Basic Assessment

for the proposed Hillside Desalination Plant to be established at the Hillside Aluminium smelter site, Richards Bay, KwaZulu-Natal

FINAL BASIC ASSESSMENT REPORT

Prepared by:

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Applicant:

Hillside Aluminium Limited

Competent Authority:

KwaZulu-Natal Department Economic Development, Tourism and Environmental Affairs (KZN DEDTEA)

DATE: May 2016

SE Solutions Ref: Hillside Desalination BA
Report Rev No: 01

PURPOSE OF THE DOCUMENT

The main objectives of the Basic Assessment (BA) application process for Environmental Authorisation (EA) in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and associated 2014 Environmental Impact Assessment (EIA) Regulations is to:

- Determine the policy and legislative context within which the proposed activity is located and how the activity complies with and responds to the policy and legislative context;
- Identify the alternatives considered, including activity, location, and technology alternatives;
- Describe the need and desirability of the proposed activity and identified alternatives;
- Through the undertaking of an impact and risk assessment process, inclusive of cumulative impacts, to determine -
    - The nature, significance, consequence, extent, duration, and probability of the impacts occurring; and,
    - The degree to which these impacts -
        - Can be reversed;
        - May cause irreplaceable loss of resources; and,
        - Can be avoided, managed or mitigated;
- Through a ranking of the site sensitivities and possible impacts the activity and alternatives will impose on the environment through the life of the activity to -
    - Identify and motivate a preferred site, activity and/or technology alternatives;
    - Identify suitable measures to avoid, manage and/or mitigate identified impacts; and,
    - Identify residual risks that need to be managed and monitored.

The purpose of this **Final Basic Assessment Report (FBAR)** is to give all registered Interested and Affected Parties (I&APs) and relevant State Departments the opportunity to review and comment on the proposed activity, impact assessment undertaken, and the recommendations and conclusions of the Environmental Assessment Practitioner (EAP). All registered I&APs and State Departments have received notification of the availability of this report for review and comment. *Note: the registered I&AP review and commenting period on the FBAR will be undertaken concurrently with the Competent Authority's (i.e. KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs (KZN DEDTEA)) review of the report towards issuing a decision on the Environmental Authorisation (EA) application.*

The **14 calendar day commenting period commences on 27 May – 10 June 2016**. The report is available for review on the SE Solutions (www.sesolutions.co.za) website (accessed via the 'Reports' tab and is entitled '*Hillside Desalination FBAR*'). All comments on this FBAR are to be submitted directly to the Competent Authority and copied to the EAP on or before **10 June 2016.**

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Should you have any difficulty accessing the Report and/or have any questions please do not hesitate to contact the above-mentioned SE Solutions team member. All comments received on the FBAR will be taken into account by the KZN DEDTEA when reviewing the EA application.

DETAILS OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONER (EAP)	
COMPANY NAME	Sustainable Environmental Solutions (Pty) Ltd – trading as SE Solutions
BRIEF COMPANY PROFILE	The establishment of SE Solutions was premised on both an interest and belief in the concept of environmental sustainability and making this a reality in South Africa, and other countries where the company works. The company strives to live up to its name of developing solutions for sustainability problems and challenges and most importantly prides itself in tailoring solutions rather than trying to implement standard approaches, regardless of the problem. To give a brief background to some of the larger projects SE Solutions has been involved in, the following examples are listed. SE Solutions was appointed by Bombela to recover a failing EIA process on the Gautrain Rapid Rail Link Project. SE Solutions was appointed by Sasol to coordinate and manage the Mafutha Environmental Assessment Programme in the Lephalale area, a programme consisting of four large scale EIAs (for a Coal-to-Liquids plant, a mine, a services corridor and a proposed town), all required for the possible establishment of a new industrial complex akin to Sasol's operations in Secunda. SE Solutions has a long history of developing environmental management programmes and systems mostly for large scale construction projects, such as the Hillside smelter in Richards Bay, the Mozal smelter Project, the Gautrain Rapid Rail Link Project and various projects for TCTA. SE Solutions is also currently the EAP assisting South32 Aluminium SA Limited with the decommissioning and remediation of the Bayside Aluminium smelter site, Richards Bay. SE Solutions has also played a leadership role on the Acid Mine Drainage Project on the Western, Central and Eastern Witwatersrand Basins. This combined experience has been used to develop a sustainable environmental management system model, which has been further developed into an electronic web based system called 'SustEMS' (Sustainable Environmental Management Systems).
EAP RESPONSIBLE FOR THIS REPORT	Vici Napier
EAP's EXPERTISE	**Highest Qualification:** Master's in Conservation Biology from the University of Cape Town, South Africa. **Years' Experience as an EAP:** 10 years **Summary of expertise:** • Registered Professional Natural Scientist with SACNASP (Reg No. 400215/09). • Experienced in managing large multi-disciplinary project teams for various types of environmental assessments. • Undertaken numerous Environmental Impact Assessments (EIAs) and Strategic Environmental Assessments (SEAs). • Undertaken numerous Water Use License Applications (WULAs) and other environmental authorisation application processes. • Experienced in training and skills transfer within the Environmental Management field. **Curriculum Vitae:** Appendix G: Other Information

EXECUTIVE SUMMARY

The current water crisis within the KZN province and, in particular, the City of uMhlathuze Local Municipality, has necessitated that Hillside Aluminium Limited investigate an alternative water supply to that of the Local Municipality (LM). Level 4 water restrictions (Industry – 15%; Domestic – 40%; Irrigation – 80%) have been in place since March 2016 and are believed to remain in place and escalate if good rainfall events are not experienced within the remainder of the year. Based on the current situation and expected worst case scenarios, it is predicted that the LM would likely run out of water by October 2016. The implications of water supply to the Hillside Aluminium smelter being halted are beyond estimation. The smelter has significant positive socio-economic impacts on the local, provincial and national economies. The following briefly highlights some of the negative impacts that may materialise should the Hillside Aluminium smelter shut down (note that these estimates apply to all the South32 smelters having to shut down, but nonetheless provides an indicative quantification of potential impact).

- Loss of up to 0.4% to the country's Gross Domestic Product (GDP) with an even greater proportional loss to the regional GDP of KwaZulu-Natal, particularly of Richards Bay amounting to more than 10% of the GDP of the area;
- Loss of approximately 20 000 jobs in South Africa and loss of income for their dependents affecting the livelihood of probably more than 80 000 people.
- The loss of at least 7 000 jobs in KwaZulu-Natal primarily located in the Richards Bay region. This would result in the loss of income for their dependents affecting the livelihood of an estimated 33 000 people.
- A direct negative impact on the current account of balance of payments of R4.3 billion. Downstream industry would now need to import its aluminium requirements. As growth returns to the global aluminium industry this could rise.
- The loss of revenue to the Receiver of Revenue would amount to more than R1.5 billion per annum.
- There would be a significant loss of revenue to associated parties (such as, the Richard Bay port authorities, the LM, etc.).

Hillside Aluminium Limited has identified the desalination of sea water as the most sustainable solution for an emergency alternative water supply for the smelter. The desalination plant will be located on the Hillside Aluminium smelter site (southern corner in close proximity to the process water reservoir). The core advantages of the desalination option, specifically the preferred alternative of using existing Foskor infrastructure) are that infrastructure already exists for the approved abstraction of sea water at the Richards Bay Harbour and associated pipeline infrastructure (i.e. Foskor's raw water pipeline) from the abstraction point to the Hillside conveyor belt system. All of this contributes to the quick turnaround time to have the desalination plant and associated infrastructure installed and commissioned.

The proposed Hillside desalination plant will have a very low negative impact on the natural environment during both the construction and operational phases of the project. However, from a cumulative impact perspective, the proposed desalination plant will have a significant positive impact on the reduction of potable water consumption. Reducing the potable water consumption of the Hillside Aluminium smelter has high positive impacts on the local and regional community in that the already scarce and rapidly declining water resource can be more effectively and efficiently distributed to those users who are most in need. In addition, and not assessed (as detailed above) is the high positive socio-economic impact of the continued operation of the Hillside smelter extending far beyond local impacts to national and perhaps international impacts. There are no fatal flaws to the development of the preferred alternative for the proposed desalination plant at the Hillside Aluminium site and as such the EAP recommends that a positive Environmental Authorisation (EA) be issued to the Applicant.

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ABBREVIATIONS AND SYMBOLS

BA	Basic Assessment
Bgl	Below ground level
BID	Background Information Document
CEB	Chemically Enhanced Backwash
CIP	Cleaning-in-place
CRR	Comment and Response Report
DEDTEA	Department of Economic Development, Tourism and Environmental Affairs
DEA	Department of Environmental Affairs (then, DEAT)
DEAT	Department of Environmental Affairs and Tourism (now, DEA)
DWA	Department of Water Affairs (now DWS)
DWS	Department of Water & Sanitation (previously DWA and DWAF)
DWAF	Department of Water Affairs and Forestry (now, DWS)
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EMF	Environmental Management Framework
EMS	Environmental Management System
HDPE	High Density Polyethylene
GDP	Gross Domestic Product
HGM	Hydrogeomorphic
I&AP	Interested and Affected Party
IDZ	Industrial Development Zone
IDP	Integrated Development Plan
IEM	Integrated Environmental Management
KZN	KwaZulu-Natal
Ml	Mega litre
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NEMBA	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
NEMWA	National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)
NGO	Non-Governmental Association
NHRA	National Heritage Resources Act, 1999 (Act No. 25 of 1999)
NEMICMA	National Environmental Management: Integrated Coastal Management Act, 2008 (Act No. 24 of 2008)
NWA	National Water Act, 1998 (Act No. 36 of 1998)

NWRS	National Water Resource Strategy
PLC	Programmable Logic Controller
PP	Public Participation
PSU	Practical Salinity Units
RO	Reverse Osmosis
SANS	South African National Standard
S&EIR	Scoping and Environmental Impact Reporting
SDF	Spatial Development Framework
SEMA	Specific Environmental Management Act
SSF	Slow Sand Filter
TNPA	Transnet National Ports Authority
ToR	Terms of Reference
UF	Ultrafiltration
WESSA	Wildlife and Environmental Society of South Africa
WMA	Water Management Area
WUL	Water Use License
WULA	Water Use License Application
ZTR	Zonal Type Rarity

GLOSSARY OF TERMS

Activities	Activities are the physical activities that typically unfold over the full product lifecycle. In the case of this application the activities are limited to construction of the desalination plant and associated infrastructure.
Air valves	Air valves are installed on pipelines and are designed to release air from the pipeline when the system is started to prevent cavitation of the pumps and shocks in the pipeline. They are also a requirement to let air into the pipe in the event of a burst, thereby preventing negative pressures and possible pipe collapse. They are also used to allow air to escape during filling and normal operations of pipelines.
Aspects	Environmental and social aspects are defined as 'an element of an organisation's activities, products or services that can interact with the environment.'
Bioaccumulation	The accumulation of substances, such as trace metals, or other organic or inorganic elements and chemicals in an organism.
Cathodic protection	To control the corrosion of the steel pipeline by making it the cathode of an electrochemical cell. A simple method of *protection* connects the steel pipeline (to be *protected)* to a more easily corroded "sacrificial metal" to act as the anode.
Cumulative impact	An impact that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or other activities in the area.
Impacts	Environmental and social impacts are defined as 'any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's activities, products or services.'
Isolation valves	Valves in water pipelines that stop the flow of water, located at convenient positions, for maintenance or safety purposes. In the event of a burst, the pipeline can be isolated to reduce the volume of water wasted/ spilled before a repair can be made.
Red Data Species	The IUCN Red List of Threatened Species is a series of Regional Red Lists that are produced by countries or organizations, which assess the risk of extinction to species within a political management unit. The aim is to convey the urgency of conservation issues to the public and policy makers, as well as help the international community to try to reduce species extinction.
Settling pond	A settling pond is a basin used in the wastewater treatment process where water is able to collect. Solid pollutants in this water settle to the bottom and excess water is, in some cases, allowed to flow over the top.
Scour valves	If repair work is required on the pipeline, scour valves allow for the draining of water within the pipe.

1 INTRODUCTION

Sustainable Environmental Solutions (Pty) Ltd (SE Solutions), was appointed by Hillside Aluminium Limited (hereinafter referred to as the 'Hillside') as the independent Environmental Assessment Practitioner (EAP), to undertake the required application for Environmental Authorisation (EA) by way of a Basic Assessment (BA) application process in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended (NEMA) for the proposed Hillside desalination plant to be established at the Hillside Aluminium smelter site (hereinafter referred to as 'Hillside') in order to provide process water to the Hillside Aluminium smelter in emergency situations, Richards Bay, KwaZulu-Natal.

2 DETAILED PROJECT OVERVIEW

2.1 LOCALITY

Hillside is located on Portion 43 of Erf 5333, Alton in Richards Bay (Figure 1) within the uMhlathuze Local Municipality and Uthungulu District Municipality. The Hillside site is accessed via the West Central Arterial to the south of the site. The proposed desalination plant would be located at Hillside (GPS coordinates of the approximate centre of the desalination plant are: 32° 1'43.25" E and 28°46'13.39" S) as seawater would be abstracted from the existing and approved abstraction point between berths 609 and 701 at the Richards Bay Harbour (GPS coordinates of the abstraction point are: 32° 02' 15" E and 28° 47' 05" S, refer to Appendix G for the Authorisation). Wastewater from the desalination plant would be pumped to the Mhlathuze Water Sea Outfall Pipeline via the existing historical Lake Mzingazi raw water pipeline located between the two smelters (Figure 1).

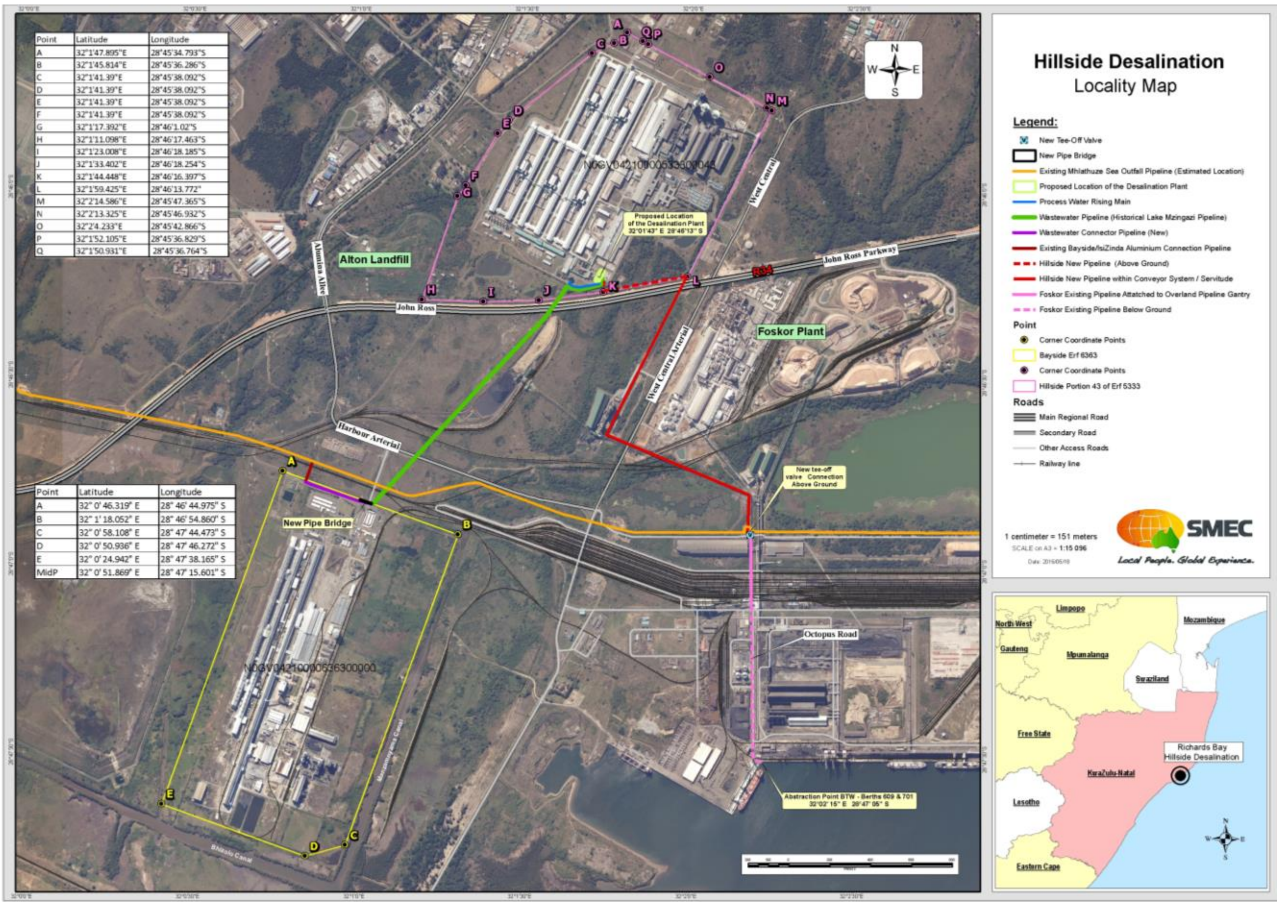

Figure 1: Locality Map for the Hillside desalination plant and associated infrastructure (Preferred Alternative) in order to provide Hillside with an alternative supply of process water; Richards Bay, KwaZulu-Natal.

2.2 SURROUNDING LAND USE

To the north of the Hillside Aluminium smelter are various industrial area with open areas present, to the east is Bullion Boulevard beyond which is largely undeveloped vacant land. To the south of Hillside is the John Ross Highway, beyond which stockpiles linked via conveyor to the Port of Richards Bay harbour are evident. The South32 Bayside operations are located 1km to the south of the Hillside operations. The Alton Landfill site is located to the south-west of Hillside, north of the John Ross Parkway. The land located between Bayside and Hillside is largely vacant, while the Foskor plant is located approximately 200m to south-east of Hillside and east of the Hillside conveyor belt system and proposed wastewater pipeline (i.e. historical Lake Mzingazi pipeline) between Bayside and Hillside. The Grinrod coal stockpiles are located directly adjacent to the proposed wastewater pipeline. The Richards Bay Harbour is located south-east of Hillside and south of the Foskor plant (Figure 1).

2.3 PROJECT DETAILS

The project assessed in this BA is the proposed Hillside desalination plant and associated infrastructure to be established at Hillside in order to provide Hillside with a temporary, emergency alternative supply of process water.

2.3.1 Seawater/ Raw Water Abstraction

Foskor has existing seawater abstraction infrastructure between Berths 609 and 701 at the Richards Bay Harbour, which is used as an emergency backup seawater supply for their Mondi water supply. This infrastructure is used for emergency situations only and is tested from time to time as a maintenance requirement for the pump infrastructure. The Foskor seawater extraction point is designed for a capacity of 1250 m^3/hr, of which only 700m^3/hr (17ML/day) is utilised in emergency situations. The abstraction infrastructure has two pump chambers of which one pump chamber is operational to abstract 800m^3/hr solely for Foskor's use, while the second chamber is currently vacant to allow for additional abstraction infrastructure in order to reach its full approved abstraction capacity of 1250m^3/hr. Hillside proposes to use this facility by adding a second pump within the vacant chamber to abstract 280m^3/hr (6.7ML/ day) of seawater to produce the 2ML/ day of process water required to keep the Hillside Aluminium smelter operational during emergency situations. The Foskor and Hillside combined abstraction remains within the approved abstraction limit of 1250m^3/hr.

2.3.1.1 Pump Station & Sump Chambers:

The existing pump chamber is built of concrete with a depth of 6 m containing 2 (two) pump chambers. Only one chamber has a pump. The vacant chamber will be duplicated with the existing Foskor pump and valve configuration. The new Hillside pump to be installed will allow for the following design parameters:

- Pumping Hours per day: 24 hours;
- Design Flow: 800 m^3/hr but operational at 35% of its capacity to provide 280m^3/hr; and,
- Elevation difference: 40m from mean sea level.

The existing power capacity at the berth is sufficient to operate the two pump configuration. Variable speed drives for both pumps will be added to ensure proper operation of the pumps when both Foskor and Hillside require seawater abstraction. Figure 2 below illustrates the arrangement of the existing sea water abstraction facilities to facilitate the pumping of seawater to the Hillside desalination plant and the Foskor plant, including the control philosophy.

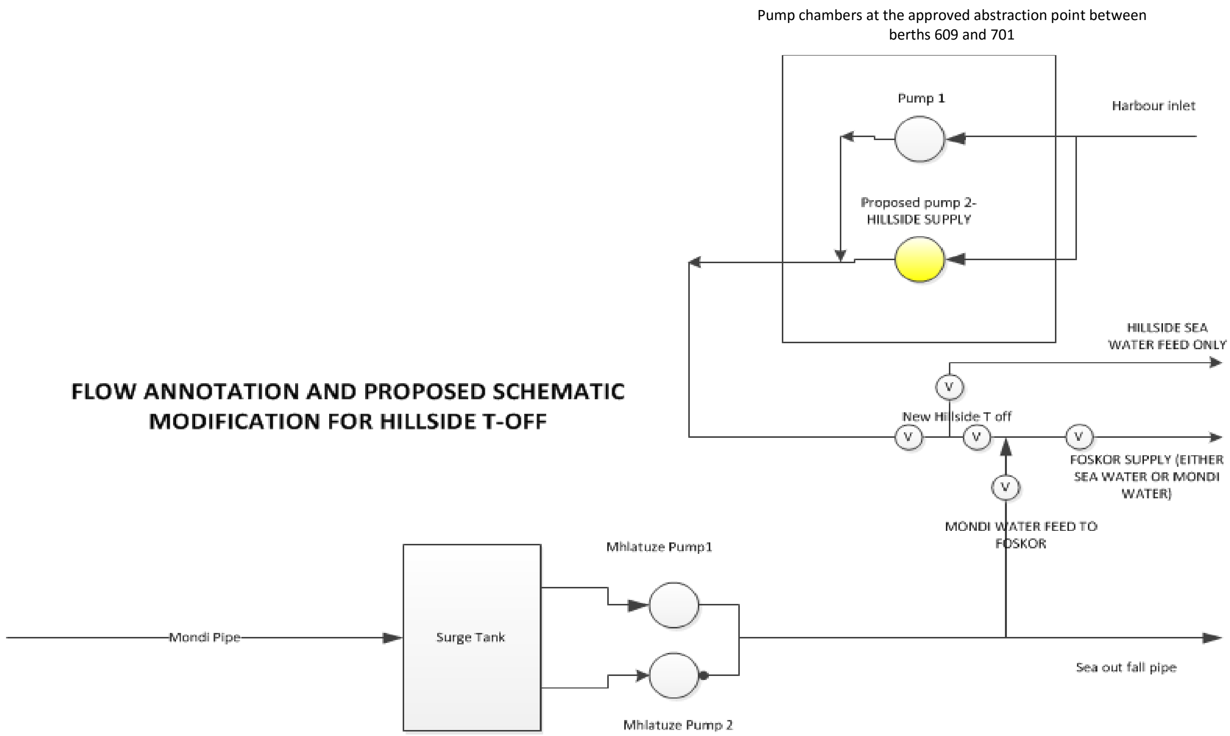

Figure 2: The arrangement of the existing sea water abstraction facilities to facilitate the pumping of sea water to the Hillside desalination plant

2.3.1.2 Foskor Piping Arrangement and Hillside New Piping Arrangement

Seawater will be piped from the abstraction point between Berths 609 and 701 at the Richards Bay Harbour to the Hillside Aluminium smelter as follows, refer to the site photographs in Appendix B:

- From the abstraction point the existing Foskor seawater pipeline runs underground for approximately 720m, parallel to the Foskor acid line, until it reaches the above ground Foskor pipe gantry/ rack. From there the 450mm diameter HDPE pipeline travels 320m on a dedicated pipe gantry/ rack to the Mhalthuze Water Surge Tank (Surge Tank Tower 1). This portion of the route is located within the Transnet National Port Authority facilities.
- At the Surge Tank Hillside will install a take-off point from the Foskor seawater line. The take-off pipe support structure will be bolted to the existing concrete trestle of Hillside conveyor 07 (Figure 3) in the immediate vicinity of the Surge Tank Tower. An isolation valve will be installed at the entry point of the pipe into conveyor 07. The pipe will travel a distance of 180m inside conveyor 07 to Transfer Tower 3.
- At Transfer Tower 3 the pipeline will be transferred to conveyor 08 and travel 930m to Transfer Tower 4. At both ends of this section of the pipe, automatic shutoff valves will be installed to limit the volume of seawater that may be spilled due to a pipe burst. These automated shutoff valves will be controlled via pressure monitoring instrumentation. These valves will be automatically controlled via Programmable Logic Controller (PLC) and a radio link set up from Hillside. Conveyor 08 is located over the northern extent of the Thula Sihleka Pan.
- The new HDPE pipe routed inside the overland Hillside conveyor 08 will continue and cross the West Central Arterial (Harbour Road) to enter Hillside Transfer Tower 4. At Transfer Tower 4 the pipe will run outside the Transfer Tower building mounted on the existing concrete structure of Transfer Tower 4 to access the west side of conveyor 09 servitude.
- From Transfer Tower 4 the pipe will be laid on the western side of conveyor 09 (i.e. the pipe will be positioned above ground in the gap between the conveyor and the Kussasa palisade fence) for 900m until it crosses the R34 John Ross Highway culvert.
- The pipe will then enter the Hillside premises where it will be laid above ground on the northern edge of the southern boundary access road. The distance from the R34 John Ross Highway culvert to the location of the

proposed desalination plant is approximately 500m in length. The HDPE pipe will be buried below the SASOL gas line where the SASOL gas line crosses the Hillside perimeter service road.

- The pipe will also cross the stormwater canal from the Hillside Impoundment Dam 2 via a pipe gantry.
- All installations will be within existing servitudes and aboveground.

Construction laydown areas for pipes and other equipment are located in the following areas – refer to the Site Plan in Appendix A:

- At the Hillside Aluminium smelter site the contractor laydown area will be next to the Casthouse Quarantine Building in the vicinity of SGB slab;
- For conveyor 07 & 08 pipe work, the laydown area will be inside Transfer Towers 3 and 4. Currently fenced off and within the Hillside servitude;
- For conveyor 09 pipe work, the laydown area will be inside Transfer Tower 4. Currently fenced off and within the Hillside servitude; and,
- For pipe work at the Bayside Aluminium smelter site, the laydown area will be located in a vacant grassed area north of the open concrete reservoir.

Figure 3: Hillside take-off point from Foskor seawater pipeline to a connection supported on existing conveyor 07 concrete trestle next to the Mhlathuze Surge Tank Tower 1.

2.3.2 Desalination Plant

The desalination plant, design capacity of 2Ml (mega litres) of process water per day, would be a fully containerised (i.e. mobile) plant in that it would be completely modular to allow for rapid deployment and capacity changes through the addition or removal of modules (Figure 4 and Appendix C). The flow diagram in Figure 5 provides details with regards to the desalination process of seawater to process water, from the point of abstraction between Berths 609 and 701 to the point of delivery to the Hillside Aluminium smelter.

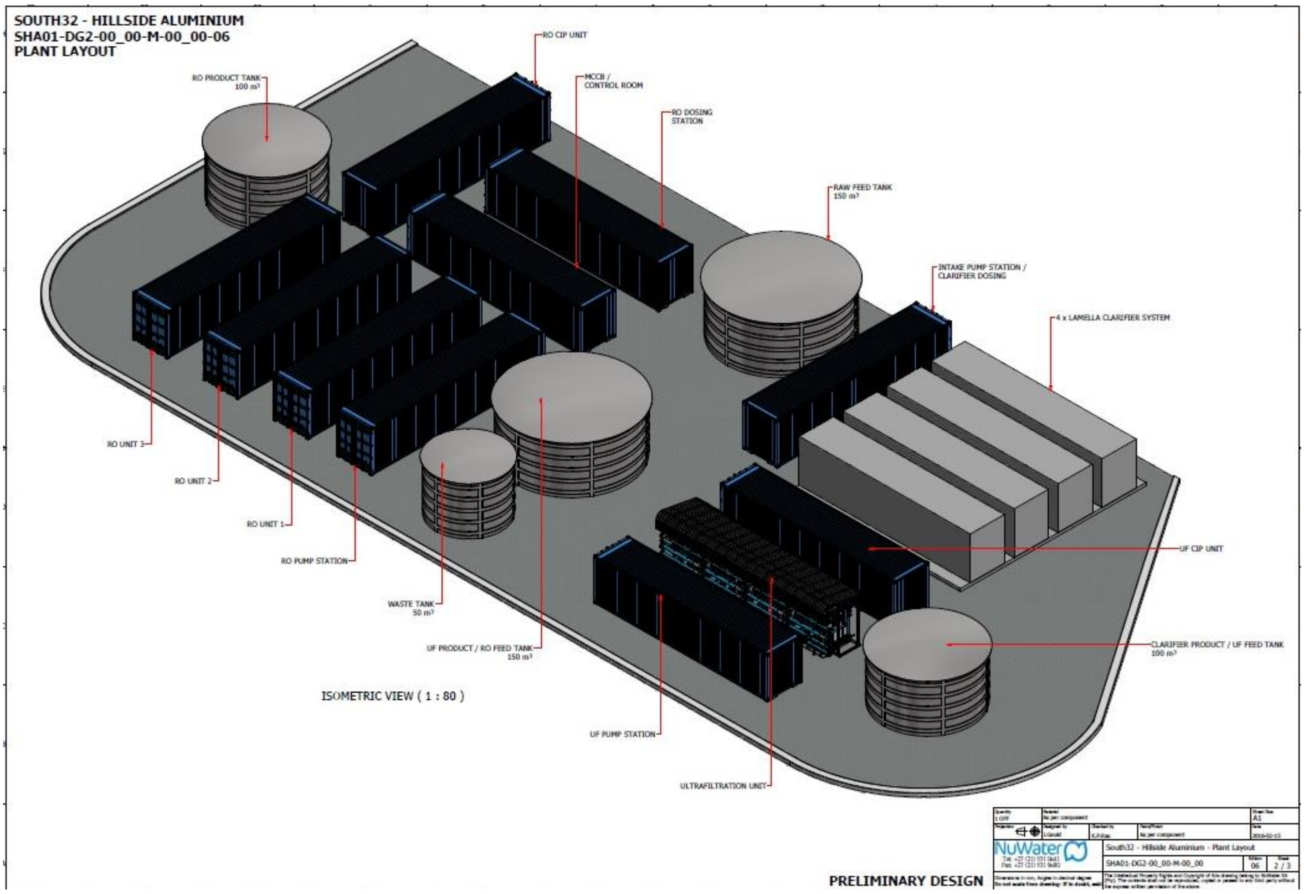

Figure 4: Isometric view of the proposed desalination plant, highlighting its containerised nature

The desalination plant would be located east of the Hillside Casthouse cooling water plant on an existing concrete slab. A pump will be installed at the desalination plant to pump process water from the desalination plant to the Hillside process water concrete reservoir.

The closest electrical point of supply for the proposed desalination plant is located in substation 06 at the Hillside Compressor House. A 300 m long 3.3kV cable will supply power to a new mini substation located in the footprint of the desalination plant. The estimated connected load of the proposed desalination plant is 800kVA. The estimated load is within the capacity of substation 06.

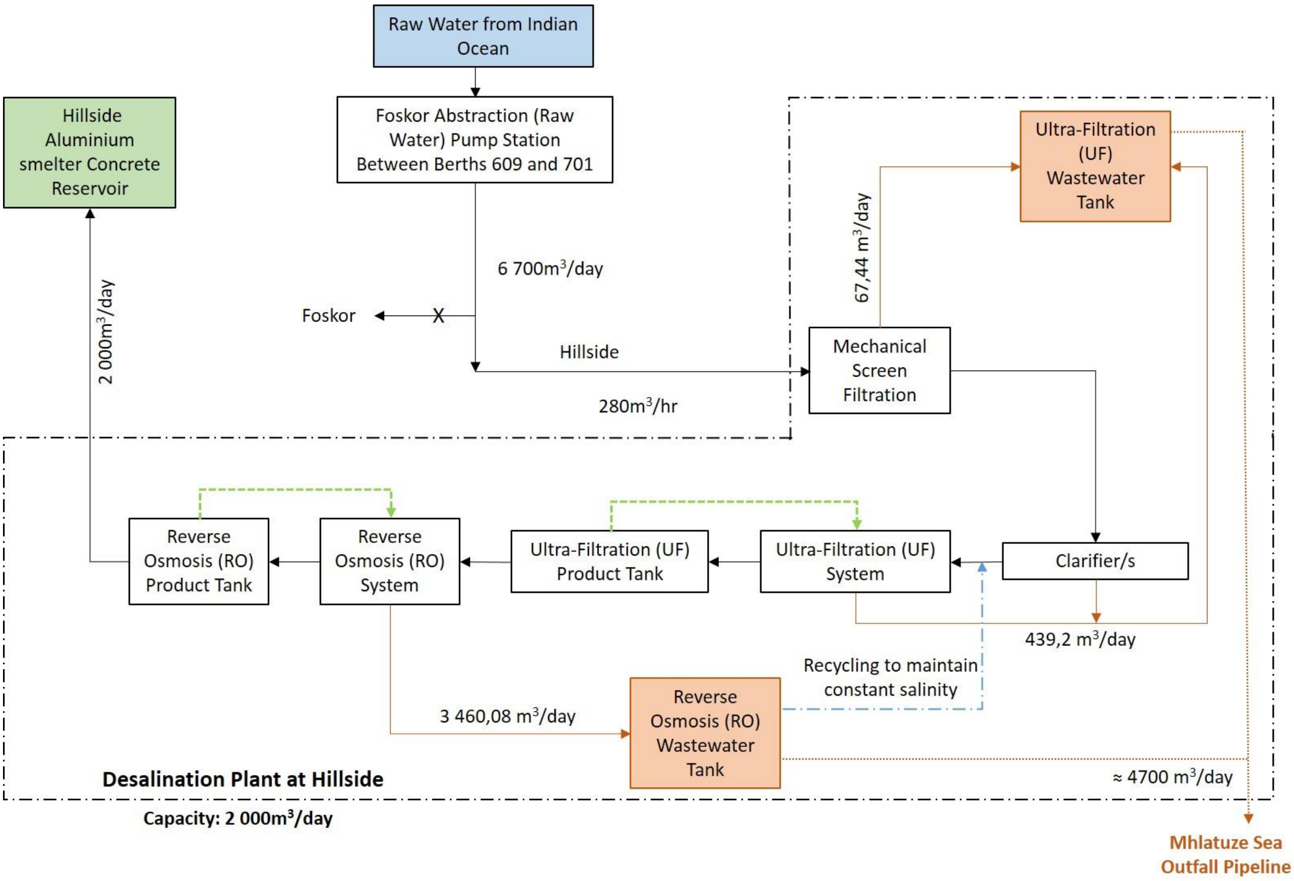

Figure 5: Diagrammatic illustration of the process flow for the desalination project to be established at the Hillside Aluminium smelter site

2.3.2.1 Pre-Treatment/ Phase 1 Filtration

Due to the abstraction of seawater directly from the harbour, the need of a pre-treatment facility will not be required. A mechanical screen will be installed with a clarifier system to remove debris and suspended solids from the seawater due to the quality of the seawater.

2.3.2.2 Phase 2 Ultra-Filtration (UF)

During ultra-filtration the suspended solids would be removed to produce Reverse Osmosis (RO) feed water that meets the required Silt Density Index. Ultra-filtration is a pressure driven purification process in which only water, dissolved solids and low molecular weight substances can permeate through the membrane, whilst particles above 0.03µm, colloids and macromolecules are rejected. Flow through the semi-permeable UF membrane is achieved by applying a pressure gradient driving force between the inner and outer wall of the membrane structure. The UF membranes typically have a pore sizes in the range of 0.01 – 0.1µm with high removal efficiency for bacteria, most viruses, colloids and silt, thereby effectively achieving separation and purification. This makes UF an ideal pre-filtration system for RO feed water.

The transmembrane pressure (which is the primary parameter used to identify the onset of fouling) is continuously monitored by the plant's control and SCADA system. In the event that the UF units start to show signs of fouling, the units can be cleaned through a backwash cycle, air scouring and a chemically enhanced backwash (CEB) to restore UF performance. Occasionally cleaning-in-place (CIP) and CEBs are required to remove any fouling not removed by the backwash process. The UF system would be automatically backwashed every 30-40 minutes, with additional air scouring occurring approximately every 40 minutes, to reduce fouling and scaling in the system.

The number of operating banks and their start/stop sequencing would be selected automatically in order to meet the indicated demand for the feed water to the RO system. The control system would automatically adjust the operating parameters to maintain a set recovery and permeate flow rate. Furthermore, shutdowns and emergency shutdown sequences would run automatically without requiring operator intervention.

The overall recovery on the UF system is expected to be up to 92%. The residual UF waste streams generated from the backwash, CIP and CEB would be discharged into a 50m^3 wastewater tank for ultimate discharge into the Mhlathuze Sea Outfall Pipeline via the historical Lake Mzingazi pipeline.

2.3.2.3 Phase 3 Reverse Osmosis (RO) (estimated efficiency = 40%)

RO feed water firstly undergoes a chemical dosing process, which entails the following:

- Sodium Metabisulphite addition for the neutralisation of any residual free chlorine;
- Antiscalant addition for the prevention of scaling within the RO membranes; and,
- pH adjustment with the addition of Hydrochloric Acid (HCL) – by controlling pH, the RO recovery can be improved and the volume of brine (waste) generated decreased.

The RO plant then removes dissolved solids through a series of membranes to produce treated water that meets the required product water specifications in terms of quantity and quality. The dissolved solids reduction system has an automated rinse system, which flushes the unit twice daily with dissolved solids reduction system product water. This greatly minimises the formation/accumulation of scaling/fouling material within the membranes. Wastewater or brine produced from the RO system is also discharged into a 50m^3 wastewater tank for ultimate discharge into the Mhlathuze Sea Outfall Pipeline via the historical Lake Mzingazi pipeline.

2.3.2.4 Wastewater Discharge Pipeline to the Mhlathuze Sea Outfall Pipeline

A new 200 m long 315mm diameter HDPE pipe will be installed from the desalination wastewater tanks to the existing valve connection adjacent to the Hillside process water concrete reservoir. An isolation valve will be installed at the discharge pumps from the desalination plant and this new HDPE pipe will be connected to the historical Lake Mzingazi pipeline at the pipe chamber next to the Hillside concrete reservoir. This pipe will carry the brine and wastewater from the desalination plant (as described above) via the historical Lake Mzingazi pipeline to the Bayside Aluminium smelter site. A short new 315mm diameter HDPE pipeline (to be constructed above ground on a pipe bridge, estimated 50m span and 5.9m in height) together with an air valve (located on the pipe bridge) with isolation valve chambers on either end of the pipe bridge will have to be constructed, to facilitate crossing over the existing access road to the isiZinda Aluminium Casthouse/ Bayside operations and Bayside potable water control area (refer to preliminary design drawings in Appendix C). The pipeline will then continue underground to the existing Bayside/ IsiZinda Aluminium pipeline connection to the Mhlathuze Sea Outfall Pipeline. A new flanged HDPE connection together with an air valve chamber will be made/ constructed next to the Bayside/ IsiZinda connection to connect the Hillside wastewater pipeline from the desalination plant to the Mhlathuze Sea Outfall Pipeline. Non return valves will be used to prevent back flow of effluent/ wastewater into the Bayside/ IsiZinda pipeline.

2.3.3 Process Water Pump Station & Rising Main/ Pipeline

A process water pump station would be a containerised pump station that would be installed alongside the desalination plant and will pump process water to the Hillside concrete reservoir via a new 200 m long 315mm diameter HDPE pipe. The scope of work envisaged in order to provide a fully operational process water pump station is as follows:

- Installation of the pump station on the existing concrete slab at the Hillside site.
- Installation of the new 200 m HDPE pipe.
- Connection via a pipe chamber to the concrete reservoir.

2.4 NEED AND DESIRABILITY

The 2015 Socio-Economic Survey undertaken by, the then BHP Billiton Aluminium SA, highlighted that water is the most limiting factor for future development in the City of uMhlathuze Local Municipality, and specifically in the industrial zone. By 2025 South Africa will not have sufficient water to meet its needs (2044 million m^3/a below - BHP Billiton Southern Africa Sustainability Report, 2011). The report further highlights that various health related issues in the district can directly be linked to water supply, such as the high rate of diarrhoea in children under 5, and the fact that diarrhoea is the 4th highest cause of years of life lost in the district. The lack of proper water, refuse and sanitation services in the area will further contribute to water pollution, and should be addressed more effectively to protect the water supply and quality. The survey also references that the local water supply capacity in uMhlathuze has been reported as fully developed in 2010 and water is being augmented from sources outside the catchment.

Based on the above, and the severe drought conditions currently experienced in KwaZulu-Natal and their reliance on municipal water supplies from the Goedertrouw Dam, South32 has identified the inherent risk to normal operations at their Hillside Aluminium smelter. Water levels at the Goedertrouw Dam are reducing at an alarming rate and the Dam is currently the only source of water supply to the region for industrial and domestic use. The City of uMhlathuze Local Municipality confirmed that without water restrictions there is the real risk that the Dam will run empty in July 2016. The graph below (Figure 6) depicts the possible scenarios, as presented by the Disaster Advisory Forum in Richards Bay, with regards to the impact of the drought on water supply in the region. As it stands, level 4 water restrictions (Industry – 15%; Domestic – 40%; Irrigation – 80%) from the Department of Water & Sanitation (DWS) have been implemented, however, should the drought continue the Dam is predicted to be at 5% by November 2016. The impact of the current drought was also discussed at the Catchment Forum and Disaster Management meetings. At these meetings the bulk water users were encouraged to find alternative sustainable sources of water supply should the worst case be experienced.

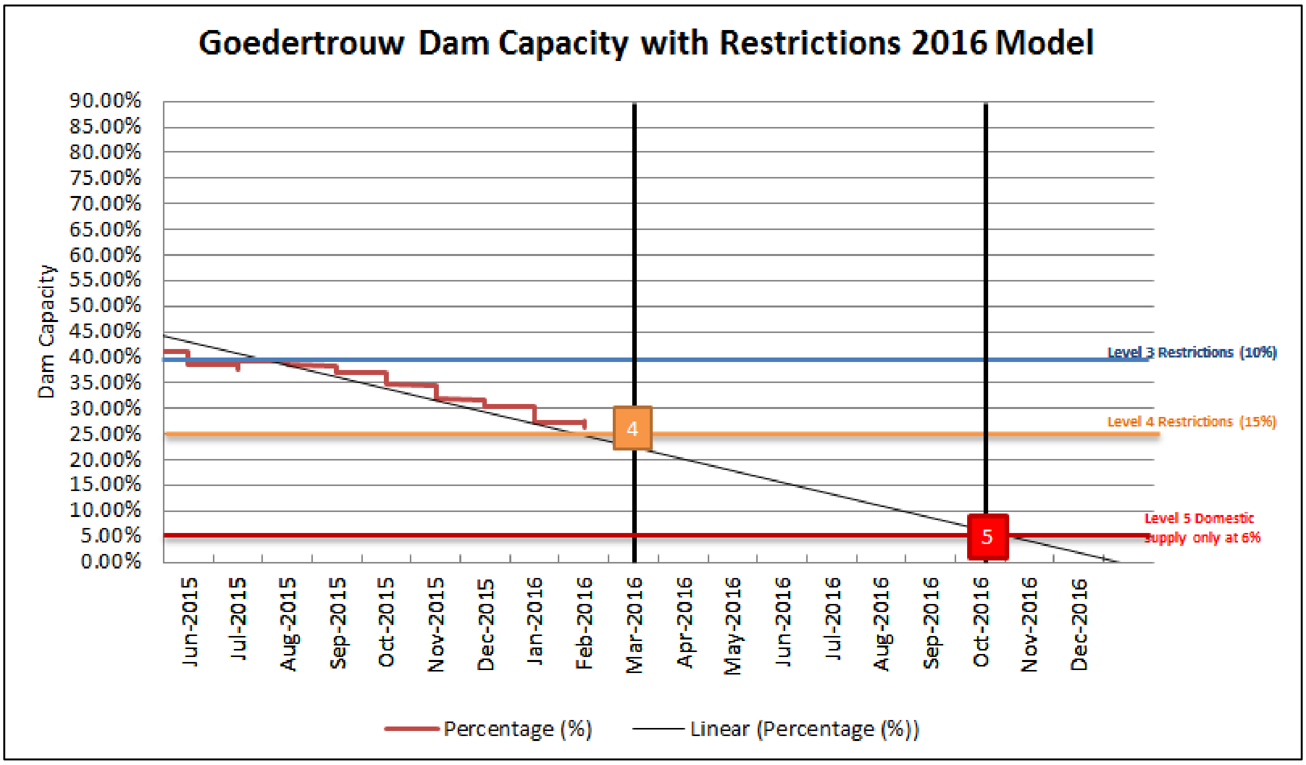

Figure 6: Predicted changes in water storage capacity at the Goedertrouw Dam as a result of the ensuing drought (Source: Disaster Advisory Forum, Richards Bay).

The following extracts from the Zululand Observer further highlights the urgent need to source alternative water supplies, dated 21 and 29 March 2016, respectively.

> Goedertrouw Dam, presently the City's only water source, last week dropped to an alarmingly 24.2%, and authorities warn if all citizens do not urgently contribute to water-saving efforts, Zululand could be bone dry in fewer than 200 days, with 80% of the district's water schemes likely to fail.

> THE Zululand Observer is currently awaiting official verification of a bulk SMS sent to residents, stating that water cuts will begin this evening (Tuesday) at 10pm.
>
> City officials are currently preparing to release a statement either verifying or denying the warning, which said that residential water supply to City residents would be cut from 10pm until 6am until further notice.
>
> We expect official comment by the close of business today.
>
> **Umhlathuze Municipality**
> 6 hrs ·
>
> City of uMhlathuze: Stage 4 Water shedding will start as from 28/03/2016 from 22:00 till 06:00am everyday. Inconvenience regretted.
>
> Like Comment Share

In addition, should the current water supply to the Hillside Aluminium smelter cease, the plant will have to shut down. The shutting down of the Hillside Aluminium smelter will have significant knock-on effects within the local, provincial and national socio-economic environment.

Hillside Aluminium Limited is the largest aluminium smelter in the southern hemisphere. Hillside is one of the world's most advanced and efficient aluminium smelters, produces high quality primary aluminium and is the largest producer of standard aluminium ingots in the southern hemisphere. A review of the aluminium smelting industry and its impacts on the South African economy was commissioned by (then) BHP Billiton Aluminium SA in 2012 and the following findings are pertinent to the need and desirability of the desalination plant which is seen as a critical alternative water supply to ensure the sustainability and continued operations of the Hillside smelter. Should the Hillside smelter shut down the following socio-economic impacts may be realised (note that these estimates are based on both the Bayside and Hillside smelters and in some cases the Mozal smelter near Maputo in Mozambique – however, they nonetheless paint the require picture in terms of the potentially significant impact of the Hillside smelter shutting down, given that the Bayside smelter has already been shut down):

- Loss of up to 0.4% to the country's Gross Domestic Product (GDP) with an even greater proportional loss to the regional GDP of KwaZulu-Natal, particularly of Richards Bay amounting to more than 10% of the GDP of the area;
- Loss of approximately 20 000 jobs in South Africa and loss of income for their dependents affecting the livelihood of probably more than 80 000 people.

- The loss of at least 7 000 jobs in KwaZulu-Natal primarily located in the Richards Bay region. This would result in the loss of income for their dependents affecting the livelihood of an estimated 33 000 people in Northern KwaZulu-Natal.
- A direct negative impact on the current account of balance of payments of R4.3 billion. Downstream industry would now need to import its aluminium requirements and this would increase the deficit on the current account of the balance of payments by more than R4.1 billion per annum. As growth returns to the global aluminium industry this could rise.
- The loss of revenue to the Receiver of Revenue, including personal taxes lost, would amount to more than R1.5 billion per annum.
- There would be a significant loss of revenue to the port authorities of Richards Bay, the City of uMhlathuze Local Municipality and Eskom.

The impact on downstream users is also significant, although they could import aluminium which would have serious implications on economic growth and employment. One such example, would be the impact on Isizinda Aluminium, which is 40% owned by Hulamin and 60% held by black investment group Bingelela Capital. Bingelela Capital comprises four 100% black-owned companies and has 52% female representation. JSE-listed Hulamin, which is headquartered in Pietermaritzburg, is currently the Casthouse's biggest customer and is the largest semi-fabricator of aluminium products in Southern Africa. The transaction is aimed at bolstering the economic transformation of Richards Bay and development of South Africa's downstream aluminium industry. The transaction includes the sale of the Bayside Casthouse and a R 10 billion liquid metal supply contract. All of the above would be in jeopardy should the Hillside smelter have to shut down due to lack of water.

2.5 ALTERNATIVES

The 2014 EIA Regulations require the identification and assessment of feasible alternatives to the proposed activity. The following definition of alternatives is provided by the EIA Regulations:

"*Alternatives", in relation to a proposed activity, means different means of meeting the general purpose and requirements of the activity, which may include alternatives to the -*

a) Property on which or location where the activity is proposed to be undertake;
b) Type of activity to be undertaken;
c) Design or layout of the activity;
d) Technology to be used in the activity; or
e) Operational aspects of the activity;

and includes the option of not implementing the activity."

Based on the above it is important to note that alternatives do not only refer to locality alternatives, but also to a variety of technical alternatives including not proceeding with the proposed activity. Thus, alternatives that are relevant, feasible and reasonable in terms of the proposed activities must be identified and assessed in the BA process. The following alternatives for the proposed desalination plant and associated infrastructure were identified and investigated:

2.5.1 Alternative Water Supply Options

2.5.1.1 Foskor's Clarified Water Supply

Mhlatuze Water supplies clarified water (water from Lake Nsezi treated for industrial use) to Foskor via a pipeline that runs directly south of the Hillside Aluminium smelter. Foskor use approximately 15-17Ml per day of clarified water within their industrial processes, however they have an agreement of up to 20Ml per day with Mhlatuze Water, as the pipeline as a design capacity of 23-25Ml per day. The Hillside Aluminium smelter requires 2Ml of water per day to ensure continued operations, thus it was investigated whether or not Hillside could tie into the existing clarified water pipeline and utilise 2Ml of the available capacity for their operations. However, if this should materialise Hillside would still need to treat the water to process water standards for use in the Hillside smelter.

2.5.1.2 Recycling Blow Down Effluent/ Wastewater

Water is used for the cooling of aluminium ingots and at the compressors within the Hillside Aluminium smelter operations. The cooling water is recycled a few times until it reaches a water quality level where it is no longer suitable for cooling, after which it is blown down to a sump from where it is discharged. Hillside investigated treating blow down wastewater/ effluent to allow additional reuse cycles. This would reduce water consumption by approximately 40%. Whilst saving 40% is significant, in the event of a zero supply this would not be sufficient to maintain operations across all processes.

2.5.1.3 Groundwater Supply

Based on the desktop study, the groundwater potential at the site is moderate to good. If groundwater was to be further investigated it would require the drilling of up to 11 exploratory boreholes within the Hillside Aluminium smelter footprint to ascertain the groundwater potential and water quality. Based on the existing knowledge of the underlying aquifers (shallow and deep) and yields from existing boreholes on site, very little confidence was placed on this solution to provide the required water demand for the Hillside smelter.

2.5.1.4 Desalination of Seawater (Preferred)

As described in Section 2.3 above.

Comparative Assessment of alternative water supply options

The following table highlights the advantages and disadvantages of each alternative water supply option investigated prior to the selection of the desalination plant as the preferred option in order to provide an alternative process water supply to the Hillside Aluminium smelter.

Table 1: Comparative Assessment of alternative water supply options investigated

Water Supply Options	Advantages	Disadvantages
Foskor Clarified Water	• Pipeline is located close to the Hillside Aluminium smelter; and, • Spare capacity exists to meet the demand of 2Ml per day.	• Clarified water requires additional treatment prior to use within the Hillside Aluminium smelter; • Installation of a water treatment plant at cost; • Ultimate water supply is still a local scare water resource – thus, continued water supply is still not secure; • Foskor expressed concern as it places additional risks in terms of security of their water supply; and, • The Local Municipality was hesitant to agree to such a tie-in, as clarified water is issued at a reduced cost to industry, thus they would lose revenue.
Recycling Blow Down Effluent/ Wastewater	• Water already in use on site could be treated for additional re-use; and, • Reuse would allow for a 40% reduction in water consumption at the plant.	• Blow down water would need additional treatment for re-use; • Installation of a RO water treatment plant at cost; and, • Ultimate water supply is still a local scare water resource – thus, continued water supply is still not secure.
Groundwater Supply	• Water is available.	• Extensive exploratory investigations (at high cost and long lead times);

		• Unknown volumes and quality of water; • Unknown water treatment options to treat water to the required standard for use in the smelter; • Groundwater is an already exploited water source within the greater area; • Potential negative impacts on downstream users; and, • A relaxation of Municipal Bylaw regarding the location of boreholes below the 50m mean sea level contour line would be required.
Desalination Plant	• Local unlimited water resource; • Independent water resource; • Relieves pressure on local potable water supplies (up to 2Ml per day = 100% reduction in water consumption at the plant) and allows for the redistribution of this water to other users; and, • No impact on downstream water users as none exist.	• Seawater would need treatment for use within the plant; • Installation of a desalination plant and associated infrastructure at cost; • Increased cost per litre of water – up to 4x that of the current water supply; and, • Decreased revenue for the Local Municipality.

2.5.2 Desalination Alternatives

2.5.2.1 Abstraction of Estuarine Water from the Manzamnyama Canal at the Bayside Aluminium smelter site

A new intake channel connecting the existing pump sump to the Manzamnyama Canal would need to be constructed. The mouth of the channel is proposed to be located at the concrete wall to the south of the historical "Mouth" area, so that no clearing or removal of mangrove trees will be required (refer to the Alternative Project Photopage in Appendix B). The channel would be approximately 14.5m (top banks) and 7.5m (bottom banks) at the canal interface, at the sump interface the width would be approximately 7.5m (Figure 7). The channel would be 3-4m deep, but up to 7m deep at the pump sump interface. The side slopes would be constructed from a combination of concrete/ gabion mattress and stone pitching to prevent erosion and the channel and the banks of the Manzamnyama Canal (Figure 7). The Manzamnyama Canal would have to be dredged to ensure the pump sump is submerged to enable pumping during low tides. A marine dredger would have to be used to dredge the Manzamnyama Canal.

The raw water pipeline/ rising main has been divided into five (5) sections from the point of abstraction to the concrete reservoir or desalination plant. Each section is detailed below and should be read in conjunction with the Alternative Project Site Plan in Appendix A.

Section 1: Abstraction Pump Sump to Point K (956m)
The old pipeline (600mm diameter steel pipe) that previously conveyed raw water to Bayside Aluminium, built upon the existing plinths, has been removed. Some of the existing plinths have been damaged and all of them need to be repaired/ refurbished (total of 16 plinths), with some having to be reconstructed (i.e. replaced – total of 10 new plinths), to support the new pipe (a 350mm diameter steel pipe installed approximately 500mm above ground). Two (2) new thrust blocks may have to be constructed. The pipe servitude is overgrown with grass and trees. The vegetation needs to be cleared to allow for access to the plinths as well as reinstallation of those plinths that are missing or require replacement.

This section of the raw water pipeline impacts on several wetlands identified on the Bayside Aluminium smelter site, the north-eastern most wetlands being identified as a sensitive system that should be protected and conserved. Protected trees (Swamp Figs (*Ficus trichopoda*)) and plants (Large Yellow Eulophia Orchid (*Eulophia speciosa*) and White Arum Lilies

(*Zantedeschia aethiopica*)) would have to be removed (i.e. destroyed and/or translocated) once permits from the Department of Agriculture, Forestry and Fisheries (DAFF) and KZN Ezemvelo Wildlife, respectively, have been obtained.

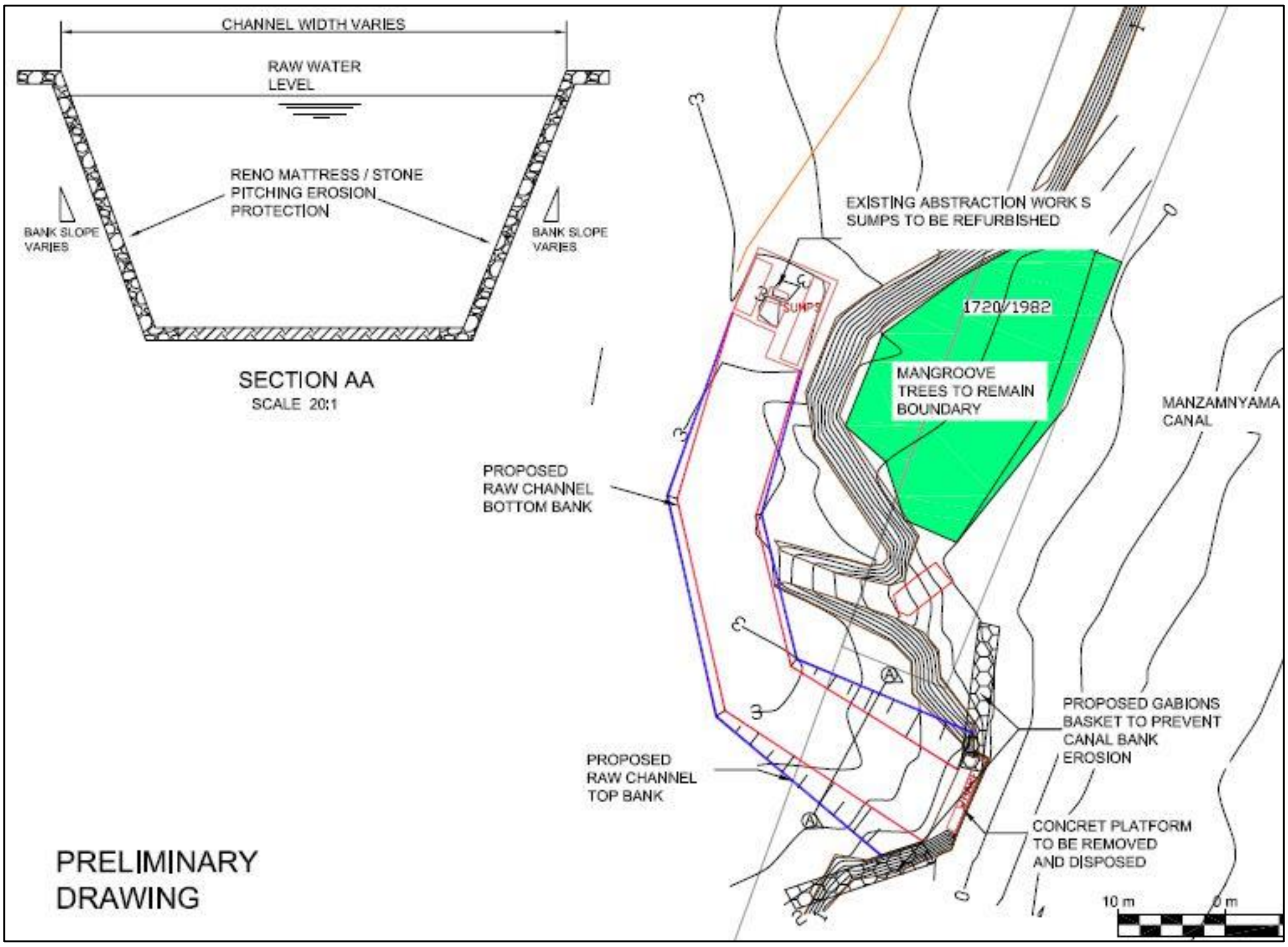

Figure 7: Preliminary design of the proposed new "intake channel" at the Manzamnyama Canal at the Bayside Aluminium smelter site

Section 2: Point K to K1 (190m)

This new section of the raw water pipeline/ rising main would be buried within a 1m wide trench, as it is required to pass underneath the existing disused railway line. The required portion of railway line tracks can be removed to facilitate the installation of the pipeline within a 600mm concrete sleeve below the railway line. The railway line tracks would then be replaced after installation of the pipe.

Section 3: Point K1 to K2 (60m)

This new section of pipeline (a 350mm diameter flanged steel pipeline) would be constructed above ground on a pipe bridge (estimated 50m span and 5.9m in height – refer to Appendix C for design drawings) in order to facilitate the crossing of the Bayside entrance/ access road and the Bayside potable water control area. The pipe bridge would also accommodate the return crossing of the process water rising main.

Section 4: Point K2 to K3 (395m)

This new section of pipeline would be buried within a 1.6m wide trench to a depth of approximately 1m. The route would cross the Eskom servitude but would avoid the Eskom pylon stay cable bases.

Section 5: Point K3 to C (concrete reservoir) (190m)
This new section of pipeline would be buried within a 1.6m wide trench to a depth of approximately 5m in order to facilitate the crossing of the Sasol Gas pipeline (a 3m clearance is required, and it is proposed to install a 750mm concrete sleeve below the Sasol Gas pipeline) and Bayside access road before tying into the existing 6Ml (Mega litres) concrete reservoir. The trench would be shared with the process water rising main (described under Section 2.3.4 below).

The process water pipeline/ rising main has been divided into three (3) sections from the process water pump station at Bayside to the process water reservoir at Hillside. Each section is detailed below and should be read in conjunction with the Alternative Project Site Plan in Appendix A.

Section 1: Points C1 to C3 (425m)
This new section of pipeline would be buried together with Section 5 of the raw water pipeline/ rising main.

Section 2: Points C3 to D (60m)
This new section of pipeline would be installed parallel to the raw water pipeline/ rising main above ground on the pipe bridge.

Section 3: Points D through to G
The process water pipeline from the desalination plant will be tied into the existing 300-315mm pipeline at point D. The existing pipeline from point D to G is what is generally referred to as the historical Lake Mzingazi pipeline. The pipeline used to transport raw water from Lake Mzingazi to the Hillside and Bayside Aluminium smelter sites. When abstraction from Lake Mzingazi ceased, the pipeline was and is still used as an auxiliary water feed (in emergency situations) pipeline from Bayside to Hillside Aluminium (PR000490: Utilities Emergency Response Procedure).

2.5.2.2 Preferred: Abstraction of Seawater using existing (Foskor) abstraction infrastructure between Berths 609 & 701 at the Richards Bay Harbour

The preferred method is detailed in Section 2.3.1 above.

Comparative Assessment of alternative abstraction methods

The following table highlights the advantages and disadvantages of each alternative investigated.

Table 2: Comparative Assessment of alternative abstraction methods investigated/ considered

Abstraction Methods	Advantages	Disadvantages
Abstraction of Estuarine Water from the Manzamnyama Canal at the Bayside Aluminium smelter site	• No protected mangrove trees need to be removed as the channel is to be located south of the historical intake "Mouth" were no mangroves have established; • Allows for the re-use of existing infrastructure on site (i.e. sump); • Safe and easy maintenance and routine inspections (cleaning); • Marine fauna can be kept away from pump sump with screens and other filters / obstructions; • Low flow velocities reducing scour impacts; and, • Improved bank erosion protection.	• Protected tree and plant permits are required before pipeline construction can commence; • Dredging of the canal is required to ensure continuous abstraction of water during low tide periods; • Low flow velocities create settlement; • A Water Use License (WUL) is required from the Department of Water & Sanitation (DWS) due to the impact on wetlands on site and abstraction of water from the estuary; and, • Lengthy implementation timeframe.
Preferred: Abstraction of	• Sensitive Manzamnyama Canal will not be impacted on;	• Shared infrastructure; • Increased cost;

Seawater using existing (Foskor) abstraction infrastructure between Berths 609 & 701 at the Richards Bay Harbour	• Protected trees and plants will not require removal and/or translocation; • No protected mangrove trees will be impacted on; • Allows for the use of the existing Foskor abstraction point and infrastructure at the harbour; • No need for a Water Use License; • Shorter implementation timeframe (as some of the abstraction and pipeline infrastructure already exists); and, • Current Mhlathuze Water Record of Decision (ROD) allows for abstraction of seawater.	• Water quality fluctuations due to the possible stirring up of sediment through the movement of ships within the harbour; and, • Design complexities associated with the conveyor to accommodate the raw water pipeline.

2.5.3 No-Development (No-Go) Alternative

The EIA regulations stipulate that the no-development alternative must also be presented. For the Hillside Aluminium smelter the no-development option is simply untenable, as this would imply that the smelter will simply run out of water for continued operations should the current drought conditions persist, thus resulting in the shutting down of the plant. In addition, the NWA compels the investigation and use of alternative water supplies that do not impact on already stressed, finite freshwater resources. In this particular case the no-go alternative poses the greatest potential threat to the socio-economic environment whereas the environmental costs associated with the proposed desalination plant are far less significant, and is therefore not considered further.

3 RELEVANT LEGISLATION AND GUIDELINES

3.1 OVERVIEW OF ENVIRONMENTAL LEGISLATION IN SOUTH AFRICA

Section 24 of the Constitution of the Republic of South Africa of 1996 guarantees everyone has a right to an environment that is not harmful to their health and well-being and to have the environment protected for the benefit of present and future generations. In order to give effect to this right, the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) was promulgated.

NEMA is the overarching environmental legislation in the country. Chapter 1 of NEMA lists the national environmental management principles (NEMA Principles) that should be the point of departure for environmental management within the country. The following two principles reflect the core of NEMA:

- Environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably.
- Development must be socially, environmentally and economically sustainable.

Several sector Specific Environmental Management Acts (SEMAs) have been promulgated and all fall under the umbrella of NEMA, these are:

- Environment Conservation Act, 1989 (Act No.73 of 1989);
- National Water Act, 1998 (Act No. 36 of 1998);
- National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003);
- National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004);
- National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004);
- National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008); and
- National Environmental Management: Integrated Coastal Management Act, 2008 (Act No. 24 of 2008).

3.2 NEMA & EIA REGULATIONS

The Environmental Impact Assessment (EIA) Regulations (Government Gazette Notice (GN) No. R. 982 – 985 of 04 December 2014) promulgated in terms of NEMA regulate the "*procedure and criteria as contemplated in Chapter 5 of the Act relating to the submission, processing and consideration of, and decision on, applications for environmental authorisations for the commencement of activities in order to avoid detrimental impacts on the environment, or where it cannot be avoided, ensure mitigation and management of impacts to acceptable levels, and to optimise positive environmental impacts, and for matters pertaining thereto*."

The following table highlights those activities that are triggered by the proposed development thus requiring Environmental Authorisation (EA) by way of a Basic Assessment (BA) application process from the Competent Authority (in this instance: the KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs (KZN DEDTEA)) prior to the commencement of the activities.

Table 3: Listed activities requiring Environmental Authorisation in terms of NEMA

Government Notice	Activity Number	Listed Activity
GN No. R. 983 (Listing Notice 1)	12	The development of- (xii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs- (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.
	16	The development and related operation of facilities for the desalination of water with a design capacity to produce more than 100 cubic metres of treated water per day.

3.2.1 Integrated Environmental Management (IEM)

"*IEM provides a holistic framework that can be embraced by all sectors of society for the assessment and management of environmental impacts and aspects associated with an activity for each stage of the activity life cycle, taking into consideration a broad definition of environment and with the overall aim of promoting sustainable development*".[1]

The general objective of IEM, according to NEMA Chapter 5, is to -

- Promote the integration of the principles of environmental management set out in Section 2 into the making of all decisions which may have a significant effect on the environment;
- Identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage, the risks and consequences and alternatives and options for mitigation of activities, with a view to minimising negative impacts, maximising benefits, and promoting compliance with the principles of environmental management set out in Section 2;
- Ensure that the effects of activities on the environment receive adequate consideration before actions are taken in connection with them;
- Ensure adequate and appropriate opportunity for public participation in decisions that may affect the environment;
- Ensure the consideration of environmental attributes in management and decision-making which may have a significant effect on the environment; and
- Identify and employ the modes of environmental management best suited to ensuring that a particular activity is pursued in accordance with the principles of environmental management set out in Section 2.

The Department of Environmental Affairs (DEA) Integrated Environmental Management Information Series guidelines were also consulted during this BA application process.

3.2.2 EIA Regulations – Guidelines

Various guidelines documents have been developed and published over the years to provide clarity on aspects of the EIA Regulations. All applicable and relevant guidelines have been used during this BA application process.

3.3 NATIONAL WATER ACT, 1996 (ACT NO. 36 OF 1996) (NWA)

The NWA recognises that water is a scarce and unevenly distributed national resource and that while water is a natural resource that belongs to all people, the discriminatory laws and practices of the past have prevented equal access to water, and use of water resources. The NWA gives expression to National Government's overall responsibility for and authority over the nation's water resources and their use, including the equitable allocation of water. The ultimate aim

[1] DEAT (2004) Overview of Integrated Environmental Management, Integrated Environmental Management, Information Series 0, Department of Environmental Affairs and Tourism (DEAT), Pretoria.

of water resource management is to achieve the sustainable use of water for the benefit of all users and that the protection of the quality of water resources is necessary to ensure sustainability in the interests of all water users. The purpose of the Act is to ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled in responsible ways.

In terms of Section 21 of the NWA, a water use must be licensed unless it is listed in Schedule I, is an existing lawful use, is permissible under a general authorisation, or if a responsible authority waives the need for a licence. The following water uses are listed in Section 21:

a) Taking water from a water resource;
b) Storing water;
c) Impeding or diverting the flow of water in a watercourse;
d) Engaging in a stream flow reduction activity contemplated in section 36;
e) Engaging in a controlled activity identified as such in section 37(1) or declared under section 38(1);
f) Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;
g) Disposing of waste in a manner which may detrimentally impact on a water resource;
h) Disposing in any manner of water which contains waste from, or which has been heated in any industrial or power generation process;
i) Altering the bed, banks, course or characteristics of a watercourse;
j) Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and
k) Using water for recreational purposes.

The preferred alternative does not require a Water Use License (WUL) in terms of Section 21 of the NWA as no water uses are triggered. The DWS will be requested to confirm this for the new preferred alternative.

3.4 OTHER RELEVANT NATIONAL LEGISLATION

3.4.1 National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) [NEMBA]

The objectives of the Act are:

- To provide for:
  - The management and conservation of biological diversity within the Republic and of the components of such biological diversity;
  - The use of indigenous biological resources in a sustainable manner; and
  - The fair and equitable sharing among stakeholders of benefits arising from bioprospecting involving indigenous biological resources;
- To give effect to ratified international agreements relating to biodiversity which are binding on the Republic;
- To provide for co-operative governance in biodiversity management and conservation; and,
- To provide for a South African National Biodiversity Institute to assist in achieving the objectives of the Act.

The preferred alternative will not impact on sensitive ecosystems, fauna and/or flora, thus no protected tree permits in terms of the historical National Forest Act, 1998 (Act No. 84 of 1998) are required from the Department of Agriculture, Forestry and Fisheries (DAFF).

3.4.2 National Heritage Resources Act, 1999 (Act No. 25 of 1999) [NHRA]

A few of the objectives of the Act are to introduce an integrated and interactive system for the management of the national heritage resources and empower civil society to nurture and conserve their heritage resources so that they may be bequeathed to future generations. The Act further lays down general principles for governing heritage resources management throughout the Republic; enables the provinces to establish heritage authorities which must adopt powers to protect and manage certain categories of heritage resources; and provides for the protection and management of conservation-worthy places and areas by local authorities.

The NHRA states in Section 38 that the relevant heritage resources authority must be notified of the proposed development/ activities where such activities trigger either of the following:

- The construction of a linear development (e.g. road, wall, etc.) or barrier exceeding 300m in length;
- The construction of a bridge or similar structure exceeding 50m in length;
- Any development or activity which will change the character of a site:
    - Exceeding 5 000m^2 (½ha) in extent; or
    - Involving 3 or more existing erven or subdivision thereof; or
    - Involving 3 or more existing erven or subdivision thereof which have been consolidated within the past 5 years; or
- The rezoning of a site exceeding 10 000m^2 (1ha) in extent.

As the preferred alternative is located exclusively on transformed land/ aboveground within existing structures, an Exemption Application will be submitted to AMAFA via the SAHRIS on-line portal. AMAFA will then comment and issue a decision on the Exemption Application.

3.4.3 Disaster Management Act, 2002 (Act No. 57 of 2002)

The uThungulu District Municipality has been declared a Disaster Management Area based on the continuing drought conditions and the fact that water resources are rapidly declining. President Jacob Zuma has committed all spheres of government to provide extra support to drought hard-hit areas including uThungulu District Municipality to ensure that communities have adequate access to clean water as the country is experiencing its worst drought in decades. In response to these challenges, President Zuma has tasked all spheres of government to intervene and ensure that all communities have water. The President further announced government's drought relief programme to effectively address the challenges facing drought affected communities in the district including handing over water tanks, wheel barrows and other equipment (*Issued by Bongani Majola on behalf of the Presidency, 3 April 2016*).

3.5 RELEVANT PROVINCIAL AND MUNICIPAL LEGISLATION

3.5.1 Environmental Health Bylaws

City of uMhlathuze Environmental Health Bylaws

The main purpose of the Environmental Health Bylaws is to enable the Council to protect and promote the long-term health and well-being of people in the municipal area. Section 10 of the Bylaws allows the Council to list "Potentially Hazardous Uses" or activities. As such, any person who uses premises in a manner or for a purpose listed in Annexure B (Potentially Hazardous Uses or "Scheduled Trades") must obtain a Public Health Permit before commencing that use and must comply with the terms and conditions of that permit (Section 13(1)) as well as Chapter 9 of the Bylaws.

The proposed desalination plant triggers the following activities listed in Annexure B (Scheduled Trades of the Environmental Health Bylaws), thus Hillside Aluminium is required to update/ renew their existing Schedule Trade Permit (renewal application was submitted on 29 April 2016):

33. Landfill sites, sewage treatment and water purification plants and activities.

3.5.2 Water Services Bylaws

uThungulu District Municipality – Water Services Bylaws (May 2003)

Bayside currently has an Effluent Disposal Agreement with Mhlathuze Water for the discharge of wastewater via the Mhlathuze Sea Outfall Pipeline. Section 76 of the Water Services Bylaws imposes conditions that must be adhered too. One such condition is compliance with the standards and criteria as set out in Schedule B of the Bylaws.

uMhlathuze Local Municipality – Water Services Bylaws (2010)

Section 95 of the Bylaws stipulate provisions applicable to the sea outfall pipeline. These provisions are in line with the uThungulu District Municipality's Water Services Bylaws, as are the standards and criteria as set out in Schedule C of the Bylaws (Schedule C is identical to Schedule B of the District Municipality's Bylaws).

3.5.3 Flammable Liquids Bylaws

City of uMhlathuze – Bylaws relating to Flammable Liquids

A certificate of compliance is required for the storage of flammable liquids in excess of certain threshold amounts / volumes. Requirements are outlined for the inspection of premises, as well as for the prohibition of storage, use and handling in certain circumstances. Hillside Aluminium has a Certificate of Registration (No. 45/2012) for the storage of flammable liquids on site.

3.6 RELEVANT POLICIES, PROGRAMMES, PLANS AND GUIDELINES

3.6.1 National Water Resource Strategy (2nd Edition, 2013)

This National Water Resource Strategy (NWRS) sets out how South Africa will achieve the following core objectives:

1. Water supports development and the elimination of poverty and inequality;
2. Water contributes to the economy and job creation; and,
3. Water is protected, used, developed, conserved, managed and controlled sustainably and equitably.

The Strategy recognises that whilst the country has well-developed water resources infrastructure (with more than 4 395 registered dams), we are fast approaching full utilisation of available surface water yields, and are running out of suitable sites for new dams. Thus, ensuring a sustainable water balance requires a multitude of strategies, including water conservation and water demand management, further utilisation of groundwater, desalination, water re-use, rain water harvesting and treated acid mine drainage. The NWRS further highlights that while South Africa benefited from a surplus of water available in 2000, the time has come where a mix of water resources is required to reconcile supply and demand. Towards this end, Reconciliation Strategies (refer to Section 3.6.2 below) have been developed to assess water balance against future needs. These strategies will inform our future water resource planning, management and investment and key issues include:

- Greater focus on water conservation and water demand management – every drop counts and we cannot afford to waste any more water, anywhere;
- Increased value and utilisation of ground water;
- Re-use of waste water at the coast as well as in inland systems;
- Opportunity for more dams (though limited) and transfer schemes (and where the opportunity exists, it is at great cost);
- Desalination:
    - Small scale seawater desalination already being used in certain areas
    - Treated mine water desalination becoming more important
    - Desalination of seawater on a large scale
- Catchment rehabilitation, clearing of invasive alien plants and rainwater harvesting is growing in importance; and,

- Making more water available in the future, but at sharply rising costs.

The proposed project is therefore in line with the NWRS as it assists with the water balance within the Richards Bay area through desalination of seawater (an alternative to using freshwater resources) during emergency situations with the City of Mhlathuze LM cannot provide the required water, allowing also for the redistribution of potable water to other water users addressing core objectives 1 and 3. By mitigating the shutting down of the Hillside smelter, the desalination plant also indirectly contributes to meeting core objective 2 within Richards Bay and the greater region.

3.6.2 Water Reconciliation Strategy for Richards Bay and Surrounding Towns (April 2015)

The objective of the Richards Bay Reconciliation Strategy Study is to develop a strategy to ensure adequate and sustainable reconciliation of future water requirements within the City of uMhlathuze Local Municipality with potential supply up to 2040, especially that of Richards Bay/ Empangeni, their significant industries, as well as the smaller towns and potential external users that may be supplied with water from the system in future. The purpose of the report is to explain the process followed to identify the potential interventions to augment the water supply system, and to describe the features of the interventions that have been evaluated. Various water requirement scenarios were tested and Table 4 below highlights the potential shortfall of water supply by 2040.

Table 4: Potential shortfall by 2040 for various water requirement scenarios (DWS, April 2015)

Water Requirement Scenario	Water requirement (million m^3/a)	Potential shortfall (million m^3/a)
Scenario 1: Low growth	244.4	30.1
Scenario 2: Low-Medium growth	267.8	53.5
Scenario 3: Medium growth	298.4	84.1
Scenario 4: High growth	356.9	142.6

Potential interventions in the Long List of interventions were interrogated by the Study Team to ascertain which of these could be seriously considered for further evaluation, and the reasons were documented. The Long List was then circulated for contributions and reviews by key stakeholders. The outcome of this screening process was the identification of the interventions that should be evaluated further (Short List of interventions), these included the following augmentation options:

- Bulk industrial water conservation and water demand management;
- Urban water conservation and water demand management;
- Rainwater harvesting;
- Limiting supply from over-abstracted coastal lakes;
- Increased capacity of the Thukela-Mhlathuze Transfer Scheme;
- Coastal pipeline from the lower Thukela River;
- On-channel transfer scheme/s from the Mfolozi River: Kwesibomvu Dam;
- Off-channel transfer scheme/s from the Mfolozi River;
- Raising Goedertrouw Dam;
- Dam on the Nseleni River;
- Groundwater schemes;
- Arboretum Effluent Reuse Scheme; and,
- **Desalination of seawater.**

The Strategy further highlighted the following positive and negative impacts of the desalination of seawater (note that a single large desalination plant for the entire region was investigated):

Possible positive impacts include:

- Utilisation of a potential previously unused water source;
- It provides a 100% reliable source of water that is not subject to climate variability or changes in allocation policies as with other surface water sources;
- It is not subject to the impacts of droughts or restrictions;
- It is not subject to water quality concerns particular from emerging contaminants or social concerns with the use of treated effluent;
- The operator will have complete control of the supply from the desalination plant; and,
- Reduced demand on natural resources.

Possible negative impacts include:

- Very high energy requirements;
- High capital and operating costs;
- High concentrations of reject water/brine disposal into the sea;
- Impacts related to the construction of the scheme;
- Specialist skills required to operate the desalination plant; and,
- Institutional implications regarding the operation and maintenance of the desalination plant.

Thus, the proposed project is in line with the Department of Water and Sanitation (DWS) Water Reconciliation Strategy for the greater area. While the report focuses on the greater municipal area, the proposed desalination plant at Bayside Aluminium to provide an alternative emergency supply of process water to Hillside Aluminium will free up some 2Ml of potable water from the City of uMhlathuze's water supply system for re-distribution to other users within the municipal area.

3.6.3 Environmental Management Framework Report

This Environmental Management Framework (EMF) was compiled in 2011, for an area of 25 000ha, containing the Richards Bay Port and Industrial Development Zone (IDZ). The overall objective of the EMF is to "secure environmental protection and promote sustainability and cooperative environmental governance"[2]. The aim of the EMF is in essence to guide decision-making in this specific area of KwaZulu-Natal. A set of main principles was established by the EMF, which reflect the desired future state for the area:

- Sustainable development;
- Pro-poor;
- Capturing value;
- Supporting local economic development;
- Focussing on important issues in this area; and,
- 'Internalising externalities'.

A Status Quo of the area and region is presented in the EMF, in order to characterise the current receiving environment. This Status Quo is followed by a Strategic Assessment of the region. Certain environmental management zones are established, which include: Lakes and Corridors; Floodplain; Port Estuary, Marine and Seashore Area; Dune Cordon; Coastal Plain Residential Area; Coastal Plain Subsistence Farming Area; Coastal Plain Commercial-Industrial Area; External Linkages; and Strategic Development Management Overlay. Finally, an implementation strategy is presented which

[2]DAERD (2011) Environmental Management Framework for the Richards Bay Port Expansion Area and Industrial Development Zone. Department of Agriculture, Environmental Affairs and Rural Development (DAERD), Pietermaritzburg, South Africa.

addresses planning concerns for the future development of the area. The EMF confirms that the environment places significant constraints on industrial development and potential port expansion. Water is the most limiting factor.

The desalination plant that is proposed speaks to some extent to the priorities and development strategies that are set forth in the EMF. This is seen in particular by some of the activities that are 'discouraged' in the various development phases that are listed as part of the EMF. The 'discouraged activities' include "Industries that demand huge quantities of water". So, indirectly the desalination plant will assist in providing an alternative supply of water to industries, such as the Hillside Aluminium smelter within the area that currently rely on potable municipal supplies.

3.6.4 uMhlathuze Integrated Development Plan 2012/2017

The City of uMhlathuze has produced this Integrated Development Plan (IDP), in order to further their vision: "The Port City of uMhlathuze offering improved quality of life for all its citizens through sustainable development." The IDP sets forth the following Development Strategies (along with a set of Action Plans in order to achieve these goals):

1. Good Governance;
2. Infrastructure and Services Provision;
3. Social and Economic Development;
4. Institutional Development; and,
5. Sound Financial Management.

The IDP presents 'projects' that the Municipality has completed, as well as future planned projects. In short, a Status Quo of the region is presented, reflecting the current situation within the Municipality. Discussion is also presented on the links between this IDP, and the previous version (2012/2013) of the IDP. The proposed desalination plant and associated infrastructure advances the 2nd Development Strategy that is presented in the IDP – "Development of an environmentally friendly, efficient and integrated city with sustainable Municipal Infrastructure Provision and Service Delivery". The Municipality is unable (within the realm of the current drought conditions) to continue with the delivery of potable water to all of its registered users. The desalination plant and associated infrastructure will do a long way in alleviating some of the demand for potable water (i.e. 2 ML of emergency water provided to the Hillside Aluminium smelter) and allow for savings in consumption that can be redistributed to other users, such as residents within the municipality.

4 ENVIRONMENTAL, SOCIAL AND ECONOMIC CONTEXT

This section provides a brief overview of the existing environment within the area of influence of Bayside and Hillside Aluminium. It is important to have an understanding of the receiving environment, as this will determine how possible impacts will manifest.

This section provides a brief overview of the existing receiving environment within the area of influence of the desalination plant and associated infrastructure. This section has been augmented with information from the specialist reports (summary of their findings) in order to ensure a comprehensive understanding of the receiving environment, as this will determine how possible impacts will manifest. Complete specialist reports are attached in Appendix D.

4.1 BIOPHYSICAL ENVIRONMENT

4.1.1 Climate

Richards Bay has a humid subtropical climate, with a particularly warm and humid summer season typical of the coastal region of Kwazulu-Natal. The average temperatures range from 22 - 25 ^{o}C in summer, to 15-18 ^{o}C during winter (Figure 8). However, maximum temperatures in excess of 40 ^{o}C have been recorded in the past[3].

Richards Bay receives most of its rainfall during summer (Figure 8), with an annual average of 1228mm. Rainfall does occur in winter to a lesser extent[3]. Summer rainfall manifests as convective showers and thunderstorms, with torrential rainfall events not uncommon. Mid-latitude frontal systems provide the winter rainfall to the region[4].

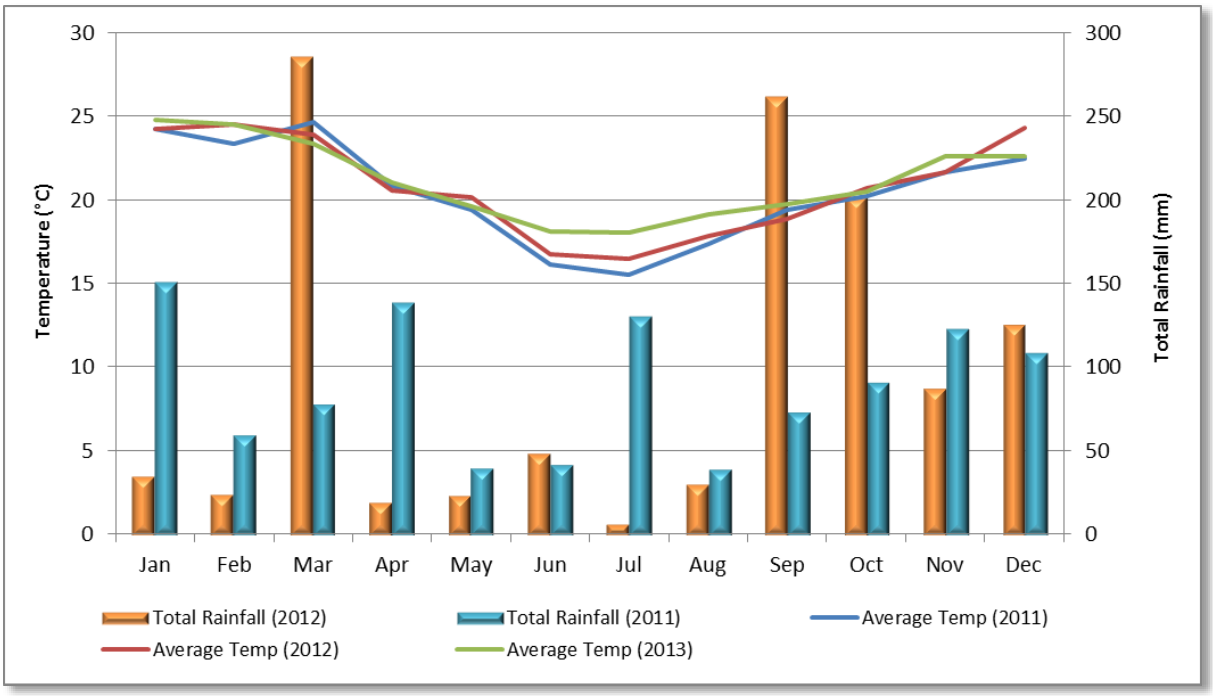

Figure 8: Total monthly rainfall and average monthly temperature for Richards Bay (Source: Temperature data - RBCAA's Harbour West station, located ~300 m east of the site; Rainfall data - South African Weather Service's Richard's Bay Airport station. Rainfall data for 2013 was not available)

[3]uMhlathuze Municipal Integrated Development Plan, 2012/2017.

[4]DAERD (2011) Environmental Management Framework for the Richards Bay Port Expansion Area and Industrial Development Zone. Department of Agriculture, Environmental Affairs and Rural Development (DAERD), Pietermaritzburg, South Africa.

The prevailing winds in the study region are north-easterly and south-westerly (Figure 9). The north-easterly winds are associated with high atmospheric pressure and fine weather systems whilst the south-westerly winds are associated with the passage of coastal low pressure systems and cold fronts and, therefore, inclement weather. In the Richards Bay area, winds originate predominantly from the north-northeast, northeast, southwest and south-southwest (Figure 9). Wind speeds range from gentle (<2 m/s) to strong (>8 m/s), with the strongest winds originating from the south-westerly sector.

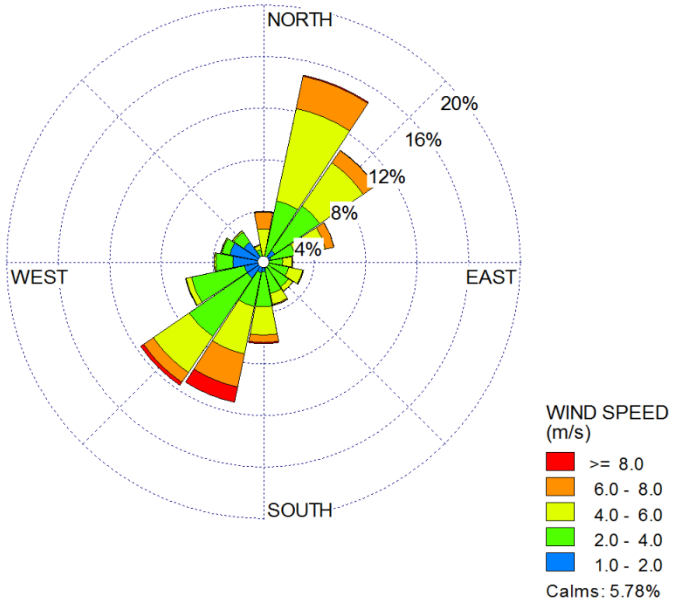

Figure 9: Surface wind rose plot for Richards Bay for the 2011 to 2013 period (from the Harbour West station) - the colour of the bar indicates the wind speed whilst the length of the bar represents the frequency of winds blowing from a certain direction (as a percentage)

4.1.2 Ecology

4.1.2.1 Regional Context

Four biomes, namely, Forest, Indian Ocean Coastal Belt, Azonal Vegetation and Waterbodies are present within the region. The vegetation that dominates the area is associated with the Indian Ocean Coastal Belt biomes, notably the Maputaland Coastal Belt, which makes up approximately 77% of the study area (Figure 10). Forest vegetation makes up a much smaller (9%) proportion of the area and comprises mostly of Northern Coastal Forest (5%) and Swamp Forest (3%). Aquatic habitats in the form of Subtropical Freshwater Wetlands and Freshwater Lakes make up the remaining 10% of the study area (Figure 10).

Approximately 54% of the broader study area comprises transformed land, dominated by commercial agriculture and plantations (38%) followed by urban and industrial developments (15%). The remaining 46% of the study area supports a mosaic of terrestrial (25%) and aquatic habitats (21%). Terrestrial habitats are dominated by bush/thicket (13%), followed by forest (7%) and grassland (5%). Aquatic habitats are mostly made up of estuarine ecosystems (15%) with freshwater aquatic ecosystems making up the remaining 6% of the study area. The natural habitats that remain within the broader study area is generally confined to small, isolated patches amongst urban/industrial development, forestry plantations and sugarcane cultivation. Furthermore, the majority of the remaining natural areas tend to be moderately to severely disturbed, particularly in terms of invasive alien plant infestations.

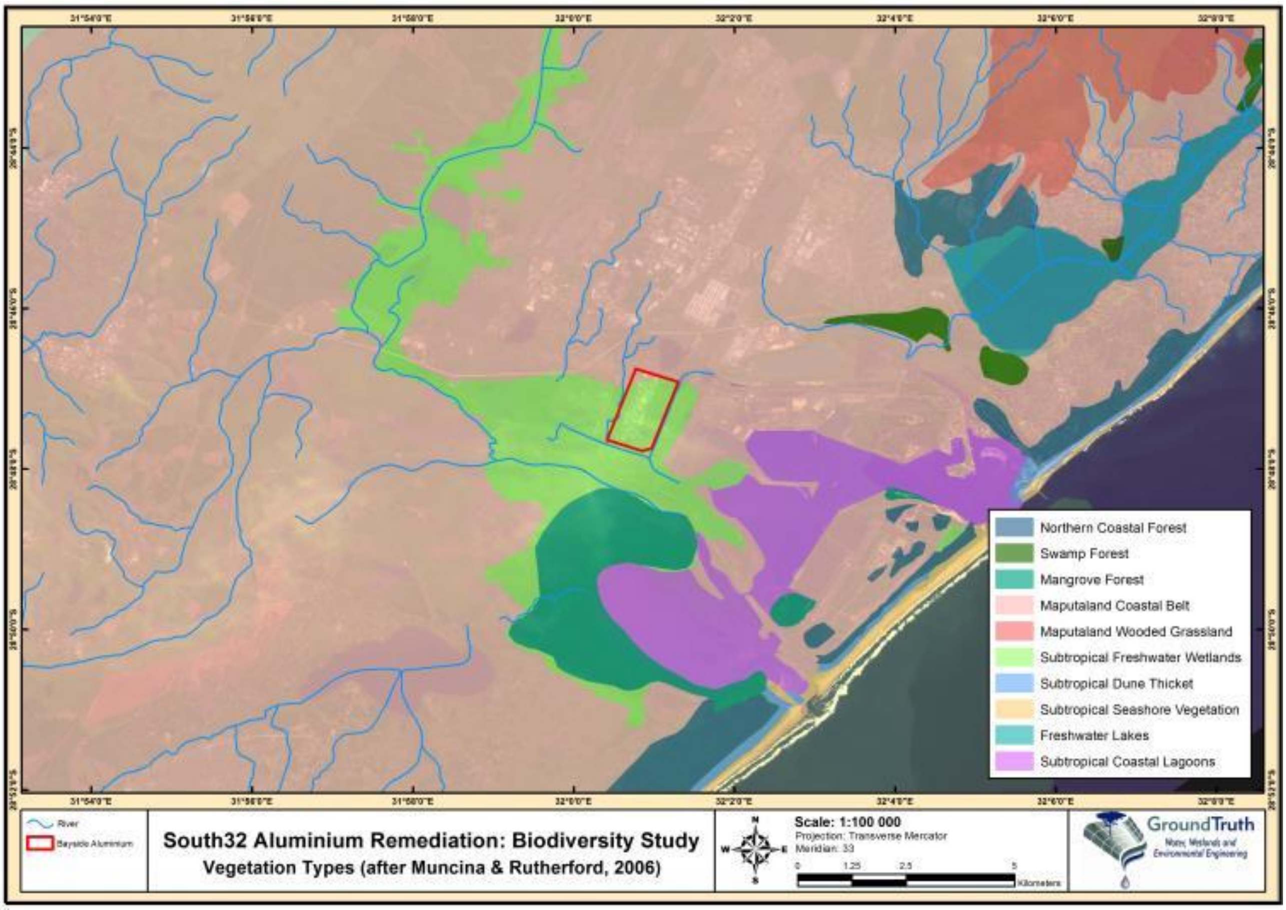

Figure 10: Map of reference vegetation that defines the landscape surrounding the project site

One "formal" protected area, the Richards Bay Nature Reserve, as listed in the National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003) (NEMPPA), occurs within the broader study area, about one kilometre south of the Bayside site. The reserve corresponds with the Mhlathuze Estuary and associated mangrove swamps. The area supports critical habitat for a variety of water birds and is considered an Important Bird Area (IBA) by Birdlife International.

Five threatened ecosystems occur within the study area (Figure 11). These include:

- **Kwambonambi Dune Forest** – originally covered 7 000 ha. At present about 50% remains and a very small proportion (<1% of the original extent) is protected. The area supports five species of conservation concern and is classified as Critically Endangered.
- **Kwambonambi Hygrophilous Grassland** – originally covered 34 000 ha. At present only about 21% remains and a small proportion (8% of the original extent) is protected. The area supports six species of conservation concern (i.e. threatened and/or endemic plants and animals) and is classified as Critically Endangered. Key biodiversity features are included, namely one amphibian (*Hyperolius pickersgilli*), four millipedes (*Centrobolus fulgidus*, *Centrobolus richardi, Centrobolus rugulosus* and *Doratogonus zuluensis*), one plant (*Kniphofia leucocephala*) and six vegetation types (KwaZulu-Natal Coastal Forest, KwaZulu-Natal Dune Forest, Mangrove Forest, Maputaland Wooded Grassland, Maputaland Coastal Belt and Swamp Forest).
- **Mangrove Forest** – original extent is not known, but at present only about 2 000 ha remains of which 73% is protected. The mangroves are considered "species poor", but nevertheless are productive ecosystems and provide important spawning habitat for various fish species. Mangrove Forest is currently classified as Endangered.

- **Maputaland Wooded Grassland** – originally covered 99 000 ha. At present about 53% remains of which 17% of the original extent is protected. The area supports five species of conservation concern and is classified as Vulnerable.
- **Swamp Forest** – original extent is not known, but at present only about 3 000 ha remains of which 67% is protected. The area supports one species of conservation concern and is classified as Vulnerable.

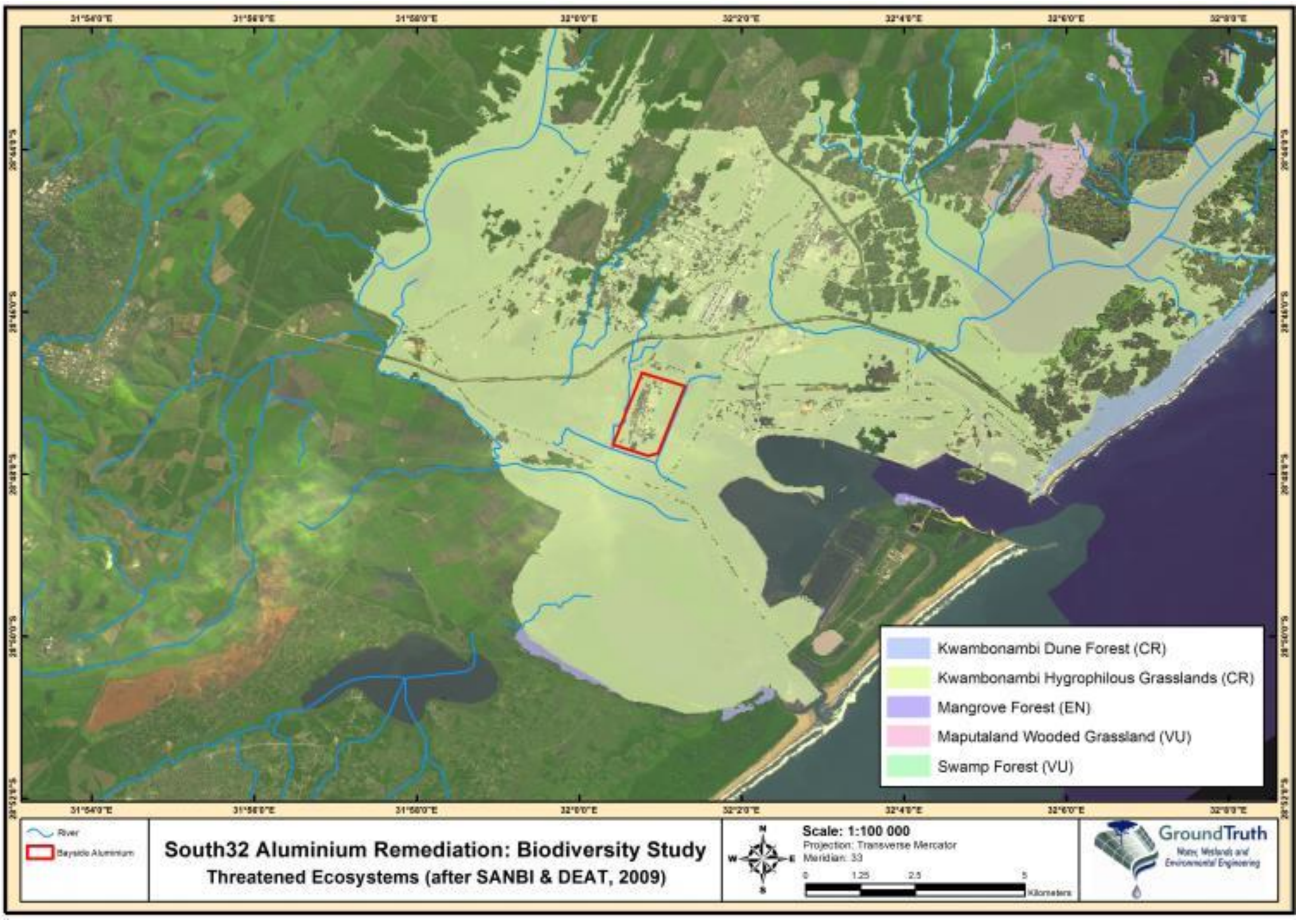

Figure 11: Overview of threatened ecosystems within the broader study area (after SANBI and DEAT, 2009)

4.1.3 Estuarine Ecology

4.1.3.1 Richards Bay and Mhlathuze Estuaries

The extent of the estuarine functional zone in respect of the Port of Richards Bay and the Mhlathuze estuary is indicated on Figure 12. The Bayside smelter is located within the estuarine functional zone of the Richards Bay/Mhlathuze estuary as defined in terms of the National Environmental Management: Integrated Coastal Management Act, 2008 (Act No. 24 of 2008) (NEMICMA).

The Mhlathuze Estuary as it exists today was created through the construction of the harbour of Richards Bay between 1972 and 1976. Prior to harbour development these two systems comprised of a single large shallow bay, approximately three times the size of the present Mhlathuze estuary, and with a relatively narrow connection with the sea (Figure 13). Approximately one third of the original bay was separated from the harbour by a sand berm and a new entrance to what became known as the Sanctuary (the Mhlathuze Estuary) was excavated. The Mhlathuze River was canalised and diverted into the new estuary, and tidal gates were constructed along the berm wall to allow flushing of the harbour, if needed (Figure 13).

Considerable change took place in both parts of the system following the separation. The tidal range in the sanctuary area (the Mhlathuze estuary) increased dramatically from around 0.4 m amsl at springs to around 1.4 m following its separation, and depth increased by as much as 1 m in places. Freshwater swamp communities, which occupied much of the system's shoreline, which had never been exposed to flooding by saline water before, suffered severe mortalities. Extensive areas of shallow, subtidal mudflats became intertidal and were exposed at low tides as a further consequence of the increased tidal range. Tidal inundation by saline water also led to the colonisation and proliferation of white mangrove (*Avicennia marina*) in the Mhlathuze estuary.

Figure 12: Location of the Bayside site (orange polygon) in relation to the Richards Bay and Mhlathuze estuaries (yellow outline polygons).

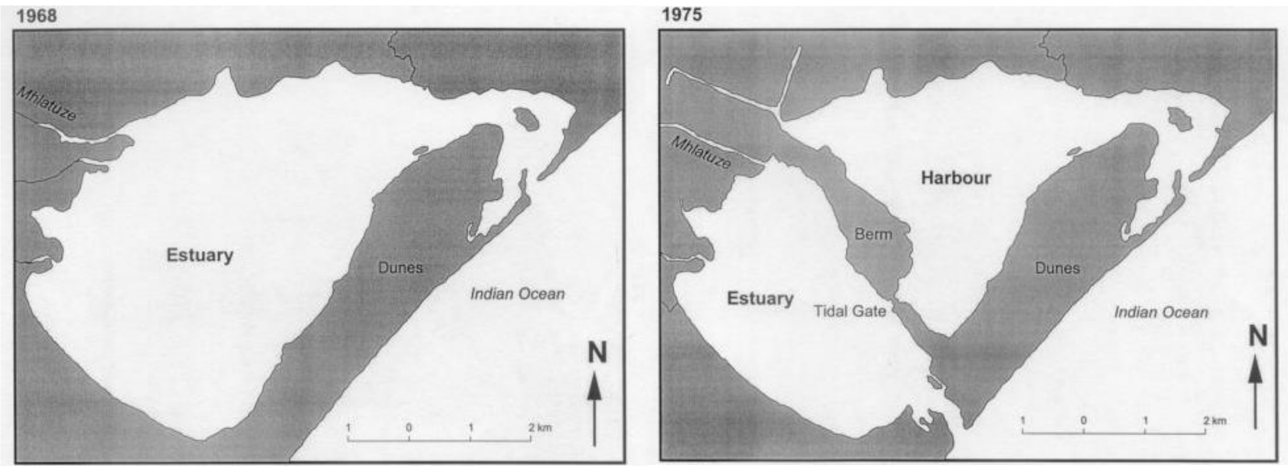

Figure 13: The Mhlathuze estuary before (1968) and after construction of the Port of Richards Bay (1975). Source: Huizinga & van Niekerk (1998).

The "port" estuary area also experienced a significant increase in tidal amplitude, with the result that mangroves also proliferated in this area. In spite of its status as a commercial port it is nonetheless includes a good deal of important estuarine habitat and is widely recognised as playing an important role in the life cycles of many marine species that associate with estuaries. Between them, the Mhlathuze and the "Port" estuary offer almost the complete range of habitat types found in tidal reaches of subtropical South African estuaries, including sandbanks, mudflats, mangroves (*Avicennia marina, Bruguiera gymnorrhiza* and *Rhizophora muncronata*) and eelgrass (*Zostera capensis*). These two systems together support almost 50% of the mangrove habitat in this country. Most of this is white mangrove *Avicennia marina*, however. Red mangrove, *Rhizophora mucronata* and black mangrove, *Bruguiera gymnorrhiza*, were reportedly abundant in the original system but both have been negatively impacted by the development of the harbour and associated infrastructure. All three species are still present in the greater Richards Bay area but the red mangrove is only present as isolated specimens within stands dominated by the other types. What was a flourishing community of black mangroves was also decimated during harbour construction, or died shortly after. It was noted that few original specimens are still found in the estuary and that those that were present, appeared to be stressed. *Bruguiera* saplings were observed in stands dominated by *Avicennia* and in *Phragmites* beds in the upper estuary, a habitat where the *Bruguiera* seedlings are known to develop particularly well. He also noted that these were two stands of *Bruguiera* (black mangrove) still present on either side on the entrance channel to the port, but expressed concern that construction of a dry dock and associated harbour infrastructure would eventually destroy the northern stand.

Mangroves in the port estuary reportedly cover approximately 305 ha, of which over 85% comprises *Avicennia*. The mangroves (both *Avicennia* and *Bruguiera*) extend up into the canals draining into the Port of Richards Bay (including the Bhizolo and Manzanyama canals). These canals reportedly actually make up some the most productive area in the harbour in terms of crustacean abundances and diversities.

Other important habitats in the Mhlathuze estuary and in the Port of Richards Bay include intertidal and shallow subtidal sand banks and mud flats. Intertidal sandbanks occur in the embayments at and near the mouths of both the estuary and the harbour. Naturally occurring sandbanks were reportedly extensive in the lower reaches and in the mouth of the original system prior to harbour development (Millard & Harrison 1954). Some of this habitat was lost during harbour construction, but sandy areas in the harbour, at least, are now considered to be more extensive than before port construction due to the creation of artificial spits and infilling with sandy spoils. Sandflats presently cover approximately 380 ha in the harbour. Much of this was area was probably composed of mud substrata in the original system. In the Mhlathuze system, sandy areas are restricted to the lower embayment and mouth (approximately 70 ha) where tidal currents keep the substratum free of fine sediments. Although large parts of the historically extensive mudflats in the system have been colonised by mangroves or have been converted to sandflats, they still constitute the greater area of the Mhlathuze embayment, covering approximately 450 ha. Mudflats also occur in the south-western corner of the harbour (125 ha) and have been identified as important areas for estuarine associated macrocrustacea.

Historic and some more recent accounts of the invertebrate fauna of the Mhlathuze estuary and Port of Richards Bay are provided by Millard and Harrison (1954), Hemens *et al*. (1970, 1971), Grindley and Wooldridge (1974), Hemens & Connell (1975), Connell et al. (1975, 1989), Oliff (1976), Begg (1978), Day (1981), Forbes & Cilliers (1998), Jerling (1998), and Mackay & Cyrus (1998). Notable changes were reported in the numbers of species of pelagic invertebrates (zooplankton) and benthic invertebrates (notably crustaceans and polychaete annelids) in the system between the 1950's and the most recent sampling surveys. Previously, crustaceans reportedly dominated the species richness and densities of benthic fauna. Although crustaceans are now still numerically dominant, polychaetes have succeeded as the most rich group. The different habitats in the estuary and port (mangroves, seagrass, sand and muddy substrata) all support distinct communities.

Fish fauna of the Mhlathuze estuary and the Port of Richards Bay have been studied by Millard and Harrison (1954), Hemens *et al*. (1970, 1971), Hemens *et al*. (1976a, b), Weerts (2002) and Weerts *et al.* (1998). Weerts *et al.* (1998) confirm that at least 133 different species of fishes from 52 families have been recorded from the Mhlathuze Estuary in these studies. Juvenile estuarine-dependent marine species reportedly dominate in both the Mhlathuze Estuary and the port estuary, and that both systems are considered to be important nursery area for these fishes. Together, these two systems offer at least five distinct habitat types for fishes: eelgrass (*Zostera capensis*), *Avicennia* mangrove fringes, *Brugeria* mangrove fringe, subtidal mudflats and intertidal sandbanks, each of which support distinct fish assemblages. *Bugeria* mangrove fringes were seen to support the highest fish densities, followed by the *Avicennia* mangrove fringes in the canals.

The bird fauna associated with the Mhlathuze estuary and Port of Richards Bay is also very rich and diverse. A total number of 107 water-associated bird species have been recorded collectively from the Mhlathuze Estuary and Port of Richards Bay, this having been highlighted as a very high number compared with any aquatic system within the whole of South Africa. These two systems, in fact, hold the second highest number of water-associated birds after Lake St Lucia along the entire KwaZulu-Natal Coastline. In terms of bird density per kilometre of shoreline, Richards Bay was ranked the fifth most important system. Resident fauna make up about 52% of the avifauna, and migratory waders about 26%. A total of 11 Red Data species have been recorded in the area, and a further four are listed as likely to occur here.

The health and importance of all 256 South African estuaries were rated based on the following four components: plants, invertebrates, fish and birds, and attributes: biodiversity, size, habitat and zonal type rarity (ZTR), respectively. Overall, the Mhlathuze estuary was ranked as the 20th most important system in the country in term of the biodiversity it supports, while the Richards Bay estuary (Port of Richards Bay) is ranked 67th. Both systems are clearly very important from a biodiversity conservation perspective. In terms of the health of its component fauna and flora, the Port of Richards Bay is actually ranked higher than the Mhlathuze estuary, owing to the fact that in its current state, the Port of Richards Bay bears a closer resemblance to the original estuary state than does the present day Mhlathuze estuary.

Table 5: Overall importance score and rank of the Mhlathuze and Richards Bay estuaries with component scores for importance (biodiversity, size, habitat and zonal type rarity (ZTR)), and component scores for biodiversity (plants, invertebrates, fish and birds).

ESTUARY	Plant	Invert	Fish	Bird	Biodiversity	Size	Habitat	ZTR	Importance Score*	Rank
Mhlathuze	10	100	70	10	53.5	100	100	80	86.4	20
Richard's Bay	10	100	90	100	85.0	100	0	80	69.3	67

The Port of Richards Bay is an important estuary both in a regional (KZN) and national context and supports important populations of mangroves, invertebrates, fish and birds. The Bhizolo (southern boundary of the site) and Manzamnyama (eastern boundary of the site) Canals are an important and integral part of this system, supporting high densities of all of these species.

4.1.3.2 Richards Bay Inshore Shelf – Mhlathuze Sea Outfall Pipeline Discharge Point

The 2014 environmental monitoring report compiled by the CSIR for the Richards Bay sea outfalls reports that toxicity of the A-line raw effluent (Mhlathuze Sea Outfall Pipeline relevant to this project) was considerably improved over the 2011-12 results and would achieve the predicted worst case dilution. Environmental water quality, however, did not meet the South African Water Quality Guidelines for Coastal Marine Waters for dissolved oxygen concentration (thought to be related to water column thermal stratification rather than effluent), pH and zinc in May 2013. Sediments in the vicinity of the A line outfall are predominantly sandy (>90%), have low total organic content and were not contaminated by trace metals. Benthic macrofaunal communities on sandy inshore habitats off Richards Bay have relatively low diversity and abundance compared to similar habitats off Durban and elsewhere off the KZN continental shelf. A high degree of spatial heterogeneity was observed in the macrobenthic community and both macrofaunal and meiofaunal communities provided no evidence of impacts due to the discharge of effluent.

The continued presence of abundant and diverse fish and macrobenthic invertebrate communities was interpreted as evidence that the sea outfalls were not having a significant impact on the greater offshore shelf off Richards Bay. Metal and fluoride concentrations in the tissue of fish caught by off Richards Bay did not indicate that fish nearer the outfall diffusers had accumulated these chemicals to higher concentrations in their tissue compared to fish caught further offshore

4.1.4 Wetland Ecology

4.1.4.1 <u>Regional Context</u>

The types of wetlands that are expected to occur within the study area are typical of the wetland systems of the Indian Ocean Coastal Belt Bioregion (Group 2) which includes a variety of wetland hydrogeomorphic (HGM) units, namely channelled valley-bottoms, depressions, flats, floodplains, seeps, unchannelled valley-bottoms, and valley-head seeps. Of these, channelled valley-bottom wetlands are the dominant wetland type occurring in the surrounding landscape, followed by unchannelled valley-bottoms and flats. Based on the wetlands and vegetation types occurring in the study area, and the level of protection currently received, all wetland HGM units occurring within the bioregion are classified as Critically Endangered. This is mostly related to the fact that the wetlands are poorly protected and the highly significant levels of transformation that have occurred within the catchment areas. Historically, the wetland HGM units within the study area would have been classified as a combination of a floodplain and estuarine system due to the contribution of multiple tributaries that flow into a large flat expanse that is connected to the ocean. However, the modifications to the landscape have altered the characteristics and functioning of this system. Based on the present flow regime and hydraulic characteristics, the remaining wetland systems are viewed as valley-bottom wetlands, supplying ecosystems services typical of this type of wetland HGM unit.

National Freshwater Ecosystem Priority Areas (NFEPAs) are areas that have been classified to assist in the conservation and sustainable use of South Africa's freshwater ecosystems, including rivers, wetlands and estuaries. The freshwater ecosystems have been classified according to their PES. Wetlands are classified as 'AB', 'C', and 'DEF' or 'Z' categories, depending on whether the systems are considered to be in good, moderately modified or heavily modified condition, respectively. These categories have not been based on field data, as there is insufficient data at a national scale. Thus, the process modelled the ecological categories to serve as a guideline to inform the selection of NFEPAs. According to the available NFEPA coverage, there are no NFEPA river systems within the study area and the wetland habitats are classified as 'low priority'. Figure 14 illustrates the extent and distribution of the 'low priority' NEFPA wetlands relative to the Bayside site.

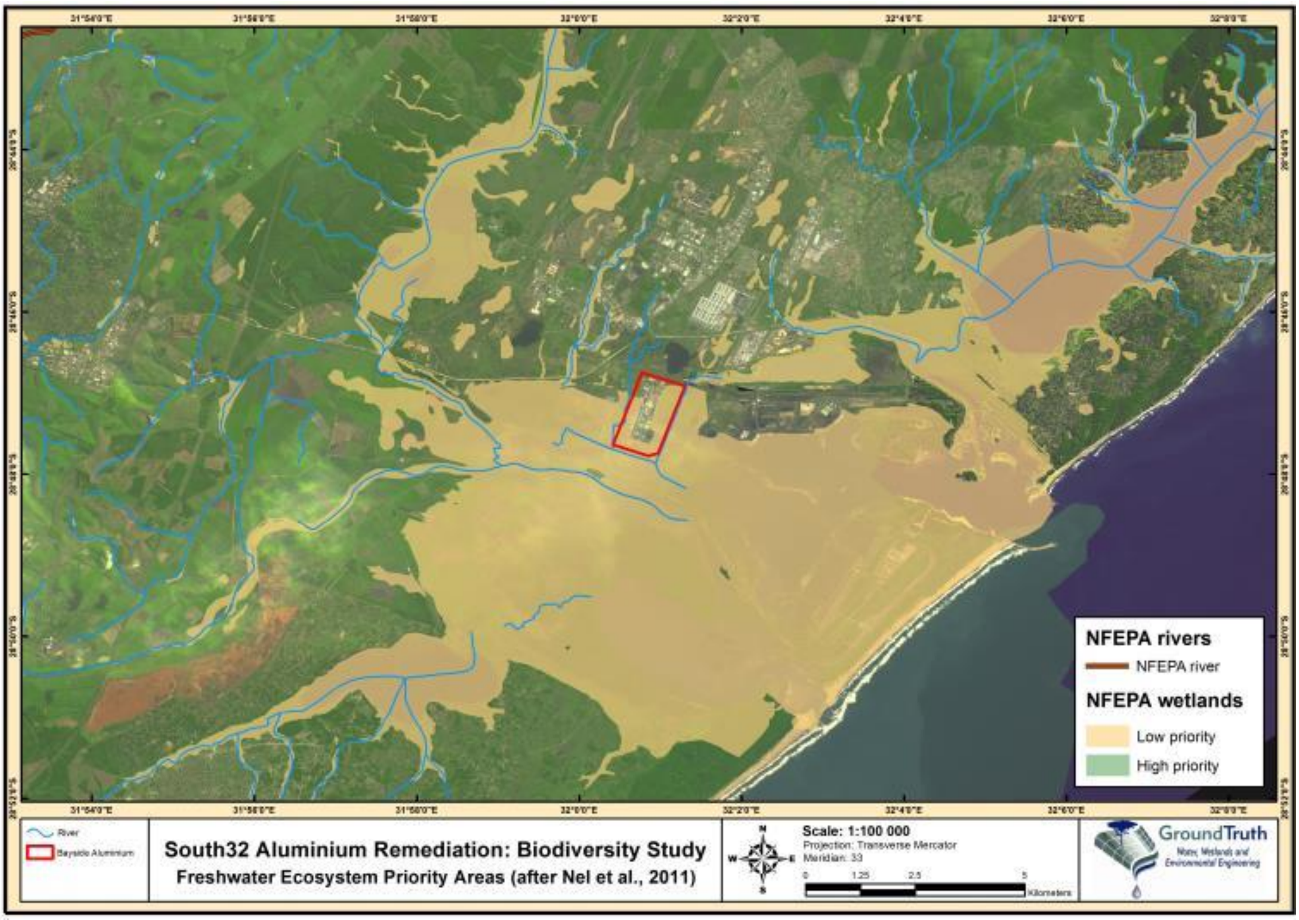

Figure 14: Overview of National Freshwater Ecosystem Priority Areas (NFEPAs) within the broader study area (after Nel *et al.*, 2011)

4.1.4.2 Site Context

The wetlands located within the Hillside Aluminium smelter footprint were delineated in 2015 (refer to the Wetland Assessment in Appendix D), of relevant to the proposed desalination plant project and associated infrastructure is the wetland (Wetland 1 in the specialist report) located south of Impoundment Dam 1 (Figure 15).

Wetland 1 comprises two distinct unchannelled wetland areas, linked by a narrow channelled wetland. The wetland is bound to the east and west by a distinct rise in the topography. The soils were considered variable, ranging from sands to clays which is anticipated from the published geology. The observations made during the site assessment are summarised as follows:

- In the vicinity of Impoundment Dam 1, the soils comprised slightly moist, tan to brown, medium-grained sands to 0.5m below ground level (bgl), with high organic matter content within the upper 0.1m of the profile. From 0.5m bgl to the final depth of the profile assessed (i.e. 1m bgl), the soils comprised alternating horizons of dark brown organic matter and slightly moist (firm) clay resulting from deposition within the wetland. The presence of alternating bands is likely due to historical changes in the sedimentation of the contributing catchment.
- Within the unchannelled portions of the wetland, the soils were dominated by dark brown (soft) clay and roots with high organic matter content within the upper soil profile. Groundwater was encountered at depths shallower than 0.5m bgl at these locations.
- Within the channelled portion of the wetland, the soil comprised moist dark brown clayey organic matter extending to 0.3m bgl, overlying moist red sandy clay.
- At the eastern edge of the wetland, the soil comprised slightly moist, dark brown silty sand which may have arisen from hill-wash from the adjacent slopes.

Both unchannelled wetlands were dominated by dense ferns and wetland grasses. The northern portion of the wetland had mature trees present at its edge. Bullrushes (*Typha*) were present at the southern extremity of the wetland. Sandy soils dominate in the region, which promotes drainage and limits the development of redoxymorphic soil conditions. As a result, the high organic content together with the presence of clayey soils was used to define the wetland boundary. This was supported by the presence of wetland vegetation, and a distinct elevation increase to the east and west. The extent of the delineated wetland is illustrated in Figure 15. Wetland 1 is fed by a three identified sources:

- A concrete channel that flows south of the existing Impoundment Dam;
- A concrete stormwater drain located north and east of Impoundment Dam 1; and,
- An unlined stormwater channel north of Impoundment Dam 1.

Figure 15: Wetlands delineated within the Hillside Aluminium smelter site (taken from WSP, 2016). Wetland 1 is located in close proximity to the aboveground raw seawater pipeline to be located along the southern boundary of the site.

The health assessment conducted for wetland 1 revealed the following:

- Hydrology (Impact Score: 1.5; Change Score: 0): relatively low impact score due to the inflow regime being controlled by the upstream Impoundment Dam 1;
- Geomorphology (Impact Score: 3.0; Change Score: -1.0): moderately high impact score of 3 as a result of the contributions of sediments from historical discharges from the upstream Impoundment Dam 1; and,
- Vegetation (Impact Score: 1.0; Change Score: 0): the present area weighted vegetative state was scored at 1.5, classified as Health Class "B"; described as a very minor change to vegetation composition (e.g. numbers of indigenous invasive species slightly higher than would be expected naturally).

For Wetland 1, the highest functionality was for the toxicant removal (score of 3.5 out of 4), and sediment trapping (3.1 out of 4). The effectiveness of the Wetland 1 in sediment trapping is due to a high effectiveness in flood attenuation as a result of the dense vegetation and flat topography. The opportunity for sediment trapping is due primarily to the presence of accumulated sediments within the upper portion of the wetland in the vicinity of Impoundment Dam 1. The effectiveness of Wetland 1 in toxicant removal is primarily due to the dominance of the permanent and seasonal wetland zones, diffuse flow across the wetland, high vegetative cover and effectiveness in trapping sediments. The opportunity for the wetland to perform this role is as a result of the extent of the potential toxicant sources contributing to the system arising from accidental spillage of Impoundment Dam 1.

Thulazihleka (or Thula Sihleka) Pan System which is fed by the Ngodweni Canal is located to the west and east of the Hillside conveyor 08 (refer to the Site Plan in Appendix A). On the southern boundary it borders on the harbour area, while north of the Pan is the Foskor Plant. The Thulazihleka Pan System is currently under conservation because of its local biodiversity value. The pan provides habitat for birds and is an internationally recognised bird hot-spot while the surrounding vegetation types constitute habitat for Red Data Species. Protected plant species are present in the grassland complex to the north of the Pan. From a vegetation perspective the area adjacent to the Foskor property and areas to the north and north-east of the Pan system has conservation significance as it contains swamp forest elements. Pollution from surrounding land uses is affecting the integrity of this area, and there are concerns about the water quality in the pan which seems to be deteriorating due to the existing pollution pressures. The Pan has been identified as a potential contaminated site but this potential risk must still be confirmed. Information for the Thulazihleka Plan was sourced from the Environmental Management Framework for the Richards Bay Port Expansion Area and Industrial Development Zone (2011).

4.1.5 Geology and Soils

The underlying geology of the Bayside Aluminium site is Sandstone and Aeolianite. The site lies above the unconsolidated Cenozoic Era sediments of the Maputaland Lithological Group. Empangeni (to the north-west of the site) lies on formations of the pre-Cenozoic Era. These two geological regimes create a distinction in the groundwater regimes of the two areas. The shallow groundwater of the Maputaland group aquifer has strong links and influence on surface ecological functions, while there are few direct influences in the Empangeni area. Groundwater resources are found within the spaces between soil particles in the Mapataland Group, and this water is associated with faults and fractures of the hard rock formation.

The coastal dunes of the Richards Bay region are comprised of calcareous sandstones and unconsolidated sands, which are deposited on top of, pebble deposits. These coastal dunes contain heavy minerals, which are mined to varying degrees. The region is also known for its rich building sand, and clay deposits. In terms of topography, the area is characterised by three main features, namely:

- A flood plain (consisting of lakes, estuary, and river channels) (the floodplain forms part of the alluvial plain, and the subsequent alluvial soils);
- Sand plains; and
- Coastal dunes. [5]

A study by DWAF in 2002 showed that the lack of soil conservation is of concern in this region (the Mhlathuze catchment in particular) as this can lead directly to sedimentation in rivers and erosion in these systems.[6]

4.1.6 Hydrology – Surface Water

4.1.6.1 Regional Context

The region consists of the following rivers: The Mhlatuze River, the Nseleni River, the Nsezi Stream, and the Richards Bay Inner City Streams (Figure 16) and collectively make up the Mhlathuze catchment. A variety of lakes occur on the coastal plain. Lakes Mzingazi and Lake Cubhu, are supplied by surface runoff, rainfall, and by groundwater and are classified as

[5] Thornhill M and Thornhill H (2010) Environmental Risk Evaluation and Guidelines for the Richards Bay Industrial Development Zone. Status Quo Report prepared for the Richards Bay Industrial Development Zone (Pty) Ltd. Report No. TX2010/C015-5, Pietermaritzburg, South Africa.

[6] DAERD (2011) Environmental Management Framework for the Richards Bay Port Expansion Area and Industrial Development Zone. Department of Agriculture, Environmental Affairs and Rural Development (DAERD), Pietermaritzburg, South Africa.

coastal lakes. Lake Nsezi occurs at the edge of the coastal plain, bordering on hard rock geological features. As with the other lakes, Nsezi is supplied by surface water (from the Nseleni River), rainfall, and groundwater, but is characterised by different hydrological functions to that of the coastal lakes, and as such is classified as a 'combination' lake[6].

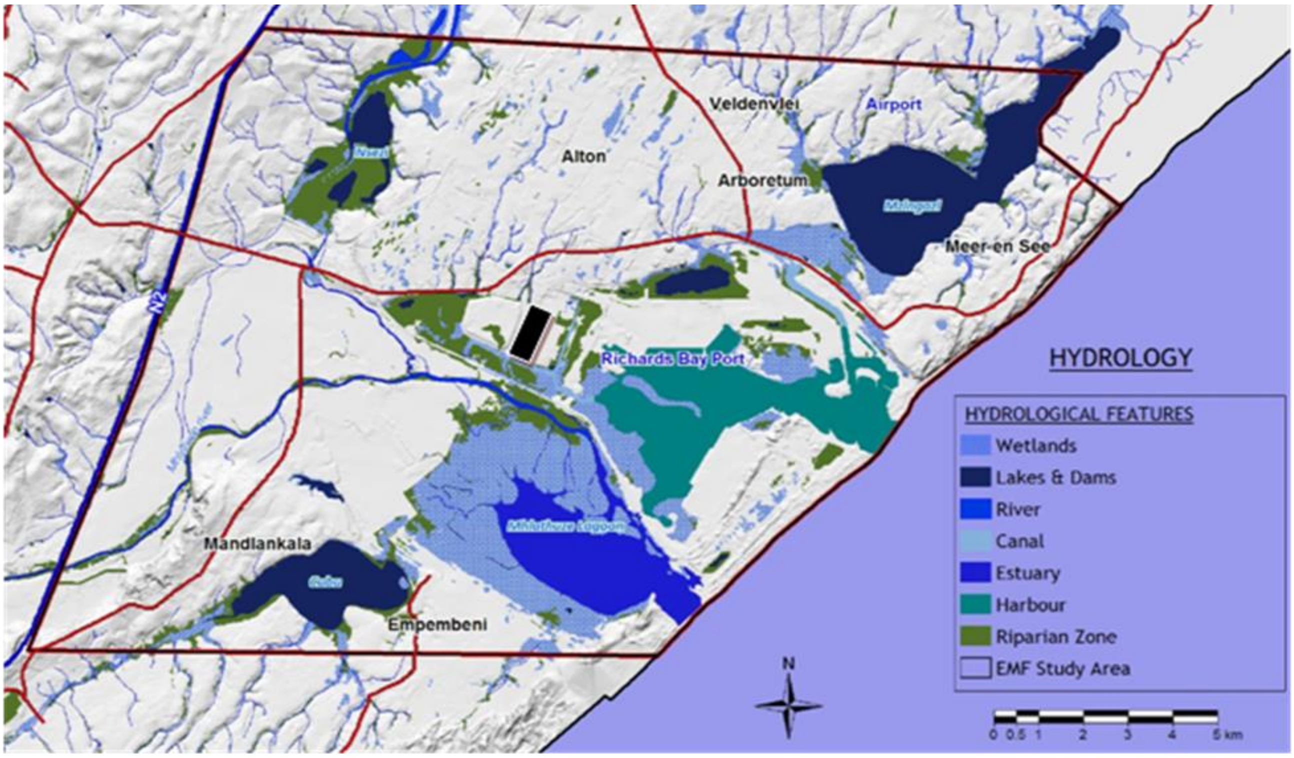

Figure 16: Surface Hydrology in the Richards Bay Area (Bayside Aluminium shown by black block)[6]

The study area falls mostly within the quaternary catchment W12F of the historical Mhlathuze River flood plain. The division of the floodplain and diversion of the Mhlathuze River to facilitate the construction of the Port of Richards Bay has resulted in the section of the floodplain containing the Bayside site to fall outside of the current Mhlathuze River catchment resulting in a reduced contributing catchment. The river systems that flow along the western and eastern boarders of the Bayside site enter the Bhizolo and Manzamnyama canals, respectively, which flow directly into the port of Richards Bay. Both canals are characterised as estuarine habitat.

According to the recent Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) study, commissioned by the then Department of Water Affairs (DWA), the lower Mhlathuze River has a seriously modified PES category. This is due to the extensive loss of natural habitat, biota and ecosystem functioning that has taken place in the catchment.

4.1.6.2 Site Context

The upstream contributing catchment of the tertiary catchment, W12 (Mhlathuze), covers an area of 4 209km^2, however owing to the canalisation of the Mhlathuze River, the upstream contributing catchments associated with Bayside site covers approximately 25km^2 and is split into two sub catchments of 18km^2 and 7km^2 (Figure 17). The two sub catchments drain into the Bhizolo and Manzamnyama canals, respectively.

Figure 17: Contributing catchments within the study area (Bayside Aluminium site depicted by the red outline)

4.1.7 Hydrology - Groundwater

4.1.7.1 <u>Regional Regime</u>

Groundwater can be separated into the primary aquifer in the unconsolidated sediments (Richards Bay and eSikhawini), and the secondary aquifers in the older fractured rock system (Empangeni). The primary aquifer provides vital replenishment of major water bodies in the region. Groundwater flow generally follows the main drainage lines and as such development can affect the direction in which groundwater flows. The general regional direction of groundwater flow is from the north-west to south-east (Figure 18).

4.1.7.2 <u>Local Regime</u>

The local groundwater resource can be categorised into a shallow, perched aquifer and a deep, regional aquifer[7]. The shallow aquifer is an unconsolidated primary aquifer, comprising an upper shallow horizon and a deeper zone separated by a discontinuous sandy-clay and continuous shell layer. The shallow aquifer zone is present from the surface to approximately 3m deep consisting of sand with interlayered clay layers. A semi confining clay and shell layer (3-8 m) is present below the shallow aquifer zone. A leaky/semi confined deep aquifer system is present below a clay layer (8 to 14 m) and consists mainly of sand and sandstone.

[7] Brown SAP, 2000. Water Study for the Environmental Impact Assessment Related to the Proposed Expansion at Hillside Aluminium. Report no: 4472/2240/1/W, Wates, Meiring & Barnard.

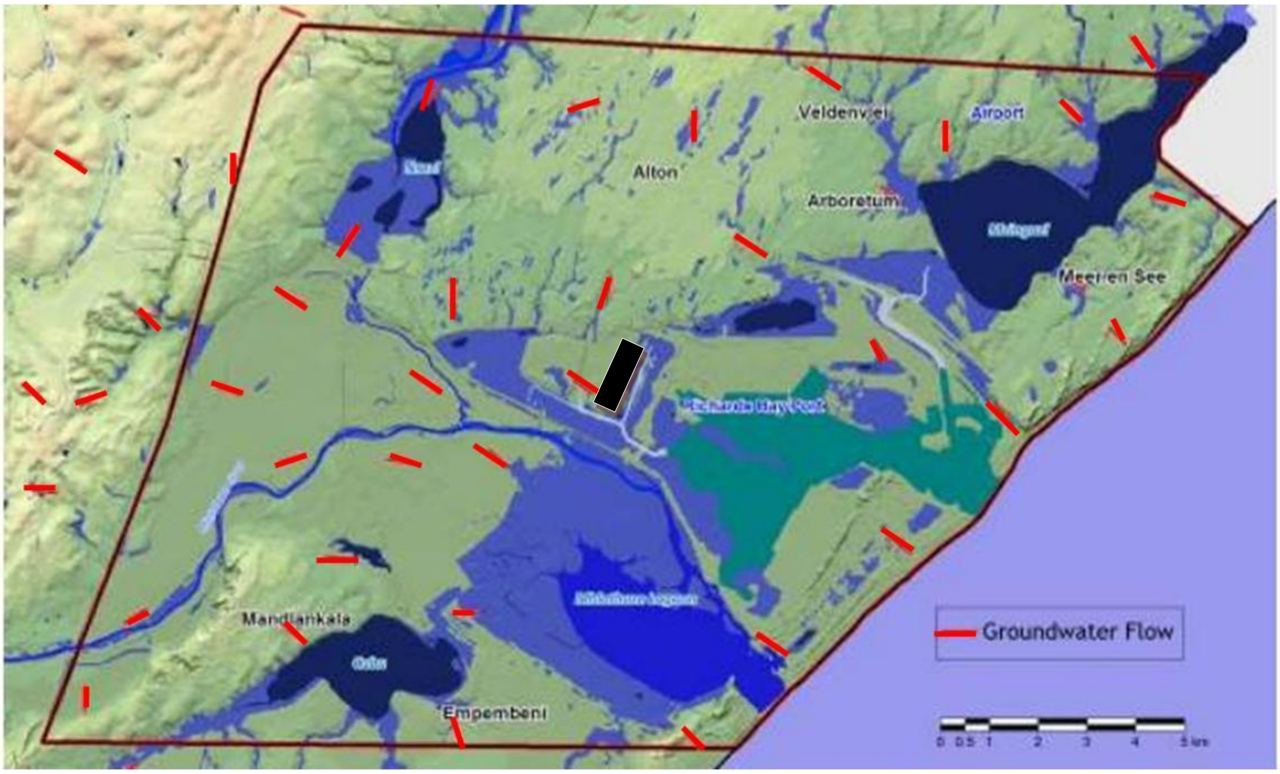

Figure 18: Regional groundwater flow in the Richards Bay area (Bayside Aluminium shown by black block)[6]

4.1.8 Ambient Air Quality

The City of uMhlathuze Local Municipality contains an established industrial development zone that currently comprises two aluminium smelters, chemical fertilizer plants, several woodchip plants, a paper mill, coal handling industries, and numerous other small scale industries. Many of the larger industries operate continuous combustion processes which release significant quantities of air pollutants into the atmosphere, thus the region has very poor air quality, which potentially constrains future industrial and other development. The majority of these industries are located within the town of Richards Bay and hence potentially pose a health risk to the surrounding community.

An air quality assessment conducted in 2005 identified certain key areas, where air quality standards are currently exceeded, or where the standards could be exceeded (Figure 19).[8] Bayside and Hillside Aluminium are situated in a "Potential Health Impact Zone", and also borders a "Nuisance Zone" (for odour detection).

[8]Thornhill M and Thornhill H (2010) Environmental Risk Evaluation and Guidelines for the Richards Bay Industrial Development Zone. Status Quo Report prepared for the Richards Bay Industrial Development Zone (Pty) Ltd. Report No. TX2010/C015-5, Pietermaritzburg, South Africa.

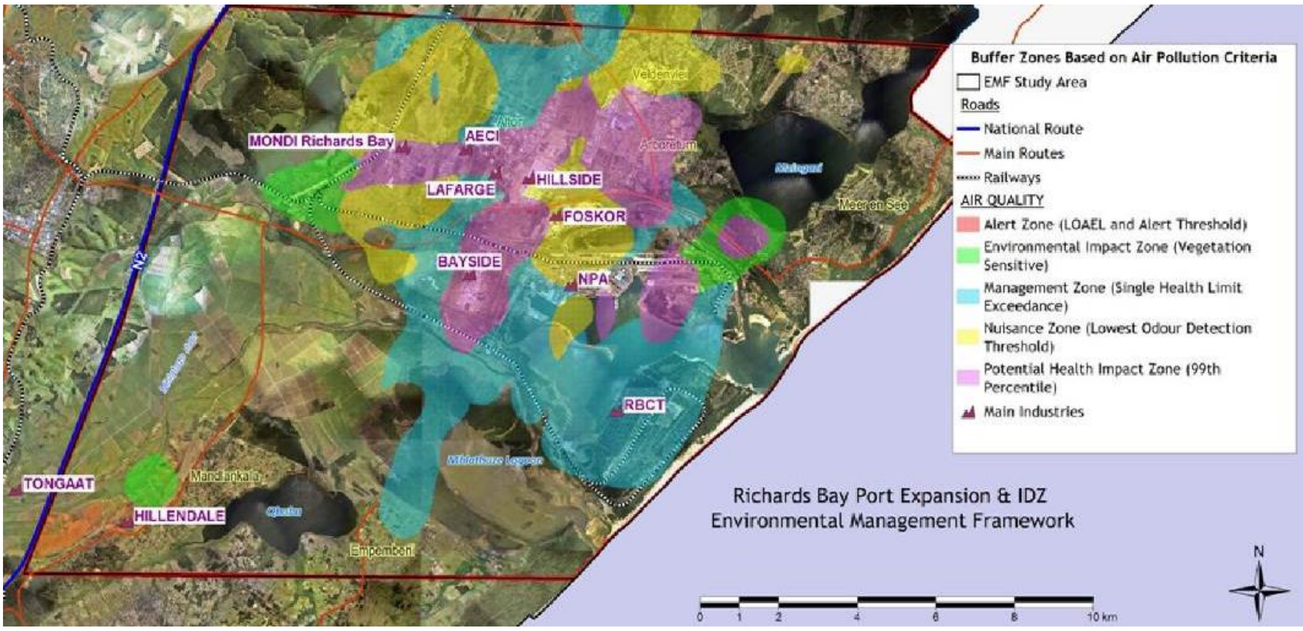

Figure 19: Regions in the Richards Bay area where air quality limits are in danger of being exceeded.[8]

Background data sourced from the RBCAA's CBD station (the closest PM_{10} station to the Bayside and Hillside Aluminium smelters, located ~4 km northeast of the Bayside facility) indicated a 2014 annual average concentration of 28.9 µg/m³ for PM_{10}. Data recovery for 2014 was 89%, thus is representative for the analysis.

4.2 SOCIO-ECONOMIC ENVIRONMENT

4.2.1 Demographics

4.2.1.1 Population

Data from the 2011 National Census states that the population within the uMhlathuze LM is 334,459 persons. This shows an annual increase of 1.5% between the 2001 and the 2011 National Census (StatsSA, 2011). This growth rate is higher than that experienced by the uThungulu DM (0.2%) and the province (0.7%) (StatsSA, 2011).

In 2011, 67% of the population in the uMhlathuze LM were reported to be between the ages of 15 and 64, which is noticeably higher than the uThungulu DM and the province which reported 61% and 63% in this age category, respectively. In addition, between 1996 and 2011 there has been a continuous increase in the percentage of the population within this age category while there has been a decrease in the population below the age of 15 (Table 6) (StatsSA, 2011).

Table 6: Breakdown of the population by age group

	KZN			uThungulu			uMhlathuze		
	1996	2001	2011	1996	2001	2011	1996	2001	2011
0-14	36%	35%	32%	41%	39%	34%	34%	33%	29%
15-64	59%	60%	63%	55%	57%	61%	63%	64%	67%
65+	5%	5%	5%	4%	4%	5%	3%	3%	4%

An increase in the population within the ages of 15 – 64 can be seen as a positive development on a provincial, district and municipal level. This is because it indicates that there are a higher number of people within the potentially economically active sector of the population, which should reduce the level of dependency.

4.2.1.2 Education

Between 2001 and 2011, there has been a significant decrease in the percentage of the population over the age of 20 within the uMhlathuze LM reporting no access to formal education, with the figure dropping from 18% to 8% (Table 7). These figures are better than those reported for both the uThungulu DM and KwaZulu-Natal, with 16% and 11%, respectively (StatsSA, 2011) (Table 7). The trend of better access to education within the uMhlathuze LM compared to the uThungulu DM and province is also evident in the percentage of the population over the age of 20 reporting to have a Grade 12 level of education and some form of tertiary education, 39% and 15% in uMhlathuze, 30% and 9% in uThungulu and 31% and 9% in KwaZulu-Natal, respectively (Stats SA, 2011) (Table 7).

Table 7: Highest level of education population over the age of 20, 2001 to 2011

	uMhlathuze		uThungulu		KZN	
	2001	2011	2001	2011	2001	2011
No Schooling	18%	8%	32%	16%	22%	11%
Grade 12	25%	39%	17%	30%	20%	31%
Higher	11%	15%	6%	9%	7%	9%

Despite improvements to education levels, school attendance by females between the ages of five and twenty remains below that of males within the LM, DM and on a provincial level (despite school attendance improving between 2001 and 2011, there has been little improvement in the disparity between school attendance between males and females).

4.2.1.3 Unemployment

Unemployment levels are an important indicator of socio-economic well-being as formal employment indicates access to an income and the ability to provide for basic needs. Despite improvements between 2001 and 2011, unemployment within the uMhlathuze LM remains high at 31%; however this is below the level of unemployment reported for the uThungulu DM (34.7%) and KwaZulu-Natal (33%) (StatsSA, 2011). The levels of unemployment reported within the LM, DM and province as a whole are all higher than the national average of 29.8% (StasSA, 2011a). Unemployment is reported to be highest in the municipal wards which encompass those areas which are developing on the urban periphery of Esikhaleni and Nseleni, while employment levels are highest in the urban areas of Richards Bay and Empangeni (uMhlathuze IDP, 2014-2015).

4.2.2 Economic Indicators

4.2.2.1 Income and expenditure patterns

There is a direct linkage between household expenditure and economic growth. Increase in household expenditure means a greater demand for goods and services, which implies an increase in production and a positive change in the size of an economy. Therefore, knowledge of the volume of the disposable income and the expenditure patterns of households can provide insight into the sectors that are most dependent on household income, thereby being most affected in the case of a change in household income. Household income levels are shown in Table 8.

Table 8: Household income distribution

Income category	South Africa	KwaZulu-Natal	uThungulu DM	uMhlathuze LM	Richards Bay
No Income	14.9%	15.1%	13.5%	15.2%	11.9%
R 1 – R 4,800	4.5%	4.9%	4.8%	4.4%	1.4%
R 4,801 – R 9,600	7.4%	8.6%	9.2%	8.0%	2.8%
R 9,601 – R 19,200	17.1%	19.4%	20.2%	13.7%	5.6%
R 19,201 – R 38,400	19.0%	19.8%	21.1%	15.5%	6.6%
R 38,401 – R 76,801	13.1%	11.9%	11.5%	11.9%	9.1%
R 76,801 – R 153,600	9.3%	8.3%	8.0%	11.1%	13.9%

Income category	South Africa	KwaZulu -Natal	uThungulu DM	uMhlathuze LM	Richards Bay
R 153,601 – R 307,200	7.2%	6.3%	6.0%	10.1%	20.9%
R 307,201 – R 614,400	4.7%	3.9%	4.1%	7.2%	18.8%
R 614,401 – R 1,228,800	1.9%	1.2%	1.2%	2.2%	7.0%
R 1,228,801 – R 2.457,600	0.6%	0.4%	0.3%	0.5%	1.2%
R 2,457,601 and above	0.3%	0.2%	0.2%	0.3%	0.8%
Average monthly income (2011)	R 8,696	R 7,100	R 6,935	R 10,502	R 23,130
Less than R3,200 pm.	62.9%	67.8%	68.8%	56.69%	28.2%

In South Africa, the average monthly household income was R 8,696 in 2011. Richards Bay had an average monthly income of R 23,130 with a significantly smaller portion of households living on less than R 3,200 per month compared to the rest of the study areas. The relatively high average income is likely attributable to the high level of industrialisation in Richards Bay. The highest number of households living on less than R 3,200 per month is observed in the uThungulu DM, with 69% of its households considered to be living in extreme poverty. This comparison with the district could be seen as an indication of the relative economic importance and the size of the development that has taken place in Richards Bay.

4.2.2.2 The economy and its structure

Analysis of the structure of the economy and the structure of its employment provides insight into the scale of reliance of an area on a specific sector(s) and, thus, the sensitivity of the area to changes in different sectors of global and regional markets.

Economic production and Gross Domestic product per Region

The Gross Domestic Product per Region (GDP-R) of the uMhlathuze LM was valued to be R 23,946 million in 2013 current prices (Table 9). This is equal to a per capita GDP-R of R 70,310, which is significantly higher than the national and provincial economies with a GDP-R per capita of R 57,160 and R 45,898, respectively (Table 9). The uThungulu DM has the weakest economy in GDP terms with a per capita figure of R 40,340 (Table 9). In addition to signalling a weak economy, a lower GDP-R per capita is usually associated with a decreasing standard of living.

Table 9: GDP-R and GVA-R per capita (2013) (Source: Quantec, 2014)

	GDP-R (R' million)	GDP-R per capita (R)
South Africa	R 3,030,263	R 57,160
KwaZulu-Natal	R 480,382	R 45,898
uThungulu DM	R 37,245	R 40,340
uMhlathuze LM	R 23,946	R 70,310

Another important indicator of the well-being of a region's economy is the rate at which it is growing. Between 2003 and 2013, the uMhlathuze LM's economy grew on average 3% per year. This is lower than the national Compounded Annual Growth Rate (CAGR) of 3.4% per annum.

When one considers the structure of the economy in nominal terms, it becomes evident that the national economy is predominantly a service economy. The tertiary sector comprised 70% of the national economy in 2013, and grew by 4%. The primary sector that includes agriculture and mining, contributes the smallest amount to the national economy. These sectors are, however, strategically important for food security and job creation. The mining and agricultural sectors experienced the lowest growth rates nationally. This could indicate potential job losses for individuals who are typically low to semi-skilled, with a specific skills set. The major drivers of the 3.4% national growth rate were the finance, insurance and business sectors and the trade, transport and communication industries.

In KwaZulu-Natal, the primary sector is significantly smaller than at national level, with agriculture comprising 4.4% of the province's primary economy as opposed to mining, which is the dominant primary sector at national level. Another notable difference between the province and South Africa is that the manufacturing industry is bigger within the provincial economy, suggesting that although the manufacturing industry grew by 2.6% in both regions, the impact is more significant in KwaZulu-Natal.

Within the primary study area, the importance of the manufacturing industry is evident in that this sector comprises more than 20% of the LM's economy. However, the manufacturing sector's growth in the LM (0.6% per annum) is below the growth recorded in the wider study area, 2.0% on a district level and 2.6% provincially and nationally per year between 2003 and 2013. The lower than average growth of this sector could be seen as an indication that the secondary sector within the uMhlathuze LM is experiencing pressure as a result of the relatively slow growth experienced by the local economy. A breakdown of the structure of the study areas' economies is show in Table 10.

Table 10: Structure of the study areas' economies (nominal 2013 prices) and Compound Annual Growth Rate (2003-2013)

Sectors	South Africa		KwaZulu-Natal		uThungulu DM		uMhlathuze LM	
	Nominal 2013	CAGR ('03–'13)	Nominal 2013	CAGR ('03-'13)	Nominal 2013	CAGR ('03-'13)	Nominal 2013	CAGR ('03-'13)
Primary sector	**11.6%**	**0.2%**	**6.6%**	**1.3%**	**13.4%**	**-1.3%**	**11.4%**	**-1.9%**
Agriculture, forestry and fishing	2.4%	1.9%	4.4%	1.8%	6.5%	1.1%	3.4%	4.4%
Mining and quarrying	9.2%	-0.4%	2.2%	-0.2%	6.9%	-4.1%	8.0%	-4.7%
Secondary sector	**18.4%**	**3.0%**	**22.1%**	**2.9%**	**25.1%**	**2.3%**	**27.3%**	**0.9%**
Manufacturing	11.6%	2.6%	15.7%	2.6%	18.6%	2.0%	20.5%	0.6%
Electricity, gas and water	3.0%	1.6%	3.0%	0.9%	2.7%	0.3%	3.3%	0.8%
Construction	3.7%	6.8%	3.5%	6.8%	3.7%	6.7%	3.5%	4.8%
Tertiary sector	**70.0%**	**4.0%**	**71.3%**	**4.1%**	**61.5%**	**4.6%**	**61.3%**	**3.8%**
Trade	16.6%	3.7%	18.2%	4.0%	16.0%	5.8%	15.2%	4.9%
Transport and communication	8.9%	3.6%	13.2%	3.9%	14.4%	4.3%	14.1%	2.4%
Finance, insurance, and business	21.5%	5.1%	18.8%	5.5%	13.9%	6.7%	13.6%	6.1%
Community services	6.0%	2.6%	6.2%	2.7%	6.1%	2.0%	6.2%	2.4%
General government	17.1%	3.3%	14.8%	3.4%	11.2%	2.3%	12.1%	2.8%
Total	**100%**	**3.4%**	**100%**	**3.6%**	**100%**	**3.0%**	**100%**	**2.1%**

Sectoral employment structure

Sectoral employment patterns are similar across all study areas with the only difference being the relatively high importance of the agricultural sector in the DM; 7.19% compared with 3.89% and 4.3% in the LM and province, respectively. Within the uMhlathuze LM, the greatest contributor towards employment creation is the utilities sector, creating almost a quarter of employment opportunities within the local economy. The manufacturing sector; which comprises 20% of the economy, creates 7.74% of the employment opportunities within the LM's economy. However, this sector, on average, is growing at a rate below that of the other sectors, which is concerning considering that it makes up one fifth of the local economy. Loss of production and employment in the manufacturing sector could, therefore, further impact on the already below average growth rate of the uMhlathuze LM's local economy. The national, provincial, district and local employment structure are illustrated in Figure 20.

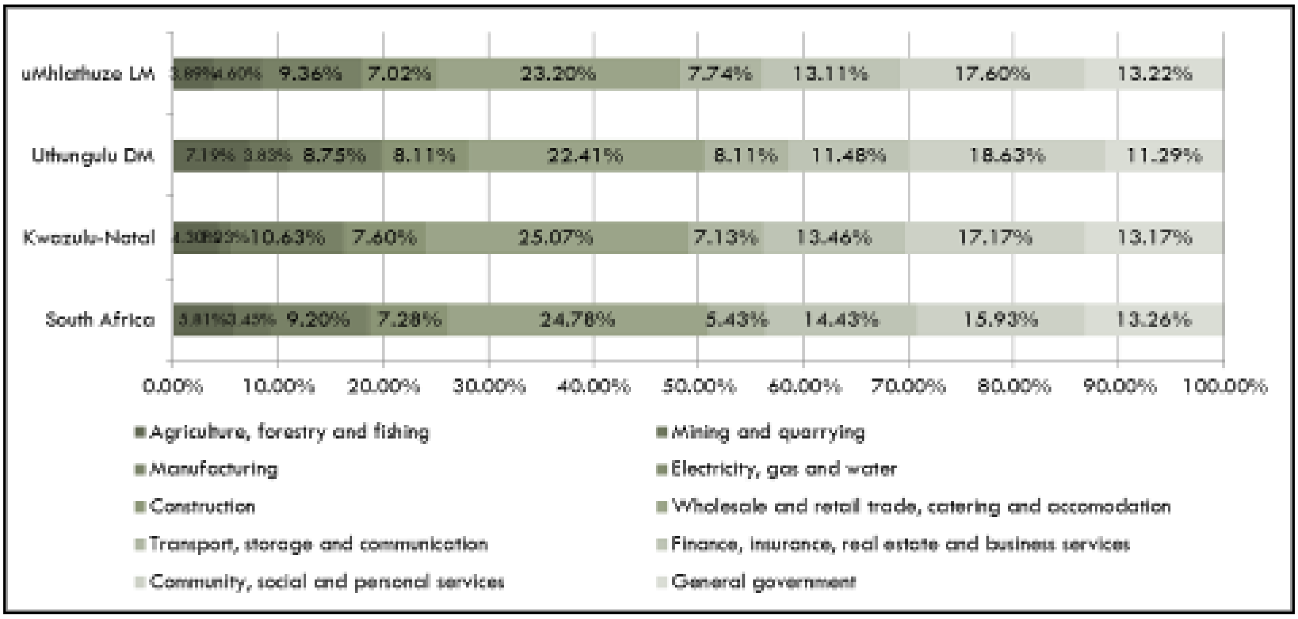

Figure 20: Employment structure 2013 (Quantec, 2014)

4.2.3 Infrastructure and Services

4.2.3.1 *Water Supply*

The EMF for the Richards Bay Port and IDZ indicates that the available water resources within the Richards Bay are fully utilised. Water is supplied through a piped network to the various users, as well as through direct abstraction from boreholes. As the population grows within the region, as well as the expansion of economic and industrial activities, the water demand is likely to increase. Concern has been raised regarding the volumes of water that will be available to service natural ecological processes. In particular, water is required for recharge to maintain the lake and estuarial ecosystems. The fear is that there will not be enough water to flush out the estuaries in the area, and the subsequent maintaining of ecosystem balances.[6]

Access to piped water improved significantly within the uMhlathuze LM between 2001 and 2011, with 92% of all households (Table 11) reported to have access to piped water either within their household or within their yard (StatsSA, 2011). The improvement in access to water is also seen in the reduction of people without access to piped water declining from 11% to 3% (Table 11) (StatsSA, 2011).

Table 11: Access to piped water

	uMhlathuze		uThungulu		KZN	
	2001	2011	2001	2011	2001	2011
Piped water inside dwelling/yard	68	92	38	65	49	64
Communal standpipe	20	5	17	19	24	22
No access to piped water	12	3	45	16	27	14

4.2.3.2 *Sewerage and Sanitation*

Effluent emanating from the City of uMhlathuze is managed through different systems, the infrastructure network of the Richards Bay area is depicted in Figure 21:

- A sea outfall pumping scheme, which deals with sewerage that originates from the various urban areas, as well as industrial zones, within Richards Bay;
- Sludge sewerage treatment plants (particularly for urban areas effluent); and
- Pit latrines found in rural areas.

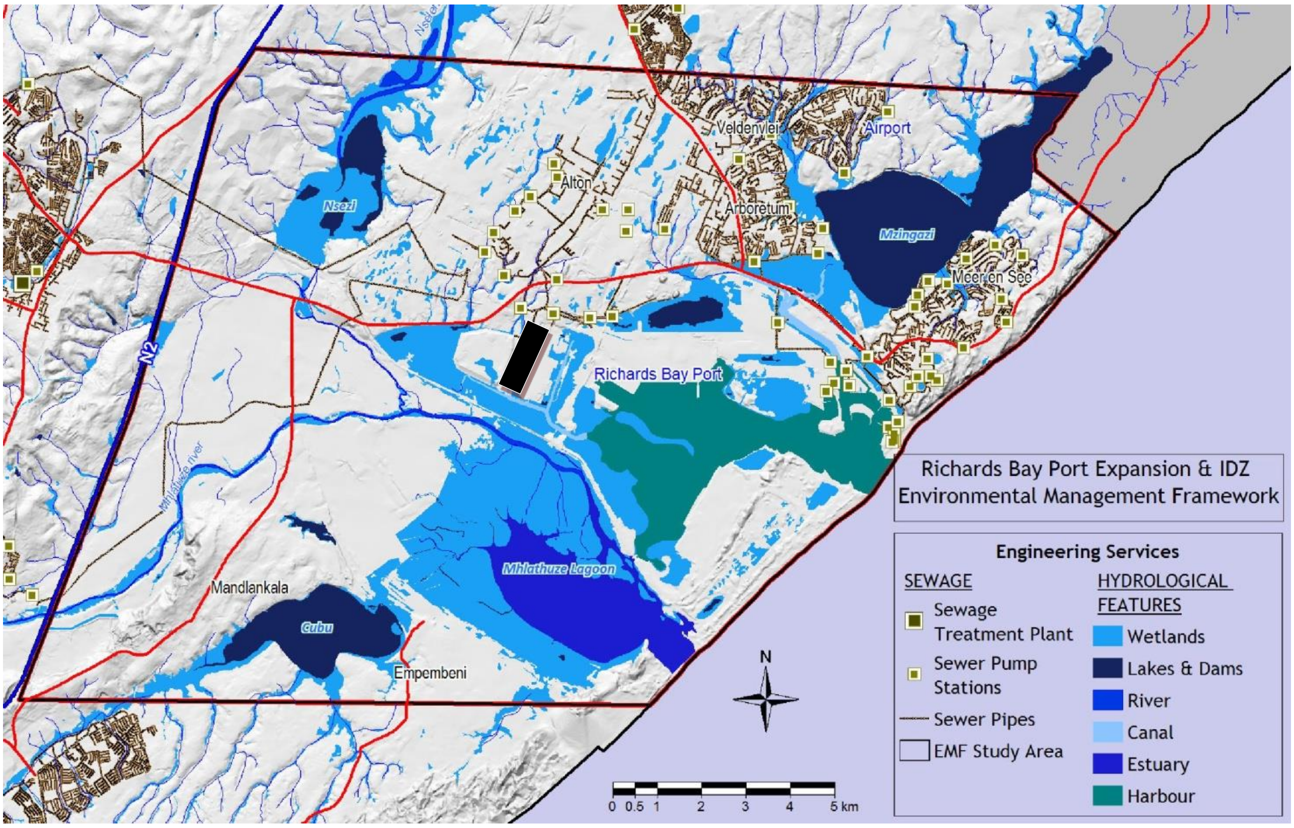

Figure 21: Sanitation Infrastructure in the Richards Bay Region (Bayside Aluminium shown by the black block)[9]

Improvements to sanitation have been experienced by households throughout KZN, within the uThungulu DM and within the uMhlathuze LM. This is evident in the reduction in the number of households without access (16% to 7% (KZN), 30% to 13% (uThungulu) and 9% to 4% (uMhlathuze)) (StatsSA, 2011) (Table 12). As is the case with access to water, access to sanitation within the uMhlathuze LM is above both the district and provincial averages.

Access to flush/chemical toilets has also improved, with access in the uMhlathuze LM higher than in the district and province (Table 12). Of concern is that there has been an increase in the number of households reporting to make use of the bucket system (Table 12).

Table 12: Access to sanitation between 2001 and 2011

	uMhlathuze		uThungulu		KZN	
	2001	2011	2001	2011	2001	2011
Flush or chemical toilet	53%	65%	32%	43%	46%	54%
Pit latrine	37%	28%	36%	41%	37%	36%
Bucket latrine	1%	3%	2%	3%	1%	3%
None	9%	4%	30%	13%	16%	7%

4.2.3.3 Electricity

Access to electricity for lighting (the most basic level of access) within the uMhlathuze LM is better than access on a district and provincial level (Table 13). However, noticeable improvements have been seen throughout KZN between 2001 and 2011 (Table 13) (StatsSA, 2011).

[9] DAERD (2011) Environmental Management Framework for the Richards Bay Port Expansion Area and Industrial Development Zone. Department of Agriculture, Environmental Affairs and Rural Development (DAERD), Pietermaritzburg, South Africa.

Table 13: Access to electricity for lighting

	Access to Electricity for Lighting	
	2001	**2011**
uMhlathuze LM	86%	94%
uThungulu DM	53%	76%
KZN	61%	78%

4.2.3.4 Healthcare

Primary healthcare within the LM is provided from two main clinics, one in Richards Bay and one in Empangeni, supported by satellite clinics. The main healthcare conditions reported are hypertension, diabetes and tuberculosis. Sexually transmitted infections are reported to remain a growing concern within the municipality (uMhlathuze IDP, 2014-2015).

4.2.3.5 Road Infrastructure and Traffic

Road infrastructure in the region is dominated by the N2 National Highway, which runs in a north to south direction, to the west of the Bayside Aluminium site (Figure 22). The main feeder route from the N2 to Bayside Aluminium is the R34, which runs east to west, just to the north of the site (refer also to the Site Plan in Appendix A).

Figure 22: Main roads in relation to Bayside Aluminium (shown by the black block) (Source: Google Maps, June 2014)

4.2.4 Heritage and Sense of Place

A baseline heritage study was conducted in 2013 in anticipation of the expansion of the Richards Bay Port. While the baseline study did recommend a full Heritage Impact Assessment, the following was identified in the report:

- No heritage resources with Grade I or Grade II status are situated within the Richards Bay Port expansion area;
- It is unlikely that buildings or structures older than sixty years are present (due to recent history and establishment of Richards Bay); and,
- It is unlikely that places associated with oral traditions or living heritage are present within the proposed development area. [10]

[10] Baseline Heritage Study: Richards Bay Port Expansion, KwaZulu-Natal: AECOM, 2013

However, a survey conducted as part of the EMF for the Richards Bay Port and IDZ[11] identified the following cultural and historical features:

- Numerous archaeological and paleontological sites were identified (with 10km of the Port);
- Numerous archaeological sites of high significance have been discovered in the coastal dune area; and,
- Significant paleontological remains have been discovered in the area.

Sense of Place is a function of the visual quality within the area and Richards Bay has conflicting visual quality. On one hand, town planning has ensured (to some degree) the preservation of the character of Richards Bay but this must be seen against a backdrop of large-scale development including large industries and the Port. The visual quality of the area is depicted in Figure 23.

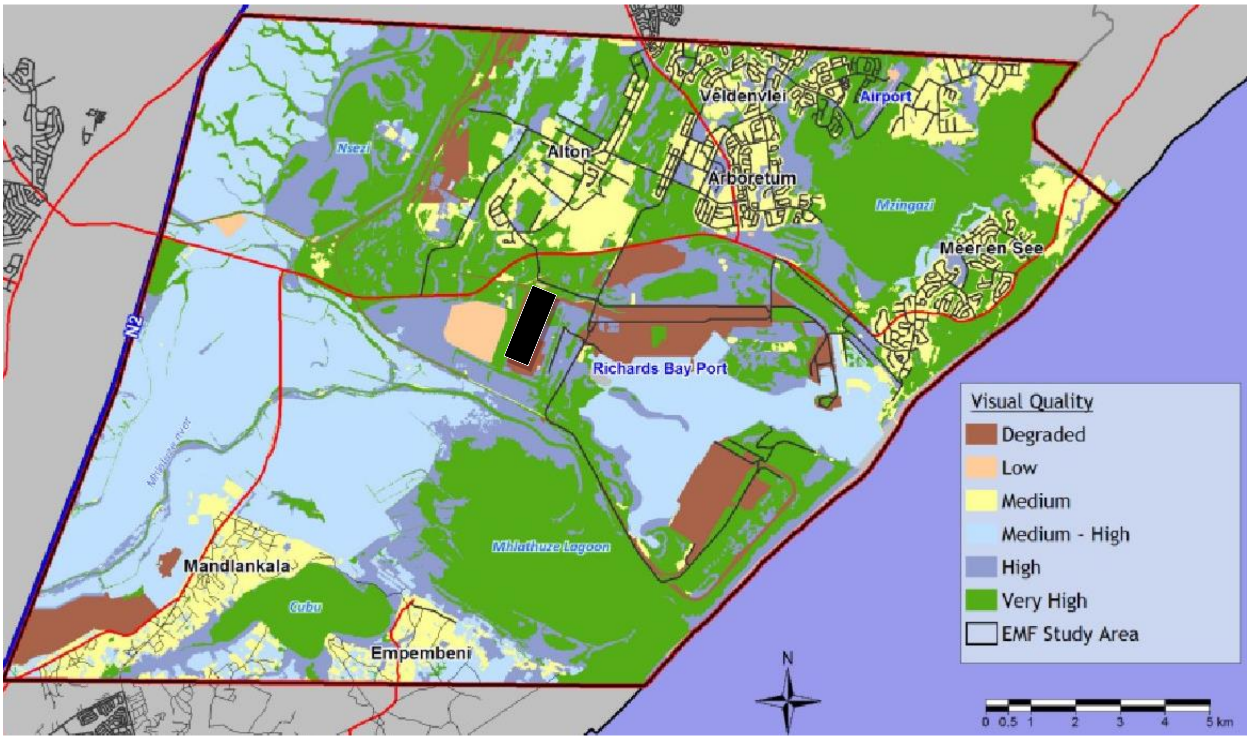

Figure 23: Visual Quality assessment of the Richards Bay Port and IDZ (Bayside Aluminium shown by black box) [11]

4.2.5 Ambient Noise

A baseline acoustic study was conducted in 2013 in anticipation of the expansion of the Richards Bay Port. No significant noise impact on sensitive receptors was identified at a distance of 1500m and greater (from the existing Richards Bay and Transnet facilities). Sensitive receptors within 1000m of the study area include the Protea Waterfront Hotel, the Waterways Residential Estate and the Mzingazi Waterfront Village. Accordingly, it was concluded that the current activities that take place within the Richards Bay Port and IDZ do not impact significantly on surrounding sensitive receptors. [12]

[11] DAERD (2011) Environmental Management Framework for the Richards Bay Port Expansion Area and Industrial Development Zone. Department of Agriculture, Environmental Affairs and Rural Development (DAERD), Pietermaritzburg, South Africa.

[12] Acoustical Baseline Report – Richards Bay Port Expansion: AECOM, 2013

5 PUBLIC PARTICIPATION PROCESS

The Public Participation guideline (DEA, 2010 - Guideline Series 7) provides the following explanation with regards to the importance and significance of the public participation process within the EIA.

"*Public participation is one of the most important aspects of the environmental authorisation process. It is considered so important that it is the only requirement for which exemption cannot be given. This is because people have a right to be informed about potential decisions that may affect them and to be afforded an opportunity to influence those decisions. Effective public participation also facilitates informed decision-making by the competent authority and may result in better decisions as the views of all parties are considered.*"

The guideline further highlights the following benefits of public participation:

- It provides an opportunity for I&APs, EAPs and the Competent Authority to obtain clear, accurate and understandable information about the environmental impacts of the proposed activity or implications of a decision;
- It provides I&APs with an opportunity to voice their support, concerns and questions regarding the project, application or decision;
- It provides I&APs with the opportunity of suggesting ways for reducing or mitigating any negative impacts of the project and for enhancing its positive impacts;
- It enables an Applicant to incorporate the needs, preferences and values of affected parties into its application;
- It provides opportunities for clearing up misunderstandings about technical issues, resolving disputes and reconciling conflicting interests;
- It is an important aspect of securing transparency and accountability in decision-making; and,
- It contributes toward maintaining a healthy, vibrant democracy.

The following sections detail the methodology employed to ensure an effective and transparent public participation process as part of this BA application process.

5.1 IDENTIFICATION OF I&APS

A database of I&APs, including State Departments, was compiled (Appendix 4). The following categories of I&APs were included in the database:

- All directly adjacent landowners (no occupiers of land are present in this situation);
- Community Organisations such as Rate Payers Associations, Home Owner Associations, Interest Groups, etc.;
- Relevant State Departments, such as:
  - Environmental, planning and other departments within Provincial Government, District and Local Municipalities;
  - Department of Water Affairs;
  - Department of Agriculture; etc.
- Ward Councillors;
- Non-Governmental Organisations (NGOs) (such as Wildlife and Environmental Society of South Africa (WESSA));
- Various environmental protection agencies/ bodies; and
- Any other party perceived as playing a role within the community/ study area.

All I&APs requesting registration on the project's database and those who submitted comments will be captured in the Registered I&APs database. The database will be maintained throughout the BA application process. Those identified I&APs (other than state departments) who do not register during the registration period will not be carried over onto the

Registered I&APs database, unless they participate in subsequent stakeholder engagement meetings and/or comment on documents placed within the public domain.

5.2 ANNOUNCE THE APPLICATION, CALL FOR I&AP REGISTRATIONS AND AVAILABILITY OF THE DRAFT BASIC ASSESSMENT REPORT FOR REVIEW AND COMMENT

The following activities were undertaken to announce the BA application, request I&APs to register and announce the availability of the Draft Basic Assessment Report (DBAR) for review and comment (refer to Appendix 4 for details):

- Newspaper advertisements in the local Zululand Observer and Eyethu Baywatch newspapers on 11 and 13 April 2016, respectively;
- Fixing of 4 site notices on 13 April 2016 at strategic locations on and around the site; and,
- A Background Information Document (BID) was sent via post/email/fax on 13 April 2016 to all I&APs on the project database.

The DBAR was made available for review and comment for a period of **30 calendar days** (excluding public holidays) **from 13 April – 16 May 2016** at the following venues/ sites:

- South32 Enterprise Supply & Development Centre; and,
- SE Solutions website – www.sesolutions.co.za.

A public/ stakeholder meeting was held on Tuesday, 10 May 2016 at the South32 Enterprise Supply & Development Centre from 17:00 – 19:00. The content of the DBAR was presented and discussed. All comments received during the public/ stakeholder meeting were acknowledged and captured in formal minutes of the meeting (refer to Appendix E).

All comments received, together with requests for registration, were acknowledged and captured in a Comment and Response Report (CRR) to be included within the Final Basic Assessment Report (FBAR).

5.3 FINAL BASIC ASSESSMENT REPORT

Once the commenting period on the DBAR has concluded, the report will be updated to a FBAR, which will include the CRR, for submission to the KZN DEDTEA for decision-making. Concurrently with the submission to KZN DEDTEA, the FBAR will also be made available to all registered I&APs for a period of 14 calendar days. All comments on the FBAR are to be submitted directly to KZN DEDTEA and copied to the EAP.

5.4 ENVIRONMENTAL AUTHORISATION

Once the KZN DEDTEA has reached a decision, the Environmental Authorisation (EA) will be issued to the Applicant. The EA will be distributed to all registered I&APs together with a notification of the appeal provisions.

6 IDENTIFICATION OF ENVIRONMENTAL ISSUES AND POTENTIAL IMPACTS

The following potential environmental impacts (both negative and positive) have been identified based on the ISO 14001 Environmental Management System (EMS) standard of firstly identifying activities, associated aspects and resultant potential impacts. Activities, aspects and impacts are defined as:

6.1 ACTIVITIES

Activities are the physical activities that typically unfold over the full product lifecycle. In the case of this application the activities are limited to installation of the desalination plant and associated infrastructure, including seawater abstraction from the Manzamnyama Canal.

6.2 ASPECTS

Environmental and social aspects are defined as 'an element of an organisation's activities, products or services that can interact with the environment.' For example, waste water discharge from washing buildings/ structures.

6.3 IMPACTS

Environmental and social impacts are defined as 'any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's activities, products or services.' For example, water quality changes that could occur as a result of the uncontrolled discharge of wash water.

The magnitude of the impact is a function of the **receiving environment** and the intensity of the aspects. For example, the impacts of a water demanding activity in the south-eastern parts of KwaZulu-Natal would mean very different impacts to establishing the self-same activity in the Limpopo Province. As such, it is necessary to be able to provide an effective indication of the likely sensitivities or vulnerabilities of the receiving environment to provide for a proper assessment of the scale and severity of the impacts.

6.4 IDENTIFIED POTENTIAL IMPACTS

The process of identifying and characterising potential impacts is illustrated in Figure 24 and summarised below as a set of consecutive steps.

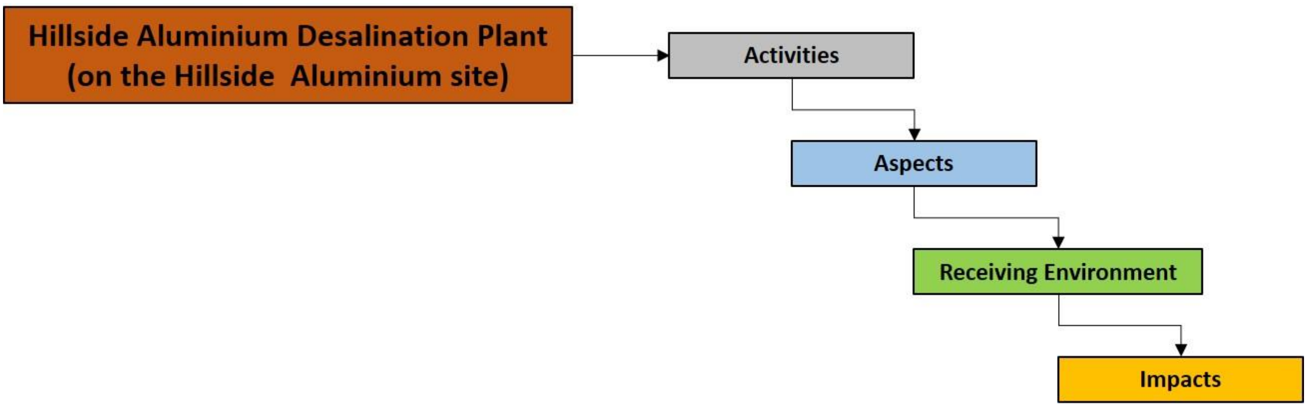

Figure 24: Schematic illustration of the process of identifying potential impacts that may occur as a result of the proposed desalination plant and associated infrastructure.

Step 1: Identifying activities

In order to identify potential impacts it is necessary to detail the activities that result from the desalination plant and associated infrastructure required. The following activities have been identified based on the detailed project description (Section 2.3 above):

- Construction Phase:
  - Site preparation activities, such as development of laydown areas (storage areas and site camps).
  - Installation of the raw water (seawater), process water, and wastewater pipelines;
  - Construction of the new minisub at the desalination plant and associated electrical supply cables from the existing Substation 06 at Hillside; and,
  - Installation/ sitting of the containerised desalination plant and associated tanks and infrastructure.
- Operational Phase:
  - Abstraction of raw water (seawater) from the Richards Bay Harbour;
  - Discharge of wastewater/ effluent via the Mhlatuze Sea Outfall Pipeline;
  - General maintenance of the predominantly automated desalination plant;
  - General maintenance of the pipeline and other associated infrastructure; and,
  - Maintenance of the pipeline servitudes through regular grass and bush cutting.

The key activities will thus be:

- Construction Phase:
  - Grass and brush cutting;
  - Excavation;
  - Pipe laying;
  - Backfilling;
  - Concrete works;
  - Mechanical installation; and,
  - Electrical installation.
- Operations
  - Abstraction;
  - Desalination;
  - Maintenance; and,
  - Grass and bush cutting.

Step 2: Identifying aspects

For each of the identified activities it is necessary to list the associated environmental and social aspects (
Table 14). These environmental and social aspects can be identified as a function of the activity list developed in Step 1.

Table 14: Broadly stated environmental and social aspects that would be generated by the activities listed in Step 1.

Resource use	Energy	Electricity
		Liquid fuels
	Water (Potable Water)	
	Water (Seawater)	
	Land Transformation	Soil
		Wetlands
Waste & Pollution	Waste	Hazardous liquid waste
		Low-hazard solid waste
		Waste concrete
	Spoil (soil & rock)	
	Effluent	Waste water
		Stormwater
	Atmospheric emissions	Dust/ PM_{10}
		Vehicle Emissions
	Radiation	Noise
	Spillage	
Socio-Economic	Jobs	
	Spending	
	Skills/ Experience	

Step 3: Characterising the receiving environment

The likely sensitivities or vulnerabilities of the receiving environment, as they pertain to the proposed desalination plant and associated infrastructure are as follows:

- Ambient Air Quality: Annual PM_{10} concentrations at 28.9 µg/m³, which is some 72% of the national ambient air quality standard.
- Ambient Noise Levels: SANS Industrial limit is 70 dB(A).
- Groundwater: Shallow aquifer connected in places with the deep aquifer.
- Wetlands identified within the study area, specifically the wetland delineated south of the Hillside Impoundment Dam 1 and the Thulazihleka (or Thula Sihleka) Pan System contribute to ecological functions, such as flood attenuation, filtration of toxins and trapping of sediments, etc., while the Pan has added value due to its conservation importance related to faunal and flora biodiversity.
- Socio-Economic Environment:
  - High levels of unemployment within the Local and District Municipalities at 31% and 34.7%, respectively.
  - Richards Bay had an average monthly income of R 23,130 with a significantly smaller portion of households living on less than R 3,200 per month. The relatively high average income is likely attributable to the high level of industrialisation in Richards Bay.

Step 4: Identifying potential impacts

The final step is then determining the impacts themselves. Key environmental and social impacts are summarised in Table 15 below.

6.5 IDENTIFIED CUMULATIVE IMPACTS

The 2014 EIA Regulations define "cumulative impact" in relation to an activity as: "*the past, current and reasonable foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities*."

The following cumulative impacts were identified based on the activities to be undertaken for the proposed desalination plant. These cumulative impacts have also been assessed in the EIA (Section 7 below).

- Changes in the density and toxicity of the Mhlathuze Sea Water Outfall Pipeline effluent; and,
- Reduction in water consumption (specifically potable water provided by the Local Municipality) (positive impact).

Table 15: Potential impacts that could be invoked by the environmental and social aspects associated with the preferred desalination plant project activities.

Environmental and Social Aspects			Activities											Potential Impacts (viz. potential changes in…)	Potentially Significant Impact Requiring Assessment (CP = Construction phase only)
			Construction							Operations					
			Grass & bush cutting	Excavation	Pipe laying	Backfilling	Concrete works	Mechanical installation	Electrical installation	Abstraction	Desalination	Maintenance	Grass & bush cutting		
Resource use	Energy	Electricity								X	X			Resource use	No
		Liquid fuels	X	X	X	X	X			X	X		X		No
	Water (Potable Water)						X								No
	Water (Seawater)									X				Marine (Harbour) ecology	No**
	Land Transformation	Soil		X		X								Physical soil characteristics	No
		Wetlands			X									Wetland ecology	No
Waste and Pollution	Waste	Hazardous liquid waste						X	X			X		Landfill airspace	No
		Low-hazard solid waste						X	X			X		Landfill airspace	No
		Waste concrete					X							Landfill airspace	No
	Spoil (soil & rock)			X			X							Biodiversity (Flora)	No
	Effluent	Wastewater									X			Marine ecology	Yes*
		Stormwater		X		X								Sedimentation	Yes
	Atmospheric emissions	Dust/ PM_{10}	X	X		X								Ambient air quality	Yes
		Vehicle Emissions	X	X	X	X	X					X	X		Yes (CP)
	Noise		X	X	X	X	X	X	X	X	X	X	X	Ambient noise	Yes (CP)
	Spillage (hydrocarbons)		X	X	X	X	X	X	X		X	X	X	Surface water & soil quality	Yes
Socio-Economic	Jobs (temporary)		X	X	X	X	X	X	X					Socio-economics	No
	Spending		X	X	X	X	X	X	X			X			No
	Skills/experience										X				No

* The impact of effluent on marine ecology at the point of discharge from the Mhlathuze Water Sea Outfall Pipeline is assessed at a very high level. Mhlatuze Water is undertaking an impact assessment of their total effluent discharge to sea as part of their Discharge Permit Application.

** Mhlathuze Water have an existing Record of Decision (ROD) for the abstraction of sea water from the Richards Bay Harbour between berths 609 and 702. The impact of the abstraction of seawater was assessed during the previous application. Hillside Aluminium will enter into an agreement with Mhlathuze Water for the use of seawater within the ambit of their existing ROD.

7 ENVIRONMENTAL IMPACT ASSESSMENT METHOD

The approach and methodology for the detailed assessment of the potential impacts highlighted in Section 6 above is detailed below.

7.1 SPECIALIST STUDIES

On the basis of the potential impacts identified during the preliminary site visit and engagement with various Competent and Commenting Authorities, experts in the relevant fields have been commissioned to conduct specialist investigations. The investigations are aimed at assessing the significance of potential impacts identified as well as identifying further aspects and impacts that may have been overlooked. Specialists will also provide feasible and appropriate mitigation measures to either reduce the significance of negative impacts or enhance positive impacts.

Based on the preliminary discussions and site visits, only two (2) specialist assessments were commissioned, namely:

- Estuarine Impact Assessment; and,
- Protected Flora Assessment and submission of Protected Tree and/or Species Applications.

The environment within the Bayside Aluminium smelter site had been previously assessed during the current National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEMWA) Scoping and Environmental Impact Reporting (S&EIR) application process for the decommissioning and remediation of the legacy landfills and contaminated areas on site. Specialist assessments that provide information on the receiving environment and that have been included within this BA application process, include:

- Biodiversity Assessment; and,
- Wetland Delineation and Functional Assessment.

The environment within the Hillside Aluminium smelter site has also been previously assessed. The Wetland Delineation and Functional Assessment conducted in 2015/16 provided valuable information on the receiving environment within the smelters footprint.

Terms of Reference (ToR) for each specialist study are included within the specialist reports themselves. Specialist reports are provided in Appendix D. *Note: Specialist studies were used to describe the receiving environment and assist with the impact assessment of the (old) alternative desalination plant location and associated infrastructure – i.e. the Manzamnyama abstraction point with the desalination plant located on the Bayside Aluminium smelter site. Additional specialist studies were not required for the (new) preferred alternative as the footprint for all project related activities are located within existing built up/ transformed areas.*

7.2 APPROACH TO ASCRIBING SIGNIFICANCE TO IMPACTS

The potential impacts of the proposed project will be assessed in terms of the following criteria, as specified in the NEMA EIA Regulations:

7.2.1 Nature of the impact

The nature of an impact refers to a description of the inherent features, characteristics and/or qualities of the impact. Thus, each impact will be comprehensively detailed and contextualised prior to being assessed.

7.2.2 Scale/extent of the impact

Extent refers to the impact footprint or stated differently the spatial area over which the impact would manifest. Note that if a species were to be lost then the extent would be global because that species would be lost to the world.

Table 16: Listing of descriptors for the extent of an impact together with definitions that serve to assist in selecting the appropriate rating.

Extent Descriptors	Definitions	Rating
Site	The impact footprint remains within the cadastral boundary of the site/ project boundary	1
Local	The impact footprint extends beyond the cadastral boundary of the site/ project boundary, to include the immediately adjacent and surrounding areas	2
Regional	The impact footprint includes the greater surrounding area within which the project is located	3
National	The scale/ extent of the impact is applicable to the Republic of South Africa	4
Global	The scale / extent of the impact is global (or world-wide)	5

7.2.3 Duration of the impact

Duration is the period of time for which the impact would be manifest. Importantly the concept of reversibility is reflected in the duration scoring. In other words, the longer the impact endures the less likely is the reversibility of the impact.

Table 17: Listing of descriptors for the duration of an impact together with definitions that serve to assist in selecting the appropriate rating.

Duration Descriptors	Definitions	Rating
Construction period only	The impact endures for only as long as the Construction period of the proposed activity. This implies the impact is fully reversible. Like noise and dust	1
Short term	The impact continues to manifest for a period of between 3 – 10 years. The impact is reversible.	2
Medium term	The impact continues to manifest for a period of 10-30 years. The impact is reversible with relevant and applicable mitigation and management actions.	3
Long term	The impact continues for a period in excess of 30 years. However, the impact is still reversible with relevant and applicable mitigation and management actions.	4
Permanent	The impact will continue indefinitely and is irreversible.	5

7.2.4 Intensity or severity of the impact

The concept of **intensity potential** is an important point of departure. This provides the acknowledgement at the outset of the potential significance of the impact. For example, emissions of SO_2 have the potential to result in adverse human health effects, which is obviously a significant potential impact, and that potential must be acknowledged in the significance ratings. The importance of this intensity potential cannot be overemphasised. If the impact is adverse health effects then even a limited extent and duration will still be significant. If the impact is loss of vegetation then the impact will only become significant if the extent is regional and the duration irreversible (for example). Thus, in the latter example the degree to which the impact may cause irreplaceable loss of a resource is taken into account.

The second important part of intensity potential is that it provides a measure for comparing significance across different specialist assessments. What this means is that specialists will have to select a potential intensity rating from the tables below that best describes the nature of the impacts identified by the specialist. Note that the EAP has defined the intensity/ severity descriptors together with their appropriate ratings, specialists are required to select the appropriate rating only when ascribing significance to various impacts. This will allow for effective comparison of significance across specialist assessments to allow for an integrated assessment of the project as a whole.

Table 18: Listing of descriptors for the intensity/ severity of an impact together with definitions that serve to assist in selecting the appropriate rating.

Descriptors: potential consequence (negative)	Rating	Score
Human health – morbidity/mortality. Loss of species	High	16
Reduced faunal/floral populations, loss of livelihoods, individual economic loss	Moderate-high	8
Reduction in environmental quality – air, soil, water. Loss of habitat, loss of heritage, amenity	Moderate	4
Nuisance	Moderate-low	2
Negative change – with no other consequences	Low	1
Descriptors: potential consequence (positive)	**Rating**	**Score**
Net improvement in human welfare	Moderate-high	8
Improved environmental quality – air, soil, water. Improved individual livelihoods	Moderate	4
Economic development	Moderate-low	2
Positive change – with no other consequences	Low	1

7.2.5 The probability (or likelihood) of the impact occurring

Likelihood is the likelihood of the impact intensity (consequence) manifesting so the 0.1, 0.2, 0.5, 0.75 and 1 serve to illustrate that if an impact is unlikely to manifest then its intensity/consequence score will be reduced and the resultant significance reduced. Although likelihood and probability may be considered interchangeable, the term likelihood is preferred as probability has a very specific mathematical and/ or statistical connotation. As such the expectation created by the term probability is that there will be an accurate empirically or mathematically defined expression of risk, which is not necessarily required.

Table 19: Listing of descriptors for the likelihood of the impact intensity/ severity manifesting together with definitions that serve to assist in selecting the appropriate rating.

Likelihood/ Probability Descriptors	Definitions	Rating
Improbable	The possibility of the impact occurring is negligible and only under exceptional circumstances.	0.1
Unlikely	The possibility of the impact occurring is low with a less than 20% chance of occurring. The impact has not occurred before.	0.2
Probable	The impact has a 20-50% chance of occurring. Only likely to happen once every three or more years.	0.5
Highly Probable	It is most likely that the impact will occur. A 51 – 75% chance of occurring.	0.75
Definite	More than 75% chance of occurrence. The impact occurs regularly.	1

7.2.6 Impact significance before mitigation

Environmental impacts identified will be evaluated according to the above-mentioned criteria. The significance of impacts will be derived through a synthesis of ratings of all criteria in the following calculation:

(Extent + Duration + Potential Intensity) x Probability/Likelihood = Significance before Mitigation

The significance of a potential impact on decision-making is indicated through significance points. Significance points indicate the following:

Table 20: Listing of descriptors for the significance score of an impact.

Descriptors	Definitions	Rating
None	The project can be authorised	< 3
Low	The project can be authorised with a low risk to of environmental degradation	3 - 4
Moderate	The project can be authorised but with conditions and routine inspections	5 – 8
High	The project can be authorised but with strict conditions and high levels of compliance and enforcement in respect of the impact in question	9 – 15
Fatally Flawed	The project cannot be authorised	> 15

7.2.7 Impact significance after mitigation

In order to reduce the significance of negative impacts and increase the significance of positive impacts, mitigation measures will be identified and discussed for each impact. The degree to which the impact can be mitigated (if negative) or enhanced (if positive) will be a function of whether the mitigation changes the intensity/ severity and/or the likelihood of the impact. Thus, once the mitigation measure/s have been described, a new significance rating will be determined by following the same steps detailed above, however taking the mitigation and controls into account.

7.2.8 Ascribing significance to cumulative impacts

Impacts cannot be assessed in isolation and an integrated approach requires that cumulative impacts will be included in the assessment of individual impacts. The nature of the impact will be described in such a way as to detail the potential cumulative impact of the activity, if there is indeed a cumulative impact. For example, dust and air emissions cannot be assessed in isolation of the potential cumulative impact of increased emissions into the atmosphere. Similarly, if water quality is improved within the immediate surroundings of the proposed activities, this will most certainly have a broader effect/ cumulative impact on the greater water quality in the area.

Once all the impacts have been assessed and significance ratings allocated, the EAP will assess the project on a holistic basis to determine the overall project impact on the receiving environment. This will be a function of the individual impacts as well as the cumulative nature of combining all those impacts within a single context/ project.

8 DETAILED ENVIRONMENTAL IMPACT ASSESSMENT

For the purposes of the BA, the term "assessment" refers to "the process of collecting, organising, analysing, interpreting and communicating data relevant to some decisions". The assessment of the data was, where possible, based on accepted methods (refer to Section 7 and specialist investigations in Appendix D). Impacts identified for the activities that will take place (Section 6 above) are assessed for the construction and operational phases of the proposed desalination plant and associated infrastructure (preferred alternative). The detailed impact assessment for the (old) project alternative is provided in Appendix G for comparative purposes.

8.1.1 Construction Phase

Potential Impacts on Soil Quality through spillages	
Nature of impact:	During the all activities to be undertaken during the construction phase soils on site may become contaminated through potential spillages or release of hazardous substances (most notably hydrocarbons).
Extent of impact:	The above potential impacts will be highly localised and generally small scale. In the event that they occur there will be an immediate intervention to contain and remediate the spill. As such the extent of the impacts is considered to be limited to the site only. Site (1)
Duration of impact & Degree to which the impact can be reversed:	The above potential impacts are all reversible and can be remediated in a short period of time. Even if some soil needs to be removed for disposal it will be small quantities only and will not affect the entire site. As such the duration of the construction phase impacts are deemed to be limited to the construction phase only. Construction Phase only (1) [reversible]
Potential intensity of impact & Degree to which the impact may cause irreplaceable loss of resource:	Spillages of hydrocarbons can result in significant reductions in soil quality and if not remediated, then potentially also reductions in surface water quality. Moderate (4) [irreplaceable loss = low]
Likelihood of the impact intensity manifesting:	The mitigation measures/ controls highlighted within the EMPr are all included in the project planning in order to reduce the risk of the impact occurring. In the event that there is a spill it is likely to be localised and relatively small scale. The existing environmental management philosophy will include regular (daily) inspections of the entire site so even if there are spills that are unreported, these would likely be identified in the inspection process. The likelihood that there will be material reductions in soil quality as a result of spills is therefore considered to have a 20-50% chance of occurring. Probable (0.5)
Significance rating of impact prior to mitigation:	*(Extent + Duration + Intensity) x Probability* (1+1+4) x 0,5 = 3 **Low**
Degree to which the impact can be mitigated:	Moderate – as mentioned above, the existing Safety, Health and Environment (SHE) policies and procedures on site for Hillside already effectively mitigate the impact of spillages on soil quality. A Hazardous Substances Mitigation and Management Plan has been included within the EMPr to reiterate the mitigation actions to reduce the likelihood of spillages occurring on site. The significance of the impact post mitigation remains "Low".

Potential Impacts on Surface Water Quality through spillages	
Nature of impact:	During the following construction phase activities: • Concrete works; and, • Mechanical and Electrical Installations. Surface water runoff on site may become contaminated through potential spillages or release of hazardous substances (such as hydrocarbons).
Extent of impact:	The above potential impacts will be highly localised and generally small scale. In the event that they occur there will be an immediate intervention to contain and remediate the spill. As such the extent of the impact is considered to be limited to the site only. Site (1)
Duration of impact & Degree to which the impact can be reversed:	The above potential impacts are all moderately reversible and can be remediated in a short period of time. As such the duration of the impact is deemed to be limited to the construction phase only. Construction Phase only (1) [moderately reversible]
Potential intensity of impact & Degree to which the impact may cause irreplaceable loss of resource:	Spillages of hydrocarbons can result in significant reductions in surface water quality. Moderate (4) [irreplaceable loss = low]
Likelihood of the impact intensity manifesting:	The mitigation measures/ controls highlighted within the EMPr are all included in the project planning in order to reduce the risk of the impact occurring. In the event that there is a spill it is likely to be localised and relatively small scale. The existing environmental management philosophy will include regular (daily) inspections of the entire site so even if there are spills that are unreported, these would likely be identified in the inspection process. The likelihood that there will be material reductions in surface water quality as a result of spills is therefore considered to have a 20-50% chance of occurring. Probable (0.5)
Significance rating of impact prior to mitigation:	*(Extent + Duration + Intensity) x Probability* (1+1+4) x 0,5 = 3 **Low**
Degree to which the impact can be mitigated:	Moderate – as mentioned above, the existing Safety, Health and Environment (SHE) policies and procedures on site for Hillside already effectively mitigate the impact of spillages on soil quality. A Hazardous Substances Mitigation and Management Plan has been included within the EMPr to reiterate the mitigation actions to reduce the likelihood of spillages occurring on site. The significance of the impact post mitigation remains "Low".
Cumulative Impact post mitigation:	Low

Potential Sedimentation Impacts on stormwater/ surface water quality	
Nature of impact:	During the following construction phase activities that will take place within the Hillside and Bayside Aluminium smelter site boundaries: • Excavations; and, • Backfilling, sedimentation of stormwater infrastructure may occur as a result of silt laden stormwater/ surface water runoff from active working areas on site.
Extent of impact:	The above potential impacts will be highly localised and generally small scale. In the event that they occur there will be an immediate intervention to prevent and remove

	sedimentation of existing stormwater infrastructure. As such the extent of the impact is considered to be limited to the site only. Site (1)
Duration of impact & Degree to which the impact can be reversed:	The above potential impact is reversible and can be remediated in a short period of time. As such the duration of the impacts is deemed to be limited to the construction phase only. Construction Phase only (1) [reversible]
Potential intensity of impact & Degree to which the impact may cause irreplaceable loss of resource:	Sedimentation can result in significant reductions in surface water quality affecting the hydrological regime of downstream water resources and/or biota depended on less turbid water conditions. Moderate (4) [irreplaceable loss = low]
Likelihood of the impact intensity manifesting:	Construction activities will produce dust and other fine materials that could easily wash into the stormwater system (after periods of heavy rain) and cause sedimentation of canals and sumps. Where excavations are required, erosion of unstabilised soils could also result in sedimentation if this sediment is allowed to enter the stormwater system. Thus, sedimentation impacts have a 51 – 75% chance of occurring on site. Highly Probable (0.75)
Significance rating of impact prior to mitigation:	*(Extent + Duration + Intensity) x Probability* (1+1+4) x 0,75 = 4,5 **Low**
Degree to which the impact can be mitigated:	High
Proposed mitigation:	• Temporary facilities should be installed at inlets to the existing stormwater system and regularly maintained to avoid sedimentation of downstream areas.
Extent of impact:	Mitigation does not alter the extent of the impact. Site (1)
Duration of impact & Degree to which the impact can be reversed:	Mitigation does not alter the duration or reversibility of the impact occurring. Construction Phase (1) [reversible]
Potential intensity of impact & Degree to which the impact may cause irreplaceable loss of resource:	The above controls will be included within the project planning to reduce the risk of the impact occurring. In addition, the stormwater system and water management plan on site (Bayside) already includes measures to limit sedimentation of stormwater infrastructure. Thus, the potential intensity of sedimentation on downstream water resources is reduced to a nuisance value as volumes of sediment required to effect a meaningful change in water quality will not be allowed to exit the site area. Moderate-Low (2) [irreplaceable loss = low]
Likelihood of the impact intensity manifesting:	The implementation of additional measures to reduce sedimentation impacts off site, reduces the likelihood of the potential intensity occurring, thus there is only a 20 - 50% chance of the impact occurring post mitigation. Probable (0.5)
Significance rating of impact post mitigation:	*(Extent + Duration + Intensity) x Probability* (1+1+2) x 0.5 = 2 **None**
Cumulative impact post mitigation:	Low

Potential Atmospheric Emission Impacts (Dust)	
Nature of impact:	During the following construction phase activities: • Excavations; and, • Backfilling; dust would largely be generated due to the: • Handling of materials; and, • The movement of vehicles on site, travelling along both paved and unpaved roads. Increased dust levels will negatively impact on the ambient air quality of the area and may negatively impact on sensitive receptors.
Extent of impact:	The above potential impact will be local in extent and negative impacts on sensitive receptors are therefore not envisaged due to the activities being small scale and limited in their footprint to short linear trenches and/or sections of roads. Local (2)
Duration of impact & Degree to which the impact can be reversed:	The above potential impact is reversible as dust will settle out of the atmosphere over time or be washed out by rain. Mechanically generated dust is normally relatively coarse and so it settles out relatively quickly because it is heavier than fine material. Dust generation is limited to the construction phase as a result of excavations and vehicle movement activities on site. Construction Phase only (1) [reversible]
Potential intensity of impact & Degree to which the impact may cause irreplaceable loss of resource:	The potential intensity of air quality impacts on receptors is rated merely as a nuisance factor. Such impacts will neither create permanent degradation to the air quality in the area due to the temporary nature of dust emissions, nor go unnoticed. Moderate-Low (2) [irreplaceable loss = low]
Likelihood of the impact intensity manifesting:	The likelihood of air quality impacts occurring is probable as a result of the proximity of these receptors to the site. This rating is also dependant on the dominant wind direction during the construction phase and whether emissions will be transported directly towards these receptors. Probable (0,5)
Significance rating of impact prior to mitigation:	*(Extent + Duration + Intensity) x Probability* (2+1+2) x 0,5 = 2,5 **None**
Degree to which the impact can be mitigated:	High – however it does not change the significance of the impact. Significance remains "None".
Proposed mitigation:	• Restricting the speed at which vehicles travel on the roads onsite to 20km/h. • All vehicles transporting material (loads including but not limited to sand, stone chip, fine vegetation and cement) that can be blown off (e.g. soil, rubble, etc.) must be covered with a tarpaulin. • Road surfaces should be treated with a commercial dust binder, as required, to form a cohesive layer that will control the dust on the access/ service roads on site. • Erection of windbreaks alongside exposed areas will limit the amount of dust that is entrained when winds blow across the surface. • Refer to the EMPr in Appendix F for additional mitigation measures.
Cumulative impact post mitigation:	Low

Potential Atmospheric Emission Impacts (Vehicle Emissions)	
Nature of impact:	During the construction phase, materials will be transported to various laydown areas and work faces and as such vehicle emissions will negatively impact on the ambient air quality of the area and may negatively impact on sensitive receptors.
Extent of impact:	The above potential impact will be local in extent and negative impacts on the sensitive receptors are therefore not envisaged due to the activities being small scale and limited in terms of the number of vehicles or equipment that produce exhaust fumes/ emissions. Local (2)
Duration of impact & Degree to which the impact can be reversed:	The above potential impact is irreversible as once vehicle emissions have been generated they cannot be controlled or "removed" from the atmosphere. Vehicle emissions is limited to the construction phase as a result of equipment and vehicles used on site. Construction Phase only (1) [irreversible]
Potential intensity of impact & Degree to which the impact may cause irreplaceable loss of resource:	The potential intensity of air quality impacts on receptors is rated merely as a nuisance factor. Such impacts will neither create permanent degradation to the air quality in the area due to the temporary nature of dust emissions, nor go unnoticed. Moderate-Low (2) [irreplaceable loss = low]
Likelihood of the impact intensity manifesting:	The likelihood of air quality impacts occurring is probable as a result of the proximity of these receptors to the site. This rating is also dependant on the dominant wind direction during the construction phase and whether emissions will be transported directly towards these receptors. Probable (0,5)
Significance rating of impact prior to mitigation:	*(Extent + Duration + Intensity) x Probability* (2+1+2) x 0,5 = 2,5 **None**
Degree to which the impact can be mitigated:	High – however it does not change the significance of the impact. Significance remains "None".
Proposed mitigation:	Refer to the EMPr in Appendix F for standard mitigation measures.
Cumulative impact post mitigation:	Low

Potential Noise Impacts	
Nature of impact:	During the following construction phase activities: • Grass and brush cutting; • Excavations; • Pipe laying; • Backfilling; and, • Concrete works; noise will be generated due to the: • Handling of materials; and, • The movement of vehicles on site, travelling along both paved and unpaved roads. Increased noise levels will negatively impact on the ambient noise environment of the area and may negatively impact on sensitive receptors (i.e. on-site workers and adjacent landowners or occupiers of land).
Extent of impact:	The above potential impact will be local in extent and negative impacts on the sensitive receptor are therefore not envisaged due to the activities being small scale and limited in

	footprint. Since construction activities will predominantly only to occur during the day, such a small increase in noise is likely to go unnoticed during the noisier daytime hours. Local (2)
Duration of impact & Degree to which the impact can be reversed:	The above potential impact is reversible as once the noise source ceases, noise ceases. Noise generation is limited to the construction phase as a result of construction activities on site. Construction Phase only (1) [reversible]
Potential intensity of impact & Degree to which the impact may cause irreplaceable loss of resource:	The potential intensity of environmental acoustic impacts on receptors is negligible. Such impacts will not create permanent degradation to the ambient noise climate in the area due to the temporary nature of the construction phase. However, the potential intensity of environmental acoustic impacts for on-site workers may be a nuisance factor. Construction related noise will be inevitable for on-site workers and even with the implementation of ear protection equipment, will still provide a nuisance factor. Moderate – Low (2) [irreplaceable loss = low]
Likelihood of the impact intensity manifesting:	The probability of environmental acoustic impacts occurring on receptors is probable as a result of the proximity of these receptors to the site. However, very low noise levels are predicted. The probability of environmental acoustic impacts for on-site workers will be definite as these workers will be on site in close proximity to construction equipment. Definite (1)
Significance rating of impact prior to mitigation:	*(Extent + Duration + Intensity) x Probability* (2+1+2) x 1 = 5 **Moderate**
Degree to which the impact can be mitigated:	High
Proposed mitigation:	• Installation of mufflers on exhausts of all vehicles. • The use of ear protection equipment for personnel working onsite in close proximity to excessive noise sources. • Refer to the EMPr in Appendix F for additional mitigation measures.
Extent of impact:	Mitigation does not alter the extent of the impact. Local (2)
Duration of impact & Degree to which the impact can be reversed:	Mitigation does not alter the duration or reversibility of the impact occurring. Construction Phase (1) [reversible]
Potential intensity of impact & Degree to which the impact may cause irreplaceable loss of resource:	Mitigation does not alter the potential intensity of the impact. Moderate – Low (2) [irreplaceable loss = low]
Likelihood of the impact intensity manifesting:	No specific mitigation recommendations are provided for noise impacts on surrounding receptors due to the low noise levels predicted. With the implementation of mitigation in the form of ear protection equipment, the likelihood of the potential intensity manifesting as a nuisance will decrease to probable, as perceived noise will decrease but will still be audible at times. Probable (0.5)
Significance rating of impact post mitigation:	*(Extent + Duration + Intensity) x Probability* (2+1+2) x 0.5 = 3,5 **Low**

Cumulative impact post mitigation:	Low

8.1.2 Operational Phase:

Potential impacts on marine ecology – Discharge of effluent via the Mhlathuze Sea Outfall Pipeline	
Nature of impact:	The impacts associated with effluent from desalination plants can include altered salinity, temperature, dissolved oxygen and the contamination of the environment by residual biocide, heavy metals and any co-discharges (cleaning in process chemicals, backwash sludge). Salinity changes may affect aquatic organisms either by direct toxicity through physiological changes (particularly osmoregulation), or indirectly by modifying their distribution. Salinity changes can also cause stratification of the water column and changes in water chemistry (e.g. dissolved oxygen saturation and turbidity). The daily brine discharge from the Hillside desalination plant of 4.5 ML will be substantially diluted with approximately 80 ML of effluent and 40 ML of sea water before discharge via the Mhlathuze Water sea outfall some 4.7 km offshore. The resultant salinity of the effluent will be substantially less than sea water and will remain buoyant. Changes in water temperature can have a substantial impact on marine species and ecosystems, with the effects either influencing the physiology of the biota (e.g. growth and metabolism, reproduction timing and success, mobility and migration patterns, and production); and/or influencing ecosystem functioning (e.g. through altered oxygen solubility). It is anticipated that there will be a maximum increase of 1°C above the ambient surface sea water in the brine discharge from the desalination plant. The plant effluent will also be diluted in a much greater volume of existing effluent and sea water prior to discharge and will only constitute about 4% by volume of the total effluent discharged via the Mhlathuze Sea outfall. The solubility of oxygen in seawater is dependent on salinity and temperature, whereby temperature is the more significant factor. Increases in temperature and/or salinity result in a decline of dissolved oxygen levels. A critical factor that needs to be observed is that oxygen depletion in the brine might also occur through the addition of sodium metabisulphite. This will be added to neutralise residual chlorine in the intake water should it be used as a biocide to prevent biofouling of infrastructure. The feedwater for the Hillside desalination plant will be extracted from the harbour and may thus contain microorganisms that may cause biofouling of the RO membranes. The feedwater will have to be dosed with a biocide to remove the microorganisms and ensure the longevity of the plant. Biocides are toxic to marine organisms and depending on the levels within the wastewater, may result in negative impacts at the discharge point out at sea. The biocide proposed at for use within the desalination plant and associated infrastructure has a half-life of about nine hours at neutral pH. Continuous biocide release maintains concentrations effective for control, while the biocide in the discharge wastewater degrades quickly. Sludge, as a result of anticoagulants, discharged directly into marine waters may lead to increases in turbidity and suspended matter. Impacts such as reduced primary production or burial of sessile organisms by increased turbidity in the discharge may thus occur. Due to low rates of degradability, dispersal and relatively long residence times of antiscalants the impact of limiting the availability of biologically essential trace metal ions cannot be ignored.

	Corrosion of the desalination plant's interior surfaces can lead to heavy metals passing into solution and being discharged with the brine. Heavy metals tend to enrich in suspended material and finally in sediments, so that areas of restricted water exchange and soft bottom habitats impacted by the discharge could be affected by heavy metal accumulation. Cleaning in process chemicals are mainly weak acids and detergents. Alkaline cleaning solutions (pH 11-12) are used for the removal of silt deposits and biofilms, whereas acidified solutions (pH 2-3) are used to remove metal oxides and scales. Other chemicals that may be added to improve cleaning efficiency are detergents, oxidants, complexing agents or biocides for membrane disinfection. Neutralization of the extremely alkaline or acidic solutions and treatment of additional cleaning agents is recommended before discharge to the ocean to remove any potential toxicity.
Extent of impact:	The above potential impacts will be highly localised and limited to the point of discharge of the Mhlathuze Sea Outfall pipeline, some 5km into the ocean. Site (1)
Duration of impact & Degree to which the impact can be reversed:	The above potential impact is reversible and will continue for a period in excess of 30 years. Long-Term (4) [reversible]
Potential intensity of impact & Degree to which the impact may cause irreplaceable loss of resource:	The potential intensity of the above mentioned impacts can range from Moderate-High to Moderate, thus a cumulative rating of Moderate-High has been adopted to reflect the realistic worst case scenario. Moderate-High (8) [irreplaceable loss = low]
Likelihood of the impact intensity manifesting:	The likelihood of the worst case potential intensity manifesting is regarded as probable without mitigation. Probable (0,5)
Significance rating of impact prior to mitigation:	*(Extent + Duration + Intensity) x Probability* (1+4+8) x 0,5 = 6,5 **Moderate**
Degree to which the impact can be mitigated:	High
Proposed mitigation:	• Mhlathuze Water (who owns and manages the Sea Outfall Pipeline) must continue to dilute the effluent with sea water prior to its discharge out at sea; • Adjust dosing levels and regimes to avoid significant environmental impacts; • Should Chlorine and Sodium metabisulphates be used, aerate effluent prior to discharge to the Sea Outfall Pipeline (note that a separate aeration process is not required, as the effluent will have passed through numerous processes and process tanks before reaching the discharge point / location, thus having adequate exposure to air); • Use metals in the desalination plant and associated infrastructure that have high resistances to corrosion by sea water; and, • Neutralise strongly acidic or alkaline wastewater prior to discharge into the Sea Outfall pipeline.
Extent of impact:	Mitigation does not alter the extent of the impact. Site (1)
Duration of impact & Degree to which the impact can be reversed:	Mitigation does not alter the duration or reversibility of the impact occurring. Long-Term (4) [reversible]

Potential intensity of impact & Degree to which the impact may cause irreplaceable loss of resource:	Mitigation does not alter the potential intensity of the impacts. Moderate-High (8) [irreplaceable loss = low]
Likelihood of the impact intensity manifesting:	The implementation of measures to reduce the abovementioned impacts, reduces the likelihood of the potential intensity occurring, thus there is less than a 20% chance of the impact intensity manifesting post mitigation. Unlikely (0,2)
Significance rating of impact post mitigation:	*(Extent + Duration + Intensity) x Probability* (1+4+8) x 0.2 = 2,6 **None**
Cumulative impact post mitigation:	Low

8.1.3 Cumulative Impacts

Potential impacts on marine ecology – Changes in the density and toxicity of the effluent discharged via the Mhlathuze Sea Outfall Pipeline	
Nature of impact:	The Mhlathuze Water sea outfall currently discharges effluent from a number of diverse sources. The volume, concentration and nature of different elements in this effluent is not precisely known, but the toxicity and potential environmental impacts of the whole effluent on the receiving offshore habitat are monitored regularly. The addition of brine and other co-discharges from the Hillside desalination plant will alter the density (and hence the plume behaviour) and potentially the environmental toxicity of the effluent.
Extent of impact:	The above potential impacts will be highly localised and limited to the point of discharge of the Mhlathuze Sea Outfall pipeline, some 5km into the ocean. Site (1)
Duration of impact & Degree to which the impact can be reversed:	The above potential impact is reversible and will continue for a period in excess of 30 years. Long-Term (4) [reversible]
Potential intensity of impact & Degree to which the impact may cause irreplaceable loss of resource:	The potential intensity of the above mentioned impacts can range from Moderate-High to Moderate, thus a cumulative rating of Moderate-High has been adopted to reflect the realistic worst case scenario. Moderate-High (8) [irreplaceable loss = low]
Likelihood of the impact intensity manifesting:	The likelihood of the worst case potential intensity manifesting is regarded as probable without mitigation. Probable (0,5)
Significance rating of impact prior to mitigation:	*(Extent + Duration + Intensity) x Probability* (1+4+8) x 0,5 = 6,5 **Moderate**
Degree to which the impact can be mitigated:	High
Proposed mitigation:	• Mhlathuze Water (who owns and manages the Sea Outfall Pipeline) must continue to dilute the effluent with sea water prior to its discharge out at sea; • Adjust dosing levels and regimes to avoid significant environmental impacts;

	• Should Chlorine and Sodium metabisulphates be used, aerate effluent prior to discharge to the Sea Outfall Pipeline (note that a separate aeration process is not required, as the effluent will have passed through numerous processes and process tanks before reaching the discharge point / location, thus having adequate exposure to air); • Use metals in the desalination plant and associated infrastructure that have high resistances to corrosion by sea water; and, • Neutralise strongly acidic or alkaline wastewater prior to discharge into the Sea Outfall pipeline.
Extent of impact:	Mitigation does not alter the extent of the impact. Site (1)
Duration of impact & Degree to which the impact can be reversed:	Mitigation does not alter the duration or reversibility of the impact occurring. Long-Term (4) [reversible]
Potential intensity of impact & Degree to which the impact may cause irreplaceable loss of resource:	Mitigation does not alter the potential intensity of the impacts. Moderate-High (8) [irreplaceable loss = low]
Likelihood of the impact intensity manifesting:	The implementation of measures to reduce the abovementioned impacts, reduces the likelihood of the potential intensity occurring, thus there is less than a 20% chance of the impact intensity manifesting post mitigation. Unlikely (0,2)
Significance rating of impact post mitigation:	*(Extent + Duration + Intensity) x Probability* (1+4+8) x 0.2 = 2,6 **None**
Cumulative impact post mitigation:	Low

Reduced Water Consumption (Positive Impact)	
Nature of impact:	The desalination of seawater from the harbour will lead to a reduction in the consumption of potable water by the Hillside Aluminium smelter (estimated 2ML) provided by the City of uMhlathuze Local Municipality.
Extent of impact:	There will be a benefit from reduced pressure on water supply. The benefits of a reduction in water consumption, and thus a subsequent increase in water availability and supply, will be felt within the greater municipal area. Regional (4)
Duration of impact & Degree to which the impact can be reversed:	The reduced pressure on these services is seen to be a temporary (thus reversible) solution in that it will only be relied on during emergency/ drought conditions when the Local Municipality is struggling to meet the demand of other water users. The desalination plant will, however, be operational for a period in excess of 30 years. Long term (4) [reversible]
Potential intensity of impact & Degree to which the impact may cause irreplaceable loss of resource:	Spare capacity in terms of water will allow for the continuation of existing economic activities within the region and may even promote limited economic growth. The spare capacity may also alleviate the water restrictions currently experienced and/or delay the increase in intensity of these water restrictions. Positive Moderate – Low (2) [irreplaceable loss = low]

Likelihood of the impact intensity manifesting:	The desalination of seawater will see a reduction in potable water consumption, where water is sourced from freshwater resources, at the Hillside Aluminium smelter. Definite (1)
Significance rating of impact prior to mitigation:	*(Extent + Duration + Intensity) x Probability* (4+4+2) x 1 = 10 **High Positive**
Degree to which the impact can be mitigated:	Low
Proposed mitigation:	N/A
Cumulative impact post mitigation:	High

9 CONCLUSIONS AND RECOMMENDATIONS

9.1 ENVIRONMENTAL IMPACT STATEMENT

The impact assessment conducted in Section 8 of this report is summarised in the table below.

Table 21: Summary of the detailed impact assessment conducted for the proposed Hillside desalination plant

Assessed Impacts	Significance Rating prior Mitigation	Significance Rating post Mitigation	Proposed Mitigation
Construction Phase			
Soil quality through spillages	Low	Low	Compliance with the Hazardous Substances MMP included in the EMPr.
Surface water quality through spillages	Low	Low	
Sedimentation – Stormwater & surface water quality	Low	None	Temporary facilities should be installed at inlets to the existing stormwater system and regularly maintained to avoid sedimentation of downstream users.
Atmospheric emissions: Dust	None	None	• Restricting the speed at which vehicles travel on the roads onsite to 20km/h. • All vehicles transporting material (loads including but not limited to sand, stone chip, fine vegetation and cement) that can be blown off (e.g. soil, rubble, etc.) must be covered with a tarpaulin. • Road surfaces should be treated with a commercial dust binder, as required, to form a cohesive layer that will control the dust on the access/ service roads on site. • Erection of windbreaks alongside exposed areas will limit the amount of dust that is entrained. • Refer to the EMPr in Appendix F for additional mitigation measures.
Atmospheric emissions: Vehicle emissions	None	None	Refer to the EMPr for standard mitigation measures.
Noise	Moderate	Low	• Installation of mufflers on exhausts of all vehicles. • The use of ear protection equipment for personnel working onsite in close proximity to excessive noise sources. • Refer to the EMPr in Appendix F for additional mitigation measures.
Operational Phase			
Marine Ecology: Discharge of effluent	Moderate	None	• Mhlathuze Water (who owns and manages the Sea Outfall Pipeline) must continue to dilute the effluent with sea water prior to its discharge out at sea. • Adjust dosing levels and regimes to avoid significant environmental impacts. • Should Chlorine and Sodium metabisulphates be used, aerate effluent prior to discharge to the Sea Outfall Pipeline (note that a separate aeration process is not required, as the effluent will have passed through numerous processes and process tanks before reaching the discharge point, thus having adequate exposure to air). • Use metals in the desalination plant & associated infrastructure that have high resistances to corrosion by sea water.

			• Neutralise strongly acidic or alkaline wastewater prior to discharge into the Sea Outfall pipeline.
Cumulative Impacts			
Changes in effluent density & toxicity	Moderate	None	Same as for Operational Phase: Estuarine Ecology: Discharge of effluent.
Reduced water consumption	High (Positive)	High (Positive)	N/A

The proposed Hillside desalination plant is the most sustainable solution to the current water crisis experienced within the greater KZN province. The relatively small desalination plant can also be efficiently and quickly erected and installed as compared to other water supply alternatives investigated. Due to the already disturbed and highly transformed nature of the proposed pipeline routes and Hillside Aluminium smelter site, the impacts associated with the construction phase can be effectively mitigated through the implementation of measures contained within this report and the attached EMPr. The operational impacts associated with the desalination plant are insignificant. The discharge of effluent via the Mhalthuze Sea Outfall Pipeline is managed by Mhalthuze Water in accordance with signed agreements with parties discharging wastewater into their pipeline.

From a cumulative impact perspective, the proposed desalination plant will have a notable impact on the reduction of potable water consumption during emergency situations when the necessary plant water cannot be provided by the City of Mhlathuze LM. Reducing the potable water consumption of the Hillside Aluminium smelter during emergency situations has high positive impacts on the local and regional community in that the already scarce and rapidly declining water resource can be more effectively and efficiently distributed to those users who are most in need. In addition, and not assessed (as detailed in the Need and Desirability section of this report) is the high positive socio-economic impact of the continued operation of the Hillside smelter extending far beyond local impacts to national and perhaps international impacts.

The no-development option is untenable, as this would imply that the smelter would simply run out of water for continued operations should the current drought conditions persist, thus resulting in the shutting down of the plant. In addition, the NWA compels the investigation and use of alternative water supplies that do not impact on already stressed, finite freshwater resources. In this particular case the no-go alternative poses the greatest potential threat to the socio-economic environment and in the very long term increased pressure on and threat to existing freshwater resources.

Thus, the overall impact of the proposed desalination plant is envisaged to have a very low negative impact on the natural environment, with a high positive impact on the socio-economic environment at the local, provincial and national level. No fatal flaws to the development of the desalination plant at the Hillside Aluminium site have been identified and as such the EAP recommends that a positive Environmental Authorisation (EA) be issued to the Applicant.

9.2 PROPOSED CONDITIONS FOR AUTHORISATION

The EAP proposes that the following conditions of authorisation be include within the positive EA issued by the KZN DEDTEA:

- All recommendations and mitigation measures as outlined within the Final Basic Assessment Report and Draft Environmental Management Programme (EMPr) must be implemented.
- An independent Environmental Control Officer (ECO) must be appointed by the Applicant and audit compliance with the approved EMPr on a monthly basis. All audit reports must be submitted to the Department, by the Applicant, within 30 days of the ECO finalising the audit report.