanitation services to the poor migrants who settle in informal areas and are unable to afford basic township services.

The medical services in the Erongo region is provided by three state hospitals, two private hospitals and 6 health centres (CZMP 1999: 82). In urban areas, 90% of households have their garbage regularly collected, while 1 out of 5 people in rural households dumps their garbage at the roadside (NPC, 2005:7).

4.4.4 Settlement Patterns

80 % of the population of the Erongo region lives in the urban areas and 60% of all households in the Erongo region occupy detached or semi-detached houses. Only 20% of households live in improvised housing (shacks). Detached and semi-detached housing dominate at constituency level, whereas only a small percentage (20%) still reside in traditional houses (NPC, 2005:5).

32 % of housing units in the region are owner occupied without mortgage and 23% reside in housing that is rented but not tied to a job. The same trend is reflected in the urban areas (NPC, 2005:5).

Compared to other regions in the country, relatively little land has been acquired for resettlement purposes. The major reason for this is that the Erongo Region has an arid landscape which is not suitable for resettlement purposes (NPC, 2005:5).

4.5 PLANNING CONTEXT AND SURROUNDING LAND USES

The main urban areas that may be impacted by the desalination plant include the coastal towns of Henties Bay, Wlotzkasbaken, Swakopmund, Langstrand, Walvis Bay and Arandis. With the proposed facility being located at about Mile 6, close to Swakopmund, the brunt of the social impact will most likely be borne by this town. Swakopmund, Henties Bay and Walvis Bay all have long term development plans and the development of the region is guided by a regional development plan which was last prepared in 2007/08 to guide the preparation of the National Development Plan 3 (NDP III). A cursory review of these plans provides no indication that the project or the site selected is likely to interfere with any of these plans. Swakopmund, during the week of 2 – 8 February 2009, briefed its public and stakeholders about the future development plans for the town. According to this briefing, urban growth is projected to take place in an easterly direction. Expansion plans to allow the town to triple in size stop short of the salt works. It is therefore unlikely that the proposed plant will be "in the way" of future development of the town. There may be some noise impacts related to the area marked 8 on the map below (*Figure 4.20*) and this needs to be investigated.

In addition to the long term plans of the various local authorities, the Strategic Environmental Assessment (SEA) for the coastal areas of the Erongo and Kunene Regions made recommendations as to the zoning of the entire coastline. However, these are not yet clarified and the legal status of these zonings is under investigation and will be included in the EIA.

Most of the required information for the social assessment have already been collected and are being processed for the EIA. Additional information has been located and is in the process of being procured.

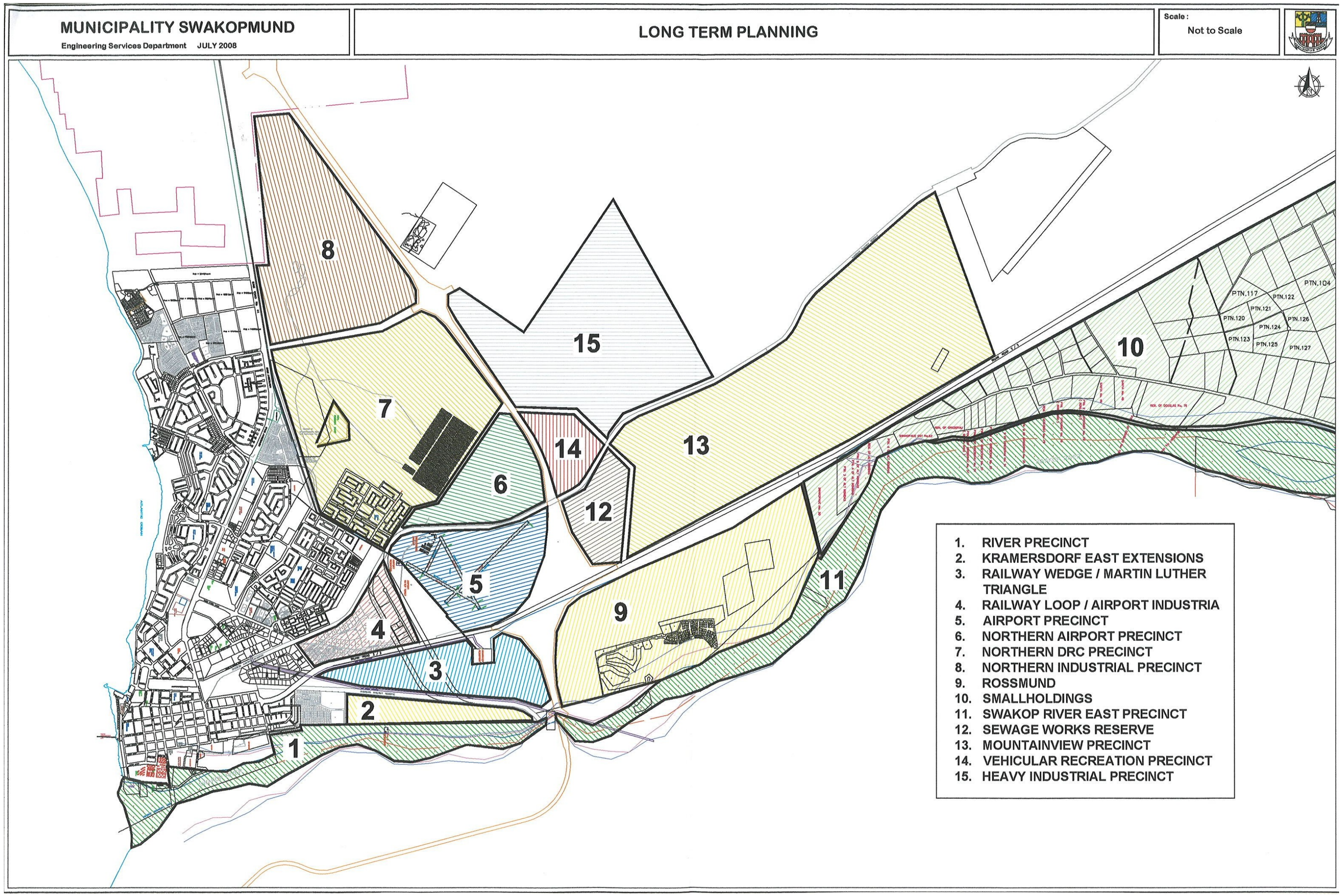

Figure 4.20: Growth Directions for Swakopmund (Source: Municipality Swakopmund, Engineering Services Department, July 2008)

Chapter 5: Approach to the Scoping Process (including Public Participation)

APPROACH TO SCOPING PROCESS

5. APPROACH TO THE SCOPING PROCESS (INCLUDING PUBLIC PARTICIPATION) 5-1

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5. APPROACH TO THE SCOPING PROCESS (including Public Participation)

This chapter presents the EIA process for the proposed development with particular attention to the steps in the Scoping Phase and associated public participation.

The EIA process is a planning, design and decision making tool used to demonstrate to the responsible authority, the Ministry of Environment and Tourism (MET), and the project proponent, NamWater, what the consequences of their decisions will be in biophysical, social, and economic terms. As such it identifies potential impacts (negative and positive) that the project may have on the environment; as well as identifying potential opportunities and constraints the environment may pose for the development. The EIA and EMP make recommendations to avoid or mitigate negative impacts, and to enhance positive benefits associated with the project.

5.1 PRINCIPLES FOR SCOPING AND PUBLIC PARTICIPATION

The public participation process for this Scoping and EIA process is being driven by a stakeholder engagement process that includes inputs from authorities, interested and affected parties (I&APs), technical specialists and the project proponent. The EIA Team considers public participation to be one of the most important aspects of the environmental authorisation process. This stems from the requirement that people have a right to be informed about potential decisions that may affect them and that they must be afforded an opportunity to influence those decisions. Consulting with all relevant stakeholders ensures that all considerations receive attention, ultimately leading to a more informed decision.

An effective public participation process could therefore result in stakeholders working together to produce better decisions than if they had worked independently. Namibia's Environmental Assessment Policy (1995), on which the Environmental Management Act of 2007 has been based, states that the EIA procedure will, as far as practically possible, set out to *inter alia:*

(i) Better inform decision makers and promote accountability for decisions taken;
(ii) Consider a broad range of options and alternatives when addressing specific policies, programmes or projects; and
(iii) Strive for a high degree of public participation and involvement by all sectors of the Namibian community in the EA process

To the above, one can add the following universally recognised principles for public participation:

- Inclusive consultation that enables all sectors of society to participate in the consultation and assessment processes;
- Provision of accurate and easily accessible information in a language that is clear and sufficiently non-technical for I&APs to understand, and that is sufficient to enable meaningful participation;

- Active empowerment of grassroots people to understand concepts and information with a view to active and meaningful participation;
- Use of a variety of methods for information dissemination in order to improve accessibility, for example, by way of discussion documents, meetings, workshops, focus group discussions, and the printed and broadcast media;
- Affording I&APs sufficient time to study material, to exchange information, and to make contributions at various stages during the assessment process;
- Provision of opportunities for I&APs to provide their inputs via a range of methods, for example, via briefing sessions, public meetings, written submissions or direct contact with members of the EIA Team.

Public participation is therefore a process and vehicle to provide sufficient and accessible information to I&APs in an objective manner to assist I&APs to identify issues of concern, to identify alternatives, to suggest opportunities to reduce potentially negative impacts or enhance potentially positive impacts, and to verify that issues and/or inputs have been captured and addressed during the assessment process.

At the outset it is important to highlight two key aspects of public participation:

- There are practical and financial limitations to the involvement of all individuals within a public participation programme (PPP). Hence, public participation aims to generate issues that are representative of societal sectors, not each individual. Hence, the PPP will be designed to be inclusive of a broad range of sectors relevant to the proposed project.
- The PPP will aim to raise a diversity of perspectives and will not be designed to force consensus amongst I&APs. Indeed, diversity of opinion rather than consensus building is likely to enrich ultimate decision making. Therefore, where possible, the public participation process will aim to obtain an indication of trade-offs that all stakeholders (i.e. I&APs, technical specialists, the authorities and the development proponent) are willing to accept with regard to the ecological sustainability, social equity and economic growth associated with the project.

5.2 OBJECTIVES OF THE SCOPING PROCESS

This Scoping process is being planned and conducted in a manner that is intended to provide sufficient information to enable the authorities to reach a decision regarding the scope of issues to be addressed in this EIA process, and in particular to convey the range of specialist studies that will be included as part of the Environmental Impact Reporting Phase of the EIA, as well as the approach to these specialist studies.

Within this context, the objectives of this Scoping process are to:

- Identify and inform a broad range of stakeholders about the proposed development;
- Clarify the scope and nature of the proposed activities and the alternatives being considered;
- Conduct an open, participatory and transparent approach and facilitate the inclusion of stakeholder concerns in the decision-making process;

- Identify and document the key issues to be addressed in the forthcoming Environmental Impact Reporting Phase of the EIA, through a process of broad-based consultation with stakeholders;
- Ensure due consideration of alternative options in regard to the proposed development, including the "No development" option.

5.3 TASKS IN THE SCOPING PHASE

This section provides an overview of the tasks being undertaken in the Scoping Phase, with a particular emphasis on providing a clear record of the public participation process followed.

Task 1: I&AP identification, registration and the creation of an electronic database

Prior to advertising the EIA process in the local and regional print media, an initial database of I&APs was developed for the Scoping process. This was supplemented with input from the EIA Project Managers, CSIR and the project proponent, NamWater. A total of **52 I&APs** were included on the project database in this manner. Appendix E contains the current I&AP database, which has been updated to include participation by I&APs at meetings and in response to requests to register their interest in the project. At the time of producing this report, the database stands at **172 registered I&APs**.

While I&APs have been encouraged to register their interest in the project from the start of the process, following the public announcements (see Task 2), the identification, and registration of I&APs will be ongoing for the duration of the study. Stakeholders from a variety of sectors, geographical locations, and/or interest groups can be expected to show an interest in the development proposal, for example:

- National, Regional and Local Government Departments
- Local interest groups, for example, residents' associations
- Private organisations, for example those with a business interest
- Environmental Groups and NGOs
- Grassroots communities and structures
- Private individuals who want to contribute towards sustainable development.

In terms of the electronic database, I&AP details are being captured and automatically updated as and when information is distributed to or received from I&APs. This ongoing and up-to-date record of communication is an important component of the public participation process.

Task 2: Announcement of the Scoping process

In order to notify and inform the public of the proposed project and invite members of the public to register as I&APs, the project and EIA process was advertised in three national and one regional newspaper, as shown in Table 5.1. Copies of the advertisements placed are contained in Appendix D of this report. Included in this media announcement was information on the website address where information available on the project could be downloaded, namely, http://www.namwater.com.na/data/Projects_Desalination.htm.

Table 5.1: Media announcements of the commencement of this EIA process

Newspaper	*Area of distribution*	*Language*	*Date placed*
Namibian	*National distribution*	*English*	*22 & 29 January 2009*
Republikein	*National distribution*	*English*	*23 January & 2 February 2009*
New Era	*National distribution*	*English*	*22 & 29 January 2009*
Namib Times	*Regional distribution*	*English*	*23 & 30 January 2009*

In addition to the newspaper advertisements, letters with personal notification regarding the EIA process were emailed in January 2009 to all pre-identified key stakeholders on the database, which at the time consisted of 52 I&APs. The letter to the I&APs included the Background Information Document (BID) developed for the project as well as a comment form. The purpose of the BID is to inform the public of the proposed project, the EIA process and provide an overview of the opportunities and mechanisms for public participation.

Task 3: *Ongoing Communication and Capacity Building*

Sound public participation principles require that we proactively solicit the involvement of stakeholders representing all three dimensions of sustainability (i.e. biophysical, social and economic dimensions), and that we provide them with sufficient and accessible information to contribute meaningfully to the process. In this manner, the public participation process aims to build the capacity of stakeholders to participate.

Within the context of the EIA process, capacity building is not viewed as a "once off" event, but rather a series of events and/or information sharing which provides information on a continuous basis thereby building the capacity and knowledge of I&APs to effectively participate in the EIA process and raise issues of concern.

Public participation by its very nature is a dynamic process with various sectors of society having varying needs, values, and interests. The core question for public participation is "How can I, the interested and affected party, meaningfully participate in the process?" This varies according to the needs of I&APs. The public participation process should be inclusive of all I&APs, and afford them the opportunity to raise their issues and concerns in a manner that suites them.

The following provides an overview of information sharing throughout the EIA process in order to develop the capacity of I&APs to engage effectively in the public participation process:

- Website – placing EIA related project information on the website http://www.namwater.com.na/data/Projects_Desalination.htm

- Language – encouraging I&APs to use the language of their choice at meetings and providing translations at meetings in English, Oshiwambo, Afrikaans, German, Otjoherero (In this project, I&APs have been comfortable so far to use English as the only language for communication).
- Background Information Document (November 2008) – which contains information on the project, EIA and public participation process. This document was e-mailed to all on the stakeholder database, was distributed at the coast over the December period and at the Uranium SEA meetings, and was distributed at all the consultation meetings conducted so far for this EIA.
- Personal discussions with stakeholders such as the Directorate of Environmental Affairs and the Parks and Wildlife Division of the Ministry of Environment and Tourism to broaden their understanding of the project. The Regional Council was also actively involved to assist in inviting community representatives to the public meetings.
- Newspaper Advertisements placed requesting I&APs to register their interest in the project, raise issues of concern or notifying I&APs of public meetings to be held.
- Letters to I&APs notifying them of the various stages of the EIA process, availability of reports for comment and inviting them to attend public meetings to be held.
- Report Distribution – providing hard and soft copies of the Scoping and EIA reports in selected locations. The Draft Scoping Report was released in March 2009 for review by I&APs, with all comments received being incorporated into the Final Scoping Report.
- Public Meetings – where representatives of the project applicant and EIA team are present to interact and engage with members of the public.
- Focus Group Meetings – to target key I&AP groups and proactively invite them to attend a meeting where they are provided with an overview of the project and EIA process.

Documents will be posted onto the website as and when they become available and I&APs will be notified accordingly.

Task 4: *Consultation with authorities*

All public participation documentation will reach the competent authority (Directorate of Environmental Affairs) as well as other relevant authorities included on the I&AP database. Additionally, consultation with relevant authorities on a one-on-one basis will be effected where necessary. The EIA project leaders, CSIR, seek to hold meetings as necessary with the key authorities at various milestones throughout the process. Notes will be provided summarising the key outcomes from these meetings with authorities, and used to provide inputs into the EIA process.

To date two meetings have been held with the authorities as part of the Scoping Process:

- Scoping meeting of 4 December 2008 with authorities and mining companies held in Swakopmund.
- Meeting with Dr Fred Sikabongo of the Directorate of Environmental Affairs held on 26 January 2009, to present the approach to the EIA and handover the EIA letter of application.

Task 5: Technical Scoping with project proponent and EIA team

The Scoping process has been designed to incorporate two complementary components: a stakeholder engagement process that includes the relevant authorities and wider interested and affected parties (I&APs); and a technical process involving the EIA team and the project proponent (i.e. NamWater).

The purpose of the technical Scoping process is to draw on the past experience of the EIA team and the project proponent to identify environmental issues and concerns related to the proposed project, and confirm that the necessary specialist studies have been identified. Consequently, a site visit and workshop was held with the EIA team and the project proponent on Thursday 5 February 2009 at the Rössmund Golf Estate, Swakopmund. The results from this workshop have informed the scope and Terms of Reference for the specialist studies. Based on the experience of the EIA team in working on similar projects and the experience of the project proponent and their technical team, the specialist studies are being initiated in parallel with the Scoping process. This enables the specialists to analyse baseline information and conduct field work that will assist the EIA team in understanding the key issues raised during the Scoping phase. The findings of the Scoping process with the public and the authorities will inform the specialist studies, which will only be completed after the public Scoping process is finalised.

Task 6: *Consultation with wider I&APs (public) to identify issues and concerns*

In order to accommodate the varying needs of I&APs as well as capture their views, issues and concerns regarding the project, various opportunities have been provided for I&APs to have their issues noted for inclusion in the Scoping Report, as follows:

- Letters were emailed to I&APs in January 2009 notifying them of the initiation of the Scoping process and providing them with a Background Information Document (BID) on the project and comment form
- Focus Group Meetings, consisting of one-on-one consultations with key I&APs or groups of I&APs. At this stage, three such meetings have been held: a meeting with authorities and uranium mining companies on 4 December 2008 in Swakopmund (discussed under Task 7); an introductory meeting with the Dr Fred Sikabongo of the Directorate of Environmental Affairs in Windhoek on 26 January 2009 (meeting notes provided in Appendix G); and an informative meeting was held (meeting notes in Appendix G) with Mr. Klein, of the neighbouring salt works.
- Written, faxed or email correspondence.
- Public Meeting was held on the Thursday 5 February 2009 at the Tamariskia Town Hall in Swakopmund (See Appendix G containing the minutes of this meeting).
- A Website, http://www.namwater.com.na/data/Projects_Desalination.htm is being maintained throughout the process and all public documents have been made available on this website for downloading by I&APs.
- A second notice was sent to I&APs in early March 2009 notifying them of the availability of the Draft Scoping Report for review.

Appendix H of this document contains a copy of the all the written comments received to date on the project. Appendix G contains the notes taken at meetings held.

Task 7: Focus Group Meetings

A stakeholder meeting was held on 4 December 2008 in Swakopmund with the uranium mining fraternity (i.e. all those represented on the Uranium Stewardship Committee) and key authorities, including the Swakopmund Municipality, the Regional Council, the Ministry of Fisheries and Marine Resources, Ministry of Works and Transport, Ministry of Health Social Services, Ministry of Environment and Tourism, and the Ministry of Agriculture, Water and Forestry. The notes from the meeting appear in Appendix G.

Task 8: Identification of Issues and Concerns

Issues and concerns raised by I&APs have been synthesized into the Issues and Responses Trail (Appendix C), having been identified through the following mechanisms:

- written submissions in response to advertisements and communications with I&APs;
- issues raised and identified at the authority meeting, the specialist workshop as well as the public meeting; and
- issues raised by the specialist team.

The Issues Trail (Appendix C) also includes responses from members of the EIA Team (and, in some cases, the project proponent) to the issues raised. In general, the responses indicate how the issues will be addressed in the EIA process. In some cases, immediate responses and clarification can be provided. Where issues are raised that the EIA team considers beyond the scope and purpose of this EIA process, clear reasoning for this view is provided. Chapter 6 provides a summary of all issues raised so far in the Issues Trail.

5.4 APPROACH TO THE ASSESSMENT OF ALTERNATIVES

The Namibian Environmental Management Act requires that alternatives to a proposed activity be considered. Alternatives are different means of meeting the general purpose and need of a proposed activity. This may include the assessment of site alternatives, activity alternatives, process or technology alternatives, temporal alternatives and/or the no-go alternative.

Best practice in EIA requires that reasonable and feasible alternatives are considered in the assessment process. I&APs must also be provided with an opportunity to provide inputs to the process of formulating alternatives. The assessment of alternatives should, as a minimum, include the following:

- The consideration of the no-go alternative as a baseline scenario;
- A comparison of the selected alternatives; and

- The providing of reasons for the elimination of an alternative.

5.4.1 No-go alternative

This alternative has been included in the EIA as a benchmark against which to assess the impacts (positive and negative) of the proposed desalination project.

The "no-development" alternative for the desalination project therefore implies that further development of the uranium mining industry may not proceed, and the proposed taxes and other direct financial and economic benefits of the industry will not be realised. The "no-development" option is from a marine perspective undeniably the preferred alternative, as all impacts associated with beach disturbance and effluent discharge will no longer be an issue. This, however, needs to be weighed up against the potential positive socio-economic impacts undoubtedly associated both with the project itself, as well as the growth of the uranium mining industry.

5.4.2 Water provision alternatives

Various alternatives were considered by NamWater for supplying the large volumes of water required by the uranium mining industry. The possible alternatives investigated included a range options, such as: further use of groundwater and surface water (this was considered to be unsustainable); towing icebergs from Antarctica to the Namibian coast capturing fog; sourcing freshwater water from the Congo River; and the establishment of a desalination plant. Only the desalination option was considered reasonable and feasible.

5.4.3 General site selection alternatives

Section 2.2 of the Scoping Report describes in more detail the process followed that led to the identification of the proposed site for the desalination project. In summary, several sites along the coastline were considered:

- An inland site, east of the proposed site and the C34 coastal road from Swakopmund to Hentiesbay. This site is restricted by the costs associated with the increased length of the inlet and discharge pipelines connecting the plant to the sea. The northern option of the preferred site might still spread east of the C34 road though, depending on the size of the plant.
- Areas north of the proposed Mile 6 site: Due to cost efficiency, the plant should be as close as possible to Swakopmund to connect cost effectively with existing water storage and supply infrastructure. The site should preferably be situated in an area used for industrial purposes (such as the present site close to the salt works), and away from pristine areas with high tourism potential and sense of place. Given that the area northwards of Mile 6 has been earmarked for conservation, it is thus not preferred for industrial development.
- South of the salt works in the Swakopmund municipal area: The noise impact will be high for sensitive receptors (i.e. nearby residential area). Furthermore, the bathymetry to the south of the current 4km stretch is too gradual, thus requiring a longer pipeline to reach the required water depth.

- A desalination plant site south of the Swakop River is not considered technically favourable, firstly due to the environmental and ecotourism sensitivity of that area, and secondly due the fact that a pipeline connecting the project to the mines would need to cross the Swakop River, which is subject to seasonal flooding. The existing bridges across the Swakop River cannot support additional pipelines.

  Refer to Section 2.2 for more detail on the factors that influenced the site selection.

5.4.4 Land use alternatives

The Mile 6 site is located just north of the Swakopmund municipal boundary and at the southern end of the National West Coast Recreation Area which stretches from Swakopmund 200 km northwards to the Ugab River. A potential land use that was proposed by a participant in the Scoping public meeting of 5 February 2009 in Swakopmund, was for the site to be used for urban expansion northwards of the current municipal boundary. The industrial activity of the salt works restricts such urban expansion northwards, as indicated in Section 4.5 of the Scoping Report. Furthermore, at planning meetings held with stakeholders in Swakopmund during the week of 2 to 8 February 2009 to discuss development plans for the town, urban growth was projected to take place in an easterly direction. Even when enough space is provided for the town to triple in size, urban expansion is still planned to stop south of the Mile 4 salt works. It is therefore unlikely that the proposed desalination plant will be "in the way" of future development of the town.

The area is at present utilized for quad biking, fishing and tourism. It is expected that these activities will continue around the borders of the desalination plant during operation.

5.4.5 Activity and layout alternatives as part of the development

Best practice for desalination plants promotes the use of an array of sub-surface intakes (i.e. pipes that are buried or inserted beneath a sandy sea bed, with the overlying layer of sand acting as a filter for the sea water intake). The feasibility of sub-surface intakes is highly dependant on local geological conditions. The geophysical survey conducted by CSIR in October 2008 for the Mile 6 site indicated that the sea bed offshore of the site is predominantly rock, with thin layers of sand that are likely to be mobile. The study area therefore does not have the right conditions to enable a sub-surface intake design.

5.4.6 Technology alternatives as part of the development

In the pre-feasibility phase of the project, two alternative design options for the intake structures are being considered (Section 2.3.1):

- *Alternative 1* is a submerged inlet structure that is situated approximately 1200 m to 1900 m offshore (*Figure 2.5*). There are two location alternatives for the pipelines, a North and a South option in 8 m and 10 m water depth respectively (refer to Figure 2.2). Both of these pipeline location alternatives are being <u>included</u> in the EIA.
- *Alternative 2* would involve the construction of a J-shaped breakwater basin extending approximately 500 m out to sea to water depth of approximately 3-4 m water depth below mean seawater level (MSL), with an open channel connecting the stilling basin with

the intake pump station (*Figure 2.6*). The intake is likely to have travelling screens to reduce the effect of entrainment, and the intake of sediments. The stilling basin concept is included in the EIA. (*Note*: A desktop assessment of the impact of the stilling basin on hydrodynamics and shoreline dynamics will be included.)

Both are open water intakes, necessitating the need for extensive pre-treatment. Pre-treatment and screen maintenance is likely to be higher for *Alternative 2* (breakwater basin) as this is a surface water intake.

For both options, the intake pump station will be located close to the shore, with the pumps being protected by a screen system. The feed water will be transferred from the pump station to the desalination plant through a transfer pipeline. A 'pigging' system for regular maintenance cleaning of the seawater supply lines (both intake and discharge pipes) will be installed. This involves the use of a 'pig' (bullet-shaped device with bristles), which is introduced into the pipeline to mechanically clean out the structure.

5.4.7 Alternative power line routings

A new 132 kV line is being established from Trekkopje to the UraMin desalination plant on the coast at Wlotzkasbaken. The proposed NamWater desalination project at Mile 6 also requires approximately 20 MW power for the operational phase, and therefore a new 132 kV line needs to be constructed. Two alternative routes were considered for this new line:

- from Dolerite (approximately 13 km southwest of Trekkopje) to the Mile 6 site, over a distance of approximately 44 km (refer to Figure 2.4); or
- from Wlotzkasbaken down the coast to Mile 6. After investigation by NamPower, this option was considered not feasible and excluded from the pre-feasibility study because of severe corrosion experienced on powerlines running parallel with the coast line. Also to route the line via Wlotzkasbaken will increase the line length which will have an effect on the power transfer capability of the line.

5.5 EIA SCHEDULE

A provisional schedule for the EIA process is provided in Table 5.2.

Table 5.2: EIA Schedule for the Proposed Desalination Plant at Mile 6 near Swakopmund, Namibia

Stage in EIA process	Nov 2008	Dec 2008	Jan 2009	Feb 2009	March 2009	April 2009	May 2009	June 2009
1) Initiate EIA, collate information, prepare Background Information Document (BID) and EIA application	X							
2) Scoping with authorities and other I&APs and prepare Draft Scoping Report		X	X	X				
3) Public Review of Draft Scoping Report, include comments and submit Final Scoping Report to authorities for decision-making					X	X	X	
4) Conduct specialist studies and prepare Draft EIA Report and draft Environmental Management Plan (EMP)			X	X	X	X	X	
5) Review of Draft EIA Report and EMP, include comments, and submit final reports to authorities for decision-making						X	X	X
6) Authority decision-making in response to request from NamWater for an Environmental Clearance Certificate							X	X
7) Appeal process								X →

Chapter 6: Summary of Issues

IDENTIFICATION OF ISSUES

6. IDENTIFICATION OF ISSUES 6-1

6.1 IDENTIFICATION OF KEY ISSUES 6-1

6.2 ISSUES SUMMARY 6-3

FIGURES

Figure 6.1: Decision-making framework for identification of key issues for the EIA 6-2

6. IDENTIFICATION OF ISSUES

6.1 IDENTIFICATION OF KEY ISSUES

An important element of the Scoping process is to evaluate the issues raised through the Scoping interactions with authorities, interested and affected parties (I&APs), the specialists on the EIA team and the project proponent, and then to focus the EIA on the key issues.

To assist in the identification of key issues, a decision-making process is applied to the issues and concerns raised, based on the following criteria (Figure 6.1):

1) Whether or not the issue falls within the scope and responsibility of the EIA process for the proposed NamWater Desalination Project; and
2) Whether or not sufficient information is available to respond to the issue or concern raised without further specialist investigation.

Section 6.2 below provides a summary of the issues identified by all stakeholders and the EIA team, at the time of the release of the Draft Scoping Report, that need to be investigated further as part of this EIA. Issues were identified through the Scoping interactions described in Chapter 5, which included inputs from authorities, interested and affected parties, the EIA team and the proponent. Appendix C contains the complete issues trail, with all comments received to date from I&APs as part of this Scoping process; Appendix H contains written correspondence received from I&APs; and Appendix G contains meeting notes. For issues that have been evaluated as not requiring further investigation, clear reasons for this decision are provided in the Issues Trail (Appendix C) and such issues are excluded from Section 6.2.

The issues in Section 6.2 are grouped according the following categories:

1) Physical characteristics and shoreline dynamics
2) Marine modelling and impacts of intake and discharge structures
3) Marine ecology
4) Terrestrial and shoreline ecology
5) Avifauna
6) Heritage
7) Visual
8) Socio-Economic (incl. tourism, planning and land use)
9) Water and waste-water management
10) Noise.

A synthesis of issues to be addressed in the Specialist Studies is provided in the Plan of Study for EIA (Chapter 7). The results of the Specialist Studies will be made available to I&APs for comment as part of the Draft EIA Report.

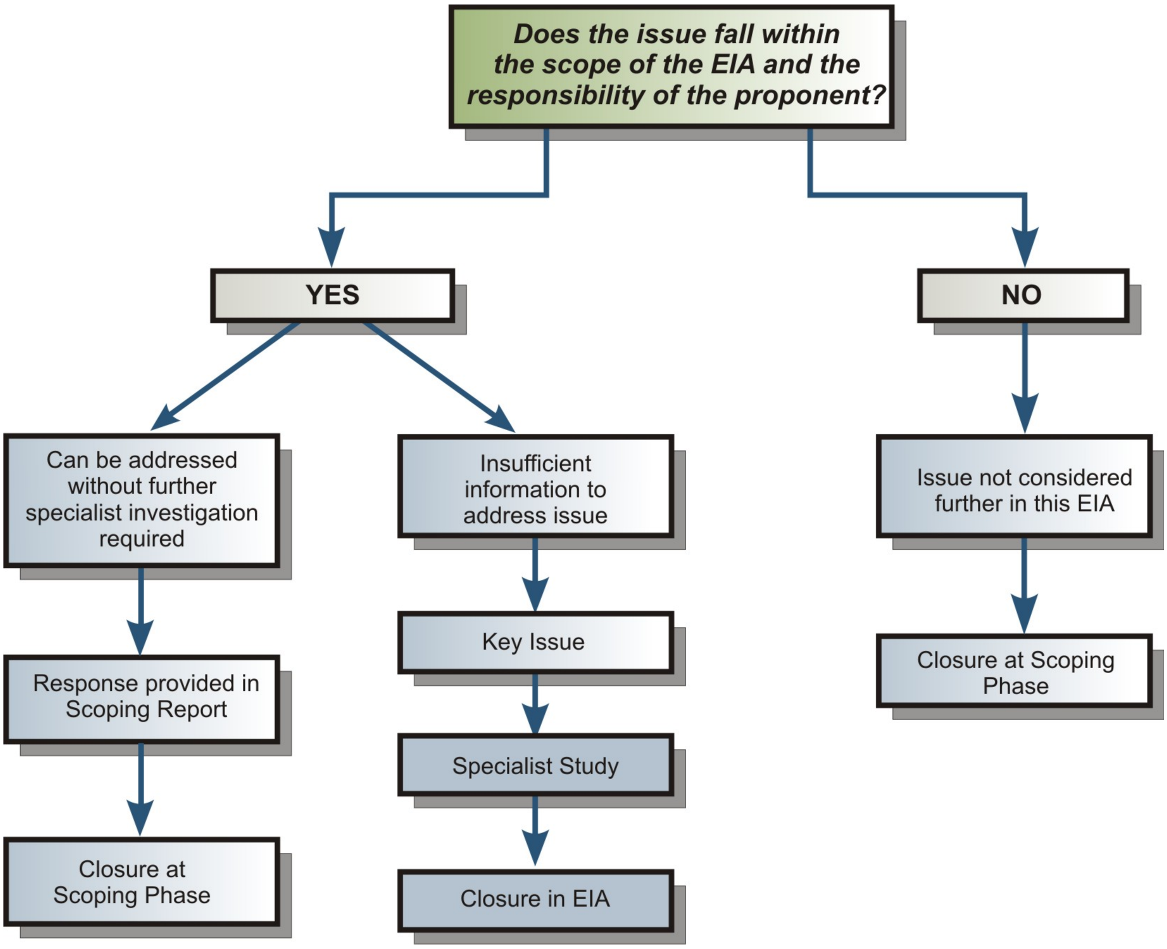

Figure 6.1: Decision-making framework for identification of key issues for the EIA

6.2 ISSUES SUMMARY

The summary of key issues to be considered during the EIA process is provided below. The EIA Report will contain this same list, together with confirmation of where in the EIA Report document each issue has been addressed.

ISSUE	DESCRIPTION
1) Coastal physical characteristics and shoreline dynamics	▪ Impact of the intake and discharge structures (i.e. pipelines and/or stilling basin) on sediment movement along the coastline, both offshore (below the high water mark) and on the beach, and associated impacts on coastal dynamics (e.g. erosion or accretion of the shoreline, changes to beach profile and sediment composition). ▪ Impact of the pipelines (where they cross the beach) on wind-blown sand (also referred to as "aeolian transport") and consequent effects on coastal dynamics. ▪ Damage to the shoreline and upper beach area during construction (e.g. from excavations and blasting). ▪ Potential rate of sedimentation of the stilling basin (if constructed), leading to the need for dredging and disposal of dredge material (this links with issues under "marine ecology").
2) Marine modelling and impacts of intake and discharge structures	▪ Identification of zone affected by brine discharge from the pipeline, i.e. what is the extent of the zone where detectable differences in salinity as a result of brine discharge, will be noticeable? ▪ Effect of seasonal changes on the brine discharge patterns, such as calm periods. ▪ Risk of bring discharge entering the intake pipeline ▪ Risk of brine discharge being trapped in the surfzone and moving along the shoreline. ▪ Predicted distribution of any co-discharges that may be part of the brine discharge, either intentionally or accidentally.
3) Marine ecology	**Construction Phase:** ▪ Impact of construction activities (e.g. vehicle usage and pipeline installation) on the shoreline. ▪ Accidental spillage or leakage of fuel, chemicals, or lubricants. ▪ Increased turbidity and resettling of marine sediments during blasting and excavation. ▪ Destruction of biota in the blasting and excavation area (inter- and sub-tidal). ▪ Disturbance to marine life and seabirds from construction, in particular blasts for the pipeline trench.

ISSUE	DESCRIPTION
	Operational Phase: ▪ Permanent presence of intake and discharge structures could result in loss of original substratum but provides new settlement ground (e.g. artificial reef) for marine organisms ▪ Impact of sedimentation in the stilling basin and associated dredging and disposal of dredge material, on marine ecosystems. ▪ Impingement and entrainment of marine organisms at the intake structure. ▪ Avoidance behaviour of fish and marine mammals, and loss of potential feeding or breeding grounds, as a result of the intake and discharge structures. ▪ Potential impacts during maintenance of pipeline. ▪ Accidental spillage or leakage of oil, fuel, chemicals, or lubricants **Operational phase - Issues on marine ecosystems associated with brine discharge:** ▪ Impact of elevated salinities in the mixing zone and potential spreading of brine on the seafloor. ▪ Impact of brine discharge at a higher temperature (e.g. 1 degree Celsius above ambient). ▪ Impact of residual chlorine and chlorination by-products in the effluent (if no de-chlorination step is included in the treatment process design). ▪ Potential occurrence of bacteria in brine. ▪ Co-discharge of constituents with the brine, e.g. increased turbidity from backwash water and discoloration near outlet from $FeCl_3$, heavy metals from corrosion processes, anti-scalants may bind nutrients and ions dissolved in seawater, cleaning solutions for membrane maintenance may interfere with natural processes of dissolved seawater constituents, salt bitterns. ▪ Removal of particulate matter in the feedwater from the water column, where it is a significant food source, may lead to reduced nutrients in the marine environment and may have localised effects on phytoplankton production. Conversely, increases in nutrients in the water column caused by discharges that include chemicals added to the water treatment process, may lead to algal blooms. ▪ Changes in dissolved oxygen, e.g. due to the use of de-chlorination with sodium bisulfite, could have a direct impact on the phytoplankton. The changes in the phytoplankton could further, as a result of nutrient input, cause a chain reaction and thus indirectly influence other organisms.

ISSUE	DESCRIPTION
4) Terrestrial and shoreline ecology	▪ Destruction or modification of breeding and foraging habitat through the construction and operational activities of the plant and associated infrastructure, including roads. ▪ Fragmentation of the sensitive desert environment which is associated with unique fauna and flora habitat, such as lichen fields, due to the power line as well as the new pipeline to link the desalination plant with the local water supply infrastructure. ▪ Secondary impacts, such as opening up pristine desert land for more vehicles due to the service tracks that will run along the power line. ▪ Influence on invertebrate fauna along the proposed power line. ▪ Influence on the lichen fields associated with dolerite outcrops along the power line. ▪ Waste disposal on site and along the power line route, especially during construction phase. ▪ Improved sustainability and reduced salinity levels for the Omdel and Kuiseb aquifers, and associated secondary ecological benefits, as a result of the reduced abstraction from these aquifers.
5) Avifauna	▪ Disturbance of the breeding patterns of birds, particularly the Red Listed Damara Tern (*Sterna balaenarum*), through the construction and operational activities of the plant and associated infrastructure. ▪ Effect of potential new habitat that will be created by the plant, e.g. the water reservoirs and breakwaters (if the stilling basin is constructed), on bird roosting and foraging patterns ▪ Mortality of birds on the proposed 44km 132kV power line and new substation at Mile 6. ▪ Potential noise impacts on birds, in particular at the neighbouring Mile 4 salt works.
6) Heritage	▪ Possibility of archaeological sites on the power line route, and impacts of the service road and construction activities on these sites. ▪ Influence of construction and construction workers on the small dolerite ridges along the power line route; sometimes associated with archaeological sites dating to within the last 5 000 years. ▪ Archaeological sites, predating the Last Glacial, that occur on the gravel plains in the area to be traversed by the power-line. These sites are very subtle and therefore difficult to recognize.
7) Visual	▪ Visual impact of power line and new substation at Mile 6, particularly for eco-tourism. ▪ Visual impact of new buildings and structures at the desalination plant (which are proposed to be 12m high) and effect on the sense of place and eco-tourism.
8) Socio-Economic (including tourism, planning and land use)	▪ What is the national affordability of the plant? Agreements should be in place with the mines to provide capital costs and funding for the plant and reduce risks for government. ▪ What are operational and financial risks for the plant, and consequently for the tax payer, if the growth of the uranium mines does not occur as predicted, leading to reduced water demand? Is there a potential oversupply of water? Who would pay the extra costs of

ISSUE	DESCRIPTION
	desalinated water if the mines did not purchase the water? ▪ Increased availability of water from the desalination project could lead to uncontrolled development such as golf estates, bottling plants, manufacturing, etc. ▪ Increased water availability in the central coastal region could lead to population influx, with consequent increased pressure on resources and services, and growth in unemployment, informal settlements and communicable diseases. ▪ The location of the desalination project neat Mile 6 could be in conflict with other development plans. ▪ What is the impact on tourism as the proposed site is prime residential beach front land and a recreational fishing area? ▪ What is the influence of the new Swakopmund Sewerage Works on the downstream pipeline and power line routes? ▪ What is the impact of the project on marine use (e.g. obstruction to vessels) and recreational activities, and what conflicts with other users might arise? ▪ What temporary (construction phase) and permanent (operations phase) employment will be created? What further employment would result from downstream developments that are possible because of the desalination project? ▪ Improved water supply infrastructure for coastal towns will facilitate development, and benefit small enterprises and the sustainability of yields from the aquifers. ▪ The desalination plant will drive regional and national economic development, and contribute to economic diversification in the Erongo Region. ▪ What is the future use of the servitude around the existing water supply pipeline? ▪ What is the ability of the local authority to receive the solid waste from the desalination plant? Is there a suitable local site, or will another waste site be used or need to be established? ▪ What will happen to the plant at the end of its lifespan? ▪ The proposed project location is at present situated on land with a mining concession and conflict could arise with present proposed land use.
9) Water and waste management	▪ What is the predicted quantity and quality of waste water from the desalination plant? (e.g. domestic waste water and industrial waste water) ▪ Is the waste water from the desalination plant managed optimally to ensure maximum re-use and recycling, before disposal? ▪ Are local facilities able to accommodate the predicted waste waters from the project? ▪ Are there other options for re-use or minimisation of solid waste from the pre-treatment process?
10) Noise	▪ What is the current noise profile for the proposed desalination plant site, by day and night? ▪ What is the noise impact during construction and operation of the plant, by day and night? ▪ What is the extent of noise impacts for different frequencies, in particular low frequency vibrations?

ISSUE	DESCRIPTION
	▪ Where are local sensitive human receptors located? (e.g. closest residential areas)? ▪ What are the potential noise impacts on birds? (to be addressed in avifauna study)
11) Issues related to the EIA Process	▪ What are the potential synergies between this EIA and the SEA for the uranium industry and are these being maximised? ▪ To what extent is the water supply pipeline to Swakopmund included in this EIA? And are both above ground and under ground options being considered? ▪ It is important to consider alternatives – these should include the pipeline vs stilling basin intake options, disposal sites for solid waste, alternative power line routes, alternative water supply pipelines sizes and routes, alternative sites for the desalination plant near Mile 6, alternative power supply options, and the no-go alternative. ▪ The timeline for the EIA process is very tight (especially for producing the specialist studies) and this could influence the credibility of the results. ▪ Regarding the methodology for the weighting of impacts, which impacts will receive priority?
12) Issues Related to Project Planning, Design and Operation	▪ There is lack of detailed description as to how and by whom the plant will be operated. ▪ The explanation of site alternatives is not clear. ▪ The options of stilling basin versus pipeline for sea water intake are not clearly explained. ▪ Water demand calculations – in the light of the recent global credit crisis, clarity is needed regarded updated information on the mining development forecasts and their estimated water demand. ▪ Not sharing facilities with UraMin.

Chapter 7:
Plan of Study for EIA

PLAN OF STUDY FOR EIA

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7. PLAN OF STUDY FOR EIA

7.1 IDENTIFICATION OF ISSUES

The Guide to the Environmental Management Act, No. 7 of 2007, states that the competent authority will make a decision on the scope and procedure of assessment before the EIA phase may commence. The purpose of the EIA phase is to:

- Address issues that have been raised through the Scoping Process;
- Assess alternatives to the proposed activity in a comparative manner;
- Assess all identified impacts and determine the significance of each impact; and
- Formulate mitigation measures.

The Plan of Study for EIA (PSEIA) sets out the process to be followed in the EIA phase and is shaped by the findings of the Scoping process. The EIA phase consists of three parallel and overlapping processes:

- Central assessment process involving the authorities where inputs are integrated and presented in documents that are submitted for approval by authorities (Sections 7.2 and 7.4)
- Public participation process whereby findings of the EIA phase are communicated and discussed with I&APs and responses are documented (Section 7.3)
- Specialist studies that provide additional information required to address the issues raised in the Scoping phase, environmental standards and clean-up/remediation requirements applicable at the time (Sections 7.5 and 7.6).

7.2 OVERVIEW OF APPROACH TO PREPARING THE EIA REPORT AND EMP

The results of the specialist studies and other relevant project information will be summarized and integrated into the Draft EIA Report. The Draft EIA Report will be released for a 14 day I&AP and authority review period, as outlined in Chapter 5. All I&APs on the project database will be notified in writing of the release of the Draft EIA for review. Comments raised, through written correspondence (emails, comments, forms) and at meetings (public meeting and focus group meetings) will be captured in a Comments and Responses Trail for inclusion in the Final EIA Report. Comments raised will be responded to by the CSIR EIA team and/or the applicant. These responses will indicate how the issue has been dealt with in the EIA process. Should the comment received fall beyond the scope of this EIA, clear reasoning will be provided. All comments received will be attached as an appendix to the Final EIA Report.

The Draft EIA Report will include a draft EMP, which will be prepared in compliance with the relevant regulations. This EMP will be based broadly on the environmental management philosophy presented in the ISO 14001 standard, which embodies an approach of continual improvement. Actions in the EMP will be drawn primarily from the management actions in the specialist studies for the construction and operational phases of the project. If the project components are decommissioned or re-developed, this will need to be done in accordance with the relevant environmental standards and clean-up/remediation requirements applicable at the time.

7.3 PUBLIC PARTICIPATION PROCESS

The key steps remaining for the EIA phase following the scoping phase are described below. The participation process for the Scoping Process is described in Chapter 5 of this report.

Task 1: Review of Draft EIA Report and EMP

The first stage in the process will entail the release of a Draft EIA Report for a 14 day public and authority review period. Relevant organs of state and I&APs will be informed of the review process in the following manner:

- Advertisements placed in two national and one regional newspaper, i.e. the Namibian, the Republikein and the Namib Times.
- A notice to all I&APs (including authorities), with notification of the 14 day public review period for the Draft EIA and invitation to attend the public meeting (this letter will include the summary of the Draft EIA Report and a Comment Form).
- Public Meeting on the Draft EIA Report, where key findings of the EIA report will be communicated and I&APs will have the opportunity to provide comments and engage with the EIA team and project proponent.
- Focus Group Meeting(s) with I&APs, if requested.
- Meeting(s) with key authorities involved in decision-making for this EIA.

The Draft EIA Report and EMP will be made available and distributed through the following mechanisms to ensure access to information on the project and to communicate the outcome of specialist studies:

- Relevant organs of state and key I&APs will be provided with a hard copy or CD version of the report
- Report to be placed on the project website: http://www.namwater.com.na/data/Projects_desalination.htm
- Note that our entire stakeholder database has access to the internet. We will therefore only make the documents available on the internet, unless there is a specific request to view a hard copy.

Task 2: Comments and Responses Trail

A key component of the EIA process is documenting and responding to the comments received from I&APs and the authorities. The following comments on the Draft EIA Report and EMP will be documented:

- Written and email comments (e.g. letters and completed comment forms)
- Comments made at focus group meetings
- Telephonic communication with CSIR and Enviro Dynamics contact person
- One-on-one meetings with key authorities and/or I&APs.

The comments received will be compiled into a Comments and Responses Trail for inclusion in the Final EIA Report. The Comments and Responses Trail will indicate the nature of the comment, when and who raised the comment. The comments received will be considered by the EIA team and appropriate responses provided by the relevant member of the team and/or specialist. The response provided will indicate how the comment received has been considered in the Final EIA Report, in the project design or EMP for the project.

Task 3: Compilation of Final EIA Report for submission to Authorities

The Final EIA Report, including the Comments and Responses Trail and EMP, will be submitted to the authorities for decision making. A notification will be sent to all I&APs on the project database notifying them of the submission of the final report.

Task 4: Environmental Authorisation and Appeal Period

The following process will be followed for the distribution of Environmental Authorisation:

- A notice will be sent to all on the stakeholder database informing them that Environmental Clearance has been issued, with access to a copy of it provided through the internet.

7.4 AUTHORITY CONSULTATION DURING THE EIA PHASE

Authority consultation is integrated into the public consultation process, with additional one-on-one meetings held with the lead authorities where necessary. It is proposed that the competent authority (MET) as well as other lead authorities be consulted at various stages during the EIA process. The authority consultation process for the Scoping Process is outlined in Chapter 5 of this report.

7.5 APPROACH TO SPECIALIST STUDIES AND IMPACT ASSESSMENT

This section outlines the assessment methodology and legal context for specialist studies.

7.5.1 Generic Terms of Reference for the assessment of impacts

The identification of potential impacts should include impacts that may occur during the construction and operational phases of the activity. The assessment of impacts is to include direct, indirect as well as cumulative impacts.

In order to identify potential impacts (both positive and negative) it is important that the nature of the proposed activity is well understood so that the impacts associated with the activity can be analysed. The process of identification and assessment of impacts will include:

- Determination of the current environmental conditions in sufficient detail so that there is a baseline against which impacts can be identified and measured.
- Determination of future changes to the environment that will occur if the activity does not proceed.
- An understanding of the activity in sufficient detail to understand its consequences; and
- The identification of significant impacts which are likely to occur if the activity is undertaken.

For the assessment of alternatives and impacts the following methodology is to be applied to the predication and assessment of impacts. Potential impacts should be rated in terms of the direct, indirect and cumulative affects:

- **Direct impacts** are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.

- **Indirect impacts** of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.

- **Cumulative impacts** are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.

- **Spatial extent** – The size of the area that will be affected by the impact:
  - Site specific
  - Local (<2 km from site)
  - Regional (within 30 km of site)

  - National.

- **Intensity** –The anticipated severity of the impact:
  - High (severe alteration of natural systems, patterns or processes)
  - Medium (notable alteration of natural systems, patterns or processes)
  - Low (negligible alteration of natural systems, patterns or processes).

- **Duration** –The timeframe during which the impact will be experienced:
  - Temporary (less than 1 year)
  - Short term (1 to 6 years)
  - Medium term (6 to 15 years)
  - Long term (the impact will cease after the operational life of the activity)
  - Permanent (mitigation will not occur in such a way or in such a time span that the impact can be considered transient).

Using the criteria above, the impacts will further be assessed in terms of the following:

- **Probability** –The probability of the impact occurring:
  - Improbable (little or no chance of occurring)
  - Probable (<50% chance of occurring)
  - Highly probable (50 – 90% chance of occurring)
  - Definite (>90% chance of occurring).

- **Significance** – Will the impact cause a notable alteration of the environment?
  - Low to very low (the impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making)
  - Medium (the impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures, and will only have an influence on the decision-making if not mitigated)
  - High (the impacts will result in major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making).

- **Status** - Whether the impact on the overall environment will be:
  - positive - environment overall will benefit from the impact
  - negative - environment overall will be adversely affected by the impact
  - neutral - environment overall not be affected.

- **Confidence** – The degree of confidence in predictions based on available information and specialist knowledge:
  - Low
  - Medium
  - High.

- **Management Actions and Monitoring of the Impacts (EMP)**
  - Where negative impacts are identified, mitigatory measures will be identified to avoid or reduce negative impacts. Where no mitigatory measures are possible this will be stated
  - Where positive impacts are identified, management actions will be identified to potentially enhance positive impacts
  - Quantifiable standards for measuring and monitoring mitigatory measures and enhancements will be set. This will include a programme for monitoring and reviewing the recommendations to ensure their ongoing effectiveness.

The Table below is to be used by specialists for the rating of impacts.

Table 7.1: Example of the Table for rating of impacts

Impact	Spatial Extent	Intensity	Duration	Probability	Significance & Status		Mitigation	Confidence
					Without Mitigation	With Mitigation		
Operations phase								
Impact of noise from the desalination plant on residents in Swakopmund	...	...	...	...	...	...	...	...

Other aspects to be taken into consideration in the assessment of impact significance are:

- Impacts will be evaluated for the construction and operation phases of the development. The assessment of impacts for the decommissioning phase will be brief, as there is limited understanding at this stage of what this might entail. The relevant rehabilitation guidelines and legal requirements applicable at the time will need to be applied.
- The impact evaluation will, where possible, take into consideration the cumulative effects associated with this and other facilities/projects which are either developed or in the process of being developed in the local area.
- The impact assessment will attempt to quantify the magnitude of potential impacts (direct and cumulative effects) and outline the rationale used. Where appropriate, national standards are to be used as a measure of the level of impact.
- The impact assessment will take into consideration relevant national and international guidelines, standards or recognised best practice measures that are practical and feasible for this particular project.

7.6 SPECIFIC ISSUES TO BE ADDRESSED IN SPECIALIST STUDIES

Based on an evaluation of issues to date, the following specialist studies are proposed as part of the EIA phase:

Table 7.2: Proposed specialists and their roles in the EIA

Specialist Study	***Proposed Specialist***
Coastal physical characteristics and shoreline dynamics	*André Theron, CSIR*
Marine modelling and impacts of intake and discharge structures	*Dr Gerhardus Diedericks, CSIR*
Marine ecology	*Dr Andrea Pulfrich, Pisces Environmental Services & Dr Nina Steffani*
Terrestrial and shoreline ecology	*Dr Juliane Zeidler, Integrated Environmental Consultants Namibia*
Avifauna (birds)	*Chris van Rooyen, Chris van Rooyen Consulting*
Heritage (archaeology)	*Dr John Kinahan, Quaternary Research Services*
Visual impacts	*Henry Holland, MapThis*
Socio-Economic (incl. tourism, planning & land use)	*Stephanie van Zyl & Ernst Simon, Enviro Dynamics*
Water and waste-water management	*Philip de Souza, Emanti Management*
Noise	*Brett Williams, Safetech*

The Terms of Reference (TORs) for the specialist studies will essentially consist of the generic assessment requirements and the specific issues identified for each study. These issues have been identified through the baseline studies, I&AP and authority consultation, as well as input from the proposed specialists based on their experience. As part of the review of the Draft Scoping Report, specialists were to propose any additional issues for inclusion in the specialist studies. Additional issues, identified through public and authority consultation during the Scoping phase, as well as specialist inputs, have been included in the final Terms of Reference for specialists.

7.6.1 Coastal physical characteristics and shoreline dynamics

- Conduct a rapid desktop review of available information that can support and inform the specialist study, in particular, information on sediment transport along the coast.
- Provide an overview description of the coastal environment: i.e. the coastal marine physical environment (the littoral active zone up to the outer surf zone), the back-beach (e.g. hummock dunes), beach, inter-tidal, surf zones.
- Identify, describe and evaluate alternative pipeline routes in terms of the location of shoreline crossing and alternative brine disposal options; the location of water intakes; and identification and assessment of alternative shoreline crossing structures/options.
- Identification of impacts: Conduct a desktop qualitative evaluation based on available information (excludes any quantification or numerical/physical modelling); The impacts shall be assessed in terms of the magnitude, significance, duration and frequency of impact on the physical coastal environment.

7.6.2 Marine modelling and impacts of intake and discharge structures

- Conduct a rapid desktop review of available information that can support and inform the modelling study, including sourcing relevant oceanograhic and meteorological data.
- Comprise a modelling study that assesses the transport and fate of brine in the relevant environments. The modelling study will be undertaken using the Delft3D-FLOW (Lesser et al, 2004) numerical model from WL|Delft Hydraulics in the Netherlands to simulate the dispersion and advection of the discharge plume. The model includes formulations and equations that take into account the following processes and driving forces:
    - Tidal forcing
    - Wave forcing
    - Seabed shear stress
    - Baroclinic currents and vertical mixing as well as barotropic effects (free surface gradients)
    - The effect of the earth's rotation (Coriolis force)
    - Water with variable density
    - Turbulence-induced mass and momentum fluxes
    - Thermocline dynamics
    - A heat flux model is incorporated to account for air-sea interactions. The incoming solar and atmospheric radiation is prescribed, while the terms related to heat loss (evaporation, back radiation and convective heat flux) are computed by the model.
- Comprise a far-field modelling study that resolves all of the major coastal processes determining the transport and fate of discharge plumes. Appropriate near-field behaviours will be assumed for use in the far-field modelling study. No detailed near-field modelling will be undertaken.

7.6.3 Marine ecology

- Write a marine baseline report (desktop), based on available information, that will describe the baseline marine biology in the project area, emphasising, but not limited to, sensitive and threatened habitats, and threatened or rare marine fauna and flora. All pertinent characteristics of the marine environment will be described.
- Do an initial marine biological survey of the nearshore marine environment in the vicinity of the proposed desalination plant to establish baseline conditions (diversity and abundance of macrofaunal communities) before the commencement of construction of, and subsequent brine discharge from, the proposed desalination plant. The results of this survey will be compiled in a separate report and will provide input into the Marine Specialist Report. This survey will provide the baseline for a monitoring study assessing the impacts of the brine disposal on the benthic marine environment.
- Compile a Marine Specialist Report, that incorporates the findings of the above two components. This Specialist Study also responds to marine issues raised during the Scoping phase of the EIA related to the marine biological issues. The study will be conducted according to accepted impact assessment conventions as well as management actions to avoid or reduce negative impacts or enhance benefits.

7.6.4 Terrestial ecology (excluding avifauna)

- Conduct a rapid desktop review of available information that can support and inform the ecology specialist study.
- Indicate whether plant or animal species in the Red Data Book listed as Near Threatened, Vulnerable, Endangered or Critically Endangered occur on site, or could potentially occur, and provide an indication of where such species are most likely to be found.
- Assess the overall sensitivity and regional conservation value of the vegetation on the site and the power line route using the above criteria, which includes relative conservation and ecological importance of the vegetation communities, presence of indigenous species of special concern (SSCs) and degree of previous disturbance, as well as the likelihood of successful rehabilitation.
- Assess the likely impacts, and likely cumulative impacts, of the proposed desalination plant and power line on the fauna and flora, during construction and operational phases, according to the final/refined development plan, e.g. impacts of habitat loss, dust, movement of vehicles, trampling, fragmentation of habitat, etc. Discuss appropriate mitigation that could be implemented to avoid or minimise these impacts.
- Description of on-site fauna and flora based on a field survey will be undertaken to determine species of special concern.

7.6.5 Avifauna (birds)

- A rapid desktop review of available information that can support and inform the specialist study i.e. potential impacts on avifauna.
- Identification of issues and potential impacts related to avifaunal such as impact of power lines.
- Description of the existing environment and the bird communities currently existing within the zone of influence of the proposed plant and associated infrastructure (including the power line).
- Description of different bird micro-habitats as well as the species associated with those habitats.
- Trends and conditions in the environment that affects the avifauna as it currently exist within the zone of influence will be identified and analysed.
- Gaps in baseline data will be highlighted and discussed. An indication of the confidence levels will be given. The best available data sources (both published and unpublished literature) will be used to establish the baseline conditions, and extensive use will be made of local knowledge (e.g. local bird clubs/amateur ornithologists) who are familiar with the study area.
- Bird sensitive areas will be mapped in a sensitivity map for easy reference, and particular emphasis will be placed on habitat for Red Data and endemic species.
- The study area will be inspected to gain a first hand impression of the bird habitat.

7.6.6 Heritage

- Desktop review and review of national heritage databases, where relevant, to source relevant background information related to the study area of the proposed project. It is expected that specialist will draw on previous experience either in the local area and/or from similar projects.
- Compile an Archaeological report, describing the possible archaeological heritage sites at the proposed desalination site and along the power line route (including impacts of the service road for the new power line).
- Establish the range and importance of the heritage sites.
- Specify the potential impact as well as potential cumulative impact of the development.
- Make appropriate management or mitigation recommendations in order to address the impacts identified, if necessary.
- Determine the type and location of artefacts as well as fossils present, if any is encountered, within the study area.

7.6.7 Visual

- Conduct a desktop study to determine the current state and character of the landscape.
- Identify issues and potential visual impacts for the proposed project, which are to be considered in combination with any additional relevant issues that may be raised through the public consultation process.
- Import CAD data into GIS software, geo-reference, and otherwise prepare data for visibility analyses.
- Import elevation data and create Digital Elevation Model (DEM) for visibility analyses.
- Source and import data for landscape baseline (topographic, vegetation, land cover and geology).
- Organise and annotate photographs taken during field work.
- Calculate viewsheds for various elements of the proposed development.

7.6.8 Socio-Economics and Planning

- Conduct a desktop study relevant to the socio-economic impact study.
- Identify issues informed by the issues trail drawn up by the EIA and public consultation team to gain an understanding of the socio-economic concerns raised during scoping.
- Conduct stakeholder liaison and consultation meetings with relevant authorities, particularly the Swakopmund Municipality, NamWater, the Henties Bay Municipality, Arandis Municipality the HERS Committee, the Erongo Regional Council.
- Investigate the following:
  - Expected increase in population size;
  - The benefits and risks associated with additional employment creation and job seekers, including job creation and poverty reduction, increased informal settlement, increased pressures on local housing, facilities and services;
  - Increased educational opportunities and skills transfer;

- Economic benefits from the project (e.g. increased rates and taxes);
- Impacts on the existing industrial base;
- Waste disposal and sewerage issues;
- Interaction with social, recreational and tourism facilities;
- Contribution to economic structure and existing socio-economic trends in the town;
- Economic benefits from sale of water from the desalination plant;
- Affordability of water;
- Implications of the project for current land use planning and compatibility with existing land usage (including exploration and mining licences);
- Beneficiaries and losers of the project.

- Investigate safety and security issues associated with the project.
- Provide a baseline description within which the socio-economic profile will be addressed at local, regional and national levels, focusing on areas of concern identified during scoping.

7.6.9 Water management study

- Review available background information including existing desalination studies (both local and international), existing environmental impact assessment reports and specific information provided by the project proponent so as to understand best practice, in waste water management for desalination plants.
- Interact with relevant officials/representatives from relevant institutions including, but not limited to, Ministry of Water, Agriculture and Rural Development, Ministry of Health and Social Services, Swakopmund, Arandis and Walvis Bay Municipalities, State Owned Enterprises.
- Conduct a rapid review of the proposed treatment technology to identify any potential gaps or inconsistencies in the project proposal.
- Consider relevant water uses for the project.
- Consider water and wastewater discharges from the project.
- Identify and quantify all wastewater streams (e.g. process, sewage, stormwater, brine streams).
- Identify constituents of concern, expected concentrations thereof (if possible), and an assessment of the potential impacts thereof.
- Describe of the proposed wastewater disposal approach for different wastewater streams and identify the points of discharge for different wastewater streams.
- Discuss the potential constraints (e.g. legislative, environmental or practical) associated with disposal of wastewater and solids (sludge).
- Consider process wastewater and stormwater treatment options.
- Investigate the need for treatment and recycling / re-use; and available options to achieve this.
- If an option, consider the operation as a Zero Effluent Discharge facility.
- Review the water balance calculations and identify any opportunities for improving integrated water management and promoting water conservation.

7.6.10 Noise

- Conduct a desktop study of available information that can support and inform the specialist noise study.
- Measure the existing ambient noise at the proposed site, during both the day and night time.
- Conduct a noise study of the future impact during construction and operation of the proposed desalination plant, taking into consideration sensitive receptors in the local area such as residential areas and the adjacent salt works and nature reserve (to the south) that is utilised by flamingos.
- Identify noise impacts associated with construction of the power line on sensitive receptors, if any.

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