Scoping and Environmental Impact Report (S&EIR)

Proposed Nseleni Independent Floating Power Plant (NIFPP) and associated infrastructure for the evacuation of power from the NIFPP to the National Grid, Port of Richards Bay, KwaZulu-Natal.

AND

Proposed Liquid Natural Gas (LNG) receiving and storage facility and associated physical infrastructure to support the Nseleni Independent Floating Power Plant, Port of Richards Bay, KwaZulu-Natal.

DRAFT ENVIRONMENTAL IMPACT REPORT

Prepared by:

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Applicants:

Nseleni Power Corporation (Pty) Ltd

AND

Anchor Energy LNG (Pty) Ltd

Competent Authority:

Department of Forestry, Fisheries and the Environment (DFFE)

Nseleni Power Corporation (Pty) Ltd: 14/12/16/3/3/2/2032

Anchor Energy LNG (Pty) Ltd: 14/12/16/3/3/2/2033

DATE: April 2021

SE Solutions Ref: NIFPP SEIR

Report Rev No: 03

PURPOSE OF THE DOCUMENT

The main aim of the **Environmental Impact Assessment (EIA) Phase** of a Scoping and Environmental Impact Reporting (S&EIR) 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, as amended, is to, through a consultative process:

- Present the findings of any specialist investigations and associated impact assessment and proposed measures to avoid, manage or mitigate impacts;
- Assess and rank, through an appropriate method of impact assessment, the potential negative and positive environmental impacts of the proposed activity;
- During the assessment of potential impacts, to determine the nature, extent, duration, consequence, significance, reversibility, likelihood of occurring, and degree of irreplaceable loss of resources; in order to inform the preferred alternative/s identified during the Scoping Phase;
- Identify suitable measures to avoid, manage or mitigate impacts;
- Identify residual risks that need to be managed and monitored; and,
- Present the consultation process to be undertaken as it pertains to Interested and Affected Parties (I&APs) (i.e. public participation process) as well as the Competent Authority.

The purpose of this **Draft Environmental Impact Report (Draft EIR)** is to give all registered I&APs and relevant State Departments the opportunity to review and comment on the findings of the S&EIR application process. All I&APs and State Departments have received notification of the availability of this report for review and comment. The **30 calendar day commenting period commences on 16 April and closes on 18 May 2021**. The Draft EIR is available on the SE Solutions (www.sesolutions.co.za) website. The Report can be accessed via the **'Reports' tab and is entitled '*NIFPP DEIR"***.

All I&APs are also invited to attend online (via Microsoft Teams) stakeholder meetings, to be hosted within the 30 day commenting period, at which the content of this Draft EIR will be presented. All comments on this Draft EIR are to be submitted to the following person on or before **18 May 2021.**

SE Solutions EAP: Vici Napier
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Tel No: 078 278 2898; Fax No: 086 664 6885; Email: vici@sesolutions.co.za

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 Draft EIR will be addressed within a **Comment and Response Report (CRR)** and included with the Final EIR to be submitted to the Competent Authority, in this case, the Department of Environment, Forestry & Fisheries (DFFE) for consideration towards Environmental Authorisation (EA). All registered I&APs will be notified of the submission of the Final EIR. Once the DFFE has issued an EA, all registered I&APs will be notified of the decision and Appeal provisions.

<table>
<tr><th colspan="2">DETAILS OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONER (EAP)</th></tr>
<tr><td>COMPANY NAME</td><td>Sustainable Environmental Solutions (Pty) Ltd – trading as SE Solutions</td></tr>
<tr><td>BRIEF COMPANY PROFILE</td><td>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 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). The company continues to work in Eastern Europe on large scale environmental assessment projects to satisfy international lender requirements.</td></tr>
<tr><td>EAP's RESPONSIBLE FOR THIS REPORT & THEIR EXPERTISE</td><td>Sean O'Beirne:

<u>Highest Qualification:</u> Master's in Radar rainfall measurement - Wits University, South Africa.
<u>Years' Experience as an EAP:</u> 27 years
<u>Summary of expertise (refer to detailed Curriculum Vitae in Appendix 1):</u>
• Certified Environmental Assessment Practitioner in South Africa
• Experienced in the design and implementation of Environmental Management Systems for ISO 14001 Certification and post EIA Environmental Management Programmes
• Experienced in Equator Principles and International Lender Requirements
• Experienced in managing large multi-disciplinary project teams for various types of environmental assessments
• Undertaken numerous environmental assessments both locally, elsewhere in Africa and in eastern Europe.
• Experienced in training and skills transfer within the Environmental Management field

Vici Napier:

<u>Highest Qualification:</u> Master's in Conservation Biology - University of Cape Town, South Africa.
<u>Years' Experience as an EAP:</u> 16 years
<u>Summary of expertise (refer to detailed Curriculum Vitae in Appendix 1):</u>
• 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 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</td></tr>
</table>

EXECUTIVE SUMMARY

Nseleni Power Corporation (Pty) Ltd (Ref No. 14/12/16/3/3/2/2032), as an Independent Power Producer, is proposing to establish a floating gas-powered power station made up of floating Combined Cycle Gas Turbine (CCGT) power plants (known as the Nseleni Independent Floating Power Plant (NFIPP)) and associated infrastructure for the evacuation of power from the NIFPP to the National Grid, in the Port of Richards Bay. The project is being proposed within the context of continued power shortages in South Africa which has seen the country's reserve margin under severe pressure and continued load shedding as a result of constrained generation potential. Richards Bay offers a deep-water harbor and relatively easy access to high voltage power transmission infrastructure that can be used to transmit the power to where it is needed as a function of the transmission grid.

It is planned to initially ship in four (4) Floating Power Barges generating a nominal 700 MW per barge resulting in 2 800 MW generation capacity. Thereafter, additional barges would be shipped in to take the combined power generation potential to as much as 8 400 MW. The power plants themselves would be CCGT providing high generation efficiencies. The gas turbines have low NOx burners and selective catalytic reduction (SCR) to control NOx emissions and three stage filtration to remove respirable Particulate Matter (PM). At the same time LNG is a clean burning fuel with relatively low PM loads. Power would be evacuated to a newly constructed land-based substation and switching yard and from there into the National Grid and/or to third party end users.

Anchor Energy LNG (Pty) Ltd (Ref No. 14/12/16/3/3/2/2033) will construct all physical infrastructure within the Port of Richards Bay associated with the receiving and storage of gas, delivered to the NIFPP as Liquid Natural Gas (LNG) and likely sourced from Angola, as well as associated infrastructure to support the NIFPP. The physical infrastructure would consist of a series of jetties with concrete platforms on marine piles and would be made up of offloading berths, LNG Floating Storage Units (FSUs), LNG storage tanks, regasification facilities and a series of berths for the NIFPP. Some dredging would be required to create sufficient draft for the LNG supply vessels and the NIFPP floating power barges.

Some 220 000 tonne of LNG would need to be delivered monthly to the NIFPP and would be offloaded from supply vessels into FSUs connected to the LNG terminal. LNG must be regasified (converted from a liquid to a gas) before it can be combusted and it is planned to optimize the heat balance using waste heat from the NIFPP CCGT power plants for the regasification. Safety is paramount and there would be multiple features to ensure the safe transfer, regasification storage and ultimately combustion of the LNG. All the facilities would be protected from fire using CO_2 as an extinguisher, automatic cutoff valves should a transfer line fail and multiple sensors to provide early indications of fire risk.

The project (as a whole) would invoke a range of listed activities from Listing Notices 1, 2 and 3 of the Environmental Impact Assessment (EIA) Regulations requiring a Scoping and Environmental Impact Reporting (S&EIR) application process for Environmental Authorisation (EA). As there are two entities responsibility for different project components (as described above), two separate EIA Applications have been submitted in order to obtain separate EAs, however a single S&EIR application process is being conducted. In addition, the following additional EAs are applicable:

- **Nseleni Power Corporation (Pty) Ltd (Ref No. 14/12/16/3/3/2/2032)**
  - Atmospheric Emissions License (AEL) in terms of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004).
- **Anchor Energy LNG (Pty) Ltd (Ref No. 14/12/16/3/3/2/2033)**
  - Water Use License (WUL) in terms of the National Water Act, 1996 (Act No. 36 of 1996); and,
  - Dumping at Sea Permit in terms of the National Environmental Management: Integrated Coastal Management Act, 2008 (Act No. 24 of 2008).

The project would also need to comply with a range of other national, provincial and municipal legislation as well as development polices, plans and programmes including the District Municipality (King Cetshwayo) and Local Municipality

(City of uMhlathuze) Integrated Development Plans (IDPs) and the Environmental Management Framework (EMF) for the Richards Bay Port Expansion and Industrial Development Zone, and others. Country commitments through various international convention ratifications would also apply. Finally, but importantly the project would also need to comply with lender requirements, namely the Equator Principles and the International Finance Corporation (IFC) Performance Standards on which the Equator Principles are based.

Receiving environment

Key elements of the receiving environment include the predominant northeasterly-southwesterly wind directions, threatened ecosystems, and the uMhlathuze/Richards Bay Estuary which is ranked one of the ten most conservation important estuaries in South Africa. There are multiple mangrove clusters, large sub- and inter- tidal areas to the south of the sand spit (the Kabeljou Flats) including mudflats that extend up into the Bhizolo and Manzamnyama Canals and multiple wetlands. Ground and surface water forms key elements of the local ecology. Air quality is categorized as 'poor'. The area experiences many of the socio-economic development challenges faced across the Country with above national average unemployment rates. The City of uMhlathuze is an industrial city, but has seen poor growth in the manufacturing sector which has limited overall economic growth. Water supply has been problematic over the last several years in the region and must be viewed as a severe constrain to development. The overall environmental sensitivity of the study area within which the proposed NIFPP and associated infrastructure is located can be described as highly sensitive (Figure 121) predominantly due to the Kabeljous Flats (and associated sandspit) and protected Mangrove forests (very high ecological sensitivity) as well as natural seral forest patches and wetlands, landside of the study area.

Public participation

As required by the EIA Regulations and good practice requirements, public participation (PP) is a key component of the S&EIR process. The PP process included identification of interested and affected parties from existing databases, advertising of the application processes and an invitation to participate, disclosure of important project information and the opportunity to comment on the proposed project. Direct public engagement will occur, within the limits of current COVID-19 restrictions. All comments received and responses issued on this draft report would be captured in the Comment and Response Report (CRR) attached to the Final Environmental Impact Report.

Alternatives

Construction and operations of the proposed NIFPP will result in a variety of impacts with varying degrees of significance. Multiple alternatives have been investigated to find ways in which potential impacts could be prevented or reduced. In the first instance, different site locations in the Port were investigated, but the scale of the project and restrictions for Port activities (such as safety zones and vessel traffic) means that the only area where the NIFPP can be sited is to the north of the Sandspit with the LNG terminal on the eastern side of the spit. Initially, it was intended to establish the substation just outside of the north-western corner of Bayside. Both that site and the routing of the power evacuation line to reach that site presented significant terrestrial biodiversity and wetland risks requiring very careful alignment to avoid such areas. Fortunately, the option of establishing the substation on the Bayside Aluminium site (currently in the process of being decommissioned) became available meaning that such impacts were effectively prevented. The power evacuation route is much more direct and straight forward now. At the request of the estuarine specialists the option of routing the power evacuation line north of the sandspit was also investigated but that option requires routing through TNPA property that is earmarked for development and where the power evacuation route is unlikely to be approved by TNPA.

The proposed routing of the power evacuation pipe and cabling bridge is now south of the sandspit, crossing the Kabeljous Flats on a series of marine piles before crossing the mangroves on a catenary bridge structure capable of spanning the entire mangrove extent without the need for direct physical impacts on the mangroves. The power evacuation alignment has also been changed to minimise impacts on the sandpit, avoid identified bird roosting areas and to minimise the number of piles that would impact on the substrate during construction and also effect hydrodynamic processes once built, and associated sedimentation processes with possible effects on biota. Other alternatives, including the use of marine cables and traditional overhead powerlines, locations of possible contractor laydown areas, and so forth were also investigated. The net outcome of the alternatives assessment has been to refine and improve the overall layout and design of the proposed NIFPP and associated infrastructure from an environmental point of view compared to the earlier design, but it should be noted that there has been no fundamental repositioning of the power barge and LNG terminals.

Predicted impacts

Air quality

Atmospheric emissions of criteria pollutants from the proposed NIFPP were defined and modelled for both construction and operations. Dust is the principal emission during construction but the areas that could result in such sources are limited. Conventional dust suppression would mitigate the impact still further. Atmospheric dispersion modelling was used to predict the ambient air quality that would result from emissions from the power plant in combination with existing sources of emissions in the Richards Bay area. Predicted SO_2 and NO_2 concentrations are within the applicable National Ambient Air Quality Standards (NAAQS) across the modelling domain. The contribution from the NIFPP is small for SO_2 (less than 5% of the hourly, daily and annual SO_2 limit values), while the contribution from the NIFPP is a maximum of 65% of the NO_2 hourly average limit when considering the project within the existing ambient air quality within the modelling domain. Cumulative PM_{10} concentrations may exceed the daily NAAQS at Harbour West, Scorpio, and Arboretum (uMthlathuze) monitoring stations due to the elevated baseline concentrations in those areas. However, the contribution from the NIFPP to those elevated concentrations would be small. Potential impacts on vegetation were also assessed by comparing predicted annual average ambient NO_2 concentrations against critical concentrations for vegetation (30µg/m³ - annual average and half-year mean (CLRTAP, 2015)). The predicted off-site ambient NO_2 concentrations are below the critical levels for all vegetation types across the modelling domain.

Given the importance of air quality management in Richards Bay (due to the large industrial sources of emissions), the RBCAA requested a cumulative assessment of the combined effect of the multiple gas to power projects being proposed for Richards Bay. A realistic worst-case scenario was defined that included the proposed NIFPP, the authorised 400MW gas-to-power project, the authorised Eskom combined cycle power plant, the not-yet authorised 320 MW gas-to-power project as well as existing industrial sources within Richards Bay. Although it was not possible to model these combined emissions, maximum possible short-term concentrations were extrapolated from assessments contained in EIA reports. The cumulative impact estimation predicts that SO_2 and NO_2 would still comply with the NAAQS (however, the potential exists for the upper end of the NO_2 cumulative hourly concentration to exceed the NAAQ limit in some areas within the modelling domain associated with existing developments). Cumulative daily and annual PM_{10} predictions do not comply with the NAAQS, most fundamentally due to the large baseline concentrations. The contribution to ambient PM_{10} concentrations from emissions from the gas-to-power projects is predicted to be relatively small (less than 20%).

Noise

Due to the overall types of activity and distance between the main work sites and nearest sensitive receptors, there is a low likelihood of the noise levels generated during construction exceeding 70 dB LAeq. Even if this noise threshold is exceeded it will only be of short duration and so the noise impacts are considered to be of low impact significance. Noise during operations of the NIFPP will be generated by various components of the project, including the turbines themselves and associated coolers, the high-voltage and power station transformers and switchyard, and ancillary facilities, such as the water treatment facility. Given the distance of sensitive receptors, excluding the avifauna on the sandpsit (which is assessed separately) potential noise impacts from the project are likely to remain below the IFC Guideline Noise thresholds for both daytime and night time operations. The overall noise impacts, again specifically excluding the avifauna on the sandspit are therefore deemed to be negative and of low significance with no need for additional noise attenuation over and above what will be *de facto* be included in the power barges.

Terrestrial biodiversity and wetland impacts

Field visits were conducted during June 2020 (for the wetland assessment) and July 2020 (for the terrestrial biodiversity assessment) covering the western portion of the study area, followed by a second site visit in January 2021 to assess both wetlands and terrestrial biodiversity in the eastern portion of the study area. It is possible that important taxa would not have been observed, in particular plants, in the western portion due to the absence of floral or propagule organs and/or species entering a dormant phase. The main fauna species of concern are typically secretive and/or nocturnal and would require focused sampling efforts over longer periods of time to confirm their presence.

Potential wetland impacts including infilling, destruction or degradation of wetlands, reduced water quality and flow impoundment are best prevented by simply avoiding direct impacts by ensuring no activities in the wetlands themselves, buffer areas or upstream. Terrestrial biodiversity impacts include direct loss and transformation of terrestrial vegetation and habitat supporting biodiversity, including features of biodiversity importance, physical disturbance to soils and subterranean habitat, disturbance/displacement of flora and fauna and allowing the establishment and spread of invasive alien plants. In similar vein to wetlands, impact prevention is best affected through avoidance and wetlands and terrestrial biodiversity features have largely been avoided through judicious routing and site location (most notably the substation). The extensive mangrove forests that constitute another highly sensitive biodiversity feature will be avoided by spanning the pipe and cabling bridge above the mangrove canopy.

Estuarine impacts

Dredging

An estimated 514 000 m^3 of sediment will be dredged, with an estimated 168 000 m^3 of sediment, comprising predominantly sands, from the area to the north of the Sandspit using a backhoe dredger with the dredge spoil disposed to Alkanstrand Beach nourishment programme. An estimated 346 000 m^3 of sediment, comprising mainly silt, will be dredged from the area east of the sandspit using a trailing suction hopper dredger. This material will be disposed of at the approved existing offshore dredge disposal site. The dredging will result in some loss of benthic habitat, but that would mostly be temporary (due to recolonisation by fauna post dredging) and restricted to the dredged area. In addition, the two dredging zones are characterized by relatively low species diversity and habitat quality. Sediment resettlement is also expected to have a low risk of impact. Predicted TSS concentrations are not expected to exceed threshold levels.

Ecotoxicological effects

Dredging also poses a risk of re-suspension of contaminated sediment with possible Cd, Cu, Cr and Zn enrichment. Provided the dredging is strictly confined to the proposed areas to be dredged the risk is deemed to be low.

Water Quality, Granulometry & Organic Content

RBH is unsurprisingly a marine dominated estuarine system with high salinity and low turbidity. Hydrodynamic modelling predicted compliance with TSS and turbidity threshold values.

Water & Sediment metals, PAH concentrations & Whole Effluent Toxicity

No metals in sediment samples exceeded the Level I threshold and as such, do not pose any unacceptable risk during dredging and dredge disposal for the proposed NIFPP.

Aquatic macrophytes

Potential impacts on mangroves would be avoided by running the power evacuation pipe and cabling bridge on an elevated structure above the mangrove canopies and using a construction method that does not require a cutline through the mangroves. Changes to hydrodynamics and sediment deposition as a result of the pipe and cabling bridge piles across the Kabeljous Flats remains unknown, but is not expected to be highly significant given the predicted 1-3 cm deposition layer.

Other biota

Impacts on macrobenthos, nematoda, microphytobenthos, macrocrustacea and ichthyofauna as a result of habitat loss risk is predicted to be high in construction areas (pile foundations), but to be no more than moderate during operations (habitat lost to infrastructure).

Avifauna (Birds)

Potential impacts on wading birds (that currently utilise the Sandspit and Kabeljous Flats intertidal sandflats and mudflats for feeding and the waders, gulls and terns that roost there during either the day or night) derive from dredging, piling and other construction activities, proximity of the development, and the impact of noise across the Sandspit. It is also anticipated that these impacts collectively will result in a loss of the area for the avifauna due to abandonment by the birds and mortality as a result of other suitable habitat already being occupied. These impacts have been deemed to be of very high significance and **a fatal flaw** for the proposed project.

Phytoplankton & Zooplankton

Despite the fact that there is limited information on the Phytoplankton and Zooplankton diversity across the study area or in the harbour, they are considered important components of the food chain as well as contributing to the functioning of estuarine ecosystems. As such, the proposed development is expected to have some localised impacts on these components, with the Residual Risk during construction considered to be Moderate and during the operational phase, Low. However, the confidence associated with these assessments is rated as Low for both.

Climate change

In addition to the emissions of criteria pollutants, the proposed NIFPP will be a significant source of greenhouse gas (GHG) emissions. The climate change assessment was based on the initially planned full generation capacity of 16 200MW. With that power output the project would emit some 834 $MtCO_2e$ over a 25-year operational lifetime or 0.274 tCO_2e/MWh. When compared to conventional coal-fired plants and the regional electricity grid, the GHG intensity of the proposed project is relatively small although in absolute terms the emissions are very large. Provided the power generated by the NIFPP replaced conventional coal-fired power generation, the proposed NIFPP would contribute significantly to reduced GHG emissions per unit of energy generated. While the maximum generation capacity has reduced to a nominal 8 400MW (just more than half of the original generation capacity), the reduction in GHG emissions compared to traditional coal-fired power stations is still significant as are the GHG emissions in absolute terms which are still large.

Provision of electricity and associated socio-economic impacts

South Africa urgently requires additional power generation capabilities so that electricity can be provided securely and reliably, providing enough reserve capacity to stop the rolling black-outs/ load shedding currently plaguing the country and its economy. Such electricity provision is highly significant to the local, regional and national economy of South Africa. The direct economic benefits that will accrue due to the construction and operation of the proposed NIFPP and associated infrastructure, excluding the benefits associated with the supply of electricity, are deemed moderately significant as are the knock-on social benefits that would be associated with the spending and job creation of the project. When the economic impacts of the additional secure power supply are considered, these would result in a broad array of additional benefits, significantly reducing power demand pressure on Eskom, and providing direct growth opportunities for a variety of industry types. It is difficult to quantify the exact economic and social benefits that will accrue, but when the direct economic costs of load shedding are considered, which run into tens of billions of rand per annum, the additional power supply can be deemed to have to a significant positive benefit to both the economy and society.

Residual risk after mitigation for Construction and Operational Phase impacts associated with the preferred alternative of NIFPP and associated infrastructure

Aspect	Impacts	Construction Phase	Operational Phase
		Residual Risk after Mitigation	
Wetland Ecology*	Spread of IAPs	Low	Low
Terrestrial Biodiversity*	Spread of IAPs	Low	Low
	Disturbance of protected plants and/or species of conservation concern	Low	N/A
Estuarine Ecology	Water quality, granulometry and organic content	Moderate	Moderate
	Metals & PAH in water and sediment, and whole effluent toxicity	Low	Low
	Macrophytes (Mangroves) – indirect impacts due to scouring and sedimentation	Moderate	Moderate
	Phyto- and Zoo-plankton	Moderate	Low
	Macrobenthos, Nematode and Microphytobenthos	High	High
	Macrocrustacea (Prawns)	High	High
	Ichthyofauna (Fish)	High	High
	Avifauna (Birds)	Fatally flawed	Fatally flawed
Heritage	Destruction of heritage resources	Low	N/A
Air Emissions	Human health impacts due to deterioration of ambient air quality (PM)	Low	N/A
	Human health impacts due to deterioration of ambient air quality (NOx & PM)	N/A	Low
	Damage to vegetation due to deterioration of ambient air quality (NOx & PM)	N/A	Low
Noise Emissions	Deterioration in ambient noise quality at sensitive receptors (i.e. humans)	Low	Low
Human Health & Safety	Injuries (or fatalities) to staff and public based on a major hazard installation	N/A	Low
Social	Visual impacts	Low	Low
	Criminal Activity	Moderate	N/A
	Spread of Disease	High	Moderate
	Informal dwellers/ destitute people	Moderate	N/A
	Safety	Low	Moderate
	Protest action and unrest	Moderate	N/A
	Traffic Safety	Low	N/A
Economic	Production	Moderate Benefit	Moderate Benefit
	Gross Value Add (GVA)	Moderate Benefit	Moderate Benefit
	Business Income	Moderate Benefit	Moderate Benefit
	Employment	Moderate Benefit	Low Benefit
	Property Values	Moderate Benefit	Moderate Benefit
	Tax	N/A	Moderate Benefit

* EAPs impact assessment based on changes to the layout as detailed in Section: 12.

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ACRONYMS, ABBREVIATIONS AND SYMBOLS

AEL	Atmospheric Emissions License
AIR	Atmospheric Impact Report
AMSL	Above Mean Sea Level
AQIA	Air Quality Impact Assessment
BH	Backhoe Dredger
BOG	Boil-Off Gas
CAGR	Compounded Annual Growth Rate
CBA	Critical Biodiversity Area
CBD	Central Business District
CCGT	Combined Cycle Gas Turbine
CD	Chart Datum
CRR	Comment and Response Report
D	Depressional (Wetland)
dBA	Descriptor that is used to indicate 10 times a logarithmic ratio of quantities that have the same units, in this case sound pressure that has been A-weighted to simulate human hearing.
DEA	Department of Environmental Affairs (now, DFFE)
DEFF	Department of Environment, Forestry and Fisheries (previously DEA, now DFFE)
DFFE	Department Forestry, Fisheries and the Environment
DM	District Municipality
DHSWS	Department of Human Settlements, Water and Sanitation (previously DWS)
DO	Dissolved Oxygen
DRC	Democratic Republic of Congo
DWA	Department of Water Affairs (now DHSWS)
DWS	Department of Water & Sanitation (previously DWA, now DHSWS)
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
AEWA	Agreement on the Conservation of African-Eurasian Migratory Waterbirds
EHS	Environment, Health and Safety
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EIS	Ecological Importance and Sensitivity
EKZNW	Ezemvelo KwaZulu-Natal Wildlife

EMF	Environmental Management Framework
EMPr	Environmental Management Programme
EMS	Environmental Management System
EP	Equator Principles
EPFI	Equator Principles Financial Institutions
ESA	Ecological Support Area
ESAP	Environmental and Social Action Plan
ESMP	Environmental and Social Management Plan
ESMS	Environmental and Social Management Plan
FSU	Floating Storage Unit
GDP	Gross Domestic Profit
GDP-R	Gross Domestic Profit per Region
GHG	Greenhouse Gases
GIIP	Good International Industry Practice
GILs	Gas-Insulated Transmission Lines
GVA	Gross Value Add
HGM	Hydrogeomorphic
HSS	Hillslope Seepage (Wetland)
HVAC	High Voltage Alternating Current
IAP	Invasive Alien Plant
I&AP	Interested and Affected Party
IBA	International Bird Area
IDZ	Industrial Development Zone
IDP	Integrated Development Plan
IEM	Integrated Environmental Management
IEP	Integrated Energy Plan
IFC	International Finance Corporation
IPP	Independent Power Producer
IRP	Integrated Resource Plan
IWWMP	Integrated Water and Waste Management Plan
KCDM	King Cetshwayo District Municipality
kV	Kilo Volt
KZN	KwaZulu-Natal
LM	Local Municipality

LNG	Liquid Natural Gas
MHI	Major Hazard Installation
MMscfd	Million standard cubic feet per day
MSAP	Multi-Species Action Plan
MW	Mega Watt
MWh	Mega Watt Hour
NAAQS	National Ambient Air Quality Standards
NBA	National Biodiversity Assessment
NDP	National Development Plan
NEA	National Energy Act, 2008 (Act No. 34 of 2008)
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NEMAQA	National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004)
NEMBA	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
NEMICMA	National Environmental Management: Integrated Coastal Management Act, 2008 (Act No. 24 of 2008)
NEMWA	National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)
MES	Minimum Emission Standards
NFA	National Forest Act, 1998 (Act No. 84 of 1998)
NFEPA	National Freshwater Ecosystem Priority Area
NIFPP	Nseleni Independent Floating Power Plant
NOx	Nitrogen Oxides
NWA	National Water Act, 1998 (Act No. 36 of 1998)
OCGT	Open Cycle Gas Turbine
OSHA	Occupational Health and Safety Act, 1993 (Act No. 85 of 1993)
PES	Present Ecological State
PM	Particulate Matter
PP	Public Participation
PS	Performance Standard
QRA	Qualitative Risk Assessment
RBCAA	Richards Bay Clean Air Association
RBIDZ	Richards Bay Industrial Development Zone
REC	Recommended Ecological Reserve
REIPP	Renewable Energy Independent Power Producer
RO	Reverse Osmosis
RSA	Republic of South Africa

SADC	Southern African Development Community
SANBI	South African National Biodiversity Institute
SANS	South African National Standard
SAWQG	South African Water Quality Guideline
S&EIR	Scoping and Environmental Impact Reporting
SEA	Strategic Environmental Assessment
SEMA	Specific Environmental Management Act
SIA	Social Impact Assessment
SO_2	Sulphur Dioxide
SQG	Soil Quality Guideline
TDS	Total Dissolved Solids
TNPA	Transnet National Ports Authority
TOC	Total Organic Content
TSHD	Trailing Suction Hopper Dredger
TSS	Total Suspended Solids
VB	Valley-Bottom (Wetland)
WBG	World Bank Group
WET	Whole Effluent Toxicity
WHO	World Health Organisation
WMA	Water Management Area
WUL	Water Use License
WULA	Water Use License Application
WWTP	Waste Water Treatment Plant

1 INTRODUCTION

Since 2008, when demand for electricity in South Africa began to outstrip supply, resulting in load shedding, the South African economy has laboured. Multiple interventions to address the supply shortfall have not yet yielded a cessation of load-shedding and electricity supply in the country remains 'severely constrained'. At the same time the high dependence on coal as an energy source has attracted growing criticism due to greenhouse gas emissions principally but also due to other coal combustion emissions such as Particulate Matter (PM) Nitrous Oxides (NO_x) and Sulphur Oxides (SO_x). Greenhouse gas emissions contribute to climate change while the other emissions have a strongly negative impact on air quality in the areas in which the coal-fired power stations operate. Apart from Kusile Power station, which is currently under construction, none of the power stations are able to comply with published Minimum Emissions Standards (MES) and have been forced to apply for postponement of the compliance time frames to enable continued legal operation. Further exacerbating this, the generation fleet is aging and will see the decommissioning of power stations towards the end of the 2020s.

Given the above and without getting into the detail of the negative environmental consequences of coal mines, there is an urgent need to diversify electricity generation in making up the existing and future shortfall in supply. To some extent that shortfall and diversification has been addressed through the Independent Power Producers (IPP) programme and especially the renewable energy projects but there remains a need for much more non-coal supply capacity. In 2016 the CSIR[1] published a study that showed that South Africa's entire electricity demand could be met through renewables provided that there was some baseload, which they argued could come from natural gas fired power plants. It is in response to this circumstance, that the Nseleni Independent Floating Power Plant (NIFPP) and associated infrastructure (Nseleni Power Corporation (Pty) Ltd (Ref No. 14/12/16/3/3/2/2032)) AND the Liquid Natural Gas (LNG) receiving and storage facility and associated physical infrastructure to support the NIFPP (Anchor Energy LNG (Pty) Ltd (Ref No. 14/12/16/3/3/2/2033)), has been proposed. The NIFPP is a project aimed at supplying natural gas based electricity for supply to the South African market.

It is proposed that Liquid Natural Gas (LNG) be shipped from source to the NIFPP located within the Port of Richards Bay. The LNG vessels will dock/ moor at an LNG Terminal and off-load LNG for storage into cryogenic floating storage units "FSUs". The power generation facility will be made up of "modular" stand-alone Floating Power Barges with Combined Cycle Gas Turbines (CCGT) for the generation electricity from LNG as the fuel source. The Floating Power Barges will be docked/ moored to the Power Barge Terminal, which in turn is linked to the LNG Terminal. The Floating Power Barges will be provided with the required process water by a centralized desalination plant as well as regasification plants to convert the LNG to gas suitable for use in the CCGT.

The project will involve a range of activities that in terms of the country's National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended (NEMA) and other Specific Environmental Management Acts (SEMAs) require Environmental Authorisation (EA) before they can proceed. Sustainable Environmental Solutions (Pty) Ltd (SE Solutions), was appointed by Anchor Energy LNG (Pty) Ltd (hereinafter referred to as the 'Applicant') as the independent Environmental Assessment Practitioner (EAP), to undertake the required application for Environmental Authorisations (EAs) for the proposed Nseleni Power Corporation (Pty) Ltd: Nseleni Independent Floating Power Plant (NIFPP) and associated infrastructure as well as the Anchor Energy LNG (Pty) Ltd: Liquid Natural Gas (LNG) receiving and storage facility and associated physical infrastructure to support the NIFPP, Port of Richards Bay, KwaZulu-Natal, and to conduct the requisite Environmental Impact Assessment (EIA) required for that decision-making. That EIA is described in this report.

[1] Formal comments on the South African Integrated Resource Plan (IRP) Update Assumptions, Base Case and Observations 2016 CSIR Energy Centre Pretoria, 31 March 2017 (with small editorial updates on 6 April 2017)

2 DETAILED PROJECT OVERVIEW

2.1 LOCALITY

The study area within which the proposed project will be located is depicted in Figure 1 (refer also to Appendix 2) while the relevant property information is provide in Table 1. The project falls largely within the Port of Richards Bay, within the City of uMhlathuze Local Municipality and King Cetshwayo District Municipality.

Table 1: Impacted cadastral properties/ farm portions per Applicant

Applicant	Cadastral Information	Surveyor General 21 digit code	Land-Use Zoning (2019 LUMS)*	Property Owner/ Custodian ***
Nseleni Power Corporation (Pty) Ltd	Remainder Farm 16230	N0GV00000001623000000	Harbour (Split Zoning)	Transnet National Ports Authority (TNPA)
	Portion 1 of Farm 16230	N0GV00000001623000001		
	Portion 45 of Erf 5333	N0GV04210000533300045		
	Erf 6363	N0GV04210000636300000	Noxious Industry (Heavy Industry)	South32 Aluminium SA Pty Limited
Anchor Energy LNG (Pty) Ltd	Port of Richards Bay (over water area)	S.G. No. 1617/2009**	Harbour (Split Zoning)	TNPA

* City of uMhlathuze Land Use Scheme Viewer (Appendix 2)
(https://gis.umhlathuze.gov.za/arcgisportal/apps/webappviewer/index.html?id=019e396d93cf490782bcfa52a77f2cbb – accessed 15 March 2021)
** Surveyor General Documentation within Appendix 2.
*** Letter of Consent in Appendix 3

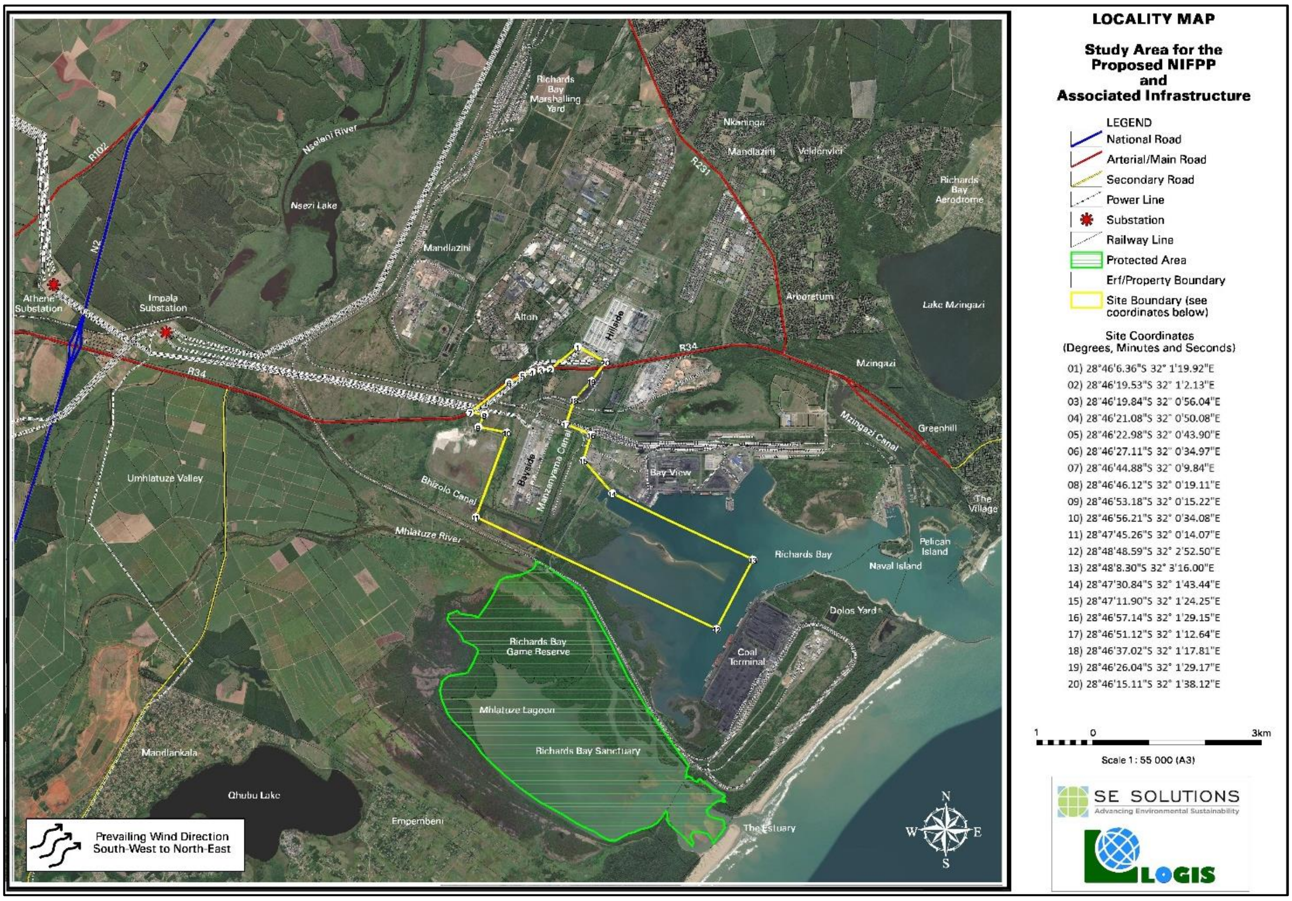


Figure 1: Locality Map for the study area within which the proposed NIFPP and associated infrastructure will be located.

2.2 SURROUNDING LAND USE

The Port of Richards Bay is managed by the Transnet National Ports Authority (TNPA); however, the "sea/estuarine" environment and bed/substrate is owned by the Minister of Forestry, Fisheries and the Environment (DFFE). On land, Remainder Erf 5333 is largely vacant and owned by the City of uMhlathuze Local Municipality, while Portion 45 of Erf 5333 and Portions 1 and Remainder of Farm 16230 are owned by TNPA. Lot 6363, Alton (located wholly within the study area) is the Bayside Aluminium smelter, owned by South32 and to the west is the Gypsum Dump, owned by Foskor (Figure 1). North of Bayside are various utility and services (such as railway lines and powerlines). Hillside Aluminium is located north of the John Ross Highway (R34).

Two canals that were established to drain the area used for the Bayside Aluminium Smelter exist on the eastern and southern boundaries of Bayside. These canals are the Manzamnyama and Bhizolo Canals respectively. The area to the south of the Port of Richards Bay (or Richards Bay Estuary) is known as the Richards Bay Sanctuary or uMhlathuze Estuary and includes the Richards Bay Game Reserve, a protected area.

The Port of Richards Bay, itself, contains a dry bulk terminal, a multi-purpose terminal and the privately-operated coal terminal. Other private operators within the Port include several wood chip export terminals and a bulk liquid terminal. The Port has extensive rail and conveyor belt systems servicing the berths from nearby factories and plants.

2.3 PROJECT DETAILS

The project assessed in this S&EIR process is the proposed Nseleni Independent Floating Power Plant (NIFPP) and associated infrastructure (Nseleni Power Corporation (Pty) Ltd (Ref No. 14/12/16/3/3/2/2032)) AND the Liquid Natural Gas (LNG) receiving and storage facility and associated physical infrastructure to support the NIFPP (Anchor Energy LNG (Pty) Ltd (Ref No. 14/12/16/3/3/2/2033)) proposed to be located (predominantly) within the Port of Richards Bay. The NIFPP will make use of Combined Cycle Gas Turbine (CCGT) technology fuelled by Liquid Natural Gas (LNG) (Box 1) supplied by Anchor Energy LNG (Pty) Ltd. The NIFPP would be made up of a series of individual floating power plants each of which would be capable of generating a nominal 700 MW. It is proposed to phase the NIFPP, gradually bringing in the power plants to create a combined generation capacity of some 2 800 MW, whereafter subsequent phases may take the combined power generation to 8 400 MW.

Box 1: What is Liquid Natural Gas (LNG)?

Natural gas is the cleanest fossil fuel and a highly efficient form of energy. Natural gas consists almost entirely of methane (CH_4), the simplest hydrocarbon compound, and differs from synthetic gas, which tends to be hydrogen rich. When methane is burned completely, the principal products of combustion are carbon dioxide and water vapour. Typically, LNG is 85 to 95-plus percent methane, along with a few percent ethane, even less propane and butane, and trace amounts of nitrogen. The exact composition of natural gas varies according to its source and processing history. Like methane, natural gas is odourless, colourless, noncorrosive, and nontoxic.

In order to transport natural gas, techniques have been developed to cool natural gas to minus 160° C at atmospheric pressure which serves to condense the gas into a liquid that is 1/600th of the original gas volume. The Liquid Natural Gas (LNG) can then be transported in purpose built cryogenic (very low temperature) containers that retain the natural gas in liquid form. For the gas to be useable as a fuel, it must be heated to return it to a gaseous form.

2.3.1 LNG SUPPLY AND TRANSPORTATION TO THE NIFPP

LNG supply and transportation to the NIFPP will be managed by Anchor Energy LNG (Pty) Ltd [14/12/16/3/3/2/2033]. Bulk LNG will be transported from source, possibly AngolaLNG's plant at Soyo, by means of dedicated LNG vessels that are sized for the NIFPP's requirements and capable of entering the Port of Richards Bay. It is envisaged that the off-take demand for the NIFPP 700 MW floating power barge modules will be in the order of 1 700 tonne per day per power barge. Based upon an initial 4 power barges, the monthly supply will be of the order of 204 000 tonne of LNG, which will necessitate a 100 000 tonne supply vessel every other week. The LNG delivery vessels would dock to the LNG Floating Storage Units (FSUs – i.e. permanently moored LNG vessels acting as LNG storage units).

A typical operating procedure for an LNG vessel, upon arrival at a Port, is as follows:

- Tugboats usually accompany the LNG vessel after embarkation of the pilot;
- An additional tugboat may be in attendance to provide assistance, as necessary, and remain for the rest of the transit;
- During the turning manoeuvres, the tugboats will normally control the vessel. When the manoeuvre is complete, tugboats provide assistance in aligning the vessel for a parallel approach and controlled speed for landing on the LNG Terminal docking fenders or FSU;
- The tugboats will normally hold the LNG vessel alongside until secured to the LNG FSU (Figure 2); and,
- Once docked, the LNG vessel will be connected to the receiving terminal via purpose designed cryogenic unloading mechanisms or flexible cryogenic hoses in the case of an FSU.

The LNG in the vessel will be unloaded to the FSU (via flexible cryogenic hoses - Figure 2), which in turn supplies the on-quay LNG bulk storage tanks at the design rate for the system using the LNG vessels' own pumps. The discharge of LNG from the vessel to the FSU will be a continuous process until all cargo has been off-loaded. During the discharge operation, ballast water will be taken on-board (in accordance with standard maritime practice) from the surrounding water into the double hull compartments to compensate for cargo discharge.

Figure 2: LNG transfer between LNG carrier and FSU via flexible cryogenic hoses.

Each LNG vessel will be compared against predetermined acceptance criteria, before being approved for LNG transfer from ship to tankship (FSUs). In addition, the requirements of the vessel's security plan shall be implemented consistent with the "International Ship and Port Facility Security Code". Once moored, staff will complete various safety checks and unloading operations will not commence until the Ship to Quay (shore) or the Ship-to-Ship Safety Checklist included in the "International Guide for Oil Tankers and Terminals" and "Ship to Shore Transfer" has been completed satisfactorily.

2.3.2 LNG TERMINAL (ANCHOR ENERGY LNG (PTY) LTD [14/12/16/3/3/2/2033])

The interface between the LNG FSU and the NIFPP is known as the LNG Terminal (refer to Appendix 4 for preliminary engineering drawings). The LNG terminal consists of a series of mooring and berthing dolphins (an isolated marine structure for berthing and mooring of vessels that serves to reduce the size of quays) with a central offloading (docking/mooring station) platform 37.5m wide and 73.5m in length (Figure 3). Access to the various dolphins is provided by steel walkways. A typical LNG docking/ mooring station consists of four berthing dolphins and between four and six mooring dolphins (each 11m wide and 11m in length).

The docking/mooring platform is founded on 0.95 m diameter vertical tubular steel piles spaced according to a 9m x 9m grid layout. The piles will be protected against corrosion by a suitable corrosion protection system. The superstructure is supported on the steel pile caps and is made up of reinforced concrete precast "U" beams 1.2m deep and 1.5m wide filled with in-situ concrete and precast slab planks 0.35m deep with 0.25m deep in-situ concrete topping to stitch the structure together. The dolphins are founded on eight 1.2m diameter raked tubular steel piles with suitable corrosion protection. The superstructure is made up of an in-situ reinforced concrete monolithic capping cast 2m deep with a concrete fender panel (where applicable).

The offloading platform supports the LNG cryogenic offloading mechanisms, which connect the vessel/ FSU manifolds to the distribution piping (Figure 4). The offloading platform is connected to the other infrastructure via an elevated access trestle roadway (i.e. on marine piles) (width of 10.5m and a total length of 622m). This road is to provide maintenance access to the offloading platforms (i.e. docking/ mooring stations). A pipe support bridge (including a roadway) will support the LNG pipeline distribution network. The cryogenic unloading mechanisms compensate for vessel movement during the LNG unloading process. They are also fitted with break-away couplings that seal both sides of the connection, in case of failure of the mooring lines. The maximum anticipated LNG vessel calling at the terminal would have a draft of approximately 12m. The berthing area (at the docking/ mooring station) would therefore be dredged to provide a minimum depth of -13.5m at extreme low tides.

The docking/ mooring station or platform also houses the fire protection equipment (i.e. foam, dry powder and firewater monitors/ systems that provide adequate safety coverage). The fire-fighting systems include high expansion foam monitors over a defined spill basin, which are actuated automatically in the event of a fire.

Figure 3: Left: Typical multiple piled concrete and steel quay; Right: Schematic design of the LNG Terminal capable of accommodating two LNG FSUs and/or vessels at the same time.

Figure 4: LNG vessel docking/ mooring station complete with LNG cryogenic unloading mechanisms located on the LNG Terminal.

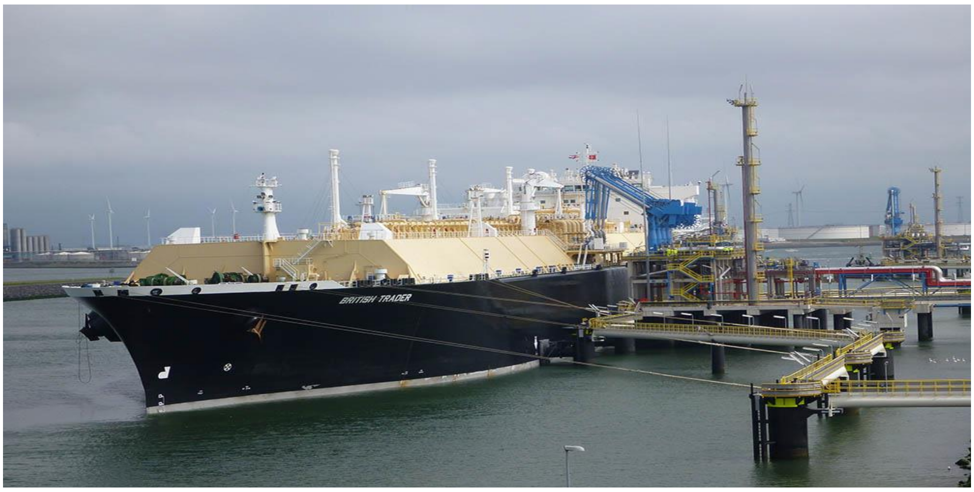


Figure 5: LNG FSU permanently moored/ berthed to the LNG Terminal's docking/ mooring station (offloading platform).

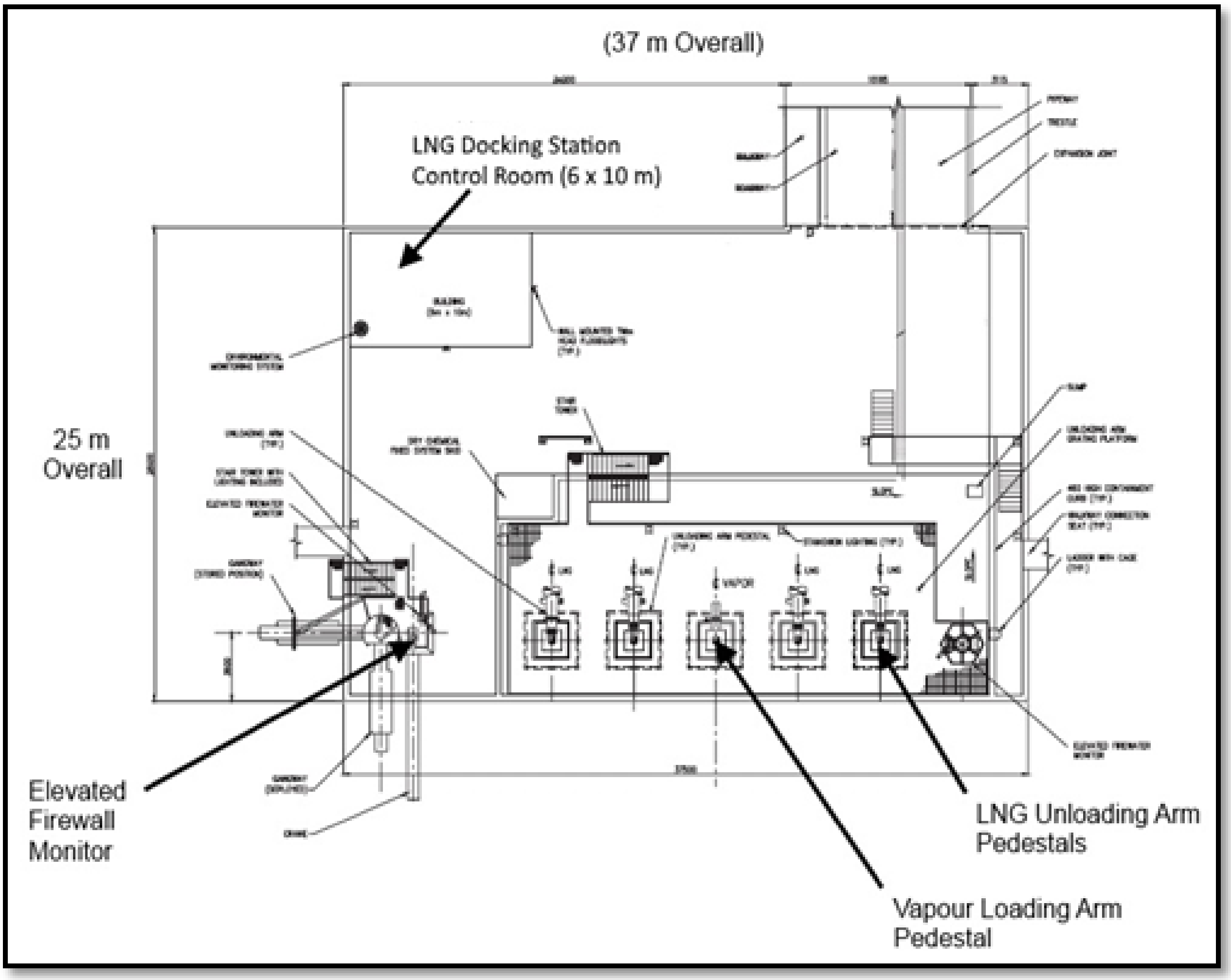


Figure 6: Top view of a typical docking/ mooring station.

The LNG terminal will normally have two main modes of operation:

1. Ship to ship Transfer – This mode of operation is the period during which the ocean-going LNG vessel is moored alongside the FSU at the LG terminal, is connected to the FSU by means of flexible cryogenic hoses and transfer of LNG takes place from the LNG vessel to the FSU until such time that the entire cargo of LNG has been transferred to the FSU. Pumps on the LNG vessel are used to affect the transfer of LNG. Once unloading is completed, pressurised nitrogen gas is be used to purge the transfer system of LNG and any residual gas prior to disconnecting.

   During cargo discharge the vapour pressure in the LNG vessel tanks will be maintained by returning vapour from the FSUs to the LNG tanker. By operating a balanced system in this manner, hydrocarbons are prevented from being released to atmosphere. Accumulation of flammable gas is also thereby prevented on both the LNG vessel and/or the FSU.

2. Ship to jetty discharge -. This mode of operation refers to the period when transfer of LNG from the FSU to the on jetty vertical bulk cryogenic tanks associated with the regasification system occurs. LNG is pumped from the FSU via articulating cryogenic arms into vacuum insulated piping connected to the on-jetty storage. During this period, cryogenic (freezing) conditions are maintained in the unloading and circulation system. In order to maintain these conditions, LNG is circulated via the unloading line to the docking/ mooring station and back to the on-quay LNG bulk storage tanks via the re-circulation line.

The following activities would be conducted on the LNG Terminal

- Receiving and mooring of the LNG Tanker;
- Operation of the LNG unloading and storage;
- Security activities;
- Traffic moving to and from the LNG facilities site;
- Unplanned events, for example, the late arrival of a LNG vessel, interruptions to gas supply or an accident in the production sequence;
- Maintenance of the asset;
- Statutory inspection and turnaround activities;
- Corrosion management of the pipeline(s); and,
- Management of the ship to shore interface in accordance with the agreed division of responsibilities between the Transnet National Ports Authority (TNPA) and the LNG operator.

Operating facilities would include:

- Dockside/ quay berthing including LNG unloading mechanisms;
- LNG containment in cryogenic vertical tanks;
- Low- and high-pressure pumping systems;
- Vapour and Boil-Off Gas (BOG) systems; and,
- Vents (low and high pressure).

The LNG Terminal will be designed and operated generally in accordance with the European Standard EN 1473: Installation and Equipment for Liquefied Natural Gas: Design of Onshore Installations. Major Design Codes include:

- LNG Terminals: EN 1473
- LNG Tanks: BS 7777 – 2 – 1993
- LNG Carriers: IGC / OCIMF / SIGTTO / Class
- LNG Gas Pipelines: ASME B31.8, IGE / TD / 1, DNV 81
- LNG Installation and Equipment: EN 1160
- LNG Production and Storage: NFPA 59A

Box 2: Boil-off Gas (BOG)
LNG is stored and transported in tanks as a cryogenic (very low temperature) liquid. LNG continuously evaporates generating Boil-Off-Gas (BOG), so named due to the LNG exceeding its boiling point (and converting from liquid to gas). Unless managed, BOG can become dangerous because it increases the pressure in the storage tank.

2.3.3 POWER BARGE TERMINAL (ANCHOR ENERGY LNG (PTY) LTD [14/12/16/3/3/2/2033])

The proposed power barge terminal comprises a series of power barge jetties/quays (refer to Appendix 4 for preliminary engineering drawings). Each jetty would support two NIFPP power barges (Figure 7). The jetties are constructed using steel pile foundations and a concrete deck. The jetty overall width is 145.5m reducing to 37.8m and the overall length is 315m. The mooring dolphin is 11 m wide and 11 m in length.

The barge jetty is founded on 0.95m diameter vertical tubular steel piles spaced according to a 9m x 9m grid layout. The piles will be protected against corrosion by a suitable corrosion protection system. The superstructure is supported on the steel pile caps and is made up of reinforced concrete precast "U" beams 1.2m deep and 1.5m wide filled with in-situ concrete and precast slab planks 0.35m deep with 0.25m deep in-situ concrete topping to stitch the structure together. The dolphin is founded on ten piles, six of them are 1.45m diameter raked tubular steel piles and four of them are 1.2m diameter raked tubular steel piles. The superstructure is made up of in-situ reinforced concrete monolithic capping cast 2m deep.

The purpose of the jetty is to provide safe mooring to the power barges as well as foundations for the barge support equipment, such as LNG storage and regasification, chillers, piped connections and power connections. An elevated roadway and pipe support trestles connect the power barge jetties to the other infrastructure (14.4m and a total length of 260m) (Figure 7). Pre-fabricated 250-300m^3 vertical cryogenic LNG bulk storage tanks (Figure 9) would be located on the quay adjacent to each NIFPP Floating Power Barge and connected via a network of cryogenic pipelines (maximum distance of 1 000m to minimise the amount of boil-off gas (BOG) produced during the transfer operation) to the docking/ mooring stations (offloading platforms) located on the LNG Terminal.

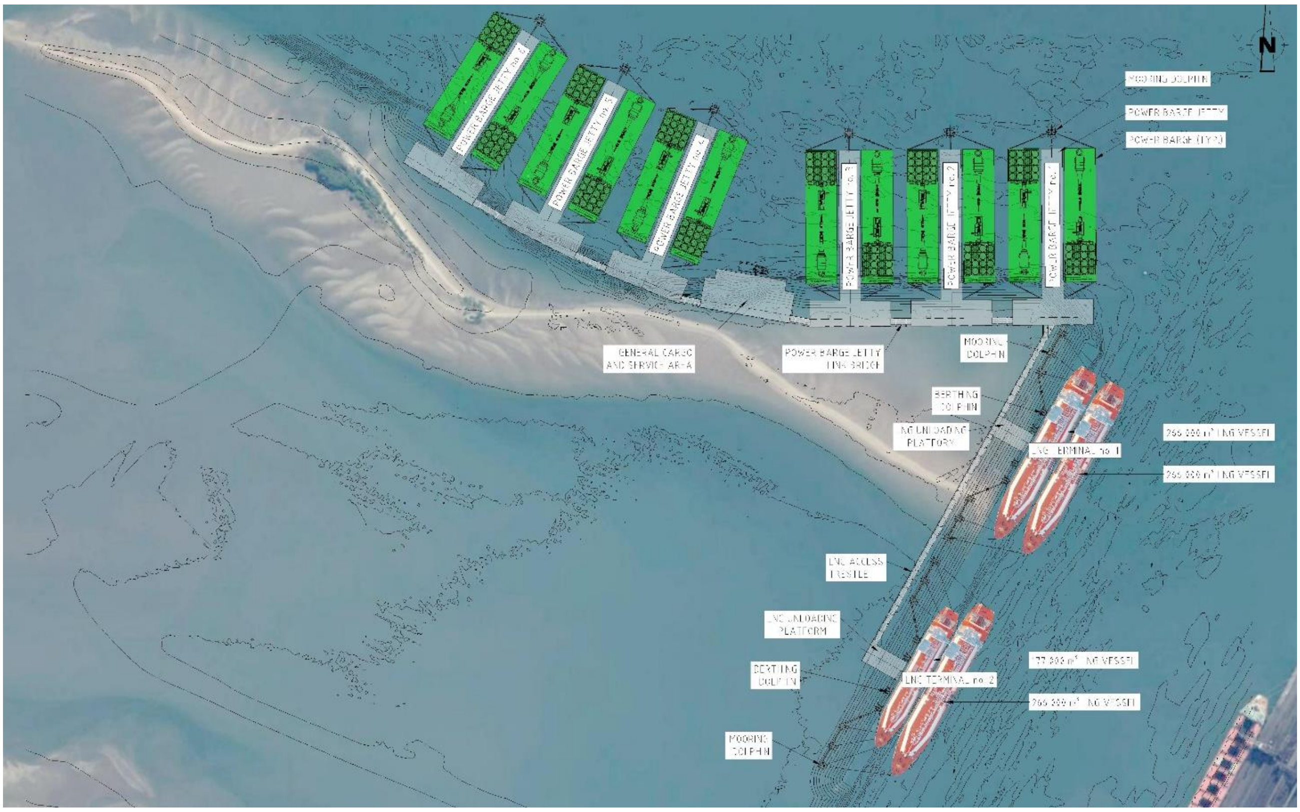


Figure 7: Power Barge Terminal/ Jetty with individual mooring bays per Floating Power Barge currently envisaged for the Richards Bay harbour. The floating power barges highlighted in green are for Nseleni Power Corporation (Pty) Ltd: 14/12/16/3/3/2/2032 while all other infrastructure and the LNG vessels and FSUs are for Anchor Energy LNG (Pty) Ltd: 14/12/16/3/3/2/2033.

2.3.3.1 Supply Vessel Quay and General Services Area (Anchor Energy LNG (Pty) Ltd [14/12/16/3/3/2/2033])

A supply vessel quay is located centrally on the power barge terminal (Figure 8) as well as a general operational and maintenance supply area behind the quay wall. The area will be constructed using a precast concrete system supported by steel piles (refer to Appendix 4 for preliminary engineering drawings). The purpose of the quay and supply area is to allow for the transfer of personnel to and from the facility, the delivery of parts and consumables to the facility as well as to provide a single multi-story control room/ office tower (estimated at 50m x 50m) to house the following facilities:

- Ablution and change room facilities;
- Canteen and mess facilities;
- Operational Offices for Terminal Operations;
- Control Room and Operational Offices for Power Generation;
- Emergency Medical facilities; and,
- A helicopter landing pad shall be accommodated on the roof of this structure.

The area will also be utilised for common utilities such as the storage warehouse facility & workshop (estimated at 25m x 40m); desalination plant and associated Waste Water Treatment Plant (WWTP) (estimated area of 45m x 45m), a small-scale incinerator for waste management (estimated area of 30m x 10m) and low voltage (400V) power generation to support critical operations (i.e. power for lighting and firefighting equipment) in the event of grid power outages. A 160-t mobile crane, service vehicles and trucks will be permanently stationed on this platform to service the Power Island.

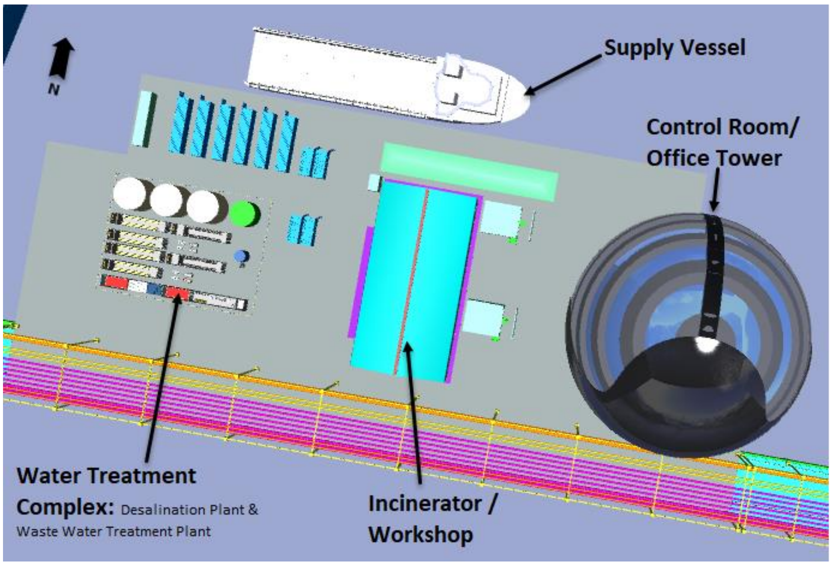


Figure 8: Schematic 3D representation of the general service area/ platform on the power barge terminal.

2.3.3.2 LNG Bulk Storage Tanks (Anchor Energy LNG (Pty) Ltd [14/12/16/3/3/2/2033])

Nominal 250-300m^3 vertical, double containment, cylindrical VS-Series metal tanks will be used in which to store LNG (Figure 9). The following describes the containment measures to ensure safe storage of LNG.

Primary Containment

International standards and rules define containment with respect to types of structures and technologies in use. The term "containment" in this document refers to safe storage and isolation of LNG. Safe use of LNG, or any cryogenic substance, requires an understanding of how materials behave at cryogenic (very low) temperatures. For example, at extremely low temperatures, carbon steel loses its ductility and becomes brittle. The material selected for tanks, piping, and other equipment that comes in contact with LNG is critical. The use of high nickel content steels, aluminium, and stainless steels is costly but necessary to prevent embrittlement and material failures. High alloy steels composed of nine percent nickel and stainless steel typically are used for the inner tank of LNG storage tanks and for other LNG applications. Several engineering design features ensure the safety of LNG storage tanks. The industry has benefitted from advances in modern materials and engineering techniques to build safe LNG storage tanks.

LNG typically is stored in double-walled tanks at atmospheric pressure. The storage tank is a tank within a tank, with insulation between the walls of the tanks. The primary container is the primary containment for the cargo. It can be constructed of stainless-steel invar (36 percent nickel steel). The most common cargo insulation materials include polyurethane, polyvinyl chloride foam, polystyrene, and perlite. Nitrogen is placed in the insulation space. Because nitrogen does not react with other gases or materials, even minor leaks can be detected by monitoring the nitrogen-filled insulation space for the presence of methane.

Secondary Containment

Secondary containment provides protection beyond the primary containment. This applies both to storage tanks at receiving/re-gasification terminals as well as LNG vessels. A double containment tank is designed and constructed so that both the inner tank and the outer tank are capable of independently containing the LNG. The inner tank contains the LNG under normal operating conditions. The outer tank or wall (composed of ≈3 feet of concrete, 1-2m away from the inner tank) is intended to contain any LNG leakage from the inner tank and the boil-off gas. The majority of LNG storage tanks built recently around the world are designed as double or full containment tanks. LNG bulk storage tanks are designed in accordance with international LNG codes (EMMUA 147,18 EN 1473).

To contain liquid in the case of LNG leakage from double and full containment tanks, secondary containment must meet the following requirements:

- If made of metal, it shall be of cryogenic grade; or,
- If made of pre-stressed concrete (alternative), the temperature of the pre-stressed cables shall remain compatible with the strength of the maximum hydrostatic head. It is to be assumed for calculation that the temperature of the LNG is applied directly onto the internal face, including the insulation, if any.

For a secondary concrete container where a rigid base/ wall connection exists (alternative), a thermal protection system is installed to prevent uncontrolled cracking in this connection area. This thermal protection system is designed in accordance with 7.1.11 of EN 14620-1:2006.

Figure 9: Typical vertical LNG cryogenic bulk storage tanks. A single 300m^3 storage tank typically stores 145 tonnes of LNG.

LNG storage tanks are designed to:

- Safely contain the liquid at cryogenic temperature;
- Permit the safe filling and removal of LNG;
- Permit the BOG to be safely removed;
- Prevent the ingress of air and moisture except as a last resort to prevent unacceptable vacuum conditions (viz. that would cause the tank to crumple) in the vapour space;
- Minimise the rate of heat in-leak, consistent with operational requirements and prevent frost heave;
- Withstand the damage leading to loss of containment due to credible internal and external factors;
- Operate safely between the design maximum and minimum (vacuum) pressures; and,
- Withstand the number of filling and emptying cycles and the number of cool down and warming operations which are planned during its design life.

The tanks would be gas and liquid tight under normal operations and would be resistant to leakage in the event of external forces such as impact damage and thermal radiation (fire). Connections to the tanks would be designed to accept loads imposed from external and internal piping. Thermal insulation of the tanks would also be selected to ensure that there are no threats to the integrity of the storage tanks and no loss of insulating efficacy. The tanks would also be designed to cope with the temperature and pressure variations brought about by filling and emptying and would also be equipped with a range of instruments to monitor liquid levels, pressure, temperature and density with independent alarms to signal the breaching of safety thresholds in any of these parameters.

2.3.4 FLOATING POWER BARGES (I.E. POWER STATION FACILITY) (NSELENI: 14/12/16/3/3/2/2032)

The proposed NIFPP Power Station Facility will comprise initially, of 4 x nominal 700MW (50 Hz) Combined Cycle Gas Turbine (CCGT) Siemens SeaFloat SGT5-8000H Floating Power Barges (or modules - Figure 10 and Figure 11) with sufficient real-estate (i.e. quays) for at least an additional 8 modules Figure 7). The initial modules will be connected, with additional units added at approximately 3 to 4 month intervals based upon power purchase agreements being concluded until the full fleet is installed, connected and operational. The berthing areas will need to be dredged to provide a minimum depth of -9.5m at extreme low tides (refer to Section 10.5 on dredging).

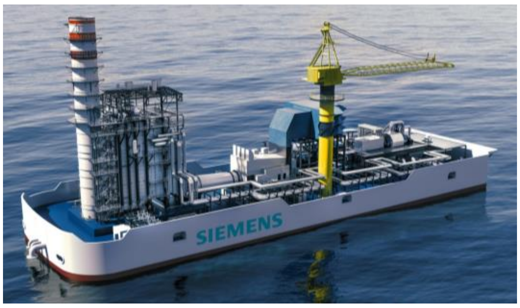


Figure 10: Typical 700 MW CCGT Floating Power Barge.

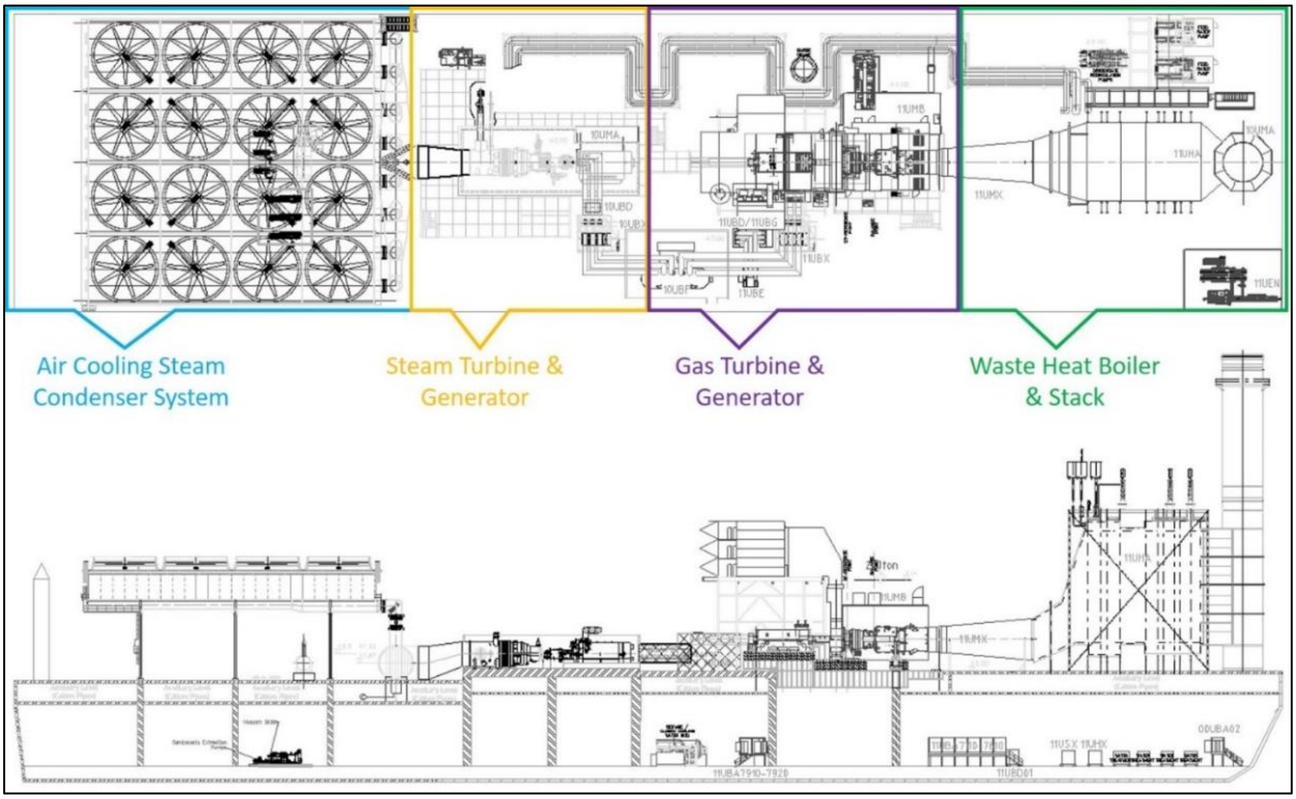


Figure 11: Schematic representation of the different components making up the CCGT Floating Power Barge (stack height is a maximum of 60m from the deck, power barge itself is estimated at 240m in length).

Each Floating Power Barge has an associated switchgear building located on a power transmission platform on the jetty. Each Barge is electrically connected (Figure 12) to the switchgear utilising overhead conductors (overhead Line). The towers located on the barge and power transmission platforms are estimated at 27m tall with a span of about 35m to accommodate the rising and falling tides. Three 400kV powerlines conduct electricity, while the two elevated lines from the top of the towers are earthing conductors utilised to electrically bond the barge to the jetty and also to serve as lightning conductors.

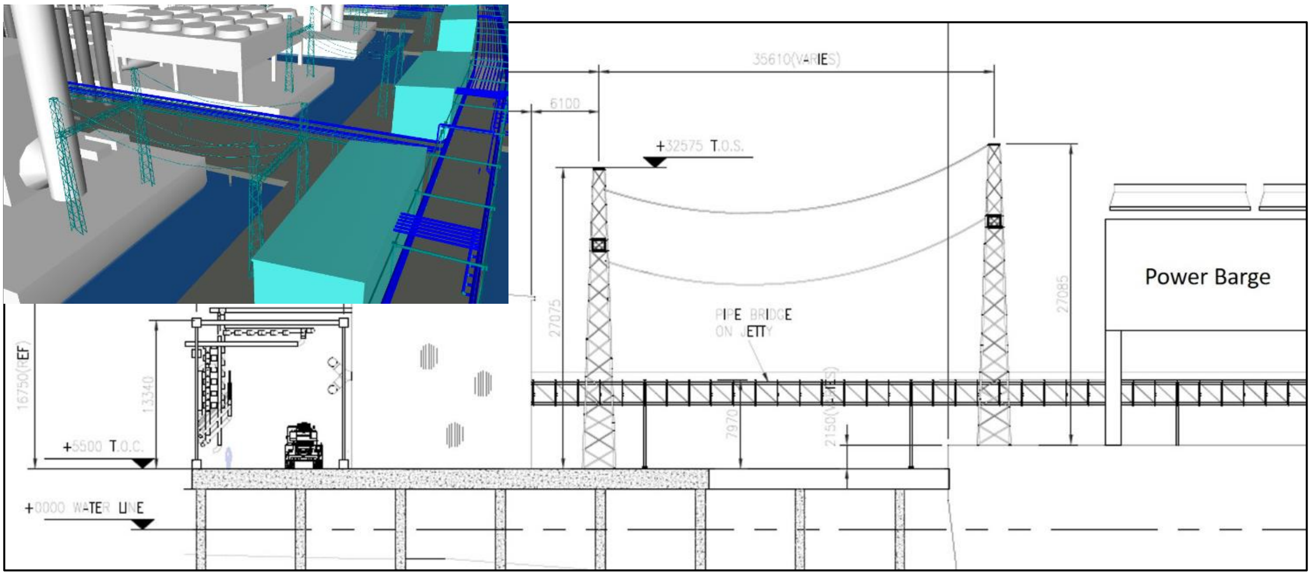


Figure 12: Conceptual electrical connection of the floating power barge to transformer platform on the power barge terminal with 3D schematic model (inset).

The NIFPP would operate 24 hours per day, 365 days per year with system 'inherent' availability being calculated as follows:

Table 2: CCGT and LNG Facilities Basic Operating Schedule

Item	Value	Unit
Annual Hours	8760	Hours
Less Un-scheduled Time (unforeseen)	175	Hours
Scheduled Time (ST)	8585	Hours
Idle Time ("no natural gas" periods)	0	Hours
Working Time (WT)	8585	Hours
Planned Maintenance (Pm)	430	Hours
Unplanned Maintenance (Um)	171	Hours
Available Time (AT = WT - (Pm + Um))	7984	Hours
Operational Delays	0	Hours
Operating Time (OT)	7984	Hours
Availability (AT/WT)	93	%
Utilization (OT/ST)	93	%
Use of Availability	99.5	%

2.3.4.1 Regasification technology (Nseleni Power Corporation (Pty) Ltd: 14/12/16/3/3/2/2032)

Regasification is a process of converting LNG at −162°C (−260°F) temperature to gas form at atmospheric temperature so that it can be combusted. The regasification facility is designed and engineered to meet the natural gas demand of the CCGTs. With an efficient combined cycle design, the regasification facility send-out requirement is approximately 80 MMscfd to support a 700 MW power generation Floating Power Barge. Each barge would have a dedicated regasification facility with 100% operational redundancy unit, located either on the floating barge itself or adjacent to it on the quay. The LNG bulk storage tank arrangements feature send-out pumps which are used to transfer the LNG via cryogenic pipes to the vaporizers/ regasification facilities. The regasification facility would be designed to utilise exhaust air from the CCGT through a glycol heat exchanger to provide initial heating of the LNG (Figure 13). Thereafter, the gas would be further heated with ambient air, to the required CCGT temperatures through a purpose-built, highly efficient vaporizer (Figure 13).

2.3.4.2 Combined Cycle Gas Turbine (CCGT) technology (Nseleni Power Corporation (Pty) Ltd: 14/12/16/3/3/2/2032)

The principle of operation of a CCGT is to capitalise on both the gas combustion process to drive a turbine as well as using, what would otherwise be waste heat, to drive steam turbines (Figure 13). This results in a recovery of 59-62% of the sensible heat. The efficiency will be further enhanced by cooling the inlet air to the gas turbine with the LNG (Figure 13). As air cools, it becomes denser meaning that more air can be drawn into the gas turbine for combustion, increasing the energy output and efficiency of the turbines. The gas turbine compresses air, delivers the compressed air to a combustion chamber where the LNG is introduced and burnt, resulting in very hot, high-pressure combustion gas. The hot high-pressure gasses expand through the power turbine (part of the gas turbine) rotating the turbine and producing electricity via an electricity generator. The turbine itself is broadly equivalent to a jet engine.

The hot exhaust gasses that have passed through the gas turbine are then used in a waste recovery boiler where demineralised water is heated to produce steam at a relatively high temperature and pressure. The steam is used to drive three stage steam turbines that each generate additional electricity (high, medium and low-pressure steam) (Figure 13). The steam leaving the low-pressure steam turbine will discharge into a condenser where all steam condenses back to liquid phase at a temperature of 25-40ºC and is then returned to the HRSG/ boiler for re-use (Figure 13). This closed-loop water cooling circuit uses water abstracted from the Port, treated to process water standards via desalination and demineralisation plants, as input water for the system, with minimal makeup water required on an *ad hoc* basis, with no discharge of heated water back into the receiving environment. The steam turbine condenser within this closed-loop circuit would then be cooled with ambient air cycled through fine tubes to enhance the heat transfer and recondensing of the steam. Residual hot exhaust gasses (between 80-90ºC) are then emitted through a 45-60m tall stack and/or directed to the LNG regasification facility (Figure 13). For the NIFPP CCGTs, there is no requirement to heat inlet air (which is often required for CCGTs operating in colder climates) as the ambient air temperatures during winter are always above the operating requirement of 4.4°C.

The use of natural gas as a fuel source has several advantages over other fuel types especially coal and oil, in that it is cleaner burning than the other hydro-carbon based fuel types with accordingly lesser air emissions and no solid waste products from the combustion process. Natural gas also results in the lowest greenhouse gas emissions of the three possible fuel types normally associated with power generation being, coal, diesel and heavy fuel oil.

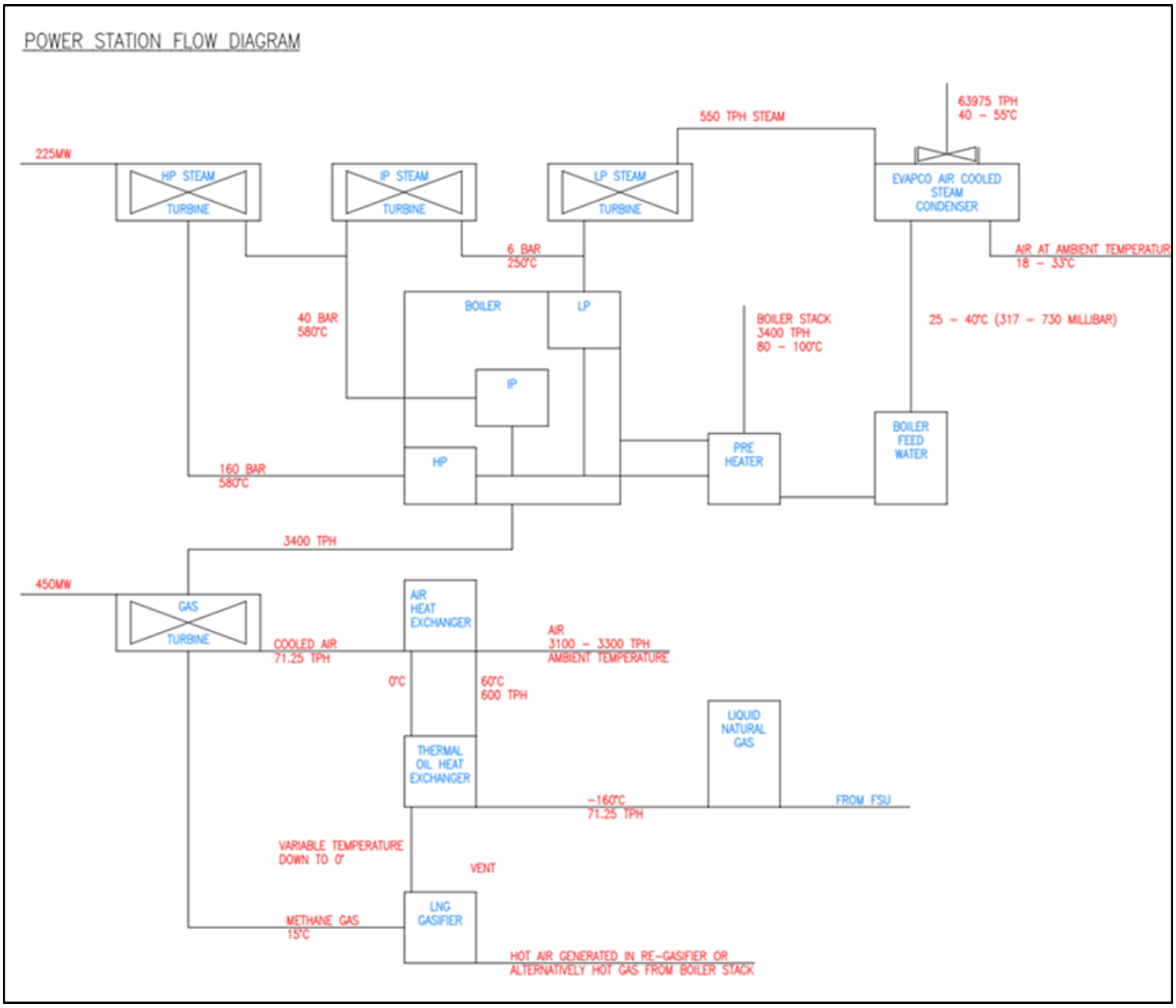


Figure 13: Schematic presentation of the Combined Cycle Gas Turbine (CCGT) within the NIFPP Floating Power Barges.

2.3.5 LNG PROCESS FLOW

The LNG process flow (Anchor Energy LNG (Pty) Ltd: 14/12/16/3/3/2/2033) is presented schematically in Figure 14.

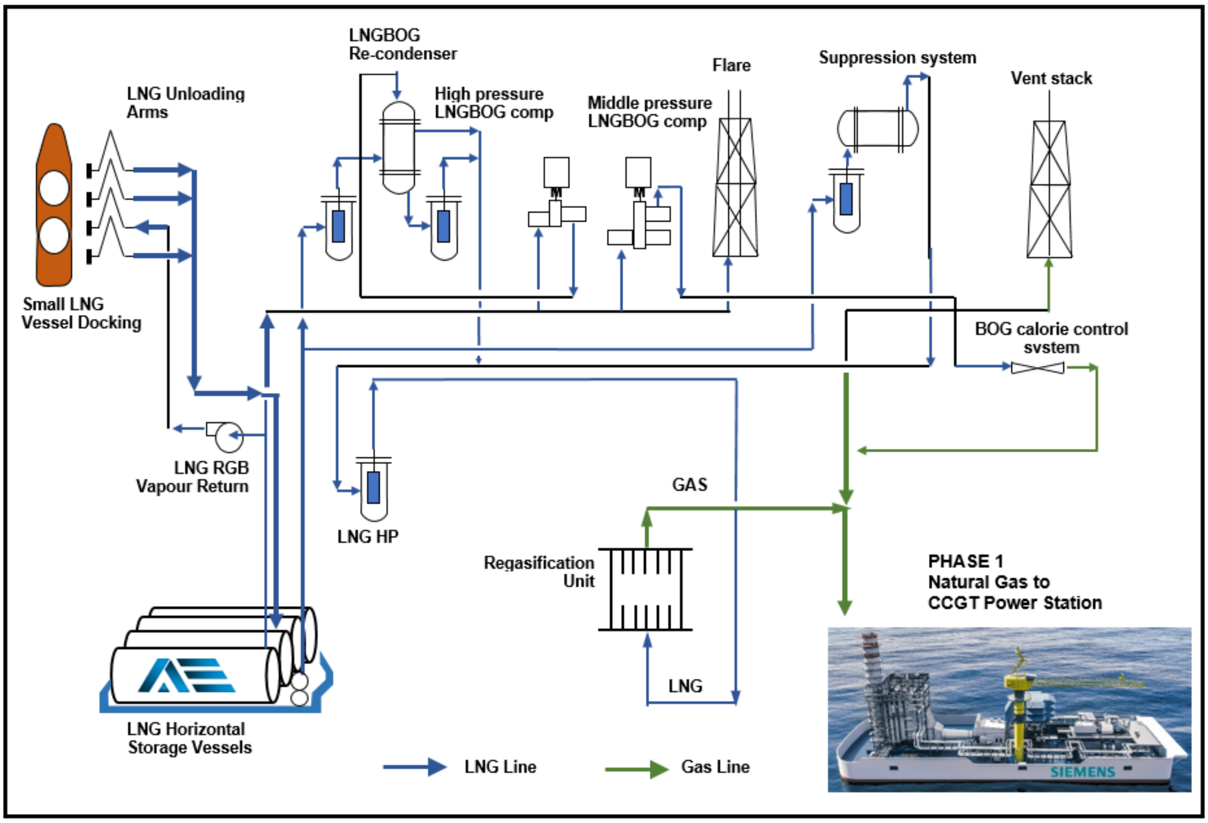


Figure 14: Schematic representation of the flow of LNG from the LNG FSU to the Floating Power Barges.

2.3.6 EXPORTING ELECTRICITY TO THE ESKOM NATIONAL GRID OR TO LOCAL THIRD-PARTY END USERS (NSELENI: 14/12/16/3/3/2/2032)

The electricity generated by the NIFPP would be transmitted from the power transmission platform (Figure 7) on the power barge terminal by way of a pipe and cabling bridge structure to a dedicated land-based substation and transmission switching yard (Figure 18) which would also be established as part of the project. The electricity is evacuated by way of a pipe and cabling bridge structure between the power barge terminal and the sub-station (refer to Appendix 4 for preliminary engineering designs). From the new substation, the electricity will be able to be transmitted either directly to local third-party end users or by means of wheeling via the Eskom national grid network. Voltages available from the new sub-station will conform to the full spectrum of Eskom voltages.

Box 3: What is a 'grid'?

A power transmission network is referred to as a "grid". Multiple redundant lines between points on the network are provided so that power can be routed from any power plant to any load centre, through a variety of routes, based on the economics of the transmission path and the cost of power. A transmission substation connects two or more transmission lines. The simplest case is where all transmission lines have the same voltage. In such cases, the substation contains high-voltage switches that allow lines to be connected or isolated for fault clearance or maintenance. Transformers are used to either step up the voltage for transmission (where the power is generated) or step down the voltage for distribution into a municipal supply or to individual users (where the power is used).

The network of high-voltage power lines linking the power station and/ or distribution sub-stations to the cities, towns, rural and residential areas where electricity is used is called the 'National Grid or Interconnected Grid' and an 'Independent Power Producer' (IPP) such as the proposed NIFPP, connecting to this grid is termed an 'Embedded Generator' (EG) i.e. a source of electricity in the grid.

2.3.6.1 Power Evacuation: Pipe and Cabling Bridge

Power evacuation will occur using gas-insulated transmission lines (GILs) (refer to Section 12.5.1.1 for more details) contained within a 12m W X 10.28m H box like structure (Figure 15). The box-like structure ensures that various safety requirements and standards are adhered to in terms of spacing between lines, and so forth.

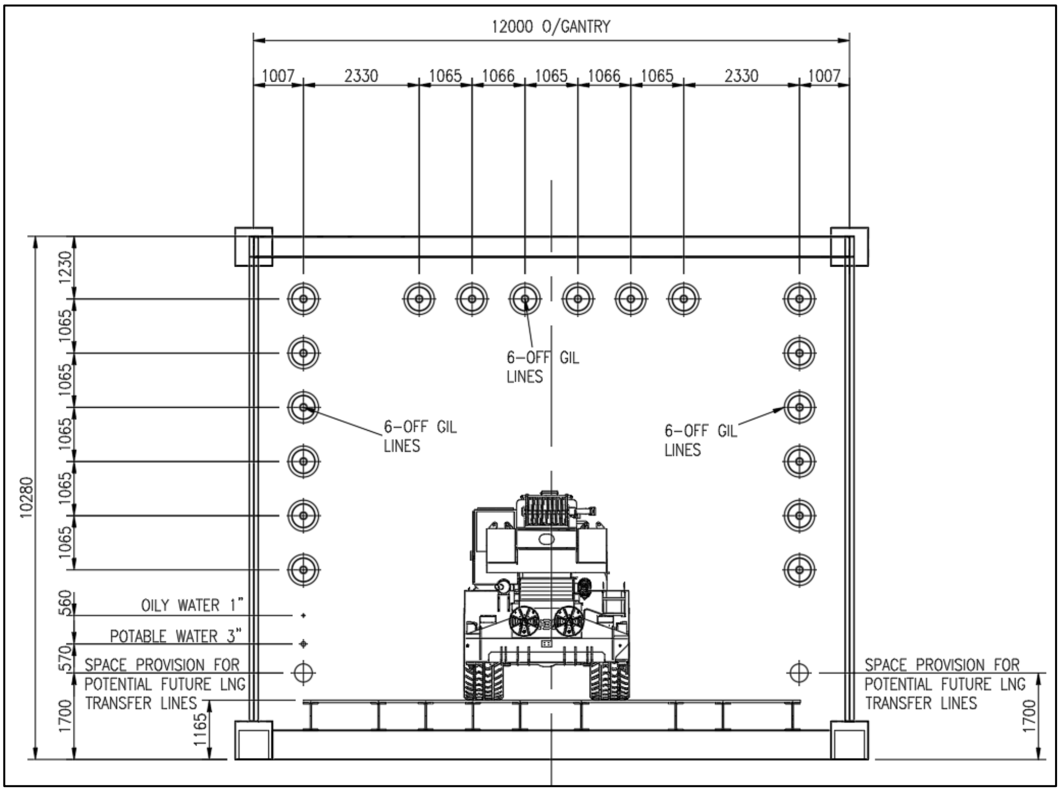


Figure 15: Schematic representation of the possible configuration of the 12m W x 10.28m H pipe and cabling box-like structure to evacuate power from the NIFPP to the new substation.

From the power barge terminal, the pipe and cabling bridge will be aligned and constructed in such a way as to minimise the impact on the sensitive Kabeljous Flats, mangrove forests, seral forest patches and estuarine environments on route to the new substation proposed to be located on the Bayside Aluminium smelter site[2]. More specifically, the pipe and cabling bridge would be:

- Supported on marine driven piles that are between 24 and 72m apart for the section from the power barge terminal to the 1st main anchorage chamber (AB) (Figure 16). This structure will be elevated at approximately 5.5mCD (4.3m AMSL) over the sandspit and Kabeljous Flats;
- From the 1st anchorage chamber (AB) to the Tower (T3) east of the mangrove forest edge, the pipe and cabling bridge structure will be suspended from two main cables of a catenary bridge structure (Figure 17) in order to span the western channel of the Kabeljous Flats associated with the strongest currents/ flows (a distance of some 350 m) (Figure 16);
- From Tower T3 the catenary bridge structure would continue to span the mangrove forest (≈720m) to the next Tower (T2) and then to Tower (T1) (≈480m over indigenous seral and mangrove forest patches) and finally over the Manzamnyama Canal (≈350m) to the main anchorage chamber in the west (located within the already disturbed footprint area of Bayside Aluminium) (refer to Figure 16). The pipe and cabling bridge would be approximately 20m above ground to clear the tops of the tallest mangroves at 12-18m;
- From the last anchorage (AA), the pipe and cabling bridge will again be supported on piles, at roughly 5.7m above ground, with spans of 24m between pile supports, to the new substation.

[2] Please refer to Section 0 for the proposed construction method.

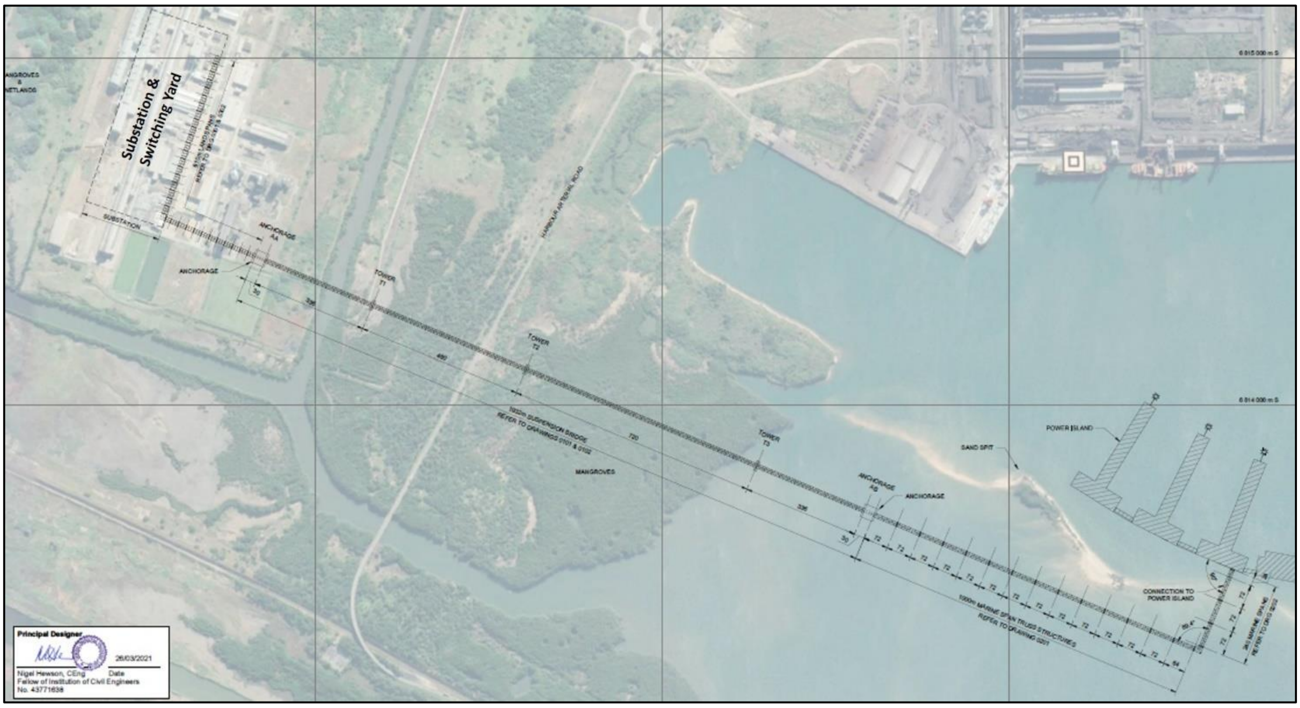


Figure 16: Route alignment and location of main anchorage chambers/ platforms and towers for the pipe and cabling bridge structure to evacuate power from the NIFPP to the land-based substation.

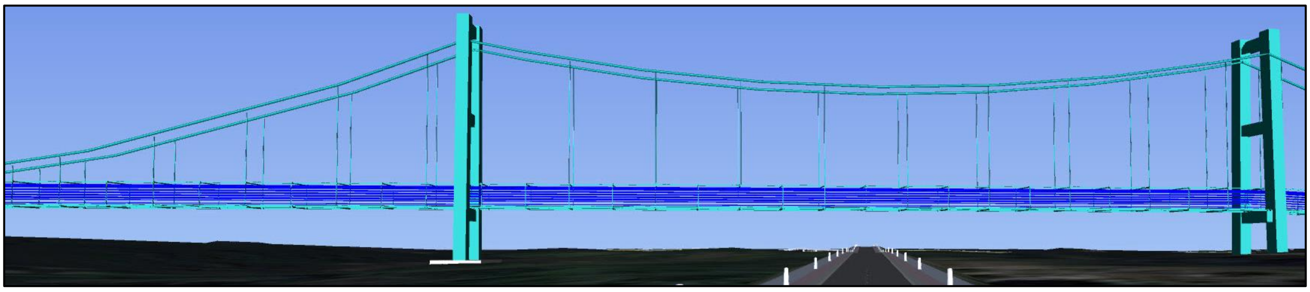


Figure 17: Graphic 3D representation of the catenary bridge structure from which the pipe and cabling bridge box structure is to be suspended for spanning over the mangrove and indigenous seral forest patches/ stands.

2.3.6.2 New Substation and Transmission Switching Yard

The new, on-land transmission substation (preferred location on the southern end of the existing, Bayside Aluminium site – refer to the Assessment of Alternatives in Section 12.3) would have an estimated maximum footprint of 13.5ha and feature voltage control/ power factor correction devices such as capacitors, reactors or static volt-ampere reactive compensators and equipment, such as phase shifting transformers to control power flow between the two adjoining power systems, as may be required, to convert the power generated at Medium Voltage (MV) for transmission to High Voltage (HV) (see Box 3 above).

2.3.6.3 Eskom National Grid and/or Third-Party End User Electricity Supply

Various options exist for the NIFPP to supply electricity generated to the end user. Eskom is undertaking a Grid Stability Study to determine the preferred power supply and tie-in requirements. The following main power supply opportunities exist (assessed in Section 12.4):

1. City of uMhlathuze Local Municipality – a combination of GILs and overhead lines would need to be established from the new substation to the Polaris substation north of Bayside, to provide an estimated 220MW of power (Figure 18).

2. Eskom National Grid supply:
    (a) As for point 1, via the Polaris substation and then via the existing 275kV overhead powerlines to the Impala substation to the west (Figure 18); and/or
    (b) GILs on a pipe gantry to the existing 132kV powerlines (from the Athene substation) and tie-ins into the existing structures between pylon towers (GILs to be placed within the current servitude of the 132kV powerlines into Bayside which are currently redundant – i.e. these powerlines will be removed and the same pylon footprints utilised as GIL structure pylon support structures); and/or
    (c) Upgrade two (2) of the existing 132kV powerlines (from the Athene substation) to 765kV powerlines – utilising the same footprints and installing larger towers/ pylons and upgrading the conductors.
3. Hillside Aluminium SA (Pty) Ltd (possible third-party end user for an estimated 1200MW) – GILs to connect the new substation to the existing overhead lines between hillside and Athene substation
    (a) Overhead powerlines to the Eskom Grid at the Hillside - Athene tie-in point in the south-western corner of Hillside Aluminium SA's property (north of the R34 John Ross Highway) (Figure 18); or,
    (b) GIL to the Hillside - Athene tie-in point in the south-western corner of Hillside Aluminium SA's property (north of the R34 John Ross Highway) (Figure 18); or,
    (c) GILs on a pipe gantry directly to Hillside Aluminium SA.

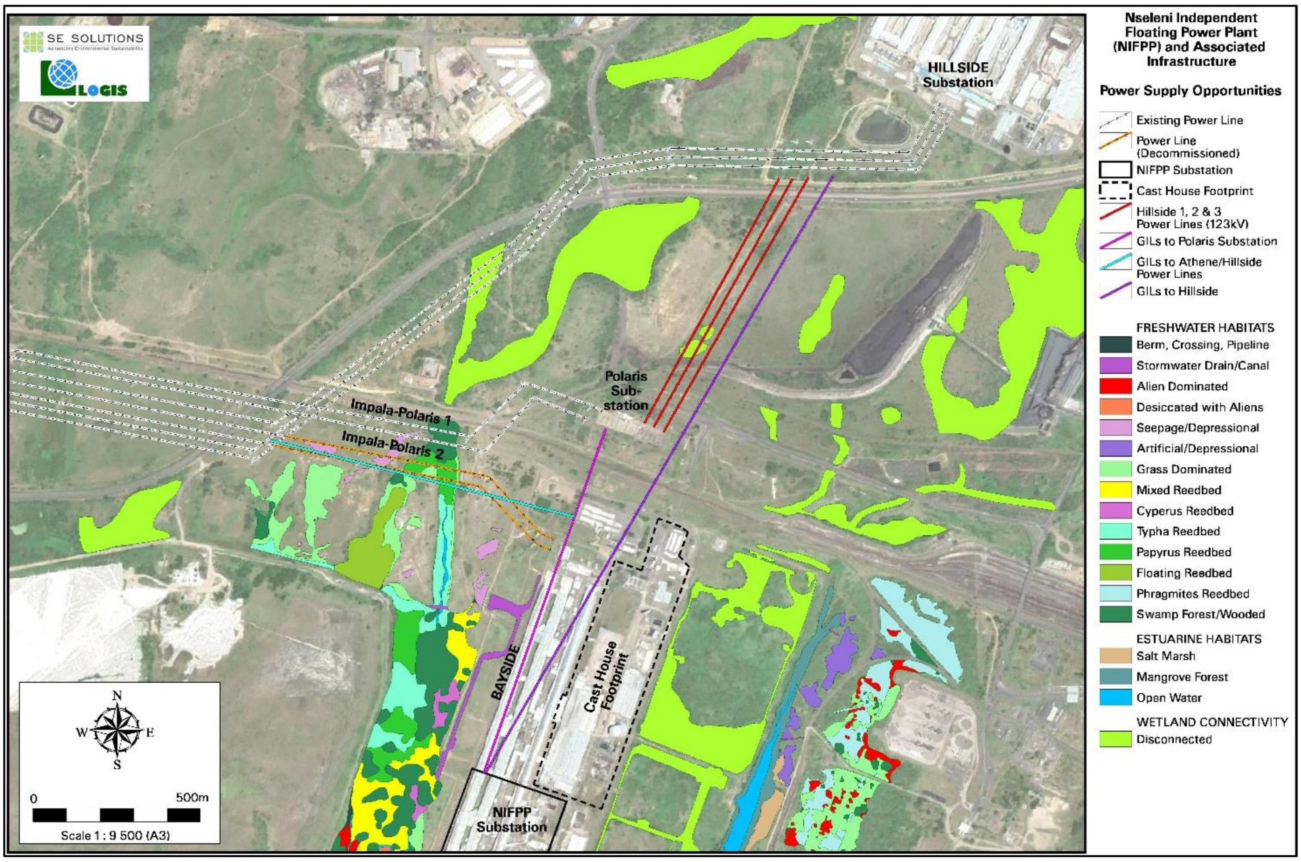


Figure 18: Preferred substation location and power evacuation opportunities to potential third-party end users.

2.3.7 LIGHTING REQUIREMENTS

The requirement on road surfaces (the Pipe & Cabling Bridge, as well as the same structure along the edge of the Power Barge Terminal and LNG Terminal) is 50 Lux (as for South African Highways). By having the lights as directional as possible, the maximum lux level of 10 can be predicted on the water (Figure 19). The clarity of the water will determine how much of the light is propagated into the water. To place the illuminance (or lux) in perspective, 10 lux is very low, a little more than the moon.

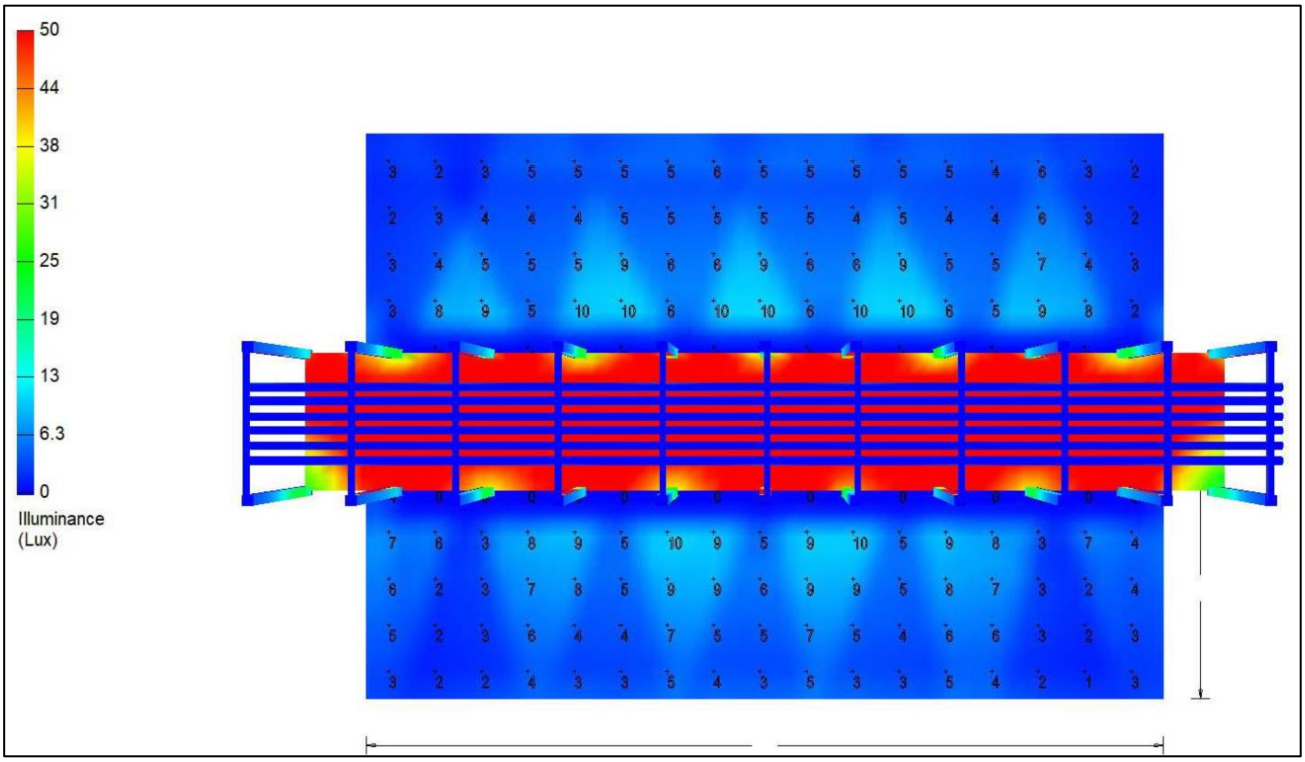


Figure 19: Illuminance (Lux) from lighting of a typical bridge structure over a water body.

There is also a requirement to light the Towers of the suspension bridge (Towers 1 – 3). These lights would probably shine upwards or onto the towers to assisting in avoiding collisions with these tall structures at night. The main anchorage chamber (AB) will also require a navigational light at the top of the structure.

Lights on the Power Island (power barge and LNG terminals) (Anchor Energy LNG: 14/12/16/3/3/2/2033):

- Lighting for safety reasons:
    - All mooring dolphins will have solar lights to sufficiently light up the mooring hooks to enable safe connection and disconnection of lines;
    - Mooring lights on the LNG offloading platforms to ensure that the areas where loading arms connect to vessels are adequately lit to identify leaks/problems/connections;
    - Probably small mast lighting along the front face of the General Service Area to assist with transfer of people and goods and also prevent people from walking off the edge at night. These can be installed to face away from the sand spit and water (i.e. onto the platform itself);
    - Sufficient light at the power barge jetty LNG connections; and,
    - Furthermore, there would be flashing navigational lights on the mooring dolphins for the power barge jetties (replacing the flashing mooring buoys) as well as realignment of the existing mooring lights (buoys) marking the channel on the LNG side.

Power Barges (Nseleni: 14/12/16/3/3/2/2032) and LNG Floating Storage Units (FSUs) and LNG Carriers (Anchor Energy LNG: 14/12/16/3/3/2/203):

- All vessels will be required to have their navigational lights on (indicating that they are in a moored state) at night. The same goes for any construction vessel/floating obstruction.
- These lights are small point sources (Red, Green and White) and does not contribute significantly to light emissions. This would be similar to the lights on the channel marker buoys currently lining the edges of the navigational channels.

- There will be lights on the mooring platforms for the power barges delineating the edge of the navigable areas. The LNG berth will rely on channel marker buoys (which is currently in place and need to be moved slightly). There is no need for permanent lights on these vessels as the danger area is clearly demarcated with the above.
- The power barge stack (45 -60m high) and power towers (27m high) may need navigational lights at the top of these structures, however the area is a no-fly zone so we could ask to waive this requirement.

Light usage during construction/working areas can be limited to be just sufficient to provide a safe working environment, depending on the activities being performed. Directional lighting will be specified so as to shield the sandspit from direct light sources.

Further mitigation measures that will be implemented during the detail design phase of the project includes:

- Adjustable lamps to ensure the lights are directed at the quays and bridge only;
- Use of LED lamps only;
- Shrouding the lamps in order to mask the light source; and,
- Reducing the light intensity on the bridge when there is no traffic on the bridge.

2.3.8 DREDGING OPERATIONS (ANCHOR ENERGY LNG: 14/12/16/3/3/2/2033)

Dredging will be required to -9.5m Chart Datum (CD), which will provide 1.0m clearance at the 1:100 year extreme low water level below the floating power barges. The LNG terminal will be dredged to -13.5m to provide a minimum clearance of the largest design vessel of 1.0m at the 1:100 year extreme water level (refer to the preliminary engineering dredging plan in Appendix 4). Please refer to Section 10.5 for details pertaining to dredging operations as well as to Section 12.6 for a brief summary of the dredge spoil disposal alternatives considered.

2.3.9 WATER TREATMENT FACILITY (ANCHOR ENERGY LNG: 14/12/16/3/3/2/2033)

Water will be abstracted from the Port, desalinated, and potable water will be supplied to the Power Barges and other users, for instance safety showers, ablution facilities, kitchen etc. All process affected water will be collected and returned to the Water Treatment Facility where it will be polished and returned to the process for re-use. The effluent, mainly desalination brine and other salts removed through demineralization and cleaning processes, will be discharged through the municipal outfall pipeline in a partnership agreement with Mhlathuze Water (refer to Appendix 3 for the in-principal agreement). Please refer to Appendix 4 for preliminary engineering layout plans for the Water Treatment Facility.

2.3.9.1 Water Abstraction & Desalination Plant

Water would be abstracted from the Port and treated in a desalination plant, based on Reverse Osmosis (RO) technology, to potable water quality. Two submersible pumps (1 duty x 1 standby) complete with intake straining screens will be located below the General Service Area/ Jetty. The screens will consist of an approximately 10m long, 500mm diameter solid section with drilled holes over the last 1m. The bottom of the pipe will be capped to prevent water from being sucked in vertically. The intake water will therefore be taken between -5.5m and -4.5m CD (on average 6m below the surface at MSL). The screen will consist of 5mm diameter holes drilled on the pipe to give an average porosity of 50%. With this arrangement the horizontal flow velocity through the screen will be limited to 0.06m/s. The screens will be manufactured from copper nickel alloys to prevent biofouling.

Approximately 1 332 689m^3 of water will be abstracted annually, estimated at a maximum of 3 651.2m^3 per day (taking into account an estimated 15.5m^3/h of water will be lost to the atmosphere via evaporation). The floating power barges require approximately 67.5m^3/hr (at full capacity, i.e. 12 power barges) and an estimated 2m^3/hr is required for all other potable water needs on-site. To balance the average and peak instantaneous demand of demineralised water on the barges, provision for a set of buffer tanks between the Desalination Plant and demineralisation units has been made.

Two buffer tanks store up to 6 hours of water (2 x 225m^3) at any given time for phase 1 of the project and a third tank will be included to allow enough capacity when operating all 12 barges.

Based on a rejection ratio of 54% for the desalination plant, ≈ 82.6m^3/hr (or ≈723 576m^3 per annum) of brine (i.e. membrane waste water) from the Reverse Osmosis treatment process, will be discharged into the Mhlathuze Water Sea Outfall Pipeline via the on-site WWTP.

2.3.9.2 Waste Water Treatment Plant (WWTP)

All collected wastewater will be fed through an oil separator then into the Wastewater Treatment portion of the Water Treatment Facility. Waste water will typically arise from the following sources:

- Power Generation Barges & LNG Floating Storage Units (contaminated water from below decks);
- Workshop/ Warehouse;
- Electrical Switchgear/ Transformers/ Emergency Power Generators; and,
- Administration Building/ Control Centre.

It is estimated that ≈ 1 296m^3 of waste water per day (additional to the desalination brine - 52.0m^3/h from the power generation circuit (bled to control water quality due to total dissolved solids, etc.) and 2m^3/h from other facilities) may be generated during operations. Some waste water is recycled for plant wash downs. The CCGT equipment package would include an "on-line" cleaning/ wash system that enables cleaning of the compressor section of the engine during full power operation. The water wash equipment is mounted on the auxiliary module that is provided with a weather protection enclosure. The same system reservoir and piping are utilized for off-line soak washing. There would be no uncontrolled discharge of cleaning water, with dirty water pumped to the WWTP.

A waste water/brine pipeline would be attached to the pipe and cabling bridge and connect to the existing Mhlathuze Sea Outfall Pipeline (either directly, north of Bayside, or via the existing infrastructure within Bayside Aluminium). A maximum of 137m^3/hr will be discharged to the Mhlathuze Sea Outfall Pipeline (1 196 909m^3/annum).

2.3.10 STORMWATER MANAGEMENT

As the project is located over water, all surface water (clean water) will runoff the physical structure (i.e. terminals, quays, barges, etc.) into the estuarine waters of the Port – as is the case with any sea based structures. However, there will be areas which would be considered dirty water areas due to the activities undertaken within those areas (for example: the Water Treatment Facility). All stormwater from the Water Treatment Facility will be treated as dirty water and treated in the WWTP and either re-introduced as process water or discharged via the Mhlathuze Water Sea Outfall Pipeline. Any oils/ residues would be incinerated (refer to Section 2.1.9 below). The oily water from the transformer bays of the substation and switching yard will be collected and disposed of by a reputable service provider.

2.3.11 WASTE MANAGEMENT

Wastes will be incinerated by means of the onsite containerised incinerator (Figure 20) located on the General Service Area on the Power Barge Terminal. The incinerator will be a small-scale operation to deal with minimal waste generated during the operational phase. Design capacity will not exceed the incineration of 10kg of general and/or hazardous wastes per day. Typical wastes to be incinerated include:

- Office wastes (that which cannot be readily recycled); and,
- Solid waste fraction from the WWTP (hazardous waste).

A 15-55kg/hr incinerator (i8-20G General Incinerator) was selected to meet the duty requirements; the unit would be run (excluding heat-up/start-up requirements) for approximately 1.5 - 4.5 hours per week. The i8-20G General Incinerator of Inciner8 uses low NOx burners and is fitted with a secondary chamber that retains and re-burns the exhaust gases for a minimum of 2 seconds at 850⁰C to meet typical EU guidelines. The possibility to interconnect with the flare system will be evaluated during the design phase of the project. Three (3) 6m dry waste storage containers will be positioned next to the incinerator container. One (1) container for hazardous waste and two (2) containers for non-hazardous waste. Approximate storage volume will be 20m3 per container (at 60% of the total container volume).

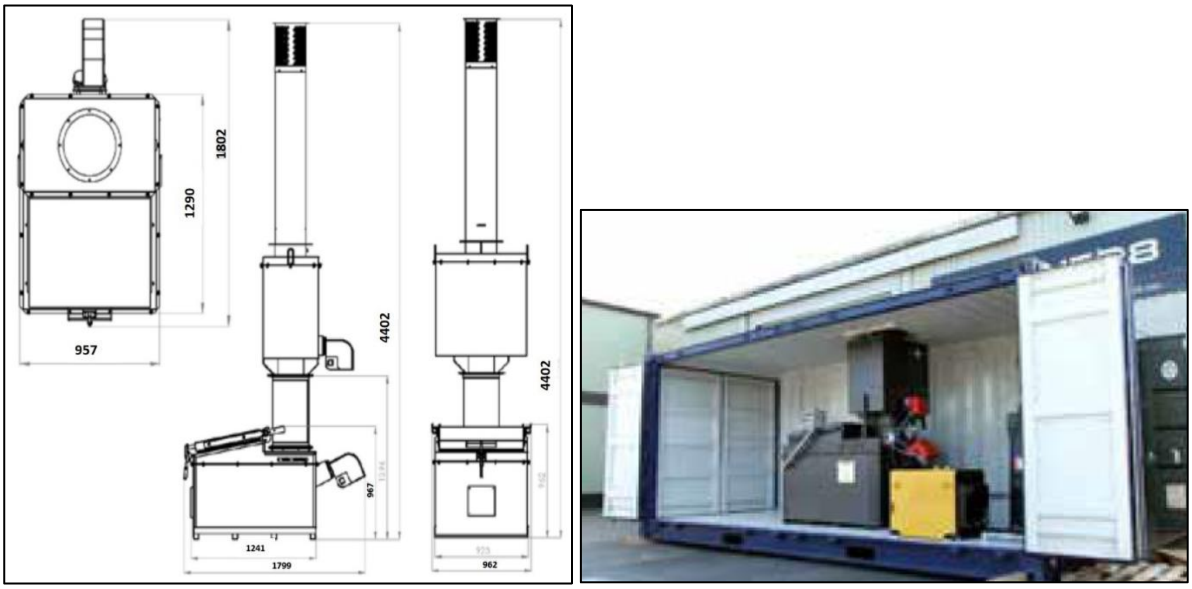


Figure 20: Schematic illustration of a containerised incinerator proposed for on-site solid waste management (max height of 4.4m).

Due to the small volumes of waste envisaged, the incinerator will not require an Atmospheric Emissions License (AEL) in terms of NEMAQA (refer to Section 5.5).

2.4 INHERENT ENVIRONMENTAL AND SOCIAL MANAGEMENT CONTROLS FOR LNG AND CCGT

In general terms the use of natural gas is considered to be more environmentally suitable than other forms of fossil fuel power generation, most notably coal and oil/diesel. This is because natural gas is generally clean burning (it has less impurities and a lower carbon content which means it has less carbon dioxide emissions), does not result in a waste, such as ash (in the case of coal combustion) and is much cleaner to handle than oil or diesel (in respect of spills, for example). That notwithstanding there are certain environmental controls that are an essential part of natural gas as a fuel source and that would be included in the design and construction of the proposed NIFPP CCGT, LNG Storage and Regasification facilities.

2.4.1 SAFETY (ANCHOR ENERGY LNG: 14/12/16/3/3/2/2033)

2.4.1.1 Safety zones and safety equipment

While an LNG vessel is moored at the LNG Terminal, the waters and waterfront surrounding the LNG Terminal, located within a defined boundary, will be demarcated as a safety zone to avoid potential collision from passing traffic. The dimensions of this zone are under review to provide optimum safety for the moored carrier with minimum disruption to other port traffic. Internationally, LNG berths and activities worldwide, are governed by strict safety zones and codes of practice. For the facility in the Port of Richards Bay, safety zones will be defined during detailed design.

The vessel-handling safety features include sophisticated radar and positioning systems that alert the crew to other traffic and hazards around the ship. Also, distress systems and beacons automatically send out signals if the vessel is in difficulty. The cargo-system safety features include an extensive instrumentation package that safely shuts down the system if it starts to operate outside of predetermined performance parameters. Vessels are also equipped with gas- and fire-detection systems. At on-quay facilities, safety features include methane detectors, Ultraviolet or Infrared fire detectors, and closed-circuit TV.

2.4.1.2 LNG spill control

The flammability of natural gas, even though it cannot ignite in liquid form, is probably the most important environmental and social consideration that must be incorporated in the design of the proposed project. The safety of both staff working at the facility and people outside of the facility is paramount. LNG hazards are usually analysed in three phases:

- Source term (how much LNG would convert into gaseous form and thus become a potential combustion/ explosion hazard);
- Dispersion (the transport of the gas by atmosphere); and,
- Effect (fire damage or pressure wave from explosion).

LNG leakage or spill is prevented by utilising a vacuum enclosure around the LNG pipe. Any release in LNG into the vacuum or rupture of the outer vacuum shell will be detected by fibre-based temperature monitoring devices. This will mitigate the risk of an undetected leak or spill.

Spilled LNG (a pool) would initially boil very rapidly with the vaporization rate controlled mainly by the heat flux into the pool from the underlying medium. If the pool is contained the medium beneath it would cool and the heat flux would diminish with time, leaving a still very hazardous pool but vaporizing slowly. If the pool is not contained, then the LNG would spread over a larger area of relatively warmer medium and rapid boiling would continue. Gas production thus increases with increasing surface area of the pool, again emphasising the importance of secondary containment to manage a potential spill. A natural gas cloud so formed is cold, concentrated and flammable and as part of the design calculations safety zones around the CCGT and the LNG Terminal would be determined. In addition, and as presented in the project description there are multiple international standards that serve to ensure a very low risk indeed of a release of LNG with high levels of redundancy being built into the design. This implies that while the consequence of an LNG spill is potentially severe, the probability of it happening, and indeed the probability of formation of a gas cloud that ignites is very low indeed.

It should also be remembered that while worker and community safety is the most important driver of the various safety controls, the CCGT and the LNG storage and regasification facilities are high costs items that cannot be risked to fire or explosion damage. The loss of LNG also constitutes the loss of valuable product so there are both social and financial drivers for ensuring plant safety.

2.4.1.3 Fire protection

The CCGT power station (Nseleni Power Corporation (Pty) Ltd: 14/12/16/3/3/2/2032) would include a factory installed fire protection system complete with optical flame detection, hydrocarbon sensing and thermal detectors, piping and nozzles in both generator and engine compartments. The fire protection system would include cylinders containing CO_2 with standby power for the fire protection system. All alarms and shutdowns would be enunciated at the unit control panel. An alarm would sound at the turbine if the gas detectors detected high gas concentrations, or if the system was preparing to release CO_2. When the emergency system is activated, the CCGT power station would shut down. The primary fire prevention CO_2 cylinders would be discharged into the turbine and generator compartments via multiple nozzles, and the ventilation dampers would automatically close. After a time delay a slow, extended discharge of CO_2 would occur.

Fire protection at the LNG terminal (Anchor Energy LNG (Pty) Ltd: 14/12/16/3/3/2/2033) includes the following:

- When an LNG vessel ties up at the terminal to transfer its cryogenic cargo, shipboard detection and Emergency Shutdown Systems (ESS) connect with those on shore so that they act an integrated system. If anything goes wrong either on the ship or in the facility, alarms would sound and the loading or off-loading procedure would be shut down automatically.

- Both the vessel and the facility have gas sensors to detect the presence of natural gas or a lack of oxygen. Other sensors would detect changes in temperature. Heat detectors would alert everyone to a possible fire while very low temperatures would indicate a possible LNG leak, triggering both an alarm and the ESS.
- Other sensors would monitor the tension on the mooring lines from the vessel to the facility dock. Any surge in tension that might part the lines (such as from the surge of a passing ship) would send the alarm and trigger the ESS.

The large product loading arms have a quick disconnect device built in. These Powered Emergency Release Couplers (PERCs) close ball valves on both sides of the coupler thus stopping flow rapidly. The coupler would then separate allowing the loading arms to retract away from the vessel while leaving the other half of the PERC valve attached to the vessel's manifold. Both halves of the PERC would have a closed ball valve at the end of the piping to prevent any flow.

An LNG vapour cloud fire cannot be extinguished with water, Dry Chemical will be required. Firefighting water is important in an LNG vapour cloud fire, for example for keeping a vapour cloud away from a source of ignition. Within the facility there would also be High Expansion Foam Generators to flood LNG retention areas with a blanket of foam.

In the facility the US Code of Federal Regulations (CFR) 49, Part 193 requires certain dry chemical firefighting equipment and supplies be installed. The following applies to dry chemical systems:

- Each marine transfer area for LNG must have a dry chemical system that provides at least two dry chemical discharges to the area surrounding the loading arms, one of which must be:
  - From a monitor (see Box 4); and,
  - Actuated and, except for pre-aimed monitors, controlled from a location other than the monitor location.
- The dry chemical system must have the capacity to supply simultaneously or sequentially each hose or monitor in the system for 45 seconds.
- Each dry chemical hose station must have at least one length of hose that—
  - Is on a hose rack or reel; and,
  - has a nozzle with a valve that starts and stops the flow of dry-chemical.

Box 4: Fire-fighting Monitors
A fire-fighting monitor is the 'cannon' that is used to spray firefighting chemicals onto a fire as shown in the picture. Such monitors are typically deployed where there is the risk of hydrocarbon fires and the need to deliver large volumes of fire-fighting chemicals in a short space of time.

The International Maritime Organization sets the requirements for firefighting equipment aboard LNG ships. The organisation requires that:

- Fixed, dry chemical powder is fitted for firefighting in the exposed cargo area with at least two hoses or monitors capable of reaching the manifold area;
- Monitors have a discharge rate of not less than 10 Kg/sec and a range of 10 to 40 meters depending on capacity;
- Hoses have a discharge rate of at least 3Kg/sec with the rate designed so one man can operate; and,
- There are two independent systems with remote control monitors to cover the manifold area and sufficient powder storage for a minimum discharge time of 45 sec.

In addition to this, several areas aboard ship will have inert-gas systems to flood enclosed spaces in the event of a leak. Water mains aboard LNG ships must operate on a higher-than-normal pressure to give a better water spray pattern to protect and cool exposures.

2.4.2 NITROGEN OXIDES (NO_X) EMISSIONS (NSELENI: 14/12/16/3/3/2/2032)

2.4.2.1 Low NO_x burners

Emissions of nitrogen oxides is an important atmospheric emission. Reducing NO_x emissions in the gas turbine is affected by the use of low NO_x burners (Dry Low Emission) that control NO_x by burning at slightly lower temperatures than those that are optimal for NO_x formation. Should higher levels of NO_x control be required then additional controls such as selective catalytic reduction could be used but this is not expected to be required to comply with the Minimum Emissions Standards (MES).

2.4.2.2 Selective catalytic reduction

Selective Catalytic Reduction (SCR) system within the HRSG reduces nitrogen oxides and/ or a catalyst to remove carbon monoxide. The inclusion of an SCR dramatically affects the layout of the HRSG. NO_x catalyst performs best in temperatures between 650 °F (340 °C) and 750 °F (400 °C). This usually means that the evaporator section of the HRSG would have to be split and the SCR placed in between the two sections. Some low temperature NO_x catalysts have recently come to market that allows for the SCR to be placed between the Evaporator and Economizer sections (350 °F - 500 °F (175 °C - 260 °C)).

2.4.3 PARTICULATE MATTER (PM) EMISSIONS (NSELENI: 14/12/16/3/3/2/2032)

The CCGT would feature a modular, three-stage filtration system consisting of inlet screens, an EU4 pre-filter and an EU7 final barrier filter. The filtration system removes more than 99.9% of all particles 5.0 micron and larger. Subject to good design and building air tightness, this filtration approach is therefore potentially effective in reducing the higher end of respirable particle concentration.

2.4.4 NOISE (NSELENI: 14/12/16/3/3/2/2032)

The CCGT Power Station would feature weather-proof acoustic enclosures that are mounted over the equipment. The enclosure provides guaranteed average noise emission of 85 dB(A) at 1 m distance measured at 1.5 m above grade in a free field condition, during full load operation although noise levels could be higher during equipment start up. A sound pressure of 85 dB(A) is the maximum tolerable noise pressure level for occupational exposure.

2.4.5 ENERGY SAVING MEASURES

A variety of measures would be used to maximise energy efficiency. As previously described an optimised heat balance would be developed for the entire system drawing heat, where required from the combustion of the natural gas, or cold, from the LNG. As the pipeline network of the NIFPP LNG Terminal does not feature underground storage systems that are typically found in the USA and Europe, it is necessary to absorb seasonal and hourly temperature fluctuations on the LNG Terminal. In order to mitigate possible restrictions due to the minimum send-outflow rate, the LNG BOG condensing rate would be kept as low as possible. As the process to pre-cool BOG can keep the LNG BOG condensing rate at a low level, the limitation due to the minimum send-out requirement can be mitigated.

2.4.6 PERFORMANCE REQUIREMENTS

Specific performance requirements that need to be met by the proposed power plant are listed in Table 3. These performance requirements have been derived from the World Bank Group's EHS Guidelines (both the General EHS Guidelines and for Thermal Power) as well as the South African national standards as set by the relevant Competent Authority.

Table 3: Performance requirements to be met by the proposed project (Nseleni: 14/12/16/3/3/2/2032).

Parameter	Pollutant	IFC EHS Guidelines		NEMAQA MES*	
		Limit	Units	Limit	Units
Atmospheric emissions	SO_x	N/A	mg/Nm³	400	mg/Nm³
	PM	N/A	mg/Nm³	10	mg/Nm³
	NO_x	240***	mg/Nm³	50	mg/Nm³
	Total VOC (Volatile Organic Compounds) from vapour recovery/ destruction units using thermal treatment			150	mg/Nm³
	Total VOC from vapour recovery/ destruction units using non-thermal treatment			40 000	mg/Nm³
Effluent	pH	6-9			
	Total Suspended Solids (TSS)	50	mg/l		
	Oils and grease	10	mg/l		
	Total residual chlorine	0.2	mg/l		
	Total chromium	0.5	mg/l		
	Total chromium VI (as CrVI)				
	Copper	0.5	mg/l		
	Zinc	1.0	mg/l		
	Iron	1.0	mg/l		
	Lead	0.5	mg/l		
	Cadmium	0.1	mg/l		
	Mercury	0.005	mg/l		
	Arsenic	0.5	mg/l		
	Cyanide				
	Fluoride				
	Ammonia (ionised & un-ionised) as Nitrogen				
	Nitrate/ Nitrite as Nitrogen				
	Temperature increase	Site specific	°C		
	Dissolved Oxygen				
	Electrical Conductivity (mS/m)/ Salinity				
	Faecal Coliforms				
Day-time noise&	Residential, institutional and educational receptors&&	55	L_{aeq} (dBA)		
	Industrial	70	L_{aeq} (dBA)		
Night-time noise&	Residential, institutional and educational receptors&&	45	L_{aeq} (dBA)		
	Industrial	70	L_{aeq} (dBA)		

* National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) National Emission Standards – refer to Section 3.5 below for the detail.
** NWA SAWQG for Coastal Marine Waters**:** Department of Water Affairs and Forestry (1995) South African Water Quality Guidelines For Coastal Marine Waters: Volume 1 - Natural Environment. Pretoria, South Africa – this does not apply as nothing will be discharged into the estuary.
***Dry gas at 3% excess O_2 content
> 80-90% saturation
@ Waters should not contain concentrations of dissolved nutrients that are capable of causing excessive or nuisance growth of algae or other aquatic plants or reducing dissolved oxygen concentrations below the target range indicated for Dissolved oxygen.
& The IFC states that noise impacts should not exceed the levels presented, **or** result in a maximum increase above background levels of 3 dBA at the nearest receptor location off-site (IFC, 2007).
&& IFC noise level guidelines for residential, institutional and educational receptors correspond with the SANS 10103 guidelines for urban districts.

2.5 PRELIMINARY CONSTRUCTION METHODOLOGY

2.5.1 MARINE INFRASTRUCTURE (LNG & POWER BARGE TERMINALS) (ANCHOR ENERGY LNG: 14/12/16/3/3/2/2033)

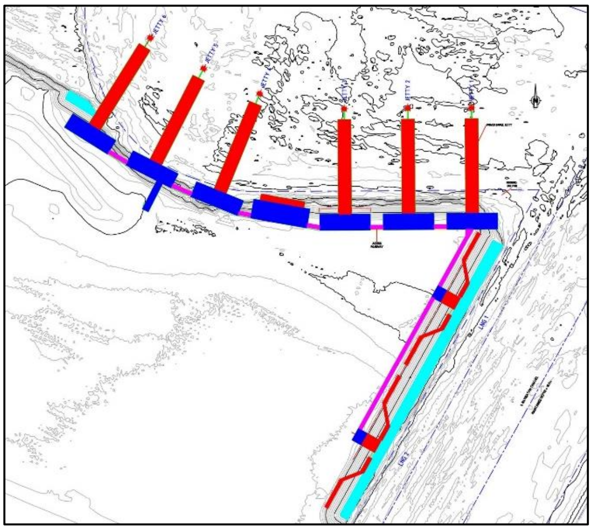
The construction methodology and timeline presented have had to be based on certain assumptions. There are various construction techniques for certain facilities and theses shall be decided by winning bidders. It is expected that the construction methodologies would be similar to that presented in this section, but details may vary depending on what is available at the time. The following has been assumed in developing the methodology and schedule:

- The contractor would have access to at least four floating cranes with suitable piling equipment;
- Four “land based” cranes capable of driving piles from previously installed structures are available with the associated piling equipment and teams;
- Sufficient barges are available to supply both piles, precast concrete and concrete to both the floating and “land based” installation crews as required;

- The barge jetty closest to the start of the power evacuation pipe and cabling bridge structure will be constructed first to enable this jetty to serve as a construction laydown area for the construction of the pipe and cabling bridge;
- All marine infrastructure required for Phase 1 (4 barges) to be completed in 24 months, while all marine infrastructure for Phase 2 will be completed within 28 months; and,
- A crane crew can install 8 x 9m x 9m cells in one month (15 piles), which includes the precast planks and decking.

For ease of interpretation, the various marine infrastructure components are colour coded to indicate the assumed construction methodologies associated with a specific colour and to reflect progress during the 28 month construction period.

- Red: Construction using floating crane/ jack-up barge for driving piles, placing precast elements and casting concrete;
- Blue: Construction using conventional ("land based") cranes where the crane is standing on previously constructed areas to install adjacent piles, precast elements and cast *in situ* concrete;
- Magenta: Areas where either specialist piling equipment will be required (such as a travelling crane gantry) or smaller temporary jetties to support in-piling and installation of these sections. The temporary structures are removed immediately after placing the section and most probably comprise smaller steel piles with a steel frame to support the piling crane; and,
- Light Blue: Dredging (completed within ≈ 2 months).



2.5.1.1 Marine Piling Requirements

Table 4: Estimated number of piles for the marine infrastructure associated with the LNG & Power Barge Terminals

Structure	Piles per Structure	No of Structures	Total No of Piles	Estimated Diameter (m)	Estimated Penetration (m)
LNG Terminal - Unloading Platform	45	2	90	0,95	37
LNG Terminal - Berthing Dolphins	8	8	64	1.2 and 1.35	40
LNG Terminal - Mooring Dolphins	8	12	96	1,3	35
LNG Terminal - Walkway Supports	4	4	16	0,5	30
LNG Terminal - Pipe and Roadway Bridge Sect 1	46	1	46	0,85	40
LNG Terminal - Pipe and Roadway Bridge Sect 2	20	1	20	0,85	40
Transformer Platforms	102	6	612	1,2	40
Power Barge Jetties	150	6	900	1,2	40
Power Barge Jetties - Mooring Dolphins	10	6	60	1,2	35
General Service Area Platform	163	1	163	0,95	35
Power Barge Jetties - Pipe & Roadway Bridge Sect 1	6	1	6	0,85	40
Power Barge Jetties - Pipe & Roadway Bridge Sect 2	6	1	6	0,85	40
Power Barge Jetties - Pipe & Roadway Bridge Sect 3	6	1	6	0,85	40
Power Barge Jetties - Pipe & Roadway Bridge Sect 4	6	1	6	0,85	40
Power Barge Jetties - Pipe & Roadway Bridge Sect 5	9	1	9	0,85	40
Power Barge Jetties - Pipe & Roadway Bridge Sect 6	9	1	9	0,85	40

Total number of piles is estimated at 2109.

2.5.1.2 Construction sequencing

Snap shots of the construction sequence are provided at 6-month intervals during construction. The contractor may alter the sequence to suit his construction equipment, so this should be treated as indicative.

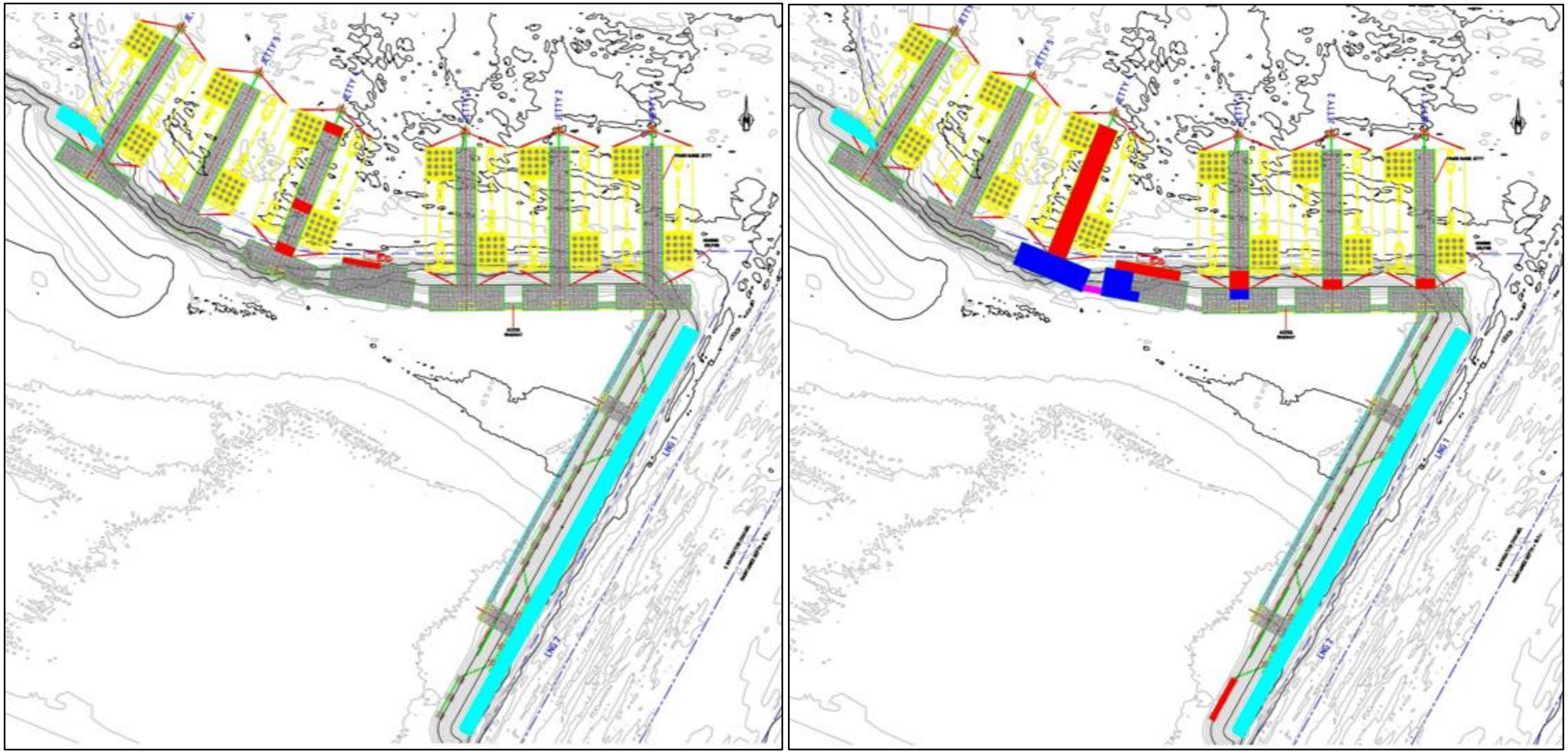


Figure 21: Month 1 (left) and Month 6 (right) reflecting the construction phase sequencing of activities for the establishment of the marine infrastructure in support of the NIFPP.

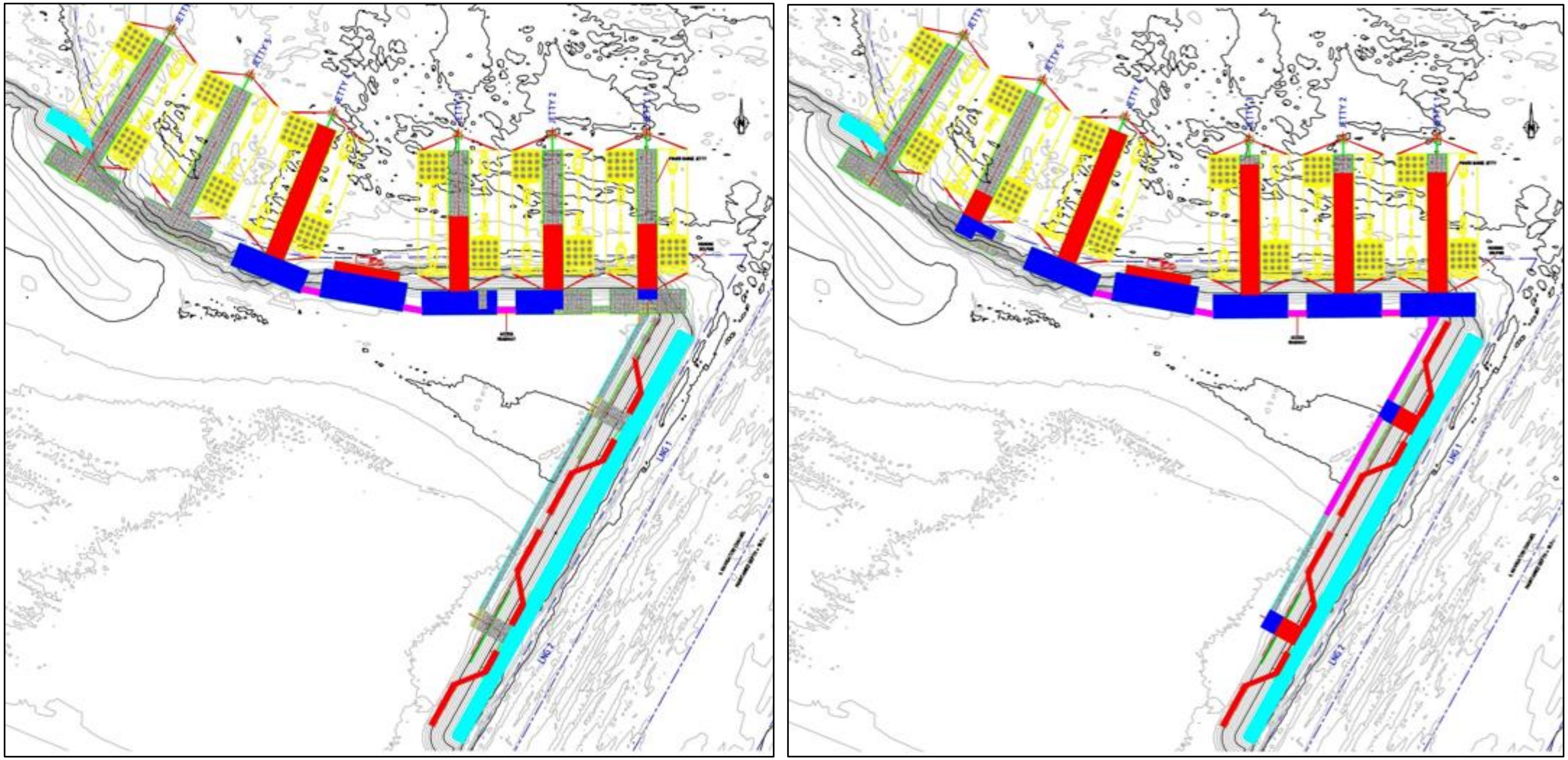


Figure 22: Month 12 (left) and Month 18 (right) reflecting the construction phase sequencing of activities for the establishment of the marine infrastructure in support of the NIFPP.

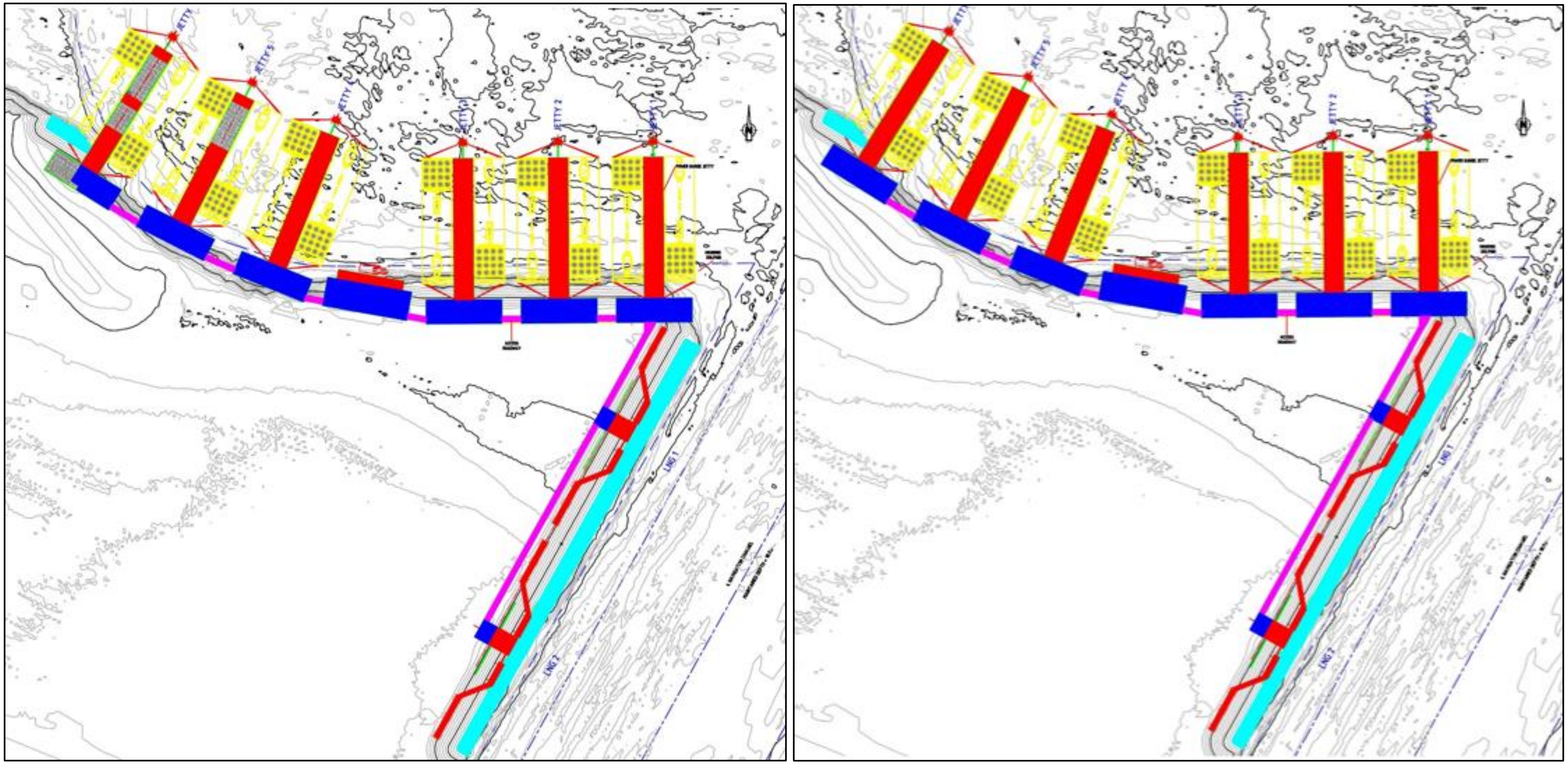


Figure 23: Month 24 (left) and Month 27 (right) reflecting the construction phase sequencing of activities for the establishment of the marine infrastructure in support of the NIFPP.

2.5.2 POWER EVACUATION PIPE & CABLING BRIDGE STRUCTURE (NSELENI: 14/12/16/3/3/2/2032)

The temporary causeway (Figure 24) will be constructed, within 5 months, as follows (to be refined once the relevant Contractor has been appointed, however, the conditions within the EMPr are to be adhered to):

- From the power barge terminal, drive 2 piles (≈800mm in diameter) an estimated 35-45m into the substrate using vibration-in piling method, and lift in the steel frame. The piling rig can then "stand" on this temporary light-weight structure and drive another set of piles (i.e. 2 piles) at a distance of ≈10m. Then the next section of the steel frame can be lifted into position. The piling rig then moves forward, piling and building the temporary deck structure "end-over-end" towards the main anchorage chamber (AB).

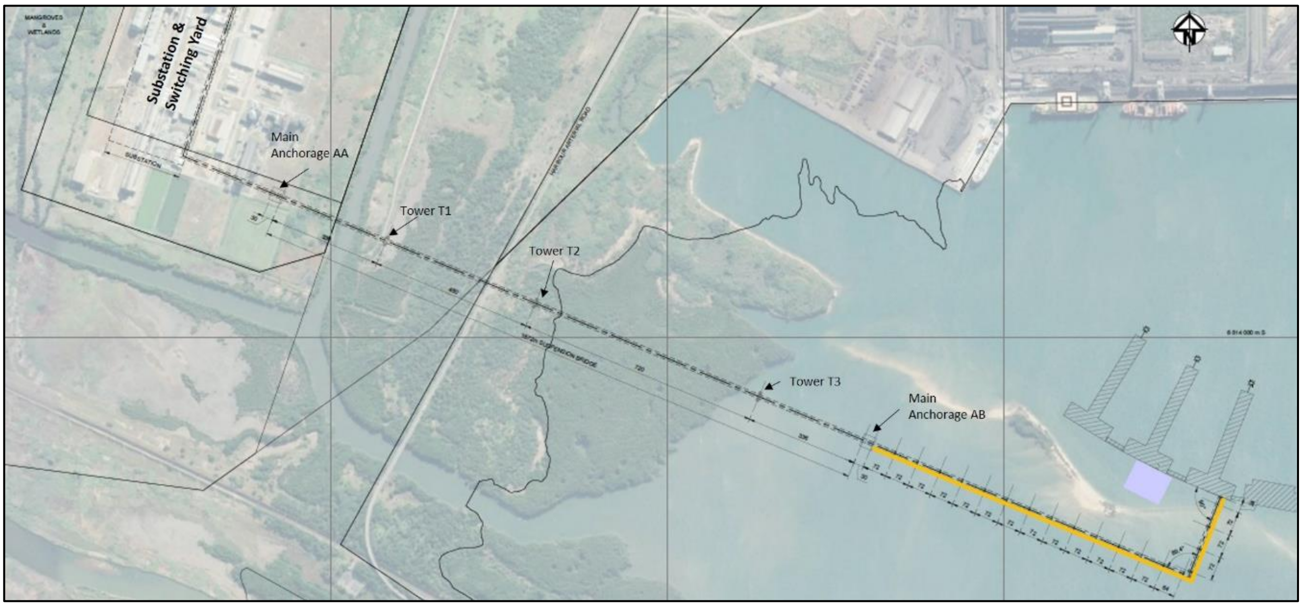


Figure 24: Temporary steel piled working platform and causeway (refer to Appendix 4 for detailed drawings)

2.5.2.1 Piling Requirements

Table 5: Estimated number of piles for the marine infrastructure associated with the LNG & Power Barge Terminals

Structure	Piles per Structure	No of Structures	Total No of Piles	Estimated Diameter (m)	Estimated Penetration (m)*
Land spans for the pipe & cabling bridge structure	4	35	140	0,6	30
Anchorage Platform AA (Land)	49	1	49	2,00	35
Towers T1	8	1	8	2,00	35
Tower T2	8	1	8	2,00	35
Tower T3	8	1	8	2,00	35
Anchorage Platform AB (Marine)	49	1	49	2,00	35
Marine spans for the pipe & cabling bridge structure	4	20	80	1,2	30

* Assumed, will be confirmed based on geotechnical investigations.

Total number of piles is estimated at 137 for marine works and 205 land-based works.

2.5.2.2 Construction sequencing & method

Snap shots of the construction sequence are provided at 6-month intervals during construction. The contractor may alter the sequence to suit his construction equipment, so this should be treated as indicative.

01 – 06 Months:

- Establish Contractors Site Camps and Laydown areas (Figure 25); and,
- Construct temporary access roads to Anchorage AA (located within the Bayside Aluminium smelter plant footprint, Figure 16) and Towers T1 and T2 (Figure 25).

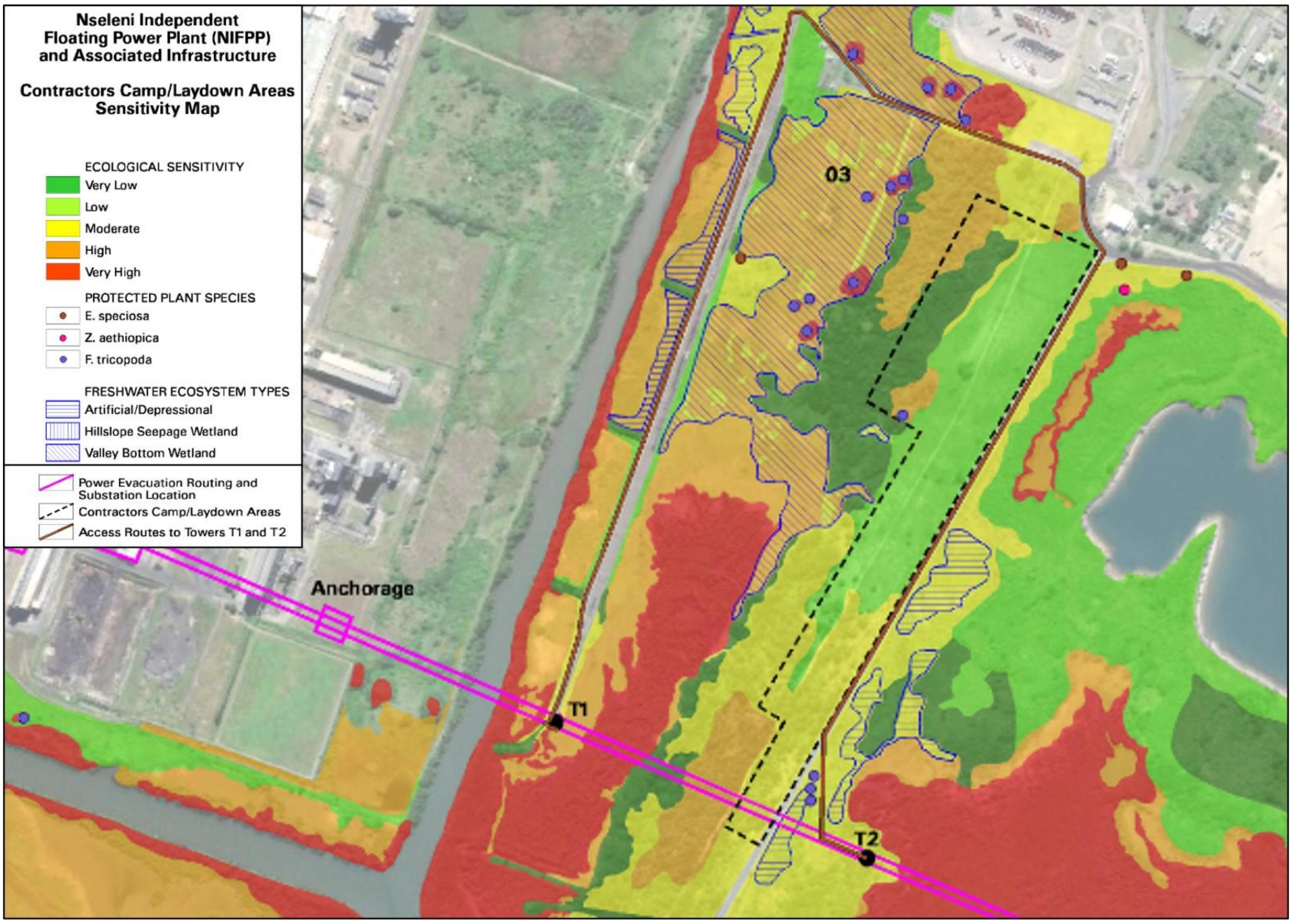


Figure 25: Proposed contractors camp/laydown areas for the construction phase of the NIFPP and associated infrastructure, including the pipe and cabling bridge structure (refer to Appendix 2 for the complete map).

06 – 12 Months (green in Figure 26):

- Begin driven piles for marine spans, from temporary causeway, to firstly construct a launch platform for marine works (south-eastern corner).
- Concrete foundation works:
    - Bored piles (marine) and excavations (land) for main anchorage chambers and towers; and,
    - Installing cofferdams (marine) for pile cap construction (base of cofferdam 0.5m above sea bed level).

12 – 18 Months (turquoise in Figure 26):

- Continue to install permanent driven piles for marine and land spans.
- Concreting works to anchorage chamber AA (from land) and anchorage AB (from barges).
- Complete high-level works, such as steel tower construction at Towers 1, 2 and 3 as well as the steel deck for the pipe and cabling bridge structure at the substation.

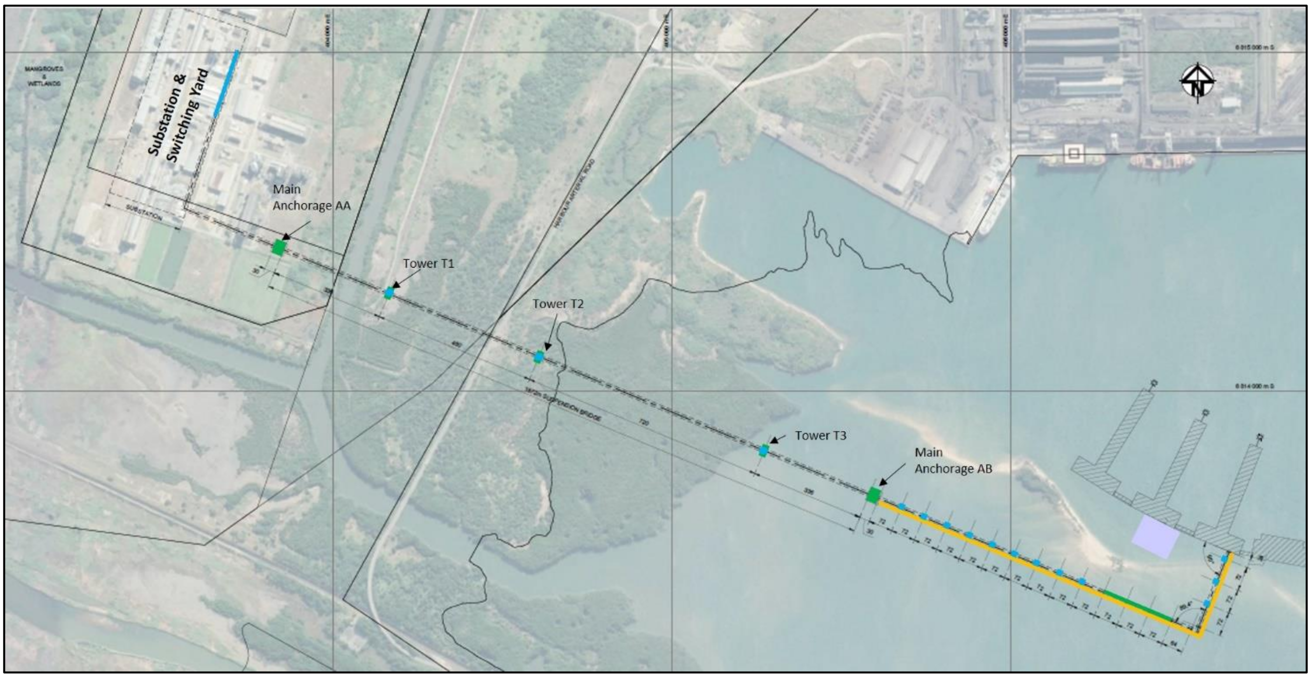


Figure 26: Pipe and cabling bridge structure construction sequencing – activities completed within 18 months.

18 – 24 Months (Yellow in Figure 27):

- Launch marine span deck (high level works) from launching platform.
- Construct suspension bridge main cable from anchorage chambers and tower tops.
- Continue with land span driven piling and continue with high level works (i.e. steel deck for the pipe and cabling bridge structure).

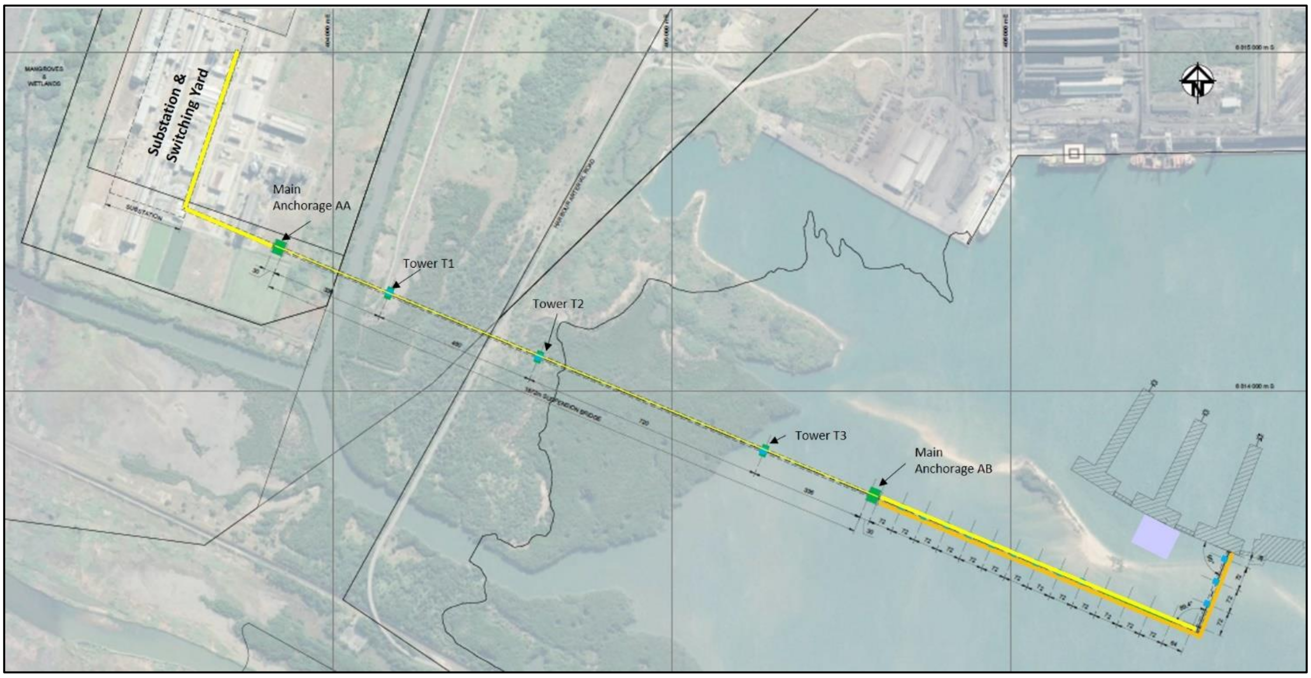


Figure 27: Pipe and cabling bridge structure construction sequencing – activities completed within 24 months.

24 – 30 Months (red in Figure 28):

- Complete remaining marine span decks.
- Construct suspension bridge deck for the pipe and cabling structure at high level.
- Complete and fit out land spans and hand over.

- Bridge completion and handover.
- Demobilise and remove temporary causeway (marine) and rehabilitate access roads to land-based Towers and contractors camp/laydown areas.

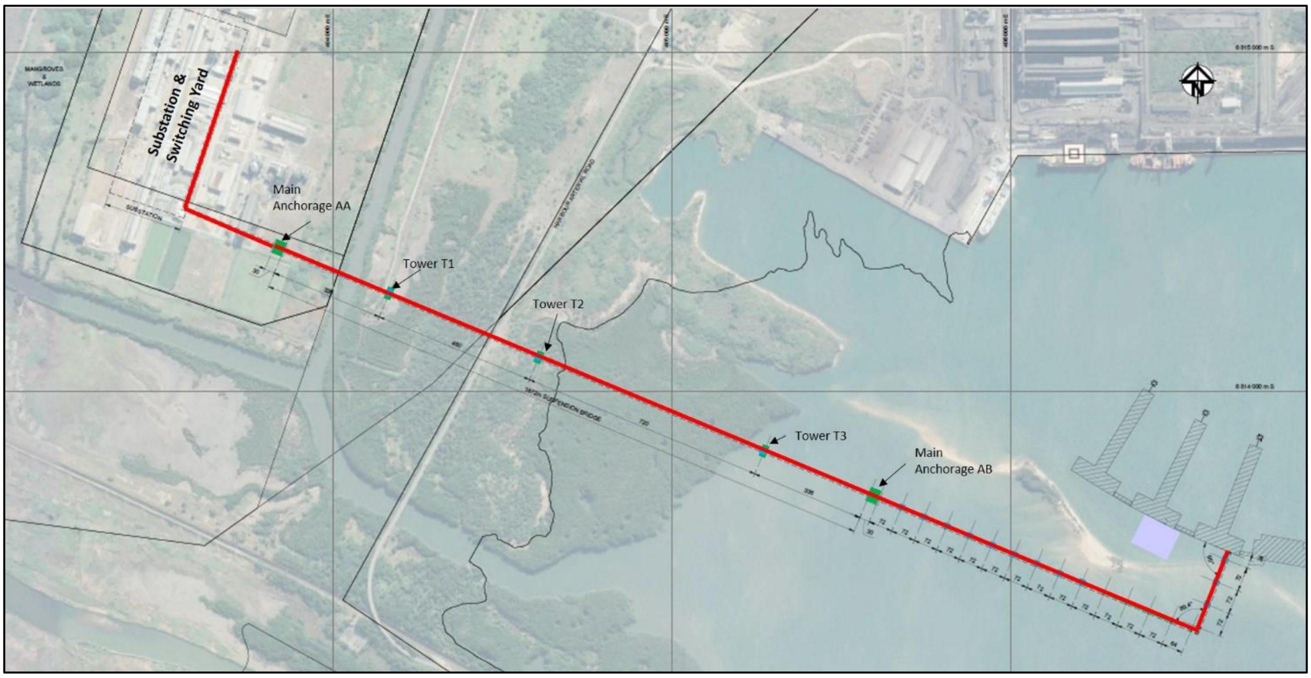


Figure 28: Pipe and cabling bridge structure construction sequencing – activities completed within 30 months.

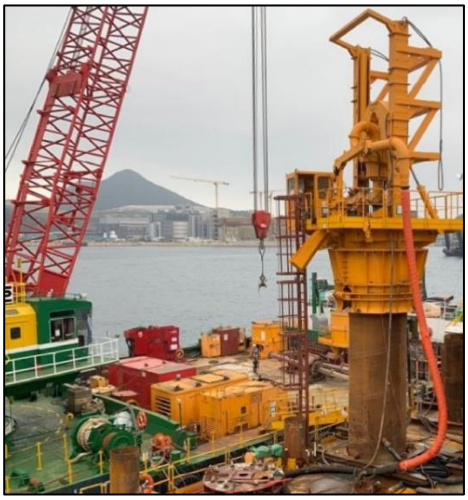
3 METHOD STATEMENT OF CONCRETE WORKS IN THE MARINE ENVIRONMENT

3.1 CONCRETING WORKS

The concreting works for the tower bases and anchorages will all be done from the temporary access causeway and/or jack-up barges.

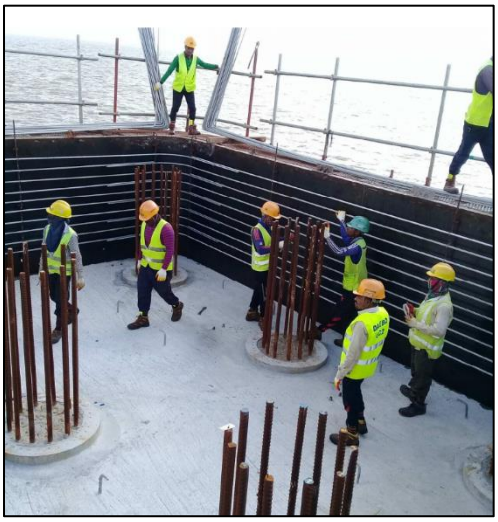
3.2 DURING PILING

Large diameter bored concrete piles are being used for the tower and anchorage chamber. The piles will be constructed within a permanent steel casing, with the concrete being placed directly into the casing. The casing can be extended sufficiently above the water with the top of the casing fitted with an enclosure to prevent any concrete spillage into the water. An example of this is shown below.



3.3 FOR PILE CAPS

The pile caps for the tower T3 and anchorage chamber AB will be constructed with a permanent precast concrete shell soffit to create a cofferdam and prevent any concrete from spilling into the water. The precast shell will be cast on land and transported to where they will be positioned over the piles and sealed to make them water-tight. A steel formwork will be placed around the soffit shell to complete the cofferdam (see image below). This then creates a water-tight construction area for the construction and casting of the pile cap, as shown below.



3.4 CONCRETE WORKS ABOVE THE PILE CAP (ANCHORAGE CHAMBER & TOWER PLINTH)

These will be carried out within formwork which will be water-tight, with the concrete being placed by a skip or concrete pump located on the temporary access causeway bridge or on the jack-up barge/s.

4 NEED AND DESIRABILITY

4.1 GROWTH IN DEMAND FOR ELECTRICITY

Although the Republic of South Africa (RSA) is ranked as possibly one of the richest countries in the world, in terms of its natural mineral resources, its ability to meet the needs of the Country by generating cost effective electrical power from its remaining enormous and still vast coal resources, is severely constrained. A sharp increase in the demand for electricity at the turn of the 20th century, saw ESKOM in 2003 re-commission three power stations: Camden, Grootvlei and Komati which had been mothballed in the late 1980s and early 1990s. The growth in the demand for electricity culminated in demand exceeding supply in 2008 and the onset of rolling blackouts as a function of load shedding required to prevent the collapse of the entire national electricity network.

4.2 CURRENT ELECTRICITY SUPPLY

ESKOM currently operates 29 power stations with a total nominal capacity of 44 134MW, comprising 36 441MW of coal-fired stations, 1 860MW of nuclear power, 2 409MW of gas-fired, 600MW hydro and 2 724MW pumped storage stations, as well as the recently commissioned 100MW Sere Wind Farm. All four units of Ingula (pumped storage), with a nominal capacity of 331MW each, were commissioned during 2016, supplementing the capacity added by Unit 6 of Medupi Power Station, commissioned in the previous year.

As of February 2020, 5 units at Medupi are in commercial operation with unit 6 currently being commissioned and 2 units in operation at Kusile with 1 unit being commissioned. Neither station is yet operating at nameplate capacity for the operational units. There is very modest hydro capacity in two dams located on the Orange River as well as three pumped storage schemes, two in the Drakensberg (including Ingula) and the other on the Palmiet River in the Western Cape. Municipalities own 22 small power stations and back-up gas turbines, but these total only 4% of national generation capacity and generally run at low load factors. Private generators comprise the remaining 1% of capacity.

4.3 THE NATIONAL ENERGY ACT, 2008 (ACT NO. 34 OF 2008) (NEA)

The NEA requires that diverse energy resources are available in sustainable quantities and at affordable prices in South Africa. In addition, the Act provides for the increased use of renewable energy, contingency energy supplies, the holding of strategic energy feedstock and carriers, and adequate investment in energy infrastructure. At the same time economically viable coal reserves at the existing large base load power stations are being rapidly depleted and the development of new replacement power stations, underpinned by coal reserves elsewhere, are encountering severe opposition from environmental activists. The Country also has international greenhouse gas emission reduction commitments that it needs to honour.

4.4 THE INTEGRATED ENERGY PLAN

The RSA government has embarked upon an Integrated Energy Plan ("IEP") which seeks to reduce the enormous carbon footprint of the existing fleet of thermal power stations, by introducing new, solar, photo voltaic, wind and concentrated solar, Independent Power Producers (IPPs) into the energy generation mix. Despite power demand being concentrated in Gauteng and along the coast where the Country's major cities are located, of necessity renewable projects are far removed from these demand centres. Solar and concentrated solar have been developed in the hinterland of the Northern Cape and wind projects being primarily located on and close to the coast of the Eastern and Western Cape (Figure 29).

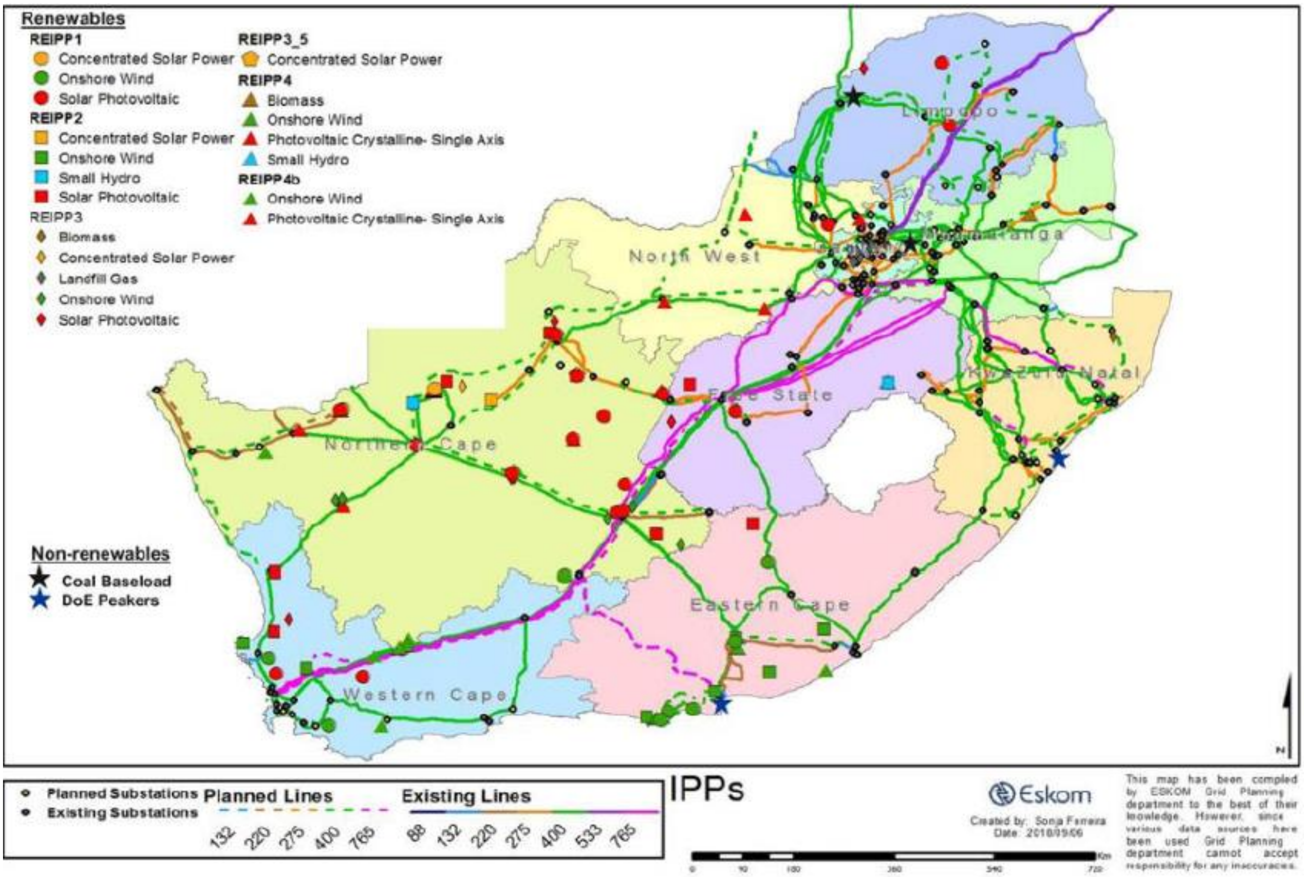


Figure 29: Approved IPP Projects in terms of the Renewable Energy Independent Power Producer (REIPP) Programme

4.5 RENEWABLE ENERGY INDEPENDENT POWER PRODUCER PROGRAMME

To date, the Renewable Energy Independent Power Producer (REIPP) programme has procured around 6 400 MW of energy from 106 IPP projects, with about 4 000 MW already in commercial operation. There are severe constraints to the further development of the REIPP programme where ESKOM is required, in terms of the programme, to finance and develop major new integration corridors (Figure 30), primarily in the Northern Cape to access the renewable projects at a time when ESKOM itself is struggling with ballooning costs and declining revenue.

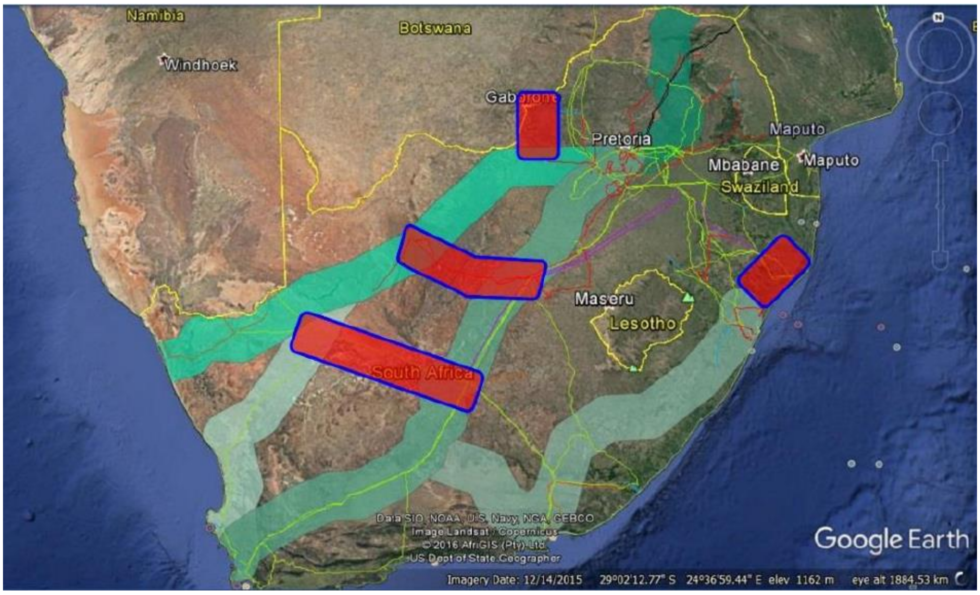


Figure 30: Transmission Network Corridors Required to Integrate IPPs

4.6 OTHER POSSIBLE SOURCES

The giant Grand Inga hydro-electric project in the Democratic Republic of Congo (DRC) is postulated to have a potential capacity in excess of 56 000 MW. The low generation cost of hydroelectric power means that the potential of Inga presents a potentially sustainable solution to the power deficit problems facing many of the countries within the SADC region, including South Africa, as well as on the African continent. It is very difficult nonetheless, to see the realisation of the project within a ten-to-twenty-year horizon, or even at all, given the significant technical and political complexities that need to be resolved not least of which would be the establishment of significant transmission infrastructure.

4.7 COMBINED CYCLE GAS TURBINE TECHNOLOGY

The single most viable technology to materially improve the current power crisis in the shortest possible timeline is Combined Cycle Gas Turbine (CCGT) fuelled by Liquefied Natural Gas (LNG). Eskom has always used single cycle gas turbines as peaking plants (emergency supplies of electricity during peak demand) but fired them using uneconomic diesel as fuel source.

4.8 NSELENI INDEPENDENT FLOATING POWER PLANT

The underlying concept, of the Nseleni Independent Floating Power Plant (NIFPP), is to construct a phased approach, 8 400MW, Utility Scale, power island complex, utilizing purpose designed floating marine power barges, moored in the harbour of Richards Bay in KZN. The turbines would be fuelled by LNG supplied from an LNG Terminal, to be constructed adjacent to the power island in the harbour with the bulk LNG being sourced elsewhere such as AngolaLNG's plant at Soyo. Dedicated LNG vessels sized for the NIFPP's requirements and capable of entering the Port of Richards Bay would be used to transport the gas.

Power generated from the facility would be evacuated from the new substation either by GILs or by means of new HVAC overhead transmission lines connected into the ESKOM primary sub-stations at Athene, uMfolozi, Mbewu (planned), Impala and Invubu. The Project would have the ability to operate efficiently as a Base Load, Mid-Merit, Peaking or Peak Shaving plant (Box 4), something unable to be achieved on a continuous basis by any other power generating facility currently in operation in the RSA.

Box 5: Categories of electricity generation plants

Base load power plants operate at maximum output, and shut down or reduce power only to perform maintenance or repair or due to grid constraints. South Africa's coal-fired power stations are typically base load plants. Historically base load plants produced the cheapest electricity.

Peaking power plants run only when there is a high demand, known as peak demand, for electricity and have the flexibility to be started up and shut down quickly. Eskom has simple cycle turbines fuelled on diesel for peak demand. Historically peaking power tended to be the most expensive electricity.

Mid-merit power plants operate between base load and peak load. Eskom's pumped storage schemes are mid merit stations. Historically the cost of electricity from mid merit stations was more expensive than base load but cheaper than peaking.

Peak shaving power plants refers to levelling out peaks in electricity use by industrial and commercial power consumers in response to variations in demand.

4.9 THE NEED FOR UTILITY SCALE POWER GENERATION PROJECTS IN RSA

When considering the geographic extent of the country and the distances between generation infrastructure and load centres as well as the complexity, of the transmission networks, it becomes apparent that there is an important role for independent utility scale generation power projects. Such generation projects would benefit from being close to transmission infrastructure or load demand centres. The proposed project has the potential to bring highly efficient, decentralized, base load type electrical power to the South African grid within a relatively short space of time and at an affordable tariff. In addition, there is no requirement for Eskom to provide the capital investment required for this project.

4.10 THE KZN TRANSMISSION NETWORK

Kwa-Zulu Natal has a transmission network with a radial pattern. With only two pumped storage peaking facilities in the Northern Drakensberg and an OCGT peaking station at Avon on the coast, the entire 6 280 Mw requirement of KZN is supplied via two HVAC lines originating at Majuba and Camden in Mpumalanga, some 600km distant (Figure 31).

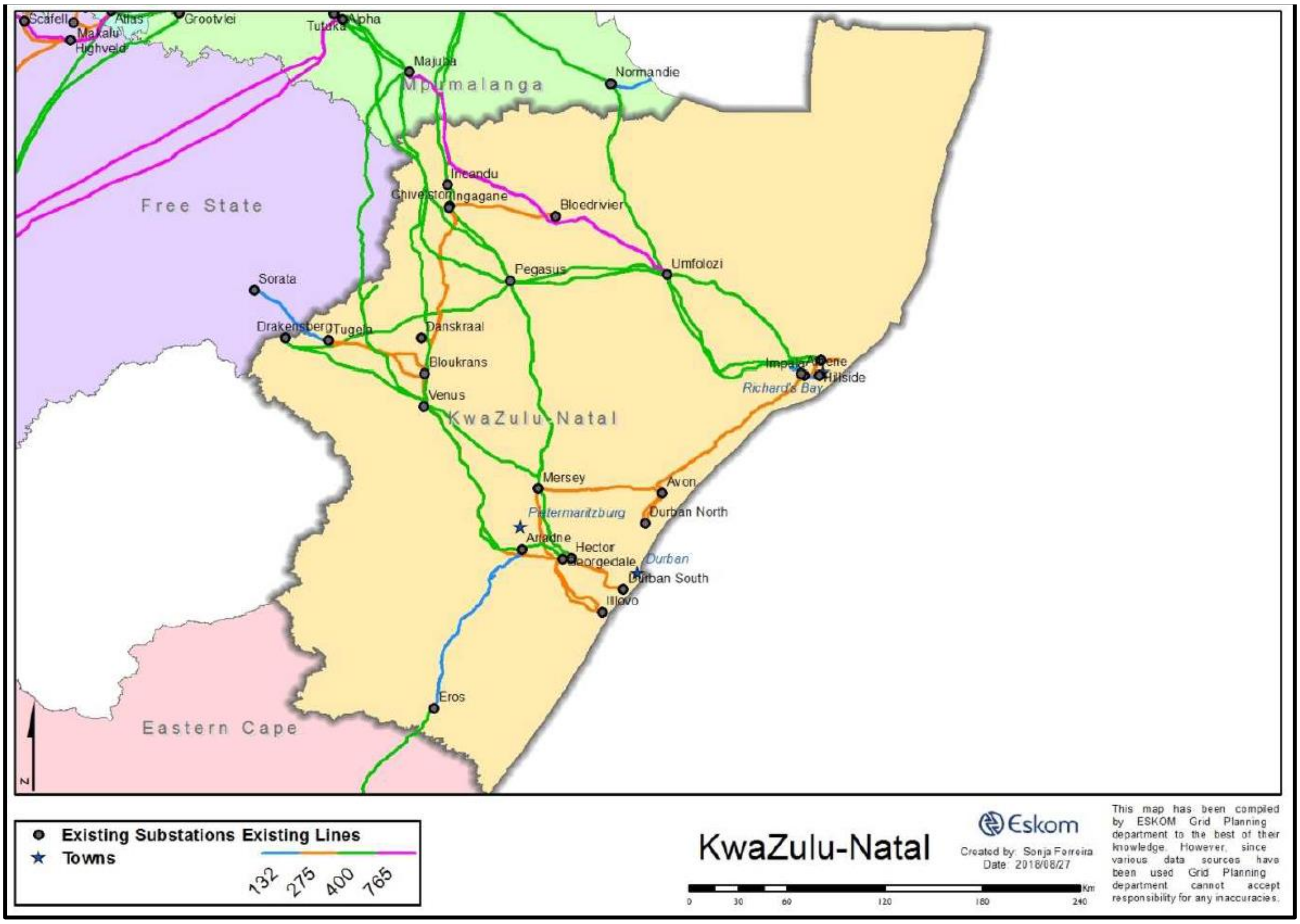


Figure 31: KwaZulu-Natal Sub-Stations and Power lines

The economic mix in KwaZulu-Natal comprises redistributors, commercial customers, and industrial customers. The demand in the province is forecast to grow steadily at about 2% annually, from 6 281 MW in 2018 to 7 562 MW by 2028 (Figure 32). The highest growth in demand is expected in the Pinetown and Empangeni Customer Load Networks due to industrial, commercial, and residential developments in those areas. Base load generating capability in Richards Bay as a function of the NIFPP, would eliminate the current scale of line losses and provide a completely new source of power capable of supplying the entire demand of KZN. As such KZN would be removed from the existing national demand profile but in addition, the flow of electricity could be reversed from KZN back into the National Transmission Network providing much needed capacity and stabilisation of the grid.

4.10.1 STRENGTHENING ELECTRICAL SUPPLY NETWORKS IN KZN

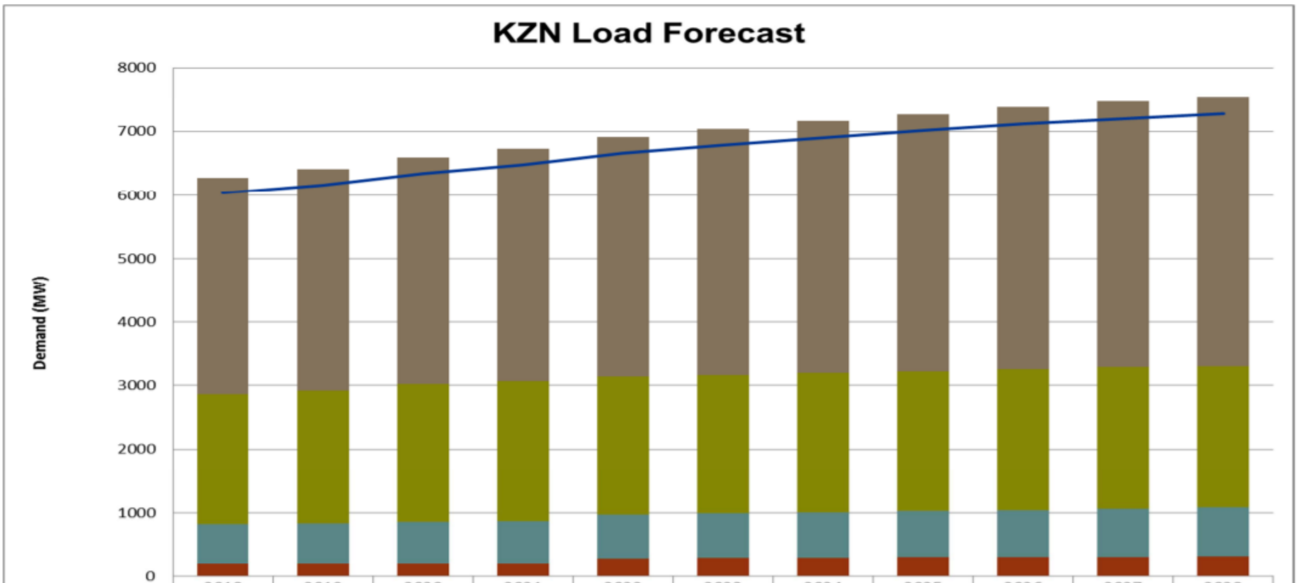
The major interventions for KwaZulu-Natal which have been undertaken by ESKOM or which could be undertaken or completed in terms of the proposed power generation project include:

4.10.1.1 KZN 765 kV strengthening

The KZN 765 kV strengthening project entails establishing 765 kV in the Pinetown and Empangeni areas, which will run from the power pool in the north and integrate it, with the 400kV network, in both areas. The Pinetown and Empangeni 765 kV networks will also be linked via two 400 kV lines. The project will be implemented in various stages.

4.10.1.2 NKZN strengthening: Iphiva 2 x 500 MVA 400/132 kV Substation

This project involves the establishment of Iphiva 400/132 kV Substation around Candover- Mkuze to address supply constraints around Pongola, Makhatini Flats, and iSimangaliso (Greater St. Lucia) Wetland Park. Two 400 kV lines, namely Normandie-Iphiva and Duma-Iphiva 400 kV lines will supply the planned Iphiva Substation. The Duma Substation is part of the planned Ermelo-Richards Bay coal link upgrade.



	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Pinetown	3411	3491	3579	3667	3755	3849	3940	4024	4107	4164	4221
Empangeni	2049	2084	2165	2193	2184	2196	2212	2218	2229	2240	2241
Newcastle	615	631	645	660	675	689	704	718	732	746	759
Ladysmith	203	206	209	213	295	300	304	307	311	316	320
TOSP	6040	6169	6348	6476	6662	6783	6903	7008	7116	7201	7275
Grid Peak	6279	6412	6598	6732	6925	7051	7176	7285	7397	7485	7562

Figure 32: KwaZulu-Natal Load Forecast

4.10.2 NIFPP ROLE IN KWAZULU-NATAL

All of the schemes mentioned above could be integrated into the proposed NIFPP in Richards Bay without burdening Eskom and thereby:

- Strengthening the National Transmission Network;
- Improving power reticulation in KZN; and,
- Securing financial capital to implement the schemes.

The technology proposed has the twofold benefit of not only providing quick to market electricity desperately needed to meet the power demands in the RSA but secondly, in assisting with the stabilisation of the national grid by virtue of the rapid response time to surge demand provided by turbine technology.

4.11 THE NATIONAL DEVELOPMENT PLAN

The NDP envisages that, by 2030, South Africa will have an energy sector that provides reliable and efficient energy service at competitive rates; that is socially equitable through expanded access to energy at affordable tariffs; and that is environmentally sustainable through reduced emissions and pollution.

4.12 THE PARIS AGREEMENT

South Africa is a signatory to the Paris Agreement on Climate Change and has ratified the agreement. In line with NDCs (Nationally Determined Contributions) submitted to the UNFCCC in November 2016, South Africa's emissions are expected to peak, plateau and from year 2025 decline. The energy sector contributes close to 80% towards the country's total GHG emissions of which 50% are from electricity generation and liquid fuel production alone. There is action to reduce emissions with investment already in renewable energy, energy efficiency and public transport but much more is needed to make such commitments a reality.

It is presented here that the proposed NIFPP would contribute materially to both objectives, while at the same time potentially facilitating the economic growth so desperately needed by the country but it must be recognised that LNG remains a non-renewable, fossil fuel.

4.13 RENEWABLE ENERGY AND THE NIFPP

The need to decarbonise especially power generation is indisputable and the promotion and growth of renewables will play a key part in that endeavour. The question that has to be asked is why, as fossil-fuel based power generation, the proposed NIFPP is not at odds with that objective? This section is intended to provide a response to that question.

4.13.1 GRID MANAGEMENT

South Africa has a large complex electrical grid that is based most fundamentally on the principle that if electricity is required (demanded) it can provide instantaneously. The grid is made up of power generation facilities (such as the large coal-fired power stations), high voltage electrical transmission lines that criss-cross the country taking power from where it is generated to where it can be distributed, and distribution networks that provide the right voltage (best thought of as the 'push' that moves electrical charge) and current (the electrical charge itself) to users. The grid also has multiple substations with transformers that step up the voltage for transmission and step it down for users. The substations also contain switchgear, essentially electrical disconnect switches, fuses or circuit breakers used to control, protect and isolate electrical equipment. Switchgear is used both to de-energize equipment to allow work to be done and to clear faults downstream. If there is a fault on the circuit the system will trip (the electrical circuit will be opened automatically to discontinue the flow of electricity). Tripping occurs when circuits carry greater current than they are designed for resulting in overheating, equipment damage and fire risk.

As long as the grid has the capacity to precisely supply the power demanded by users and there are no faults, the grid will be stable. Demand changes continuously sometimes following well-established patterns such as the morning increase in demand as people wake up and start using electrical appliances and industrial applications that only use power during the day. Demand also generally increases from summer to winter as power is used for heating and lighting purposes. There are other circumstances too where the demand changes completely unpredictability such as when a large power use operation trips out or multiple users start up industrial processes. Even where the power demand patterns are well understood, there is still uncertainty in exactly how power will be demanded at any given point. This means that grids must always have reserve or 'spinning'[3] capacity so that there is always enough supply to meet the demand. In general terms that excess capacity is about 15% higher than the anticipated demand.

South Africans are all too familiar with load shedding. Load shedding happens when the grid does not have enough reserve capacity to guarantee that all demand can be met. Load shedding is done countrywide to protect the electricity power system from a total blackout by which is meant the complete shutdown of the grid. If demand exceeds supply, the power system trips in its entirety. Many countries and cities have experienced complete blackouts but these are usually able to source start-up power from a neighbour meaning that the blackout can be resolved quickly. If the South African grid trips the system has to be started slowly and systematically, energising one power plant and one section of the country at a time. It could take up to two weeks to restore full power after a total grid trip in South Africa with disastrous economic and social consequences.

4.13.2 DISPATCHABILITY

Dispatchability refers to the ability of a power generator to 'dispatch' power in direct response to changing (especially increasing) power demand. The benefit of a national grid is that the grid can accommodate multiple sources of power generation which can be brought on line as and when needed to dispatch the power to meet the demand. A key challenge with renewables is dispatchability of power, as renewables generate power in response to the availability of their primary energy sources such as sunlight and wind. In time, the dispatchability issue could be dealt with through the development of improved storage of electric power such as batteries and there are already initiatives to facilitate increased storage through battery arrays being piloted. Solar thermal technology also has the potential for improved dispatchability. Redundancy and improved power storage is needed to improve the dispatchability of renewables but there are other constraints too that will be detailed later.

To make renewables commercially viable in the face of dispatchability constraints, the grid operator, Eskom, currently has a 'take it or pay' tariff obligation with the renewable IPPs. Whenever the solar and wind farms produce power, it is dispatched and Eskom has to accept the power regardless of whether or not they need it. The effect of the take it or pay tariff is to make the financial cost of that power significantly more 'expensive' than the direct production cost because there cannot be a cost recovery if the electricity is not sold to a user. The variability of the power inputs and matching those with power demand introduces significant complexity in electrical grid management, especially one as complex as the South African national grid. With power being generated by renewables in a grid, the uncertainty of demand is extended to an uncertainty of supply, and the grid operator now has to match variable demand with supply that is also variable.

4.13.3 INTEGRATING RENEWABLES INTO THE GRID

Following on from the points above, there are a number of ancillary services that are required to safely run a large, interconnected power system such as the South African national grid. Such ancillary services are presently not available from renewable energy sources and are unlikely to become available unless the entire market structure changes. These required ancillary services include frequency regulation, instantaneous reserve and black-start

4.13.3.1 Frequency regulation

Frequency control or regulation means that active power generated should at each moment equal the active power consumed (active power is that which does the useful work such as driving motors, lighting and so forth and is dissipated through that use). A deviation from this equilibrium results in a deviation from the 50 hz frequency, so regulating frequency means keeping this equilibrium. With the take or pay contracts with renewable power plants there is no

[3] Spinning implies that the turbines are running (spinning) but the electrical generator has not been engaged. The generator can, however, be engaged at a moment's notice.

incentive to provide frequency control, or react to changes in load. Gas turbines, especially at the scale being proposed for the NIFPP, introduce a significant ramp rate (rate at which power can be brought on line in response to demand), where the total ramp rate is simply a function of the number of turbines on line for NIFPP the ramp rate is approximately 6 MW per minute per turbine. Where renewable power is available it can be used to the maximum extent, knowing that if it reduces, even unexpectedly, additional supply can be affected quickly. In a future scenario where the majority of coal-fired generation is replaced by renewables and mid-merit plant (also known as a 'load following power plant'[4]) frequency control will be extremely challenging in bringing the renewables into the grid.

Even were frequency control required from renewable sources it is extremely difficult to effect frequency regulation only with renewables. Wind turbines are easier than photovoltaic but requirements for system inertia (frequency control) will have to be addressed from other sources. The relatively heavy synchronous gas turbines are an attractive way of doing so. In an alternating current (AC) electric power system as used in South Africa, synchronization means matching the speed and frequency of a generator or other source to a running network. An AC generator cannot deliver power to an electrical grid unless it is running at the same frequency as the network (all phases - red, blue and white - must match) . Gas turbines, on the other hand, are ideally suited to this as they are able to rapidly respond to frequency deviations in order to regulate the frequency within the limits imposed by the Grid Code.

4.13.3.2 Fault current

Synchronous generation sources, such as gas turbines, are also an essential source of fault current, as inverter-based technologies such as solar panels, do not provide sufficient current under fault conditions. What that means is that if there is a fault (trip) from an inverter source of power, there is no way of determining where the fault occurred. For example, if the fault was on a 300 km transmission line the entire line would need visual inspection to identify the position of the fault. The fault current generated by synchronous generation can be maintained for a specific period of time thereby allowing the fault to be immediately pin- pointed for access and repair. Furthermore, as described above, inverter-based technologies must "synchronise" to an active source, which is provided by traditional synchronous generators, such as gas turbines.

In addition, effective voltage control is heavily influenced by network fault level, as small changes in load can have a significant impact on voltage in weak networks (those with little fault current typically associated with renewables). The fault current contribution from the gas turbines therefore increases the system fault level, which improves the voltage control performance of the network too.

4.13.3.3 Instantaneous reserve

Total renewable energy production normally falls away at the same time as system load (power demand) increases. This energy generation reduction is due to the load profile of especially solar PV installations that reduces towards the end of the day, although wind turbines often experience greatest wind speeds in the late afternoon/early evening. This drop-off imposes increased ramping requirements on the remaining generation resources as they have to cater for both the normal load increase and the "lost" solar contribution. Units and/or facilities such as CCGTs that are able to rapidly change power output (in some circumstances simply by being accelerated) are ideally suited to this environment. This drop-off effect can be largely compensated by the addition of energy storage (batteries, or other), but this comes at a significant financial cost, especially at the scale required for the renewable projects.

4.13.4 BLACK START

A black start is the process of restoring an electric grid without relying on an external electric power transmission network to recover from a total or partial blackout. In the absence of grid power, a black start is needed to provide the initial power needed for the progressive start-up up of the different generation sources.

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[4] A mid-merit plant can adjust power output in response to demand changes as demand for electricity fluctuates throughout the day

The risk of a complete network trip has already been described together with the particular changes South Africa has in dealing with such a network trip. A gas turbine facility is also an ideal candidate to provide a black-start service as the facility has the ability to self-start without any power requirements from the grid and then to supply local customer load. At the same time elements of the transmission system can be energised, connecting other remote load and restarting other conventional generators that require auxiliary power to start. The fact that there is a significant store of fuel on site, and more fuel can be readily procured, means that the facility qualifies as a true black-start facility, as opposed to only having a self-start capability.

5 INSTITUTIONAL AND LEGAL FRAMEWORK, GUIDELINES AND INTERNATIONAL LENDER REQUIREMENTS

5.1 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).

5.2 NEMA & EIA REGULATIONS

The Environmental Impact Assessment (EIA) Regulations (Government Gazette Notice (GN) No. R. 326, 327, 325 and 324 of 07 April 2017) promulgated in terms of NEMA regulate the "*procedure and criteria as contemplated in Chapter 5 of the Act relating to the preparation, evaluation, submission, processing and consideration of, and decision on, applications for environmental authorisations for the commencement of activities, subjected to environmental impact assessment, in order to avoid or mitigate detrimental impacts on the environment, and to optimise positive environmental impacts, and for matters pertaining thereto*."

The following tables highlights those activities that will be triggered by the proposed NIFPP and associated infrastructure project, thus requiring two separate Environmental Authorisations (EAs), by way of a single integrated Scoping and Environmental Impact Reporting (S&EIR) application process, from the Competent Authority (in this instance: the National Department of Forestry, Fisheries and the Environment (DFFE)) prior to the commencement of the activities. Two separate EA Applications will be submitted in order to obtain two separate EAs, as the project is a collaboration between two entities, one responsible for infrastructure development and the other for the operational phase generation of electricity. The two applications are as follows:

1. Anchor Energy LNG (Pty) Ltd – Proposed Liquid Natural Gas (LNG) receiving and storage facility and associated physical infrastructure to support the NIFPP. i.e. all marine based infrastructure development (refer to Table 6).
2. Nseleni Power Corporation (Pty) Ltd - Proposed NIFPP and associated infrastructure for the evacuation of power from the NIFPP to the National Grid. i.e. all construction and operational aspects associated with power generation and evacuation into the national grid (refer to Table 7).

Table 6: NEMA Listed activities that apply to Anchor Energy LNG (Pty) Ltd: marine infrastructure development [14/12/16/3/3/2/2033]

Government Gazette No.	Listed Activity No.	Description of the Listed Activity	Describe the portion of the proposed project to which the applicable listed activity relates.	Co-ordinates for Applicable Project Areas
GN. No. R. 325 – Listing Notice 2	**4**	The development and related operation of facilities or infrastructure, for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic metres.	LNG will be stored in LNG FSUs and on the LNG and Power Barge Terminals in specially designed cryogenic bulk storage tanks each with a capacity of 1 000m³. LNG FSU vessels can hold up to 250 000m³.	Proposed power island corner co-ordinates: A. -28°48'01.72"S 32°03'14.79"E B. -28°48'41.63"S 32°02'49.45"E C. -28°48'00.80"S 32°02'18.86"E D. -28°47'51.64"S 32°02'24.88"E
	6	The development of facilities or infrastructure for any purpose or activity which requires a permit or licence or an amended permit or license in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent.	The proposed project will require a Dumping at Sea Permit in terms of NEMICMA for dredged material.	Corner Co-ordinates of the three areas to be dredged: 1) -28° 47’ 58.398”S 32° 2’ 16.553”E 2) -28° 47’ 56.684”S 32° 2’ 18.211”E 3) -28° 47’ 59.176”S 32° 2’ 24.099”E 4) -28° 48’ 1.926”S 32° 2’ 22.111”E 5) -28° 48’ 7.805”S 32° 2’ 42.571”E 6) -28° 48’ 7.658”S 32° 3’ 1.488”E 7) -28° 48’ 9.819”S 32° 3’ 1.509”E 8) -28° 48’ 9.965”S 32° 2’ 42.593”E 9) -28° 48’ 10.084”S 32° 3’ 2.104”E 10) -28° 48’ 11.714”S 32° 3’ 5.487”E 11) -28° 48’ 39.597”S 32° 2’ 47.451”E 12) -28° 48’ 37.245”S 32° 2’ 43.369”E
	14	The development and related operation of – (i) an anchored platform; or (ii) any other structure or infrastructure – on, below or along the sea bed.	The proposed development entails the construction of the LNG & Power Barge Terminals which are essentially quays/ jetties based on marine piles within the Port of Richards Bay (or Richards Bay Estuary).	Proposed power island area corner co-ordinates: A. -28°48'01.72"S 32°03'14.79"E B. -28°48'41.63"S 32°02'49.45"E C. -28°48'00.80"S 32°02'18.86"E D. -28°47'51.64"S 32°02'24.88"E

GN. No. R. 325 – Listing Notice 2	**26**	Development – (i) in the sea; (ii) in an estuary; (iii) within the littoral active zone; (iv) in front of a development setback; or (v) if no development setback exists, within a distance of 100 metres of the high-water mark of the sea or an estuary, whichever is the greater; in respect of – a) Facilities associated with the arrival and departure of vessels and the handling of cargo; b) Piers; c) Inter- and sub-tidal structures for entrapment of sand; d) Breakwater structures; e) Coastal marinas; f) Coastal harbours or ports; g) Tunnels; or h) Underwater channels; But excluding the development of structures within existing ports or harbours that will not increase the development footprint of the port or harbour.	The proposed development entails the construction of the LNG and Power Barge Terminals which are essentially quays/ jetties based on marine piles within the Port of Richards Bay (or Richards Bay Estuary). The CCGT power plants will be modular and located on floating barges moored to the Power Barge Terminal. LNG will be supplied via LNG vessels and offloaded when vessels dock/moor with the LNG Terminal and/or FSUs.	Proposed power island area corner co-ordinates: A. -28°48'01.72"S 32°03'14.79"E B. -28°48'41.63"S 32°02'49.45"E C. -28°48'00.80"S 32°02'18.86"E D. -28°47'51.64"S 32°02'24.88"E

GN. No. R. 327 – Listing Notice 1	**17**	Development – (i) in the sea; (ii) in an estuary; (iii) within the littoral active zone; (iv) in front of a development setback; or (v) if no development setback exists, within a distance of 100 metres of the high-water mark of the sea or an estuary, whichever is the greater; in respect of – (a) Fixed or floating jetties and slipways; (b) Tidal pools; (c) embankments; (d) rock revetments or stabilising structures including stabilising walls; or (e) infrastructure or structures with a development footprint of 50 square metres or more - But excluding - (aa) the development of infrastructure and structures within existing ports or harbours that will not increase the development footprint of the port or harbour; (bb) where such development is related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies; (dd) where such development occurs within an urban area.	The proposed infrastructure to receive and store LNG will be constructed within the Port of Richards Bay (thus, within the sea / estuary). The definition of an urban area is an area adopted as such by the Competent Authority – no such area exists. The entire Port of Richards Bay (including future expansion activities) is included within the Urban Development Boundary as per the City of uMhlathuze's Spatial Development Framework; however, this document has not been adopted by the Competent Authority. The adopted Environmental Management Framework (EMF) of the Richards Bay Industrial Zone and Port Expansion – does not specifically define the urban area. The actual estuarine environment of the Port and the remainder of the study area (on land) falls outside of a "built up environment".	Proposed power island area corner co-ordinates: A. -28°48'01.72"S 32°03'14.79"E B. -28°48'41.63"S 32°02'49.45"E C. -28°48'00.80"S 32°02'18.86"E D. -28°47'51.64"S 32°02'24.88"E
	19A	The filling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from – (ii) the littoral active zone, an estuary or a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever distance is the greater.	Dredging of or movement of sediment on the estuary bed (Port of Richards Bay) will be required to construct the necessary infrastructure (i.e. quays/ terminals) for the receiving and storage of LNG and for the mooring of LNG vessels/ Floating Storage Units and Floating Power Barges.	Proposed power island area corner co-ordinates: A. -28°48'01.72"S 32°03'14.79"E B. -28°48'41.63"S 32°02'49.45"E C. -28°48'00.80"S 32°02'18.86"E D. -28°47'51.64"S 32°02'24.88"E

Table 7: NEMA Listed activities that apply to Nseleni Power Corporation (Pty) Ltd: power generation & evacuation into the National Grid [14/12/16/3/3/2/2032]

Government Gazette No.	Listed Activity No.	Description of the Listed Activity	Describe the portion of the proposed project to which the applicable listed activity relates	Co-ordinates for Applicable Project Areas
GN. No. R. 325 – Listing Notice 2	**2**	The development and related operation of facilities or infrastructure for the generation of electricity from a non-renewable resource where the electricity output is 20 megawatts or more.	While the development of the CCGT floating power plants/ barges will be built/ developed off-site and shipped to site, the operation of the CCGT will be undertaken on site. It is proposed that the total capacity of the NIFPP will be between 2 800 – 8 400MW.	Proposed power island area corner co-ordinates: A. -28°48'01.72"S 32°03'14.79"E B. -28°48'41.63"S 32°02'49.45"E C. -28°48'00.80"S 32°02'18.86"E D. -28°47'51.64"S 32°02'24.88"E
	4	The development and related operation of facilities or infrastructure, for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic metres.	The NIFPP will have storage of dangerous goods in combined capacities of more than $500m^3$.	Proposed power island area corner co-ordinates: A. -28°48'01.72"S 32°03'14.79"E B. -28°48'41.63"S 32°02'49.45"E C. -28°48'00.80"S 32°02'18.86"E D. -28°47'51.64"S 32°02'24.88"E Proposed substation area corner co-ordinates: A. -28°47'14.75"S 32°00'39.80"E B. -28°47'17.86"S 32°00'50.07"E C. -28°47'36.03"S 32°00'42.80"E D. -28°47'34.48"S 32°00'37.40"E E. -28°47'35.79"S 32°00'36.77"E F. -28°47'34.41"S 32°00'31.79"E

GN. No. R. 325 – Listing Notice 2	**6**	The development of facilities or infrastructure for any purpose or activity which requires a permit or licence or an amended permit or license in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent.	The proposed NIFPP will require an Atmospheric Emissions License (AEL) in terms of NEMAQA. The proposed NIFPP may require a Dumping at Sea Permit in terms of NEMICMA for any operational phase dredging.	Estimated central co-ordinates of each power barge: 1. -28°48'03.19"S 32°02'38.92"E 2. -28°48'04.55"S 32°02'46.62"E 3. -28°48'01.72"S 32°02'35.83"E 4. -28°48'04.44"S 32°02'50.22"E 5. -28°48'00.66"S 32°02'32.65"E 6. -28°48'04.11"S 32°02'53.40"E 7. -28°47'59.12"S 32°02'29.43"E 8. -28°48'04.11"S 32°02'56.99"E 9. -28°47'57.65"S 32°02'26.50"E 10. -28°48'04.40"S 32°03'00.13"E 11. -28°47'55.75"S 32°02'23.61"E 12. -28°48'04.41"S 32°03'03.81"E Corner Co-ordinates of the three areas to be dredged: 1) -28° 47' 58.398"S 32° 2' 16.553"E 2) -28° 47' 56.684"S 32° 2' 18.211"E 3) -28° 47' 59.176"S 32° 2' 24.099"E 4) -28° 48' 1.926"S 32° 2' 22.111"E 5) -28° 48' 7.805"S 32° 2' 42.571"E 6) -28° 48' 7.658"S 32° 3' 1.488"E 7) -28° 48' 9.819"S 32° 3' 1.509"E 8) -28° 48' 9.965"S 32° 2' 42.593"E 9) -28° 48' 10.084"S 32° 3' 2.104"E 10) -28° 48' 11.714"S 32° 3' 5.487"E 11) -28° 48' 39.597"S 32° 2' 47.451"E 12) -28° 48' 37.245"S 32° 2' 43.369"E

GN. No. R. 325 – Listing Notice 2	**9**	The development of facilities or infrastructure for the transmission and distribution of electricity with a capacity of 275 kilovolts or more, outside an urban area or industrial complex.	The proposed power evacuation structure (i.e. pipe and cabling bridge containing Gas-Insulated Transmission Lines (GILs) and the power supply opportunity transmission lines (GIL and/or overhead) may be more than 275kV.	Pipe & Cabling Bridge Start @ Power Island: -28°48’8.669”S 32°2’36.112”E Corner: -28° 48’ 16.357”S 32° 2’ 32.49”E Chamber AB: -28° 48’ 3.179”S 32° 1’ 57.488”E Tower 3: -28° 47’ 58.699”S 32° 1’ 45.582”E Tower 2: -28° 47’ 49.505”S 32° 1’ 21.162”E Tower 1: -28° 47’ 43.375”S 32° 1’ 4.882”E Chamber AA: -28° 47’ 38.892”S 32° 0’ 52.978”E End @ Substation: -28°47’35.165”S 32°0’43.08”E Power Supply Opportunities To Hillside: Start: -28° 46’ 41.813”S 32° 1’ 0.442”E To Hillside: End: -28° 46’ 17.067”S 32° 1’ 16.127”E To Hillside: Start: -28°46’41.006”S 32°0’58.339”E To Hillside: End: -28° 47’ 14.944”S 32° 0’ 41.031”E To Hillside: Start: -28°46’41.528”S 32°0’54.116”E To Hillside: End: -28° 46’ 16.86”S 32° 1’ 18.839”E To Polaris: Start: -28° 46’ 17.178”S 32° 1’ 14.396”E To Polaris: End: -28° 46’ 17.179”S 32° 1’ 12.911”E Athene/Hillside: Start: -28°46’41.362”S 32°0’59.381”E End: -28°47’14.983”S 32°0’41.203”E GILs to Hillside: Start: -28°46’50.072”S 32°0’50.77”E End: -28°46’42.967”S 32°0’17.326”E

GN. No. R. 325 – Listing Notice 2	**14**	The development and related operation of – (i) an anchored platform; or (ii) any other structure or infrastructure – on, below or along the sea bed.	The proposed pipe and cabling bridge will be supported overhead on marine piles.	Start @ Power Island: -28°48'8.669"S 32°2'36.112"E Corner: -28° 48' 16.357"S 32° 2' 32.49"E Chamber AB: -28° 48' 3.179"S 32° 1' 57.488"E Tower 3: -28° 47' 58.699"S 32° 1' 45.582"E
GN. No. R. 327 – Listing Notice 1	**12**	The development of – (ii) infrastructure or structures with a physical footprint of 100 square metres or more, where such development occurs – (a) Within a wetland; (b) In front of a development setback; or (c) If no development setback exists, within 32 metres of a watercourse, measured from the edge of the watercourse.	The proposed supporting structures for the overhead pipe and cabling bridge and power supply opportunities (GIL gantries/ overhead lines) may be located within 32m of wetland environments.	Pipe & Cabling Bridge: Tower 2: -28° 47' 49.505"S 32° 1' 21.162"E Chamber AA: -28° 47' 38.892"S 32° 0' 52.978"E Power Supply Opportunities To Hillside: Start: -28° 46' 41.813"S 32° 1' 0.442"E To Hillside: End: -28° 46' 17.067"S 32° 1' 16.127"E To Hillside: Start: -28°46'41.006"S 32°0'58.339"E To Hillside: End: -28° 47' 14.944"S 32° 0' 41.031"E To Hillside: Start: -28°46'41.528"S 32°0'54.116"E To Hillside: End: -28° 46' 16.86"S 32° 1' 18.839"E To Polaris: Start: -28° 46' 17.178"S 32° 1' 14.396"E To Polaris: End: -28° 46' 17.179"S 32° 1' 12.911"E Athene/Hillside: Start: -28°46'41.362"S 32°0'59.381"E End: -28°47'14.983"S 32°0'41.203"E GILs to Hillside: Start: -28°46'50.072"S 32°0'50.77"E End: -28°46'42.967"S 32°0'17.326"E Contractors Camp/ Laydown Area: A. -28° 47' 18.785"S 32° 1' 26.704"E B. -28° 47' 21.332"S 32° 1' 32.998"E C. -28° 47' 48.944"S 32° 1' 15.541"E D. -28° 47' 48.088"S 32° 1' 13.763"E E. -28° 47' 43.218"S 32° 1' 16.779"E F. -28° 47' 42.51"S 32° 1' 15.433"E G. -28° 47' 29.782"S 32° 1' 23.786"E H. -28° 47' 28.358"S 32° 1' 20.955"E

GN. No. R. 327 – Listing Notice 1	**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 treater water per day.	A Desalination Plant will be required to treat estuarine/ sea water abstracted from the Port of Richards Bay for use in the Combined Cycle Gas Turbine (CCGT) Power Plants. Potable water will also be required for personnel during the operational phase of the facility.	Water Abstraction Point: 28°48'07.61" 32° 02'39.57"
	17	Development – (i) in the sea; (ii) in an estuary; (iii) within the littoral active zone; (iv) in front of a development setback; or (v) if no development setback exists, within a distance of 100 metres of the high-water mark of the sea or an estuary, whichever is the greater; in respect of – (a) Fixed or floating jetties and slipways; (b) Tidal pools; (c) embankments; (d) rock revetments or stabilising structures including stabilising walls; or (e) infrastructure or structures with a development footprint of 50 square metres or more - But excluding - (aa) the development of infrastructure and structures within existing ports or harbours that will not increase the development footprint of the port or harbour; (bb) where such development is related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies; (dd) where such development occurs within an urban area.	The proposed power evacuation pipe and cabling bridge structure (corridor/ servitude) will be located in the Richards Bay Port/ Estuary and within the estuarine functional zone. The definition of an urban area is an area adopted as such by the Competent Authority – no such area exists. The entire Port of Richards Bay (including future expansion activities is included within the Urban Development Boundary as per the City of uMhlathuze's Spatial Development Framework; however, this document has not been adopted by the Competent Authority. The adopted Environmental Management Framework (EMF) of the Richards Bay Industrial Zone and Port Expansion – does not specifically define the urban area. The actual estuarine environment of the Port and the remainder of the study area (on land – excluding the Bayside Aluminium site) falls outside of a "built up environment".	Pipe & Cabling Bridge: Start @ Power Island: -28°48'8.669"S 32°2'36.112"E Corner: -28° 48' 16.357"S 32° 2' 32.49"E Chamber AB: -28° 48' 3.179"S 32° 1' 57.488"E Tower 3: -28° 47' 58.699"S 32° 1' 45.582"E Tower 2: -28° 47' 49.505"S 32° 1' 21.162"E Tower 1: -28° 47' 43.375"S 32° 1' 4.882"E Chamber AA: -28° 47' 38.892"S 32° 0' 52.978"E End @ Substation: -28°47'35.165"S 32°0'43.08"E Contractors Camp/ Laydown area: A. -28° 47' 18.785"S 32° 1' 26.704"E B. -28° 47' 21.332"S 32° 1' 32.998"E C. -28° 47' 48.944"S 32° 1' 15.541"E D. -28° 47' 48.088"S 32° 1' 13.763"E E. -28° 47' 43.218"S 32° 1' 16.779"E F. -28° 47' 42.51"S 32° 1' 15.433"E G. -28° 47' 29.782"S 32° 1' 23.786"E H. -28° 47' 28.358"S 32° 1' 20.955"E
	19	The filling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse.	No longer applicable – all watercourses and wetlands are to be avoided entirely.	No longer applicable.

GN. No. R. 327 – Listing Notice 1	**19A**	The filling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from – (ii) the littoral active zone, an estuary or a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever distance is the greater.	Dredging of the estuary bed (Port of Richards Bay) during the operational phase may be required to provide sufficient draft depth for the Floating Power Barges. The construction of support towers (on-land) and/or main anchorage chamber for the pipe and cabling bridge will require excavation of material within an estuarine environment as the entire area falls within the estuarine function zone. Contractors Camp/ Laydown area will require depositing of a hard-core layer to facilitate the storage of equipment and contractor activities on site.	Corner Co-ordinates of the three areas to be dredged: 1) -28° 47’ 58.398”S 32° 2’ 16.553”E 2) -28° 47’ 56.684”S 32° 2’ 18.211”E 3) -28° 47’ 59.176”S 32° 2’ 24.099”E 4) -28° 48’ 1.926”S 32° 2’ 22.111”E 5) -28° 48’ 7.805”S 32° 2’ 42.571”E 6) -28° 48’ 7.658”S 32° 3’ 1.488”E 7) -28° 48’ 9.819”S 32° 3’ 1.509”E 8) -28° 48’ 9.965”S 32° 2’ 42.593”E 9) -28° 48’ 10.084”S 32° 3’ 2.104”E 10) -28° 48’ 11.714”S 32° 3’ 5.487”E 11) -28° 48’ 39.597”S 32° 2’ 47.451”E 12) -28° 48’ 37.245”S 32° 2’ 43.369”E Pipe & Cabling Bridge: Start @ Power Island: -28°48’8.669”S 32°2’36.112”E Corner: -28° 48’ 16.357”S 32° 2’ 32.49”E Chamber AB: -28° 48’ 3.179”S 32° 1’ 57.488”E Tower 3: -28° 47’ 58.699”S 32° 1’ 45.582”E Tower 2: -28° 47’ 49.505”S 32° 1’ 21.162”E Tower 1: -28° 47’ 43.375”S 32° 1’ 4.882”E Chamber AA: -28° 47’ 38.892”S 32° 0’ 52.978”E End @ Substation: -28°47’35.165”S 32°0’43.08”E Contractors Camp/ Laydown Area: A. -28° 47’ 18.785”S 32° 1’ 26.704”E B. -28° 47’ 21.332”S 32° 1’ 32.998”E C. -28° 47’ 48.944”S 32° 1’ 15.541”E D. -28° 47’ 48.088”S 32° 1’ 13.763”E E. -28° 47’ 43.218”S 32° 1’ 16.779”E F. -28° 47’ 42.51”S 32° 1’ 15.433”E G. -28° 47’ 29.782”S 32° 1’ 23.786”E H. -28° 47’ 28.358”S 32° 1’ 20.955”E

GN. No. R. 327 – Listing Notice 1	**25**	The development and related operation of facilities or infrastructure for the treatment of effluent, wastewater or sewage with a daily throughput capacity of more than 2 000 cubic metres but less than 15 000 cubic metres.	The NIFPP and associated infrastructure will generate wastewater that will be treated within a Waste Water Treatment Plant (WWTP) prior to discharge into the Mhalthuze Water Sea Outfall Pipeline.	28°48'8.34" 32° 2'39.27"
	27	The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation.	The tower footprints supporting the pipe and cabling bridge as well as the temporary laydown areas and footprints associated with the power supply opportunities GIL gantry and/or overhead lines will require the clearing of indigenous vegetation.	Pipe & Cabling Bridge: Tower 2: -28° 47’ 49.505”S 32° 1’ 21.162”E Tower 1: -28° 47’ 43.375”S 32° 1’ 4.882”E Chamber AA: -28° 47’ 38.892”S 32° 0’ 52.978”E Contractors Camp/ Laydown Area: A. -28° 47’ 18.785”S 32° 1’ 26.704”E B. -28° 47’ 21.332”S 32° 1’ 32.998”E C. -28° 47’ 48.944”S 32° 1’ 15.541”E D. -28° 47’ 48.088”S 32° 1’ 13.763”E E. -28° 47’ 43.218”S 32° 1’ 16.779”E F. -28° 47’ 42.51”S 32° 1’ 15.433”E G. -28° 47’ 29.782”S 32° 1’ 23.786”E H. -28° 47’ 28.358”S 32° 1’ 20.955”E Power Supply Opportunities (start & end coordinates per line) To Hillside: Start: -28° 46’ 41.813”S 32° 1’ 0.442”E To Hillside: End: -28° 46’ 17.067”S 32° 1’ 16.127”E To Hillside: Start: -28°46’41.006”S 32°0’58.339”E To Hillside: End: -28° 47’ 14.944”S 32° 0’ 41.031”E To Hillside: Start: -28°46’41.528”S 32°0’54.116”E To Hillside: End: -28° 46’ 16.86”S 32° 1’ 18.839”E To Polaris: Start: -28° 46’ 17.178”S 32° 1’ 14.396”E To Polaris: End: -28° 46’ 17.179”S 32° 1’ 12.911”E Athene/Hillside: Start: -28°46’41.362”S 32°0’59.381”E End: -28°47’14.983”S 32°0’41.203”E GILs to Hillside: Start: -28°46’50.072”S 32°0’50.77”E End: -28°46’42.967”S 32°0’17.326”E

GN No. R. 324 – Listing Notice 3	**12**	The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan. a. KwaZulu-Natal iv. Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004. vi. Within the littoral active zone or 100 metres inland from high water mark of the sea or an estuarine functional zone, whichever distance is the greater, excluding where such removal will occur behind the development setback line or erven in urban areas. xii. Sensitive areas as identified in an environmental management framework as contemplated in Chapter 5 of the Act and as adopted by the competent authority; or xiii. In an estuarine functional zone.	The tower footprints supporting the pipe and cabling bridge as well as the temporary laydown areas and footprints associated with the power supply opportunities GIL gantry and/or overhead lines will require the clearing of indigenous vegetation. The majority of the study area falls within the estuarine functional zone and areas identified as sensitive in the EMF for the Richards Bay Industrial Zone and Port Expansion. Kwambonambi Dune Forest and Kwambonambi Hygrophilous Grassland ecosystems are listed as Critically Endangered and occur within the greater study area.	Pipe & Cabling Bridge: Tower 2: -28° 47’ 49.505”S 32° 1’ 21.162”E Tower 1: -28° 47’ 43.375”S 32° 1’ 4.882”E Chamber AA: -28° 47’ 38.892”S 32° 0’ 52.978”E Contractors Camp/ Laydown Area: A. -28° 47’ 18.785”S 32° 1’ 26.704”E B. -28° 47’ 21.332”S 32° 1’ 32.998”E C. -28° 47’ 48.944”S 32° 1’ 15.541”E D. -28° 47’ 48.088”S 32° 1’ 13.763”E E. -28° 47’ 43.218”S 32° 1’ 16.779”E F. -28° 47’ 42.51”S 32° 1’ 15.433”E G. -28° 47’ 29.782”S 32° 1’ 23.786”E H. -28° 47’ 28.358”S 32° 1’ 20.955”E Power Supply Opportunities (start & end coordinates per line) To Hillside: Start: -28° 46’ 41.813”S 32° 1’ 0.442”E To Hillside: End: -28° 46’ 17.067”S 32° 1’ 16.127”E To Hillside: Start: -28°46’41.006”S 32°0’58.339”E To Hillside: End: -28° 47’ 14.944”S 32° 0’ 41.031”E To Hillside: Start: -28°46’41.528”S 32°0’54.116”E To Hillside: End: -28° 46’ 16.86”S 32° 1’ 18.839”E To Polaris: Start: -28° 46’ 17.178”S 32° 1’ 14.396”E To Polaris: End: -28° 46’ 17.179”S 32° 1’ 12.911”E Athene/Hillside: Start: -28°46’41.362”S 32°0’59.381”E End: -28°47’14.983”S 32°0’41.203”E GILs to Hillside: Start: -28°46’50.072”S 32°0’50.77”E End: -28°46’42.967”S 32°0’17.326”E

GN No. R. 324 – Listing Notice 3	**14**	The development of- (ii) infrastructure or structures with a physical footprint of 10 square metres or more; where such development occurs- (a) within a watercourse; or (b) in front of a development setback; or (c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse; excluding the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour. (d) In KwaZulu-Natal: i. In an estuarine functional zone; vii. Critical biodiversity areas or ecological support areas as identified in schematic biodiversity plans adopted by the competent authority or in bioregional plans. viii. Sensitive areas as identified in an environmental management framework as contemplated in Chapter 5 of the Act and as adopted by the competent authority. x. Outside urban areas (bb) Areas seawards of the development setback line or within 1 kilometre from the high-water mark of the sea if no such development setback line is determined. xi. Inside urban areas (cc) Areas seawards of the development setback line or within 100 metres from the high-water mark of the sea if no such development setback line is determined.	The proposed support structures for the overhead pipe and cabling bridge and power supply opportunities (GIL gantries/ overhead lines) and the Contractors Camp/ Laydown Area may be located within 32m of wetland environments. The majority of the study area falls within the estuarine functional zone and areas identified as sensitive in the EMF for the Richards Bay Industrial Zone and Port Expansion. The proposed NIFPP and associated infrastructure is located within the Port of Richards Bay.	Proposed power island area corner co-ordinates: A. -28°48'01.72"S 32°03'14.79"E B. -28°48'41.63"S 32°02'49.45"E C. -28°48'00.80"S 32°02'18.86"E D. -28°47'51.64"S 32°02'24.88"E Pipe & Cabling Bridge: Start @ Power Island: -28°48'8.669"S 32°2'36.112"E Corner: -28° 48' 16.357"S 32° 2' 32.49"E Chamber AB: -28° 48' 3.179"S 32° 1' 57.488"E Tower 3: -28° 47' 58.699"S 32° 1' 45.582"E Tower 2: -28° 47' 49.505"S 32° 1' 21.162"E Tower 1: -28° 47' 43.375"S 32° 1' 4.882"E Chamber AA: -28° 47' 38.892"S 32° 0' 52.978"E End @ Substation: -28°47'35.165"S 32°0'43.08"E Proposed substation area corner co-ordinates: A. -28°47'14.75"S 32°00'39.80"E B. -28°47'17.86"S 32°00'50.07"E C. -28°47'36.03"S 32°00'42.80"E D. -28°47'34.48"S 32°00'37.40"E E. -28°47'35.79"S 32°00'36.77"E F. -28°47'34.41"S 32°00'31.79"E Contractors Camp/ Laydown Area: A. -28° 47' 18.785"S 32° 1' 26.704"E B. -28° 47' 21.332"S 32° 1' 32.998"E C. -28° 47' 48.944"S 32° 1' 15.541"E D. -28° 47' 48.088"S 32° 1' 13.763"E E. -28° 47' 43.218"S 32° 1' 16.779"E F. -28° 47' 42.51"S 32° 1' 15.433"E G. -28° 47' 29.782"S 32° 1' 23.786"E H. -28° 47' 28.358"S 32° 1' 20.955"E

				Power Supply Opportunities To Hillside: Start: -28° 46’ 41.813”S 32° 1’ 0.442”E To Hillside: End: -28° 46’ 17.067”S 32° 1’ 16.127”E To Hillside: Start: -28°46’41.006”S 32°0’58.339”E To Hillside: End: -28° 47’ 14.944”S 32° 0’ 41.031”E To Hillside: Start: -28°46’41.528”S 32°0’54.116”E To Hillside: End: -28° 46’ 16.86”S 32° 1’ 18.839”E To Polaris: Start: -28° 46’ 17.178”S 32° 1’ 14.396”E To Polaris: End: -28° 46’ 17.179”S 32° 1’ 12.911”E Athene/Hillside: Start: -28°46’41.362”S 32°0’59.381”E End: -28°47’14.983”S 32°0’41.203”E GILs to Hillside: Start: -28°46’50.072”S 32°0’50.77”E End: -28°46’42.967”S 32°0’17.326”E

5.2.1 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*".[5]

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 S&EIR application process.

5.2.2 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 S&EIR application process.

5.3 NATIONAL ENVIRONMENTAL MANAGEMENT: WASTE ACT, 2008 (ACT NO. 59 OF 2008), AS AMENDED [NEMWA]

NEMWA aims to *inter alia* protect health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development, to provide for specific waste management measures, to provide for the licensing and control of waste management activities, to provide for the remediation of contaminated land, and to provide for compliance and enforcement.

In terms of Section 19(1) of the Act, the Minister published a list of waste management activities which have, or are likely to have a detrimental effect on the environment on 03 July 2009 (GN No. R 718 of July 2009). As such no person may commence, undertake or conduct a waste management activity, except in accordance with the requirements or standards determined in terms of Section 19(3) for that activity or a Waste Management License (WML) issued in respect of that activity, if a license is required (Section 20 of NEMWA).

The proposed development does not require a WML.

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

5.4 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 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.

Based on the project description, the proposed activities may require a Water Use License (WUL) from the Department of Human Settlements, Water & Sanitation (DHSWS) as the NIFPP and associated infrastructure would trigger the following Section 21 water uses, and they are not regarded as either an existing water use or permissible in terms of a General Authorisation (GA):

a) Taking water from a water resource;
e) Engaging in a controlled activity identified as such in section 37(1) or declared under section 38(1): 37(1)(c) A power generation activity which alters the flow regime of a water resource; and,
g) Disposing of waste in a manner which may detrimentally impact on a water resource.

Anchor Energy LNG (Pty) Ltd [14/12/16/3/3/2/2033] will apply for the WUL.

5.5 NATIONAL ENVIRONMENTAL MANAGEMENT: AIR QUALITY ACT, 2004 (ACT NO. 39 OF 2004) [NEMAQA]

The objectives of the Act are to:

- Protect the environment by providing reasonable measures for:
    - The protection and enhancement of the quality of air in the Republic;
    - The prevention of air pollution and ecological degradation; and
    - Securing ecologically sustainable development while promoting justifiable economic and social development; and

- Generally to give effect to the Constitution in order to enhance the quality of ambient air for the sake of securing an environment that is not harmful to the health and well-being of people.

In terms of Section 21(1)(a) and 21(3)(a) and (b) of the Act, the Minister published a list of activities and associated minimum emission standards in March 2010 (GN No. R 248 of March 2010). As such, no person may without a provisional atmospheric emission license or an Atmospheric Emission License (AEL) conduct an activity listed on the national list anywhere in the Republic, or listed on the list applicable to a province anywhere in that province (Section 22 of NEMAQA).

The proposed NIFPP and associated infrastructure [Nseleni Corporation (Pty) Ltd: 14/12/16/3/3/2/2032] will require an AEL from DFFE as it triggers listed activities subcategory 1.4 – gas combustion installations and subcategory 2.4 - all liquid storage facilities with combined storage of greater than 1000 m³ (see below) in terms of the list of activities (GN No. R 248 of March 2010) and all power generation AEL are considered a National competency.

5.5.1 SUB-CATEGORY 1.4: GAS COMBUSTION INSTALLATIONS

Description:	Gas combustion (including gas turbines burning natural gas) used primarily for steam raising or electricity generation.		
Application:	All installations with design capacity equal to or greater than 50 MW heat input per unit, based on the lower calorific value of the fuel used.		
Substance or mixture of substances		**Plant status**	**mg/Nm³ under normal conditions of 3% O_2, 273 Kelvin and 101.3 kPa.**
Common name	**Chemical symbol**		
Particulate matter	NA	New	10
		Existing	10
Sulphur dioxide	SO_2	New	400
		Existing	500
Oxides of nitrogen	NO_X expressed as NO_2	New	50
		Existing	300

(a) The following special arrangements shall apply –

(i) Reference conditions for gas turbines shall be 15% O_2, 273K and 101.3kPa.

(ii) Where co-feeding with waste materials with calorific value allowed in terms of the Waste Disposal Standards published in terms of the Waste Act, 2008 (Act No.59 of 2008) occurs, additional requirements under subcategory 1.6 shall apply.

5.5.2 SUB-CATEGORY 2.4: STORAGE AND HANDLING OF PETROLEUM PRODUCTS

(4) *Subcategory 2.4: Storage and Handling of Petroleum Products*

(a) The following transitional arrangement shall apply for the storage and handling of raw materials, intermediate and final products with a vapour pressure greater than 14kPa at operating temperature: –

Leak detection and repair (LDAR) program approved by licensing authority to be instituted, by 01 January 2014.

(b) The following special arrangements shall apply for control of TVOCs from storage of raw materials, intermediate and final products with a vapour pressure of up to 14kPa at operating temperature, except during loading and offloading. (Alternative control measures that can achieve the same or better results may be used) -

(i) Storage vessels for liquids shall be of the following type:

Application	All permanent immobile liquid storage facilities at a single site with a combined storage capacity of greater than 1000 cubic meters.
True vapour pressure of contents at product storage temperature	**Type of tank or vessel**
Type 1: Up to 14 kPa	Fixed-roof tank vented to atmosphere, or as per Type 2 and 3
Type 2: Above 14 kPa and up to 91 kPa with a throughput of less than 50'000 m³ per annum	Fixed-roof tank with Pressure Vacuum Vents fitted as a minimum, to prevent "breathing" losses, or as per Type 3
Type 3: Above 14 kPa and up to 91 kPa with a throughput greater than 50'000 m³ per annum	a) External floating-roof tank with primary rim seal and secondary rim seal for tank with a diameter greater than 20m, or b) fixed-roof tank with internal floating deck / roof fitted with primary seal, or c) fixed-roof tank with vapour recovery system.
Type 4: Above 91 kPa	Pressure vessel

(ii) The roof legs, slotted pipes and/or dipping well on floating roof tanks (except for domed floating roof tanks or internal floating roof tanks) shall have sleeves fitted to minimise emissions.

(iii) Relief valves on pressurised storage should undergo periodic checks for internal leaks. This can be carried out using portable acoustic monitors or if venting to atmosphere with an accessible open end, tested with a hydrocarbon analyser as part of an LDAR programme.

(c) The following special arrangements shall apply for control of TVOCs from the loading and unloading (excluding ships) of raw materials, intermediate and final products with a vapour pressure of greater than 14kPa at handling temperature. Alternative control measures that can achieve the same or better results may be used:

(i) All installations with a throughput of greater than 50'000 m³ per annum of products with a vapour pressure greater than 14 kPa, must be fitted with vapour recovery / destruction units. Emission limits are set out in the table below -

Description:	Vapour Recovery Units		
Application:	All loading/ offloading facilities with a throughput greater than 50 000 m³		
Substance or mixture of substances		**Plant status**	**mg/Nm³ under normal conditions of 273 Kelvin and 101.3 kPa.**
Common name	**Chemical symbol**		
Total volatile organic compounds from vapour recovery/ destruction units using thermal treatment.	N/A	New	150
		Existing	150
Total volatile organic compounds from vapour recovery/ destruction units using non-thermal treatment.	N/A	New	40 000
		Existing	40 000

(ii) For road tanker and rail car loading / offloading facilities where the throughput is less than 50'000 m³ per annum, and where ambient air quality is, or is likely to be impacted, all liquid products shall be loaded using bottom loading, or equivalent, with the venting pipe connected to a vapour balancing system. Where vapour balancing and / or bottom loading is not possible, a recovery system utilizing adsorption, absorption, condensation or incineration of the remaining VOC's, with a collection efficiency of at least 95%, shall be fitted.

5.6 OTHER RELEVANT NATIONAL LEGISLATION

5.6.1 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.

Based on the Wetland and Terrestrial Biodiversity Assessment and on discussions with the specialists, the majority of the proposed development does not require any NEMBA permits prior to the construction phase. However, depending on the exact siting of the support structures (i.e. pylons/ piles) for the GIL gantry that extends westwards from the Bayside Aluminium smelter site towards the collection of ESKOM powerlines in the north-west of the study area, NEMBA permits may be required for possible impacts on intact Maputaland Coastal Belt (Endangered) vegetation. Please refer to the EMPr (Appendix 5) for specific management measures to be implemented prior to the commencement on construction activities. NEMBA permits would be the responsibility of Nseleni Corporation (Pty) Ltd [14/12/16/3/3/2/2032].

5.6.2 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.

With the change of the substation and switching yard to within the Bayside Aluminium smelter site, no heritage sites will be impacted by the proposed development activities. The routing of the GIL gantry westwards from the Bayside site towards the ESKOM powerlines is currently south of two known heritage site (refer to the Heritage Impact Assessment Report in Appendix 6) locations. No impacts, as a result of the proposed NIFPP and associated infrastructure, on these two heritage sites are anticipated.

5.6.3 NATIONAL ENVIRONMENTAL MANAGEMENT: INTEGRATED COASTAL MANAGEMENT ACT, 2008 (ACT NO. 24 OF 2008) [NEMICMA]

The objectives of the Act are:

- To determine the coastal zone of the Republic;
- To provide for the co-ordinated and integrated management of the coastal zone by all spheres of government;
- To preserve, protect, extend and enhance the status of coastal public property;
- To secure equitable access to the opportunities and benefits of coastal public property; and,
- To give effect to the Republic's obligations in terms of international law regarding coastal management and the marine environment.

In terms of Section 70 of NEMICMA no person may dump any waste or other material at sea or even load this material on a vessel/ ship with the intention of dumping at sea, without a Dumping Permit issued in terms of Section 71 of the Act. The proposed project [Anchor Energy LNG (Pty) Ltd: 14/12/16/3/3/2/2033] will require a Dumping at Sea Permit. This permit can only be applied for once NEMA EA has been received and should be applied for "no later than 90 calendar days prior to the date on which dumping is intended to take place". The authority issuing the Dumping Permit must take into account the following before making a decision:

- The Waste Assessment Guidelines set out in Schedule 2 of the Act;
- Any coastal management programme applicable in the area;
- The likely environmental impact of the proposed activity;
- National legislation dealing with waste;
- The interests of the whole community;
- Transboundary impacts and international obligations and standards; and,
- Any other factors that may be prescribed.

Schedule 2 of the Act presents the guidelines for reducing the necessity for dumping at sea in accordance with Schedule II to the Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matters adopted on 7 November 1996. Of particular relevance is the need to establish the following during the assessment of the alternatives to dumping at sea:

- The types, amounts and relative hazard of wastes generated;
- The feasibility of the following waste reduction techniques;
- Destruction of hazardous constituents;
- Treatment to reduce or remove the hazardous constituents; and,
- The practical availability of other means of disposal should be considered in the light of a comparative risk assessment involving both dumping at sea and the alternatives.

In addition, a detailed description and characterisation of the waste is an essential precondition for the consideration of alternatives and the basis for a decision as to whether a waste may be dumped. If a waste is so poorly characterised that a proper assessment cannot be made of its potential impacts on health and the environment, that waste may not be dumped. Characterisation of the wastes and their constituents must take into account -

- Origin, total amount, form and average composition;
- Properties: physical, chemical, biochemical and biological;
- Toxicity;
- Persistence: physical, chemical and biological; and,
- Accumulation and biotransformation in biological materials or sediments.

5.6.4 NATIONAL FOREST ACT, 1998 (ACT NO. 84 OF 1998) (NFA)

The objectives of the Act are:

- Promote the sustainable management and development of forests for the benefit of all;
- Create the conditions necessary to restructure forestry in State forests;
- Provide special measures for the protection of certain forests and trees;
- Promote the sustainable use of forests for environmental, economic, educational, recreational, cultural, health and spiritual purposes;
- Promote community forestry; and,
- Promote greater participation in all aspects of forestry and the forest products industry by persons disadvantaged by unfair discrimination.

The NFA has listed a number of protected trees (latest listing: Government Gazette Notice No. R. 1602 of 23 December 2016) that require a permit from DFFE prior to the disturbance or destruction of any protected tree. The following protected trees (identified in the immediate surrounding areas) may require permits from DFFE, issued to Nseleni Power Corporation (Pty) Ltd [14/12/16/3/3/2/2032], prior to the commencement of activities that specifically impact on the trees identified:

- *Ficus tricopoda* (Swamp Fig);
- Various Mangrove Tree species and/or Mangrove Forests; and,
- *Sclerocarya birrea* subsp. *caffra* (Marula).

Based on the current proposed development layout it is unlikely that protected tree permits in terms of the NFA will be required. However, specific management interventions and conditions have been stipulated within the attached EMPr (Appendix 5) to ensure that no protected tree and/or forest patches are negatively impacted on without the necessary permits being in place. If required, Nseleni Power Corporation (Pty) Ltd [14/12/16/3/3/2/2032] would apply for such permits.

5.6.5 NATIONAL ENERGY ACT, 2008 (ACT NO. 34 OF 2008)

The Act requires that diverse energy resources are available in sustainable quantities and at affordable prices in South Africa. In addition, the Act provides for the increased use of renewable energies, contingency energy supplies, the holding of strategic energy feedstock and carriers, and adequate investment in energy infrastructure.

5.7 RELEVANT PROVINCIAL AND MUNICIPAL LEGISLATION

5.7.1 NATAL NATURE CONSERVATION ORDINANCE (NO. 15 OF 1974)

In terms of Chapter XI: Indigenous Plants, the removal and/or relocation of possible individuals of Large Yellow Eulophia (*Eulophia speciosa*), i.e. orchid (found on the adjacent Bayside site) requires a permit from Ezemvelo KZN Wildlife. The White Arum Lily (*Zantedeschia aethiopica)* (Regionally Protected) may occur in marshy habitats corresponding with wetland areas and would also require a permit prior to any disturbances.

Based on the current proposed development layout it is unlikely that protected tree permits in terms of the NFA will be required. However, specific management interventions and conditions have been stipulated within the attached EMPr (Appendix 5) to ensure that no protected tree and/or forest patches are negatively impacted on without the necessary permits being in place. If required, Nseleni Power Corporation (Pty) Ltd [14/12/16/3/3/2/2032] would apply for such permits.

5.7.2 ENVIRONMENTAL HEALTH BYLAWS

5.7.2.1 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 project may trigger the following activities listed in Annexure B: Scheduled Trades of the Environmental Health Bylaws:

48. The handling or storage of any substance or material which can lead to a public health hazard.

5.7.3 WATER SERVICES BYLAWS

5.7.3.1 uThungulu District Municipality – Water Services Bylaws (May 2003)

Section 76 of the Water Services Bylaws imposes additional conditions that must be adhered too, over and above conditions imposed in terms of the NWA. One such condition is compliance with the standards and criteria as set out in Schedule B of the Bylaws.

5.8 RELEVANT SOUTH AFRICAN POLICIES, PROGRAMMES, PLANS AND GUIDELINES

5.8.1 WHITE PAPER ON THE ENERGY POLICY, DECEMBER 1998

The White Paper was developed so as to clarify government policy regarding the supply and consumption of energy for the next decade. It was intended to address all elements of the energy sector as practically as it could. This White Paper gives an overview of the South African energy sector's contribution to GDP, employment, taxes and the balance of payments. It concludes, that the sector can greatly contribute to a successful and sustainable national growth and development strategy. The main objectives of the White Paper are the following:

- Increasing access to affordable energy services;
- Improving energy governance;
- Stimulating economic development;
- Managing energy-related environmental impacts; and,
- Securing supply through diversity.

The proposed NIFPP will address and positively contribute to all of the main objectives listed above, refer to Section 3: Need and Desirability for more details.

5.8.2 INTEGRATED ENERGY PLAN (IEP)

The IEP is a multi-faceted, long-term energy framework which takes into consideration the crucial role that energy plays in the entire economy and is informed by the output of analyses founded on a solid fact base. The IEP was undertaken to determine the best way to meet current and future energy service needs in the most efficient and socially beneficial manner. The IEP has multiple objectives, some of which include:

- To guide the development of energy policies and, where relevant, set the framework for regulations in the energy sector;
- To guide the selection of appropriate technologies to meet energy demand (i.e. the types and sizes of new power plants and refineries to be built and the prices that should be charged for fuels);
- To guide investment and the development of energy infrastructure in South Africa; and,

- To propose alternative energy strategies which are informed by testing the potential impacts of various factors, such as proposed policies, introduction of new technologies, and effects of exogenous macro-economic factors.

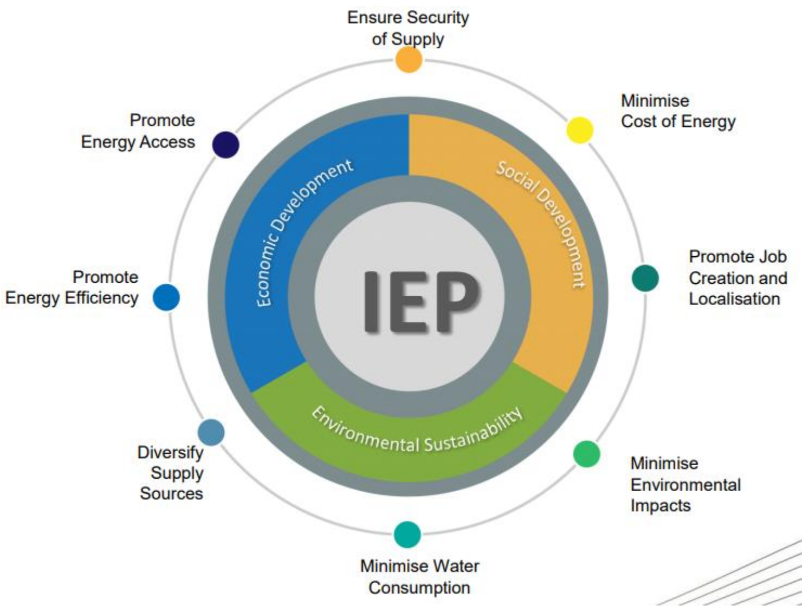


Figure 33: 8 key energy planning objectives as highlighted in the Integrated Energy Plan (2016)

The proposed NIFPP will address and contribute to all of the 8 key energy planning objectives as reflected in Figure 33 above, refer to Section 3: Need and Desirability for more details.

5.8.3 INTEGRATED RESOURCE PLAN (IRP) 2019

The IRP is an electricity infrastructure development plan based on least cost supply and demand balance taking into account security of supply and the environment (minimize negative emissions and water usage). The promulgated IRP 2010–2030 identified the preferred generation technology required to meet expected demand growth up to 2030. It incorporated government objectives such as affordable electricity, reduced greenhouse gas (GHG) emissions, reduced water consumption, diversified electricity generation sources, localisation and regional development. Following the promulgation of the IRP 2010–2030, implementation followed in line with Ministerial Determinations issued under Section 34 of the Electricity Regulation Act, 2006 (Act No. 4 of 2006). The Ministerial Determinations give effect to planned infrastructure by facilitating the procurement of the required electricity capacity. Since the promulgated IRP 2010–2030, the following capacity developments have taken place:

- A total 6 422 MW under the Renewable Energy Independent Power Producers Programme (REIPPP) has been procured, with 3 876 MW operational and made available to the grid.
- In addition, IPPs have commissioned 1 005 MW from two Open Cycle Gas Turbine (OCGT) peaking plants.
- Under the Eskom build programme, the following capacity has been commissioned:
    - 1 332 MW of Ingula pumped storage;
    - 1 588 MW of Medupi, 800 MW of Kusile; and,
    - 100 MW of Sere Wind Farm.
- In total, 18 000MW of new generation capacity has been committed to.

Besides capacity additions, a number of assumptions have changed since the promulgation of IRP 2010–2030. Key assumptions that changed include the electricity demand projection, Eskom's existing plant performance, as well as new technology costs. These changes necessitated the review and update of the IRP. In the period prior to 2030, the system requirements are largely for incremental capacity addition (modular) and flexible technology, to complement the existing installed inflexible capacity (refer to Table 8 for timelines).

Coal: Beyond Medupi and Kusile coal will continue to play a significant role in electricity generation in South Africa in the foreseeable future as it is the largest base of the installed generation capacity and it makes up the largest share of energy generated.

Nuclear: Koeberg Power Station reaches end of design life in 2024. The development of small nuclear units elsewhere in the world is therefore particularly interesting for South Africa, and upfront planning with regard to additional nuclear capacity is requisite, given the >10-year lead time, for timely decision making and implementation.

Natural Gas: Gas to power technologies in the form of CCGT, CCGE or ICE provide the flexibility required to complement renewable energy. While in the short term the opportunity is to pursue gas import options, local and regional gas resources will allow for scaling up within manageable risk levels. Exploration to assess the magnitude of local recoverable shale and coastal gas are being pursued and must be accelerated.

Renewable Energy: Solar PV, wind and Concentrated Solar Power with storage present an opportunity to diversify the electricity mix, to produce distributed generation and to provide off-grid electricity. Renewable technologies also present huge potential for the creation of new industries, job creation and localisation across the value chain.

Hydro: South Africa's rivers carry potential for run-off river hydro projects.

Energy Storage: The traditional power delivery model is being disrupted by technological developments related to energy storage, and more renewable energy can be harnessed despite the reality that the timing of its production might be during low-demand periods. Storage technologies including battery systems, compressed air energy storage, flywheel energy storage, hydrogen fuel cells etc. are developments which can address this issue, especially in the South African context where over 6 GW of renewable energy has been introduced, yet the power system does not have the requisite storage capacity or flexibility.

5.8.3.1 Key considerations and actions from the IRP 2019 which are relevant in terms of the proposed NIFPP:

Decision 1: Undertake a power purchase programme to assist with the acquisition of capacity needed to supplement Eskom's declining plant performance and to reduce the extensive utilisation of diesel peaking generators in the immediate to medium term. Lead-time is therefore key.

Decision 7: To support the development of gas infrastructure and in addition to the new gas to power capacity, convert existing diesel-fired power plants (Peakers) to gas.

Decision 9: In support of regional electricity interconnection including hydropower and gas, South Africa will participate in strategic power projects that enable the development of cross border infrastructure needed for the regional energy trading.

Table 8: IRP 2019

	Coal	Coal (Decommissioning)	Nuclear	Hydro	Storage	PV	Wind	CSP	Gas & Diesel	Other (Distributed Generation, CoGen, Biomass, Landfill)
Current Base	37 149		1 860	2 100	2 912	1 474	1 980	300	3 830	499
2019	2 155	-2373					244	300		Allocation to the extent of the short term capacity and energy gap.
2020	1 433	-557				114	300			
2021	1 433	-1403				300	818			
2022	711	-844			513	400 1000	1600			
2023	750	-555				1000	1600			500
2024			1860				1600		1000	500
2025						1000	1600			500
2026		-1219					1600			500
2027	750	-847					1 600		2000	500
2028		-475				1000	1 600			500
2029		-1694			1575	1000	1 600			500
2030		-1050		2 500		1 000	1 600			500
TOTAL INSTALLED CAPACITY by 2030 (MW)	33364		1860	4600	5000	8288	17742	600	6380	
% Total Installed Capacity (% of MW)	43		2.36	5.84	6.35	10.52	22.53	0.76	8.1	
% Annual Energy Contribution (% of MWh)	58.8		4.5	8.4	1.2*	6.3	17.8	0.6	1.3	

Installed Capacity
Committed / Already Contracted Capacity
Capacity Decommissioned
New Additional Capacity
Extension of Koeberg Plant Design Life
Includes Distributed Generation Capacity for own use

- 2030 Coal Installed Capacity is less capacity decommissioned between years 2020 and 2030
- Koeberg power station rated / installed capacity will revert to 1926 MW (original design capacity) following design life extension work.
- Other / Distributed generation includes all generation facilities in circumstances in which the facility is operated solely to supply electricity to an end-use customer within the same property with the facility
- Short term capacity gap is estimated at 2000 MW

The model is unable to deploy gas to complement renewables as it is assumed gas will only be available from year 2024.

Risk and mitigation considerations within the IRP as they pertain to gas

Gas	The availability of gas in the short to medium term is a risk as South Africa does not currently have gas resources. There is also a supply and foreign exchange risk associated with likely increase in gas volumes depending on the energy mix adopted post 2030 when a large number of coal fired power stations are decommissioned.	• For the period up to 2030 gas to power capacity in the IRP has realistically taken into account the infrastructure and logistics required around ports/pipelines, electricity transmission infrastructure. The IRP has therefore adjusted the lead times. • As proposed in the draft IRP update, work to firm up on the gas supply options post 2030 is ongoing. This work will inform in detail the next iteration of the IRP.

The proposed NIFPP will significantly contribute to the Natural Gas component of the energy mix as well as assist with key decisions 1, 7 and 9 as listed above. Please refer to Section 3: Need and Desirability for more details.

5.8.4 NOISE CONTROL REGULATIONS (1992) AND SOUTH AFRICAN NATIONAL STANDARD (SANS) 10103 (2008)

The 1992 Noise Control Regulations (The Republic of South Africa, 1992) published in terms of Section 25 of the Environment Conservation Act, 1989 (Act no. 73 of 1989) (ECA) defines a “disturbing noise” as a noise level which exceeds the zone sound level or, if no zone sound level has been designated, a noise level which exceeds the ambient sound level at the same measuring point by 7 dBA or more.

SANS 10103 (2008) successfully addresses the manner in which environmental noise measurements are to be taken and assessed in South Africa, and is fully aligned with the WHO guidelines for Community Noise (WHO, 1999). It should be noted that the values given in Table 9 are typical rating levels that it is recommended should not be exceeded outdoors in the different districts specified. Outdoor ambient noise exceeding these levels will be annoying to the community.

Table 9: Typical rating levels for outdoor noise

Type of district	Equivalent Continuous Rating Level ($L_{Req,T}$) for Outdoor Noise		
	Day/night $L_{R,dn}^{(c)}$ (dBA)	Day-time $L_{Req,d}^{(a)}$ (dBA)	Night-time $L_{Req,n}^{(b)}$ (dBA)
Rural districts	45	45	35
Suburban districts with little road traffic	50	50	40
Urban districts	55	55	45
Urban districts with one or more of the following; business premises; and main roads.	60	60	50
Central business districts	65	65	55
Industrial districts	70	70	60

Notes
(a) LReq,d =The LAeq rated for impulsive sound and tonality in accordance with SANS 10103 for the day-time period, i.e. from 06:00 to 22:00.
(b) LReq,n =The LAeq rated for impulsive sound and tonality in accordance with SANS 10103 for the night-time period, i.e. from 22:00 to 06:00.
(c) LR,dn =The LAeq rated for impulsive sound and tonality in accordance with SANS 10103 for the period of a day and night, i.e. 24 hours, and wherein the LReq,n has been weighted with 10dB in order to account for the additional disturbance caused by noise during the night.

SANS 10103 also provides a useful guideline for estimating community response to an increase in the general ambient noise level caused by intruding noise. If Δ is the increase in noise level, the following criteria are of relevance:

- “Δ ≤ 0 dB: There will be no community reaction;
- 0 dB < Δ ≤ 10 dB: There will be ‘little’ reaction with ‘sporadic complaints’;
- dB < Δ ≤ 15 dB: There will be a ‘medium’ reaction with ‘widespread complaints’. ⍰ = 10 dB is subjectively perceived as a doubling in the loudness of the noise;
- 10 dB < Δ ≤ 20 dB: There will be a ‘strong’ reaction with ‘threats of community action’; and
- 15 dB < Δ: There will be a ‘very strong’ reaction with ‘vigorous community action’.

The categories of community response overlap because the response of a community does not occur as a stepwise function, but rather as a gradual change.

The IFC states that noise impacts should not exceed the levels presented in Table 10, or result in a maximum increase above background levels of 3 dBA at the nearest receptor location off-site (IFC, 2007). For a person with average hearing acuity an increase of less than 3 dBA in the general ambient noise level is not detectable. Δ = 3 dBA is, therefore, a useful significance indicator for a noise impact.

It is further important to note that the IFC noise level guidelines for residential, institutional and educational receptors correspond with the SANS 10103 guidelines for urban districts

Table 10: IFC Noise Level Guidelines

Area	One Hour L_{Aeq} (dBA) 07:00 to 22:00	One Hour L_{Aeq} (dBA) 22:00 to 07:00
Industrial receptors	70	70
Residential, institutional and educational receptors	55	45

The proposed NIFPP does not exceed any of the guideline values at off-site sensitive receptors. Please refer to Section 12.3.1.3 for findings from the Noise Impact Assessment study.

5.8.5 2035 KZN PROVINCIAL GROWTH AND DEVELOPMENT STRATEGY (2016)

The KZN's Provincial Growth and Development Strategy (PGDS) is concisely summarised in the figure below. Of particular relevance to this project is "***Strategic Objective 4.5: Ensure access to affordable, reliable, sustainable and modern energy for all. Sufficient electricity is available for the growth and development needs of KZN***". The PGDS states that energy supply in the province, and country, is becoming increasingly expensive for both domestic and business/industrial consumers, and this is exacerbated by the lack of investment in electricity infrastructure (new and maintenance of existing infrastructure). It highlights that the province must prioritise alternative energy projects and/or programmes as a reliable supply of energy. Alternative energy supply or the green economy must become measurable within the Provincial Growth and Development Plan.

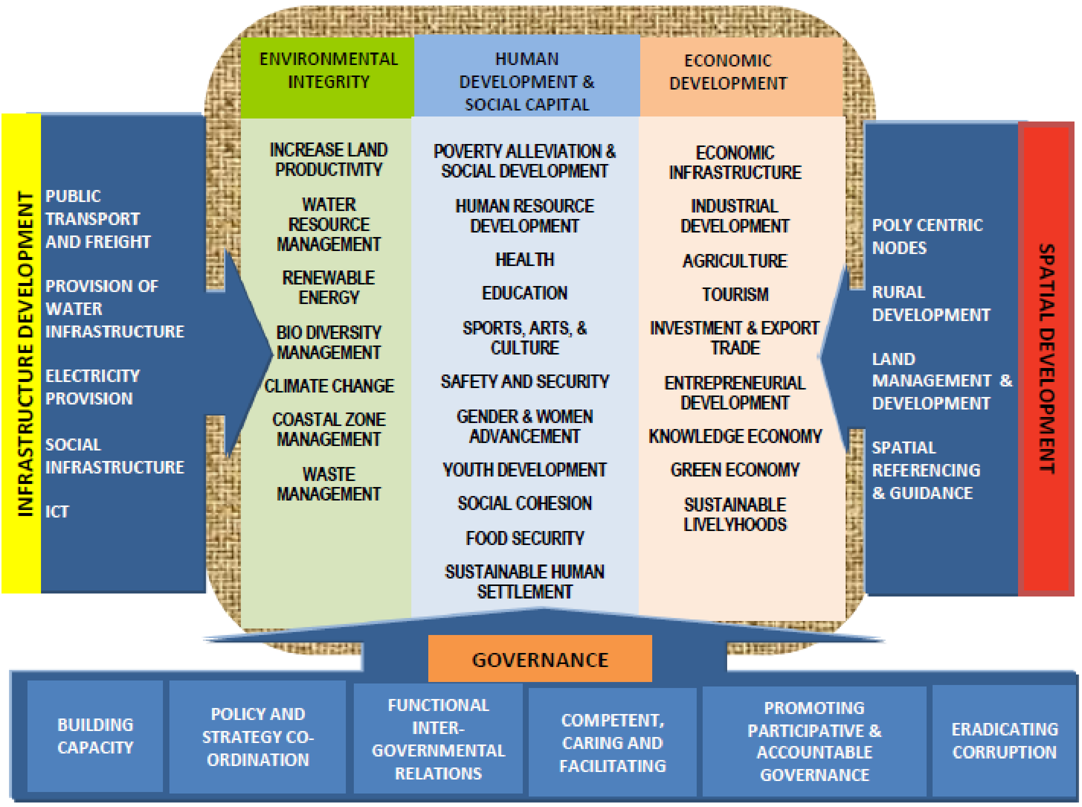


Figure 34: KZN Provincial Growth and Development Strategy

The NIFPP will significantly contribute to the overall sustainability and security of electricity within the KZN province. Please refer to Section 3: Need and Desirability for more details.

5.8.6 KING CETSHWAYO DISTRICT MUNICIPALITY INTEGRATED DEVELOPMENT PLAN (2019/20 – 2021/22)

The KCDM IDP's Vision is "*By 2035 King Cetshwayo District Municipality will be a cohesive; economically viable district, with sustainable strategic infrastructure; supporting job creation through radical economic transformation rural development and promotion of our heritage*".

KCDM's mission is that it will serve its communities to create a prosperous district through:

- Provision of sustainable; quality water and sanitation services;
- Developing the economy through radical economic transformation and job creation;
- Promoting rural development; agrarian reform and food security;
- Co-ordinate planning, spatial equity and environmental sustainability; and,
- Promoting heritage, community participation, nation building and good governance.

The articulated vision of the KCDM is as follows:
By 2035, King Cetshwayo district is renowned for the vastly improved socio-economic status of its residents resulting from 15 years of sustained economic growth. The district is internationally recognized as a world leader in innovative and sustainable manufacturing based on the successful implementation of the RBIDZ initiative. This economic growth, together with the district rural development programme resulted in the creation of decent employment opportunities leading to the fastest growing household and individual income levels in the province, and reducing the unemployment rate of the youth in the district by more than 50%. It also resulted in a significant decrease in the economic dependency ratio and improving the overall quality of life in the district. The economic growth is underpinned by a vastly improved information and telecommunication infrastructure network with the entire district having access to a wireless broadband service, all businesses, and more than 50% of households with access to a computer and internet service. By 2035, the district is characterised by a high-quality infrastructure network supporting both household needs and economic growth. All households are provided with access to appropriate water infrastructure, adequate sanitation, and sustainable energy sources. Improved access to health facilities and quality of health services provided resulted in continually improving health indictors in the district. The quality of the output from the primary and secondary education system has improved dramatically and all learners have access to fully equipped primary and secondary education facilities. Sustainable and coherent spatial development patterns have been successfully implemented through innovative spatial planning frameworks and effective land use management systems implemented by highly skilled officials. Improved public sector management and skills levels resulted in sound local governance and financial management.

The KCDM IDP specifically emphasises that the national energy crises has far reaching implications on the supply and maintenance of infrastructure services to the district, notable the cost for stand by generators at pump stations as well as the running costs of such generators. The environmental costs of increased combustion into the atmosphere as a result of generator operations was also highlighted as a risk to be considered.

The proposed NIFPP will contribute to the 2035 vision of the District Municipality through the provision of sustainable and assured supply of electricity for supporting households and economic growth envisioned. Please refer to Section 3: Need and Desirability for more details

5.8.7 CITY OF UMHLATHUZE FINAL IDP REVIEW 2019/2020 (2ND REVIEW OF THE 2017/2022 IDP)

The City of uMhlathuze has produced the 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 review highlights the Sustainable Development Goals (SDG) offer major improvements on the Millennium Development Goals (MDGs). The SDG framework addresses key systemic barriers to sustainable development such as inequality, unsustainable consumption patterns, weak institutional capacity, and environmental degradation that the MDGs neglected. As such, the City of uMhlathuze have outlined how their interventions will align with the SDGs. The following is of relevance to this proposed project:

7.	Ensure access to affordable, reliable and modern energy for all.		• Energy Master Plan • Target reduction of 30% of coal powered stations by 2030 • 2000MW Gas to Power • Renewable Energy Efficiency initiatives • Waste to Energy Project • Energy infrastructure upgrade
13.	Take urgent action to combat climate change and its impacts.	Optimal management of natural resources and commitment to sustainable environmental management.	• Climate Change Action Plan • International Partnerships and collaborations (ICELI) • Adaptation and Mitigation Programme • Accelerating low emission development • Responding with adaption initiatives • Urban Air Quality Management • Signed Global Compact of Mayors • Gas to Power Project • Waste Water Reuse

Figure 35: Extracts from the table within the IDP review that highlights the alignment between the SDGs and the City of uMhlathuze's Strategic Framework.

The proposed NIFPP will assist in meeting the gas to power target of 2000MW, which in addition may also lead to a reduced dependence on electricity from the Highveld coal powered stations. LNG is also known to be a cleaner and more environmentally friendly alternative to coal and other fossil fuels. This will also assist with reducing air quality and knock-on climate change impacts. Please refer to Section 3: Need and Desirability for more details.

5.8.8 ENVIRONMENTAL MANAGEMENT FRAMEWORK FOR THE RICHARDS BAY PORT EXPANSION AND INDUSTRIAL DEVELOPMENT ZONE – ADOPTED 01 DECEMBER 2015

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"[6]. The baseline assessment showed that the study area has four distinct landscape features, namely floodplain on low-lying areas, coastal plain on higher ground, coastal dunes and surface water features. The adjoining oceans make up the fifth distinct feature and, although not part of the EMF, interacts with and influence the characteristics of the area. Within these broad areas there are distinct sub-areas that are defined by biophysical, economic and social factors. The EMF focused on these subareas to distinguish them from each other in terms of how they are used, their environmental sensitivity, their respective opportunities and constraints, and the expectations that stakeholders have for them. This focus was necessary to establish the way they should be managed in future to realize the EMF vision. The result of this process is eight environmental management zones that spatially depict sensitive environmental features and attributes, and land use characteristics of the area (Figure 36). A ninth management zone has been created as an overlay to address issues of conflicting and long-term land use proposals (Figure 36).

[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.

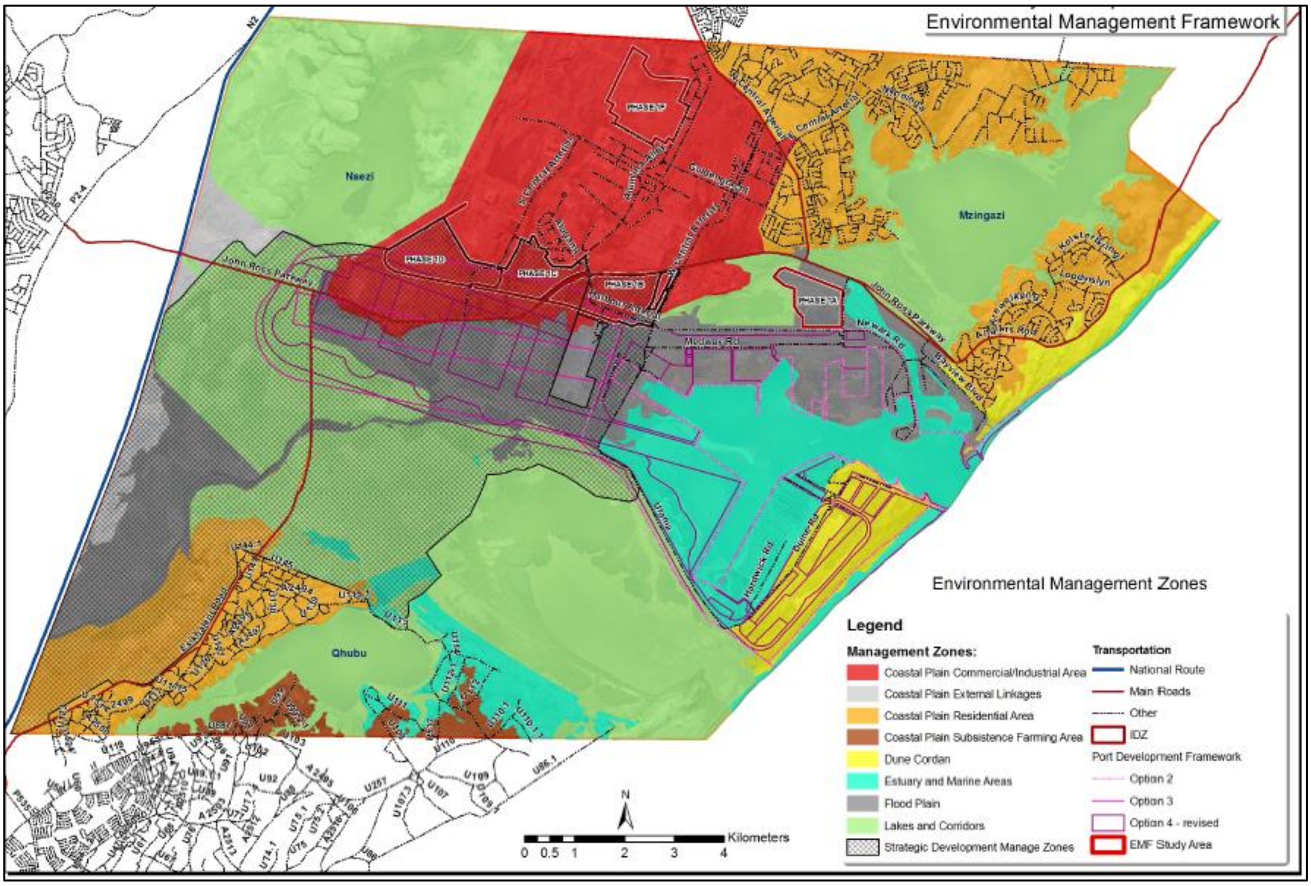


Figure 36: Environmental Management Zones as well as well as the Strategic Development Management Zone of the Richards Bay Port Expansion and IDZ EMF.

Zone 3: Port Estuarine, Marine & Seashore Area: Figure 37 below highlights the environmental sensitivities applicable to the study area for the proposed NIFPP.

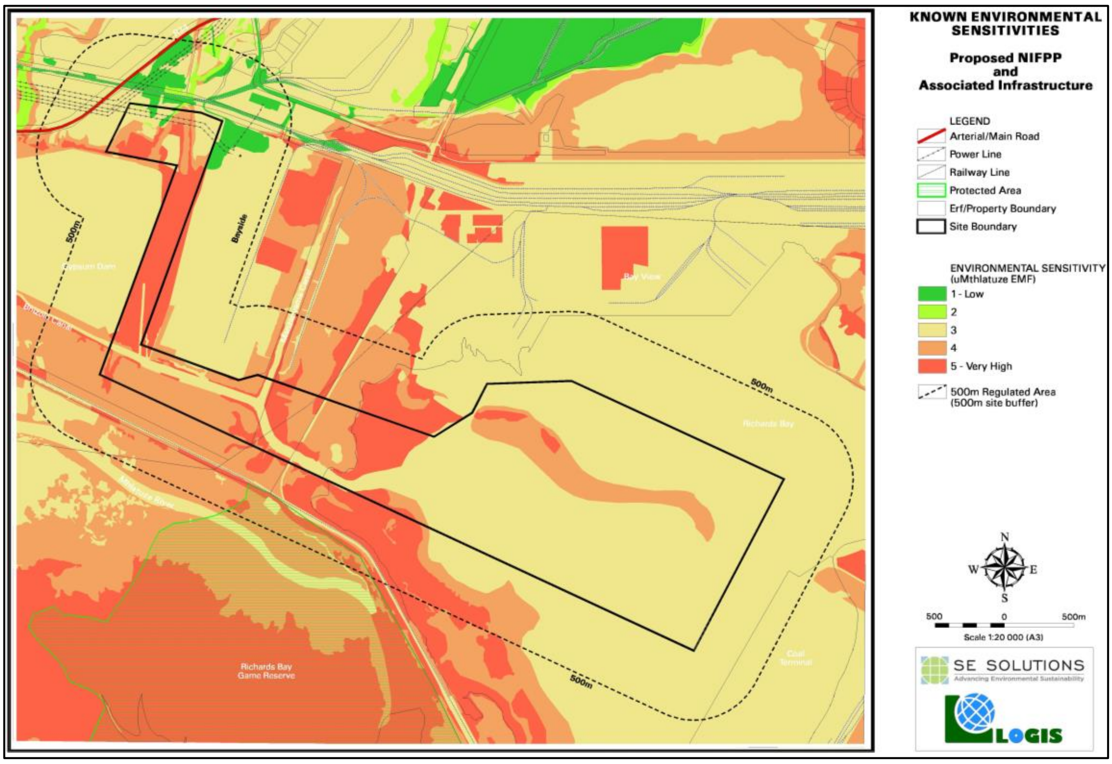


Figure 37: Environmental sensitivity of Zone 3 as per the Richards Bay Port Expansion and IDZ EMF.

Table 11 highlights the assessment issues and decision-making criteria within this zone, while Table 12 provides the strategic management guidelines that should be considered for all development within this zone.

Table 11: Sustainability criteria for Zone 3.

DECISION-MAKING CRITERIA FOR THE PORT ESTUARY, MARINE AND SEASHORE AREA (ZONE 3)			
Sustainability Objective (Policy Priorities)	**Strategic Issues**	**Sensitive attributes** (Assessment issues)	**Thresholds** (Measurement endpoints)
1. Protect the quality and character of the landscape	Conservation Priorities	• Character of the landscape (areas of high visual quality and/or scenic value, as well as sense of place). • The interaction between the estuary and the coastal plain, lakes in the area and the marine environment. • Hydrodynamic features and changes in the hydrodynamic functioning of the port • Coastal erosion	• Development should not significantly impact on the landscape or townscapes, changing the sense of place. • Development should not disturb the hydrological linkages it contains with the coastal plain, the area's lake systems or the marine environment.
2. Protect the hydrological functioning of the area (including water quality and quantity)	Conservation Priorities	• Hydrological functioning of the estuarine systems • Water quality of the estuaries • Flow and water quality of hydrological linkages entering the system • The area where the Mhlathuze enters the Sanctuary (Mhlathuze Lagoon) • Tidal prism	• Development should not impair the hydrological functioning of the estuary • Development should not affect water quality and/or the Sanctuary. • There should be 100% compliance with water quality guidelines
3. Protect critical ecological assets to maintain biodiversity integrity	Conservation Priorities	• Formal conservation areas • Mangrove forests (critically endangered vegetation types) • Estuarine habitats • Intertidal habitat productivity	• Development should not impact/destroy the remaining ecological assets (critical habitats) in the area. • Development should not compromise the future of the conservation area. • 100% of mangrove forests are protected
4. Protect atmospheric integrity and air quality in the interest of local people	Consumption & Production	• Shipping emissions • Air quality limits and/or emission standards	• Development should not exceed local air quality guidelines (cumulative impact) and it must comply with national emission standards. • Indicators as defined for air quality (emission standards)
5. Promote sustainable consumption and production patterns whilst rectifying the results of past practices.	Consumption & Production	• Energy efficiency of sectors • Waste streams and disposal • Pollution potential of activities (air, water and land) to ground and surface water. • Existing waste management infrastructure and services	• Improvement in energy efficiency as per the demand side energy targets for sectors specified in the Mhlathuze Energy Strategy (2009) • Development must manage and minimise waste streams • 0 waste to landfill policy with targets of 50% reduction by 2012 and 0% waste by 2020.
6. Protect community needs & secure sustainable livelihoods 7. Protect the interests of the Port of Richards Bay 8. Protect the interest of industrial development. 9. Protect the interests of locally important development (tourism and recreation. 10. Protect and maintain services infrastructure	Development Priorities	• Port Development Framework • SDF and other development plans and proposals • Areas that have recreational value to communities. • Areas that have subsistence value to communities.	• Development should not have detrimental impact on the value of, or access to, recreational areas that are important to communities. • Development should not have detrimental impact on the value of, or access to, resources that have subsistence value to communities.
11. Promote integrated planning and improve coordination between relevant stakeholders to achieve the sustainability objectives	Institutional Capacity	• Port access control legislation and protocols • Transnet Sustainability Framework and associated environmental management programmes • Arrangements for the implementation, management and monitoring of offsets	• Decisions that are made in respect of offsets without a national offset policy is an institutional risk with potential ecological consequences. • Decisions that ignore the impact of development on the whole study area should be discouraged.
12. Manage risks and uncertainties 13. Build resilience in the landscape to adapt to climate change and sea level rise	Uncertainty	• Flood cycles • Landscape-level ecosystem risks • Sea level rise • The historical floodplain delineation (2m contour) and the potential impact of sea level rise on parcels of land over time.	• Development should not reduce the ecosystem's resilience and ability to adapt to changes associated with global warming and sea level rise.

Table 12: Strategic Management Guidelines for Zone 3.

Strategic Issues	Guideline	Responsibility
Conservation Priorities	**Critical ecological assets and linkages** must be protected and managed in this zone by: • Discouraging activities that would cause irreparable damage to remaining ecological assets as identified in the EMF and/or assets that are currently protected in the City's Environmental Service Management Plan; • Discouraging activities that would impair the hydrological functioning and ecological integrity of the Mhlathuze River and the Mzingazi canal; • Discouraging uncontrolled resource harvesting; • Implementing buffers zones around key assets to reduce disturbances; • Implementing a precautionary management strategy for biodiversity offsets to facilitate a no net loss policy and preferably a net gain of biodiversity on the ground with respect to species composition, habitat structure, ecosystem function and people's use and cultural values associated with biodiversity; • Implementing the best practice guidelines and recommendations for land use planning and management of specific coastal features and aspects of development as specified in local guidelines (CSIR, 2006: Schoonees et al, 2008; and CPEC, 2008); and • Initiating the development of an Estuary Management Plan in terms of the Integrated Coastal Management Act (2008) for the Port Estuary.	• The City of uMhlathuze • Ezemvelo KZN Wildlife • Provincial Environmental Affairs (DAERD) • Transnet • Landowners/Developers
Consumption & Production	Current and future **waste and pollution streams** in this zone must be managed by: • Strengthening port environmental management programmes to manage the range of environmental issues associated with port construction such as water pollution, contamination of bottom sediments, loss of bottom biota, damage to fisheries, beach erosion, waste discharges, oil leakages and spillage, hazardous materials, air emissions, noise and odour, etc; • Adhering to minimum emission standards as promulgated by national government (GN 248 of 31 March 2010); and • Ensuring that development proposals adjacent to this zone minimise and/or avoid waste and pollution that may negatively impact water quality through appropriate design measures.	• The City of uMhlathuze • Provincial Environmental Affairs (DAERD) • Transnet • Landowners/Developers
Development Priorities	The **port expansion potential** in this zone and the associated offset proposals must be managed by: • Implementing a precautionary management strategy for biodiversity offsets to facilitate a no net loss policy and preferably a net gain of biodiversity on the ground with respect to species composition, habitat structure, ecosystem function and people's use and cultural values associated with biodiversity; • Taking into account the draft policy documents and Best Practice Guidance that were developed by relevant authorities and other organisations as listed in Addendum 8 of this report; and • Adhering to the desired state and guidelines as specified in Zone 9 of the EMF.	• The City of uMhlathuze • Ezemvelo KZN Wildlife • Provincial Environmental Affairs (DAERD) • National Department of Environmental Affairs • SANBI • Transnet
	Planning must ensure that **tourism and recreational development** is sustainable over the long-term. This must be achieved by: • Ensuring that development is compatible with the long-term port development objectives and plans (50 years+) and the potential impact that this may have on short-term proposals; • Discouraging proposals that may significantly reduce public access to recreational assets; • Encouraging low-density tourism and recreational activities; • Incorporating the potential impact that port operations, specifically nuisance factors such as noise, dust and visual impacts, may have on the establishment of development; • Ensuring that the layout and design of development proposals have incorporated current knowledge and scenarios of sea level rise; • Ensuring that the layout & design of development proposals secure adequate access to the variety of landscape features that are presently available; and • Implementing measures to control the quality of stormwater runoff.	• The City of uMhlathuze • Ezemvelo KZN Wildlife • Provincial Environmental Affairs (DAERD)
Institutional Capacity	Due to the adverse impacts that are expected with port expansion appropriate **institutional arrangements for achieving conservation priorities** must be designed and implemented by: • Addressing the "policy vacuum" that exist on a national level to give effect to offsets by implementing the desired state and guidelines as specified in Zone 9 of the EMF.	• The City of uMhlathuze • Ezemvelo KZN Wildlife • Provincial Environmental Affairs (DAERD) • National Environmental Affairs • SANBI • Transnet • Landowners • Scientific Community
Uncertainty	Due to the long-term risks that **climate change and sea level** rise pose to this area, the long-term sustainability of all developments in this zone must be secured by: • Assessing the adaptive capacity, impacts and risk tolerance of proposed projects in this zone making use of the sea level rise estimates that were undertaken for the area (Mather & Smith, 2009); • Ensuring that development has capacity to adapt to change by employing appropriate design and engineering measures; • Ensuring that the layout and design of development proposals have considered current knowledge and scenarios of sea level rise; • Implementing mitigating and adaptation measures through various engineering and ecological management methods (such as artificial manipulation of environments); • Reviewing and implementing appropriate setback lines and natural buffers; and • Considering the recommendations made by the City's Climate Change Strategy (uMhlathuze, 2009).	• All role-players
	Due to the vulnerability of the area and its interconnectedness with asset systems beyond the zone on various scales, all assessments in this zone must carefully consider the area of impact, and report on cumulative impacts and **landscape risks**. This must be done by referring to the following guideline documents : • DEAT (2002) Ecological Risk Assessment, Integrated Environmental Management, Information Series 6, Department of Environmental Affairs and Tourism (DEAT), Pretoria. • DEAT (2004) Cumulative Effects Assessment, Integrated Environmental Management, Information Series 7, Department of Environmental Affairs and Tourism (DEAT), Pretoria.	• Environmental Assessment Practitioners (Consultants) • Decision-makers

This EIA is designed to investigate and assess the potential positive and negative impacts on environmentally sensitive areas; socio-economic aspects related to increased economic development and its knock-on effects on social issues. The specialist studies to be undertaken will provide a description of sensitive receptors and propose mitigation to either enhance positive impacts and/or reduce negative impacts. The above sustainability criteria and management guidelines will be taken into account to assist with the decision-making for this proposed project.

5.8.9 UMHLATHUZE/ RICHARDS BAY ESTUARINE MANAGEMENT PLAN (JULY 2020)

The Estuarine Management Plan was developed in accordance with the provisions of the NEMICMA and the National Estuarine Management Protocol. This introductory chapter is followed by a synopsis of the Situation Assessment Report (largely summarised in Section 4.1.3 below). The Vision and Objectives to achieve the vision (or Goals) for estuarine management planning in the uMhlathuze/Richards Bay estuarine systems, as developed by the stakeholders, is provided. Overall management objectives, as well as associated actions to address those objectives are summarised, including objectives and proposed actions relating to awareness and education. Details on each of the proposed management actions to assist with the confirmation of specific priorities for implementation over the next five years are provided. The proposed zonation planning for the uMhlathuze/Richards Bay estuarine system, including the demarcation of protected areas, sensitive ecosystems as well as different use areas, is also provided. The Estuarine Management Plan also presents an integrated monitoring plan, specifically related to environmental management in the uMhlathuze/Richards Bay estuarine system. The following highlights information pertinent to the proposed development of the NIFPP and its associated infrastructure.

5.8.9.1 Threats to biodiversity and socio-economic value

The estimated extent of existing (negative) impacts associated with identified threat (or issues) on the biodiversity and socio-economic value of the uMhlathuze/Richards Bay, as well as the status of existing legislation and management responses to mitigate such impacts, are summarised in Table 13.

Table 13: Estimated extent of existing (negative) impacts of identified threats on biodiversity and socio-economical value of the uMhlathuze and Richards Bay estuaries (depicted as H= high; M = medium; L = low), as well the status of existing legislation and management responses to mitigate such impact (G = good; F = fair; P = poor) (uMhlathuze/Richards Bay Estuarine Management Plan, 2020)

GROUPING	EXISTING THREAT/ISSUE	NEGATIVE IMPACT		EXISTING LEGISLATION	MANAGEMENT RESPONSE
		Biodiversity	Socio-Economic		
Loss and destruction of habitat	Dredging activities in Port	H	L	G	F
	New port infra-structure development	H	L	G	P
Exploitation of resources	Illegal gill netting and poaching of fish	H	H	F	P
	Illegal harvesting of mangroves	L	L	F	P
	Sand mining	L	M	P	P
Modification of freshwater inflows	Increased water abstraction	H	M	G	F
	Weirs and barriers in water courses	H	M	P	P
Deterioration of water quality	Contamination of ground water inflow	M	L	F	P
	Pollution from Hillendale Slimes Dam	M	L	G	P
	Pollution from industrial areas (water)	M	L	F	P
	Pollution from industrial areas (air)	M	M	F	P
	Pollution from dredging activities	M	L	G	G
	Pollution from cargo handling activities	M	L	F	P
	Pollution from agricultural activities	M	L	F	P
	Pollution from urban settlements (diffuse stormwater)	L	L	P	P
	Ballast water discharges	L	L	F	F
	Brine discharge (desalination)	L	L	F	F
	Pollution from alien vegetation treatment	H	M	F	P
	Pollution from marine aquaculture	L	L	F	P
Inappropriate Governance	Non-compliance and lack of enforcement	H	H	G	P
	Not fully enclosed formally protected areas	M	L	G	F
	Lack of trust and collaboration among stakeholders	H	H	F	P
	Lack of education and awareness initiatives	M	M	F	P
Climate change	Impact of sea level rise on mangroves	H	L	F	P
	Increased coastal vulnerability (e.g. erosion)	H	H	G	P

5.8.9.2 Opportunities and constraints

Future planning and development holds several socio-economic opportunities, but a number of potential constraints, both in terms of biodiversity and sustained socio-economic value, pose some challenges. ***The Richards Bay area (including the Richards Bay Estuary) has been identified as a development node within the KZN province***, and will therefore benefit from envisaged economic investments with excellent opportunities for socio-economic growth and development for surrounding communities. On the other hand, the uMhlathuze Estuary is largely managed as a conservation area, and present potential opportunities for eco-tourism development, also involving the local communities living along its shores. The Richards Bay Estuary has also been earmarked for key development projects under the national government's Operation Phakisa initiative (www.operationphakisa.gov.za) aimed at fast tracking the aims of the National Development Plan (NDP). These include a marine aquaculture development (i.e. cage culture of Dusky cob) and ship repair terminal and dry-docking facilities. While initiatives of this nature hold great growth and development opportunities for the area, implementation of environmentally unsustainable practices can hold serious constraints or risks to socio-economic values benefiting other users.

The biggest challenges (or potential constraints) relate to the ability to conduct growth and development in an environmentally sustainable manner. This is especially relevant to the large port, industrial and municipal infrastructure developments planned for the Richards Bay Estuary and its surroundings. ***While it is recognised that future growth and development for the Richards Bay areas need to have a stronger economic/industrial focus, all efforts must be taken to construct and operate these facilities in an environmentally responsible manner.***

5.8.9.3 uMhlathuze/ Richards Bay Estuarine Management Plan Vision

"The uniqueness and socio-economic values of our beautiful estuaries are sustainably protected for future generations through responsible, holistic and inclusive management approaches"

5.8.9.4 Management objectives to support the vision

The following highlights those management objectives and associated activities that have a bearing on the proposed NIFPP development.

Objective 6: Ensure that planning, construction, maintenance of infrastructure in uMhlathuze/ Richards Bay EFZs e.g. in Port of Richards Bay, Richards Bay IDZ and Waterfront Development, is undertaken in an environmentally sustainable manner to protect biodiversity and socio-economic values benefiting other users.

- Action 6.1: Conduct strategic planning for future port development, Richards Bay IDZ and Waterfront development taking into consideration biodiversity requirements and socio-economic values benefiting other users in uMhlathuze/Richards Bay estuaries.
- Action 6.2: Conduct appropriate EIA studies for infrastructure developments in port (e.g. boat repair and dry dock facilities), IDZ and waterfront for future marine aquaculture development in Richards Bay EFZ as per requirements under the NEMA EIA regulations Notice 3.
- Action 6.3: Maintain infrastructure in the study area so as to not detrimentally impact on biodiversity and socio-economic values benefiting other users in uMhlathuze/Richards Bay estuaries.

Objective 7: Ensure appropriate pollution prevention/mitigation measures are implemented in uMhlathuze/Richards Bay estuaries

- Action 7.1: Prepare standard operational procedures (SOPs) for pollution management and control in uMhlathuze/Richards Bay system, explicitly stating relevant legislation applying to atmospheric emissions, wastewater discharges (both point and diffuse stormwater runoff) and solid waste disposal, specifying approval and permitting processes, operational requirements, as well as responsible authorities in terms of approval, compliance and enforcement.
- Action 7.2: Prepare an inventory of sources of atmospheric emissions originating within uMhlathuze/Richards Bay and stipulate mitigation actions where required in accordance with SOPs.
- Action 7:3: Prepare an inventory of sources and location of wastewater discharges into uMhlathuze/Richards Bay estuaries (surface and sub-surface runoff) and stipulate mitigation actions, where required, in accordance with SOPs.
- Action 7.4: Prepare an inventory of sources and location of solid waste disposal within uMhlathuze/Richards Bay EFZs and stipulate mitigation actions, where required, in accordance with SOPs.
- Action 7.5: Prepare/revise oil spill contingency plan for uMhlathuze/Richards Bay estuaries, including disaster management planning, and handling and disposal of waste originating from clean-up.
- Action 7.6: Instate a ballast water auditing programme for vessels entering Port of Richards Bay.

Objective 11: Address coastal vulnerability to climate change in uMhlathuze/Richards Bay estuaries

- Action 11.1: Establish appropriate management lines in terms of the NEMICMA to reduce hazard risks (e.g. flooding) and to ensure environmentally suitable development in uMhlathuze/Richards EFZs to assist with preventing “coastal squeeze” under future sea level rise conditions.
- Action 11.2: Prepare and implement coastal defence strategies (e.g. retreat, environmental engineering) to ensure community safety and protect infrastructure from potential climate change impacts (e.g. increased storminess, sea level rise, fluvial flooding) in uMhlathuze/Richards EFZs.

Objective 13: Establish a coordinated environmental monitoring programme among various mandated authorities within uMhlathuze/Richards Bay estuaries to share and optimise limited human and financial resources.

- Action 13.1: Prepare standard operational procedures (SOPs) on agreed roles and responsibilities to implement environmental monitoring programmes (as proposed in this EMP), so as to optimally utilise limited resources across various mandated authorities.

Objective 17: Encourage collaboration with tertiary education and other scientific research institutions to strengthen research initiatives within the uMhlathuze/Richards Bay study area so as to build a stronger evidence-based knowledge system in support of the EMP.

- Action 17.1: Establish an extensive, large-scale sediment dynamic research programme to inform management interventions to the regional-scale problem affecting sediment processes across the KZN coastal region, including the uMhlathuze/Richards Bay area.

5.8.9.5 Proposed zonation plan

The following figures highlight the existing environmental sensitivities (Figure 38) and industrial and other activities (Figure 39) within the Port Estuary.

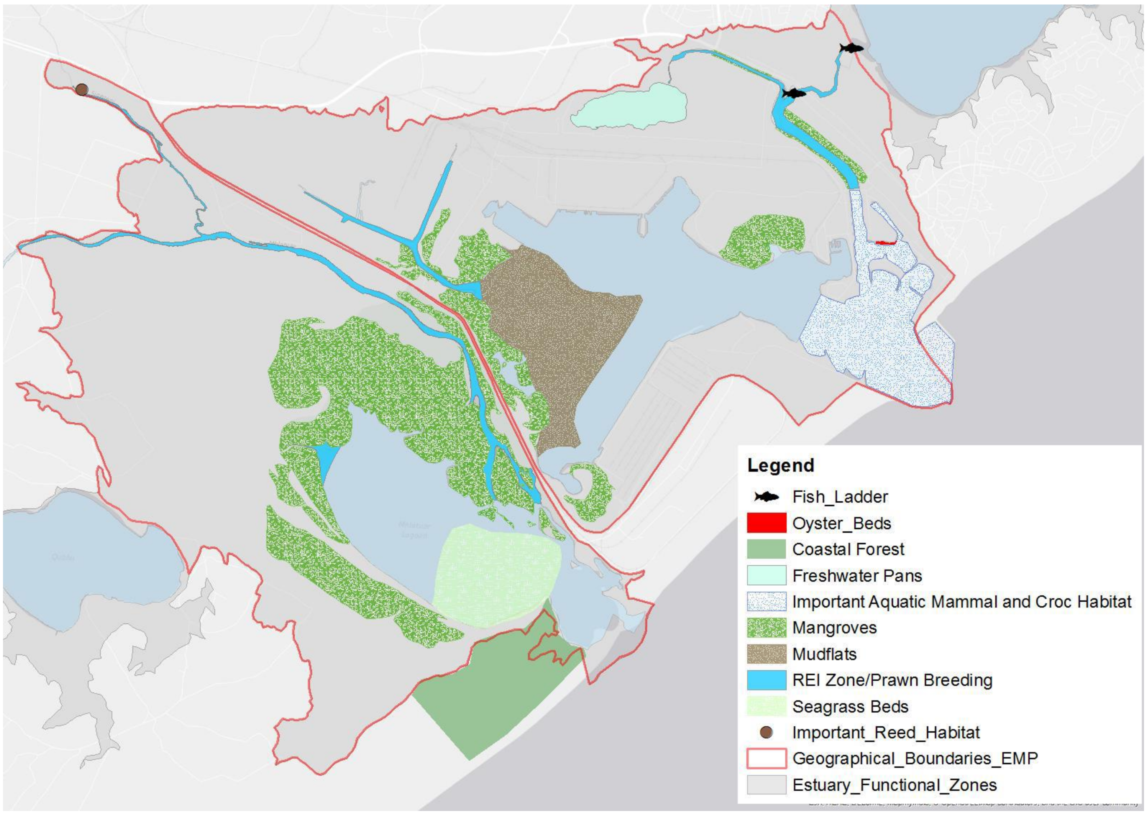


Figure 38: Zonation of sensitive and important estuarine habitats within geographical boundaries of the uMhlathuze/Richards Bay Estuarine Management Plan.

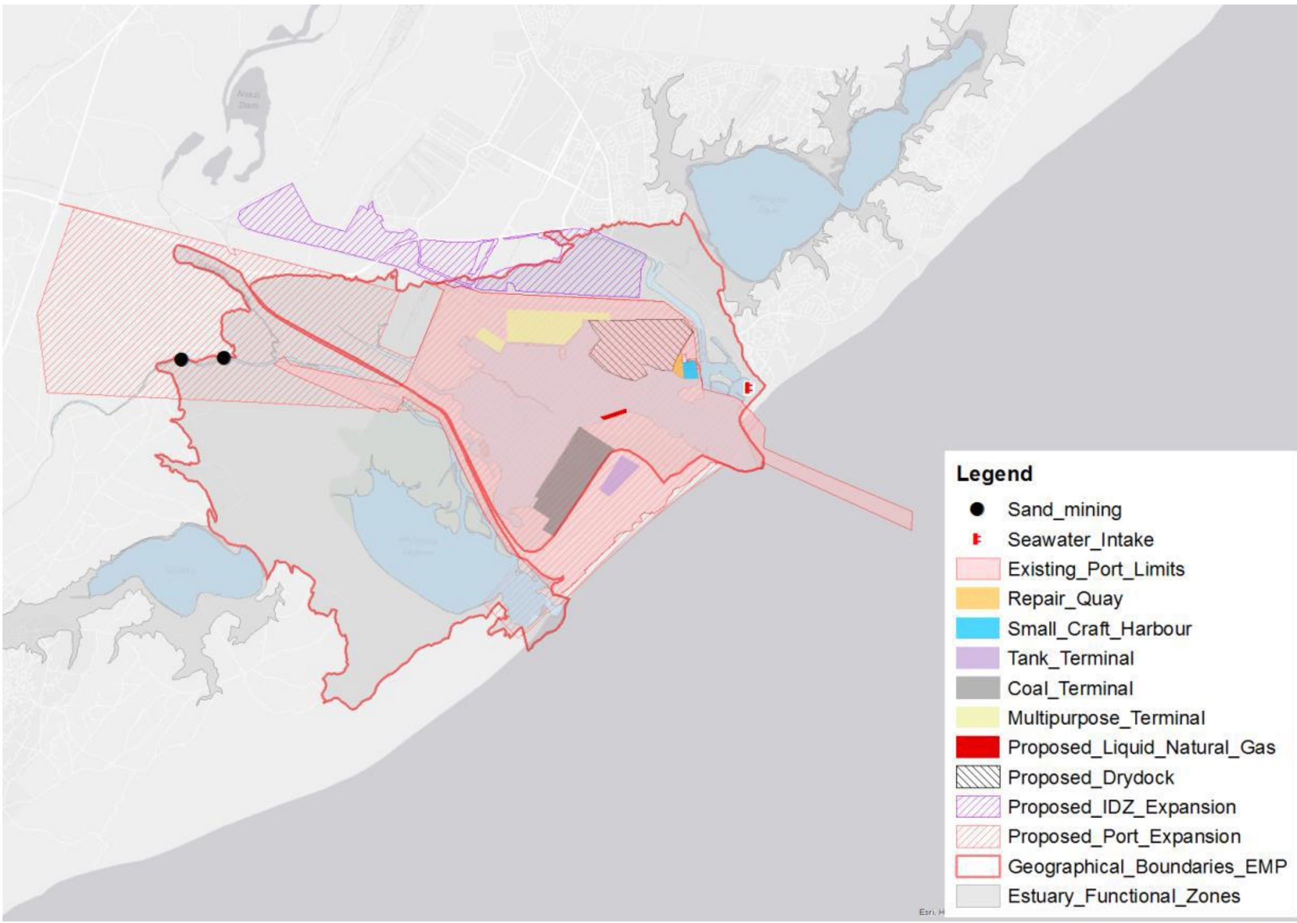


Figure 39: Industrial and mining facilities within the geographical boundaries of the uMhlathuze/Richards Bay Estuarine Management Plan.

Several proposed industrial facilities also are being planned for the area, specifically in the Richards Bay Estuary (Figure 39). These include a new dry dock and an LNG terminal. Major port expansions are also on the cards which will expand port limits further into the EFZ of both the uMhlathuze and Richards Bay estuaries. Of critical importance is that the environmental sustainability of these proposed developments be thoroughly investigated through dedicated environmental impact assessment (EIA) studies. Specifically, these assessments need to consider potential conflicts with existing zoned use, as well as proposed use, as well as the proposed waterfront expansions.

This EIA is designed to investigate and assess the potential positive and negative impacts on environmentally sensitive areas; socio-economic aspects related to increased economic development and its knock-on effects on social issues (refer to Section 10.9). In addition, the NIFPP would be able to assist stakeholders in achieving Management Objective 13.1 in terms of shared resources to implement environmental monitoring programmes, while at the same time assisting with two key information gaps acknowledged within the EMP (refer to Section 14.2), namely:

- Detailed surveys of aquatic associated avifauna are required for the uMhlathuze and Richards Bay estuaries, distinguishing between the individual and relative importance of each of these systems. This is required based on the importance of these systems in terms of its water bird populations, both regionally and nationally.
- A long-term ecological monitoring programme for the uMhalthuze Estuary is required (unless already implemented by EKZNW. This programme, as well as the Richards Bay Estuary's programmes should consider all relevant abiotic and biotic ecological components. Development and implementation of these long-term programmes should be co-ordinated and shared across the responsible agents.

5.8.10 CITY OF UMHLATHUZE SPATIAL DEVELOPMENT FRAMEWORK 2017/2018 – 2021/2022 (MAY 2017)

There are a number of existing natural and man-made phenomenon that have shaped and continue to shape the uMhlathuze Municipality spatial landscape. The area to the east of the Municipality is inundated with a system of wetlands and natural water features such as Lakes Cubhu, Mzingazi, Nsezi and Nhlabane. Major rivers include the uMhlathuze and Nsezi. The main access into the municipal area is via the N2 in a north south direction and in an east west direction the R34. Other significant roads in the area include the MR431 (that provides a northerly entry into Richards Bay from the N2) as well as the Old Main Road that straddles the N2 on its inland. Railway lines are prevalent in the municipal area but do not provide a passenger service, only a commercial/ industrial service is provided. The municipality has the benefit of about 45km of coastline of which about 80% is in its natural state. Linked to its coastal locality is the Richards Bay deep-water port that has been instrumental in the spatial development of the area in the past and will definitely impact on the municipal area.

The vision of nodal area Richards Bay is provided as follows, "an urban centre poised for economic transformation and development opportunities based on a new ethos which aims at creating a unique high performance, unique sense of place, and belonging i.e. work-play-trade environment".

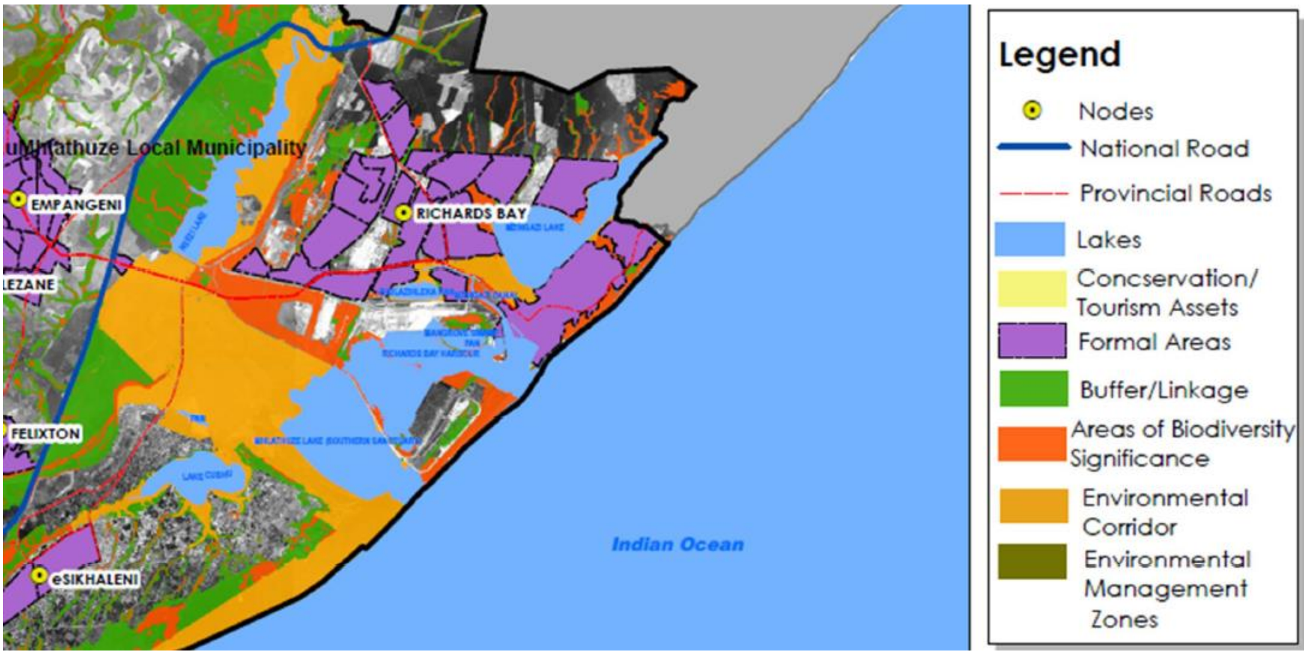


Figure 40: Extract from the Environmentally Sensitive Areas map within the uMhlathuze SDF (May 2017), depicting the area to the north-west of the port as "areas of biodiversity significance".

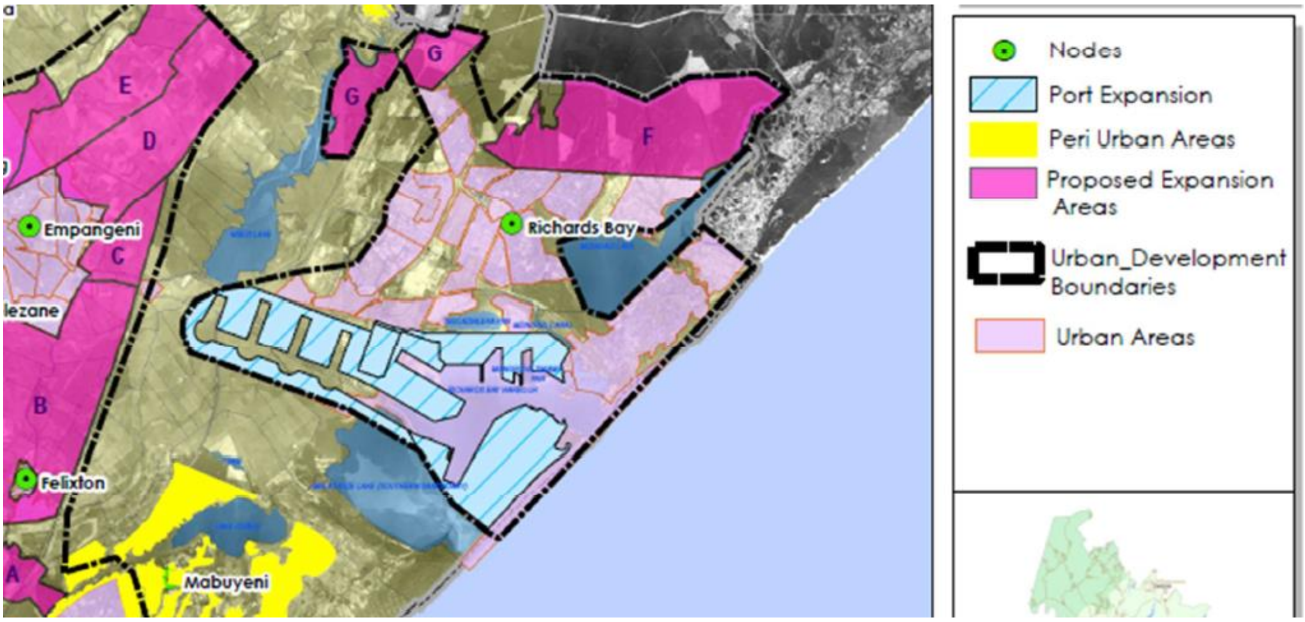


Figure 41: Extract from the Urban Development Plan map within the uMhlathuze SDF (May 2027), depicting the study are for this proposed development to be completely within the urban edge.

The SDF confirms that the proposed NIFPP and associated infrastructure falls within the urban development boundary of Richards Bay. There are identified areas of biodiversity significance that will be impacted on by the proposed project, however these impacts will be assessed through this EIA process as associated specialist studies. It must be noted that the proposed Port Expansion largely impacts on the identified sensitive areas in any event; however, the proposed project may serve to protect or mitigate against some of the future negative impacts of Port Expansion.

5.8.11 CITY OF UMHLATHUZE DISASTER MANAGEMENT SECTOR PLAN 2021

The Draft Disaster Management Policy Framework is available (January 2018). The following SWOT analysis is provided within the Framework:

STRENGTHS	WEAKNESSES
○ Willingness to prioritize disaster management ○ Contingency plans are in place ○ Emergency procedures in place ○ Disaster Advisory Forum in place ○ Industrial Emergency Planning Committee in place (part of the Disaster Advisory forum) ○ Disaster Management is in the IDP	○ Current limited resources to handle disasters ○ Disaster management centre not yet established ○ Head of municipal disaster management not yet appointed. ○ Outdated Disaster Management Plan Level 1 – 2009 ○ Municipal inter-departmental committee still to be established
OPPORTUNITIES	**THREATS**
○ One staff member already in the employ of the Municipality ○ Compilation of a Level 2 Disaster Management Plan	○ Municipality not disaster ready (not ready to handle disasters should they occur)

Since the publication of the Draft Framework, the City of uMhalthuze has addressed the following as stated within their 2021 Sector Plan:

- A Disaster Management Centre was bought from the private owner; however, revamping and refurbishment of the building is required to comply with Disaster Management functions;
- Head of municipal disaster management has been appointed;
- The process of formulating a disaster management plan level 2 was completed and is in stage of adoption, COVID-19 was a delaying factor for its adoption;

- The internal committees on disaster management are in the process of being established where each internal department will have a representative, the department portfolio committee is functional and sits twice a month where issues of disaster management are discussed; and,
- The disaster management advisory forum is functional with an average of ≈ 40 members, it sits quarterly. The functioning of the advisory forum has an approved and adopted terms of reference.

Comments during the Scoping Phase online stakeholder meetings highlighted Interested and Affected Parties (I&APs) concerns that the City of uMhlathuze Local Municipality is not “disaster ready”, as highlighted within the Draft Frameworks SWOT analysis. The proposed NIFPP and associated infrastructure will provide for all disaster management infrastructure and equipment. These include firefighting and tugboat provisions (please refer to Section 2.4 above). Numerous Hazardous Operation Studies (HAZOPS) are being undertaken to quantify and qualify the disaster management interventions required.

5.9 INTERNATIONAL AGREEMENTS AND CONVENTIONS

South Africa is signatory to a number of international agreements and conventions relating to environmental management. These are listed in Table 14 below.

Table 14: International agreements and conventions to which South Africa is a signatory

Environmental Aspect	Agreement/ Convention
Climate change/air quality.	• United Nations Framework Convention on Climate Change, 1994.* • Kyoto Protocol, 1997.* • Vienna Convention for the Protection of the Ozone Layer, 1985. • Montreal Protocol on Substances that Deplete the Ozone Layer, 1989.
Biodiversity and protected areas.	• Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar/Wetlands Convention), 1971. • Convention on the International Trade of Endangered Species of Wild Fauna and Flora, 1973. • United Nations Convention on Biological Diversity, 1992. • Cartagena Protocol on Biosafety. • United Nations Convention to Combat Desertification, 1994. • Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal. • Rotterdam Convention on the Prior Informed Consent Procedure on Certain Hazardous Chemicals and Pesticides in International Trade, 1998. • Stockholm Convention on Persistent Organic Pollutants. • United Nation’s Forum on Forests. • Treaty on Central African Forests Commission, 2004. • Algiers Convention. • Bonn Convention on Migratory Species.
Cultural heritage.	• United Nations Educational, Scientific and Cultural Organization (UNESCO) Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property, 1970. • UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage, 1972 (World Heritage Convention).
Human rights.	• International Convention on the Prevention and Punishment of the Crime of Genocide. • International Convention on the Elimination of All Forms of Racial Discrimination. • International Covenant on Civil and Political Rights. • International Covenant on Economic, Social and Cultural Rights. • International Convention on the Elimination of All Forms of Discrimination Against Women. • Convention on the Rights of the Child.
Labour, health and safety.	• Elimination of all forms of forced and compulsory labour – Convention 29 and 105. • Elimination of discrimination in respect of employment and occupation – Convention 100 & 111. • Effective Abolition of Child Labour – Convention 138 and 182.

* In 1992, countries joined an international treaty, the United Nations Framework Convention on Climate Change, as a framework for international cooperation to combat climate change by limiting average global temperature increases and the resulting climate change, and coping with impacts that were, by then, inevitable. By 1995, countries launched negotiations to strengthen the global response to climate change, and, two years later, adopted the Kyoto Protocol. The Kyoto Protocol legally binds developed country Parties to emission reduction targets. The Protocol's first commitment period started in 2008 and ended in 2012. The second commitment period began on 1 January 2013 and will end in 2020. There are now 197 Parties to the Convention and 192 Parties to the Kyoto Protocol. The 2015 Paris Agreement, adopted in Paris on 12 December 2015, marks the latest step in the evolution of the UN climate change regime and builds on the work undertaken under the Convention. The Paris Agreement charts a new course in the global effort to combat climate change. The Paris Agreement seeks to accelerate and intensify the actions and investment needed for a sustainable low carbon future. Its central aim is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius. The Agreement also aims to strengthen the ability of countries to deal with the impacts of climate change (UNFCCC, 2017).

5.10 INTERNATIONAL LENDER REQUIREMENTS

5.10.1 INTERNATIONAL FINANCE CORPORATION (IFC)

The International Finance Corporation (IFC) is a part of the World Bank Group, but has its own Policy on Environmental and Social Sustainability. The Policy defines principles and approaches to the investment activities by the IFC premised on compliance with Performance Standards (PS), which serve to give effect to the policy. The PS are listed below and briefly described:

PS 1: Assessment and Management of Environmental and Social Risks and Impacts
The client should conduct an environmental and social assessment and establish and maintain an environmental and social management system together with on-going consultation with and disclosure to, stakeholders during the entire project life cycle.

For the proposed NIFPP, PS 1 would mean the completion of the EIA (or the ESIA – Environmental and Social Impact Assessment to use lender nomenclature) required of the lenders, the environmental authorisation (EA) (should that be issued) all associated permits and licences (including the WUL, AEL and others), ongoing stakeholder engagement together with the maintenance of a grievance mechanism throughout the project lifecycle that would be used to capture and have resolved, community grievances. The lenders would also likely develop an Environmental and Social Action Plan (ESAP) that would detail (at high level) key environmental and social management actions for the project. The ESAP would be included in the loan agreement with full compliance obliged as a function of that agreement. The project would also be expected to have an effective Environmental and Social Management System (ESMS) not necessarily, but preferably, certified (e.g. ISO14001). In a nutshell the ESMS would be required to elaborate all EHS risks associated with the project, define overarching objectives together with apposite performance indicators, provide environmental and social management procedures/plans to detail how the objectives would be met, and monitoring that would serve to provide the performance management information need to identify and implement preventative and corrective action where required. Apart from the EIA and the EMPr which would be completed in compliance with the national regulatory requirements, much of the PS 1 requirements would need to be developed and implemented as part of the project implementation. The EMPrs prepared for the NIFPP has been packaged to provide a base for the development of an ESMS at a very early stage of the project (refer to Appendix 5).

PS 2: Labour and Working Conditions
The client should ensure safe and non-discriminatory conditions based on the equal opportunity, for both permanent and temporary personnel. Occupational health and safety is a core element of the PS and applies to all workers in the supply chain (e.g. contractors, and suppliers).

For the proposed NIFPP, PS2 would mean most simply complying with all South African labour legislation. As a member of the International Labour Organisation (ILO) South Africa's labour legislation complies with the requirements of the ILO which would make national compliance de facto compliance with PS 2. That said, an important element of PS 2 is occupational health and safety, and NIFPP would need to develop and implement robust health and safety management for all project phases. The specific PS 2 labour obligations have not been assessed as such in the EIA but would simply need to be implemented as required by South African law.

PS 3: Resource Efficiency and Pollution Prevention

The client's activities must be geared towards resource efficiency and pollution prevention. Performance benchmarks are detailed in a series of EHS guidelines including both general and industry specific (sectoral) guidelines.

Key elements of PS 3 for the NIFPP are atmospheric emissions control both in respect of criteria pollutants (impact risks largely confined to the immediate vicinity of the power terminal and the emissions sources) and greenhouse gas emissions (principally but not exclusively, CO_2). In respect of the latter category, the proposed use of CCGT means that the thermal efficiency of the power generation is increased significantly over coal fired power but that does not change the fact that LNG remains a fossil fuel and the proposed NIFPP would still be a significant source of greenhouse gas emissions. In respect of the former, the General EHS Guidelines together with the Sector Specific guidelines described in Section 4.10.2 would provide performance expectations for both atmospheric emissions and for ambient air quality together with other efficiency environmental and social aspect benchmarks and targets. Lenders' expectations are that borrowers must comply with the stricter of either national defined performance requirements or those representing Good International Industry Practise (GIIP) as defined in the EHS Guidelines. The PS 3 requirements are largely detailed in the project description

PS 4: Community Health, Safety, and Security

The client must ensure that their activities do not invoke public health and safety risks through off-site pollution or other risks and develop and implement Emergency Preparedness and Response Plans to deal with emergency conditions. The maintenance of human rights also falls under this PS.

Key elements of PS 4 for the proposed NIFPP relate to the public safety risks of LNG and ensuring that the necessary emergency management requirements and infrastructure are in place to minimise such risks. At the same time these risks may also manifest through atmospheric emissions, noise and other environmental aspects that may impact on surrounding communities. The offsite manufacture of the power barges serves to reduce the risks otherwise associated with the movement of large construction vehicles on roads in and around Richards Bay. Maintaining the security of the facility will require a large well-organised and well-qualified security detail. While it is unlikely that such a security detail would pose risks of human rights abuses, it is nonetheless a risk that lenders would need to see effectively managed. The risks to community health and safety are assessed in the specialist assessments that are included in Chapter 10 and Chapter 11 of this report (please refer to Appendix 6 for the specialist reports).

PS 5: Land Acquisition and Involuntary Resettlement

The PS stipulates requirements for involuntary resettlement, which includes both physical and economic displacement.

Land acquisition for the NIFPP would unfold as a willing buyer willing seller transaction which for the most part would not trigger the requirements of PS 5. It may prove necessary to ascertain whether or not the proposed project might have an impact on artisanal fishermen but at this stage of the assessment it seems unlikely.

PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources

The objectives of this PS are to protect and conserve biodiversity, maintain the benefits from ecosystem services; and promote the sustainable use of living natural resources. Again, it seems highly unlikely that this PS would be invoked by the proposed project.

The NIFPP would almost certainly be scrutinised by lenders in respect of possible impacts on the sensitive biodiversity that exists within the Port area. Of particular concern would be the Kabeljous Flats and the Sandspit area which acts as a resting area for migratory birds. Although not specifically assessed yet, these areas would definitely be viewed as natural habitat by lenders (where impacts would need to be offset) and is highly likely to be critical habitat (where net gain is required for potential impacts).

PS 7: Indigenous Peoples

This PS serves to protect indigenous people leading a traditional lifestyle. Only very limited groups of people are recognized by the IFC as indigenous peoples and these do not include the people living in and around the project area. As such the PS would not be invoked by the proposed project.

PS 8: Cultural Heritage

This PS serves to ensure the protection of both tangible and intangible forms of cultural heritage from the adverse impacts of project activities and the preservation of such cultural heritage.

The requirements of PS 8 for the NIFPP require the characterisation of heritage resources in the area and an assessment as to how these may be affected by the proposed NIFPP infrastructure (to this end refer to Section 10.6 and 11.6 of this report).

5.10.2 WORLD BANK GROUP ENVIRONMENT, HEALTH AND SAFETY GUIDELINES

The WBG EHS Guidelines[7] are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP) applicable to Performance Standard 3 (Resource Efficiency and Pollution Prevention). The EHS Guidelines provide a series of performance benchmarks that can be used during the assessment process representing as they do, performance that is typically acceptable to the IFC. Importantly, the EHS Guidelines are generally considered to be achievable in new facilities at reasonable costs with existing technology. The environmental assessment process may recommend alternative (higher or lower) levels or measures as a function of the state of the receiving environment, which, if acceptable to IFC, become project- or site-specific requirements.

In the event that host country regulations do not exist then the EHS guidelines serve to define acceptable performance, where host country regulations differ from the EHS Guidelines, then it is expected that the project will assume the more stringent of the two. Less stringent performance measures can be adopted provided that there is a clear justification for doing so as a function of the environmental and social assessment and demonstrating consistency with the objectives of Performance Standard 3. The following EHS Guidelines are relevant to the proposed NIFPP CCGT Project.

5.10.2.1 General EHS Guidelines

The General EHS Guidelines are potentially applicable to all industry sectors as they contain information on cross-cutting environmental, health, and safety issues and performance prescriptions. The General EHS Guidelines include:

1.1 Air Emissions and Ambient Air Quality;
1.2 Energy Conservation;
1.3 Wastewater and Ambient Water Quality;
1.4 Water Conservation;
1.5 Hazardous Materials Management;
1.6 Waste Management;
1.7 Noise; and,
1.8 Contaminated Land.

[7] https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/ehs-guidelines

The general EHS Guidelines would apply to the proposed NIFPP, together with relevant industry sector guidelines that are listed below.

5.10.2.2 Environmental, Health, and Safety Guidelines for Liquefied Natural Gas (LNG) Facilities

The EHS Guidelines for Liquefied Natural Gas (LNG) Facilities include information relevant to LNG base load liquefaction plants, transport by sea, and regasification and peak shaving terminals. For coastal LNG facilities including harbours, jetties and in general coastal facilities (e.g. coastal terminals marine supply bases, loading / offloading terminals), additional guidance is provided in the EHS Guidelines for Ports, Harbours, and Terminals. For EHS issues related to vessels, guidance is provided in the EHS Guidelines for Shipping.

5.10.2.3 Environmental, Health, and Safety Guidelines for Thermal Power Plants

This document includes information relevant to combustion processes fuelled by gaseous, liquid and solid fossil fuels and biomass and designed to deliver electrical or mechanical power, steam, heat, or any combination of these, regardless of the fuel type (except for solid waste which is covered under a separate Guideline for Waste Management Facilities), with a total rated heat input capacity above 50-Megawatt thermal input on Higher Heating Value basis. It applies to boilers, reciprocating engines, and combustion turbines in new and existing facilities.

The summary performance requirements from the three guidelines are presented earlier in this document in Table 3.

5.10.3 EQUATOR PRINCIPLES

The Equator Principles (EPs)[8] is a risk management framework, adopted by financial institutions, for determining, assessing and managing environmental and social risk in projects. The EPs serve to provide a minimum standard for due diligence assessments to support responsible decision-making for financial institutions. The EPs have been adopted by 84 financial institutions in 35 countries and includes some 70% of international project finance in emerging markets. Financial Institutions that have adopted the EP are referred to as Equator Principles Financial Institutions (EPFIs). The EPFI's commit to implementing the EP and will not finance clients that are unwilling or unable to comply with the EP. The principles themselves are listed below and briefly described.

Principle 1: Review and Categorisation

Projects proposed for financing are categorised as a function of potential environmental and social risks and impacts using the categorisation process of the International Finance Corporation (IFC), namely:

- Category A – Projects with potential significant adverse environmental and social risks and/or impacts that are diverse, irreversible or unprecedented;
- Category B – Projects with potential limited adverse environmental and social risks and/or impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures; and
- Category C – Projects with minimal or no adverse environmental and social risks and/or impacts.

The NIFPP would most likely be viewed as a Category A project, given the significant greenhouse gas emissions, the extent of the infrastructure required and the proximity to the highly sensitive areas of the Kabeljous Flats and the Sandspit area.

Principle 2: Environmental and Social Assessment

The client must conduct an environmental and social assessment commensurate with the risks posed by the proposed projects including an Environmental and Social Impact Assessment (ESIA). The ESIA must be an adequate, accurate and objective assessment and should propose measures to minimise, mitigate, and offset adverse impacts. All projects that

[8] https://equator-principles.com/about/#:~:text=The%20Equator%20Principles%20%28EPs%29%20is%20a%20risk%20management,diligence%20and%20monitoring%20to%20support%20responsible%20risk%20decision-making.

would GHG of more than 100,000 tonnes of CO_2 equivalent annually require an analysis to evaluate less intensive GHG alternatives.

This EIA document serves as the Environmental and Social Assessment requirement to comply with the EPs. The proposed NIFPP would emit more than 100,000 tonnes of CO_2 and as such, has been the subject of a detailed GHG emissions assessment in Section 10.8. Given the quantities of electricity that would be produced by the proposed NIFPP, this is likely to be (relatively) the least quantity of GHG emissions where a fossil fuel is used to generate power.

Principle 3: Applicable Environmental and Social Standards

The Assessment process should address compliance with relevant host country environmental and social laws, regulations and permits and compliance with IFC PSs on Environmental and Social Sustainability (Performance Standards) and the WBG EHS Guidelines which represent the minimum standards adopted by the EPFI.

Please refer to Section 4.10.1 for a description as to how the requirements of the IFC PS would apply to the proposed NIFPP. At the same time this entire EIA has been compiled to comply strictly with the requirements of the South African EIA Regulations and the various environmental license and permit requirements defined in the various SEMAs.

Principle 4: Environmental and Social Management System and Equator Principles Action Plan

The client must develop and maintain an Environmental and Social Management System (ESMS) and an Environmental and Social Management Plan (ESMP) that serves to detail the actions that are required for compliance with the applicable standards. In addition, an Equator Principles Action Plan may also be developed to highlight compliance gaps and commitments to address such gaps.

As described in Section 4.10.1 the development of a comprehensive Environmental and Social Management System (ESMS) is beyond the remit of an EIA and would typically be developed and implemented with project implementation. That does not change the fact that the EIA should contribute significantly to the development of the ESMS, with the ESMS being structured to ensure that risks identified in the EIA process are effectively managed and that the mitigation defined with the mitigation defined is properly planned and implemented to reduce or prevent those risks.

Principle 5: Stakeholder Engagement

Effective Stakeholder Engagement must be established and maintained in a structured and culturally appropriate manner with stakeholders. The consultation process must be tailored to project risks and impacts and the development phase; language preference, decision-making processes and the needs of disadvantaged and vulnerable groups. Consultation should be free from external manipulation, interference, coercion and intimidation. Appropriate Assessment documentation will be readily available to stakeholders in the local language and a culturally appropriate manner. The results of the Stakeholder Engagement process will be documented and addressed, occur early in the Assessment process and be maintained.

Also as described in Section 4.10.1, the stakeholder engagement conducted for this EIA would be extended to become a process that would continue through project implementation affording stakeholders the opportunity to engage with the NIFPP as and when needed to ensure that stakeholders are both informed and have the opportunity to raise queries and concerns regarding any project activities, and to have these answered by the NIFPP.

Principle 6: Grievance Mechanism

The client will establish a grievance mechanism designed to receive and facilitate resolution of project concerns and grievances. The mechanism should not impede access to judicial or administrative remedies and stakeholders informed about the mechanism during the Stakeholder Engagement process.

In similar vein to Principle 5, and again as previously described for the IFC PS (Section 10.4.1), the stakeholder engagement process would also see the establishment of a grievance mechanism. The grievance mechanism would serve as a formal process for stakeholders to raise complaints/grievances with the NIFPP and to have these effectively resolved.

Principle 7: Independent Review

An Independent Environmental and Social Consultant will carry out an Independent Review of the Assessment Documentation including the ESMPs, the ESMS, and the Stakeholder Engagement process documentation to assess EP compliance.

For the NIFPP, an independent review of the quality of this environmental assessment documentation and the associated EMPr, as well as the stakeholder engagement process would be commissioned by the lenders. The review would also consider the planning (and implementation) of the ESMS at the time of the review. Omissions identified by the independent reviewer would be rolled up into an Equator Principles Action Plan (essentially equivalent to the ESAP required by the IFC PS) as a series of supplementary actions that would need to be conducted by the NIFPP to ensure full compliance with the EP.

Principle 8: Covenants

The client will covenant in the financing documentation to comply with all relevant host country environmental and social laws to comply with the ESMPs and Equator Principles Action Plan (where applicable) during the construction and operation of the Project in all material respects, to provide periodic reports in a suitable format and to decommission the facilities in accordance with an agreed decommissioning plan. The EPFI is required to intervene as necessary to ensure compliance with the covenants.

In much the same way that the IFC PS require compliance with the PS and the ESAP (as a statement of areas of potential non-compliance together with the actions needed to ensure compliance) to be included in the loan agreement the EP would require the legal formalisation of the NIFPP’s commitment to compliance with the EP and the EPAP for project implementation.

Principle 9: Independent Monitoring and Reporting

The client is required to appoint an Independent Environmental and Social Consultant, to verify monitoring information shared with the EPFI.

This requirement would need to be implemented subsequent to project go ahead (should that be authorised) to ensure the veracity of the information being reported to the EPFI.

Principle 10: Reporting and Transparency

The client will ensure that, at a minimum, a summary of the ESIA is accessible and available online and will publicly report GHG emission levels where emissions exceed 100,000 tonnes of CO_2 equivalent annually.

6 EVIRONMENTAL, SOCIAL AND ECONOMIC CONTEXT

This section provides a brief overview of the existing environment within the area of influence of the NIFPP and associated infrastructure[9]. The EIA method is based on the principle of defining impacts as 'changes in the receiving environment' as a result of the activities and associated environmental and social aspects. To implement that method, it is obviously necessary to define the state of the environment before the project is implemented and that is the role of this section.

6.1 BIOPHYSICAL ENVIRONMENT

6.1.1 CLIMATE

Richards Bay has a warm, humid subtropical climate, heightened during the summer and typical of the coastal region of Kwazulu-Natal. Monthly mean, maximum and minimum temperatures from the Weather Research and Forecasting (WRF) model data are summarised in Table 15. Temperatures are seen to range between 10°C and 42°C with the highest in September and the lowest in July. During the day, temperatures increase to reach maximum at around 14:00 in the afternoon thereafter decreasing to a daily minimum at around 06:00 i.e. just before sunrise.

Table 15: Monthly average, maximum and minimum temperatures based on WRF data for the period January 2016 to December 2018 (units: °C)

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Average	24	25	25	23	21	19	19	20	21	21	22	24	22
Maximum	36	37	34	34	31	30	34	33	42	36	36	39	42
Minimum	16	17	14	14	11	11	10	12	12	12	13	16	10

This WRF data rainfall pattern is shown in Figure 42. Rainfall peaks between October and March, with approximately 1 070 mm of rainfall in a year. The lowest rainfall months are generally June and July. Cyclones and cut off-lows bring about abnormal rainfall events with high rainfall intensity and risk of flooding (South African Weather Service).

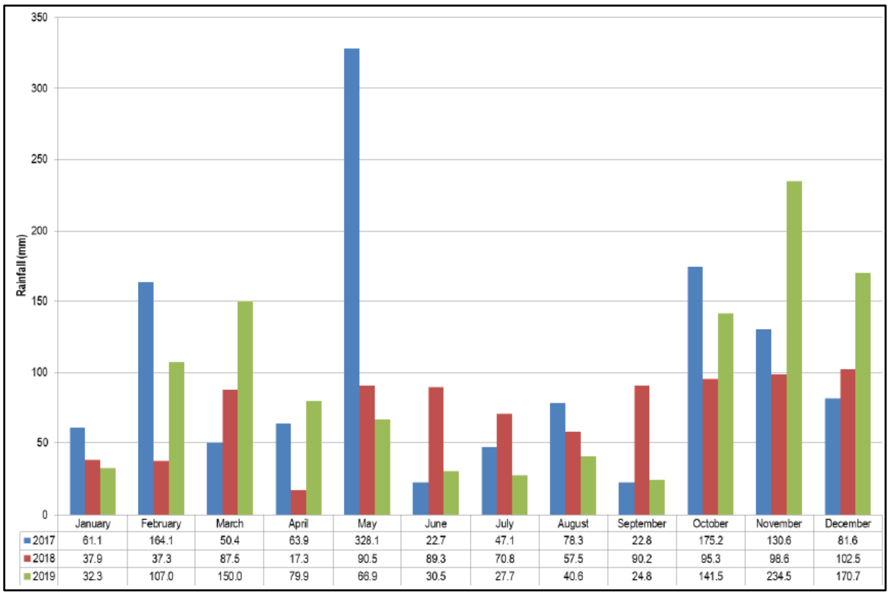
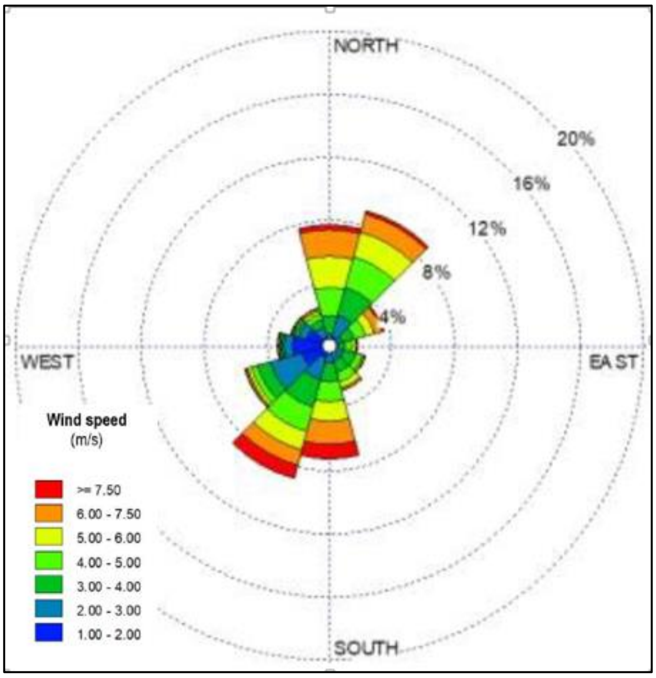


Figure 42: Monthly rainfall based on WRF data for the period January 2017 to December 2019

[9] Appendix 2B contains a draft map where known environmental sensitivities (at a scoping level) have been overlaid with the proposed development footprint (also draft at scoping level).



The prevailing winds in the study region are north-easterly and south-south-westerly (Figure 43). 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 43). The average period wind speed is 5.7 m/s. Night-time conditions reflect a decrease in wind speeds ranging mainly from 2-3 m/s in comparison to daily wind speeds of 3-4 m/s.

Figure 43: Surface wind rose plot for Richards Bay for the January 2016 to December 2019 period (from the Harbour West station) - the colour of the bar indicates wind speed whilst the length represents the frequency of winds blowing from a certain direction (as a percentage)

The seasonal variation in the wind field shows a slight northerly dominance in winter while north-north-easterlies are more dominant in summer and spring. Highest wind speeds are likely in spring.

6.1.2 TERRESTRIAL AND WETLAND ECOLOGY

The majority of the information presented is taken from the GroundTruth Biodiversity Assessments undertaken for the Environmental Authorisation (EA) applications for the decommissioning of the Bayside Aluminium smelter. That information has been supplemented with the ecological status quo included in the Freshwater Ecosystems and Terrestrial Biodiversity Assessments undertaken for this EIA (refer to Appendix 6 for the full specialist report).

6.1.2.1 Terrestrial Ecological Context

The dominant vegetation in the broader area is typical of the Indian Ocean Coastal Belt. The belt constitutes roughly 53% (or 18 269 ha) of the broader study area (see Figure 44), of which 37% is the Maputaland Coastal Belt (CB 1) (Table 16). Wetland habitats (alluvial and freshwater wetlands) together with azonal forest (i.e. mangrove and swamp forest) make up an additional 12 520 hectares (or 41%). Terrestrial forest vegetation (i.e. excluding mangrove and swamp forest) make up a much smaller proportion (6%) of the study area, and comprise mostly KZN Maputaland Dune Forest (7% or 1 405 ha).

The NIFPP study area generally coincides with the original extent of subtropical freshwater wetlands and subtropical coastal lagoons that together make up 90% (or 555.5 ha) of the site. Small patches of *Ficus trichopoda* swamp forest making up 0.3 ha (or <1%) of the site are nested within the freshwater wetlands. The transitional areas between the wetlands and the lagoons comprise of mangrove forests that occupy 32.8 ha (or 5%) of the NIFPP site. The terrestrial component of the site is defined largely as Maputaland Coastal Belt, which is restricted to 26.7 ha (or 4%) of the northern areas of the site. There are other vegetation types such as Maputaland Wooded Grassland and different forest community patches, i.e. KZN Dune Forest, KZN Coastal Forest and Barringtonia Swamp Forest (Figure 44).

Importantly, the spatial definition, classification and assessment (in terms of conservation status) of vegetation types in KZN, by Scott-Shaw and Escott (2011) was undertaken at a provincial scale. The KZN vegetation types map provides a more regionally appropriate, up-to-date representation of the vegetation types compared to those described in Mucina and Rutherford (2006). However, the vegetation types merely define the "type" and "extent", but do not explicitly establish what constitutes "pristine/climax" vegetation state, which would be expected under the natural scenario.

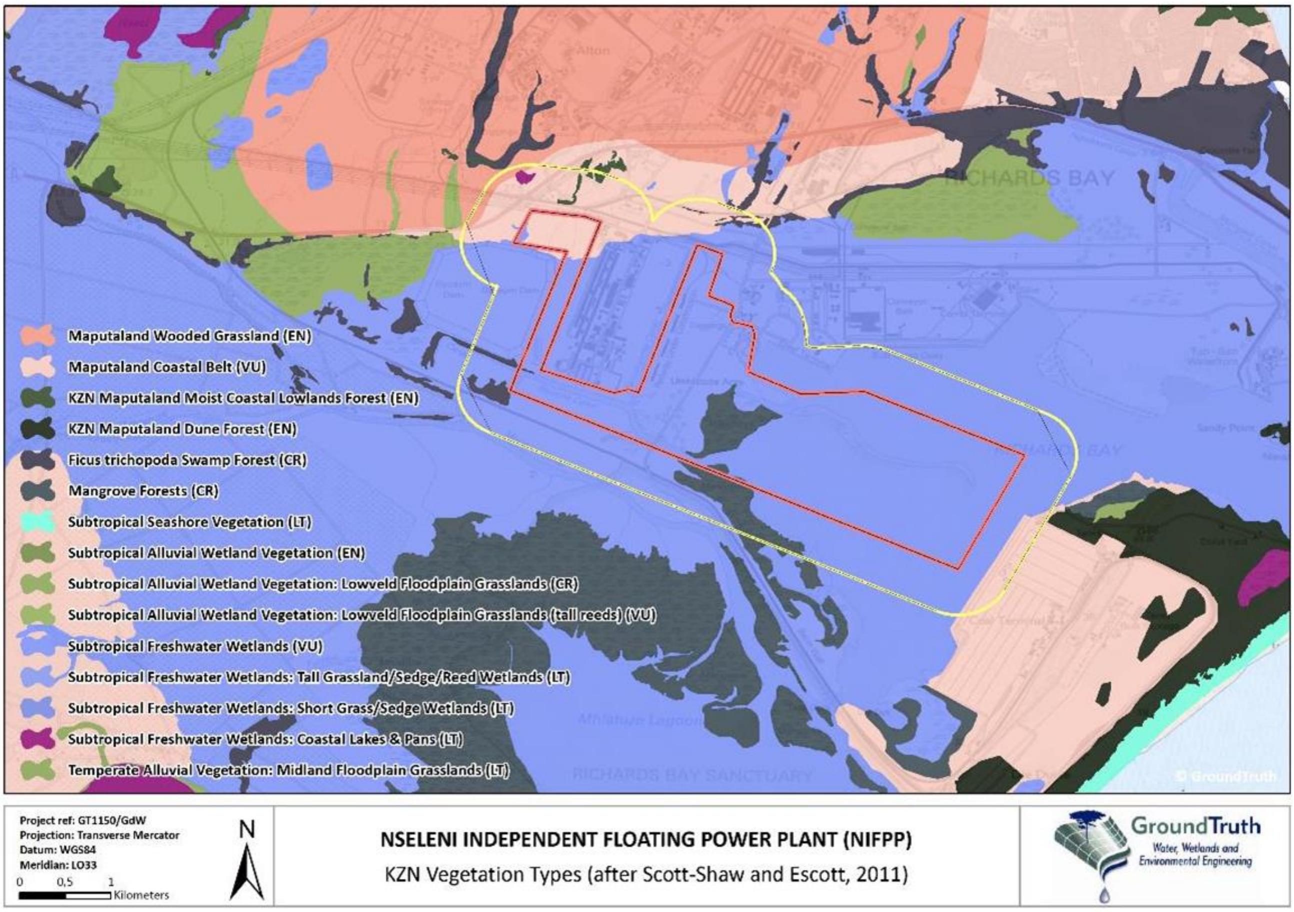


Figure 44: Map of reference vegetation that defines the greater landscape (refer to Table X for applicable vegetation types to the project's study area).

Table 16: Summary of the dominant vegetation types according to the respective biomes (after Scott-Shaw and Escott, 2011) that occur within the broader study area. Vegetation types in bold occur within the NIFPP study area, and are highlighted as terrestrial (green), freshwater (blue), and estuarine (purple) components.

Vegetation type	Conservation Status	Area (ha)	Area (%)
Forests			
KwaZulu-Natal Coastal Forests: Maputaland Moist Coastal Lowlands Forest	Endangered	174	1%
KwaZulu-Natal Coastal Forests: Maputaland Mesic Coastal Lowlands Forest	Endangered	574	2%
KwaZulu-Natal Dune Forests: East Coast Dune Forest	Critically Endangered	2	<1%
KwaZulu-Natal Dune Forests: Maputaland Dune Forest	Endangered	1405	7%
Licuati Sand Forests: Eastern Sand Forest	Least Threatened	<1	<1%
Indian Ocean Coastal Belt			
Maputaland Coastal Belt	**Endangered**	**12 697**	**37%**
Maputaland Wooded Grassland	Endangered	5 390	16%
Subtropical Seashore Vegetation	Least Threatened	173	<1%
Azonal Vegetation			
Mangrove Forests	**Critically Endangered**	**1051**	**3%**
Swamp Forests: *Barringtonia* Swamp Forest	Critically Endangered	41	<1%
Swamp Forests: *Ficus trichopoda* Swamp Forest	Critically Endangered	928	3%
Subtropical Alluvial Vegetation	Endangered	188	1%
Subtropical Alluvial Vegetation: Lowveld Floodplain Grasslands	Critically Endangered	951	3%

Vegetation type	Conservation Status	Area (ha)	Area (%)
Subtropical Alluvial Vegetation: Lowveld Floodplain Grasslands: Tall Reed Wetland	Vulnerable	405	1%
Temperate Alluvial Vegetation: Midland Floodplain Grasslands	Least Threatened	5	<1%
Freshwater Wetlands: Subtropical Freshwater Wetlands	Vulnerable	8 425	24%
Subtropical Freshwater Wetlands: Coastal Lakes and Pans	Least Threatened	654	2%
Subtropical Freshwater Wetlands: Short Grass/ Sedge Wetlands	Least Threatened	33	<1%
Subtropical Freshwater Wetlands: Tall Grassland/Sedge /Reed Wetlands	Least Threatened	672	2%
Waterbody			
Subtropical Coastal Lagoons: Estuary		969	3%

Approximately 54% of the broader study area comprises land that is already transformed. The transformed area is dominated by commercial agriculture and plantations (38%) followed by urban and industrial developments (15%). The remaining 46% of the 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%). Wetland 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 are 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.

Five threatened ecosystems occur within the study area. These include:

- **Kwambonambi Dune Forest** – historically 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 include, 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).
- **KZN Coastal Forest** – The original extent is not known, but the current remaining natural area is 21 000 ha. These forests occur as small patches along the KwaZulu-Natal coast, from Southern Natal to beyond the Mozambique border. Just over 60% of KZN Dune Forest is protected. Key biodiversity features include an endemic mammal, the Zulu Golden Mole (*Amblysomus hottentotus* subsp. iris), and at least one endemic plant species. The fact that these forests are very species rich, coupled with their coarse grain, disturbance driven ecology, means that large tracts must be protected in order to conserve the full range of species. KZN Coastal Forest is currently classified as Endangered.
- **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.
- **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.

One "formal" protected area, the **Richards Bay Nature Reserve**, listed in the National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003), occurs within the broader study area, approximately 1km south of the proposed development site. The reserve includes the uMhlathuze Estuary and associated mangrove swamps. The area supports crucial habitat for a variety of water birds and is considered an **Important Bird Area (IBA)** by Birdlife International.

Ezemvelo KwaZulu-Natal Wildlife's (EKZNW's) Systematic Conservation Assessment (SCA, also referred to as systematic conservation planning) highlights areas that vary in terms of conservation importance as identified and mapped under the KZN biodiversity spatial planning terms and processes (EKZNW, 2016). The SCA broadly classifies areas of biodiversity value/importance using two categories, namely Critical Biodiversity Area's (CBA's) and Ecological Support Areas (ESAs). CBAs comprise two subcategories, CBA: Irreplaceable and CBA: Optimal. PUs designated as CBA: Irreplaceable represent the only localities where conservation targets for specific biodiversity features can be met under the current conservation planning scenario. CBA: Optimal areas represent the best localities that provide critical linkages for CBA: Irreplaceable areas. ESAs represent areas that support and sustain the ecological functioning of the CBAs thereby ensuring the persistence and maintenance of biodiversity patterns and ecological processes.

Almost the entire NIFPP site, with exception of the open water areas associated with the Richards Bay Port, is classified as **CBA: Irreplaceable** (Figure 45). These areas are considered highly sensitive from a biodiversity conservation perspective, and are considered mandatory by EKZNW (i.e. as the competent conservation authority for KZN) in terms of maintaining biodiversity targets within the province.

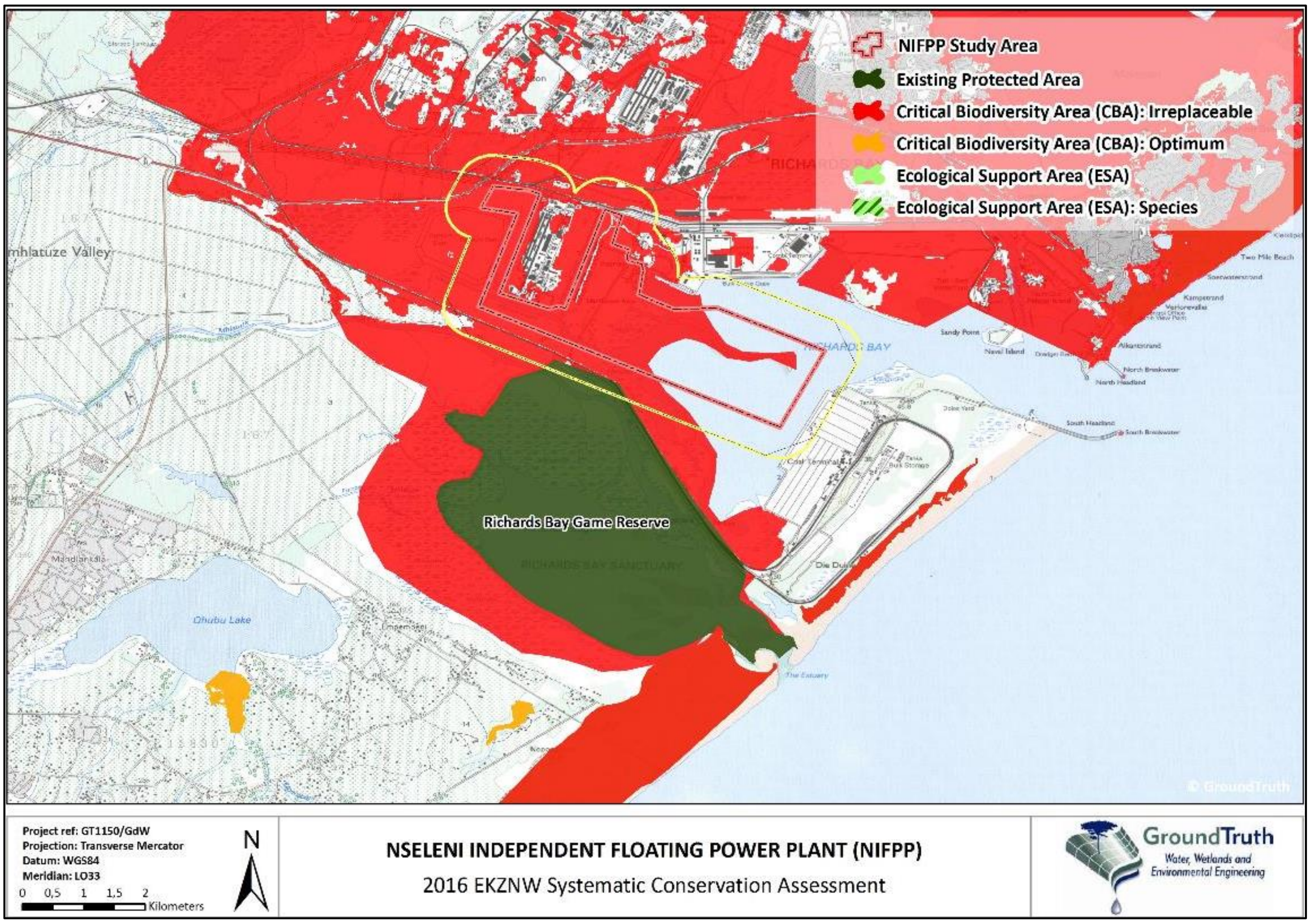


Figure 45: Map of important conservation areas within and surrounding the NIFPP study area (after EKZNW, 2016)

6.1.2.2 Wetland Ecological Context

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 Present Ecological State (PES). 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 46 illustrates the extent and distribution of the 'low priority' NEFPA wetlands relative to the NIFPP study area.

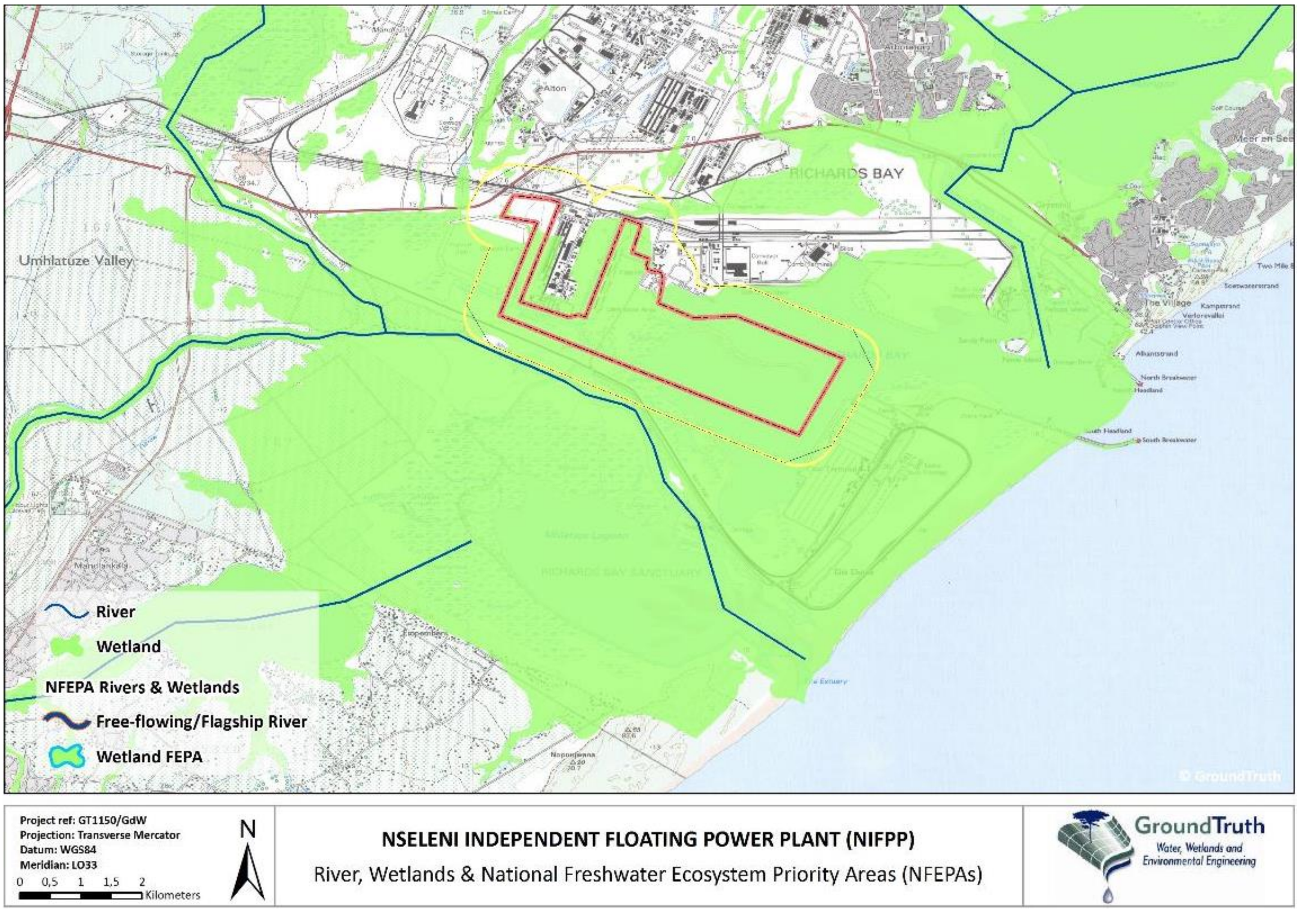


Figure 46: Overview of National Freshwater Ecosystem Priority Areas (NFEPAs) within the broader study area (after Nel *et al.*, 2011). The NIFPP study area is highlighted.

The KZN priority wetlands are some of the largest wetlands in the province and therefore, are considered important for the providing ecosystem goods and services. According to Macfarlane *et al.* (2012) the priority wetlands can generally be described as moderately modified. The Mhlatuze priority system partially extends into the study site boundary (Figure 47). According to Macfarlane *et al.* 2012, the Greater Mhlatuze Wetland System comprises of a suite of different wetland complexes extending inland from the Port of Richards Bay. The portion of the Mhlatuze system within the study site boundary is referred to as the Mhlatuze Zone (Mhlatuze 1). This system has been classified as a floodplain wetland system and originated in meandering rivers and tributaries, with the Mhlatuze being the main river system but also including the Nseleni and Mposa rivers. This floodplain system covers an area of more than 4000ha and is almost 20km in length. Along the coastal side of the system, the floodplain borders estuarine habitat. Based on the health assessment undertaken in 2012 (Macfarlane *et al.* 2012), the overall Mhlatuze system is considered to be a D category system, with further predicted deterioration during the following 5-year period. This deterioration mostly derives from the substantial modifications of the Richards Bay area including, inter alia, the construction of the port but also associated urbanisation and agricultural activities such as forestry and sugar cane production. These modifications to the system have reduced the ecosystem services the system is able to provide but some degree of services are still provided.

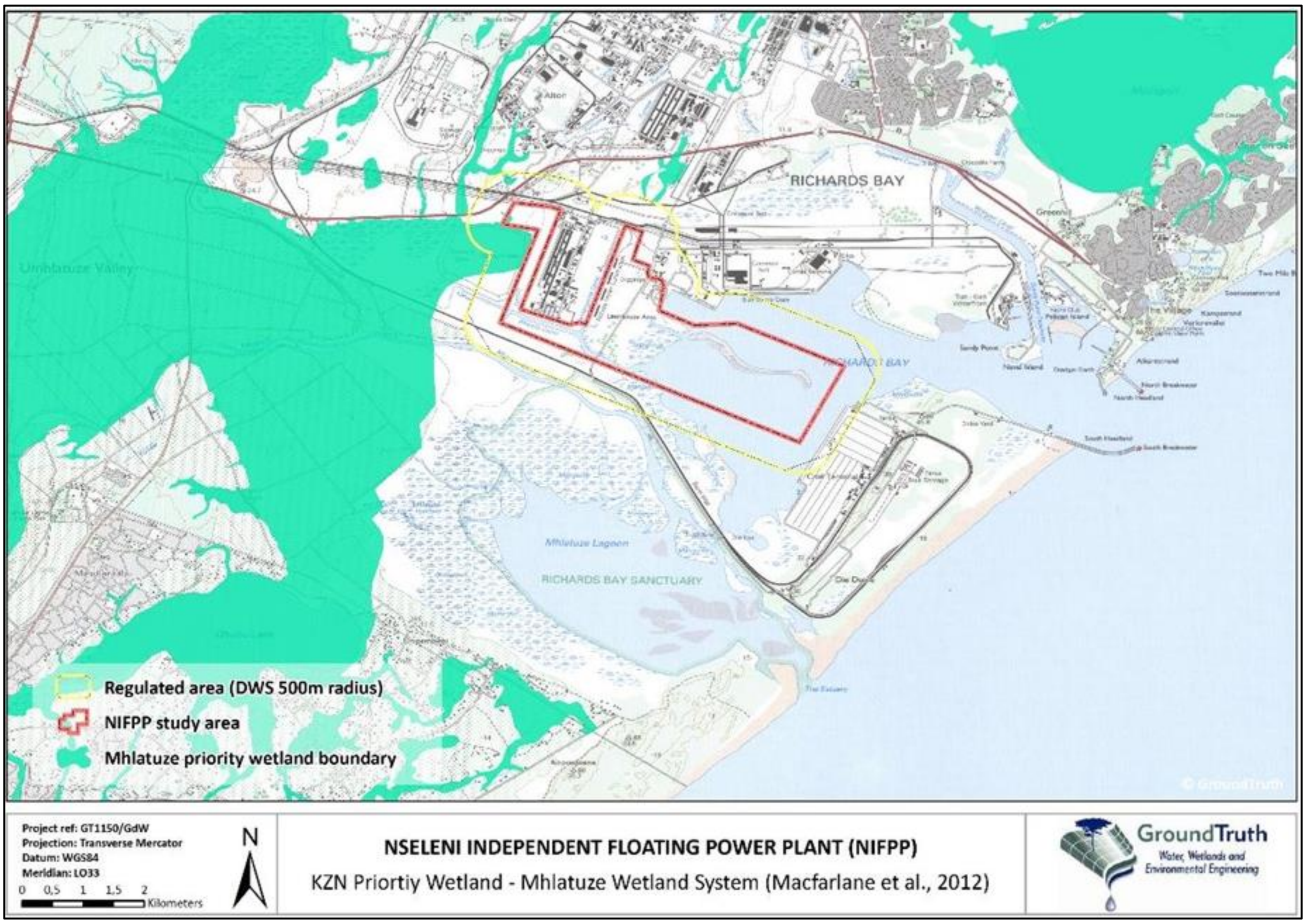


Figure 47: Overview of the Mhlatuze KZN priority wetland system in relation to the NIFPP study area.

6.1.3 ESTUARINE ECOLOGY

The extent of the estuarine functional zone in respect of the Port of Richards Bay and the uMhlathuze estuary is indicated on Figure 48. The site for the proposed NIFPP and its associated infrastructure is located within the estuarine functional zone of the Richards Bay/uMhlathuze estuary as defined in terms of the National Environmental Management: Integrated Coastal Management Act, 2008 (Act No. 24 of 2008) (NEMICMA). The following description of the existing estuarine ecological environment is taken from the November 2019 Draft uMhlathuze/ Richards Bay Estuarine Management Plan.

Richards Bay historically qualified as one of three estuarine bays in South Africa, along with Durban Bay and the Knysna estuary, on the basis of its size and strong marine influence. Five rivers flowed into the original system: the uMtantatweni (draining Lake Cubhu), the uMhlathuze (the major river that drained through a delta area of swamp vegetation into the western part of the basin), the Bhizolo and Manzamnyama (currently serving as drainage canals) and the Mzingazi (draining Lake Mzingazi) (Figure 49).

Radical transformation of the greater Richards Bay environment began in the 1970s with the port development, the separation of the original bay into north and south sections and the redirection of the uMhlathuze River into the southern Sanctuary area as it was initially known (Figure 49). This was followed by activities associated with normal port development in the northern section including i.e. dredging, wharf construction, infilling, mouth widening and stabilisation, breakwater construction and terrestrial infrastructure, all of which have resulted in an environment different from that which existed previously.

Figure 48: Location of the Bayside site (orange polygon) in relation to the Richards Bay and uMhlathuze estuaries (yellow outline polygons).

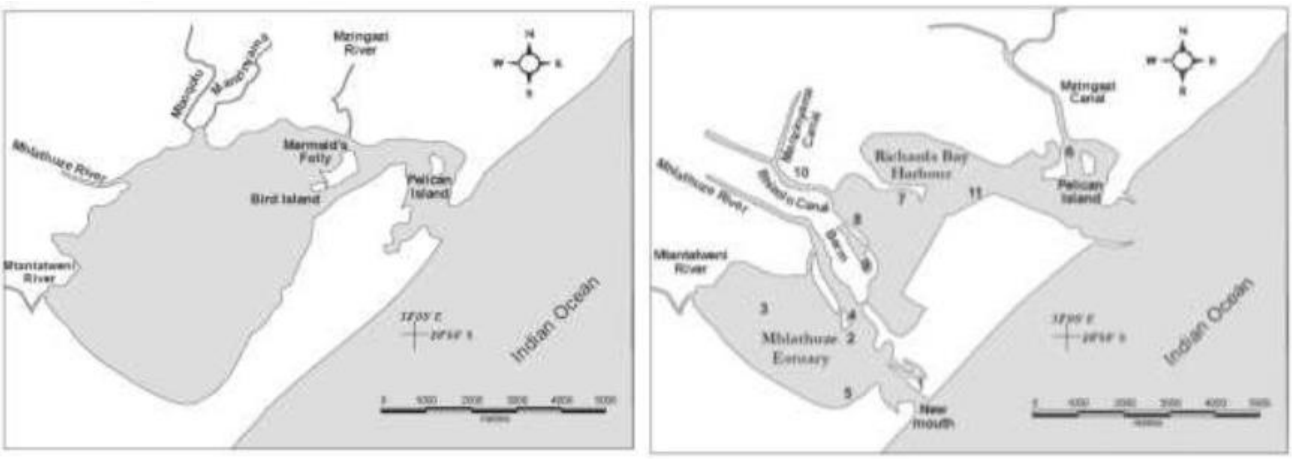


Figure 49: Historical configuration of the uMhlathuze estuarine lake system (left, prior to 1964) and its current configuration (right, post 1976) of an artificially divided system comprising the uMhlathuze and Richards Bay estuaries (Source: uMhlathuze/ Richards Bay Estuarine Management Plan, Draft November 2019)

Currently Lakes Cubhu and Mzingazi function as freshwater lakes as a result of their disconnection from the uMhlathuze/Richards Bay estuarine water bodies. The 2015 Reserve Determination Study conducted in the Usutu-uMhlathuze Water Management Area (WMA) by the Department of Water and Sanitation (DWS also categorised the lakes as freshwater lakes/pans (DWS water resource: wetlands), separate from the uMhlathuze/Richards Bay systems which were classified as estuaries (DWS water resource: Estuaries) (DWS 2014).

An Ecological Freshwater Requirement Study (2000) adopted the following in terms of the Reference Condition (or Natural State) of these estuaries: “Prior to the creation of the harbour, the estuary was considered an estuarine lake. The present uMhlathuze Estuary is classified as an estuarine embayment. As harbour construction changed the fundamental character of the estuary, the reference state for the uMhlathuze Estuary was considered to be the pristine condition, as an estuarine embayment rather than the pristine condition of an estuarine lake. In other words, the "pristine state" of the estuary assumes that the harbour had always existed and considers the situation prior to any alteration in freshwater flow patterns or volumes"

The National Biodiversity Assessment of 2011 (Van Niekerk and Turpie 2012) included desktop Present Ecological Status (PES) assessments for all South African estuaries, including the uMhlathuze and Richards Bay estuaries (Table 17).

Table 17: Desktop Present Ecological Status, as well as preliminary Recommended Ecological Categories (REC) allocated to uMhlathuze and Richards Bay estuaries in NBA 2011 (Draft EMP, Nov 2019: adapted from Van Niekerk and Turpie 2012; Turpie et al. 2012)

COMPONENT	MHLATHUZE ESTUARY	RICHARDS BAY ESTUARY
Hydrology	80	80
Hydrodynamics	100	100
Water Quality	62	56
Physical habitat	30	30
Habitat Status	**68**	**67**
Microalgae	72	66
Macrophytes	40	20
Invertebrates	60	30
Fish	50	45
Birds	40	80
Biological Status	**52**	**48**
PRESENT ECOLOGICAL STATUS	**C/D**	**D**
RECOMMENDED ECOLOGICAL CATEGORY (REC)	**C**	**D**

The uMhlathuze Estuary is ranked in the top ten (10) most important estuaries in South Africa from a conservation perspective. This ranking was based on a conservation classification system that considers surface area, biodiversity, zonal type rarity and estuarine type of some 250 functional estuaries along the South African coast. By comparison, the Richards Bay Estuary is ranked the 26th most important estuarine system. Collectively these two estuaries have the largest area of mangroves of all South African estuaries, even larger than at St Lucia. Also, the Richards Bay Estuary is known to have the oldest area of mangroves in the country (Van Niekerk and Turpie 2012).

The Richards Bay Estuary also contains the Kabeljous Flats (refer to Figure 50) which is ecologically of great significance in terms of the Port of Richards Bay maintaining a functioning estuarine type ecosystem[10]. In addition, the sand spit which is a major intertidal area has been identified as potentially significant for fauna including birds. The Kabeljous Flats comprise the entire shallow south-western section of the port, bounded by a sandspit in the North and the mangroves on the berm in the South adjacent to the uMhlathuze Estuary (Figure 50). of the flats consist of aquatic habitats for different ecological functions and biotic communities. Table 18 presents the total size (ha) of the Kabeljous Flats, as well as the area of the different habitat types within the flats. The reason for considering the mangroves as part of the Kabeljous Flats is because mangroves are essentially intertidal areas which are linked to the intertidal mud- and sand flats.

[10] CRUZ ENVIRONMENTAL: Report No. 18: Overall Findings & Assessment: Specific Abiotic & Biotic Components associated with Priority Habitats in Transnet Capital Projects Richards Bay Port Expansion Project: November 2014

Figure 50: Location of the Kabeljou Flats and "sand-spit" within the Port of Richards Bay. Blue stippled line indicates the boundary of the flats.

Table 18: The area (ha) of the different types of aquatic habitat that comprise the Kabeljous Flats in the Port of Richards Bay

Area (ha)				Comment
Total area	438.1			Inclusive, all intertidal, subtidal and mangrove areas (See Figure 2.2)
Open water at high tide		312.2		
Intertidal			208.3	Approximate, based on CSIR (2005) division between
Subtidal			103.9	intertidal and subtidal areas and aerial photo's, including southern intertidal section adjacent to tidal gates
Mangroves		113.9		
South-western stand			79.2	All mangroves from tidal gates to Bhizolo canal
North-western stand			31.7	Mangrove stand north-east of Bhizolo canal
On sandspit			3.0	Two small stands on north-western end of sand-spit
Sand-spit supratidal		12.0		Exposed sandbank during high tide

The 2005 Strategic Environmental Assessment (SEA) undertaken by the CSIR for the port, emphasised the ecological importance of the Kabeljous Flats, with the three habitat types in the area ranked 1st, 2nd and 5th. The CSIR report concluded that the system sustains considerable diversities of crustaceans and juvenile fishes, and that it functions ecologically as a very important nursery system for juveniles of many marine taxa. The large size of this system relative to the majority of estuaries in KwaZulu-Natal (many of which are in a degraded ecological state) renders Richards Bay important to the conservation of estuarine flora and fauna along the South African coast with both direct and indirect importance to several fisheries. These fisheries include subsistence, recreational and commercial operations locally as well as along the greater KwaZulu-Natal coastline.

Along the KZN coast the uMhlathuze and Richards Bay estuaries, together with St Lucia, provide the majority of the suitable nursery habitat for penaeid prawns. Based on expert opinion it can be assumed that these three estuaries each contribute about a third of the nursery function to inshore prawn species (DWA 2010). The NBA 2011 (Van Niekerk and Turpie 2012) lists both estuaries as very important estuarine nursery areas in South Africa both in terms of protecting biodiversity but also important fisheries. These two systems are viewed as important nurseries for various Cob species, and possibly also for Zambezi sharks. The NBA 2011, therefore, included the uMhlathuze/Richards Bay estuarine system on the list of national priority estuaries for biodiversity conservation. The greater system should, at a minimum, be partially protected with at least 50% of its margins kept undeveloped (Turpie *et al.* 2012). For this reason, its Recommended Ecological Category (REC) should be a Category A or if not, at least in a Best Attainable State. The uMhlathuze Estuary has already been declared a Marine Protected Area (MPA), managed by Ezemvelo KZN Wildlife (provincial conservation authority). The most recent NBA assessment (2018) indicated a negative trend in ecosystem health status due to increasing pressure on estuarine habitat integrity (Van Niekerk *et al.* 2019). Cumulative pressure on ecosystem functioning was rated as High. Of the individual ecosystem components that were incorporated in the assessment, pressure from pollution was rated as high, while the pressure from habitat loss and overfishing was rated as very high. The system was rated as an Ecological Category D estuary, while the REC was reduced to Category D.

The ecosystem services provided by estuarine ecosystems, and their relevant importance in South African estuaries have been evaluated previously (Van Niekerk and Turpie 2012; DWA 2010). Specifically, the ecosystem service potential of the uMhlathuze/Richards Bay estuarine system is summarised in Table 19.

Table 19: Important ecosystem service potential of the uMhlathuze/Richards Bay estuaries (DWA 2010)

ECOSYSTEM SERVICE		DESCRIPTION/RELEVANCE	ESTIMATED ANNUAL VALUE in 2009)
Provisioning service	Water	-	
	Food and medicine	Small scale/subsistence fisheries	R 400 K
	Raw materials	Plant resources	R 100 K
Regulating services	Carbon sequestration	Support extensive areas of mangroves and other estuarine vegetation to taking up CO_2 from the atmosphere through photosynthesis, acting as carbon sinks	R 300 K
	Flood regulation	Harbour development, as well as	Expected loss in value (not

	Flow regulation	construction on new mouth largely reduced these regulatory services of system which relies on large undeveloped flood plains to enable water and sediment retention	quantified)
	Sediment erosion control/ retention		
	Ecological regulation	-	Not valued
	Water purification	Assimilation of contaminated stormwater runoff from harbours areas	Not valued
Supporting services	Biological refuge/Nursery areas	Important nursery and export function for, sediment and nutrient exports, and prawns	R13.5 million (fish) R1.6 million (sediment/nutrients) R4 million (prawn)
	Exporting function		
	Genetic resources	-	Not valued
Aesthetic/ cultural services	Nature-based tourism	Mostly linked to birding	R 2 million
	Property value	-	Not valued
	Recreational angling	-	Not valued
	Spiritual/cultural value	-	Not valued
	Scientific/educational value	Scientific value (based on research outputs)	R 100 K

Based on the above assessment in 2009, the estimated value of ecosystem services provided by the uMhlathuze/Richards Bay estuarine system comes to more than R22 million per annum (DWA 2010).

The main types of existing uses (or activities) within the geographical boundaries of the uMhlathuze/Richards Bay estuaries - many relying on the ecosystem service potential of the area include:

- Coastal reserves and conservations areas;
- Commercial and subsistence farming;
- Port of Richards Bay;
- Richards Bay Industrial Development Zone;
- Yacht Club Harbour and Sea Rescue;
- Marine aquaculture;
- Commercial and small-scale farming;
- Commercial and recreational areas;
- Recreational and subsistence fisheries; and,
- Mining.

6.1.3.1 Bhizolo and Manzamnyama Canals

Golder Associates in conjunction with the Coastal Research Unit of Zululand (CRUZ) conducted an aquatic receptor assessment in January 2012 to determine the current state of the Bhizolo (southern boundary of the Bayside site) and Manzamnyama (eastern boundary of the site) Canals. The study was commissioned as part of the EIA for the decommissioning of the Bayside Aluminium smelter site. The following provides a summary of their findings.

The 1.8 km long Manzamnyama Channel, which drains the wetland area around Hillside Aluminium, was dredged to run behind the port infrastructure towards the southern boundary of the port. The 4.1 km long Bhizolo Channel drains the extensive Papyrus swamp and industrialized wetland area north-west of the port. The two channels join at right angles south of Bayside and combine to form the 1.2 km long lower section of the Bhizolo Channel, which opens onto the Kabeljous Flats, the large sub- and intertidal mudflat area that is still a remnant of the muddy bay of the old Richards Bay. The channels and mangroves have a muddy substrate, are 45-60 m wide and range in depth from 1-2 m at mid-tide. The lower section of the Bhizolo Channel after the confluence of the two channels flows through the biggest stand of mangroves in the harbour, while the middle and upper sections of the Bhizolo and Manzamnyama Channels are lined by narrow strips of mangroves 15-30 m wide.

The mangrove fringed tidal channels, although being artificially created dredged channels, have been shown since port development to sustain a diverse biotic invertebrate and fish community and to be important nursery areas for juveniles of many marine fish and prawn species. The most important aquatic habitat types associated with the channels are the intertidal and subtidal mudbanks and the intertidal mangrove areas.

6.1.4 GEOLOGY AND SOILS

The underlying physical geological foundation results in specific landscape features. More importantly the geology also controls the occurrence, distribution and type of water resources in the area, including the groundwater. The Richards Bay area lies on unconsolidated Cenzonic Era sediments of the Maputaland Lithological Group that stretch along the Maputaland coastal plain into Mozambique as illustrated in Figure 51.

As stated in the Richards Bay Port Expansion and IDZ Environmental Management Framework, the soils in the area are closely related to the geology and landforms and compromise three main types, namely deep grey sands, deep alluvial soils and red and yellow adepal soils (Figure 52).

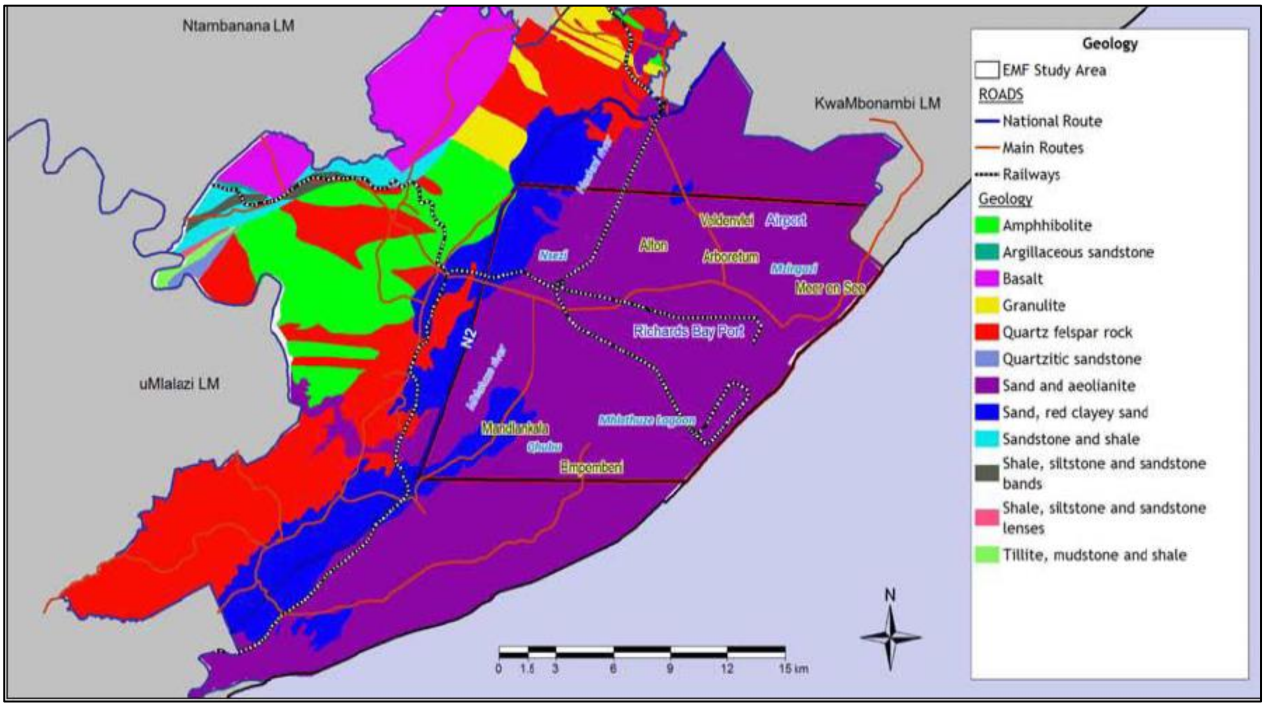


Figure 51: Geology of the greater area as per the Richards Bay Port Expansion and IDZ EMF.

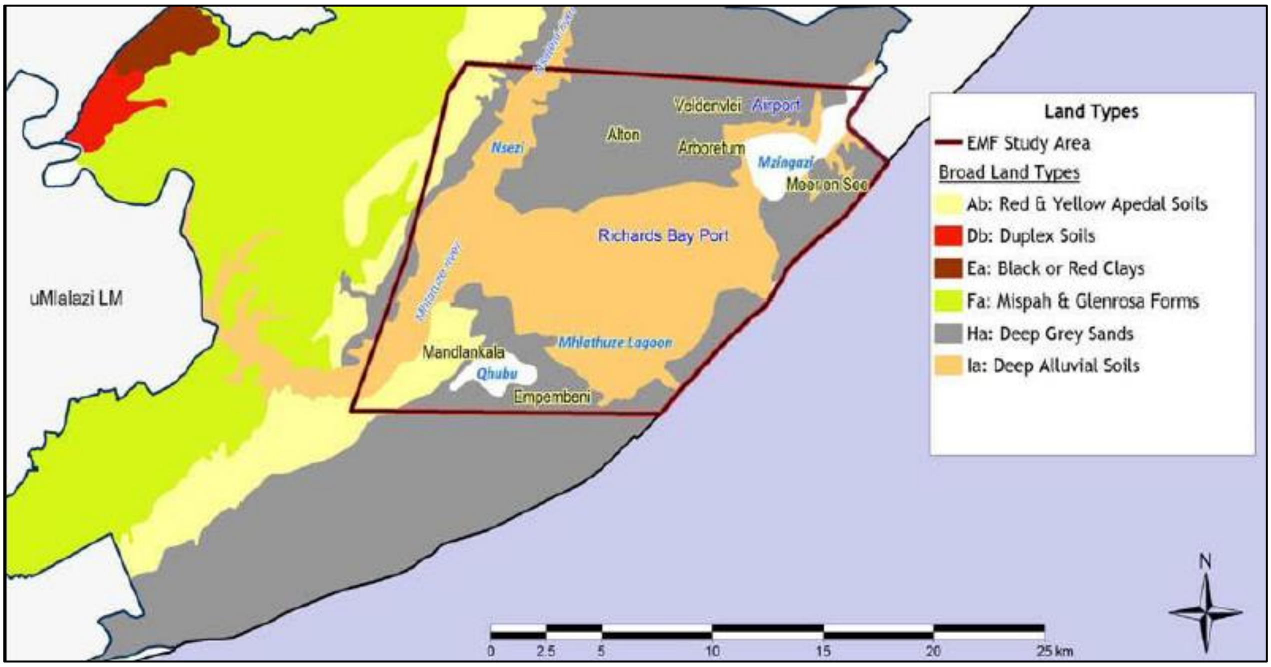


Figure 52: Soil types within the greater area as per the Richards Bay Port Expansion and IDZ EMF.

6.1.5 HYDROLOGY – SURFACE WATER

6.1.5.1 Regional Context

The Mhlatuze River, the Nseleni River, the Nsezi Stream, and the Richards Bay Inner City Streams (Figure 53) are found in the region and collectively make up the Mhlatuze catchment. A variety of lakes also occur on the coastal plain. Lakes Mzingazi and Lake Cubhu, are supplied by surface runoff, rainfall, and by groundwater and are classified as 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.[11]

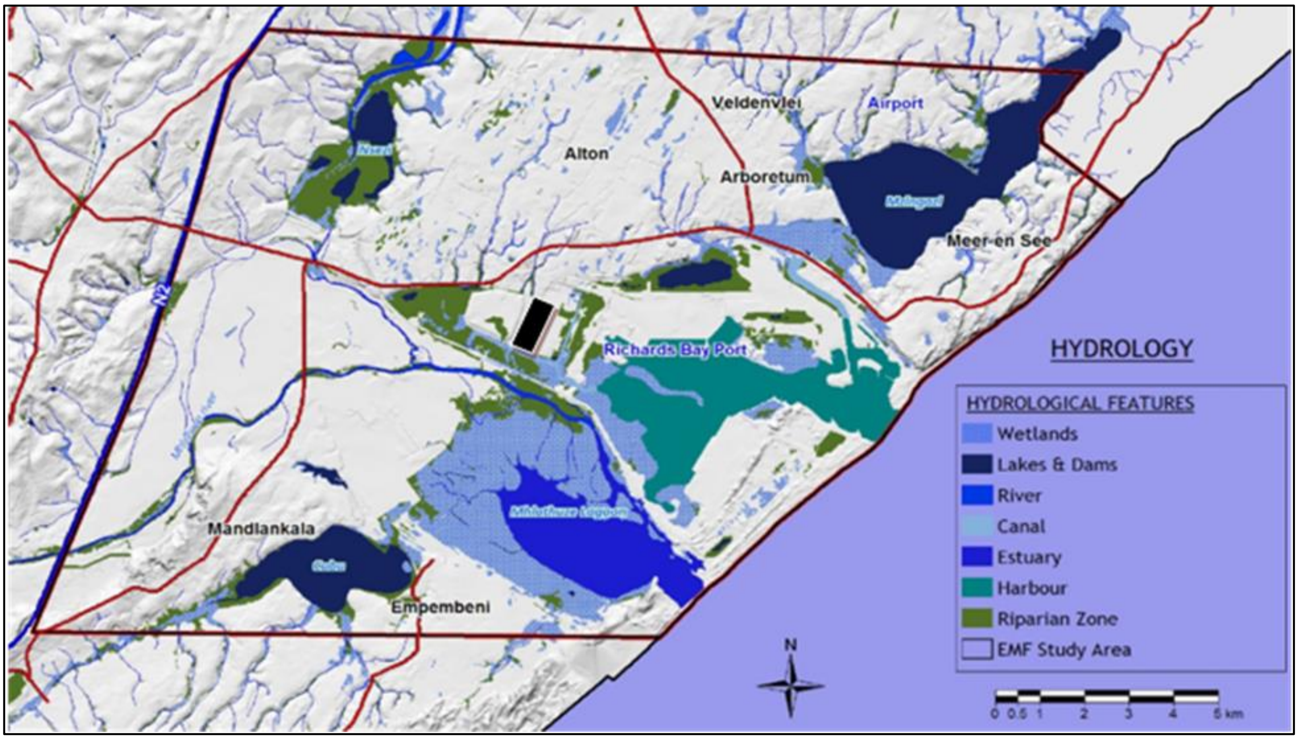


Figure 53: Surface Hydrology in the Richards Bay Area (Bayside site shown by black block, as reference point)[11]

The study area falls mostly within the quaternary catchment W12F of the historical Mhlatuze River floodplain (refer to Figure 54 for the 1:100 year floodline). The division of the floodplain and diversion of the Mhlatuze River to facilitate the construction of the Port of Richards Bay resulted in the section of the floodplain containing Bayside to fall outside of the current Mhlatuze River catchment thereby reducing the contributing catchment. The river systems that flow along the western and eastern borders of Bayside enter the Bhizolo and Manzamnyama canals, respectively, which flow directly into the Port of Richards Bay. Both canals are characterised as estuarine habitat.

[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.

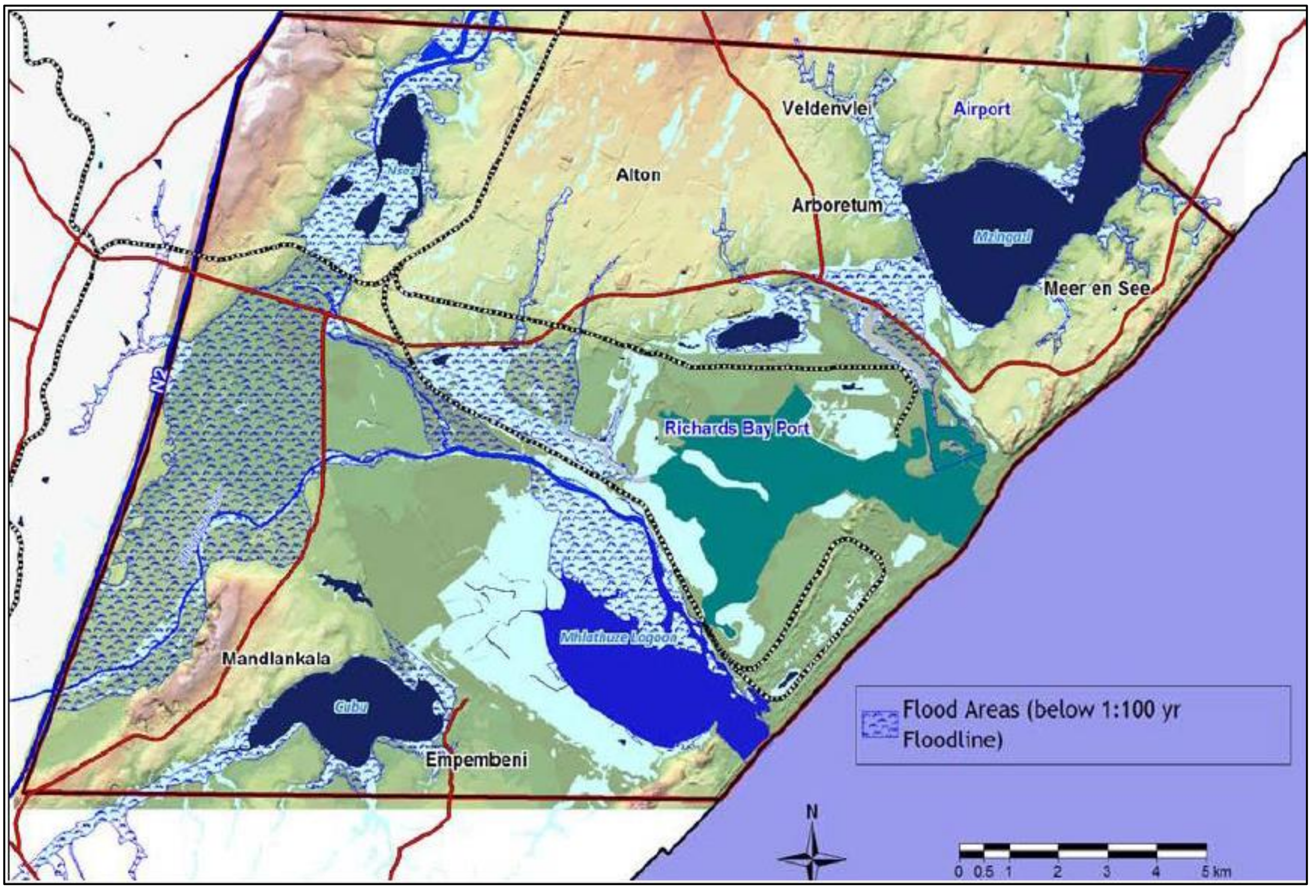


Figure 54: Flood areas defined by the 1:100 year floodline for the greater area.

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 Mhlatuze 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.

6.1.6 HYDROLOGY - GROUNDWATER

6.1.6.1 Regional Context

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. Groundwater flows are shown in Figure 55.[12]

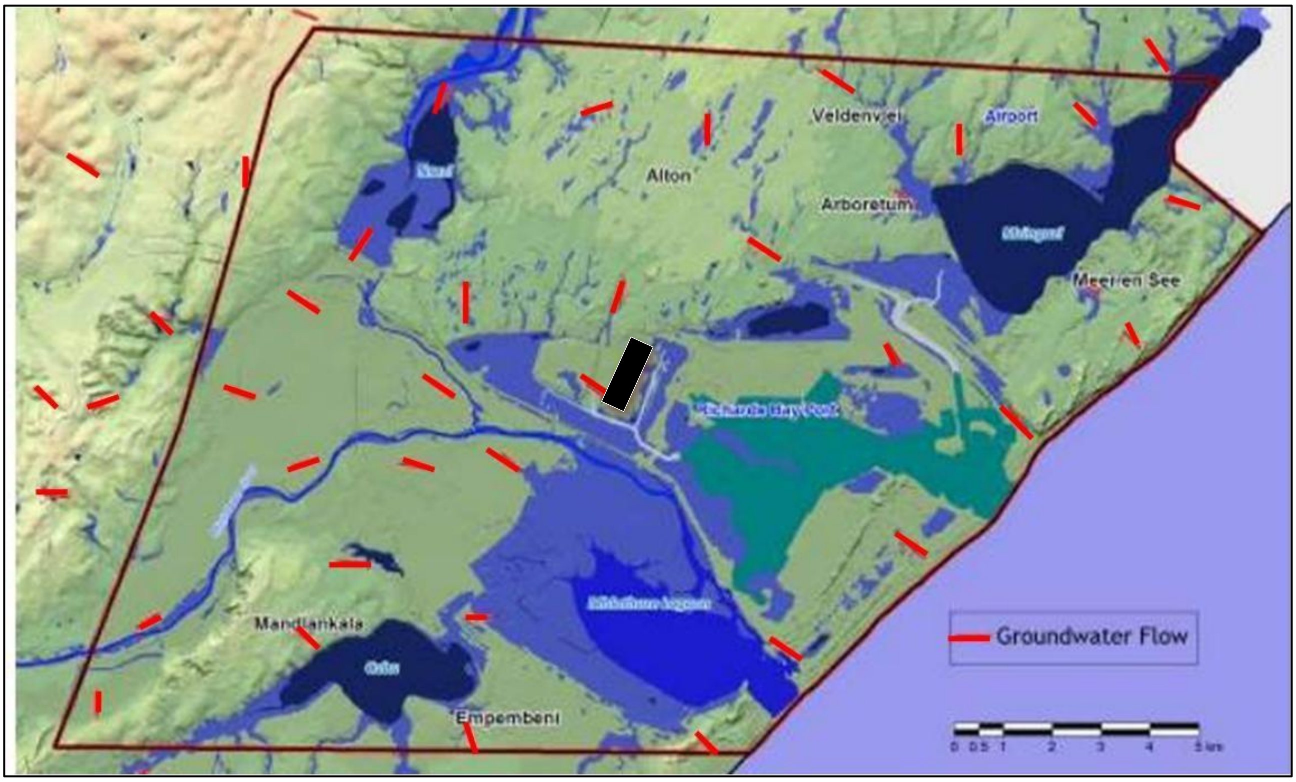


Figure 55: Groundwater Flow in the Richards Bay Area (Bayside Aluminium shown by black block)[12]

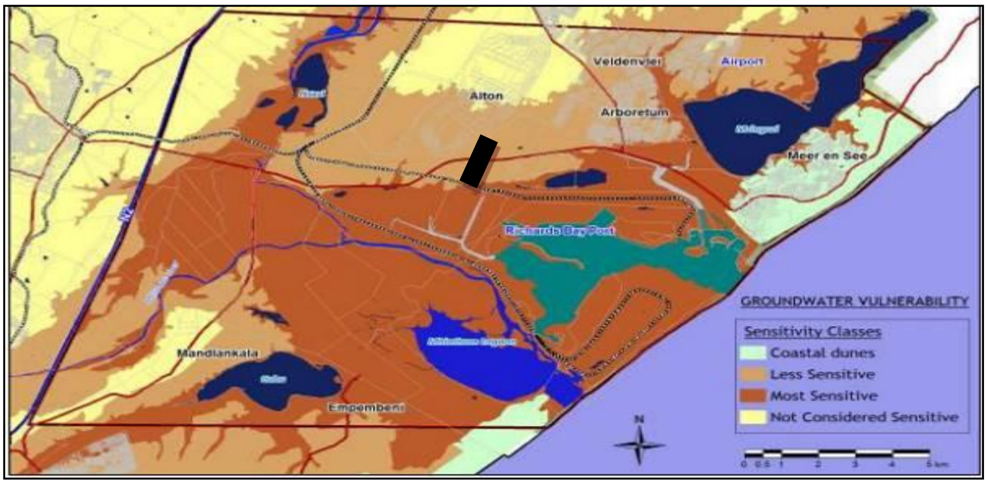


Figure 56: Sensitivity classes of groundwater in the Richards Bay region (Bayside Aluminium shown by black block)[12]

6.1.7 AMBIENT AIR QUALITY

The City of uMhlathuze Local Municipality contains an established industrial development zone with two aluminium smelters (one of which no longer operates other than the Casthouse), a chemical fertilizer plant, 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 emit significant quantities of air pollutants into the atmosphere. The region has very poor air quality as a result, 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

[12]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.

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 57).[13]

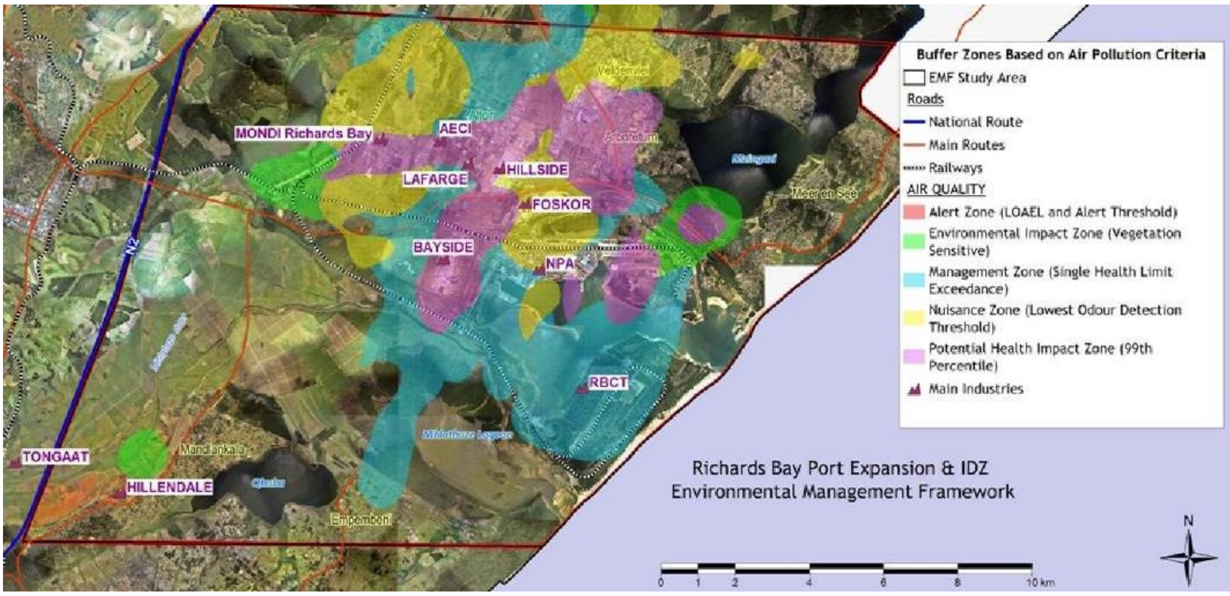


Figure 57: Regions in the Richards Bay area where air quality limits are in danger of being exceeded.[13]

Community concerns about the levels of air pollution in Richards Bay saw the Richards Bay Clean Air Association (RBCAA) established. The RBCAA is a local non-profit organisation that voices community concerns regarding air quality issues. The RBCAA comprises representatives from a number of local industries and successfully runs an independent air quality monitoring network (Figure 58). One of the organisation’s aims is to ensure that ambient concentrations of airborne pollutants comply with the national ambient air quality standards. The organisation retains a register of community complaints regarding air quality, and when possible investigates these. The organisation has no regulatory powers, with air quality management remaining the purview of the local government, but maintains pressure on the local authorities to fulfil their enforcement roles.

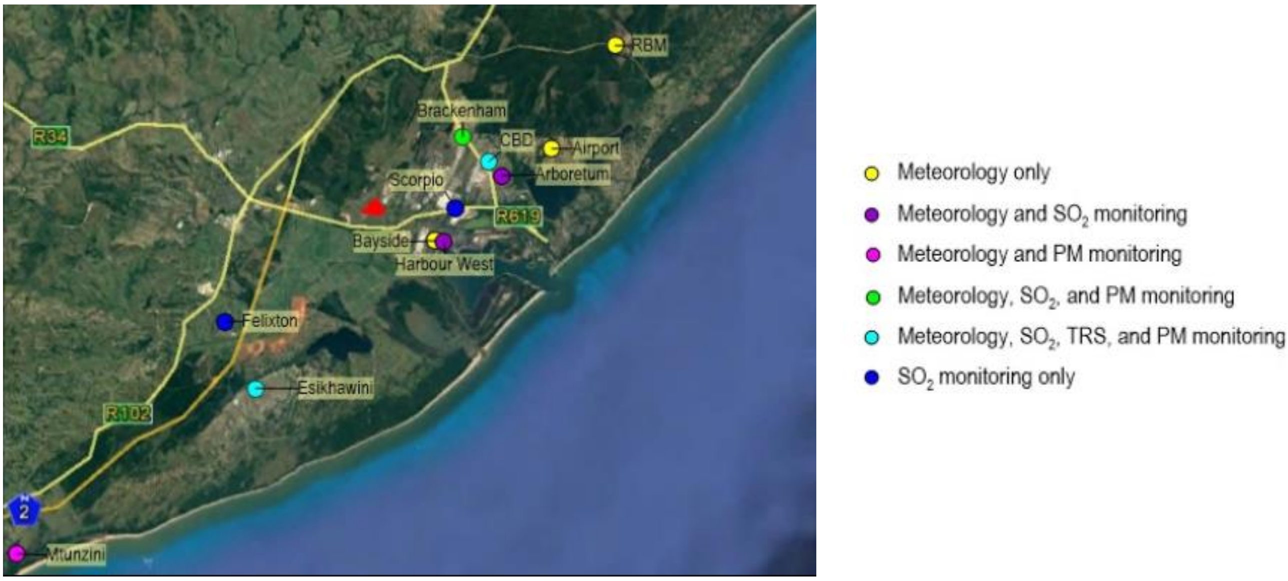


Figure 58: RBCCA Air Quality Monitoring Stations[14]

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[13] 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.

[14] Airshed Planning Professionals: Air Quality Impact Assessment for the Proposed Development of the Richards Bay Combined Cycle Power Plant (CCPP) and associated Infrastructure on a site near Richards Bay, KwaZulu-Natal Province – Scoping Report

In general, the ambient air quality in Richards Bay is in compliance with the NAAQS, with the exception of Harbour West for daily SO_2, Brackenham for daily PM_{10}, and eSikhaleni for $PM_{2.5}$ and PM_{10} (Table 20).

Table 20: NAAQS Compliance Summary for Ambient monitoring network of Richards Bay (2016-2019) from the Airshed AQIA Report (refer to Appendix 6 for the details).

Monitoring Station	SO_2			NO_2		PM_{10}		$PM_{2.5}$	
	hour	day	annual	hour	annual	day	annual	day	annual
Arboretum (RBCAA)	√	√	√						
Brackenham (RBCAA)	√	√	√			X (2018)	√		
CBD (RBCAA)	√	√	√			√	√		
eNseleni (RBCAA)	√	√	√			√	√		
eSikhawini (RBCAA)	√	√	√			√	√		
Felixton (RBCAA)	√	√	√			√	√		
Harbour West (RBCAA)	√	X (2018)	√						
Scorpio (RBCAA)	√	√	√						
Arboretum (uMhlathuze)	√	√	√	√	√	√	√	√	√
Brackenham (uMhlathuze)	√	√	√	√	√	√	√	√	√
eSikhaleni (uMhlathuze)	√	√	√	√	√	X 2019	√	X 2019	X 2019

A recent air quality dispersion modelling study assessed the cumulative air quality impact of operations in Richards Bay[15] The RBCAA considers this to be the most comprehensive assessment of normal operations of the industries in the Richards Bay airshed, although some limitations are detailed in the report. These limitations include omission of some industrial sources (where information was not available); exclusion of traffic emissions and intermittent sources such as sugarcane burning. Simulated annual average concentrations of PM_{10}, NO_2, and SO_2 were provided for cumulative assessment of the baseline conditions. The results show:

- Simulated Annual Average Respirable Particulate Matter (PM_{10}) concentrations: exceedances of the NAAQS (40 µg/m^3) across much of the port area and adjacent areas mainly due to coal stockpiling and handling operations;
- Simulated Annual Average Sulphur dioxide (SO_2) concentrations: normal operations of the industrial sources comply with the NAAQS with the highest concentrations predicted close to Richards Bay central, Alton, and Brackenham; and,
- Simulated Annual Average Nitrogen dioxide (NO_2) concentrations: comply with the NAAQS with maximum concentrations occurring near Alton and Richards Bay Central.

6.1.8 AMBIENT NOISE

Potential noise sensitive receptors within the Richards Bay area, include the residential areas of Gubhethuka (~6 km southwest of the project), Meer En See (~4.6 km east-northeast of the project) and Arboretum (~4 km northeast of the project). The closest industrial receptors are ~ 400 m from the project site (to the north and southeast) (refer to the specialist Qualitative Noise Assessment in Appendix 6).

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[15] The report was used with the permission of the authors (WSP Environment and Energy) and the RBCAA (under request for confidentiality of its members).

The main meteorological parameters affecting the propagation of noise include wind velocity and temperature. These along with other parameters such as relative humidity, air pressure, solar radiation and cloud cover affect the stability of the atmosphere and its ability to absorb sound energy. The following applies to the study area, as discussed by the Noise Specialist (refer to Appendix 6):

- Noise impacts are expected to be more notable southwest and south of the proposed project activities due to the predominant wind direction in the area;
- Temperature gradients in the atmosphere create effects that are uniform in all directions from a source. On a sunny day with no wind, temperature decreases with altitude and creates a 'shadowing' effect for sounds. On a clear night, temperatures may increase with altitude thereby 'focusing' sound on the ground surface. Noise impacts are therefore generally more notable during the night. The average temperature for the site (as obtained from the WRF data set for the period 2016 to 2020) was 22°C; and,
- The effect of the ground is different for acoustically hard (e.g., concrete or water), soft (e.g., grass, trees or vegetation) and mixed surfaces. Ground attenuation is often calculated in frequency bands to take into account the frequency content of the noise source and the type of ground between the source and the receiver (Brüel & Kjær Sound & Vibration Measurement A/S, 2000). Based on observations, ground cover for the area is acoustically mixed.

A baseline noise survey was undertaken on 18 and 19 March 2021. The following results were recorded:

- The acoustic baseline sources included movement of water onto the sand bar and harbour operations.
- Day-time baseline noise levels:
  - L_{Aeq}'s ranged between 49.2 dBA and 55.5 dBA which is considered typical of suburban to urban areas according to SANS 10103.
  - Calculated $L_{Req,d}$ (52.7 dBA) were within IFC guidelines for residential, institutional and educational receptors (55 dBA).
- Night-time baseline noise levels:
  - L_{Aeq}'s ranged between 47.8 dBA and 56.2 dBA which is considered typical of urban to central business district areas according to SANS 10103.
  - Calculated $L_{Req,n}$ (53.7 dBA) were above IFC guidelines for residential, institutional and educational receptors (45 dBA).

6.2 SOCIO-ECONOMIC ENVIRONMENT

The majority of information contained within this section has been updated and is based on the Socio-Economic Assessment conducted by ACER (Africa) Environmental Consultants and Urban-Econ Development Economists, undertaken as part of the EIA. Please refer to Appendix 6 for the full report. The socio-economic environment within which the proposed Project falls, was divided into two areas, the primary and secondary study area (Figure 59).

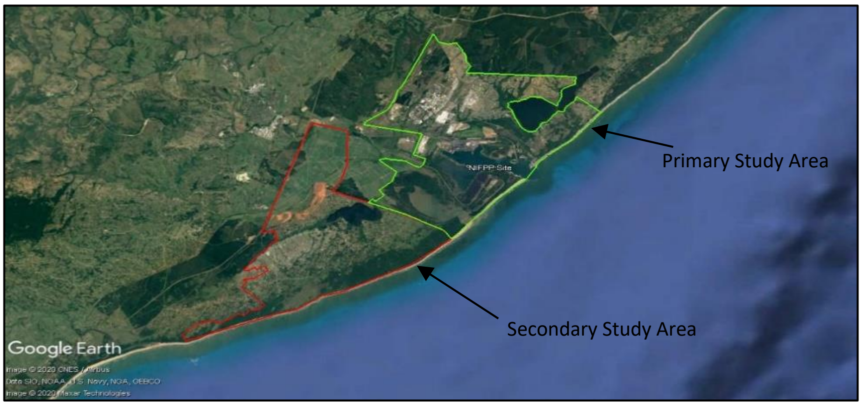


Figure 59: Delineation of the primary and secondary study areas for the socio-economic assessment

6.2.1 DEMOGRAPHICS

6.2.1.1 Population

The 2011 National Census states that the population of the uMhlathuze LM is 334,459 persons with an annual increase of 1.5% between the 2001 and the 2011 National Census (StatsSA, 2011). However, the 2016 community survey estimated the population to be 410,465 persons, a growth rate of 4.5% annually between 2011 and 2016 (StatsSA, 2016). This growth rate is higher the KCDM (0.2% and 1.4%) and the province (0.7% and 1.5%) (StatsSA, 2011 and StatsSA, 2016, respectively). While the incorporation of the former Ntambanana LM into the City of uMhlathuze LM may have contributed to the sharp increase in growth within the LM, there is clearly a significant influx of people into Richards Bay itself, which may also account for the higher population growth in the City of uMhlathuze LM compared to the DM and province as a whole.

For the period 1996 to 2016, the percentage of total population of the City of uMhlathuze LM classified as 'potentially economically active' (ages of 15 and 64) has been consistently higher than the percentage of the population within this age group in the DM and province (Table 21). In addition, data from the 2011 Census shows that the trend is more pronounced in Richards Bay than other areas with a significantly higher portion of the population falling within the potentially economically active age bracket (Table 22). While the Secondary study area has a lower percentage of the population classified as potentially economically active, it is still higher than the DM and provincial average.

Table 21: Breakdown of the population by age group

	KwaZulu-Natal				King Cetshwayo DM				City of uMhlathuze LM			
	1996	2001	2011	2016	1996	2001	2011	2016	1996	2001	2011	2016
0-14	36%	35%	32%	35%	41%	39%	34%	40%	34%	33%	29%	35%
15-64	59%	60%	63%	60%	55%	57%	61%	56%	63%	64%	67%	62%
65+	5%	5%	5%	5%	4%	4%	5%	4%	3%	3%	4%	3%

Table 22: Breakdown of population by age group in Richards Bay

	Richards Bay (2011)	Secondary study area (2011)	City of uMhlathuze LM (2011)
0-14	24%	33%	29%
15-64	72%	65%	67%
65+	4%	2%	4%

These data, coupled with the increase in the population within the LM and Richards Bay itself, indicate that there is a movement of people into the LM, Richards Bay and the surrounding communities and that these people are of working age and thus are likely moving to the area in search of employment opportunities.

6.2.1.2 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 23). These figures are better than those reported for both the KCDM and KwaZulu-Natal, at 16% and 11%, respectively (StatsSA, 2011) (Table 23). The trend of better access to education within the uMhlathuze LM compared to the KCDM and province is also evident in the percentage of the population over the age of 20 with Grade 12 and some form of tertiary education viz., 39% and 15% in uMhlathuze, 30% and 9% in KCDM and 31% and 9% in KwaZulu-Natal, respectively (Stats SA, 2011) (Table 23).

Table 23: Highest level of education population over the age of 20, 2001 to 2011

	uMhlathuze		KCDM		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%

6.2.1.3 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 KCDM (34.7%) and KwaZulu-Natal (33%) (StatsSA, 2011). Unemployment is shown to have improved, following the 2011 census with unemployment currently estimated at 24.6% within the LM, again below the average for the DM (City of uMhlathuze IDP, 2019/2020). There are 102,650 employed people in the City of uMhlathuze LM local municipality.

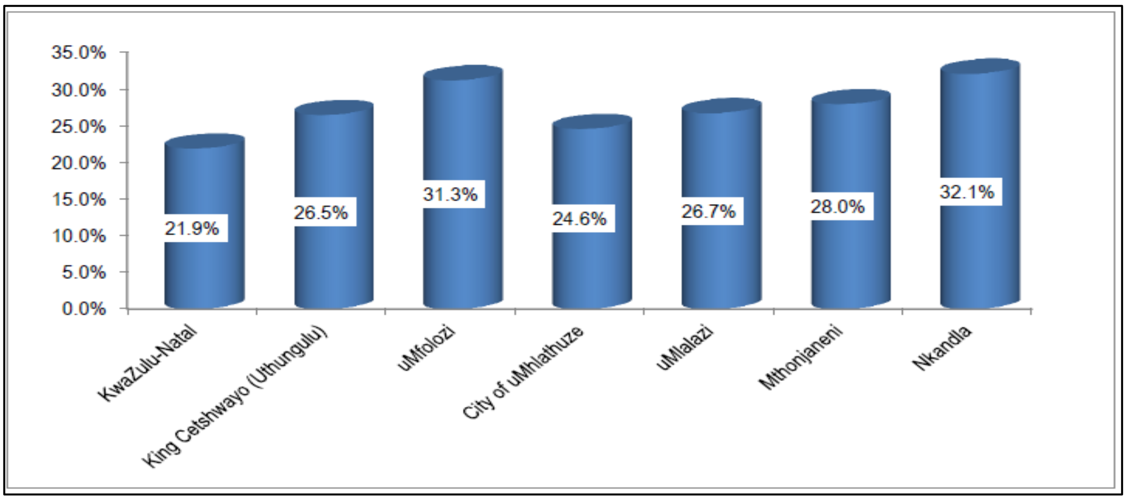


Figure 60: Local and regional unemployment rates 2018 (Source: City of uMhlathuze LM IDP, 2019/20)

Unemployment within the LM, DM and province as a whole is all higher than the national average (Figure 60). Unemployment is highest in the municipal wards which encompass those areas 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, 2019/2020). While these figures reflect the population employed in the formal sector it should be noted that an estimated 17,158 people are reported to be employed in the informal sector within the LM accounting for approximately a further 7.6% of potentially economically active population (City of uMhlathuze IDP, 2019/2020).

6.2.1.4 Income profile

Household income within the City of uMhlathuze LM varies throughout the municipality. On average 15.2% of households within the LM reported no annual income. Comparatively, 11.9% of households in Richard Bay and 16.3% of households in the secondary study area reported no annual income (StatsSA, 2011). This trend (higher levels of income within Richards Bay than the rest of the LM) was also evident in other income groups with 41.1% of households in the LM classified as middle to high income, 71.6% of households in Richards Bay and 35.6% of households in the secondary study area (StatsSA, 2011) (Figure 61). Data on household income levels was not available for the 2016 Community Survey.

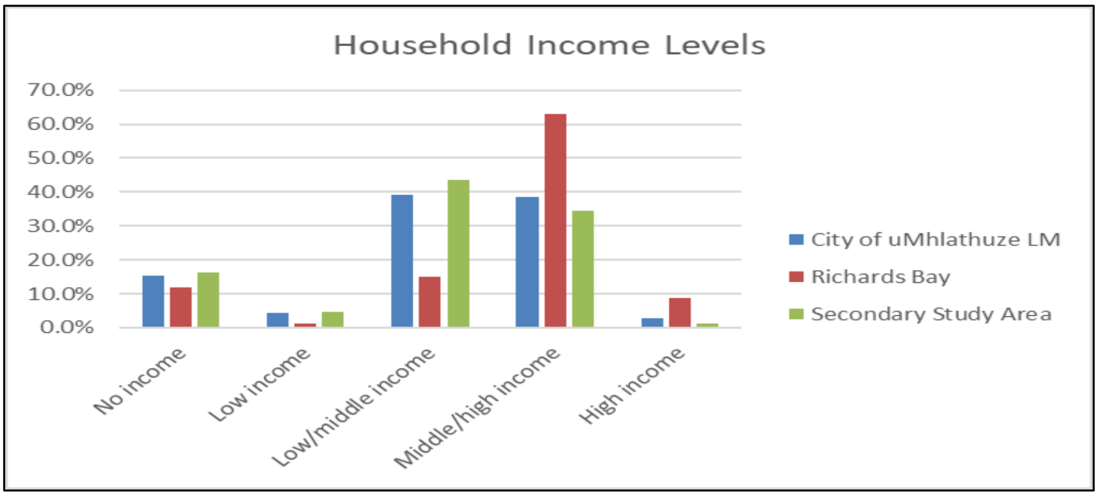


Figure 61: Household income levels

The significance of the low levels of income and high levels of unemployment (Section 5.2.1.3) is evident in that during the year proceeding the 2016 Community Survey, 22% of households in the City of uMhlathuze LM reported running out of money to purchase food and 15% of households reported foregoing meals due to a lack of income (StatsSA, 2016).

6.2.2 ECONOMIC PROFILE

6.2.2.1 National economy

The South African economy is currently characterised by a near stagnant growth environment, high unemployment and stubborn structural challenges such as high inequality and poverty. The South African economy has been on a downward growth path since 2009 and has experienced sluggish growth to date (Figure 62).

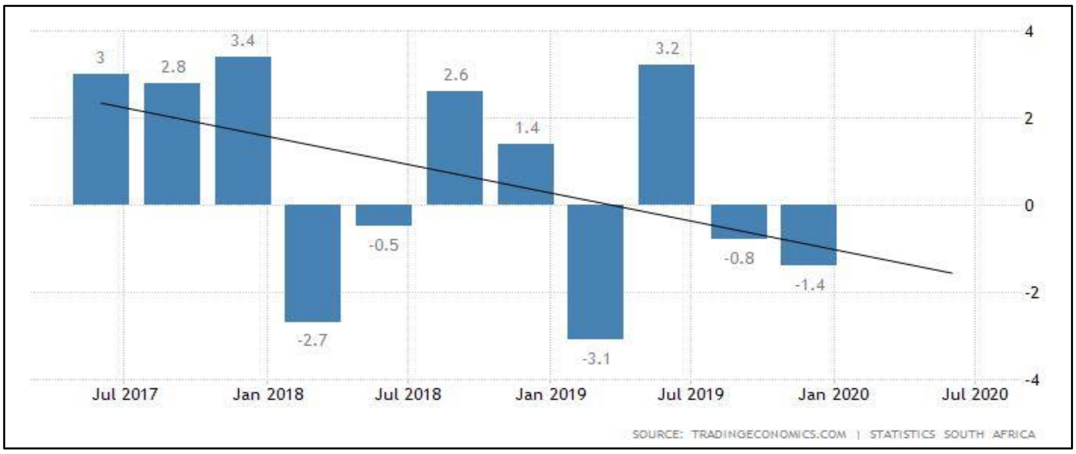


Figure 62: South African growth trends (2017 – 2020) (Source: Trading Economics, 2020; StatsSA, 2020)

Global economic shutdowns due to COVID-19 have caused turmoil, both in financial markets and in many large and small corporates that have experienced severe weakening of balance sheets, with the economic effect likely to parallel the recession from the global financial crisis just over a decade ago. South Africa was already in recession prior to the COVID-19 shock, and the situation has become more challenging since. Consensus expectations are currently for the global economy to recover in 2021The expectation is similar for South Africa, with a particularly sharp contraction in the second quarter of this year. The current year growth forecast was -0.2% as of March 2020. More recent analysis suggests 2020 growth will be in a range of -2% to -4%, with downside risks should the global economy weaken more than currently projected. Further out, there is limited scope for a rebound, but growth is now unlikely to exceed 1% in 2021 (SARB, April 2020).

South Africa's economy has been traditionally centred in the primary sectors as a result of large reserves of mineral resources and favourable agricultural conditions. Recent decades, however, have seen a structural shift in output. South Africa is moving towards becoming a knowledge-based economy, with a greater focus on technology, e-commerce and financial and other services. Since the early 1990s, economic growth has been driven mainly by the tertiary sector, which includes wholesale and retail trade, tourism and communications. The tertiary sector employs 71.7% of the workforce and represents 61% of the country's Gross Domestic Profit (GDP). Figure 63 outlines the structure of South Africa's economy indicating the largest sector based on respective contribution per industry to South Africa's GDP.

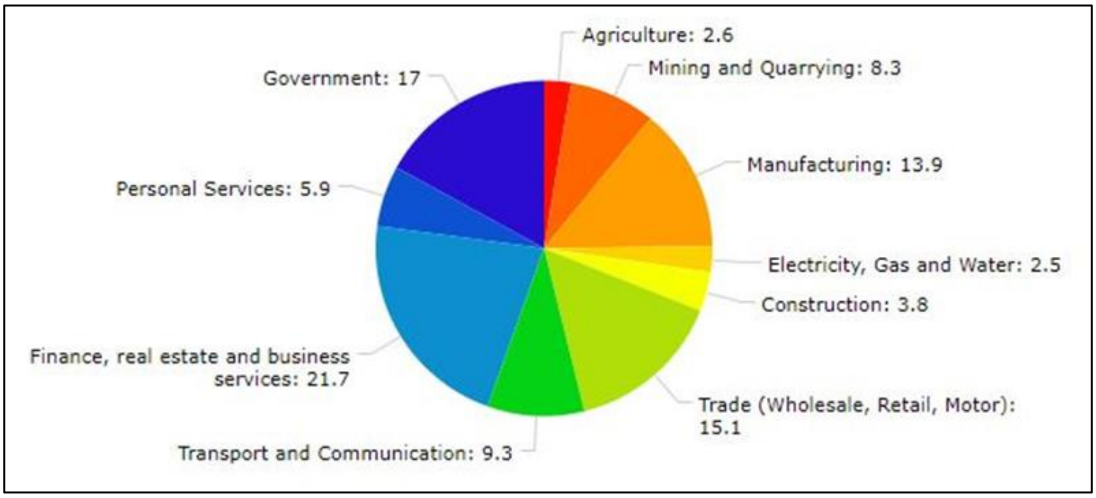


Figure 63: Contribution per industry to South Africa's GDP, 2019 (Source: South African Market Insights, 2020)

Finance, real estate and business services is the largest industry in South Africa contributing about 21% of South Africa's GDP. Government is the second largest contributor, contributing 17% to the overall GDP. Manufacturingsuffered a significant drop in contribution to GDP in 2009 and it has struggled to gain momentum ever since (partly due to lower demand for goods, and partly due to lack of stable power supply from ESKOM). The electricity, gas and water industry has also been adding less value to the South African economy over the last couple of years, largely due to the power supply issues experienced by ESKOM especially from 2008 when ESKOM's load shedding started (South African Markets Insights, 2020).

Some electricity usage decline has taken place over the last number of years, partly due to significant price increases and partly due to less demand for electricity (as businesses become more electricity efficient, especially after load shedding started and calls from ESKOM to use electricity more efficiently). However, the energy sector in South Africa is an important industry at the centre of economic and social development. It creates jobs and value by extracting, transforming and distributing energy goods and services throughout the economy. This role is particularly important when economic growth and job creation are such high priorities in the country. In addition to the energy sector's economic contributions in general, relatively lower and stable energy prices are key to stimulating the country`s economy.

South Africa's increasing focus on industrialisation and a mass electrification programme to take power into deep rural areas, has seen a steep increase in the demand for energy in recent years. At the same time, an ageing coal fired infrastructure base and a lack of investment in power plants are causing shortages in supply. After the energy crisis in 2008 the South African Government started to introduce renewable energies on a large scale and promoted energy efficiency in all sectors to meet the demand of energy while reducing CO_2 emissions and creating jobs. Significant investment in renewable energy and energy efficiency is still needed though. Increasing the diversity of South Africa's electricity generation mix is important – not only for enhancing the crucially important security of supply of the country – but also to support job creation and mitigate climate change (The South African Energy Sector Report, 2019).

Issues such as high inequality and a lack of inclusive growth, unemployment as well as poverty are recurring themes contributing to social instability. There are approximately 16 126 895 employed persons in South Africa. Unemployment remains a key challenge, standing at 29.1% (expanded unemployment rate of 37,1%) in 2019 Q4 (StatsSA, 2020) (Figure 64). This is about 6 times the global average which is dangerously high. Job growth stalled in 2019, with the total number of employed people declining from 16.44 million at the end of 2018 to 16.34 million at the end of 2019 (using seasonally adjusted data). Meanwhile, the labour force continued to expand, with a net increase of 481 000 people during 2019 (SARB, April 2020).

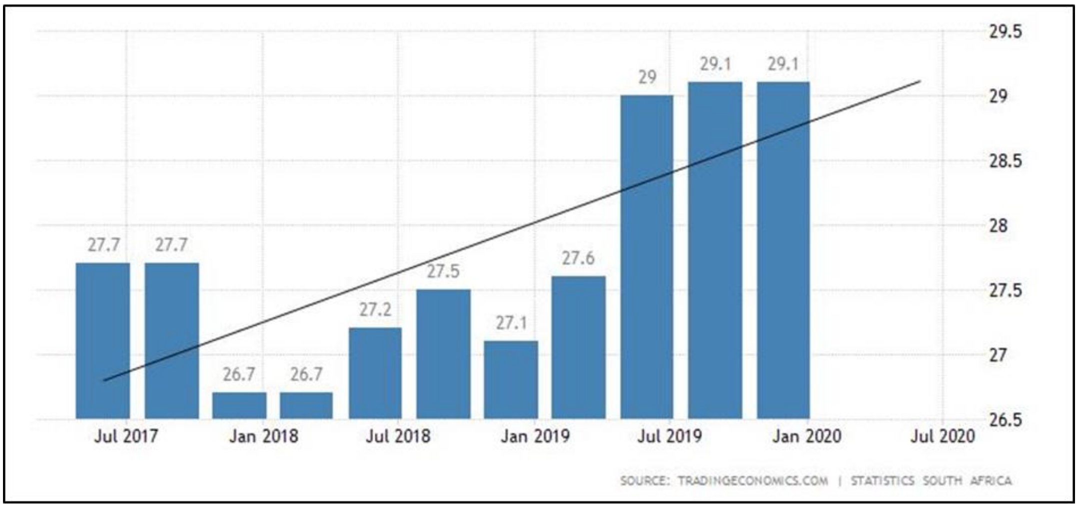


Figure 64: South African unemployment trends 2017 – 2020 (Source: Trading Economics, 2020; StatsSA, 2020)

The COVID-19 global pandemic has seen large portions of the economy stagnate and a supply side slump worsening the unemployment crisis. For 2020, preliminary estimates suggest South Africa could lose about 370 000 jobs, on a net basis, with business insolvencies increasing by roughly 1 600 firms as the economy contracts (SARB Monetary Policy Review, April 2020).

6.2.2.2 City of uMhlathuze Local Municipality Economy

Data on the economic structure and sectoral contribution are not collected at a sub-municipal level in South Africa for non-metropolitan municipalities and, as such, it is not possible to determine the exact structure of the Richards Bay economy. However, based on a review of existing information as well as local knowledge, it is understood that industrial activity in Richards Bay drives the economy of the City of uMhlathuze LM and, therefore, significantly influences its economic structure. For this reason, the economic profile of the City of uMhlathuze LM is an indicator of the profile of Richards Bay.

The GVA of City of uMhlathuze LM was valued to be R36,122 million in 2018 current prices (Table 24). This is equal to a GDP per capita of R102 152 which is significantly higher than the national and provincial economies with a GDP-R per capita of R75,205 and R61,174 respectively.

Table 24: GVA and GDP-R figures for the local, regional and national economy

	GVA (R Millions)	GDP R Per Capita (R)
South Africa	R4 341 282	R75 205
KwaZulu-Natal	R696 458	R61 174
King Cetshwayo DM	R52 031	R53 145
City of uMhlathuze LM	R36 122	R102 152

Source: Quantec data, 2020, Urban-Econ Calculations, 2020

Within City of uMhlathuze LM the manufacturing industry is important in comprising more than 20% of the LMs economy. However, the manufacturing sector's growth in the LM is lower than the growth recorded in both the DM and the province between 2008 and 2018. The lower than average growth of this sector could be seen as an indication that the secondary sector within the City of uMhlathuze LM is experiencing pressure as a result of the relatively slow growth experienced by the local economy as a whole. A breakdown of the structure of the local, regional and national economies is shown in the Table 25. Figure 65 illustrates the economic profile of the City of uMhlathuze LM in terms of GVA per sector.

Table 25: Summary breakdown of the structure of the local, regional and national economies

	South Africa		KwaZulu-Natal		King Cetshwayo		City of uMhlathuze	
	Nominal	CAGR [16](08-18)[17]	Nominal	CAGR (08-18)	Nominal	CAGR (08-18)	Nominal	CAGR (08-18)
Total	**100.0%**	***7.3%***	**100.0%**	***7.0%***	**100.0%**	***6.3%***	**100.0%**	***6.0%***
Primary sector	**10.5%**	***5.6%***	**5.4%**	***4.2%***	**8.8%**	***2.0%***	**5.8%**	***1.1%***
Agriculture, forestry and fishing	2.4%	*4.6%*	3.8%	*4.1%*	5.6%	*3.5%*	2.1%	*4.2%*
Mining and quarrying	8.1%	*5.9%*	1.6%	*4.5%*	3.2%	*-0.2%*	3.7%	*-0.2%*
Secondary sector	**20.9%**	***6.8%***	**25.9%**	***6.8%***	**28.1%**	***4.9%***	**31.3%**	***4.1%***
Manufacturing	13.2%	*5.3%*	17.5%	*5.5%*	19.8%	*3.3%*	22.7%	*2.5%*
Electricity, gas and water	3.8%	*16.0%*	4.0%	*16.5%*	3.7%	*16.3%*	3.9%	*16.2%*
Construction	3.9%	*6.2%*	4.4%	*7.0%*	4.6%	*7.3%*	4.6%	*7.1%*
Tertiary sector	**68.5%**	***7.8%***	**68.7%**	***7.3%***	**63.1%**	***7.9%***	**62.9%**	***7.7%***
Wholesale and retail trade, catering and accommodation	15.0%	*8.2%*	15.2%	*5.7%*	13.4%	*6.4%*	14.1%	*6.6%*
Transport, storage and communication	9.8%	*6.8%*	13.2%	*7.1%*	14.7%	*7.6%*	16.3%	*7.8%*
Finance, insurance, real estate and business services	19.7%	*6.7%*	16.9%	*6.4%*	13.1%	*7.8%*	13.8%	*7.5%*
General government	18.1%	*9.8%*	17.2%	*9.9%*	15.9%	*9.8%*	13.4%	*9.3%*
Community, social and personal services	5.9%	*7.5%*	6.2%	*7.7%*	6.0%	*7.6%*	5.3%	*7.6%*

Source: Quantec, 2020, Urban-Econ Calculations, 2020

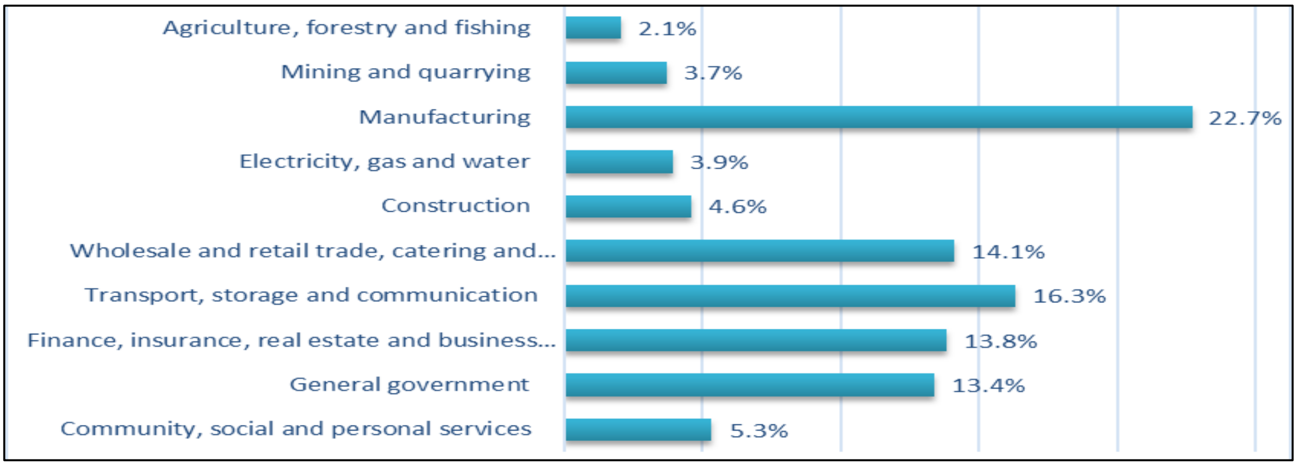


Figure 65: City of uMhlathuze LM GVA contribution by sector, 2018 (Source: Quantec Research, Urban-Econ Calculations, 2020)

The economy of the City of uMhlathuze LM is dominated by manufacturing, which accounts for about a fifth of the economy (23%) (Figure 65). The high percentage of manufacturing is indicative of the high concentration of industrial activity in Richards Bay, with the Port of Richards Bay, the RBIDZ and associated industries playing a significant economic role. Transport storage and communication is the next highest contributor (16%), followed by wholesale and retail trade sector contributing 14%. Finance, insurance and business services and General government sectors each contribute about 14%. These sectors are typically associated with the provision of services to industry. General government contributes 13%, which is to be expected given that Richards Bay is home to both the DM and LM governments, as well as a number

[16] CAGR: Compound Annual Growth Rate - a measure of average year on year change expressed as a percentage. A negative number indicates a retraction and a positive number indicating growth.

[17] CAGR is calculated for a 10 year period from 2008 - 2018

of satellite provincial departments which service the north of KwaZulu-Natal (KZN). The remaining 20% is made of the agriculture, mining, construction, and social and personal services sectors.

The sectoral employment pattern of City of uMhlathuze LM shows that the largest sector is the Wholesale and retail trade sector with about 23% of total employment (Figure 66). This is followed by the Finance, insurance, real estate and business services and the Community and social services sectors (Figure 66).

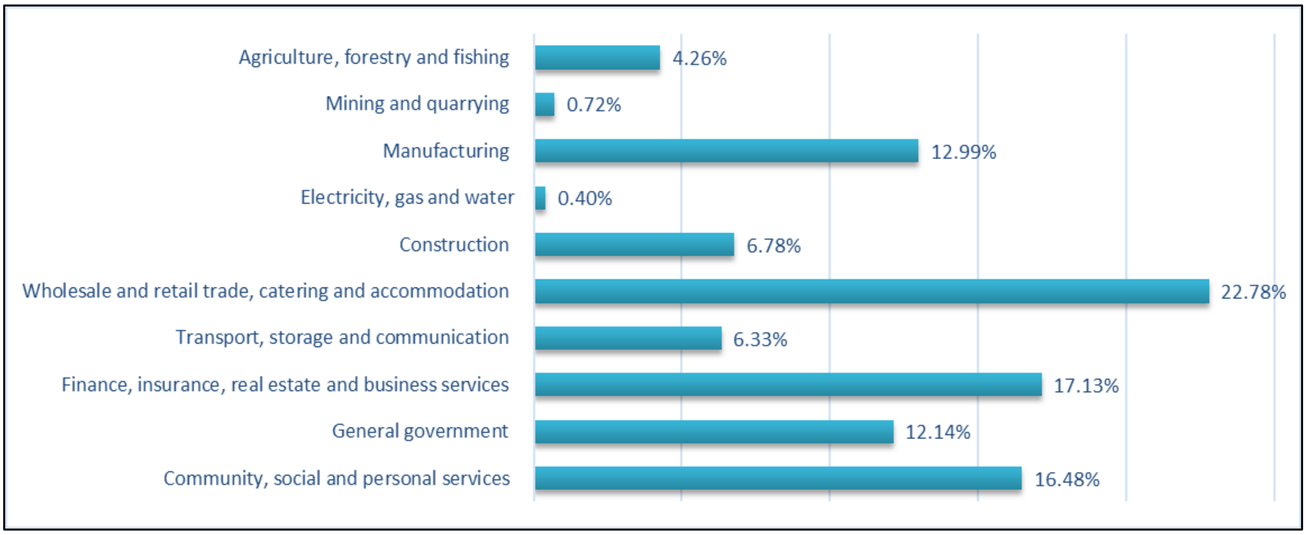


Figure 66: City of uMhlathuze LM Employment per sector 2018 (Source: Quantec, 2020; Urban-Econ Calculations, 2020)

Figure 67 illustrates the year-on-year GVA growth for the City of uMhlathuze LM as a whole, as well as for the key sectors of the economy, which are linked to industrial activity in Richards Bay, in part supported by the Port of Richards Bay, viz. manufacturing; transport, storage and communication; and finance, insurance, real estate and business services, over the period 2015 - 2018.

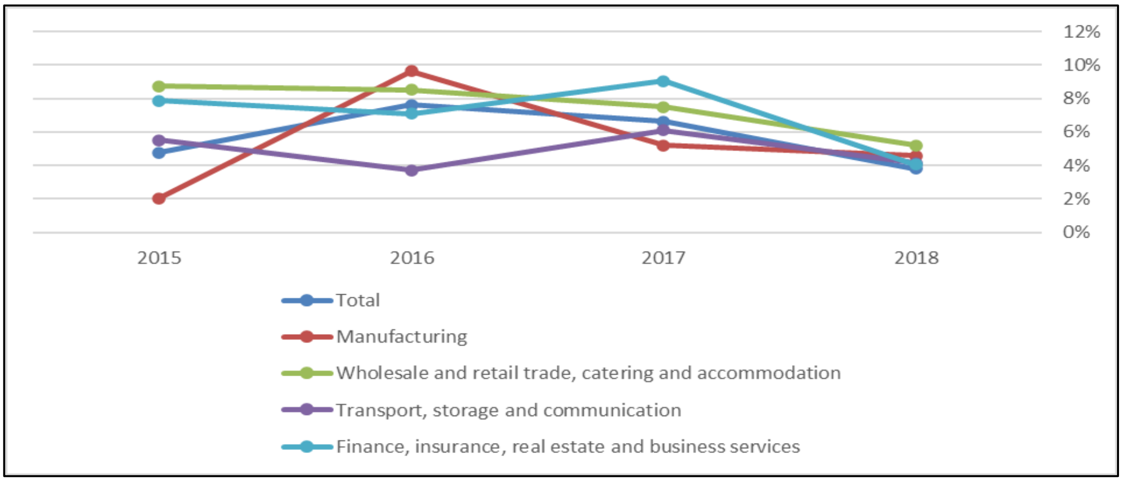


Figure 67: Year-on-year GVA growth for the City of uMhlathuze LM 2015 – 2018 (Source: Quantec, 2020; Urban-Econ Calculations, 2020)

The large annual decline of the manufacturing sector in 2009, during the height of the global financial crisis, heavily weighed on the LM's entire economy, resulting in a year-on-year contraction of 8%. It also weighed heavily on the sectors which are largely dependent on the manufacturing sector, although they narrowly avoided moving into negative territory. Post-2009, there has been a general economic recovery in the LM, although GVA growth stagnated between 2013 and 2016. Again, the significant role of the manufacturing sector is evident, as it experienced contraction during this period, falling to a post-2009 low of -2.4% year-on-year. Stimulating the manufacturing sector in the LM, by encouraging investment in industrial activity in the Port of Richards Bay, the RBIDZ, and associated industries in Richards Bay, is likely to grow the entire LM economy.

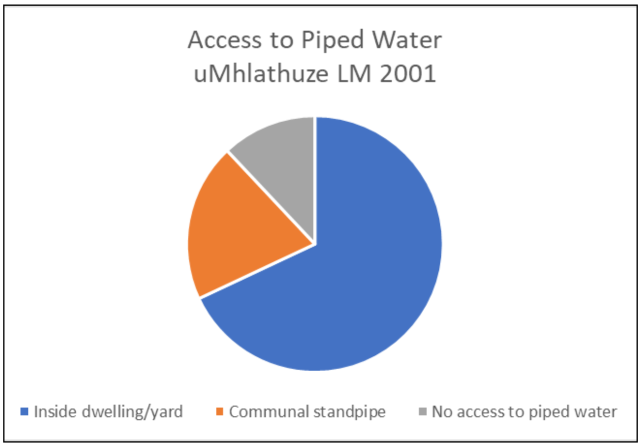
Of particular concern, however, is that none of the sectors have yet recovered to pre-2009 levels, indicating that there has been a 'levelling-out' within the local economy, reflecting the state of the national economy. Cheap electricity, one of the major attractions for industrial development in Richards Bay is no longer available (resulting in the closure of some industries), Growth prospects for the local economy need to be considered nd whether the demand projections provided by Transnet are an accurate reflection of potential future throughput of the Port.

6.2.3 INFRASTRUCTURE AND SERVICES

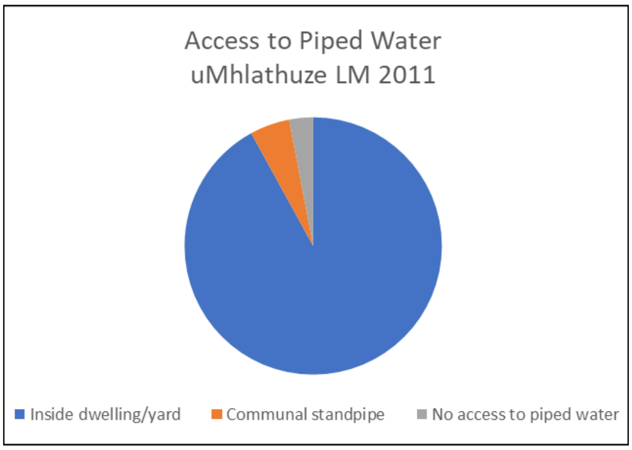
6.2.3.1 Water Supply

Access to piped water improved significantly within the City of uMhlathuze LM between 2001 and 2016. In 2016, 93% of all households had access to piped water either within their household or within their yard (Figure 68) (StatsSA, 2012, 2016).

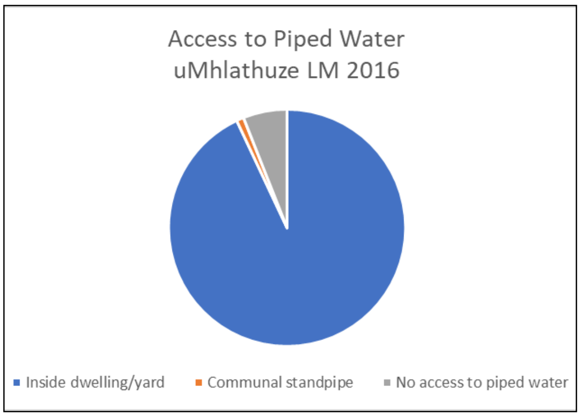
Access to piped water is better in Richards Bay than in the LM as a whole, with 95% of households having access within their dwelling or within their yards (StatsSA, 2011). Comparatively, only 90% of households in the secondary study area have this level of access, which is also lower than the LM average (Figure 68). This once again exhibits the difference in the level of socio-economic development within the LM itself.



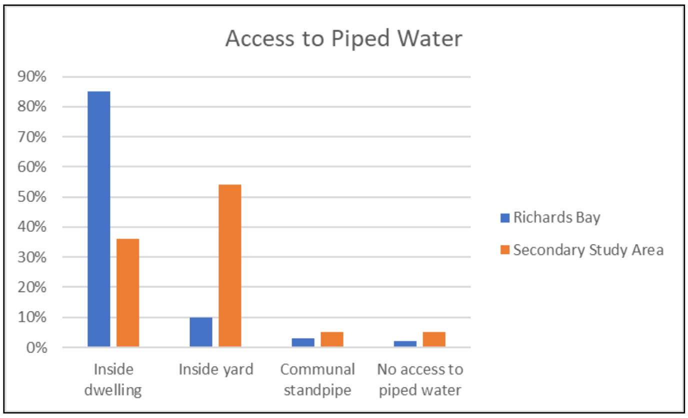
Access to piped water in the LM 2001



Access to piped water in the LM 2011



Access to piped water in the LM 2016



Access to piped water in Richards Bay and the Secondary study area 2011

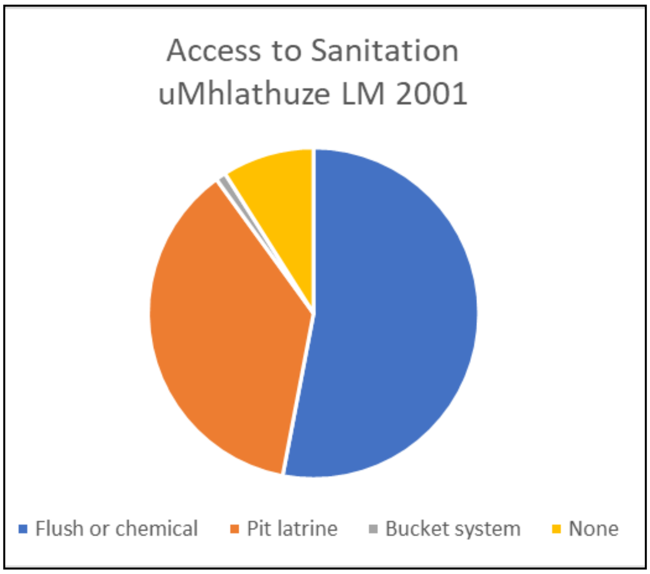
Figure 68: Statistics regarding access to piped water, 2001 – 2016 within the City of uMhlathuze LM

6.2.3.2 Sewerage and Sanitation

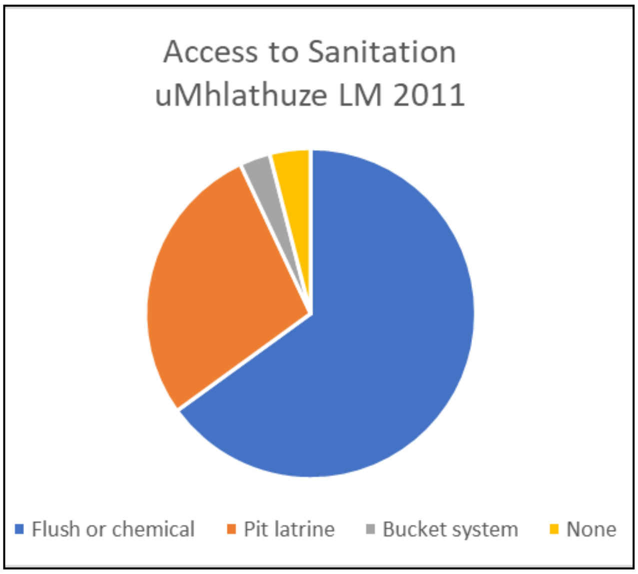
Improvements to sanitation have been experienced by households throughout KwaZulu-Natal, within the King Cetshwayo DM and within the City of uMhlathuze LM. This is evident in the reduction in the number of households without access (16% to 6% (KZN), 30% to 6% (King Cetshwayo DM) and 9% to 2% (City of uMhlathuze LM)) between 2001 and 2016

(StatsSA, 2012, 2016). As is the case with access to water, access to sanitation within the City of uMhlathuze LM is above both the district and provincial averages. The improvements in access to sanitation are provided in Figure 69.

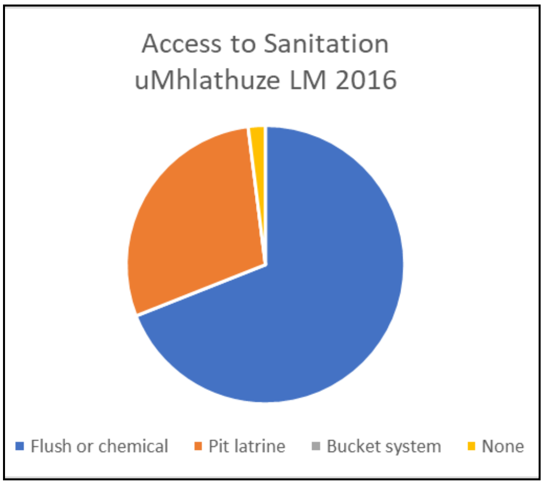
Access to water borne sanitation in Richards Bay is significantly higher than in the LM as a whole although 5% of households still report making use of the bucket system and 3% report no access to sanitation (StatsSA, 2016). Again, these data show the difference in living standards within the LM, with access to water borne sanitation in the secondary study area below the LM average and well below the average for Richards Bay (and 5% of households in this area reportedly not having any access to sanitation (Figure 69) (StatsSA, 2016)).



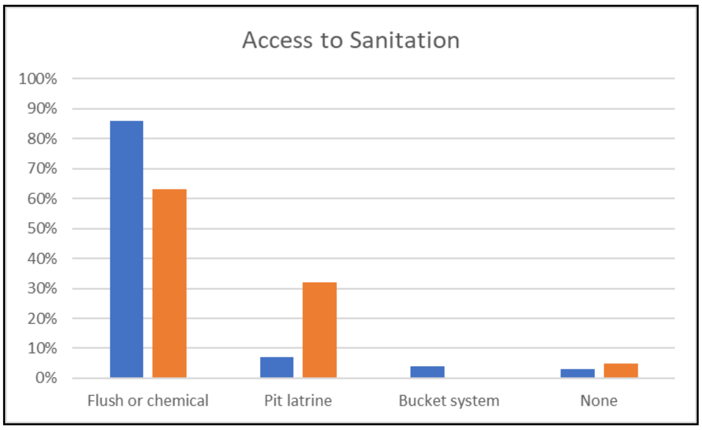
Access to sanitation in the LM 2001



Access to sanitation in the LM 2011



Access to sanitation in the LM 2016



Access to sanitation in Richards Bay and the Secondary study area 2011

Figure 69: Statistics regarding access to sanitation, 2001 – 2016 within the City of uMhlathuze LM

6.2.3.3 Electricity

While access to electricity for lighting (the most basic level of access) within the City of uMhlathuze LM is better than access on a district and provincial level, access in 2016 is reported to have improved significantly with above 90% of households in both the local and district municipal areas reported to have access (Figure 70) (StatsSA, 2012, 2016).

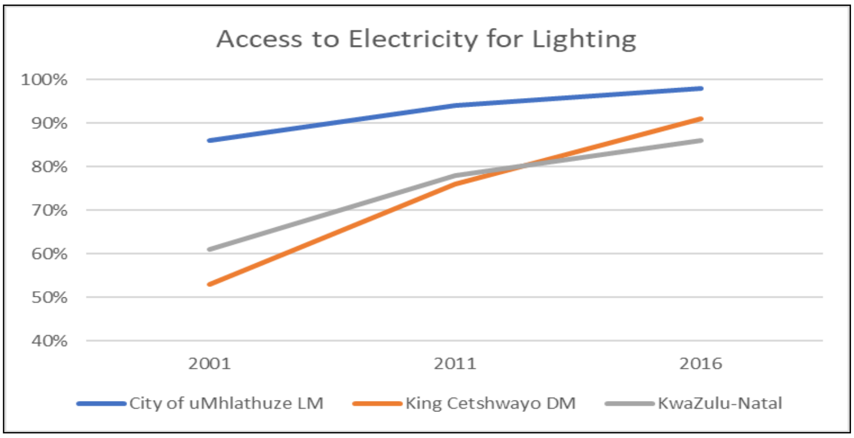


Figure 70: Access to electricity for lighting

6.2.3.4 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 remain a growing concern within the municipality (uMhlathuze IDP, 2014-2015).

There is a lack of reliable data on HIV and AIDS infections at a local municipal level. However, two broad assumptions can be drawn for the municipality.

- Due to its location on a major transportation route, which results in transient people, being home to one of the biggest ports in Africa and being a major provincial node, which attracts a large number of people in search of work, suggests that a high HIV and AIDS rate will prevail in the area; and,
- Secondly, HIV and AIDS prevalence in KwaZulu-Natal is the highest of all the provinces and there is no reason to believe that the City of uMhlathuze LM would be an exception (AECOM, 2014).

Barnes (2018) notes that these two assumptions are supported by the finding that the collection of Anti Retro Viral drugs was one of the main reasons for clinic visits. Data from 2018 show that approximately 33% of pregnant woman visiting the clinic area were HIV positive (Barnes, 2018).

6.2.3.5 Perceptions on Air Quality

Considering the highly industrial nature of Richards Bay coupled with the agricultural and rural areas in the immediate surrounds where the burning of sugarcane and wood is common practice, air quality viewed by the community as a major public health concern (City of uMhlathuze IDP, 2019/2020). Various studies have been undertaken on the impact of air quality on the health of local residents and while the LM undertakes air quality monitoring at three monitoring stations throughout the municipality (City of uMhlathuze IDP, 2019/2020), the Richards Bay Clean Air Association (RBCAA) identified the following as being of major concern to the health of residents:

- SO_2 – up to 19 000 tons per annum – mainly from the Hillside smelter;
- Fluoride – from loading bays at the port terminals;
- Coal dust - from loading bays at the port terminals; and,
- Magnetite - from loading bays at the port terminals.

6.2.4 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. [18]

However, a survey conducted as part of the EMF for the Richards Bay Port and IDZ[19] 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 71.

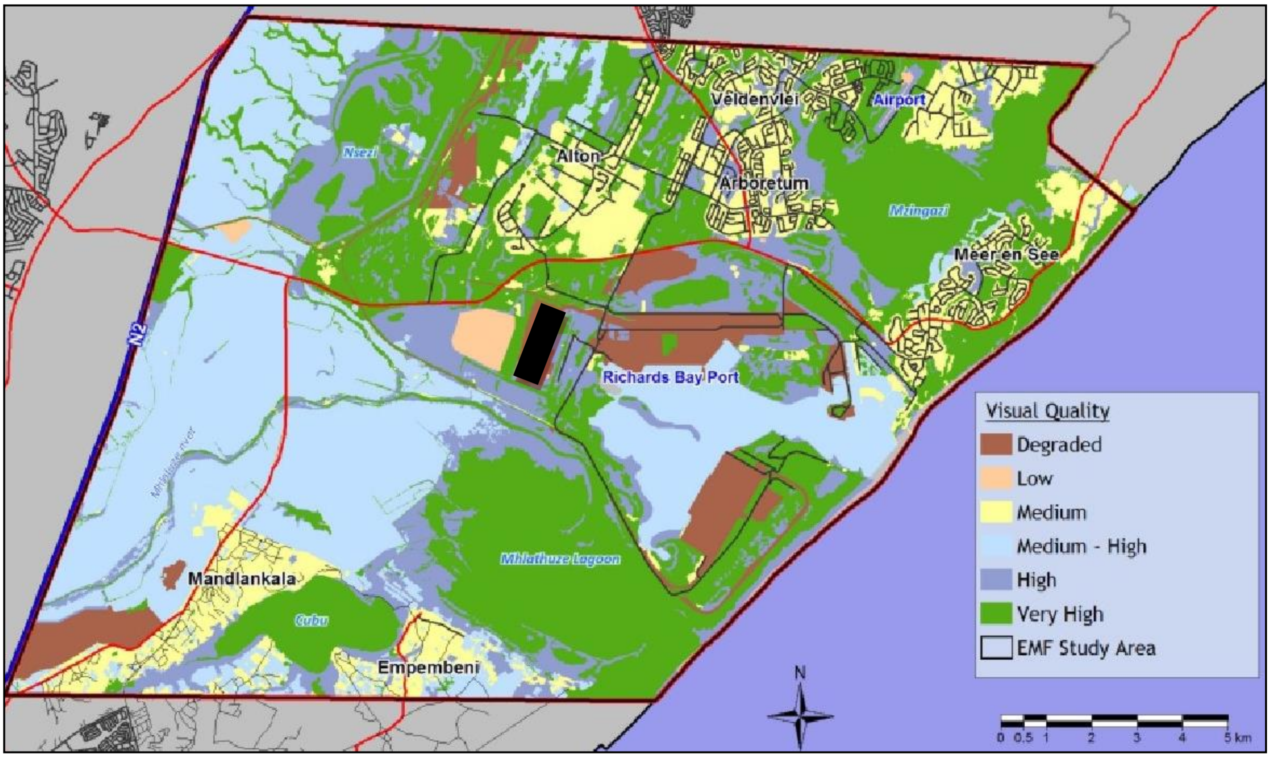


Figure 71: Visual Quality assessment of the Richards Bay Port and IDZ (Bayside Aluminium shown by black rectangle)

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

[19] 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.

7 PUBLIC PARTICIPATION PROCESS

The Public Participation guideline (DEA, 2017) provides the following introduction and legal background with regards to the public participation process within the EIA.

According to Section (2)(4)(f) and (o) of the Act,

- *the participation of all interested and affected parties (I&APs) in environmental governance must be promoted and all people must have the opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation, and participation by vulnerable and disadvantaged persons must be ensured, and*
- *the environment is held in public trust for the people, the beneficial use of environmental resources must serve the public interest and the environment must be protected as the people's common heritage.*

In order to give effect to the above sections, it is essential to ensure that there is adequate and appropriate opportunity for public participation (PP) in decisions that may affect the environment. Section 24(1A) (c) of the Act allows for this participation by requiring that the person conducting PP comply with any regulated procedure related to public consultation and information gathering through the public participation process (PPP).

The guideline further highlights the following characteristics of a comprehensive public participation process:

- It provides an opportunity for all role players (including potential and registered I&APs, EAPs, state departments, organs of state, 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 role players with an opportunity to voice their support, concerns and questions regarding the project, application or decision;
- It provides role players with the opportunity of suggesting ways for reducing or mitigating any negative impacts of the project and for enhancing its positive impacts;
- It enables the person conducting the public participation process to incorporate the needs, preferences and values of potential or registered I&APs into its proposed development that becomes subject of an application for an EA;
- It provides opportunities for clearing up misunderstandings about technical issues, resolving disputes and reconciling conflicting interests;
- It encourages transparency and accountability in decision-making;
- It contributes towards maintaining a healthy, vibrant democracy; and,
- It gives effect to the requirement for procedural fairness of administrative action as contained in the Promotion of Administrative Justice Act, 2000 (Act No. 3 of 2000).

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

7.1 IDENTIFICATION OF I&APS

A database of all potential I&APs, including State Departments, was compiled (Appendix 7). The following categories of I&APs were included in the database:

- Landowners;
- All directly adjacent landowners;
- 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 and Sanitation (DWS);
  - Department of Public Works; etc.
- Ward Councillors;
- Non-Governmental Organisations (NGOs) (such as Wildlife and Environmental Society of South Africa (WESSA));
- Various environmental protection agencies/ bodies (e.g. AMAFA and Ezemvelo KZN Wildlife); and
- Any other party perceived as playing a role within the community/ study area.

The details of all I&APs requesting registration on the project's database and those who submitted comments (to-date) have been captured on the Registered I&APs database which will be maintained throughout the S&EIR 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.

7.2 ANNOUNCE THE APPLICATION, CALL FOR I&AP REGISTRATIONS AND REVIEW OF THE DRAFT SCOPING REPORT

The following activities were undertaken to announce the S&EIR application, to request I&APs to register, to announce the availability of the Draft Scoping Report for review and comment (refer to Appendix 7 for details):

- Newspaper advertisements in the local Eyethu Baywatch (in Zulu) and Zululand Observer (English) on 04 and 06 November 2020, respectively;
- Fixing of 4 site notices on 05 and 06 November 2020 at strategic locations on and around the site (at the Permit Office for TNPA – Port of Richards Bay access control; Richards Bay Public Library; City of uMhalthuze Local Municipal Offices; and at the entrance to the South32 Bayside Aluminium/ Isiszinda Aluminium site); and,
- Notification letters were sent via email on 05 November 2020 to all potential I&APs on the project database.

The Draft Scoping Report was available for review and comment for a period of **30 calendar days** (excluding public holidays) **from 06 November – 07 December 2020** on the SE Solutions website – www.sesolutions.co.za. Two public/ stakeholder online meetings were hosted on 23 and 24 November 2020 via Microsoft Teams. Comments and queries and responses issued were captured in a Comment and Response Report (CRR) circulated to all registered I&APs whether or not they participated in the meetings. In addition, all written comments received during the review and commenting period of the Draft Scoping Report, were included within a project CRR which was attached to the Final Scoping Report (Appendix 7).

7.3 FINAL SCOPING REPORT

The Scoping Report was updated based on the comments and inputs received during the review and commenting period on the draft report. The updated report was submitted to DEFF on Friday, 11 December 2020 for review and acceptance. All registered I&APs were also notified of the Final Scoping Report and that it was available on the SE Solutions website for review and comment, should they wish to review it again. No additional comments were submitted. DEFF issued acceptance of Scoping on 11 February 2021 (received on 15 February 2021).

7.4 DRAFT ENVIRONMENTAL IMPACT REPORT (EIR)

This Draft Environmental Impact Report (EIR) summarises the findings of the EIA Phase of the S&EIR process. The Report highlights and discusses the findings of various specialist assessments as well as the detailed assessment of significant negative and positive impacts associated with the proposed development. The following activities were undertaken to notify all registered I&APs of the availability of the Draft EIR for review and comment (refer to Appendix 7 for details):

- Newspaper advertisements in the local Eyethu Baywatch (in Zulu) Zululand Observer (English) newspapers on 14 and 16 April 2021, respectively; and,
- Notification letters were sent via email on 16 April 2021 to all registered I&APs on the project database.

The Draft EIR is available for review and comment for a period of **30 calendar days** (excluding public holidays) **from 16 April – 18 May 2021** on the SE Solutions website – www.sesolutions.co.za. Two public/ stakeholder online meetings will be hosted on **03 & 04 May 2021** via Microsoft Teams at which the content of this Draft EIR (i.e. findings and recommendations) will be presented. Comments, queries and responses issued will be captured within a Comment and Response Report (CRR) and circulated to all registered I&APs whether or not they participated within the meetings.

It is proposed that the Competent Authority (i.e. DFFE) will be consulted during the 30 day review period of this Draft EIR. A full electronic copy of the Draft EIRs (via the online portal) will be submitted to the DFFE case officer for review and comment. The Applicant and EAP will present the findings and recommendations as detailed within this Draft EIR, should DFFE agree to such a presentation. This will enable the team to address any outstanding issues and/or comments from the DFFE prior to the submission of the Final EIR for review towards a decision.

7.5 FINAL EIA REPORT

All written comments received during the review and commenting period of the Draft EIR, will be included within the existing project CRR which will be attached to the Final EIR. The Final EIR will be submitted to the DFFE for review and consideration towards a decision. All registered I&APs will be notified of the submission and the availability of the Final EIR for review and comment, should they choose to do so, via SE Solutions' website. Any additional comments will then be directed to DFFE and copied to SE Solutions.

7.6 ENVIRONMENTAL AUTHORISATION

After review, the DFFE will issue their decision in the form of two Environmental Authorisations (EAs). The EAs are formal statements of decision and typically include a range of conditions that will need to be met during project implementation, if authorised. All registered I&AP's will be notified of the decision by the competent authority. This is to provide I&AP's with the opportunity to review the EAs and conditions and to exercise their right of appeal, should they feel the decision or components thereof is or are incorrect. The EIA Regulations stipulate that a Notice of Intent to Appeal must be lodged within 20 days from the date of the EAs. During this 20-day period any party (including the Applicant) has the right to appeal the decision.

8 SCOPING PHASE: IDENTIFICATION OF ENVIRONMENTAL ISSUES AND POTENTIAL IMPACTS

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

8.1 ACTIVITIES

Activities are the physical activities that typically unfold over the full product lifecycle. In the case of this application the activities Are presented for the construction and operations of the proposed NIFPP.

8.2 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, atmospheric emissions from the power barges

8.3 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, air quality changes as a result of atmospheric emissions from the NIFPP.

The magnitude of the impact will be a function of the **receiving environment.** 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.

8.4 IDENTIFIED POTENTIAL IMPACTS

The process of identifying and characterising potential impacts is illustrated in Figure 72 and summarised below as a set of consecutive steps.

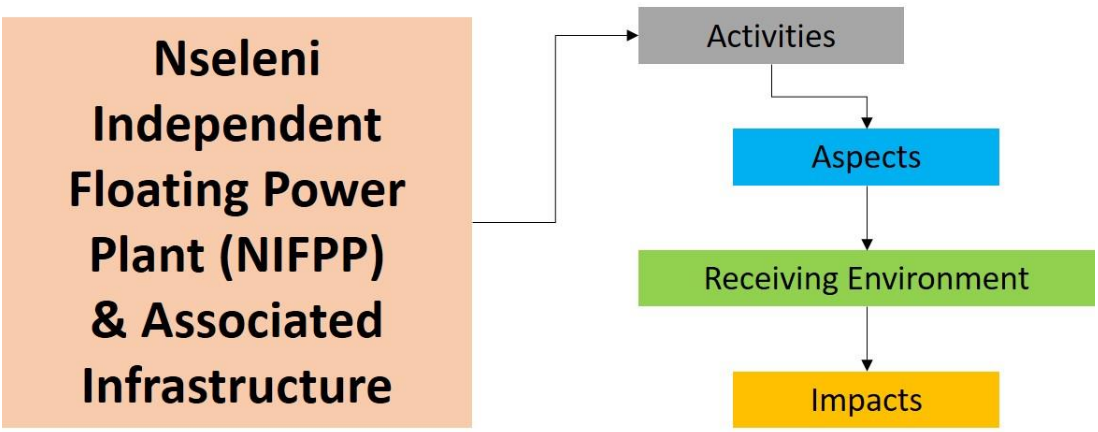


Figure 72: Schematic illustration of the process of identifying potential impacts that may occur as a result of the proposed development.

Step 1: Identifying activities

In order to identify potential impacts, it is necessary to detail the activities that result from the construction and operational phases of the proposed development project. The following activities have been identified based on the detailed project description:

Nseleni Power Corporation (Pty) Ltd: 14/12/16/3/3/2/2032

Construction Phase:

- Evacuation of Electricity (overhead gantry with GIL transmission line):
  - Clearing of vegetation (land-based) for overhead gantry pylon footprints;
  - Erection of gantry on land-based pylons;
  - Construction of the new substation and switching yard and connection to the local ESKOM grid;
  - Off-site transport of spoil material from vegetation clearing activities;
  - Excavation backfilling and compaction, as needed, and topsoil placement; and,
  - Re-vegetation with appropriate (indigenous) species (hydroseeding and/or manual planting).

Operational Phase:

- Floating Power Barges – power generation:
  - Operation of the CCGT power plants;
  - Abstraction of water from the Port environment;
  - Demineralisation/ desalination of water for the CCGT plants and for other potable water uses; and,
  - Discharge of treated wastewater into the Port environment.
- On site handling and temporary storage of waste materials; and,
- Off-site transport and disposal of waste materials.

Anchor Energy LNG (Pty) Ltd: 14/12/16/3/3/2/2033

Construction Phase:

- Construction vessels moving in and out of the Port.
- LNG & Power Barge Terminals:
  - Marine piling;
  - Construction of the concrete and steel quays/jetties;
  - Construction of the LNG docking/ mooring stations and other on-quay plants/ infrastructure; and,
  - Dredging.
- Evacuation of Electricity (overhead gantry with GIL transmission line):
  - Marine piling for overhead gantry platform; and,
  - Erection of gantry on marine piles.

Operational Phase:

- Delivery and storage of LNG:
  - LNG vessels entering the Port of Richards Bay & docking to the LNG docking/ mooring stations;
  - Offloading of LNG from the LNG vessels to the on-quay LNG bulk storage tanks;
  - Storage of LNG in bulk storage tanks; and,
  - Regasification of LNG for the CCGT plants.
- On site handling and temporary storage of waste materials;
- Off-site transport and disposal of waste materials;
- On site management of stormwater;
- On-going dredging to maintain the necessary draft for the Floating Power Barges; and,
- On-going maintenance of the quays/ jetty infrastructure.

Step 2: Identifying aspects

For each of the identified activities it is necessary to list the associated environmental and social aspects (Table 26). These environmental and social aspects can be identified as a function of the activity list developed in Step 1.

Table 26: Broadly stated environmental and social aspects that would be evoked by the activities listed in Step 1.

Resource Use	Energy	Liquid Fuels
		LNG
	Water (Estuarine)	
	Land Transformation	Vegetation
		Wetlands
		Estuary
		Heritage & Cultural Resources
Waste & Pollution	Waste (off-site disposal)	Hazardous solid/ liquid wastes
		Waste concrete
		Vegetation waste
	Effluent	Stormwater
		Wastewater
	Atmospheric emissions	Dust/ PM_{10}
		SO_2; NO_x; PM
		Greenhouse Gases (GHG)
	Radiation	Noise
		Temperature flux
	Spillage	Hydrocarbons
		LNG
	Aesthetics	Visual
Socio-Economic	Jobs	
	Spending	
	Skills/ Experience	

Step 3: Characterising the receiving environment (brief summary highlighting the main characteristics)

Importantly the environment and society can never be understood as a series of discrete, unrelated components, but rather should be viewed as a system. The receiving environment is now, and will always be a dynamic system where change is the only constant. 'Impact Mapping' is an approach to mapping the components of the receiving environment highlighting the key elements and how these are related to one another in cause-effect relationships. A proposed impact map for the NIFPP and associated infrastructure is shown in Figure 73. A brief summary highlighting the main characteristics of the receiving environment, follows.

- Ambient Air Quality:
    - Annual average PM_{10} concentrations were compliant with the NAAQS at all RBCCA stations, in particular the Richards Bay CBD station yielded concentrations between 25-30 $\mu g/m^3$.
    - Annual average SO_2 at all RBCCA stations was compliant with the NAAQS with a slight trend towards improvement at all stations, in particular the Harbour West station yielded concentrations less than 25 $\mu g/m^3$.
- Residential areas to the north-east of the Port of Richards Bay.
- Ambient Noise Levels: SANS Industrial limit is 70 dB(A).

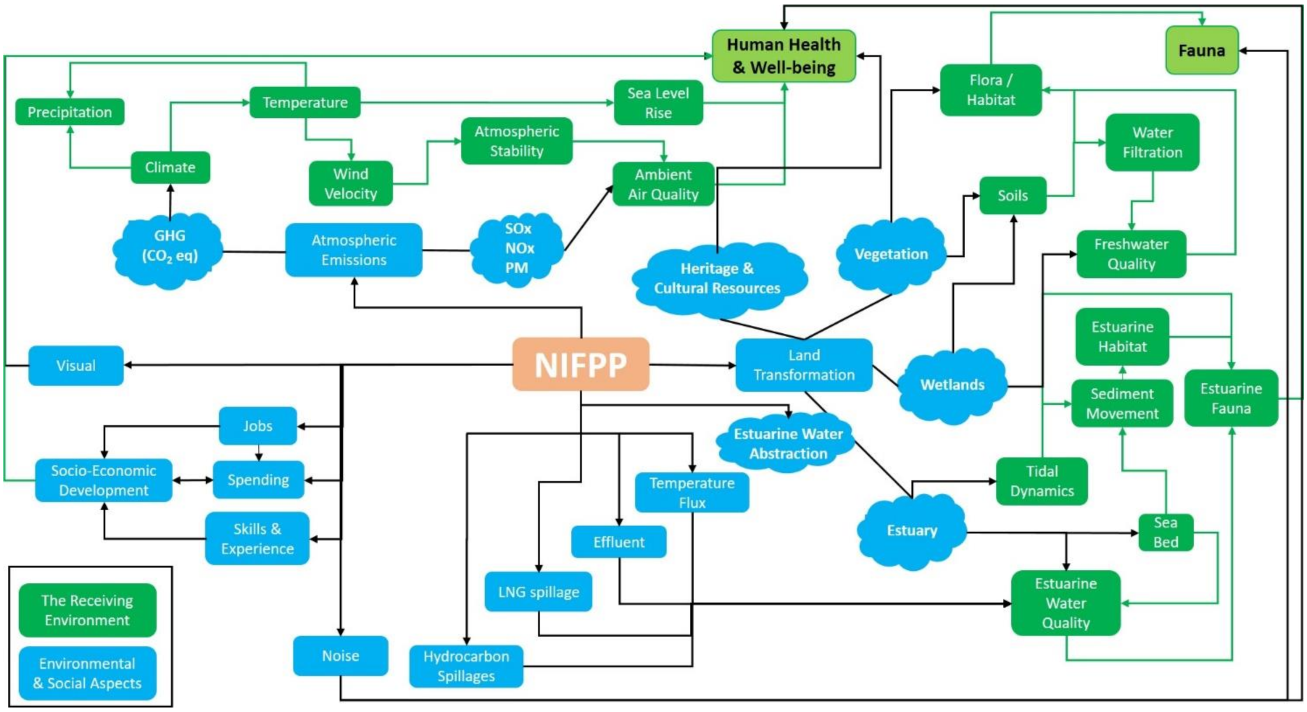


Figure 73: Characterisation of the receiving environment for the proposed development in the Port of Richards Bay.

- Sensitive flora (that may be present within the land-based study area):
  - Swamp Fig *Ficus trichopoda* (Protected Tree ito National Forests Act, 1998 (Act No. 84 of 1998) (NFA)). They are predominantly concentrated in low-lying areas where the groundwater table is at or near the surface.
  - Marula *Sclerocarya birrea subsp. caffra* (Protected Tree ito NFA).
  - Blue Waterlily *Nymphaea nouchali* (Regionally Protected) – occurs in freshwater habitats.
  - Large Yellow *Eulophia Eulophia speciosa* (Declining; Regionally Protected).
  - White Arum Lily *Zantedeschia aethiopica* (Regionally Protected) – occurs in marshy habitats.
  - Mangrove Swamp (Black Mangrove – *Burguiera gymnorrhiza* (Protected Tree) and White Mangrove – *Avicennia marina*) – Critically Endangered vegetation type in KwaZulu-Natal and is predominantly located along the edges of the Manzamnyama, Bhizolo and Lower Bhizolo channels, east and south of the Bayside site leading into the Port of Richards Bay.
- Estuarine ecology
  - Intertidal mangroves (Protected Trees);
  - Subtidal mudbanks/ mudflats within Manzamnyama, Bhizolo and Lower Bhizolo channels and the Port of Richards Bay.
  - Kabeljou Flats (sandspit) within the Port of Richards Bay is known to support numerous ecological functions and biodiversity within the Port Estuary.
  - Sediment/ bed of the Port Estuary is believed to be contaminated and mobilisation of sediments through marine piling and dredging activities may have negative impacts on the biodiversity and ecology of the Port Estuary.
  - Water quality is believed to be consistent with that of Port environments.
- Wetland ecology
  - Numerous wetlands are present within the greater area. A large wetland exists along the western boundary of the Bayside Aluminium smelter site.
  - Overall wetlands were considered to be important in terms of flood attenuation and enhancing water quality within the landscape.

- Groundwater: The underlying shallow aquifer is connected in places with the deep aquifer underlying the land-based study area. Elevated groundwater levels are present in the south-west relative to the Bayside Aluminium smelter site.
- Socio-Economic Environment:
    - Load shedding ito electricity supply is a reality within the KZN province and greater Country.
    - 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 27 and Table 28 below.

8.5 IDENTIFIED CUMULATIVE IMPACTS

The 2014 EIA Regulations define "cumulative impact" in relation to an activity as: "*the past, current and reasonably 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 on site as well as those known to be underway and/or present within the surrounding area.

- Additional dredging activities within the Port of Richards Bay, specifically in addition to the already authorised:
    - Construction of 2 new Panamax shipping berths at the 600 series berths, with associated dredging of a channel to a depth of 14m and 800m turning circle.
- Increased disturbance within the greater surrounding estuarine and wetland sensitive environments;
- Increase in air emissions and an overall potential decrease in air quality;
- Increase in wastewater discharge into the Port environment;
- Increased power generation capacity and supply of electricity into the local and national Grid (positive impact); and,
- Socio-economic impacts, such as an increase in local and regional economic activities.

Table 27: Construction Phase: Potential negative and positive impacts identified during the Scoping Phase that could be invoked by the environmental and social aspects associated with the proposed development.

Environmental and Social Aspects			Activities – Construction Phase: Construction vessels moving in & out of the Port	Marine Piling	Construction of concrete & steel quays	Construction of docking/ mooring stations & other on-quay infrastructure	Dredging	Clearing of vegetation	Erection of land-based pylons to support overhead GIL gantry	Construction of the substation and switching yard	Excavation of soil	Backfilling & compaction & revegetation	Potential Impacts (viz. potential changes in…)	Potentially Significant Impacts Requiring Assessment
Resource Use	Energy	Liquid fuels	X	X	X	X	X	X	X	X	X	X	Resource use	No
		LNG												No
	Water (Estuarine)													-
	Land Transformation	Vegetation						X	X	X	X	X	Terrestrial biodiversity	Yes
		Wetlands						X	X	X	X	X	Wetland ecology	Yes
		Estuary		X	X		X						Estuarine ecology	Yes
		Heritage & Culture						X	X	X	X		Heritage Resources	No
Waste & Pollution	Waste (off-site disposal)	Hazardous solid/ liquid waste			X	X							Landfill airspace	No
		Waste concrete		X	X	X			X	X			Landfill airspace	No
		Vegetation waste						X	X	X	X		Landfill airspace	No
	Atmospheric emissions	Dust/ PM_{10}						X	X	X	X	X	Ambient air quality	Yes
		SO_2; NO_X; PM	X											No
		Greenhouse Gases											Climate	-
	Radiation	Noise	X	X	X	X	X	X	X	X	X	X	Ambient noise quality	No
		Temperature Flux											Ambient temperatures	-
	Effluent	Stormwater						X	X	X	X	X	Sedimentation	Yes
		Wastewater											Water quality	
	Spillage	Hydrocarbons	X	X	X	X	X	X	X	X	X	X	Water & soil quality	Yes
		LNG											Water quality	-
	Aesthetics	Visual						X	X	X	X		Aesthetics	No
Socio-Economic	Jobs (temporary)		X	X	X	X	X	X	X	X	X		Socio-economics	No
	Spending		X	X	X	X	X	X	X	X	X	X		No
	Skills/experience		X	X	X	X	X		X	X				No

Table 28: Operational Phase: Potential negative and positive impacts identified during the Scoping Phase that could be invoked by the environmental and social aspects associated with the proposed development.

Environmental and Social Aspects			Activities – Operational Phase: LNG vessels entering Port & docking/ mooring with LNG Terminal	Off-loading of LNG into LNG bulk storage tanks	Storage of LNG	Operation of the CCGT Plants	Regasification of LNG	Abstraction of estuarine water	Demineralisation/ desalination of estuarine water	Discharge of treated wastewater	On-site handling & temporary storage of waste materials	Off-site transport & disposal of waste materials	Stormwater Management	Maintenance: dredging	Maintenance: quay/ jetty infrastructure	Potential Impacts (viz. potential changes in…)	Potentially Significant Impacts Requiring Assessment
Resource Use	Energy	Liquid fuels	X	X		X	X	X	X	X		X		X	X	Resource use	No
		LNG	X	X	X	X	X		X								No
	Water (Estuarine)							X	X	X							Yes
	Land Transformation	Vegetation														Terrestrial biodiversity	-
		Wetlands														Wetland ecology	-
		Estuary												X	X	Estuarine ecology	Yes
		Heritage & Culture														Heritage Resources	-
Waste & Pollution	Waste (off-site disposal)	Hazardous solid/ liquid waste	X	X	X	X	X	X	X	X	X	X		X	X	Landfill airspace	No
		Waste concrete													X	Landfill airspace	No
		Vegetation waste														Landfill airspace	-
	Atmospheric emissions	Dust/ PM_{10}										X				Ambient air quality	Yes
		SO_2; NO_X; PM	X			X											Yes
		Greenhouse Gases	X			X										Climate	Yes
	Radiation	Noise	X	X		X	X	X	X	X	X	X		X	X	Ambient noise quality	No
		Temperature Flux					X		X	X						Ambient temperatures	-
	Effluent	Stormwater														Sedimentation	-
		Wastewater				X	X		X	X			X			Water quality	Yes
	Spillage	Hydrocarbons	X	X		X	X	X	X	X	X	X		X	X	Water & soil quality	Yes
		LNG	X	X	X											Water quality	-
	Aesthetics	Visual	X	X	X	X	X		X							Aesthetics	No
Socio-Economic	Jobs (temporary)													X	X	Socio-economics	No
	Spending		X	X	X	X	X	X	X	X	X	X	X	X	X		No
	Skills/experience		X	X	X	X	X		X	X				X	X		No

9 APPROACH TO ASCRIBING SIGNIFICANCE FOR DECISION-MAKING

The best way of expressing the cost-benefit implications for decision-making is to present them as risks. Risk is defined as the consequence (implication) of an event multiplied by the probability (likelihood) of that event. Many risks are accepted or tolerated on a daily basis, because even if the consequence of the event is serious, the likelihood that the event will occur is low. A practical example is the consequence of a parachute not opening, which is potentially death, but the likelihood of such an event happening is so low that parachutists are prepared to take that risk. The risk is low because the likelihood of the consequence is low even if the consequence is potentially severe.

It is also necessary to distinguish between the event itself (as the cause) and the consequence. Again using the parachute example, the consequence of concern in the event that the parachute does not open is serious injury or death, but it does not necessarily follow that if a parachute does not open that the parachutist will die. Various contingencies are provided to minimise the likelihood of the consequence (serious injury or death) in the event of the parachute not opening, such as a reserve parachute. In risk terms, this means distinguishing between the **inherent risk** (the risk that a parachutist will die if the parachute does not open) and the **residual risk** (the risk that the parachutist will die if the parachute does not open, but with the contingency of a reserve parachute) i.e. the risk before and after mitigation.

9.1 CONSEQUENCE

The ascription of significance for decision-making becomes then relatively simple. It requires the consequences to be ranked (Table 29) and a likelihood to be defined of that consequence occurring. It should be noted that there is no equivalent 'high' score in respect of benefits as there is for the costs. This high negative score serves to give expression to the potential for a fatal flaw where a fatal flaw would be defined as an impact that cannot be mitigated effectively and where the associated risk is accordingly untenable. Stated differently, the high score on the costs, which is not matched on the benefits side, highlights that such a fatal flaw cannot be 'traded off' by a benefit and would render the proposed project to be unacceptable. Note that the EAP has defined the consequence descriptors, specialists are required to select the appropriate descriptor when ascribing significance to various impacts. This will allow for efficient comparing of significance across specialist assessments to allow for an integrated assessment of the project as a whole.

Table 29: Ranking of consequence

Environmental Costs	**Inherent Risk**
Human health – morbidity/mortality. Loss of species	High
Reduced faunal populations, loss of livelihoods, individual economic loss	Moderate-high
Reduction in environmental quality – air, soil, water. Loss of habitat, loss of heritage, amenity	Moderate
Nuisance	Moderate-low
Negative change – with no other consequences	Low
Environmental Benefits	**Inherent Benefit**
Net improvement in human welfare	Moderate-high
Improved environmental quality – air, soil, water. Improved individual livelihoods	Moderate
Economic development	Moderate-low
Positive change – with no other consequences	Low

9.2 LIKELIHOOD

Although the principle is one of probability, the term 'likelihood' is used to give expression to a qualitative rather than quantitative assessment, because the term 'probability' tends to denote a mathematical/empirical expression. A key point here is that likelihood of the consequence occurring must *de facto* take into account the good international industry best practice that is 'intrinsically built-in' to activities or methods. For example: an electricity transformer will never be constructed without bunding and stones to contain any oil spills due to potential failure of the transformer. To highlight bunding as a specific mitigation measure to reduce the consequence of a spill is simply inappropriate. Likelihood descriptors that can be used to characterise the likelihood of the costs and benefits occurring are presented in the table below.

Table 30: Likelihood descriptors and definitions

Likelihood Descriptors	Definition
Highly unlikely	The possibility of the consequence occurring is negligible
Unlikely but possible	The possibility of the consequence occurring is low but cannot be discounted entirely
Likely	The consequence may not occur but a balance of probability suggests it will
Highly likely	The consequence may still not occur but it is most likely that it will
Definite	The consequence will definitely occur

9.3 RESIDUAL RISK

The residual risk is then determined as a function of the consequence together with the likelihood of that consequence. The residual risk categories are shown in Table 31 where consequence scoring is shown in the rows and likelihood in the columns. The implications for decision-making of the different residual risk categories are shown in Table 32. Additional mitigation to manage (and potentially further reduce) and monitor the residual risk may also be defined. All mitigation is then prescribed in the Environmental Management Programme (EMPr). What is important is that the residual risk is what decision-makers must accept if they decide to authorise the proposed activity even if that residual risk is 'high'. The residual risk cannot and will not be artificially reduced within the assessment to 'low' to facilitate decision-making.

Table 31: Residual risk categories

		Residual risk				
Consequence	High	Moderate	High	High	Fatally flawed	
	Moderate – high	Low	Moderate	High	High	High
	Moderate	Low	Moderate	Moderate	Moderate	Moderate
	Moderate – low	Low	Low	Low	Low	Moderate
	Low	Low	Low	Low	Low	Low
		Highly unlikely	Unlikely but possible	Likely	Highly likely	Definite
		Likelihood				

Table 32: Implications for decision-making of the different residual risk categories shown in Table 31.

Rating	Nature of implication for Decision – Making
Low	Project can be authorised with low risk of environmental degradation
Moderate	Project can be authorised but with conditions and routine inspections
High	Project can be authorised but with strict conditions and high levels of compliance and enforcement
Fatally Flawed	The project cannot be authorised

9.4 A NOTE ON 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 ripple 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.

9.5 DESCRIBING THE IMPACT

The EIA Regulations also require, in addition to consequence, likelihood and significance (as described above), that the nature, extent, duration, reversibility and irreplaceable loss of a resource also be highlighted for identified impacts. These additional impact attributes are defined as follows:

9.5.1 NATURE OF THE IMPACT

The nature of an impact refers to a description of the inherent features, characteristics and/or qualities of the impact.

9.5.1.1 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 33: Listing of descriptors and associated definitions to determine the extent of an impact

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

9.5.1.2 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 34: Listing of descriptors and associated definitions to determine the duration of an impact.

Duration Descriptors	Definitions
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.
Short term	The impact continues to manifest for a period of between 3 – 10 years. The impact is reversible.
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.
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.
Permanent	The impact will continue indefinitely and is irreversible.

9.5.1.3 Irreplaceable loss of resources

Irreplaceable loss of resources refers to the degree to which the impact will result in the loss of a resource that is impossible to replace.

Table 35: Listing of descriptors and associated definitions to determine the irreplaceable loss of resources due to an impact.

Extent Descriptors	Definitions
High	The impact is most likely to or will result in the irreplaceable loss of a resource/s.
Medium	The impact may result in the irreplaceable loss of a resource/s, however applicable mitigation or management interventions may prevent complete loss or provide a suitable substitute/"offset".
Low	The impact will not result in the irreplaceable loss of a resource/s.

9.5.2 AN EXAMPLE OF THE ASSESSMENT OF THE SIGNIFICANCE OF IMPACTS

The following serves to highlight, by way of an example, how the significance of the impact will be presented, using the method provided above.

Example: Operational Phase: Atmospheric Emissions:

Atmospheric emissions as a result of the proposed project were modelled to determine the impact on ambient air quality, with a view to understanding the human health and environmental risks posed by such emissions as illustrated in the impact map for this aspect (Figure 74).

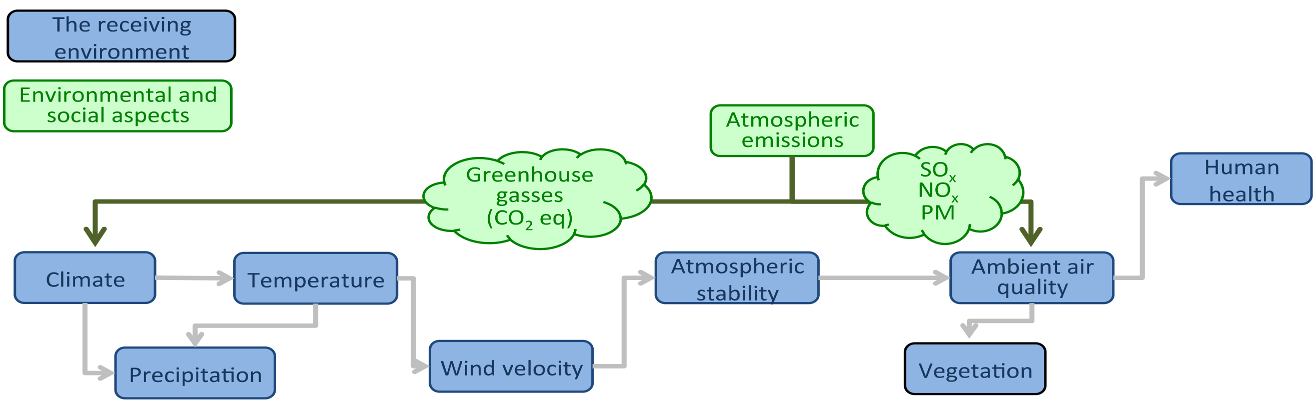


Figure 74: Example: Systems depiction of the components of the receiving environment that would be affected by atmospheric emissions from the proposed project.

The inherent risk of human health effects is high, but the likelihood of these manifesting as a result of atmospheric emissions from the proposed project is highly unlikely implying an impact significance of 'low'. Similarly, the inherent risk of vegetation damage and habitat loss as a result of atmospheric emissions from the proposed project is moderate-high, but the risk of that consequence manifesting is considered highly unlikely, resulting in an impact significance of low.

Table 36: Example: Impact significance for possible adverse human health risks as a result of atmospheric emissions from the proposed project.

Activity	Power Generation by way of Combined Cycle Gas Turbine (CCGT) technology
Environmental/ Social Aspect	Atmospheric Emissions (NO_x and PM)
Nature of the Impact	Adverse human health effects brought about by a change (deterioration) in the ambient air quality from atmospheric emissions of the power plant.
Consequence Inherent risk	High
Extent/ Scale	Regional
Duration & Reversibility	Long-term & reversible
Irreplaceable loss of a resource	Low
Causes of impacts / Event	**Likelihood of the consequence:**
Emissions of NOx result in ambient concentrations that exceed defined health-based limits (i.e. NAAQS)	Definite both on and off-site for short term averaging periods, but very limited in extent within the project footprint for longer term averaging periods. Highly unlikely for the sensitive receptors identified given the prevailing wind direction and the distance of the proposed project to the residential areas.
Emissions of PM (TSP, PM_{30}, PM_{10}, $PM_{2.5}$) result in ambient concentrations that exceed defined health-based limits (i.e. NAAQS)	Definite both on and off-site for short term averaging periods, but limited to within the project footprint for longer term averaging periods. Also likely that the predicted concentrations in the Hills area are exaggerated by the modelling, which treats hills and ridges as transparent. Highly unlikely for the sensitive receptor given the prevailing wind direction and the distance of the proposed project to the residential areas.
Presence of communities within the 'exposure area/ zone' that may be exposed to ambient concentrations that exceed health-based limits (i.e. NAAQS)	Highly unlikely given that there are no communities within a 10 km radius of the proposed project, and as such there would be no exposure to ambient concentrations that exceed health-based limits (i.e. NAAQS).
Residual risk	Low
Extrinsic/ additional mitigation measures	None required.
Residual risk after mitigation	Low

Table 37: Example: Impact significance for possible damage to vegetation and reduced habitat risks as a result of atmospheric emissions from the proposed project.

Activity	Power Generation by way of Combined Cycle Gas Turbine (CCGT) technology
Environmental/ Social Aspect	Atmospheric Emissions (NOx and PM)
Nature of the Impact	Damage to vegetation and reduced habitat brought about by a change (deterioration) in the ambient air quality from atmospheric emissions of the power plant.
Consequence Inherent risk	Moderate - High
Extent/ Scale	Regional
Duration & Reversibility	Long-term & reversible
Irreplaceable loss of a resource	Low
Causes of impacts / Event	**Likelihood of the consequence:**
Emissions of NOx result in ambient concentrations that exceed defined environmental damage based limits	Unlikely as vegetation damage would typically only occur with longer term exposure to elevated pollution concentrations which is not predicted by the dispersion model.
Emissions of PM (TSP, PM30, PM10, PM2.5) result in ambient concentrations that exceed defined environmental damage based limits	Unlikely as vegetation damage would typically only occur with longer term exposure to elevated pollution concentrations which is not predicted by the dispersion model.
Presence of sensitive vegetation/ habitat that may be exposed to ambient concentrations that exceed defined environmental damage based limits	Highly unlikely given the generally small, longer term averaging period ambient concentrations even over the immediate project area. No sensitive vegetation/ habitat exists within the broader study area.
Residual risk	Low
Extrinsic/ additional mitigation measures	None required.
Residual risk after mitigation	Low

10 SUMMARY OF SPECIALIST INVESTIGATIONS: METHODS & FINDINGS

On the basis of the potential impacts identified during the Scoping Phase as well as concerns raised by I&APs, the table below highlights the specialist assessments that were undertaken as well as the environmental, socio-economic and/or cultural elements assessed. This chapter contains a summary of the key findings of the specialist investigations. Readers are reminded that the pre-development environmental baseline within and surrounding the site, is presented in Section 6: Environmental, Social and Economic Context. This section provides a summary of methods and findings where various alternatives were detailed, modelled and/or assessed. The detailed assessment of impacts is provided in Section 11. ***Note that specialists assessed the potential impacts associated with the Original and/or Amended (Sandspit Mangroves) power evacuation route alignment and substation location north-west of the Bayside Aluminium smelter site (Figure 111).***

Table 38: Specialist assessments undertaken in support of the EIA of the proposed development

Specialist Assessment	Appointed Specialist Company	Aspect Assessed
Air Quality Impact Assessment	Airshed Planning Professionals	Atmospheric emissions: Dust, PM, SO_2 and NO_x
Qualitative Noise Impact Statement	Airshed Planning Professionals	Noise
Terrestrial Biodiversity Assessment	GroundTruth: Water, Wetlands and Environmental Engineering	Land transformation: terrestrial fauna & flora
Wetland Delineation, Functional Assessment and Impact Assessment		Land transformation: wetlands
Heritage Impact Assessment	Heritage Contracts and Archaeological Consulting cc	Heritage & cultural resources
Quantitative Risk Assessment for Major Hazard Installations	Riscom	Waste & pollution: spillage of LNG
Socio-economic Impact Assessment	ACER Africa and Urban Econ	Social: employment; skills transfer; spending; impact on the local and regional economy
Estuarine Ecological Assessment	CRUZ Environmental & Associates	Seabed transformation
Hydrodynamic Modelling	WSP Africa	Seabed transformation/ disturbance Waste & pollutions: effluent discharge
Climate Change Impact Assessment	Climate Neutral Group	Atmospheric emissions: GHG emissions

10.1 AIR QUALITY IMPACT ASSESSMENT (AQIA)

Airshed Planning Professionals (Pty) Ltd (Airshed) was appointed to assess the potential impacts on air quality by conducting a comprehensive Air Quality Impact Assessment (AQIA) for the proposed NIFPP. The format of the assessment meets the prescribed format of an Atmospheric Impact Report (AIR), as set out in the Regulations gazetted on 11th of October 2013 (Government Gazette, 2013). An AIR must also accompany the application for an Atmospheric Emissions License (AEL) which is also required for the proposed NIFPP. The summary findings of the AIR are presented here with the full report available as Appendix 6.

10.1.1 SENSITIVE RECEPTORS

The National Ambient Air Quality Standards (NAAQS) are based on human exposure to specific criteria pollutants and as such, sensitive receptors were identified where the public is likely to be exposed. NAAQS are enforceable outside of the property boundary of the licensed facility, therefore the sensitive receptors identified (Table 39) included the nearby residential areas, hospitals and schools. The nearest large residential areas to the proposed Project site are Richards Bay CBD (5.5 km north); Meer en See (5.4 km north-east); Arboretum (6 km north-northeast); and Gubhethuka (7 km south-west). There are several schools, hospitals and clinics located within 5 km of the proposed location (Figure 75).

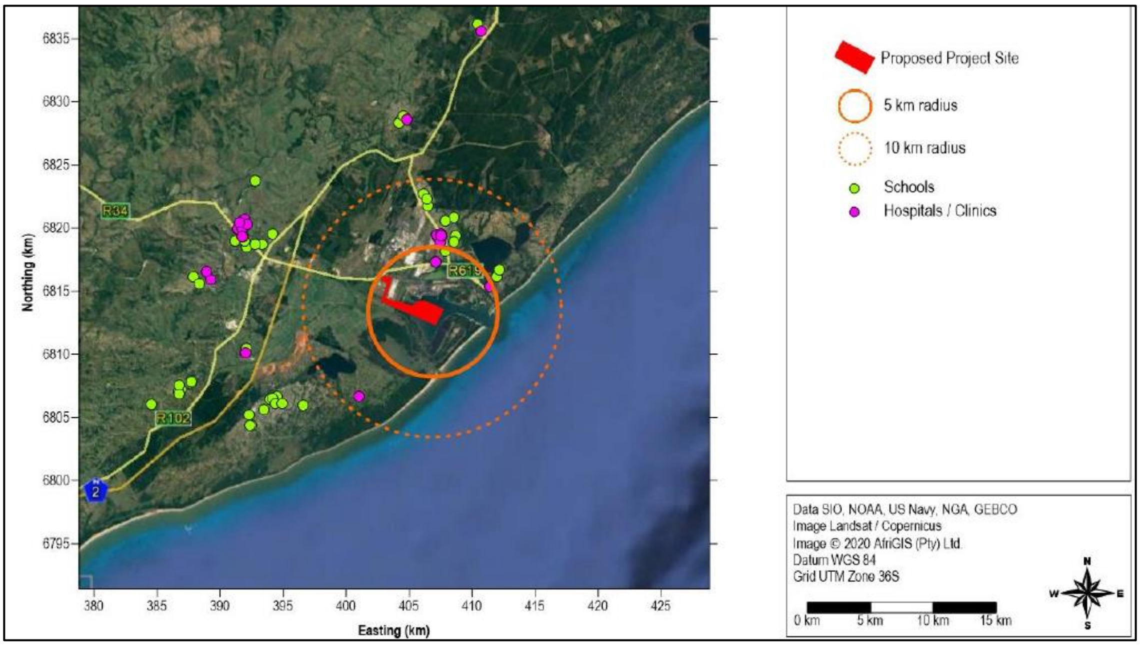


Figure 75: Sensitive receptors (schools and hospitals) within 5km and 10km of the proposed Project site.

Table 39: Air quality monitoring stations and sensitive receptors and their proximity to the proposed Project site

Air Quality Monitoring Station Name	Distance from proposed site (km)	Direction from proposed site
Harbour West (RBCAA)	2.5	NW
Bayside (RBCAA)	2.9	NW
Scorpio (RBCAA)	3.9	NNW
Arboretum (uMhlathuze)	5.8	NE
Arboretum (RBCAA)	6.0	NNE
CBD (RBCAA)	6.6	N
Brackenham (RBCAA)	8.1	N
Brackenham (uMhlathuze)	8.3	N
Airport (RBCAA)	8.7	NNE
Esikhawini (RBCAA)	14.6	WSW
Felixton (RBCAA)	15.0	WSW
eSikhaleni (uMhlathuze)	15.0	WSW
eNseleni (RBCAA)	15.8	N
RBM (RBCAA)	15.9	NNE
Mtunzini (RBCAA)	31.8	WSW
St Lucia (RBCAA)	60.0	NE
Receptor name / details	**Distance from proposed site (km)**	**Direction from proposed site**
John Ross College	4.9	NNE
Headache Clinic | Bay Chiropractic | Smile Dent	5.1	ENE
Arboretum	5.2	NNE
Richards Bay Municipal Clinic	5.4	N
Umhlathuze Dental	5.5	N
Richards Bay Central	5.6	N

Arboretum Primary School	5.8	NNE
Richards Bay Primary School	5.9	ENE
Mens Clinic International - Richards Bay	5.9	N
The Bay Hospital	6.1	N
Better2Know Private STD Health Centre	6.1	N
Richards Bay Medical Institute	6.1	N
Mandlazini Clinic	6.2	N
Richardsbaai Hoerskool	6.3	NNE
St Francis Pre-Primary School	6.4	ENE
Veldenvlei Primary School	7.3	N
Meer en See	7.3	ENE
Richards Bay Christian School	7.7	NNE
Wild En Weide	7.7	N
Birdswood	7.9	NNE
Richards Bay Secondary School	8.4	N
Isiboniso Clinic	8.8	SW
Brackenham Primary School	8.9	N
Richards Bay - New	9.3	NE
Bay Primary School	9.4	N

10.1.2 ATMOSPHERIC EMISSIONS

The following table highlights the atmospheric emissions likely to occur during each project phase.

Table 40: Expected atmospheric sources of emissions and associated pollutants per project phase.

<table>
<tr><th rowspan="2">Aspect or Project Phase</th><th colspan="4">Expected Atmospheric Sources of Emissions and Associated Pollutants</th><th rowspan="2">Rationale</th></tr>
<tr><th>Source</th><th>NO_x</th><th>PM[(a)]</th><th>SO_2</th></tr>
<tr><td rowspan="2">The construction phase of the NIFPP</td><td>Fugitive dust from civil and building work such as excavations, piling, foundations and buildings</td><td>n/a</td><td>ü</td><td>n/a</td><td rowspan="2">The nature of emissions from construction activities is highly variable in terms of temporal and spatial distribution and is also transient. Detail regarding the extent of construction activities and equipment movements was not available for inclusion in the study. Fugitive dust emissions are, however, mostly generated by land-clearing and bulk earthworks. Most of the construction activities will be undertaken within the port - i.e. via ships. Fugitive dust is expected to be minimal and limited to the proposed new substation and switching yard.</td></tr>
<tr><td>Exhaust gases from dredging and piling operations</td><td>ü</td><td>ü</td><td>ü</td></tr>
<tr><td rowspan="3">The normal operation phase of the NIFPP</td><td>Exhaust gases from the proposed turbine units</td><td>ü</td><td>ü[(c)]</td><td>ü[(c)]</td><td rowspan="3">The project is designed to operate on natural gas. The focus of the assessment is on the operation of the proposed turbine units since it triggers Subcategory 1.4 MES.
Exhaust gases from backup diesel generator to power LNG vessel in port, dredging operations and LNG vessels coming into port will also be quantified.
Exhaust gases from the incinerator have not been quantified.</td></tr>
<tr><td>Exhaust gases from dredging operations, diesel generators, LNG vessels coming into port</td><td>ü</td><td>ü</td><td>ü</td></tr>
<tr><td>Exhaust gases from incinerator</td><td>ü</td><td>ü</td><td>ü</td></tr>
</table>

Aspect or Project Phase	Expected Atmospheric Sources of Emissions and Associated Pollutants				Rationale
	Source	NO_x	PM[(a)]	SO_2	
NIFPP upset conditions that may result in atmospheric impacts	Unstable combustion conditions within turbine unit	ü	ü[(c)]	ü	Incomplete combustion and unstable combustion temperatures may result in higher than normal PM, CO, NO_x and VOC emissions.
Decommissioning phase of the project	Fugitive dust from civil work such as rehabilitation and demolition.	n/a	ü	n/a	The nature of emissions from decommissioning activities is highly variable in terms of temporal and spatial distribution and is also transient. Detail regarding the extent of decommissioning activities and equipment movements was also not available for inclusion in the study. Fugitive dust emissions are however mostly generated by demolition and rehabilitation activities. As with construction, most of the decommissioning activities will be undertaken within the port - i.e. via ships. Fugitive dust is expected to be minimal and limited to the proposed new substation and switching yard.

Notes:
(a) PM includes PM_{10} and $PM_{2.5}$
(b) n/a – not applicable
(c) neg. negligible for natural gas

10.1.3 ATMOSPHERIC EMISSIONS

A comprehensive emissions inventory for the project, is the basis of the air quality impact assessment. All stack parameters were provided by the client (Table 41). The project is planned to have 4 power barges (one stack per barge) initially, with subsequent phases to include a total of 12 barges. Normal operations were assessed in two emission scenarios: (1) at the MES (Table 42) for 4 barges and (2) at the Minimum Emission Standards for 12 barges. The choice of MES emissions presents a realistic worst-case scenario for project operations.

Table 41: Parameters for point sources of atmospheric pollutant emissions at the proposed project

Point Source code	Source name	Latitude (decimal degrees)	Longitude (decimal degrees)	Height of Release Above Ground (m)	Height Above Nearby Building (m)	Diameter at Stack Tip/ Vent Exit (m)	Actual Gas Exit Temp (°C)	Actual Gas Volumetric Flow (m³/hr)	Actual Gas Exit Velocity (m/s)
Phase 1 – 4 barges									
ST1	BT* stack 1	-28.80173	32.04319	45	NA	7.5	260	7 952 156	50
ST2	BT stack 2	-28.80185	32.04421	45	NA	7.5	260	7 952 156	50
ST3	BT stack 3	-28.80200	32.04630	45	NA	7.5	260	7 952 156	50
ST4	BT stack 4	-28.80204	32.04728	45	NA	7.5	260	7 952 156	50
Phase 2 – additional 8 barges, total 12 barges									
ST5	BT stack 5	-28.80202	32.04805	45	NA	7.5	260	7 952 156	50
ST6	BT stack 6	-28.80203	32.04914	45	NA	7.5	260	7 952 156	50
ST7	BT stack 7	-28.80204	32.04997	45	NA	7.5	260	7 952 156	50
ST8	BT stack 8	-28.80207	32.05098	45	NA	7.5	260	7 952 156	50
ST9	BT stack 9	-28.80042	32.03935	45	NA	7.5	260	7 952 156	50
ST10	BT stack 10	-28.80081	32.04023	45	NA	7.5	260	7 952 156	50
ST11	BT stack 11	-28.80118	32.0412	45	NA	7.5	260	7 952 156	50
ST12	BT stack 12	-28.80147	32.04221	45	NA	7.5	260	7 952 156	50

*BT = Barge Turbine

Table 42: Atmospheric pollutant emission rates for the proposed project (MES)

Point Source code	Pollutant Name	Maximum Release Rate				Emissions Hours	Type of Emissions (Continuous/ Routine but Intermittent/ Emergency Only)
		mg/Nm³	mg/Am³[(a)]	g/s	Averaging period		
ST 1-12	Particulates	10	5	11.7	Hourly	24 hours per day; 7 days per week	Continuous during operation
	Sulphur dioxide (SO_2)	400	212	469.3	Hourly	24 hours per day; 7 days per week	Continuous during operation
	Oxides of Nitrogen (NO_X)	50	27	58.7	Hourly	24 hours per day; 7 days per week	Continuous during operation

Note:
(a) Varies depending on actual temperature

Table 43: Atmospheric pollutant emission rates for the proposed project (actual sulphur content)

Point Source code	Pollutant Name	Maximum Release Rate				Emissions Hours	Type of Emissions (Continuous/ Routine but Intermittent/ Emergency Only)
		mg/Nm³	mg/Am³[(a)]	g/s	Averaging period		
ST 1-12	Sulphur dioxide (SO_2)	2.4	1.3	2.8	Hourly	24 hours per day; 7 days per week	Continuous during operation

Note:
(a) Varies depending on actual temperature
Assumed sulphur content of 0.004%.

In addition to the power barge emissions, emissions from vessels transporting the LNG and dredging the port and diesel generators on the LNG vessel in port have also been included. The LNG vessel in port will be operating standby power to operate LNG pumps, lighting etc. The most likely scenario is where the client simply supplies electrical power to the vessels from the power station, but as a worst-case scenario it has been assumed that a 1 MW diesel generator will operate as auxiliary power. Currently TNPA dredge the channel on a weekly basis and the applicant wants to use the same vessel, however, if this is not possible Airshed assumed specifications for a larger vessel than necessary, as a worst-case estimate. Parameters and emission rates for the point source emissions are given in Table 44 and Table 45.

Table 44: Ship point source parameters

Unique Source ID	Source Name	Source Description	Latitude (decimal degrees)	Longitude (decimal degrees)	Height of Release Above Ground (m)	Diameter at Stack Tip / Vent Exit (m)	Actual Gas Exit Temperature (°C)	Actual Gas Volumetric Flow (m³/hr)	Actual Gas Exit Velocity (m/s)
DG	Diesel generator	Auxiliary power for LNG vessel in port	-28.804065	32.051754	45	1	200	113 097	40
LNG	LNG tanker	LNG tanker bringing LNG delivery into port	Various – moving point source		45	1	200	113 097	40
DR	Dredging vessel	Dredging port for LNG tanker to manoeuvre	Various – moving point source		45	1	200	113 097	40

Table 45: Point source emissions during normal operating conditions

Point Source code	Pollutant Name	Maximum Release Rate (g/s)	Average Annual Release Rate (t/a)	Emission Hours	Type of Emission (Continuous / Intermittent)
DG	SO_2	0.35	11	24/7	Continuous
	NOx	5.24	165		
	PM	0.37	12		
LNG	SO_2	34.22	154	1 day per week	Intermittent
	NOx	51.96	234		
DR	SO_2	12.43	56	1 day per week	Intermittent
	NOx	21.14	95		

10.1.4 APPROACH & METHOD

Three levels of assessment are defined in the Air Dispersion Modelling Regulations A Level 3 assessment (the most comprehensive) was selected for the proposed NIFPP. The models recommended for Level 3 assessments are CALPUFF or SCIPUFF. In this study, CALPUFF was selected as the preferred model. The model uses specific input data to run various algorithms to estimate the dispersion of pollutants between the source and receptor. The model output is in the form of a predicted time-averaged concentration at the receptor. These predicted concentrations are then compared with the relevant ambient air quality standard or guideline. Post-processing can be carried out to produce percentile concentrations or contour plots that can be prepared for reporting purposes.

Modelled concentrations were assessed against NAAQS (Table 46) as prescribed by South African legislation (Government Gazette, 2009). In addition, Minimum Emission Standards (MES) are prescribed for different emissions sources in *List of activities which result in atmospheric emissions and which are believed to have significant detrimental effects on the environment and human health; and, social welfare.* The Listed Activities and MES were published on the 31st of March 2010 (Government Gazette, 2010) and the revised MES on 22 November 2013 (Government Gazette No. 37054).

Table 46: National Ambient Air Quality Standards applicable for the assessment of the proposed facility

Pollutant	Averaging Period	Concentration (µg/m³)	Frequency of Exceedance	Compliance Date
Nitrogen Dioxide (NO_2)	1 hour	200	88	Currently enforceable
	1 year	40	0	
Inhalable particulate matter less than 10 µm in diameter (PM_{10})	24 hours	75	4	
	1 year	40	0	
Inhalable particulate matter less than 10 µm in diameter ($PM_{2.5}$)	24 hours	40	4	
	1 year	20	0	
Sulphur Dioxide (SO_2)	10 minutes	500	526	
	1 hour	350	88	
	24 hours	125	4	
	1 year	50	0	

MES applicable to the proposed facility include:

- Gas Combustion Installations– Gas combustion used primarily for steam raising or electricity generation (more than 50 MW) heat input per unit). MES subcategory 1.4 is applicable (Table 47) during normal operating conditions using natural gas.
- LNG Storage – The storage and handling of petroleum products within permanent immobile liquid tanks larger than 1000 m³ in total or loading and off-loading more than 50 000 m³ of petroleum product at more than 14 kPa (true vapour pressure) triggers Subcategory 2.4 (Table 48).

Subcategory 2.4 MES distinguishes between petroleum products with various vapour pressures. The vapour pressure of LNG is above 91 kPa. However, LNG is in a liquid phase through pressure and low temperatures for the purposes of storage and transport and would not be liquid at room temperature and pressure.

Table 47: MES for gas combustion installations.

Substance or mixture of substances		mg/Nm³ under normal conditions of 3% O2, 273 K and 101.3 kPa (New Plant)
Common Name	**Chemical Symbol**	
Particulate Matter (PM)	Not Applicable	10
Sulphur Dioxide	SO_2	400
Oxides of Nitrogen	NOx expressed as NO_2	50

Reference conditions for gas turbines shall be 15% O_2, 273 K and 101.3 kPa

Table 48: MES for the storage and handling of petroleum products.

Substance or mixture of substances		mg/Nm³ under normal conditions of 273 K and 101.3 kPa
Common Name	**Chemical Symbol**	
Total volatile organic compounds (TVOCs) from vapour recovery/ destruction units (thermal treatment)	Not Applicable	150
Total volatile organic compounds (TVOCs) from vapour recovery/ destruction units (non-thermal treatment)	Not Applicable	40 000

MES apply to permanently operated plants and pilot plants with a design capacity equivalent to the appropriate listed activity. MES are applicable under normal operating conditions. Should normal start-up, maintenance, upset, and shut-down conditions exceed a period of 48 hours, Section 30 of the NEMA shall apply unless otherwise specified by the Licensing Authority.

10.1.4.1 Atmospheric dispersion potential

Meteorological mechanisms govern the dispersion, transformation, and eventual removal of pollutants from the atmosphere. The analysis of hourly average meteorological data is necessary for understanding the dispersion potential of the site. This study accessed different sets of meteorological data: simulated meteorological data for the Richards Bay airshed, and, measured meteorological data at four locations in the Richards Bay domain. For the purposes of CALPUFF dispersion modelling, Weather Research and Forecasting model (WRF) data for the period 2017 to 2019 on a 4 km horizontal resolution for a 50 km by 50 km domain was used. Four RBCAA air quality monitoring stations (AQMS) (Airport, Brackenham, CBD and Harbour West) were included for comparison to assess how representative the WRF data set is for the proposed project site.

The local wind, temperature and rainfall data is summarised in Section 5.1.1 above. Atmospheric stability and mixing depth are also important meteorological inputs into the model. Diurnal variation in atmospheric stability, as calculated from measured data, and described by the inverse Obukhov length and the boundary layer depth is provided in Figure 76. The highest concentrations for ground level, or near-ground level releases from non-wind dependent sources would occur during weak wind speeds and stable (night-time) atmospheric conditions. For elevated releases (ie. via a stack), unstable conditions can result in very high concentrations of poorly diluted emissions close to the stack. This is called looping and occurs mostly during daytime hours. Neutral conditions disperse the plume fairly equally in both the vertical and horizontal planes and the plume shape is referred to as coning. Stable conditions prevent the plume from mixing vertically, although it can still spread horizontally and is called fanning. For ground level releases such as fugitive dust the highest ground level concentrations will occur during stable night-time conditions.

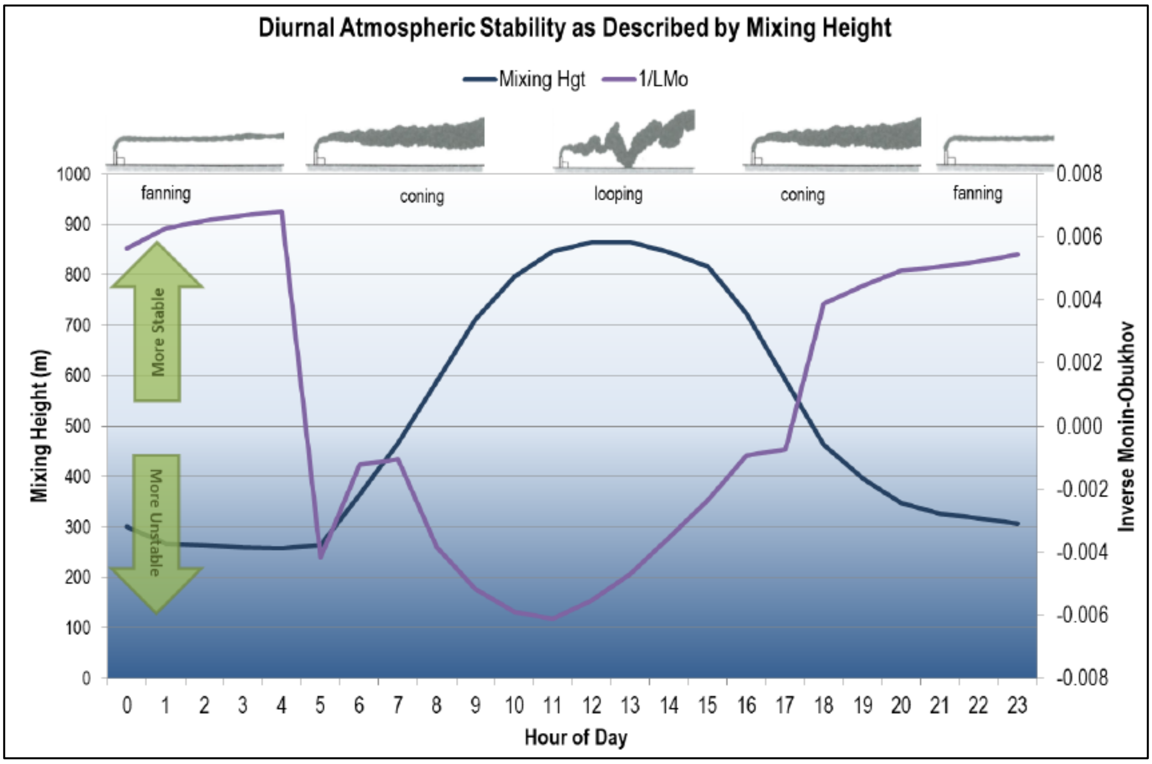


Figure 76: Diurnal atmospheric stability (CALMET processed WRF data, January 2017 to December 2019)

10.1.4.2 Ambient Air Quality and Modelled Baseline Pollutant Concentrations

Please refer to Section 5.1.8 for the summary of ambient air quality within the Richards Bay area based on the monitoring network data available as well as the baseline for pollutant concentrations.

10.1.5 MODELING RESULTS – FLOATING CCGT POWER BARGES

10.1.5.1 Incremental Impacts of Construction Phase

For the LNG and Power Barge Terminals, the floating power barges are constructed off-site and towed into the port and anchored to the jetty infrastructure, therefore significant dust emissions are unlikely. There may be some dust emissions due to the construction of the proposed new substation and switching yard. This is, however, a small area (~ 5%) of the entire project area, the remaining project area is over water. Although emissions have been estimated, due to the short-term impact and size of the area, these have not been included in the dispersion simulations.

In estimating emissions due to construction activities, it was assumed that the full extent of the proposed new substation and switching yard (≈25ha) would be cleared before the various construction activities started. Construction was assumed to occur 9-hours per day (equivalent to 45hr/week) for 21 days per month and for a period between 1 and 2 months, where annual emissions because of construction activities are given in Table 49.

Table 49: Annual emissions due to construction activities

	Total Suspended Particles (TSP)	**PM_{10}**
Annual emissions (tonnes/annum)	135	47

10.1.5.2 Operational Phase Impacts

Total annual point source emissions for the pollutants of concern are summarised in Table 50. Although there are MES for SO_2, due to the small sulphur content in natural gas, SO_2 based on actual sulphur content has also been included in the dispersion modelling.

Table 50: Proposed NIFPP annual pollutant emission rates

Source Group	Annual emission rates (tonnes per year)			
	SO_2 (MES)	SO_2 (Sulphur content of 0.004%)	NOx	PM_{10}
Phase 1 – 4 barges	59 194	350	7 399	1 480
Phase 2 – additional 8 barges (total 12 barges)	177 581	1 051	22 198	4 440

Short-term (hourly or daily) concentrations were extracted at the 99th percentile, to account for the number of exceedances allowed by the NAAQS. All concentrations are provided in isopleth plots and at AQSRs.

Simulated PM Concentrations

- No exceedances of the NAAQS were simulated across the modelling domain due to the project.
- Annual $PM_{2.5}$ concentrations were simulated to be less than 1 µg/m³ across the domain.

Simulated NO_2 Concentrations

The impact area of NO_X emissions was estimated as ground-level NO_2 concentrations using the total conversion method. The tier 1 method of total conversion only needs refining if simulated concentrations exceed NAAQS.

- No exceedances of the hourly NO_2 NAAQS (200 µg/m³) were simulated across the modelling domain due to the project for either phase.
- Annual concentrations were simulated to be less than 2 µg/m³ across the domain.

Simulated SO_2 Concentrations

Assuming the MES for SO_2:

- No exceedances of the hourly SO_2 NAAQS (350 µg/m³) or the daily NAAQS (125 µg/m³) were simulated at the closest AQSRs due to the project for either phase.
- Annual concentrations were simulated to be less than 20 µg/m³ across the domain.

Taking into account the actual sulphur content of the LNG:

- The simulated concentrations are well below the NAAQS.
- Annual concentrations were simulated to be less than 0.1 µg/m³ across the domain.
- Maximum hourly SO_2 concentrations were 2.5 µg/m³ and well below the NAAQS (350 µg/m³).

If the facility operates at the regulated emission limits for Subcategory 1.4 exceedances of the hourly and daily SO_2 NAAQS could occur off-site. However, natural gas inherently has a very small sulphur content. It is therefore highly probable that the normal operation of the facility will be much less than the emission limits.

10.1.6 MODELLING RESULTS – SHIP EMISSIONS

Total annual point source emissions for the pollutants of concern are summarised in Table 51.

Table 51: Proposed ship annual pollutant emission rates

Source Group	Annual emission rates (tonnes per year)	
	NOx	SO_2
LNG Vessels	234	154
Dredge Vessels	95	56
Diesel generator on board LNG Vessel	165	11

Although the vessels will be moving sources, they were modelled as a single point source at the entrance to the port, nearest to the closest on-shore AQSR. This gives a worst-case scenario for the AQSR of concern, however, the impact will move as the ship moves, so only short-term impacts are shown. The dredge and LNG vessel will only be moving around the port once per week, so these will not be continuous sources as with the power plant. Short-term (hourly) concentrations were extracted at the 99th percentile, to account for the number of exceedances allowed by the NAAQS.

Simulated SO_2 Concentrations

- No exceedances of the hourly SO_2 NAAQS (350 µg/m³) due to the ship emissions, were simulated across the modelling domain

Simulated NO_2 Concentrations

The impact area of NO_X emissions was estimated as ground-level NO_2 concentrations using the total conversion method. The tier 1 method of total conversion only needs refining if simulated concentrations exceed NAAQS.

- No exceedances of the hourly NO_2 NAAQS (200 µg/m³) were simulated across the modelling domain due to the ship emissions.

10.1.7 MODELLING RESULTS – CUMULATIVE EMISSIONS

The potential for impacts associated with the NIFPP to be more significant when considered in combination with existing industrial activities within the Richards Bay area as well as the known or proposed gas to power projects is assessed in this section. All known and viable large-scale industrial developments located within a radius of 10 km from the project site – as identified during stakeholder consultations and using information available in the public domain at the time of this assessment - are presented in Table 52. At the time of writing this report, 10 facilities are operational and one has been authorised.

Table 52: Large-scale industrial developments within a 10 km radius of the NIFPP project site

Development Name	Approximate distance from 320MW RMPP	Project Status
Bayside Aluminium Richards Bay	3 km north-west	Existing
Hulamin (previously Isizinda)	3 km north-west	Existing
Foskor Richards Bay	3 km north	Existing
Mondi Richards Bay	5.5 km north-west	Existing
Port Richards Bay	900 m north	Existing
Richards Bay Coal Terminal	2 km south east	Existing
South32 Aluminium	3.7 km north	Existing
Tata Steel	6.3 km north east	Existing (non-operational)
Bidvest Tank Terminals	2.0 km south east	Existing
Fermentech Fertilizer Supplier	1.8 km north	Existing

The following cumulative impact scenarios were considered:

1. Scenario 1: NIFPP and existing baseline sources;
2. Scenario 2: NIFPP, authorised 400 MW gas to power project, and existing baseline sources;
3. Scenario 3: NIFPP, authorised 400 MW gas to power project, authorised Eskom combined cycle power plant, and existing baseline sources; and,
4. Scenario 4: NIFPP, authorised 400 MW gas to power project, authorised Eskom combined cycle power plant, not-yet authorised 320 MW gas to power project, and existing baseline sources.

10.1.7.1 Scenario 1: NIFPP & Existing Sources

The simulated and measured Richards Bay baseline pollutant concentrations were added to the simulated concentrations as a result of the NIFPP. Cumulative SO_2 and NO_2 concentrations are likely to be within the applicable NAAQS across the domain. The contribution from the NIFPP is small for SO_2 (less than 5% for hourly, daily and annual SO_2). The contribution from the NIFPP is a maximum of 65% for NO_2 hourly. Cumulative PM_{10} concentrations may exceed the daily NAAQS at

Harbour West, Scorpio, and Arboretum (uMthlathuze) monitoring stations due to the *elevated baseline concentrations* in those areas. However, the contribution from the NIFPP will be minimal.

10.1.7.2 Cumulative Impact - Proposed Gas-to-Power Developments and Existing Sources

The Department of Mineral Resources and Energy, under the Risk Mitigation Independent Power Producer Procurement Programme (RMIPPPP) and in accordance with the IRP 2019, requested proposals to meet a stated electricity supply shortfall of 2 000 MW generation capacity. In addition to the proposed NIFPP, there are 3 facilities (proposed within Richards Bay) bidding into the RMIPPPP and one other gas to power facility, all at various stages of development, located within a 10km radius of the project site. Not all projects listed above will be developed and implemented. The focus of the assessment was on those facilities that already have EA, followed by those still in the EA application process. For the purposes of the cumulative assessment, the Karpowerships facility has been excluded, because the proposed development location is the same as that proposed for the NIFPP.

Table 53: Gas to power facilities located proposed within a 10 km radius of the proposed NIFPP

AQMS	Simulated NIFPP	Measured[(a)]	Simulated 2016 baseline[(b)]	Cumulative[(c)]	Project contribution to Cumulative	Cumulative contribution to NAAQS
1-hour[(d)]						
Scorpio (RBCAA)	1.27	232.30	54.80	233.57	0.5%	67%
Harbour West (RBCAA)	1.23	246.20	125.87	247.43	0.5%	71%
Brackenham (RBCAA)	1.71	18.30	137.50	139.21	1.2%	40%
Brackenham (uMhlathuze)	1.65	28.80	125.85	127.50	1.3%	36%
CBD (RBCAA)	1.95	97.10	114.27	116.22	1.7%	33%
Arboretum (RBCAA)	1.77	50.00	71.94	73.70	2.4%	21%
Arboretum (uMhlathuze)	1.25	31.40	38.56	39.81	3.1%	11%
eNseleni (RBCAA)	0.94	19.10	(e)	20.04	4.7%	6%
Felixton (RBCAA)	0.79	34.50	(e)	35.29	2.3%	10%
eSikhaleni (RBCAA)	0.96	107.60	(e)	108.56	0.9%	31%
eSikhaleni (uMhlathuze)	0.96	21.00	(e)	21.96	4.4%	6%
24-hour[(d)]						
Scorpio (RBCAA)	0.41	115.60	10.56	116.01	0.4%	93%
Harbour West (RBCAA)	0.58	102.80	25.10	103.38	0.6%	83%
Brackenham (RBCAA)	0.49	14.10	27.59	28.07	1.7%	22%
Brackenham (uMhlathuze)	0.54	13.80	24.69	25.23	2.1%	20%
CBD (RBCAA)	0.69	57.90	23.16	58.59	1.2%	47%
Arboretum (RBCAA)	0.52	20.70	14.46	21.22	2.4%	17%
Arboretum (uMhlathuze)	0.42	16.60	7.81	17.02	2.5%	14%
eNseleni (RBCAA)	0.29	14.40	(e)	14.69	2.0%	12%
Felixton (RBCAA)	0.29	19.50	(e)	19.79	1.5%	16%
eSikhaleni (RBCAA)	0.27	20.20	(e)	20.47	1.3%	16%
eSikhaleni (uMhlathuze)	0.27	17.00	(e)	17.27	1.6%	14%
Annual						
Scorpio (RBCAA)	0.05	22.9	4.11	22.95	0.2%	46%
Harbour West (RBCAA)	0.04	23.60	10.10	23.64	0.2%	47%
Brackenham (RBCAA)	0.07	3.40	10.82	10.89	0.7%	22%
Brackenham (uMhlathuze)	0.07	4.10	9.91	9.98	0.7%	20%
CBD (RBCAA)	0.10	10.70	9.26	10.80	0.9%	22%
Arboretum (RBCAA)	0.09	9.3	5.80	9.39	0.9%	19%
Arboretum (uMhlathuze)	0.04	8.20	3.12	8.24	0.5%	16%
eNseleni (RBCAA)	0.04	3.40	(e)	3.44	1.1%	7%
Felixton (RBCAA)	0.02	7.40	(e)	7.42	0.3%	15%
eSikhaleni (RBCAA)	0.03	9.30	(e)	9.33	0.3%	19%
eSikhaleni (uMhlathuze)	0.03	10.00	(e)	10.03	0.3%	20%

Notes:
(a) Maximum measured at each station irrespective of year of measurement or variability between years
(b) Hourly and daily average concentrations extrapolated from annual averages from the simulated baseline (Section **Error! Reference source not found.**) using the veraging time conversion factors defined in Table 8 of the Regulations regarding Air Dispersion Modelling (Gazette No. 37804, vol. 589; 11 July 2014)
(c) Sum of the NIFPP and the maximum of measured or simulated concentrations
(d) 99th percentile used for simulated NIFPP and measured concentrations
(e) Not included in the baseline simulation domain

To quantitatively assess the cumulative impact of the identified facilities and the existing sources of air pollution maximum 1 hour, 24 hour, and annual average SO_2, NO_2, and PM concentrations due to the projects were gathered from simulations or from EIA or AQIA Reports as made available to I&APs. These maximum values were either for the domain or receptors, depending on what level of detail was available for the respective projects.

Scenario 2: NIFPP, authorised 400 MW gas to power project & existing sources

The additive effect of the projects equates to less than 10% of the applicable NAAQ limit concentrations and standards and is therefore in line with the general guideline suggested by the IFC that projects contribute less than 25% of air quality guidelines and standards to allow for future sustainable development in the airshed (IFC, 2007). Potential exceedances of the NAAQS for PM_{10} are associated with the existing baseline sources and the gas-to-power projects are minimal.

Scenario 3: NIFPP, authorised 400 MW gas to power project, authorised Eskom combined cycle power plant & existing sources

The findings of the cumulative impact estimation indicate that:

- The range of cumulative hourly, daily, and annual SO_2 concentrations comply with the applicable NAAQS;
- The lower end of the range of cumulative hourly NO_2 concentrations is less than the NAAQ limit concentration, but the upper end of the range suggests that exceedances of the NAAQ limit could occur in some areas of the domain and are associated with existing developments, the Eskom facility and the proposed NIFPP;
- The range of cumulative annual NO_2 concentrations is close to the NAAQS limit concentration where the largest contributions are associated with the existing sources and the Eskom facility; and,
- Cumulative daily and annual PM_{10} - based on an atypically high measured concentration - exceeds the NAAQS, however, the contribution from the gas-to-power projects is relatively small (less than 18%).

Scenario 4: NIFPP, authorised 400 MW gas to power project, authorised Eskom combined cycle power plant, not-yet authorised 320 MW gas to power project & existing sources

The findings of the cumulative impact estimation indicate that:

- The range of cumulative hourly, daily, and annual SO_2 concentrations comply with the applicable NAAQS;
- The lower end of the range of cumulative hourly NO_2 concentrations is less than the NAAQ limit concentration, but the upper end of the range suggests that exceedances of the NAAQ limit could occur in some areas of the domain and are associated with existing developments, the Eskom facility and the proposed NIFPP;
- The range of cumulative annual NO_2 concentrations is close to the NAAQS limit concertation where the largest contributions are associated with the existing sources and the Eskom facility; and,
- Cumulative daily and annual PM_{10} - based on an atypically high measured concentration - exceeds the NAAQS, however, the contribution from the gas-to-power projects is relatively small (less than 20%).

10.2 QUALITATIVE NOISE IMPACT STATEMENT[20]

Airshed Planning Professionals (Pty) Ltd (Airshed) was commissioned to undertake a qualitative noise impact study for the NIFPP. The findings are summarised here and the full report is provided in Appendix 6.

If the dimensions of a noise source are small compared with the distance to the listener, it is called a point source. All sources for the proposed project are point sources or areas/lines represented by point sources. The sound energy from a point source spreads out spherically, so that the sound pressure level is the same for all points at the same distance from the source and decreases by 6 dB per doubling of distance. This holds true until ground and air attenuation

[20] Note that a full noise impact assessment (including modelling) was conducted and is discussed within Section 13 of this report – this is to give effect to the story telling and how understanding of the potential impacts developed and on which the EAPs assessment of impacts due to changes in ambient noise were based.

noticeably affect the level. The impact of an intruding industrial noise on the environment will therefore rarely extend over more than 5 km from the source and is therefore always considered "local" in extent.

10.2.1 SPECIALIST FINDINGS

The closest industrial area to the project site is ~400 m. The IFC noise guideline is 70 dBA for industrial receptors (refer to Section 4.10.2.4). With the CCGT power plant enclosures designed to guarantee average noise emission of 85 dB(A), the noise level of 70 dBA due to operational activities are unlikely to extend more than 200 m from the source. Additional noise sources during operations will include mobile equipment such as LNG vessels and dredging equipment. These sources may result in incidents of high noise levels (70 dB LAeq) but will be of short duration.

The closest residential receptor to the project site is ~4 km. The IFC noise guideline for residential receptors is 55 dBA (06:00 – 22:00) and 45 dBA (22:00 – 06:00). These noise levels are unlikely to extend further than 1 km from the project site and would thus not be exceeded at the residential areas. According to the Gauteng GPEMF this industry would require a buffer zone of 1 500 m to 750 m (refer to Section 4.8.4). Although this project is not located within the Gauteng province, this activity would meet the required buffer zone distance.

10.3 FRESHWATER ECOSYSTEM AND TERRESTRIAL BIODIVERITY ASSESSMENT

10.3.1 WETLAND ASSESSMENT

10.3.1.1 Approach & Method

Site visits were conducted on the 23rd -24th June 2020 and 12th-13th January 2021 to verify the extent of the freshwater ecosystems within the study site that are hydrologically linked to the proposed study site and to assess the current ecological integrity and ecosystem services provided by the freshwater ecosystems.

The boundary between the freshwater ecosystems and adjacent terrestrial areas has been delineated. Desktop identification and mapping of all freshwater ecosystems within a 500m radius of the proposed project infrastructure was undertaken utilising available aerial imagery and contour data. The freshwater ecosystems that will be primarily impacted were then delineated infield in accordance with the DWS guideline document (DWAF, 2005). The derived boundaries were determined at appropriate intervals within the study area and recorded using a Global Positioning System (GPS A Geographic Information System (GIS) spatial coverage of the boundaries of the freshwater ecosystems was then prepared. In accordance with the preferences of the regional authorities, the study also included:

- Zones of wetness within the study area; and
- Stream channel classifications.

Wetlands were classified in accordance with the South African National Biodiversity Institute's (SANBI) wetland classification system (Table 54) (Ollis *et al.*, 2013) to differentiate wetland systems and prioritise systems for conservation or management purposes. However, for the purpose of assessing each Hydrogeomorphic (HGM) unit, Kotze *et al.* (2007) was used to classify the wetland systems as particular HGM units rather than Level 4 of the SANBI system. The HGM unit types defined by Kotze *et al.* (2007) differ from Ollis *et al.* (2013), with the river classification being excluded and flat wetlands being grouped with the depression wetlands. Table 54 provides an overview of the wetland ecosystems hydrologically-linked to the proposed development.

Table 54: A description of the onsite wetlands based on the SANBI classification and Kotze *et al.* (2007)

System (Level 1)	Bioregion (Level 2)	Landscape Unit (Level 3)	HGM Unit (Level 4)	Description of HGM Units (Kotze *et al.* 2007)
Inland systems	Indian Ocean Coastal Belt (CB) bioregion	Valley floor landscape units	**Valley-bottom**	
			Channelled (CVB)	Valley-bottom areas with a well-defined stream channel but lacking characteristic floodplain features. May be gently sloped and characterised by the nett accumulation of alluvial deposits or may have steeper slopes and be characterised by the nett loss of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes.
			Unchannelled (UCV)	Valley-bottom areas with no clearly defined stream channel, usually gently sloped and characterized by alluvial sediment deposition, generally leading to a nett accumulation of sediment. Water inputs mainly from channel entering the wetland and also from adjacent slopes.
			Hillslope seepage	
			Linked to a stream channel	Slopes on hillsides, which are characterised by the colluvial (transport by gravity) movement of materials. Water inputs are mainly from sub-surface flow and outflow is usually via a well-defined steam channel connecting the area directly to a steam channel
			Depression	
			Depression (includes pans)	A basin-shaped area with a closed elevation contour that allows for the accumulation of surface water (i.e. it is inward draining). It may also receive sub-surface water. An outlet is usually absent, and therefore this type is usually isolated from the stream channel network

The wetland types in the study site are within the Indian Ocean Coastal Belt bioregion. Based on the wetlands and vegetation types, and the level of protection these systems receive, the ecosystem threat status can be assessed (Nel *et al.*, 2011). Table 55 depicts the HGM units found within the study site and the corresponding threat status.

Table 55: HGM units classified according to their threat status and level of protection (after Nel *et al.,* 2011)

Wetland Type (WT)	Ecosystem Threat Status (ETS)	Level of Protection (WT)	ETS per Wetland Vegetation Group
Channelled valley-bottom	Least Threatened (LT)	Well Protected (WP)	LT
Unchannelled valley-bottom	LT	WP	LT
Hillslope seepage wetland	LT	WP	LT
Depression	LT	WP	LT

Least threatened ecosystems have experienced little or no loss of natural habitat or deterioration in condition (Nel and Driver, 2012). However, it should be noted that the wetland systems identified within the study area are considered to be substantially modified from their original wetland type and are now in an alternate, stable state. Nonetheless, further modifications and/or degradation of these alternate stable state systems should be prevented and/or minimised. Even though the wetland vegetation groups for all HGM unit types have been classified as least threatened, the swamp forest vegetation type found within these HGM unit types is considered to be critically endangered within KZN.

The assessments of the HGM units was derived by evaluating the level of ecosystem functioning and ecological integrity/condition of the identified wetlands for the current and post-development scenarios. **There is no riparian habitat identified within the study area**. The Bhizolo and Manzamnyama Canals, located to the south and east respectively, are artificial and are considered to be estuarine and as such beyond the scope of this study. The Mhlatuze River is located to the south of the study site boundary, and therefore an assessment of riparian habitat is not deemed t be required. The wetland assessment methods are outlined below.

Wetland Functionality:

A Level 2 WET-EcoServices (Kotze *et al.*, 2007) assessment was performed for the HGM units hydrologically linked to the proposed development to quantify the functioning of the wetland systems, and to determine their relative importance in providing ecosystem benefits and services at a landscape level. The Level 2 WET-EcoServices assessment technique determines the extent to which a benefit is being supplied by each wetland system, based on both:

- The opportunity for the wetland to provide the benefits; and,
- The effectiveness of the particular wetland in providing the benefit.

Ecosystem services, which include direct and indirect benefits to society and the surrounding landscape, were assessed by rating various characteristics of the wetland and its surrounding catchment, based on the following scale:

- Low (0);
- Moderately Low (1);
- Intermediate (2);
- Moderately High (3); and,
- High (4).

The scores obtained from these ratings for the wetland was then incorporated into WET-EcoServices scores for each of the fifteen ecosystem services (Table 56).

Table 56: Ecosystem services supplied by wetlands (Kotze *et al.*, 2007; p14)

Ecosystem services supplied by wetlands	Indirect benefits	Regulating and supporting benefits	Flood attenuation		The spreading out and slowing down of floodwaters in the wetland, thereby reducing the severity of floods downstream
			Stream flow regulation		Sustaining stream flow during low flow periods
			Water quality enhancement benefits	Sediment trapping	The trapping and retention in the wetland of sediment carried by runoff waters
				Phosphate assimilation	Removal by the wetland of phosphates carried by runoff waters
				Nitrate assimilation	Removal by the wetland of nitrates carried by runoff waters
				Toxicant assimilation	Removal by the wetland of toxicants (e.g., metals, biocides and salts) carried by runoff waters
				Erosion control	Controlling of erosion at the wetland site, principally through the protection provided by vegetation
			Carbon storage		The trapping of carbon by the wetland, principally as soil organic matter
	Direct benefits	Biodiversity maintenance			Through the provision of habitat and maintenance of natural process by the wetland, a contribution is made to maintaining biodiversity
		Provisioning benefits	Provision of water for human use		The provision of water extracted directly from the wetland for domestic, agricultural or other purposes
			Provision of harvestable resources		The provision of natural resources from the wetland, including livestock grazing, craft plants, fish, etc.
			Provision of cultivated foods		The provision of areas in the wetland favourable for the cultivation of foods
		Cultural benefits	Cultural heritage		Places of special cultural significance in the wetland, e.g., for baptism or gathering of culturally significant plants
			Tourism and recreation		Sites of value for tourism and recreation in the wetland, often associated with scenic beauty and abundant birdlife
			Education and research		Sites of value in the wetland for education or research

It should be noted that WET-EcoServices assists in identifying the importance and sensitivity of specific wetlands, but is recognised as having limitations in terms of:

- Quantifying specific impacts linked to development or changes within the landscape; and,
- Accounting for the size of the wetland and ecosystem services strongly associated with the size of the systems.

<u>Wetland Ecological Important and Sensitivity (EIS):</u>
The ecological importance of a water resource provides an expression of its importance to the maintenance of ecological diversity and functioning at local and wider scales (DWAF, 1999). As WET-EcoServices does not provide a consolidated score that can be used as a target, the assessment scores were incorporated into the Ecological Importance and Sensitivity (EIS) assessment framework to provide an EIS score based on scores for ecological importance and sensitivity, hydro-

functional importance, and direct human benefits (DWA, 2013). Table 57 provides an overview of the ratings used to interpret the derived EIS scores.

Table 57: Ecological Importance and Sensitivity Classes (DWA, 2013; p.43)

Ecological Importance and Sensitivity Categories	Range of EIS Score	EIS Class
Very high: Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these systems is usually very sensitive to flow and habitat modifications. They play a major role in moderating the quantity and quality of water of major rivers.	4	**A**
High: Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these systems may be sensitive to flow and habitat modifications. They play a role in moderating the quality and quantity of water in major rivers.	>3 and <4	**B**
Moderate: Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these systems is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major river.	>2 and </=3	**C**
Low/Marginal: Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these systems is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water of major rivers.	>1 and </=2	**D**
None: Wetlands that are rarely sensitive to changes in water quality/hydrological regime.	0	**E**

Wetland Conditions and Integrity/ Present Ecological State (PES):

It was anticipated that a formal assessment of wetland conditions, based on the original extent of the freshwater ecosystems, would be distorted by the degree of modification within the landscape and would not illustrate the value of the systems at a local scale. In addition, the wetland systems were considered to be substantially different to the original benchmark state, potentially further discounting the systems importance. For these reasons, the formal assessment of the wetland condition, using the WET-Health (Macfarlane *et al.*, 2007) assessment framework, was considered unsuitable. The formal assessment of the system therefore, focussed on the ecosystem services supplied by the remaining wetland habitat within the study area. Nonetheless, the principles of the WET-Health assessment framework were adopted to describe and understand the systems' driving ecological processes. Understanding the driving processes of a system provide insight into the potential problems and/or threats posed to the hydrological, geomorphic and vegetation components of the systems.

10.3.1.2 Results

Anthropogenic modifications to the landscape were evident within the study site as changes to the hydrology (i.e. canals and additional stormwater inputs) and soils (i.e. large-scale physical disturbance of the soil profile) could be observed visually onsite. These modifications have substantially altered the remaining historical systems from their benchmark state, and as such the assessment results of these systems would be skewed as the available assessment tools would not accurately reflect the remaining functioning and importance of these systems within the vastly modified landscape. An overview of the freshwater ecosystems within the study site in relation to the modified landscape is provided in Figure 83. Historically, the majority of the flows were in an easterly direction, whilst now, flows have been diverted away from the original flows paths, around infrastructure and towards the Manzanyama and Bhizolo canals and into the Richards Bay harbour.

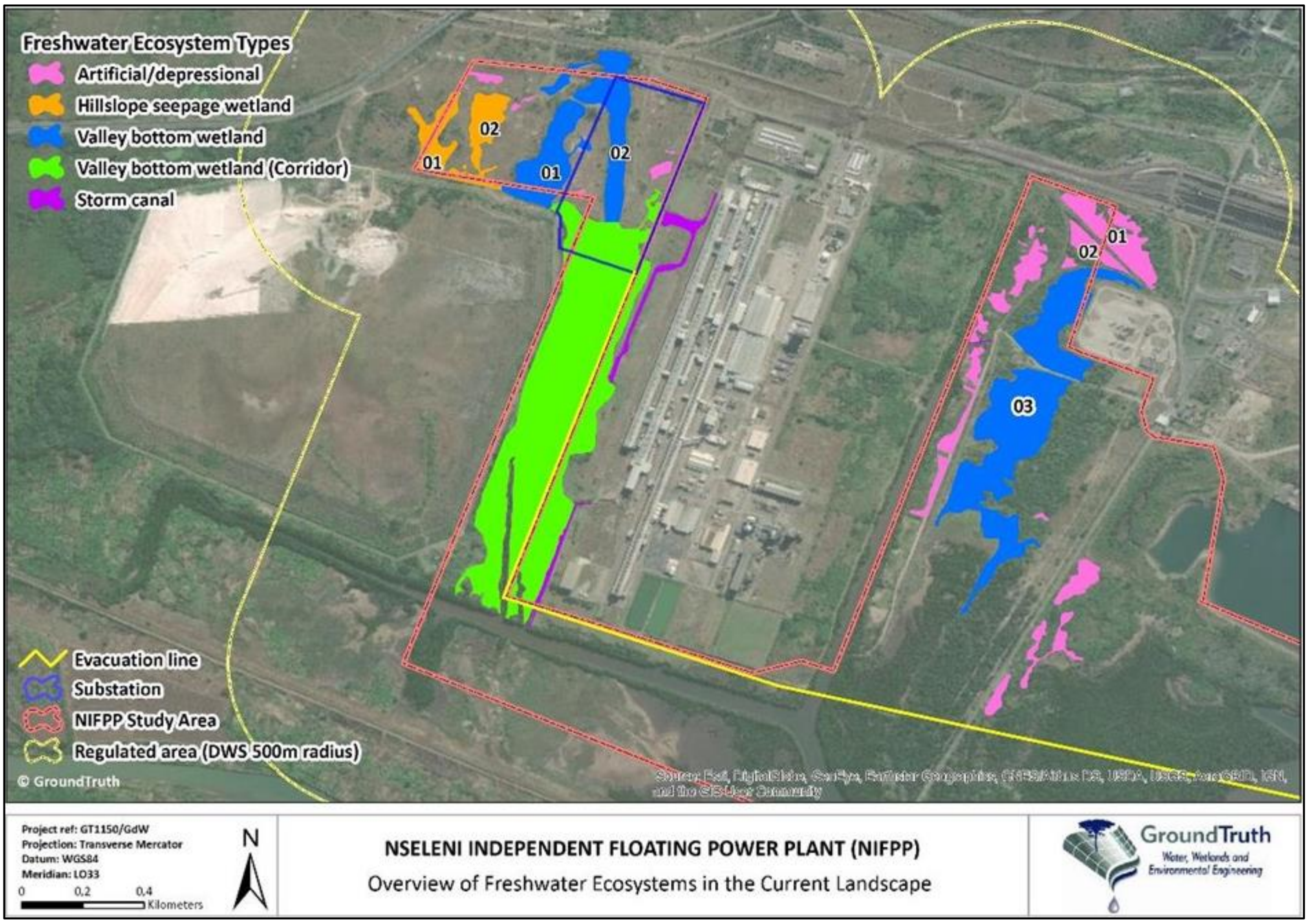


Figure 77: Overview of the freshwater ecosystems delineated within the study area

Comparing the historical and current imagery, **HSS1 and VB1 are the two systems evident in the 1930s imagery**. Currently these systems are surrounded by a number of small isolated depressional wetlands or seepage zones, which decant into these systems. The presence of these depressional systems is generally a result of the modifications within the landscape, e.g. hillslope runoff accumulating within artificial depressions. Similarly, artificial depressional type systems were identified within the eastern portion of the study site, which are also a result of the modifications within the landscape. The topographical and hydrological modifications to the landscape combined with the ambient environmental conditions are conducive to the artificial formation of wetland habitat, which is clearly evident within the site. **Although these artificial depressions are classified as wetland habitat, the services supplied by these systems to the broader landscape are considered negligible, generally due to the size of these systems being less than 0.89ha with most being less than 0.24ha in extent.** Additionally, the **soil characteristics of the majority of these artificial depressional systems are classified as man-made soils** – which is the "man-made deposit of soil material (Soil Classification Working Group 2006, pp.38)". This further supports the fact that these systems have been artificially augmented through the modifications of the landscape.

The remaining systems within the western portion of the study site include **HSS2 and VB2** which (although two major systems) **are both considered to be artificial** in terms of their origin, **nevertheless, these systems provide a range of various habitats and a suite of ecosystems services within the landscape**. The remaining systems within the eastern portion of the study site include **VB3, D1 and D2**, and **are considered to provide a range of habitats and ecosystem services within the landscape**, despite the degree of habitat provision and the services supplied by D1 and D2 being limited due to their confined nature, i.e. surrounded by railway lines. The vegetation composition (Figure 78) within the wetland habitat across the site, has been disturbed, which is evident in certain portions of the system, with the infestation of disturbance tolerant and alien invasive species.

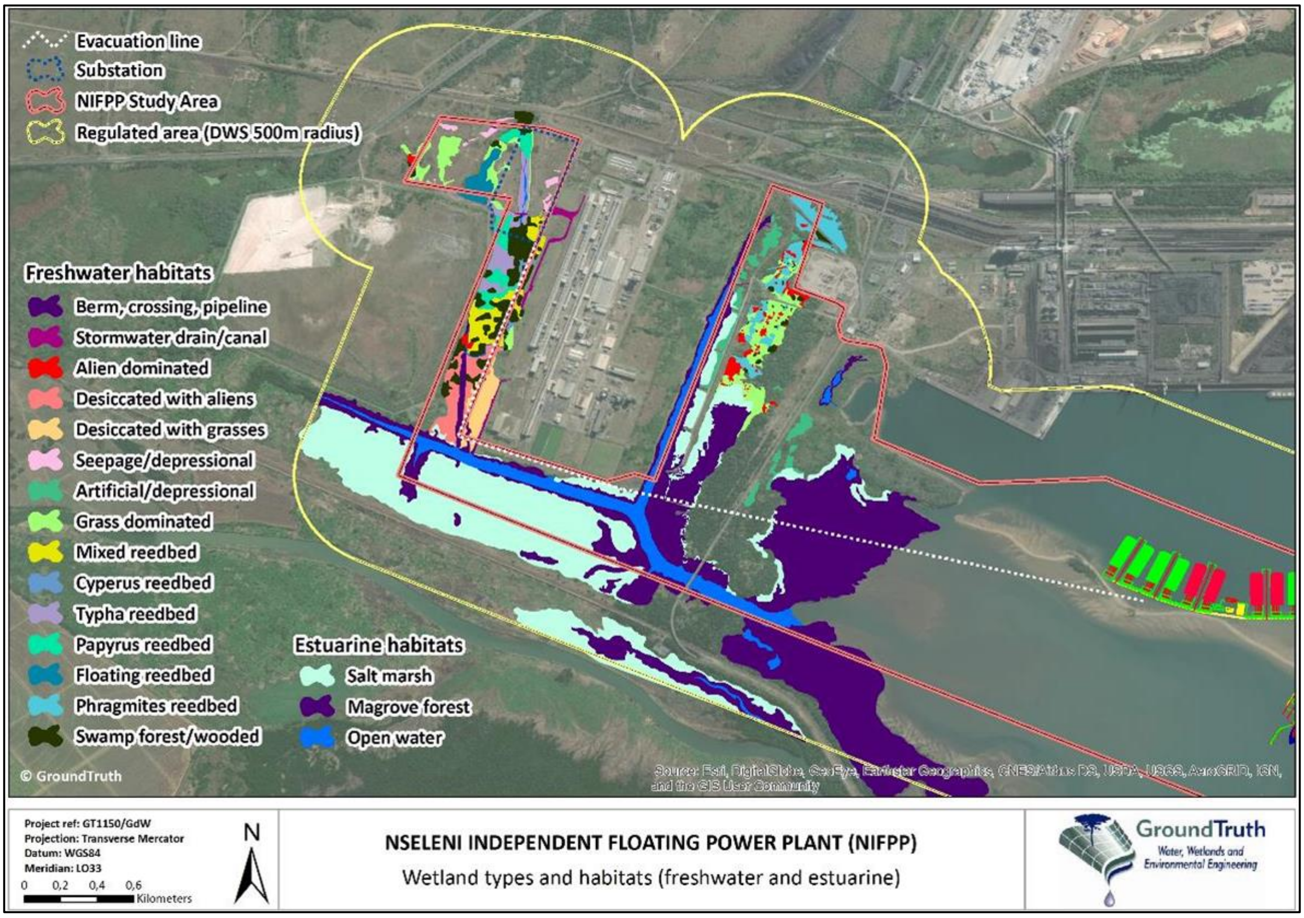


Figure 78: Overview of the various habitat types of the freshwater and estuarine ecosystems within the study area.

<u>Western portion: Wetland habitat</u>

- HSS1 and HSS2: sedge-meadow wetland habitat.
- VB1 and VB2: dominated by reedbeds. VB1 comprised of a floating papyrus reedbed, under which the ground level could not be ascertained.
- Main portion of VB Corridor: comprises of reedbed wetland habitat, with pockets of sedges and swamp forest (Critically Endangered) habitat.
- Lower portion of VB Corridor: characterised by an artificial channel to direct the flows from the upstream wetland habitat towards the Bhizolo Canal. A major impact of the artificial channels/drains is that of lowering the groundwater table with a knock-on impact of desiccating the wetland habitat, which has led to the encroachment of alien invasive vegetation.

<u>Eastern portion: Wetland habitat</u>

- Less diverse compared to the western portion of the study area.
- East of Harbour Arterial: all are considered to be artificial, depressional wetland systems. The soil profile is highly disturbed, and the soils are considered to be man-made soils, even though some wetland vegetation species are present including, inter alia, *Juncus krausii*. This is further supported by a review of the historical imagery dating back to the period of the harbour construction.
- VB3: dominated by *Phragmites australis* reeds in the wetter southern portions of the system. Moving in a northerly direction and as the soil profile becomes drier, the wetland is dominated by large grassy areas, almost completely dominated by *Sporobolus virginicus*, with small patches of reeds interspersed. The eastern boundary of the system is generally defined by woody vegetation, with small patches of swamp forest habitat along its fringes, although it is predominantly dominated by alien invasive vegetation e.g. *Schinus terebinthifolius*. The northern portion is dominated by reeds with some pockets of swamp forest.

- D1 and D2 (upstream by not connected to VB3): dominated by reedbeds with some swamp forest species along the fringes. Characterised by permanently wet conditions.
- Although there have been modifications and/or disturbances within the landscape linked to the three systems (VB3, D1 and D2), all of these systems display typical hydromorphic characteristics within the soil profile, even though portions of these systems have been artificially created and/or maintained, suggesting conditions for wetland formation have been in existence for an extended period of time.
- Between the Manzamnyama Canal and the railway line: several pockets of artificial fringe estuarine/freshwater wetland habitats dominated by Phragmites reeds and *Sporobolus virginicus*. The flows in these systems tend to be towards the canal and as such are not hydrologically linked to the other wetland systems.

Ecosystem Functioning:

The general features of the HGM units hydrologically linked to the study site were assessed in terms of the ecosystem functioning at a landscape level for the current scenario using a Level 2 Wet-EcoServices assessment. The score for each ecosystem service represents the likely extent to which that benefit is being supplied by the wetlands and was interpreted based on the following rating outlined by Kotze *et al.* (2007):

- <0.5 Low
- 0.5-1.2 Moderately low
- 1.3-2.0 Intermediate
- 2.1-2.8 Moderately high
- >2.8 High

Generally, the values recorded for the regulating and supporting services for the current scenario were **Intermediate to Moderately High** (Table 58). The predominant services these systems are able to supply are associated with flood attenuation and water quality enhancement. The valley-bottom systems (VB1, VB2 and VB3) and depressional systems (D1 and D2) recorded High values for biodiversity maintenance, which is mostly associated with the fact that there are patches of swamp forest habitat within the systems. Although the hillslope seepage systems only recorded values at an Intermediate level, these systems are considered to be good examples of seepage systems within a substantially modified landscape. The depressional systems generally recorded values at Intermediate to Moderately High which are linked to the nature of the system, as the effectiveness of these systems to supply these services is considered to be Intermediate to Moderately High, however, the opportunity for these systems to provide these services within the landscape are limited due to the isolated nature of these wetlands.

Table 58: Summary of current ecosystem services scores for the HGM unit complexes within the study area.

Ecosystem services	VB1 & VB2	VB3	HSS	D1 & D2
Flood attenuation	2.1	2.1	2.4	2.6
Score for effectiveness:	2.1	*2.2*	2.3	*3.3*
Score of opportunity:	2.0	*2.0*	2.5	*1.8*
Stream flow regulation	2.2	1.8	1.8	1.3
Sediment trapping	2.0	1.7	1.5	1.5
Score for effectiveness:	2.1	*2.1*	1.7	*1.7*
Score of opportunity:	2.0	*1.3*	1.3	*1.3*
Phosphate trapping	2.0	2.0	1.8	1.7
Score for effectiveness:	3.0	*3.3*	3.2	*3.4*
Score of opportunity:	1.0	*0.7*	0.3	*0.0*
Nitrate removal	2.6	2.3	2.1	2.3
Score for effectiveness:	3.6	*3.6*	3.6	*4.0*
Score of opportunity:	1.5	*1.0*	0.5	*0.5*
Toxicant removal	2.6	2.3	1.7	1.9
Score for effectiveness:	3.2	*3.2*	3.1	*3.5*
Score of opportunity:	2.0	*1.3*	0.3	*0.3*
Erosion control	2.5	2.7	2.1	3.1
Score for effectiveness:	2.5	*3.0*	2.3	*3.8*
Score of opportunity:	2.4	*2.4*	2.0	*2.4*
Carbon storage	1.3	1.3	1.3	2.3
Biodiversity maintenance	3.0	3.0	1.9	3.0

Ecosystem services	VB1 & VB2	VB3	HSS	D1 & D2
Score for noteworthiness:	3.0	*3.0*	2.0	*3.0*
Score for integrity:	1.0	*1.1*	1.8	*1.5*
Water supply	1.0	0.8	0.8	0.9
Source of harvestable goods	1.2	0.4	1.0	0.4
Source of cultivated goods	0.2	0.0	0.2	0.0
Socio-cultural significance	0.0	0.0	0.0	0.0
Tourism and recreation	0.3	0.0	0.1	0.0
Education and research	1.0	0.0	1.0	0.0

The provisioning services and cultural benefits of the wetlands within the western portion of the study site, were valued relatively low in comparison to the regulating and supporting services, but these provisioning services included the availability of land for the grazing of cattle and the harvesting of reeds. The limited use of these systems is predominantly linked to the fact that the wetlands are located within the industrial zone of Richards Bay. The provisioning services and cultural benefits associated with the wetlands within the eastern portion of the study site are low due to the resources being unavailable due to limited accessibility as the systems are located within the confines of the harbour facility, which is controlled by TNPA.

Ecological Importance and Sensitivity (EIS):

According to the DWA (2013) Manual for Rapid Ecological Reserve Determination of Inland Wetlands (Version 2.0), the valley-bottom, hillslope seepage and the depression wetland systems hydrologically linked to the study site are considered to be a **C category** (Table 59). The EIS score is strongly linked to the fact that these relatively intact systems are located within a substantially modified landscape and as such providing a suite of services within the landscape.

Table 59: Ecological Importance and Sensitivity Score for the wetland complexes for the current scenario

Ecological Importance and Sensitivity	VB 1 & VB 2	VB 3	HSS	D 1 & D 2
Ecological Importance and Sensitivity	2.3	2.3	2.4	2.2
Hydro-functional Importance	2.2	2.0	2.1	2.1
Direct Human Benefits	0.6	0.2	0.5	0.2
Overall Importance and Sensitivity Score	2.3	2.3	2.4	2.2
Overall Importance and Sensitivity Category	**C**	**C**	**C**	**C**

Present Ecological State (PES):

The remnant wetland habitat (HSS1 and VB1), when assessed considering the benchmark conditions, would be considered as critically modified (i.e. a PES category of 'F'). The site visit, however, highlighted that the wetland systems are relatively intact, if compared to valley-bottom and seepage systems, i.e. a PES category of 'B' or 'C' with only moderate modifications to the system (refer to Macfarlane *et al.*, 2007). Even though these systems have been substantially modified, they are considered to be important systems within a substantially modified landscape and as such, the principles of the Wet-Health assessment framework have been used to describe these systems, in order to understand the current ecological driving processes. The following provides a summary of the factors to which the general modifications to the wetlands' current driving processes are primarily linked:

Valley-bottom systems (VB1, VB2 and VB Corridor):

- Three canals within the lower portion of the wetland habitat, which is substantially lower than the surrounding ground level and having a desiccating effect on the adjacent wetland habitat;
- Altered water flows into the wetland linked to catchment impacts associated with the development of Bayside, Foskor discard Gypsum dump and the upstream industrial zone. This alters the ability of water to lift, transport and deposit sediment;
- Infilling within the wetlands associated with the railway line, power line, dam walls, and hillock extending into the system;

- Impeding features, i.e. two dam walls – earthen and gabion; and the development of the Foskor discard Gypsum dump, affecting the movement of water through the system; and,
- Alien invasive vegetation within the wetland and its associated catchment, increasing the direct uptake of water.

Nonetheless, despite all of these modifications, the valley-bottom wetlands are providing a suite of ecosystem services within the landscape and are able to support rare wetland habitat within the less disturbed areas e.g. swamp forest and floating reedbed.

Hillslope seepage systems (HSS1 and HSS2):

- The dumping of fill material and excavation within portions of the wetland habitat;
- Altered water flows into the wetland linked to catchment impacts associated with the development of railway lines, power lines and the R34 John Ross Highway. This alters the ability of water to lift, transport and deposit sediment; and,
- Alien invasive vegetation within the wetland and its associated catchment, increasing the direct uptake of water.

Although the ecosystem services supplied by these systems are not provided to the same extent as the valley-bottom systems, they are still considered to be important features within the landscape.

Valley-bottom system (VB3):

- An extensive drainage network within the northern portion of the wetland system, channelling flows through the system;
- Infilling of portions of the wetland habitat, associated with the construction of the Manzamyama canal, the railway line, the dirt road and raised access tracks and buildings, modifying the flows through the system;
- Altered water flows into the wetland linked to catchment impacts associated with the surrounding infrastructure development; and,
- Alien invasive vegetation within the wetland and its associated catchment, increasing the direct uptake of water.

Nonetheless, despite the listed modifications, the valley-bottom wetland is considered to be providing some degree of ecosystem services within the landscape, albeit limited in comparison to the systems within the western portion of the study site.

Depressional systems (D1 and D2):

- Altered flows into the wetlands linked to the confinement of the systems between the railway lines and as such, the artificial catchment extents. This alters the ability of water to lift, transport and deposit sediment; and,
- Alien invasive vegetation within portions of the wetlands, increasing the direct uptake of water.

Although the ecosystem services supplied by these systems are not provided to the same extent as the valley-bottom system, they are still considered to be important features within the landscape, particularly as refuge for birds within the substantially modified landscape.

10.3.1.3 Overview of potential impacts

Proposed Substation:

- The proposed substation will require an area of ≈16ha (400m by 400m) to host the 400kV substation (Figure 77 and Figure 78).
- Due to the size of the proposed substation, the loss of wetland habitat is unavoidable for the originally proposed site.
- The potential loss of HSS1 and VB1, historical wetlands systems would render the placement of the proposed substation on this site as fatally flawed.

- VB2, is not a historically linked wetland, however, it is considered to be a crucial system within the landscape as the majority of the flows from the upstream catchment area decants into this system and sustains the downstream wetland habitat (VB Corridor) between Bayside and Foskor's Gypsum Dump.
- To the east of VB2 is a modified raised area which could serve to house the substation, however, it is not considered to be sufficiently sized to meet the 400m x 400m requirements. The available area for development is highlighted in Figure 79, this area does contain some isolated seepage systems, but these have formed as a result of the modifications to the landscape and the development of the Bayside platform. The loss of these systems would not result in a loss of ecosystem services within the broader landscape. Should the proposed area be considered sufficient for the development of the substation platform, it is recommended that a minimum buffer of 15m is adopted around the VB 2 wetland system.

Figure 79: Developable area identified for the proposed substation that avoids sensitive buffered wetland systems.

- The loss of VB2 would have detrimental impacts on the downstream wetland habitat, desiccating the reedbeds and swamp forest systems. As such, the flows sustaining these downstream systems, which predominantly originate from VB2, would have to be maintained within the post-development landscape. There are some possibilities that may be considered, these includes *inter alia*:
    - To pipe all of the flows underneath the proposed platform and ensure that they are safely discharged into the downstream wetland habitat; or
    - To divert the flows from VB2 into VB1 (the original system), however, this would be subject to hydrological modelling of the system and the associated catchment in order to ascertain whether VB1 would be able to safely sustain the additional water inputs and if these can be decanted into the downstream VB corridor around the north-eastern corner of the Foskor Gypsum Dump.

Power evacuation line:

- The alignment of the power evacuation route needs to minimise the risk to the wetland habitat. The potential and assumed impacts associated with the construction and operation of the power evacuation structure is outlined below.
    - Based on the proposed approach for the construction of the overhead structure, the level of physical disturbance to wetland habitat may be nominal (i.e. less than 0.1ha). The pile caps supporting the GIL

box structure (at a height of around 5-10m) would be constructed on 3x 1m-diameter piles, approximately 24m spans between pile cap structures.

- The most notable impact though would be the access/haul road that is required to construct the power evacuation structure. That access/haul road would follow the entire length of the power evacuation route with a width of 5-10m, which translates to between 0.6ha and 1.2ha of wetland being directly impacted.
- To avoid wetland habitat the power evacuation route along the western boundary of Bayside would need to be shifted eastwards approximately 100m into the Bayside property. If this is not possible, then careful consideration on the placement of each pile supported structure is required, and access to each support should preferably be arranged via the Bayside site and not a new access road.
- Should the power evacuation structure be placed along the grassy, more temporary wetland zones (i.e. as close to the existing Bayside fence-line as possible), then mowing of the vegetation would be an acceptable maintenance activity during the operational phase to manage vegetation growth along the new servitude. However, this type of management of the vegetation within wetter zones (e.g. reedbeds and swamp forests) is not considered feasible.

Contractor's Camp & Laydown areas:

- Areas that present the least possible impact on both wetland and terrestrial habitats are shown in Figure 80. There are better options east of the Harbour Arterial Road, albeit slightly smaller than the option west of the Harbour Arterial Road. Both sites have been significantly disturbed over the last two decades (i.e. post 2000), which is not only evident in the disturbance tolerant and alien invasive vegetation (notably extensive patches of the invasive tree, *Schinus terebinthifolius*), but also in the soil profile, i.e. this area is dominated by man-made soils. These areas also include other signs of modification from historic construction activities such as large platforms and berms, giving rise to a suite of disturbance tolerant vegetation and alien invasive species.

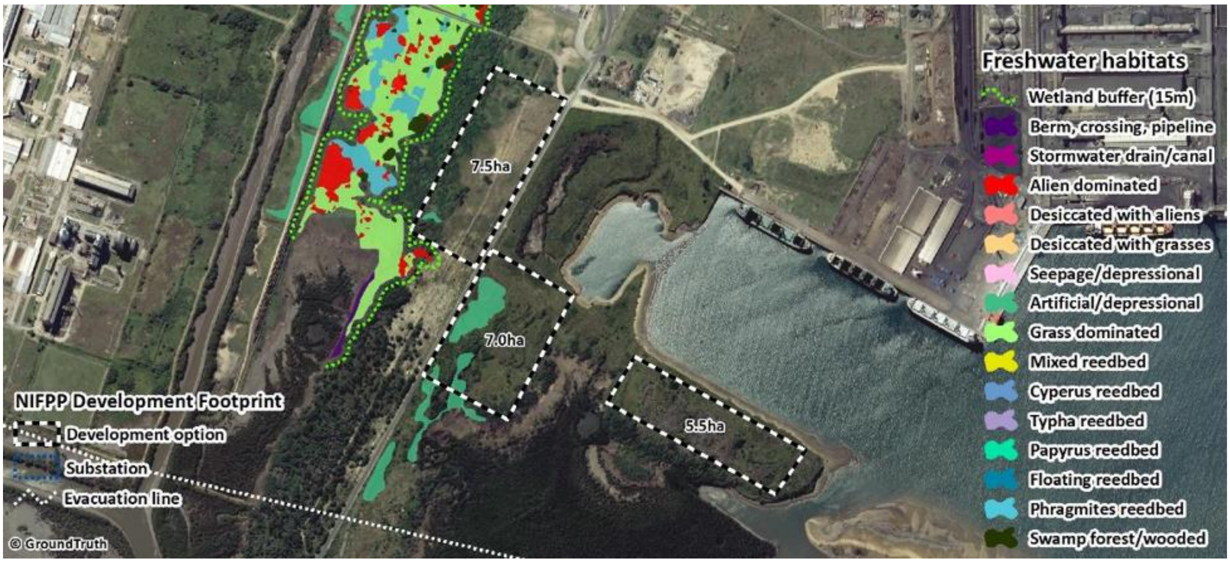


Figure 80: Proposed contractor camp/ construction phase laydown areas that are located outside of buffered sensitive wetland habitats

10.3.2 TERRESTRIAL BIODIVERSITY ASSESSMENT

10.3.2.1 Approach & Method

Data and literature relating to terrestrial ecosystems associated with the proposed site, and to a lesser extent the broader study area, were sourced to characterise and spatially define biodiversity features within the study area. All spatially relevant data (e.g. habitats/ecosystems, vegetation communities, sensitive areas, etc.) were mapped using ESRI ArcMap

10. The desktop mapping was then verified by interrogation of high-resolution aerial imagery, provided by the Applicant. Also, historical imagery from the 1930s was used to identify areas that have undergone disturbance or even transformation due to Richards Bay harbour and industrial zone developments. The desktop mapping was also verified in-field. Potentially sensitive features occurring within the site and/or in close proximity to the site were identified.

10.3.2.2 Results

Classification and mapping of vegetation and habitats:

The NIFPP study area is characterised by several distinctive vegetation/ecological units, which can be ascribed according to the prevailing plant communities. Although this section focuses only on the terrestrial component, other components are included to provide a more integrated overview of ecological features and sensitivities. Table 60 provides a summary of the ecological units and vegetation communities following the desktop mapping, while Figure 81 illustrates the spatial extent and distribution of these units (including finer details where distinguishable).

Table 60: Summary of the vegetation types associated with the broad ecological components occurring within the project site

Vegetation type	Area (ha)	Proportion of component (%)	Proportion of NIFPP area (%)
Terrestrial component			
Grassland	30.3	29%	5%
Scrub/shrublan	25.7	24%	4%
Thicket	6.3	6%	1%
Thicket dominated by IAPs/Brazillian Pepper	18.4	17%	3%
Seral forest	22.3	21%	4%
Disturbed (tracks, rubble, concrete structures)	3.3	3%	1%
Total	**106.3**	**100%**	**17%**
Freshwater component			
Herbaceous wetland: grasses and sedges	16.5	32%	3%
Herbaceous wetland: tall sedges, bulrushes and reeds	16.8	32%	3%
Swamp forest wetland	7.6	15%	1%
Wooded wetland	2.0	4%	0%
Wetland channel	0.4	1%	0%
Desiccated/alien infested wetland	7.8	15%	1%
Disturbed/transformed wetland	1.1	2%	0%
Total	**52.3**	**100%**	**8%**
Estuarine component			
Salt marsh/mudflats	35.2	8%	6%
Mangrove forest	70.1	16%	11%
Open water	345.	77%	56%
Total	**450.3**	**100%**	**73%**

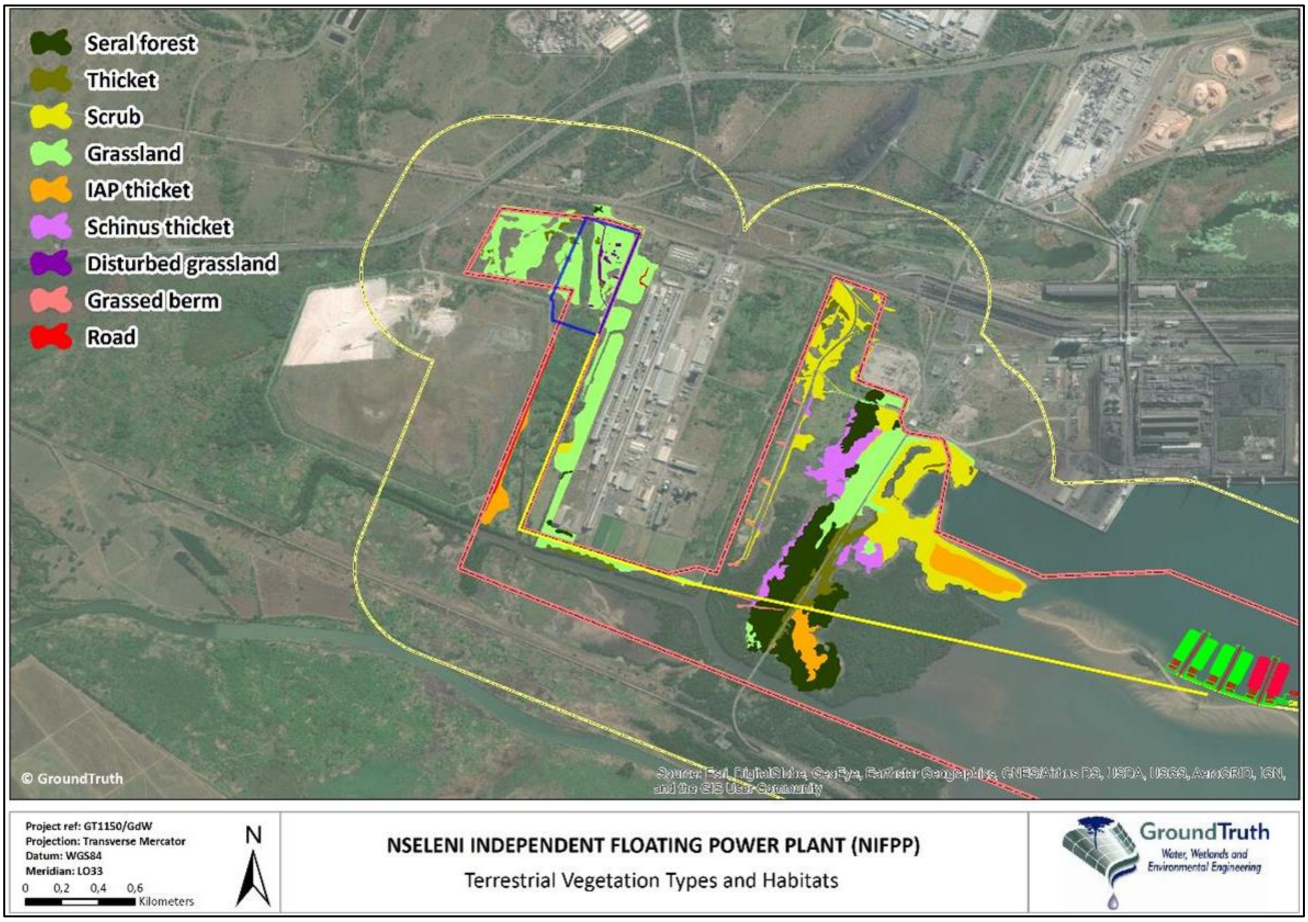


Figure 81: Map showing the extent and distribution of vegetation types and ecological units within the project site

Grasslands:

- Grasslands make up most of (i.e. 86%) of the terrestrial areas in the western portion of the NIFPP site, while in the eastern portion it is only 13%.
- Characteristic of the Maputaland Coastal Belt ranging from moderate to good condition, with elements of hygrophilous grassland that merge with the grassy wetlands that form part of the wetland areas.
- Western Grassland: The grassland patch (~12 ha) west of the main valley-bottom (VB 1) supports a noticeably higher diversity of plants, particularly in terms of herbs, and forms a critical component in the landscape supporting patches of hygrophilous wetland (i.e. wet grassland). The smaller, eastern patch of grassland (~7 ha) is in a poorer condition. The grassland patch to the west of the vehicle track (western side of the eastern patch of grassland) appears to be secondary in nature following the reshaping and formation of the man-made VB2 wetland to manipulate and control stormwater from upstream. The eastern grasslands extend as a narrow strip down the western boundary of Bayside, but just outside of the NIFPP site, as well as along the southern boundary of Bayside. The vegetation here is secondary and more disturbed compared to the main patches to the north.
- Eastern Grassland (within TNPA land): one large (~7ha) patch of grassland that runs along the western edge of the Harbour Arterial Road. This grassland is moderately degraded and has established in response to the historic disturbances associated with the development of the Port, mainly from extensive excavations that took place around the 1970s followed by port infrastructure thereafter. The integrity of this grassland has become compromised in more recent years by the spread of Invasive Alien Plants (IAPs).

Seral Forest:

- Semi-continuous band (≈22ha or 28% of the eastern area's terrestrial component) mainly on the western side of the Harbour Arterial Road.

- Trees have reached and maintained a canopy height of ≈10m, and the extent of the seral forest has expanded in a northerly and easterly direction. Thus, the south-western portions of the seral forest represent the oldest, most established patch.

Thicket:

- Several thicket patches are scattered across both the western and eastern portions of the NIFPP site (Figure 81), the largest of which occurs within the Richards Bay Port area (~8 ha).
- Within the western portion of the site, the thickets form part of a mosaic plant community interspersed within grassland, which together make up the Maputaland Coastal Grasslands that once dominated the landscape. The long-narrow thicket along the south-western boundary is heavily infested by IAPs.
- Within the eastern portion the thickets tend to grade into the seral forest patches and represent part of the ecological succession of woody vegetation from grassland, through scrub, to seral forest. Thickets occupy around 28% (or 21ha) of the eastern terrestrial component, but are more degraded due to IAP infestations, the most severe being a dense stand of Brazillian Peppers (*Schinus terebinthifolius*).
- Thickets in the northern parts of the western portion of the study site are largely in a moderate condition, with low infestations of IAPs.

Scrub:

- More evident within the eastern portion of the site where it covers a relatively large area (~26ha or 32% of the eastern terrestrial component), particularly in the more northern parts.
- A significant proportion of the scrub vegetation occurs on areas that have been historically disturbed by extensive excavations, notably the areas east of the Harbour Arterial Road.

Herbaceous wetland:

- The greatest diversity of wetland plants occurs within the “grassy” wetlands/hygrophilous grasslands within the northern western side of the NIFPP site.
- Lower down the main valley-bottom system (VB Corridor) within the western portion, the wetland areas have become desiccated due to the incised channel as a result of headcut erosion that is working its way up the system. This has resulted in terrestrialisation of the wetland, with a heavy infestation of IAPs.
- The eastern wetlands support a much lower diversity of wetland plants.

Swamp Forest:

- Emergent swamp forest patches ranging in size from 0.1 ha to 3.0 ha are distributed down the length of the main valley-bottom wetland systems (VB Corridor and VB 3). Most of the swamp forest (~93% or 7ha) occurs within VB Corridor, with only a few, small patches within the eastern portion (within VB 3) that together make up 0.5ha.
- The composition of swamp forest patches is generally made up of a low diversity of plants dominated by one tree species, *Ficus tricopoda*.
- Lower down the western VB Corridor, where the system has become desiccated, swamp forest patches are more disturbed with encroachment by more terrestrial woody species.

<u>Species of Conservation Concern:</u>

A few species of conservation concern were recorded within the NIFPP site (Figure 82). These include:

- Large Yellow Eulophia *Eulophia speciosa* (Declining; Regionally Protected): this species of orchid occurs in various habitats including sand dunes, bushveld, thornveld and montane grasslands. Only 3 individual plants were recorded on-site, and within the eastern portion of the study area.
- Star-flower *Hypoxis hemerocallidea* (Regionally Protected): occurs within grassland with one individual observed within the western grassland on site.

- Swamp Fig *Ficus trichopoda* (Protected Tree): a habitat specialist that has a restricted distribution, occurring in coastal areas in swamp forest habitat. Swamp fig is protected under the NFA. The site supports 24 patches of swamp forest, which cover an area of 7.1 ha (Figure 78 and Figure 82). Collectively, these patches contain a large number of Swamp Figs, as well as a few more isolated trees that are scattered across the wetlands and into the terrestrial areas.
- White Arum Lily *Zantedeschia aethiopica* (Regionally Protected): occurs in marshy habitats with only a few plants observed on site within swamp forest.

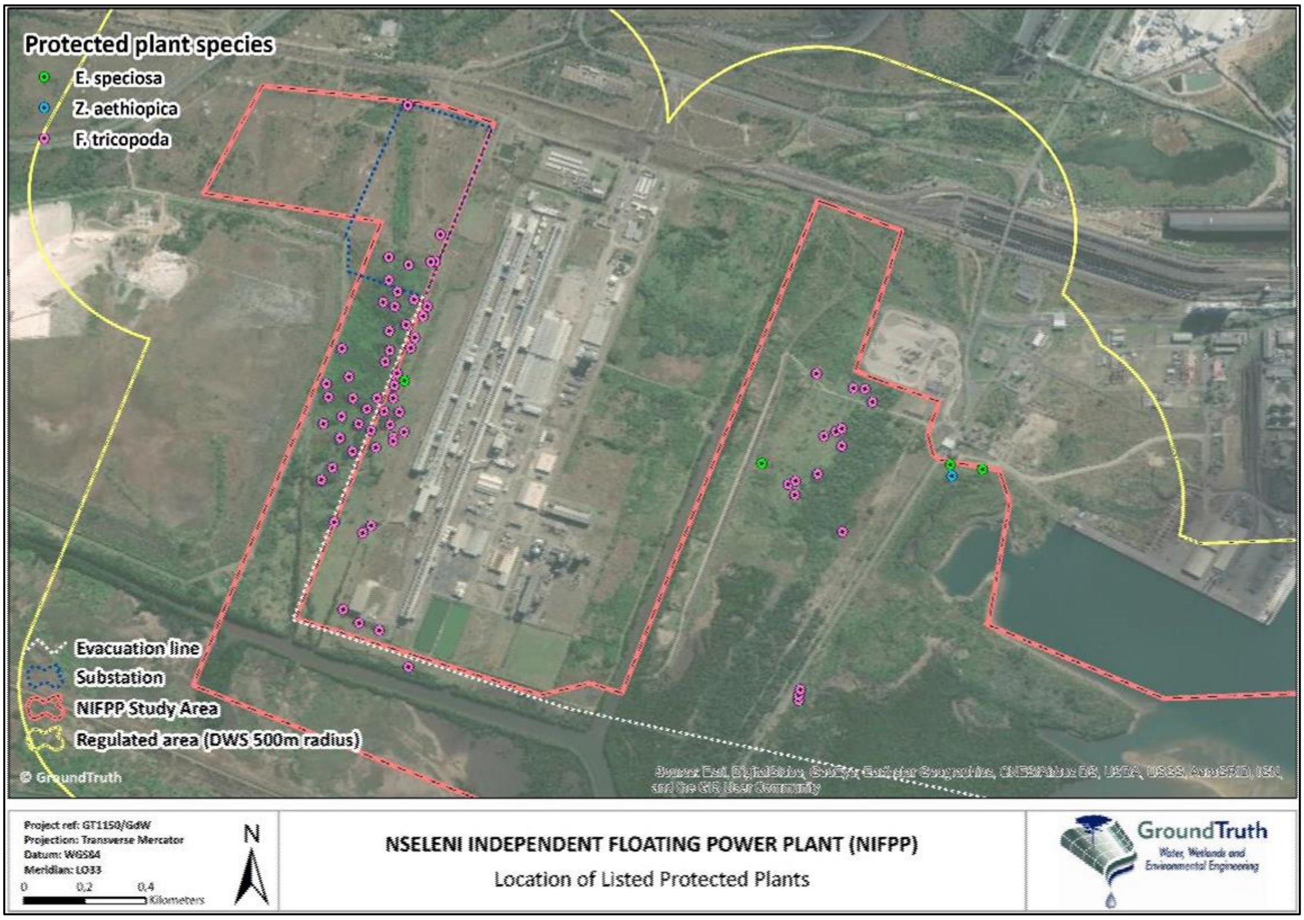


Figure 82: Map of protected plants observed within and surrounding the NIFPP site

The NIFPP site is likely to support other species of conservation concern, as well as potentially Threatened species such as *Asclepias gordon-grayae* (Endangered), which is known to occur in hygrophilous grasslands in the Richards Bay area. More widespread/locally abundant species, such as the orchid *Eulophia speciosa*, are also expected to occur in the western portion of the site.

<u>Fauna Composition:</u>
The site visits enabled the assessment of available habitats that would potentially support conservation important fauna, rather than assessing the actual faunal diversity through detailed surveys. Notable fauna that can be expected to occur on-site based on the types and condition of habitats available includes:

Butterflies:

- 165 species of butterfly (or 35% of the KZN diversity) have been recorded from the Richards Bay area.
- Species of conservation concern that may potentially inhabit the site area: Amakosa Rocksitter *Durbania amakosa flavida* (Endangered) – a range restricted species endemic to KZN that inhabits rocky areas within moist grassland. It is only known to occur at two to five locations, and has an extent of occurrence of 9 470 km^2 and

an area of occupancy wherein < 1 000 individual emerge each year. The host plant for its larvae are lichen that grow on rocky substrates.

Dragonflies and Damselflies:

- 65 species of dragonfly and damselfly (or 49% of the KZN diversity) have been recorded locally from the Richards Bay area.
- Species of conservation concern that may potentially inhabit the site area:
    - Eastern Duskhawker *Gynacantha usambarica* (Vulnerable) – this large dragonfly has only been recorded from coastal northern KZN, but its range extends to East Africa. It inhabits dense coastal forest, especially swamp forest.
    - Brown Duskhawker *Gynacantha villosa* (Vulnerable) – this large dragonfly has also only been recorded from coastal northern KZN, and its range extends to East Africa and West Africa. It inhabits dense coastal forest with streams and pools.
    - Gracious Wisp *Agriocnemis gratiosa* (Vulnerable) – a very small damselfly that is highly localised in South Africa, and only known from coastal KZN - it also occurs in central Africa and Madagascar. It inhabits pools in coastal swamp or dune forest with openings with tall grasses, ferns and herbs.
    - African Emerald *Hemicordulia afrciana* (Near Threatened) – this medium-sized dragonfly occurs in northern coastal KZN, and its range extends to East Africa. It inhabits grassy forest clearings and margins near pools or streams in swamp forest.
    - Robust Skimmer *Orthetrum robustum* (Near Threatened) – this large dragonfly is distributed across the Maputaland region up to elevations of 100m. It inhabits open pools and natural dune lakes with margins of grasses, sedges and low reeds.
    - Banded Duskdarter *Parazyxomma flavicans* (Vulnerable) – this medium-sized dragonfly occurs in northern coastal KZN, and its range extends to West and East Africa. It inhabits swamp forest adjacent to large coastal rivers.

Amphibians:

- 27 species of amphibian (or 40% of the KZN diversity) have been recorded in the Richards Bay area, however, the actual diversity is likely to be closer to 40 species based on the known distributions and habitat requirements of other species.
- The majority of amphibians that are expected to occur on site will be confined to the wetland habitats, particularly during the breeding season, but will utilise terrestrial habitats surrounding these wetlands to forage and hibernate.
- Species of conservation concern that may potentially inhabit the site area:
    - Pickersgill's Reed Frog *Hyperolius pickersgilli* (Endangered) – a KZN endemic that is restricted to the Indian Ocean Coastal Belt region in KZN. Its range extends from Kingsburgh in the south to St Lucia in the north where it inhabits coastal bushveld and grassland, where it breeds in wetlands containing dense stands of sedges such as *Cyperus immensus* (FrogMAP, 2020a). It is only known from 22 localities (Tarrant and Armstrong, 2013), and the population is severely fragmented with more than 50% occurring in small and isolated patches (IUCN SSC, 2016). Only three of the known localities are in protected areas and the remainder are at threat of degradation or loss.
    - Spotted Shovel-nosed Frog *Hemisus guttatus* (Vulnerable) – is endemic to SA and is restricted to central and eastern KZN, occurring mainly along the coast from Durban in the south to Hluhluwe in the north, extending up into southern and central Mpumalanga (FrogMAP, 2020b). Within its coastal range, it inhabits coastal bushveld and grassland. It breeds on the edges of pans and other wetland areas, as well as along rivers with gentle gradients and alluvial deposits. Given its fossorial habit it is difficult to detect and thus may be more abundant.

Reptiles:

- 26 species of reptile (or 15% of the KZN diversity) have been recorded from locally from the Richards Bay area. However, based on reptile distributions, the actual diversity could include a number of additional species, ≈75 species of reptile potentially occur within the study area, including: 45 snakes, 23 lizards, six tortoises/terrapins and 1 crocodile (although unlikely). According to Bates *et al.* (2014), 9 of these probable species are Red Listed, and 4 of these may occur on site based on their habitat requirements.
- Species of conservation concern that may potentially inhabit the site area:
  - Large-scaled Grass Lizard *Chamaesaura macrolepis* (Near Threatened) – near endemic to SA (KZN, Mpumalanga and Limpopo), extending into Swaziland and Zimbabwe, but may also be found in southern Mozambique. Within its coastal range it inhabits dry, open, sandy grasslands.
  - Green Mamba *Dendroaspis angusticeps* (Vulnerable) – restricted largely to coastal KZN, but its range extends up to Kenya. In SA it is restricted to low altitude forests, including swamp forest.
  - Natal Black Snake *Macrelaps microlepidotus* (Near Threatened) – Endemic to the eastern parts of SA, from north-eastern KZN to East London. It is a semi-fossorial species that tends to inhabit moist leaf litter and humic soil in forests, but in coastal areas it is also associated with damp localities near water.
  - Pygmy Wolf Snake *Lycophidion pygmaeum* (Near Threatened) – a SA endemic that is restricted to north-eastern KZN, but may extend into southern Mozambique and eastern Swaziland. It inhabits lowland forests, grasslands and savannas, and has even been recorded from pine plantations.

Birds:

- Over 350 bird species (or 50% of the KZN diversity) have been recorded in the Richards Bay area and surrounds, including 22 Red Listed species. The NIFPP terrestrial land site, however, is likely to support a much smaller diversity of birds than is expected for the broader region. Furthermore, the avifaunal diversity for the study area is expected to comprise primarily common, widespread species.
- Conservation important bird species that are often recorded from the Richard Bay area include: Greater Flamingo *Phoenicopterus ruber* (Near Threatened), African Marsh-Harrier *Circus ranivorus* (Endangered), Great White Pelican *Pelecanus onocrotalus* (Vulnerable), Pink-backed Pelican *Pelecanus rufescens* (Vulnerable) and Caspian Tern *Sterna caspia* (Vulnerable). Mangrove Kingfisher *Halcyon senegaloides* (Endangered) is a habitat specialist that frequents the mangroves in the area.

Mammals:

- Up to 70 species of mammal (or 37% of the KZN diversity) potentially occur in the area, including 23 Red Listed species, 9 of which are classified as Data Deficient and 11 are Near Threatened. The majority of these Red Listed mammals are small and/or crepuscular/nocturnal and thus difficult to detect (e.g. rodents, shrews and bats, etc.).
- The NIFPP site is only likely to support a small fraction of the potential mammal diversity, and it is expected that the actual diversity comprises no (or very few) sensitive species out of the potential 23 Red Listed species. This is largely due to the disturbed condition of the available habitats in the surrounding landscape.
- The only threatened mammal (i.e. species of conservation concern) that may potentially occur in the study area is Sclater's Mouse Shrew *Myosorex sclateri* (Endangered), which would inhabit the swampy, wetland areas.

10.3.2.3 Overview of potential impacts

Originally proposed substation location:

- A 400m x 400m substation footprint within the north-western area of the site would result in the direct (and unavoidable) loss of both wetland and terrestrial habitat (collectively up to 16ha), including fauna and flora that inhabit these areas, some of which may be species of conservation concern. In addition, there will also be additional disturbance and degradation through increased edge effects (i.e. loss of habitat condition and function around the edges of remaining habitat), loss in habitat connectivity within the broader landscape, increased light and noise pollution, and so forth.

- In terms of the mitigation hierarchy, avoiding terrestrial grassland habitat loss within the NIFPP study site is important. This applies mainly to the more intact grasslands west of VB2, which supports Maputaland Coastal Belt (Endangered) with elements of Kwambonambi hygrophilous grassland (Critically Endangered) (Figure 83). Hygrophilous grassland occurs to the west of the valley-bottom (VB1) wetland system, and just south of the existing powerlines – **this area should be entirely avoided**.
- This leaves the areas east of VB2 to accommodate the substation (Figure 83). In this situation, the grassland and thicket vegetation that will be directly affected by the substation is secondary in nature having established following extensive earthmoving activities that took place around the 1970s. There are also patches that are highly disturbed by building rubble and relic buildings/infrastructure. **Overall, the grassland vegetation is in a poor (at best fair) condition, but does provide some value in the landscape for biodiversity patterns and processes, as well as providing grazing land for livestock from local communities.** It will not be possible to address all of the inherent risk of the NIFPP substation development through the implementation of mitigation measures to manage impacts to terrestrial vegetation onsite. However, **the significance of impacts is considered low (based on the irreplaceability of the vegetation in this area given that the area has been heavily impacted by historical activities in and around the RBIDZ) to moderate (given the extent, duration and severity of the impacts associated with the substation footprint). Thus, additional steps to address residual impacts are not considered necessary, provided reasonable commitments are put in place to help manage and conserve the Maputaland Coastal Belt Grasslands and Kwambonambi hygrophilous grasslands that occur within the NIFPP site, west of the proposed substation area.**

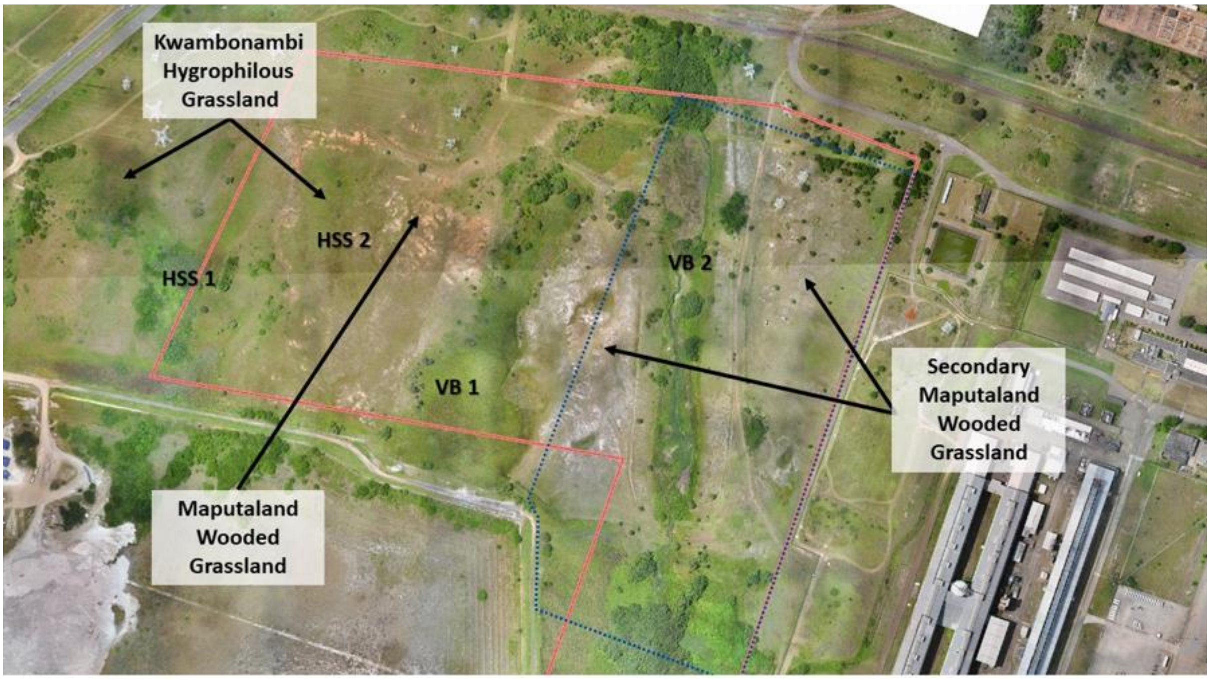


Figure 83: Aerial view of the northern parts of the NIFPP western portion and substation site that contain sensitive vegetation features that vary in condition

Power evacuation line:

- The main impact will be associated with loss of seral forest vegetation due to the placement of the 2nd and 3rd support towers (from the floating power station). To minimise such impacts, it will be important to position the towers within already disturbed areas. For the towers, there are patches of *Schinus terebinthifolius* (Brazilian Pepper) that are best suited to accommodate the towers. In addition, the construction of the towers must make use of the existing access tracks that lead to the position of the 3rd tower.

Figure 84: Aerial view of the southern section of the NIFPP evacuation line with recommended sites to position the towers/chambers (including access routes)

- The portion of the power evacuation line along the southern and western boundaries of the Bayside site will have negligible impacts on terrestrial biodiversity based on the current routing and alignment, but freshwater wetlands (and associated biodiversity) will be affected largely by the placement of supporting structures and the need for access, particularly during the construction phase. In order to limit impacts on these wetland habitats, which include a number of swamp forest patches and associated *Ficus tricopoda* trees, it is strongly recommended that the power evacuation line be shifted at least 50m, or preferably 100m, east to avoid impacts on wetland systems and biodiversity.

Contractor's Camp/ Laydown Areas:

- It is recommended that the laydown area (≈16ha in extent) makes use of existing disturbed/degraded areas, and specifically avoids the VB3 and the seral forest patches.
- The more preferred site: the peninsula that extends into the harbour, as most of this area was filled in with waste material around the late 1990s/early 2000s. The vegetation in this area is degraded and is infested with IAPs, notably *Schinus terebinthifolius* (Brazillian Pepper) (Figure 80, Figure 85).
- Alternative site: along the western edge of the Harbour Arterial Road within the area that contains the degraded grassland and IAP/Brizillian Pepper thicket (i.e. immediately south-west of the entrance to the Port area) (Figure 80, Figure 85).
- Another alternative site: along the eastern edge of the Harbour Arterial Road, however, this will require the laydown footprint to be substantially reduced to avoid the estuarine areas and mangroves to the north and south-east (Figure 80, Figure 85).

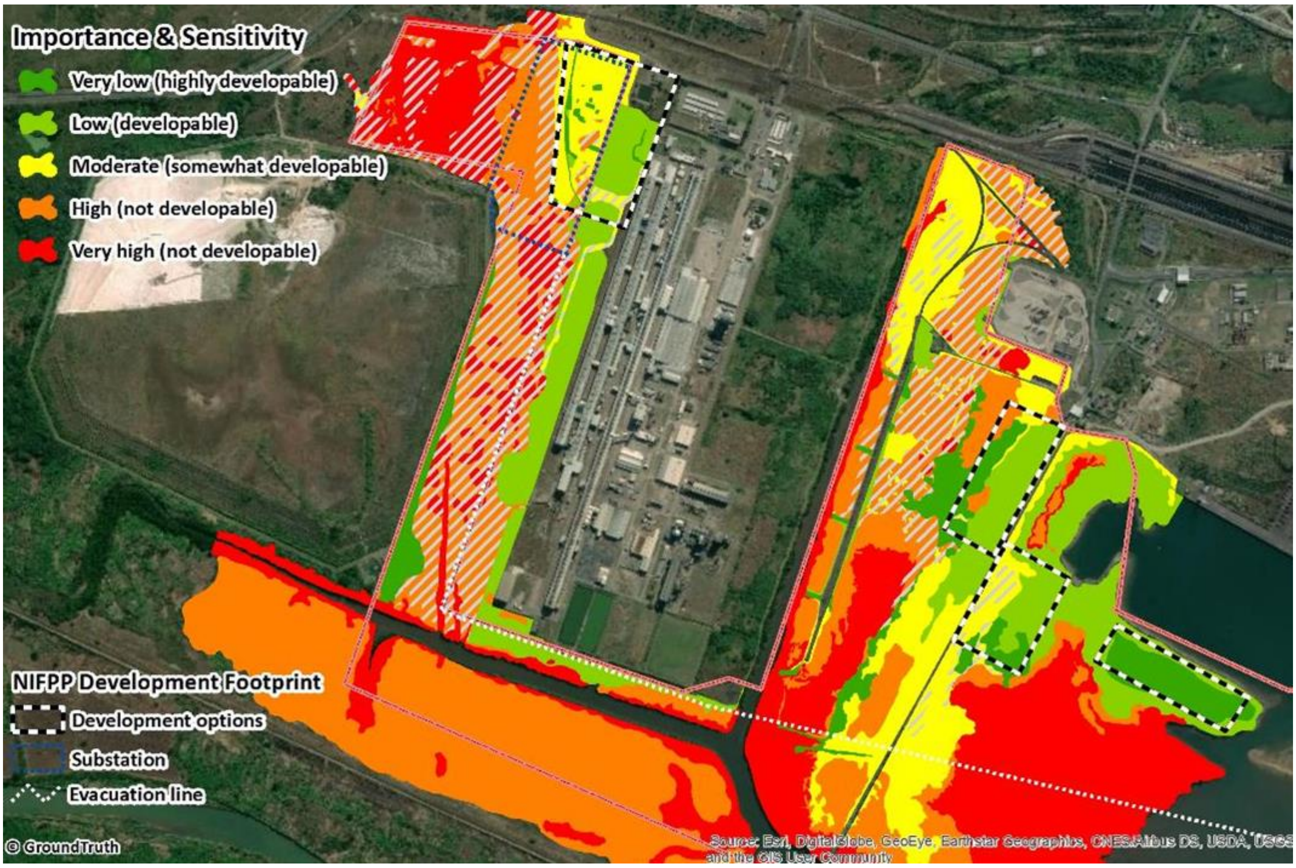


Figure 85: Combined terrestrial biodiversity and wetland importance and sensitivity map of the study area, specifically highlighting land areas for potential development that avoids key sensitivity areas

10.4 ESTUARINE ECOLOGICAL IMPACT ASSESSMENT

CRUZ Environmental was appointed to undertake an ecological assessment of the Kabeljous Flats/Sandspit area within Richards Bay Harbour, followed by an ecological impact assessment related to the proposed development. Due to the extent of the ecological assessment work undertaken, it was decided to separate the Ecological Status Assessment and the impact assessment components into two reports:

- Ecological status of the estuarine environment associated with the proposed development (Appendix 6),
- Assessment of impacts related to the estuarine environment (Appendix 6).

10.4.1 APPROACH & METHOD

Due to the number of physico-chemical (water and sediment) and ecotoxicological (water and sediment) abiotic and biotic (fauna and flora) components assessed, the method used for each component is not provided in summary format here, the reader is encouraged to review the ecological status quo report in Appendix 6 for the sampling methodology for each ecological biotic and abiotic component assessed.

In order to ensure the entire study area was effectively assessed in terms of the current estuarine status quo, 26 sampling sites were decided on and sampled for various abiotic and biotic components (Figure 86).

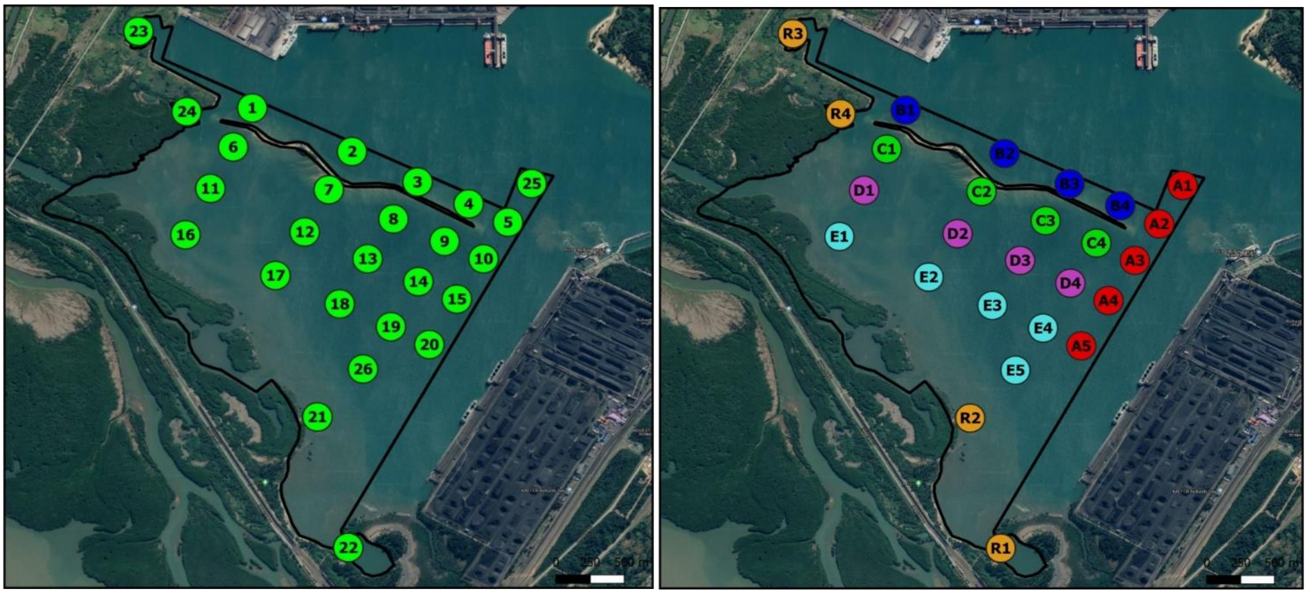


Figure 86: Estuarine ecological assessment sampling sites (left) and grouped by zone (right) throughout the proposed development study area.

For ease of comparison between sites and meaningful grouping of data between sites from different regions relative to the sandspit, Kabeljous Flats and distance from the proposed development area, the 26 sampling sites were grouped into 5 Zones (Zones A-E) for analysis and discussion of some of the ecological components (Table 61, Figure 86). The four reference sites (sites 21, 22, 23 and 24) were also coded as R1-R4 (Table 61). The zones and the locality of the sites within each zone are illustrated in Figure 86.

Table 61: The 26 sampling sites, grouped by zone according to locality relative to the sandspit and the development zone. See Figure 2.6 for site localities.

Zone	Sites	Description
Zone A	A1-A5	Five deep-water sites along the RBCT channel (Sites 5, 10, 15, 20 and 25)
Zone B	B1-4	Four sites on the northern side of the sandspit along the main shipping channel (Sites 1-4)
Zone C	C1-4	First row of four sites on the Kabeljous Flats adjacent to the sandspit (Sites 6-9)
Zone D	D1-4	Second row of four sites on the Kabeljous flats (Sites 11-14)
Zone E	E1-5	Third row of four sites on the Kabeljous flats (Sites 11-14), also including Site 26
Zone R	R1-4	Four Reference Sites: R1 = Coal Terminal (RBCT) Basin (Site 22) R2 = Sandbank site opposite RBCT (Site 21) R3 = RB Bulk Terminal basin (Site 23) R4 = Backwater into Kabeljous flats mangroves (Site 24)

10.4.2 SPECIALIST FINDINGS

10.4.2.1 Abiotic (water and sediment quality and ecotoxicological components)

<u>Water Quality:</u>

- Mean salinity across all sites of 34.2, ranging between 33.7-34.3 and 33.8-34.5.
- With the exception of the deep-water sites (Zone A), most sites showed hardly any salinity stratification, suggesting a well-mixed water column.
- The strong marine influence was also evident in Total Dissolved Solids (TDS), conductivity measurements and pH levels, with an average pH of 8.25 across all sites.

- Water depth at all Zone A sites exceeded 20 m, while the average depth of the 13 sites on the Kabeljous Flats was 2.1m (range 0.8 – 2.9 m).
- The water temperature reflected a typical subtropical estuary in summer, with surface water temperatures as high as 29.6 °C being recorded. Even in the deep-water areas, at a depth exceeding 20 m, the minimum water temperature at the bottom was 24.3 °C.
- Oxygen saturation remained >50% at the bottom. Top dissolved oxygen (DO) concentrations ranged between 6.0-7.4 mg/l, while the bottom concentrations in deep-water areas were markedly lower compared to shallow areas (Figure 87). Deepwater sites had a mean bottom oxygen concentration of 4.7 mg/l. The relatively small surface and bottom oxygen level differential in shallow areas suggest considerable water mixing during tidal inundation and a well-mixed water column throughout.

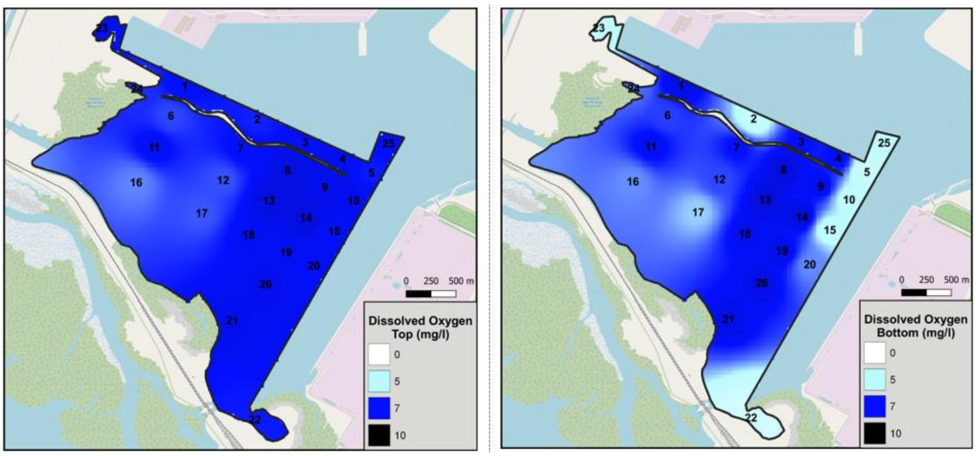


Figure 87: DO concentration (mg/l) at the top (left) & bottom (right) of the water column (February 2020).

- Top and bottom water turbidity levels were low throughout the system, with a maximum turbidity of 26 NTU at the muddy mangrove basin, site R1 (Figure 88).

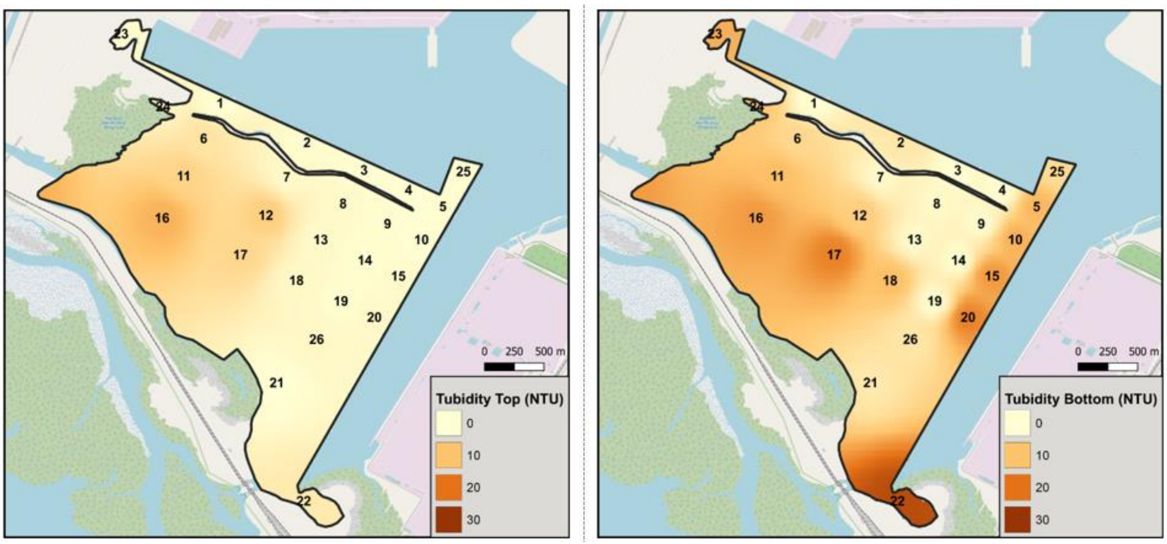


Figure 88: Water turbidity (NTU) at the top (left) and bottom (right) of the water column (February 2020).

<u>Granulometry and Organic content:</u>

- The sediment particle size ranged from fine sand (2.0<Φ<3.0) to mud (mud = coarse silt, Φ >4.0).
- The mean mud, very fine sand and fine sand content at the 13 sites on the Kabeljous Flats were 42%, 22% and 29%, respectively.

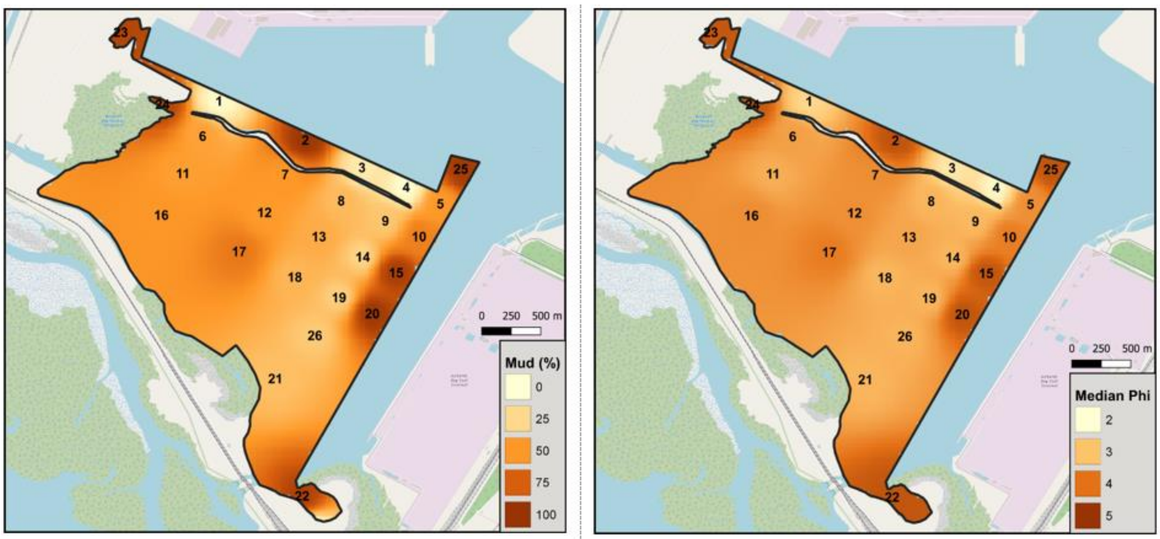


Figure 89: Sediment mud content (%) (left) and sediment grain size (median phi) (right) (February 2020).

- The muddy deep-water sediments (Zone A) and the predominantly sandy sediments (shallow Zone B sites) tended to be more uniform in composition and thus well sorted (range 0.2-0.6). In contrast, the well mixed sediment on the Kabeljous Flats were generally poorly sorted (range 0.9-1.4)
- Total Organic Content (TOC) in sediment is generally a function of the mud content, with muddy sediments typically showing high TOC values. The TOC ranged from very low in the sandy sites of Zone B to high in the muddy Zone A sites. On the Kabeljous Flats, the TOC ranged from 0.2 – 1.2%, with more muddy sites typically showing higher TOC values.
- Deep-water sites (Zone A and B2) are associated with deep, colder and lower oxygenated waters, the shallow Zone B sites are associated with sandy substrate and low turbidity, the inner Kabeljous Flats sites (C1, C2, D1, D2 E1, E2) are characterised by shallow and turbid waters with muddy substrate, while the outer Kabeljous sites are less muddy, less turbid and well oxygenated.

<u>Metals in water:</u>

- Concentrations of most metals were below detection limits or not exceeding the target value by more than a factor of 1.5, including metals of concern, such as Cr, Cu and Cd.
- Zinc (Zn) concentrations exceeded the target value of 20µg/l at 10 sites and is an ongoing cause for concern, with medium risk to biotic communities.

<u>Metals in sediment:</u>

- None of the metals exceeded the Level I South African Sediment Quality Guidelines (SQG) target value and as such, dredging of the sediment is not expected to represent an acceptable risk for environmental contamination and it is suitable for unconfined open water disposal.
- Highest concentrations of metals were consistently observed in the deeper muddy habitat (Zone A, site B2, R1, R3 and R4), while the sandy areas (B1, B3 and B4) as well as the Kabeljous Flats (with the exception of manganese) revealed lower metal concentrations.
- The Enrichment Factor levels for the metals of concern (Cu, Cr, Ni and Zn) were consistently low throughout the Kabeljous Flats, suggesting low levels of enrichment.
- The high enrichment of Cr and Cu observed in the deep-water areas (A1-5, B2, R3 and R4), suggests that contamination is not restricted to the series 600 and 700 berths (as per previous studies), but is expected to gradually radiate towards deep water areas away from the berths, e.g. at B2 and R3 and R4. The high Cr and Cu concentrations observed at these sites and at A1-5 therefore suggest that the source of the contamination is the series 600 and 700 berths.

<u>PAH in water and sediment:</u>

- PAH concentrations of all components at all sites were below detection limits for both water and sediments.
- Low perceived ecological risk from PAH concentrations in the water column and sediment.

<u>Whole Effluent Toxicity (WET) testing:</u>

- Toxicity of the water at all sites was very low, with >98% fertilization and development rates within sea urchins.
- Low perceived toxicity of water based on WET results.

10.4.2.2 Biotic components

<u>Macrophytes:</u>

- National vegetation types within the estuarine assessment's study area, include:
    - Mangrove Forest (Critically endangered);
    - Maputaland Coastal Belt (Vulnerable);
    - Subtropical Estuarine Salt Marshes (Least threatened); and,
    - Subtropical Dune Thicket (Least threatened).

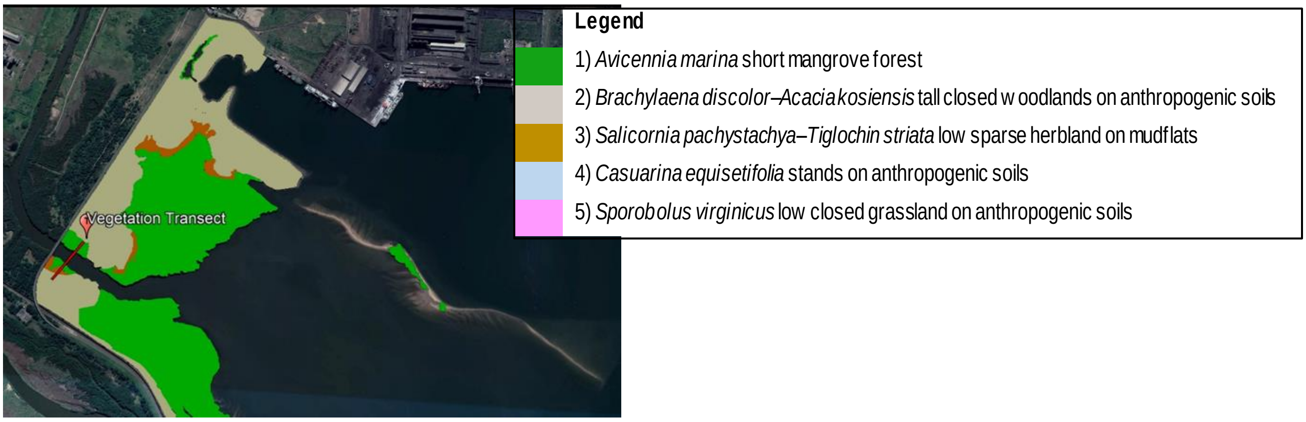


Figure 90: Macrophyte plant communities of the northern section of the estuarine study area

- Short mangrove forest areas: although species richness is very low, based on its ecological functionality it is considered to be of very high conservation value.
    - Dominated by the mangrove tree species *Avicennia marina*, covering 75% – 100% of the sample area.
    - Saplings of the **protected tree mangrove tree species *Bruguiera gymnorrhiza*** are colonising the more stable inland edges of the waterlogged mudflats of this plant community.
- *Brachylaena discolor–Acacia kosiensis* tall closed woodlands on anthropogenic soils: regarded to have a relatively low conservation value. A few individuals of the **protected tree species *Sideroxylon inerme* and *Mimusops cafra* were recorded.**
- *Salicornia pachystachya–Tiglochin striata* low sparse herbland on mudflats: plant community is relatively low. However, from an ecosystem function perspective, it is considered to be of very high conservation value.
- The short mangrove forest and herbland on mudlats plant communities are of international importance to conservation because they form part of the Maputaland–Pondoland–Albany biodiversity hotspot, which is listed as one of the world's 36 most important biological hotspots, it forms the southern limit of the Maputaland Centre of Endemism.
- Mangrove Forest vegetation types are considered to be Critically Endangered due to the steady loss of these ecosystems.
- At a plant species level, the **protected tree species *Bruguiera gymnorrhiza*, *Ficus trichopoda, Sideroxylon inerme* and *Mimusops cafra*** were recorded during this study.

Nematodes:

- The nematode densities recorded are, in general, higher than most studies with similar conditions. It is possible that the high densities recorded are because this represents a once-off sampling event during the summer months as compared to published studies which usually record information over several seasons. Many studies reported higher densities during the summer than winter months.
- The genus and family richness encountered within this study was comparable with several other studies globally but diversity in Richards Bay Harbour was relatively lower than reported elsewhere.
- All sites were dominated by c-p 2 class nematodes. These are considered colonisers and hence tolerant of a wide range of environmental conditions and disturbances. This indicates that all sites are likely to be in some way anthropogenically impacted.
- The dominance of non-selective deposit feeders at nearly all sites is expected in organically loaded muddy sediments, but may also indicate that the study area is widely impacted.
- The dominance of Axonolaimidae (comprising mainly *Axonolaimus* and *Parodontophora*) at most sites (but *Dorylaimopsis* at Site 24 and *Bathylaimus* at Sites 4 and 21) indicates that the entire study area is to some degree impacted as these taxa are regarded as indicators of environmental stress.
- When diversity is low and the relative abundance of taxa known to be indicators of anthropogenic stresses is high, one can safely conclude that these habitats are potentially at risk. Site 24 is strongly dominated by the colonising predator *Dorylaimopsis*, which is known to be tolerant of organic enrichment and heavy metal contamination.
- The overall ecological status of the system ranks from poor to moderate with three sites rated as bad (Figure 91). This status of this system is comparable with studies of other impacted harbour systems worldwide.

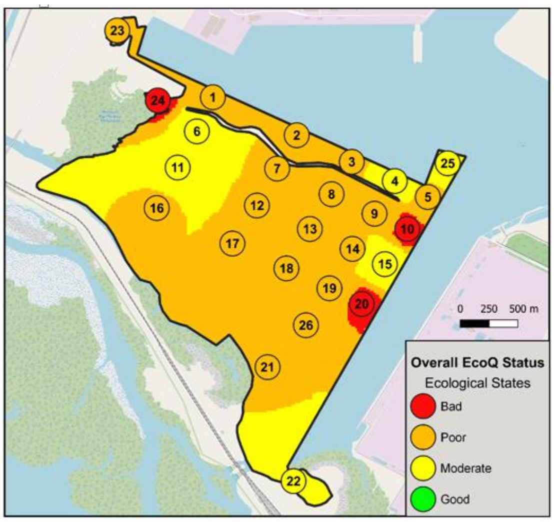


Figure 91: The overall ecological quality status based on nematode metrics as per Moreno *et al.* (2011) and expert assessment of site scores in each category.

Macrobenthos:

- The macrobenthic community was completely dominated by polychaetes (53 taxa), which accounted for 59% of all taxa recorded. This was followed by molluscs (26 taxa – 11.8%) and crustaceans (15 taxa – 20%). The abundance of crustaceans was dominated by the mudcrab *Paratylodiplax blephariskios*.
- The mudcrab was most abundant in the deeper waters of Zone A and at sites R1 & R4. The crab was only recorded on the Kabeljous Flats in relatively low numbers, with the possible exception of D1 (Site 16). The relatively high abundance of this keystone macrobenthic species in deep off-channel habitat (Zone A) has not previously been observed. In a recent survey, Cyrus and Vivier (2020) found the mud crab in high numbers in the lower Bhizolo and Manzamnyama canals, but not in the upper intertidal ends of the two canals. A similar pattern was observed during a survey of the canal system in 2012 (Vivier 2012).
    - The abundance of this crab in Zone A means that dredging for the proposed development will affect the population of this species in these areas. The distribution of the crab is, however, not restricted to this zone and recovery of the population is expected to occur over time.
- The majority of taxa were most abundant in Zones C-E (i.e. on the Kabeljous Flats). Highest species richness and species diversity in the Kabeljous Flats zones (notably Zone C) compared to Zones A and B, are of high ecological significance. This is regarded as an indication of the ecological importance of the Kabeljous Flats. Of particular significance is the fact that highest species richness and species diversity were observed in Zone C, the shallow intertidal zone (Figure 92).

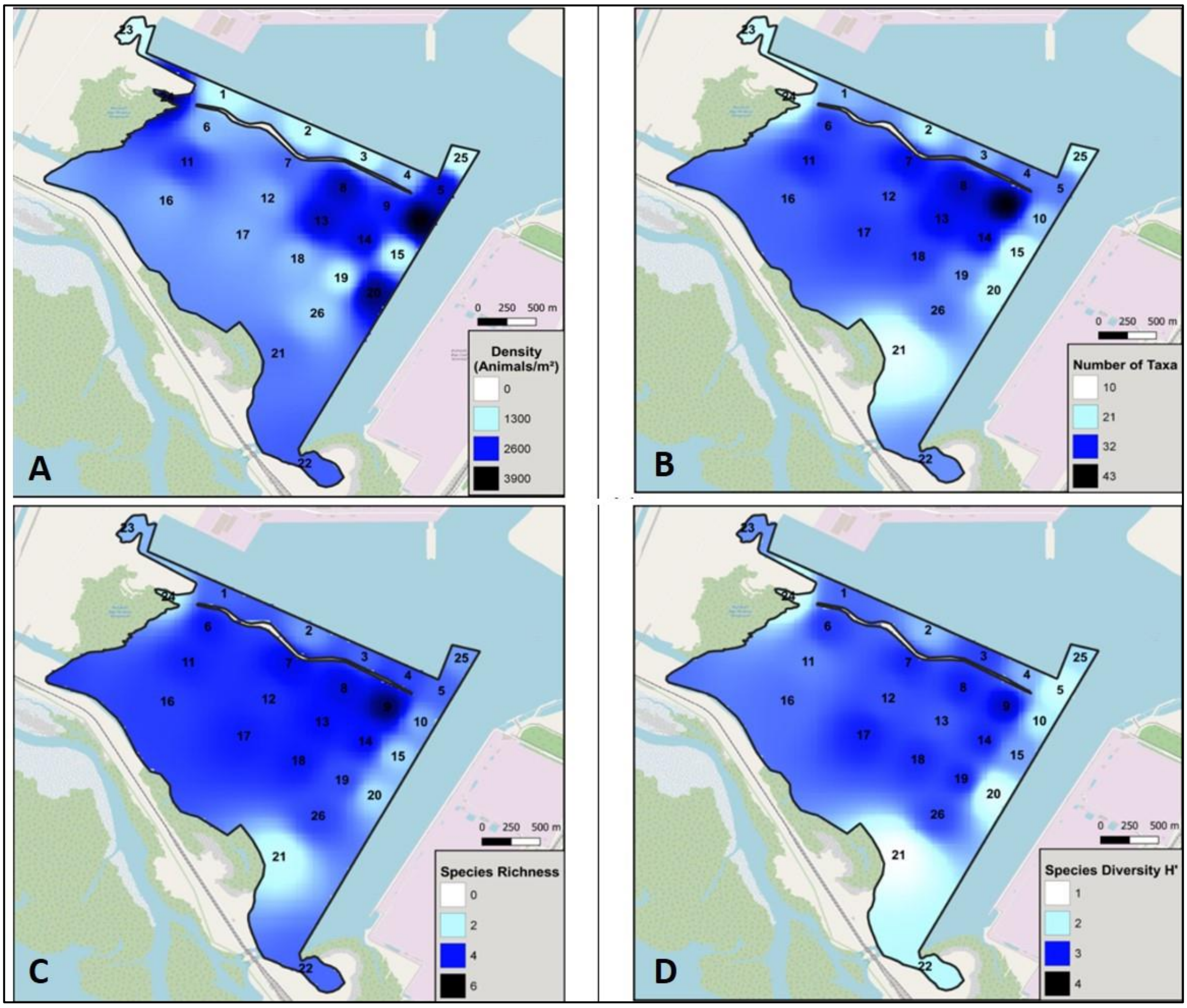


Figure 92: GIS plots of a) macrobenthic density, b) number of taxa, c) species richness (D) & d) species diversity (February 2020)

- The macrobenthic community structure of the Kabeljous Flats (Zones C, D and E) differ significantly from all other areas sampled (Zones A, B and R) and as such, the Kabeljous Flats support a unique macrobenthic community distinct from the surrounding areas. Any habitat transformation in the northern section of the Kabeljous Flats could result reduced macrobenthic diversity.
- The highest frequencies of Category I taxa (most sensitive) were observed in Zones C, D and E, together with sites B1, B3 and R3. The relative abundance of sensitive taxa in these areas suggest good quality macrobenthic habitat that can support many sensitive species. Zones C-E also contained a higher frequency of Category II taxa, compared to Zones A, B and R. In contrast, the frequency of sensitive taxa in Zone A sites was relatively low, indicating poorer quality macrobenthic habitat. Zone A sites, together with B2 and B4 (Zone B) and R1 and R3 (reference sites) were dominated by Category III-IV taxa. R1 and R3, in particular, were dominated by Category III-IV taxa, with very low representation of Category I and II taxa, suggesting that these areas were dominated by relatively tolerant taxa.
    - Even though Zones C-E were dominated by Category I-II taxa, some of these sites (e.g. C2, C4 and D3) also contained a surprising high frequency of Category V taxa, suggesting that the macrobenthic habitat quality on the Kabeljous Flats did not reflect pristine conditions. Similarly, C2, C3 and D3 also contained a high frequency of Category IV taxa, providing further evidence that the macrobenthic habitat quality on the Kabeljous Flats was not near-pristine.

- The M-AMBI assessment incorporates not only the relative sensitivity of taxa to habitat disturbance, but also species richness and species diversity and is therefore a better indication of the overall status of the macrobenthic community and macrobenthic habitat quality.
  - The macrobenthic habitat quality of all Kabeljous Flats sites (Zone C, D and E) classified as high.
  - Zone C showed the highest mean M-AMBI scores, followed by Zones D and E.

Macrocrustacea/ Prawns:

- Low prawn diversity, with only six species recorded, of which only three are penaeid prawn species.
- Very low abundance of prawns across the Kabeljous Flats, with only one species (*M. monocerus*) in low numbers at C1.
- The very low catch of a previously highly abundant species, *A. erythraeus*, is a concern, as this suggests a marked decline in the population size of this pelagic prawn.

Ichthyofauna/ Fish:

- Of the 41 species caught in the study area, 78.1% (32 species) are in one way or another dependent on having access to an estuarine environment in order to be able to complete their life cycle. Within this group 12 species, 29.3% of all species caught are totally dependent on the area which provides a nursery ground for them.
- A review of the size ranges of the 41 species caught clearly shows that the vast majority of individuals caught during sampling were juveniles. This supports other studies which have indicated that the harbour plays a major role as a nursery habitat for Estuarine Dependent marine fish.
- Based on the current and past surveys the fish fauna of the area currently comprises a total of 69 species, 10 are endemic to SA and there are 6 species listed as threatened in terms of their IUCN status.

Avifauna/ Birds:

- The importance of Richards Bay Harbour/uMhlathuze Estuary complex for aquatic avifauna may be summarized as follows:
  - Turpie (1995) analysed the waterbird data from 42 estuarine systems as a means of prioritizing SA estuaries for conservation importance. The Richards Bay Harbour/uMhlathuze Estuary complex was ranked 3rd on the Abundance rating, 3rd on the Conservation Value Index, 2nd on the Endemism Index and 1st on the Population Size index.
  - Turpie *et al.* (2002), in a national conservation status and ecological importance study of all estuaries in South Africa, concluded that the Richards Bay Harbour/uMhlathuze Estuary complex ranked no less than 3rd nationally in terms of its importance to waterbird populations (after the St Lucia and Berg River Systems).
  - The uMhlathuze Estuary is a registered southern African Important Bird Area (IBA).
  - Under the Ramsar Convention, sites can also qualify as Wetlands of International Importance if they regularly support at least 1% of the individuals in a population of one species or subspecies of waterbird. The Richards Bay Harbour/uMhlathuze Estuary complex has seven regularly occurring waterbird species that meet this requirement, each of which would therefore qualify the site as a Wetland of International Importance, although the Richards Bay Harbour/uMhlathuze Estuary complex is not officially identified as a RAMSAR site. These species are: Great White Pelican, White-breasted Cormorant, White-backed Duck, White-fronted Plover, Caspian Tern, Common Tern and Whiskered Tern (Allan 2009).
  - In terms of the Conservation of Migratory Species, notably the conservation of African-Eurasian Migratory Waterbirds, 78 of the 109 waterbirds (72%) regularly recorded at Richards Bay Harbour/uMhlathuze Estuary complex has been recognized as of conservation importance. Of these, 11 species that are common in Richards Bay, have been recognized as of greatest relative concern in terms of international conservation status, including the African Spoonbill, Greater Flamingo, Lesser

Flamingo, White-backed Duck, Chestnut-banded Plover, Broad-billed Sandpiper, Eurasian Curlew, Pied Avocet, Caspian Tern, Swift Tern and Lesser Crested Tern.
  - Of the 29 waterbird species that appear in the South African Avian Red Data book, the Richards Bay Harbour/uMhlathuze Estuary complex support 19 (66%) species, this being 17% of the 109 waterbird species regularly recorded at Richards Bay.
- A total of 33 waterbirds were recorded during all fieldtrips to the study site, with the maximum count yielding a total of 801 individuals. The most important groups were the Palearctic migrant waders and the terns and gulls.
- A total of 44 terrestrial bird species were recorded in the mangroves and adjoining vegetation.
- Thus, a total of 77 bird species recorded in the study area, including a total of **six Red Data species**, of these, the **Mangrove Kingfisher**, a mangrove specialist, is Nationally Endangered, whilst the Eur**asian Curlew and Curlew Sandpiper** are Globally Near-threatened and the **Great White Pelican, Pink-backed Pelican and Caspian Tern** are classified as Nationally Vulnerable.
- The waterbirds present in the area essentially comprise two groups, wading birds, that feed in association with the rising and falling tides (e.g. plovers, sandpipers & herons) and those that use the Sandspit for roosting after feeding in the harbour area or out at sea (e.g. terns, gulls, kingfishers & pelicans).
- Some 65% of the species utilizing the Sandspit are nonbreeding migrants (waders & terns) from the northern Hemisphere which spend the summer in southern Africa and return to breed during our winter months.
- In terms of waterbirds annually present in the Richards Bay Harbour/uMhlathuze Estuary Complex the Sandspit/Kabeljous Flats provides habitat for some 25% of the total number of birds representing 75% of the total number of species.
- Based on the overall count and observations during all fieldtrips to the study site, the Sandspit is still by far the most important waterbird site within the Port of Richards Bay.
- Study limitation: this study is based on a one-off set of samples collected in February 2020 and it is possible that some waders and terms may already have started their migration northward before the counts, resulting in an undercount of numbers and species utilizing the Kabeljous Flats/Sandspit area. The only other data available and which was used for this assessment was collected 12 and 19 years ago.

10.5 HYDRODYNAMIC MODELLING STUDY

WSP Ports and Maritime completed the dredging and dredge spoil disposal modelling study (hydrodynamic modelling study) focused on the prediction of potential turbidity, smothering and shoreline impacts associated with dredging and dredge spoil disposal activities. In addition, their professional opinion was sought on the likely impacts of the proposed power evacuation route and bridge design on hydrodynamic processes and benthic habitats. This section summarises the key aspects of their studies. Please refer to Appendix 6 for the full reports.

10.5.1 DESCRIPTION OF DREGING ACTIVITIES

10.5.1.1 Areas and volumes to be dredged

Figure 93 illustrates the areas to be dredged to allow sufficient draft for the Floating Power Barges and LNG carriers/ vessels. More recent estimates indicate a reduced *in situ* total dredge volume of ~ 104 725 m^3 for the power barge berths, meaning that the use of the dredge quantities (Figure 93) comprises a conservative approach to the impact assessment.

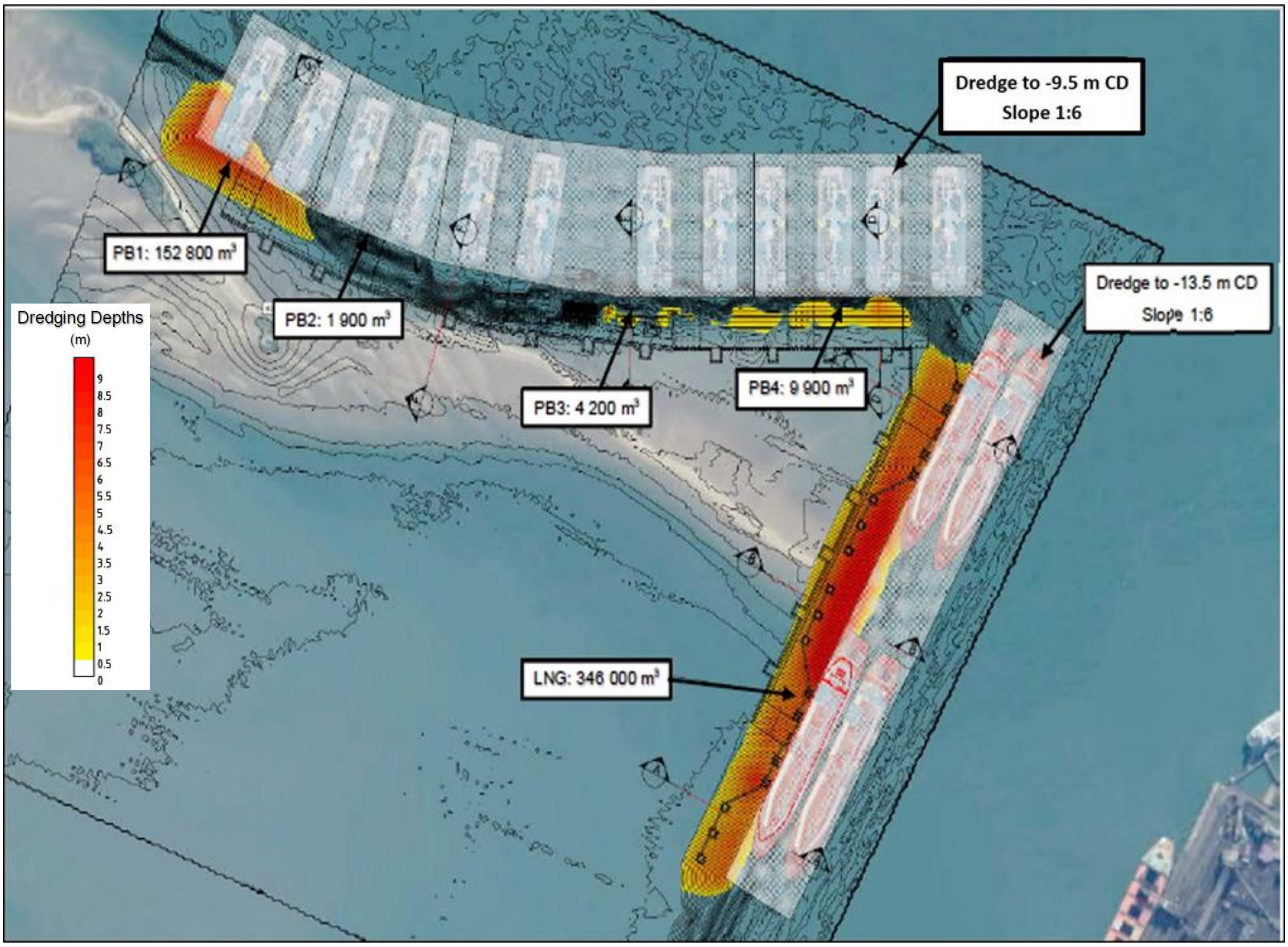


Figure 93: Areas to the dredged and associated dredging depths and volumes of material.

10.5.1.2 Physical grain size of material to be dredged

The physical characteristics of the in-situ dredge material assumed for the modelling study is summarised in the table below. The quality of the material has been estimated from a number of sources: previous geotechnical surveys and analyses, geophysical survey data for this project, analysis of surficial sediment samples for this project and previous dredging studies.

Figure 94: Physical characteristics of the dredged material – input into the hydrodynamic modelling study

Dredge Area	LNG Berths	Power Barge Berths
In-situ dredge volume	346 000 m³	168 000 m³
Sand (d50 ~ 125 to 150 µm)	20 %	90 %
Muds (silt and clays)	80 %	10 %

10.5.1.3 Dredging technology

The preferred dredging technology to be utilised is determined by, amongst other factors; the dredgeability of the sediments, the volumes of material to be dredged, the physical constraints associated with the dredging location, required dredging accuracies and environmental considerations, and as such the following is recommended and the modelling based on these recommendations:

- a Trailing Suction Hopper Dredger (TSHD) is deployed for the dredging of the LNG berths. It will need to sail to the offshore dredge spoil disposal site to discharge dredge spoil. This will result in an effective dredging rate over the duration of the dredging activities that is significantly less than the maximum possible in situ dredging rate of the TSHD.

- a Backhoe Dredger (BH) be deployed to dredge the power barge berths and that this material be disposed of on the northern shoreline due to its expected high sand content. The BH dredge material, although likely to remain consolidated in the hopper, will not remain so as it will be discharged via the existing dredge spoil discharge system that pipes the spoil to the upper beach at Alkanstrand.

10.5.1.4 Dredging rates and sediment loadings

The parameters used to determine the dredging rates and durations for the two dredge areas and associated dredge technologies are summarised in Table 62. The estimated dredging rates and sediment loadings at the dredging location and the dredge spoil locations are summarised in Table 63 and Table 64, respectively.

Table 62: Parameters used to determine dredging rates and associated dredging durations.

PARAMETER		LNG BERTHS	POWER BARGE BERTHS
Volume of material to be dredged		346 000 m^3	168 000 m^3
Sediment characteristics	Sand (d50 ~125 to150 µm)	20 %	90 %
	Muds (silt and clays)	80 %	10 %
In-situ density of dredge material	Wet/bulk density	1 646 kg/m^3	1 955 kg/m^3
	Dry density	1 014 kg/m^3	1 516 kg/m^3
In-situ density of Material in hopper	Wet/bulk density	1 457 kg/m^3	1 522 kg/m^3
	Dry density	705 kg/m^3	811 kg/m^3
Hopper Size		2 850 m^3	1 350 m^3
% Hopper fill (by volume of in-situ dredge volumes)		69.0 %	80%
% Hopper fill (% volume comprising dry material)		26.6 %	30.6 %
In- situ dredge volume per cycle		1 980 m^3	1 080 m^3
Instantaneous (max) dredging rates		~ 500 m^3/h^{*2} (small TSHD)	~ 200 m^3/h (small backhoe)
Assumed instantaneous dredge rates		515 m^3/h	191 m^3/h
Loading time		3.85 h	5.65 h
Discharge time		6 minutes	~ 15 minutes
Total Cycle Time Loading time Travel, coupling/de-coupling & positioning time Discharge time		5.48 hour 3.85 hours 1.53 hours 6 minutes	7.84 hours 5.65 hours 1.93 hours ~ 15 minutes
Production rate (assuming 24/y operation)		361 m^3/h	191 m^3/h (138 m^3/h)
Assumed operational hours per week		~ 135	~120
Effective daily dredge rate		6 934 m^3/day	3 234 m^3/day
Dredge cycles per day		3.5 cycles/day	3.0 cycles/day
Total number of dredge cycles		175	157
Dredging duration		7.12 weeks	7.46 weeks

Table 63: Dredge rates and associated sediment and metal loadings at the dredging location

PARAMETER	LNG BERTHS	POWER BARGE BERTHS
SEDIMENT LOADING AT THE DREDGING LOCATION		
Dredge Technology	TSHD	BH
In-situ material in each hopper load	1 980 m^3	1 080 m^3
Time taken to load hopper	3.85 hours	5.65 hours
Instantaneous dredging rate during active dredging (m^3 of *in situ* dredge material / s)	515 m^3/h	191 m^3/h
	0.143 m^3/s of in situ dredge material	0.053 m^3/s of in situ dredge material
Dry density of *in-situ* dredge material	1 014 kg/m^3	1 516 kg/m^3
Dredging rates (kg dry material/s)	144.861 kg/s	80.485 kg/s
Sediment loading at the dredge head (kg dry material /m^3 of *in-situ* material dredged)	12 kg / m^3 dredged	10 kg / m^3 dredged
Sediment loading rate at the dredge head (kg dry material / s)	1.714 kg dry material/s	0.531 kg dry material/s
Sediment loading due to hopper overflow (kg dry material /m^3 of *in-situ* material dredged)	15 kg / m^3 dredged	15 kg / m^3 dredged
Sediment loading rate at the hopper overflow (kg dry material /s)	2.143 kg dry material/s	0.796 kg dry material/s
Total metal concentration in sediments (mg/kg of dry weight of *in-situ* dredge material)	301.14 mg/kg	300.74 mg/kg

% of metals in the sediments assumed to be released and remain dissolved in the water column	0.5%	0.5%
Metal loading at the dredge head (mg/kg of dry weight of *in-situ* dredge material)	1.506 mg/kg	1.504 mg/kg
Metal loading rate at the dredge head (kg metals /s)	2.58 x 10^{-6} kg/s	0.80 x 10^{-6} kg/s
Metal loading rate due to hopper overflows (kg metals /s)	3.23 x 10^{-6} kg/s	1.20 x 10^{-6} kg/s

Table 64: Dredge rates and associated sediment and metal loadings at the dredge spoil discharge location

PARAMETER	LNG BERTHS	POWER BARGE BERTHS
SEDIMENT LOADING AT THE DREDGE SPOIL DISPOSAL LOCATION		
Dredge Technology	TSHD	BH
Dredge spoil location	Offshore disposal site	Northern shoreline
In-situ material in each hopper load	1 980 m^3	1 080 m^3
Time taken to discharge dredge spoil from hopper	~ 6 minutes	~ 15 minutes
Instantaneous discharge rate during active dredge spoil disposal (m^3 of *in situ* dredge material / s)	19 808 m^3/h	4 267 m^3/h
	5.502 m^3/s of in situ dredge material	0.053 m^3/s of in situ dredge material
Dry density of dredge material	1 014 kg/m^3	1 516 kg/m^3
Dredging spoil disposal rates (kg dry material/s)	5 579.11 kg/s	1 796.50 kg/s
Sediment loading into the water column (% of kg dry material in the dredge spoil)	10% of muds dredged (8% of all material dredged)	100% of muds dredged (10% of all material dredged)
Sediment loading into the water column (muds) (kg dry material /s)	446.33 kg dry material /s	179.65 kg dry material /s
Sediment loading on the seabed (kg dry material/s) sand mud	 1 115.82 kg dry material/s 4 016.96 kg dry material/s	 1 616.83 kg dry material/s 0.00 kg dry material/s
Total metal concentration in sediments (mg/kg of dry weight of *in-situ* dredge material)	301.14 mg/kg	300.74 mg/kg
% of metals in the sediments assumed to be released and remain dissolved in the water column	0.5%	0.5%
Metal loading at the spoil disposal site (mg/kg of dry weight of *in-situ* dredge material)	1.506 mg/kg	1.504 mg/kg
Metal loading rate at the spoil disposal site (kg metals /s)	8.40 x 10^{-3} kg/s	2.70 x 10^{-3} kg/s

Key notes:

- BH dredging rates and associated sediment loadings are based on the assumption that the BH loads dredge spoil into one of two available independent hopper barges and therefore the dredge rates are not affected by sailing times to the existing dredge spoil discharge system. This, however, not the case for the TSHD where the effective dredge rate is reduced due the time spent sailing to and from the offshore dredge spoil disposal site.
- Relatively high discharge rates were assumed for dredge spoil discharges onto the Alkanstrand Beach in the modelling study. These may, however, be too conservative should local dredgers be used. The modelled TSS concentrations reported in the time series could, then be, an estimated factor of 2 or more times too high in close proximity to the dredge spoil discharge location (Alkanstrand Beach) and just to the north of this location, thus the modelling results for discharges onto the northern beaches are indicative of a very worst-case scenario in terms of likely dredging rates.
- Loadings assumed in the study are not necessarily the loads entering the environment, but rather are the assumed loads used in the far-field model (i.e. typically the sediment loads that remain in the water column at the end of the near-field).

10.5.1.5 Dredge spoil disposal sites

The shoreline discharge of dredge spoil has occurred at three locations (Figure 95), namely beaches to the south of the uMhlathuze Estuary mouth, on the Central Beach between the uMhlathuze Estuary mouth and the entrance to the Port of Richards Bay and onto the beaches to the north of the Port entrance. The offshore disposal of dredge material from both capital and maintenance dredging, has occurred at a number of offshore dredge spoil disposal sites. Presently the official dredge spoil disposal site is Site D. This is the location at which the dredge spoil from the Berth 306 development project were disposed and also the dredge spoil location assessed for the Port of Richards Bay Capacity Expansion project and for this proposed Project.

Figure 95: Location of key features in and around the Port of Richards Bay. The dredge spoil disposal site located on this map corresponds to Site D currently used for Port dredging capital projects.

The dredge volumes for this Project (514 000 m^3) typically is 25% to 50% of the annual Port maintenance dredging volumes (that over the long-term averages ~ 1 510 000 m^3 for the period 1980 to 2003). Furthermore, the proposed dredge spoil volumes to be disposed of at the offshore dredge spoil disposal site for this Project (346 000 m^3), is roughly 40% of the average annual volume of dredge spoil from maintenance dredging (855 100 m^3 for the period 1980 to 2003) being discharged annually at the offshore dredge spoil disposal site. Similarly, the dredge spoil volumes to be disposed of on the northern shoreline (168 000 m^3) for the NIFPP project are roughly 28% of the volume of dredge spoil from maintenance dredging (625 000 m^3 for the period 1980 to 2003) being discharged annually at Alkanstrand (i.e. on the northern shoreline).

10.5.2 ENVIRONMENTAL QUALITY OBJECTIVES

The environmental quality objectives for this study have been specified in terms of water and sediment quality guidelines. The guidelines relate to potential visual impacts, ecological impacts of elevated turbidity in the water column and potential toxicological effects associated with the dredging of contaminated sediments; however, no clear guidelines exist for smothering effects and changes in grain sizes in benthic habitats.

10.5.2.1 Water Quality Guidelines

The water quality guidelines deemed relevant to this study are:

- The South African Water Quality Guidelines (SAWQG) for Coastal Marine Waters (Natural Environment) (DWAF, 1995, Table 65) are utilized to determine the maximum upper limits for dissolved trace metals in the water column and as an initial guideline for suspended sediments in the water column;
- Water quality guidelines for suspended sediment concentrations in the water column from dredging activities relevant to the west coast of southern Africa (EMBECON, 2004);

- Site-specific thresholds of concerns for the Port of Richards Bay and surrounds developed in the turbidity baseline study (CSIR, 2013c) for the Port of Richards Bay Capacity Expansion project dredging studies;
- Guidelines in the Operational Environmental Management Plan (TNPA, 2009) for dredging in the Port of Ngqura; and,
- Guidelines for TSS concentrations for possible use in situations where insufficient data exists to develop a robust statistical characterisation of ambient or background conditions (i.e. the CCME (2002) guidelines for TSS concentrations in the water column as reported in the proposed new SAWQG (DEA, 2018).

Table 65: Water Column: Recommended SAWQG or target values for the protection of marine ecosystems DWA (1995).

CONSTITUENT	TARGET VALUE
The following target values apply to marine waters outside a specific sacrificial zone:	
Colour/ turbidity/ clarity	Should not be > 35 *Hazen units* above ambient concentrations (colour). Should not reduce the depth of the euphotic zone by more than 10% of ambient levels measured at a suitable control site (turbidity).
Suspended solids	Should not be increased by more than 10% of ambient concentrations. This is largely based on aesthetic impacts.
Dissolved oxygen (DO)	DO should not fall below 5 mg/ℓ (99% of the time) and below 6 mg/ℓ (95% of the time).
Ammonium, Nitrate, Nitrite, Phosphate, Silicate	Waters should not contain concentrations of dissolved nutrients that are capable of causing excessive or nuisance growth of algae or other aquatic plants or reducing DO concentrations below the target range indicated for *DO* (see above).
Ammonia	20 µg N per litre (as NH_3) or 600 µg N per litre (as NH_3 plus NH_4^+)
Arsenic (As)	12 µg/ℓ
Cadmium (Cd)	4 µg/ℓ
Chromium (Cr)	8 µg/ℓ
Copper (Cu)	5 µg/ℓ
Lead (Pb)	12 µg/ℓ
Mercury (Hg)	0.3 µg/ℓ
Nickel (Ni)	25 µg/ℓ
Zinc (Zn)	25 µg/ℓ

The guideline for suspended solids (Table 65) is not believed to be appropriate. Of greatest relevance, to Richards Bay are the thresholds identified in CSIR (2013c) that, if exceeded, would require management of dredging activities to reduce the turbidity and suspended solid concentrations to below these thresholds.

- Turbidity of 93 NTU or TSS concentrations of 142 mg/ℓ for location in the Bhizolo Canal or on the mudflats;
- Turbidity of 66 NTU or TSS concentrations of 100 mg/ℓ for all other locations in the Port of Richards Bay;
- Turbidity of 10.2 NTU or TSS concentrations of 16.4 mg/ℓ for offshore location in the vicinity of the dredge spoil disposal site. There however, exist some concerns around the validity of this threshold due to the limited temporal resolution of the profiling data used to derive this threshold and a likely resultant bias in the data towards lower values.

In assessing potential aesthetic (visual) effects, a conservative guideline of 10 mg/ℓ elevation in suspended sediments in the upper water column has been assumed for a threshold above which plumes are likely to be visible in the marine environment (i.e. to assess potential aesthetic impacts). This is an appropriate guideline in offshore waters influenced by the Agulhas Current. However, in the nearshore waters off Richards Bay, sediment inputs due to upstream estuary inflows, erosion of the coastline and even from the outfalls in the region, can lead to significantly more turbid waters. Thus, a less conservative guideline of 25 mg/ℓ has also been used in the assessments of potential visual impacts of turbid plumes associated with dredging or dredge spoil disposal activities along the northern shoreline.

The model has been set up to simulate dissolved Cu, Cr and Zn concentrations in the water column under a conservative assumption that 0.5% of the trace metal concentrations contained in the sediments being dredged are released into the water column. This was based on the following:

- Metal contamination in the surficial sediments sampled at areas proposed for dredging indicates that, for the metals listed as part of the South African National Action List (Table 66), the largest trace metal concentrations in the sediments are for Cu, Cr and Zn;
- Previous studies have indicated that only 0.2% of the trace metal concentrations in the sediments being dredged typically enter the water column and that it is highly likely that the trace metals at the most seriously contaminated sites in the Port are likely to be in particulate form rather that the metalsorbed form (only the metal-sorbed form can be remobilised into the water column during dredging); and,
- Only the surficial sediment (that form a very small percentage of the material proposed to be dredged), are contaminated.

The model results have been assessed for potential toxicological effects of trace metals in terms of achievable dilutions of trace metals and the extent to which there would be compliance with the existing SAWQG.

10.5.2.2 Sediment Quality Guidelines

South Africa is a signatory to the London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (1972) (the London Convention) and to the 1996 Protocol to the London Convention (the London Protocol), and the NEMICMA gives effect to their provisions. As per the conditions, a National Action List that comprises a number of Action Levels and associated sediment quality guidelines (Table 66) are used to make decisions of whether sediment proposed to be dredged is of a suitable nature for unconfined, open water disposal. Sediment with metals at concentrations ≤ Level I is taken as posing a low risk to bottom-dwelling organisms and is suitable for unconfined open water disposal. Sediment with metals at concentrations ≥ Level II is taken as posing a high risk to bottom dwelling organisms and in the absence of other information to refute this conclusion, is considered unsuitable for unconfined open water disposal.

Table 66: Sediment quality guidelines used to determine whether sediment identified for dredging in South African coastal waters is of a suitable quality for unconfined open water disposal.

Metal	Warning Level	Level I	Level II
Arsenic	42	57	93
Cadmium	1.2	5.1	9.6
Chromium	135[a]/250[b]	260	370
Copper	110	230	390
Mercury	0.43	0.84	1.5
Nickel	62[a]/88[b]	140	370
Lead	110	218	530
Zinc	270	410	960
a - for Eastern and Western Cape, b - for KwaZulu-Natal			

10.5.3 APPROACH & METHOD

The dredging scenario assumed for the modelling study comprises:

- Dredging of the power barge berthing areas using a backhoe dredger where the material to be dredged (168 000m^3) comprises predominantly sands and therefore is planned to be discharged via the ports existing maintenance dredging facilities onto the northern beaches (i.e. a discharge onto Alkanstrand Beach located just to the north of the port entrance); and,
- Dredging of the LNG berths using a trailing suction hopper dredger where the material to be dredged (346 000m^3) is considered to comprise mainly silts and clays and therefore will be disposed of at the offshore dredge spoil disposal site.

The environmental scenarios for the modelling study comprise:

- A late winter/early spring period representing a period of high swell conditions and strong SW winds and a typically well-mixed water column; and,

- A summer period of low swell conditions and an increased NE wind conditions and a typically more stratified water column.

A coupled wave-hydrodynamic-morphology model has been used to inform potential impacts associated with:

- Elevated turbidity and smothering effects due to dredging and dredge spoil disposal activities, and;
- Possible long-term changes in hydrodynamic flow and wave conditions and possible consequent changes in flushing rates of benthic habitats (i.e. operational phase post dredging).

The assumed dredging scenario has been simulated for a representative range of environmental conditions (stated above), the dredging scenarios having a duration of 61 days and those related to changes in hydrodynamic flow and wave conditions having a more limited duration of 42 days.

10.5.3.1 Bathymetry

The bathymetry used in the modelling study is that used for the recent Port of Richards Bay Capacity Expansion dredge modelling study, supplemented by a high-resolution bathymetry supplied for this study.

10.5.3.2 Wave Simulations

The waves for the modelling study are simulated, refer to the specialist report for detailed information. Included in the model simulations are locally generated seas both in the offshore and within the Port of Richards Bay, as it is expected that wave generated turbulence and resultant enhanced bottom stresses are likely to be important over the tidal flats.

10.5.3.3 Hydrodynamic simulations

The objective of the hydrodynamic flow modelling is to accurately simulate the flow both within the Port of Richards Bay and those in the offshore region that will influence the re-suspension and re-distribution of sediments from the dredge spoil disposal sites. Considering that the main forcings of water movement are wind, waves, tides, the Agulhas Current and to a lesser extent water column stratification; the following processes need to be adequately simulated in the hydrodynamic model:

- Tidal forcing;
- Wind forcing;
- Wave forcing in the surf-zone;
- The influence of the Agulhas Current;
- Baroclinic effects (i.e. on currents and vertical mixing), insofar as they affect vertical shear in horizontal velocities;
- The effect of the earth's rotation (Coriolis force); and,
- Combined bed shear stresses due to currents and waves.

Since many of these processes are strongly three-dimensional, a three-dimensional hydrodynamic model was used. Please refer to the specialist report for details of model set up and calibration.

10.5.3.4 Sediment transport simulations

The sediment transport and morphological simulation capability of the 3-D hydrodynamic model was used to determine sediment concentrations, sediment transport rates (suspended and bedload) and morphology of cohesive and non-cohesive sediments. Please refer to the specialist report for details of model set up and calibration.

10.5.3.5 Assumptions & limitation of the modelling study

The assumptions made in the modelling study and the limitations of the modelling study are as follows:

- The project description is as provided at the commencement of the study. Should this change significantly this may affect the validity of the model outcomes;
- There exists a degree of uncertainty around the exact physical nature of the material to be dredged from the power barge berths. There exists an outside possibility that the percentage of fines in the material dredged in the power barge berths could be greater that specified for this study. Should this be the case, this could lead to increased turbidity at the dredge spoil disposal site at Alkanstrand Beach. However, it is not expected that the resultant changes in turbidity will be of a sufficient magnitude to change the conclusion of the study, unless the percentage fines are significantly different to that specified, which is deemed highly unlikely;
- The model calibration is adequate for the purposes of this study. To the extent that there exist discrepancies between measured data and modelled result, the discrepancies, in general, result in a more conservative assessment (i.e. flows are over-predicted leading to greater potential for re-suspension of sediments and therefore elevated water column turbidity); and,
- The assumed behaviour of sediment in the model is based on a number of parameterisations that have associated with them a degree of uncertainty. These parameters have been selected based on observed water column turbidity measurements of a previous capital dredging operation in the region (Berth 306 development in 2005 to 2006) that suggested a much lower rate of re-suspension of sediments and redistribution of dredge spoil from the offshore dredge spoil disposal site that predicted by previous modelling studies. Model sensitivity studies indicate that changes in the modelling outcomes using a range of probable parameterisations are of a nature that they are unlikely to affect significantly the conclusions drawn from the analyses of the model results.

10.5.4 MODELLING RESULTS

10.5.4.1 Visual Impacts from TSS in surface waters

Potential visual (aesthetic) impacts are associated with the generation of visible sediment plumes and the following summarises the main findings of the modelling study:

- Visual impacts within the Port and at the offshore dredge spoil disposal site (based on a 10 mg/ℓ threshold, visual impacts extend both 2.5 km SW and NE for ≈ 5-10 days in a season) are predicted to be limited; and,
- Dredge spoil disposal along the northern shoreline (i.e. a discharge onto Alkanstrand Beach) will cause chronic elevations of TSS concentration in the inshore waters. Based on a 25 mg/ℓ threshold, the visual impacts are both persistent and extensive and are predicted to extend to just beyond Kleiklip Klofie for 30-50 days per season.
    - Despite comprising finer material than the maintenance dredging spoil, the impact is expected to be indistinguishable from those associated with the maintenance dredging; and,
    - The impact is likely to be partly offset by the resultant reduction in shoreline erosion and the high fines loads entering the nearshore region from continual erosion along the shoreline.

10.5.4.2 Impacts from TSS in the water column

Findings are highly summarised, kindly refer to the specialist report for maps and time-series plots for more detailed information.

- Limited to no impacts associated with the elevation of TSS concentrations in the water column are expected within the Port where such impacts are predicted to be confined to the immediate vicinity of the areas being dredged.
    - Based on a threshold of 20 mg/ℓ no exceedances in surface waters, however, it is exceeded in the bottom waters but only in the areas being dredged and typically for 5-10 days per season, rising to between 10-20 days or even as much as 30 days on the steeper slopes of the areas being dredged.

    - Typically between 1.5 mg/ℓ and 2.0 mg/ℓ but always < 4 mg/ℓ for two sites on the mudflats adjacent to the dredging sites.
    - Threshold of 80 mg/ℓ is never exceeded in either the surface or the bottom waters.
- Limited exceedance of the relevant water quality guidelines occurs in the surface waters surrounding the offshore dredge spoil disposal site.
    - Exceedance of a 20 mg/ℓ threshold for a cumulative total of < 2 days per season in late winter/spring but less than one day in summer.
    - The contour plots of (cumulative) days of exceedance of an 80 mg/ℓ threshold indicate that this threshold and higher thresholds of 100 mg/ℓ and 150 mg/ℓ are not exceeded.
- The exceedance of thresholds of concern in the bottom waters is constrained to within 500-750 m beyond the immediate confines of the offshore dredge spoil disposal site.
    - The 20 mg/ℓ threshold,
        - at a distance of 2 km to the SW and NE is exceeded for up to a cumulative period of 5 days in a season
        - at a distance of 1 km SW and NE is exceeded for a cumulative period of up to 30 days
        - only in the immediate confines of the dredge spoil site is exceeded for a cumulative period of more than 50 days in a season
    - The 80 mg/ℓ threshold is exceeded for up to a cumulative 20 days per season within 500m and for a cumulative period of up to 5 days per season at a distance of 750 m to the SW and NE.
    - The 100 mg/ℓ and 150 mg/ℓ thresholds are exceeded for up to a cumulative 20 days per season within the immediate confines of the dredge spoil disposal site and for a cumulative period of up to 5 days per season at a distance of 750 m to the SW and NE.
- The exceedance of relevant thresholds of concern are fairly extensive along the northern shoreline. However, given the modest quantities of dredge spoil, any negative effects will be significantly less than those of maintenance dredging and therefore unlikely to be easily discernible from the effects of maintenance dredging. Furthermore, more recent estimates of dredge quantities suggest that the actual in situ dredge quantities for the power barge berths, and consequently the volumes of dredge spoil onto the northern beaches, are likely to be even more modest than those assumed for the modelling study.
    - It should be noted that in the modelling study, relatively high discharge rates were assumed for dredge spoil discharges onto the Alkanstrand Beach. These may, however, be too conservative (may be as little as 25% of those assumed, based on limitations of local dredgers). Thus, the modelled TSS concentrations reported in the time series could be a factor of two or more times too high in close proximity to the dredge spoil discharge location and just to the north of this location.

10.5.4.3 Accumulation of sediments

- Within the Port, sediment deposition will be largely confined to the areas being dredged with only limited (negligible) sedimentation on the southern areas of the mudflats (<5-10mm) in the immediate vicinity of the proposed LNG terminal/ berths. Sedimentation in the shipping basins are not expected to exceed 20 mm in the medium to long-term.
- For the limited quantities of material being disposed of at the offshore dredge spoil disposal site, the sediment deposition thicknesses remain insignificant beyond the immediate confines of the dredge spoil disposal site where the maximum thickness of sediments is predicted not to exceed 0.45m (< the maximum sediment deposition thickness of 0.5m in a 20m water depth);
    - The predictions are that it would take approximately 6 month (under winter conditions) to almost 18 months (under summer conditions) for the sediments disposed at the offshore dredge spoil site to be dispersed to the extent that there would be no discernible dredge spoil mound.
- The fine nature of the dredge spoil to be discharge onto the northern shoreline suggests that the dredge spoil will be distributed relatively rapidly northwards along the shoreline and therefore that the beach nourishment

effects will be of limited duration, i.e. relatively lower efficacy compared to dredge spoil from maintenance dredging of the sand trap and/or within the Port entrance channel.

10.5.4.4 Toxicity Impacts

The toxicity effects from potential contaminants released into the water column will be negligible as the predicted trace metal concentrations released into the water column will not exceed the relevant water quality guidelines at the dredging locations or either of the two dredge spoil disposal locations.

10.5.4.5 Changes in hydrodynamic flow patterns

The long-term predicted changes in flow within the Port of Richards Bay are predicted to be largely confined to the immediate project area, having negligible effect on benthic habitats beyond the immediate project area. The simulations are relevant to the period of the proposed dredging activities, extending to approximately 5 years. On such time scales the anticipated effects of sea levels rise and/or changes in storminess on the model outcomes will be very limited, and more than likely negligible.

10.5.5 CLIMATE CHANGE EFFECTS ON MODELLED OUTCOMES

Climate change is expected to have significant consequences for coastal ecosystems; with effects of sea level rise, changes in storminess (e.g. winds and waves) and possible long-term changes in circulation patterns of relevance to this Project. However, the anticipated effects of sea level rise and/or changes in storminess will be very limited, and more than likely negligible, over the short to medium term when potential dredging impacts are likely to be observed. Any changes in ocean circulation, would be speculative, at best.

10.5.6 POWER EVACUATION BRIDGE STRUCTURE

Two design options were assessed to compare potential impacts of the power evacuation bridge structure in terms of changes to hydrodynamic processes and benthic habitats. The first design provided for a flat bridge structure supported by multiple piles and a single large anchorage platform at the edge of the mangroves (from there the bridge structure changes to a suspension bridge/ catenary bridge structure to span over the top of the mangroves), refer to Figure 96. Based on initial comments regarding strong currents in the channel between the sand-spit and the eastern edge of the mangrove stand that would increase scour areas at the base of each pile, the design was amended to extend the suspension bridge/ catenary bridge structure to a large anchorage platform just east of this channel (Figure 97).

This opinion considers only the potential impacts on the water edge of the mangroves and the open waters between the mangroves and the sand-spit. The potential impacts associated with the pipeline and cabling bridge include:

- Potential changes in wind conditions and consequent very localised changes in sea state, as well as possible aeolian transport of sand on and around the sand-spit;
- Changes in local waves (sea) generated over the Kabeljou Flats due to the influence of the bridge piers and piles;
- Changes in tidal and wind-generated flows due to the influence of the bridge piers and piles; and,
- Localised scour and changes in benthic habitats (e.g. in grain size distributions) due to the influence of the bridge piers and piles. As the locally wind generated waves are quite modest under all but the strongest SW wind conditions, most changes in benthic habitats are likely to be due to tidal and wind-driven flows.

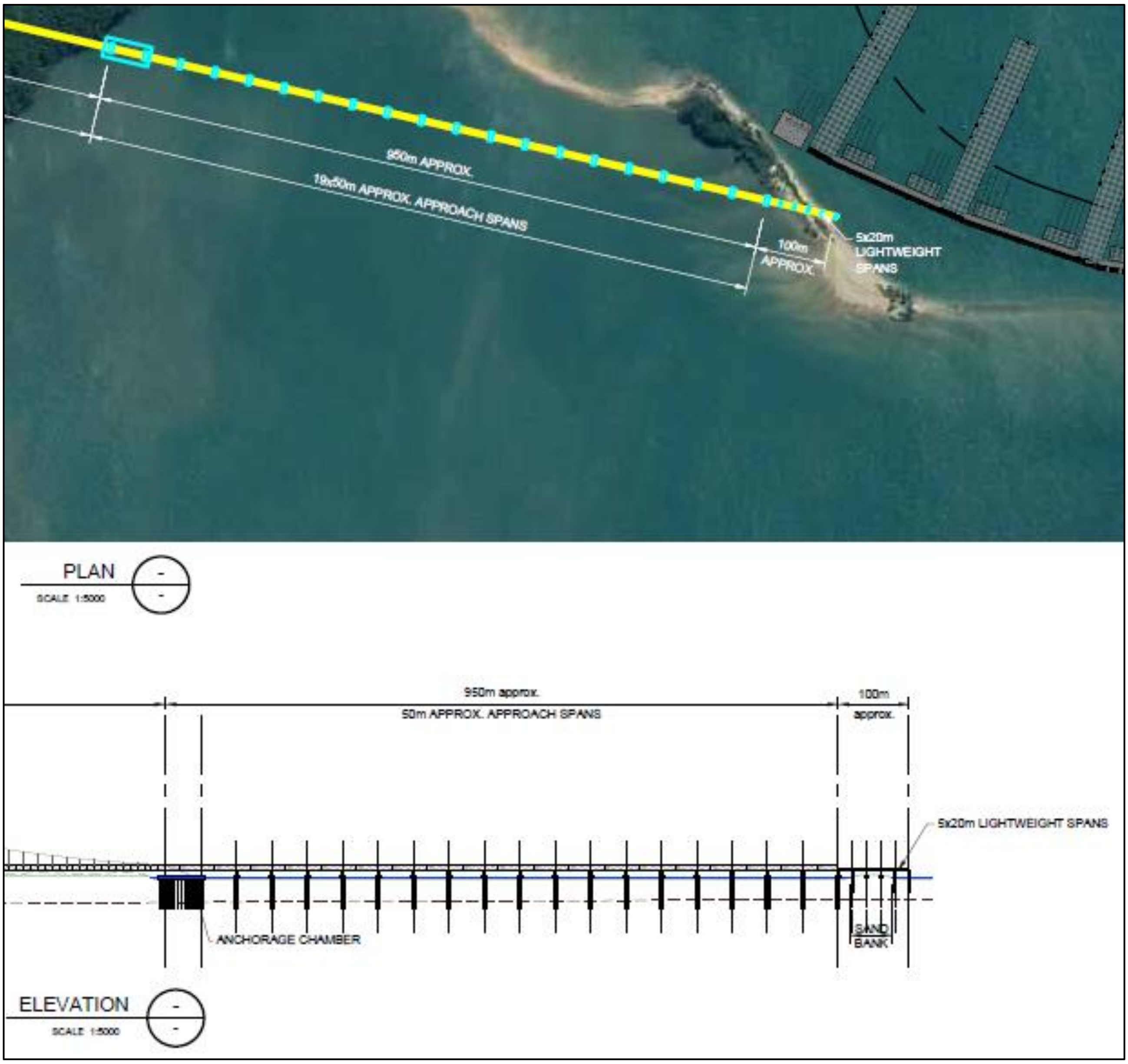


Figure 96: Preliminary concept drawing (Alternative 1) of the proposed power evacuation bridge structure to span the estuarine Kabeljou Flats from the NIFPP to land-based infrastructure. Only this portion over the water, if relevant to the hydrodynamic modeller's opinion of potential impacts on hydrodynamic processes and benthic habitats.

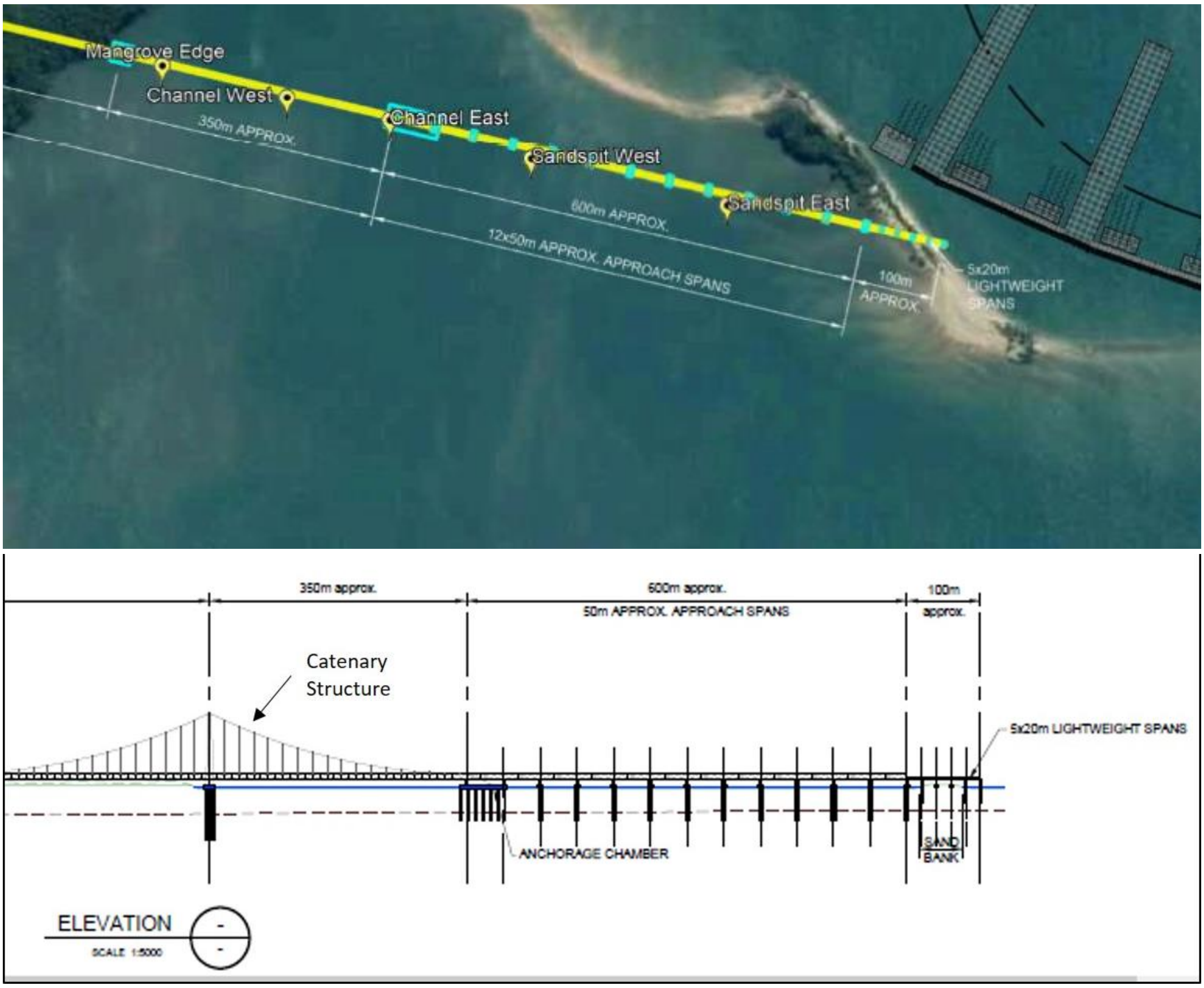


Figure 97: Preliminary concept drawing (Preferred Alternative) of the proposed power evacuation bridge structure to span the estuarine Kabeljou Flats from the NIFPP to land-based infrastructure. Only this portion over the water, if relevant to the hydrodynamic modeller's opinion of potential impacts on hydrodynamic processes and benthic habitats.

10.5.6.1 Assessment method

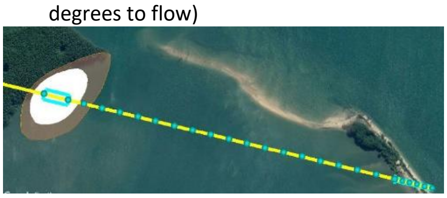
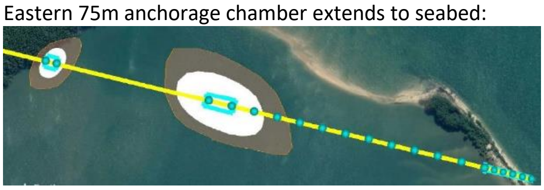
Time series of wind, wave and current parameters derived from the post-dredging layout modelling results, at a number of locations along the bridge, have been utilised to characterise the wave and current conditions at various locations along the bridge and have been used as inputs to the formulae used to determine the vertical and horizontal extent of scour around the bridge pier and piles.

The following approach was used to assess scour at the bridge piers, piles and anchorage chambers. Time-series of flow velocities and wave conditions was extracted from the Delft3D modelling results and the maximum depth-averaged flow velocity was extracted at each position, together with the average depth. These parameters were used to calculate scour dimensions that would result from a 1m diameter pile.

10.5.6.2 Assessment findings

A comparative qualitative assessment of potential impacts was provided and are summarised in Table 67 below. The detailed findings can be found in the attached opinion in Appendix 6.

Table 67: Comparative assessment of impacts associated with the proposed power evacuation bridge structures

<table>
<tr><td></td><td>Alternative 1:
Anchorage chamber east of mangroves: ≈65m wide
Bridge Structure supported by ≈17 bridge piers (pile caps: ≈8m wide) each supported by 2-4 1m ϴ piles
Bridge piers ≈0.3m above high water levels
Vertical bridge pier height ≈3m
In shallow water, most bridge piers would extend to the seabed (i.e. footprint of 8m)</td><td>Preferred Alternative:
Anchorage chamber east of mangroves: ≈30m wide
Additional anchorage chamber eastern edge of deeper channel: ≈70m wide (0.2m from seabed)
Bridge Structure supported by ≈10 bridge piers (pile caps: ≈8m wide) each supported by 2-4 1m ϴ piles
Bridge piers at least 0.3m above high water levels
Vertical bridge pier height ≈3m
In shallow water, most bridge piers would extend to the seabed (i.e. footprint of 8m)</td></tr>
<tr><td>Potential changes in wind conditions</td><td colspan="2">It is not expected that the changes in wind will be sufficient to result in changes in aeolian sand transport or changes in sediment movement of a nature that will change the morphology of the sand-spit.</td></tr>
<tr><td>Potential changes in wave conditions</td><td colspan="2">The wind wave heights generated at the time series locations are relatively modest 0.2-0.3m and are of a very short wave period (< 2s). Therefore, the piles are likely to have very little effect on the waves, while the larger bridge piers are likely to develop a wave shadow downwind of the bridge piers. The changes in wave conditions will be very localised and generally of little consequence in these downwind areas. Nevertheless, an allowance has been made for changing wave effects on bottom shear stresses and resultant changes in benthic habitats.</td></tr>
<tr><td>Potential changes in flow conditions</td><td colspan="2">Under strong NE wind conditions and flood tide conditions:
There will be significant flow modification, changes in bottom stress and resultant changes in the seabed in the shallow waters along the eastern edge of the mangroves.
The flows on the eastern side of the bridge comprise relative strong currents in shallow waters and flow along the alignment of the bridge. Here the flow remains strong near the seabed, resulting in high bed shear stresses and a higher potential for changes in the seabed.
Under strong SW wind conditions and ebb tide conditions:
There will be significant flow modification, changes in bottom stress and resultant changes in the seabed in the shallow waters along the eastern edge of the mangroves.
The flows on the eastern side of the bridge comprise moderately strong currents in shallow waters and flow along the alignment of the bridge. Here the flow remains moderate to high near the seabed, resulting in high bed shear stresses and an increased potential for changes in the seabed.</td></tr>
<tr><td rowspan="3">Potential changes in benthic habitat</td><td colspan="2">The piles (or possibly groups of piles), the bridge piers (when they extend to the seabed) and the anchorage chambers will cause some scour of the sea-bed, namely a scour hole. The impact of scour on the benthic habitat therefore would be:
A relatively rapid initial creation of the scour hole. This would probably remove any flora which may occur on the sea-bed;
Persistence of the scour hole that is created – resulting in a localised deepening; and,
Fairly widespread distribution of the scoured sediments in the areas surrounding the scour areas.
Key to defining the extent of the impact on the benthic habitat is to quantify the depth and horizontal extent of the scour hole which would form adjacent to piles or larger structures such as the bridge piers/anchorage chambers.</td></tr>
<tr><td>Horizontal scour extent @ 65m anchorage chamber = 55m (perpendicular flows) / 74m (45 degrees to flow)
</td><td>Horizontal scour extent @ 30m anchorage chamber = 25m (perpendicular flows) / 34m (45 degrees to flow); Max scour depth = 1.2m (perpendicular flows) / 1.6m (45 degrees to flow)
Horizontal scour extent @ 75m anchorage chamber = 64m (perpendicular flows) / 85m (45 degrees to flow)
Eastern 75m anchorage chamber extends to seabed:

Eastern 75m anchorage chamber <u>does not</u> extend to seabed (70% reduction in footprint):
</td></tr>
<tr><td colspan="2">8m wide bridge pier (for the eastern end of the bridge structure (50m spans):
Max scour depth = 1.2m (perpendicular flows) / 1.6m (45 degrees to flow)
Horizontal scour extent = 6.8m (perpendicular flows) / 9.0m (45 degrees to flow)</td></tr>
</table>

The total scour footprint on the sea bed could be roughly estimated by applying an 8m margin around every pile, ignoring the areas of overlap, and a margin of 9m at the piers, and then summing the area of the bed impacted. The scour depths and footprints, although initially form quite rapidly, are likely to remain fairly stable with only minor changes over time.

It is estimated that the material scoured initially will be distributed within a distance 2 to3 times that of the scour footprint (i.e. the orange areas indicated in the figures in Table 67). Given the relatively modest volume of material scoured, the deposition thickness within these areas in likely to be of the order of centimetres at the most. However, this material will rapidly be more widely dispersed resulting in minimal long-term benthic changes beyond the areas impacted by scour. The only exception to this possibly being where the mangroves “trap” these sediments and then grow and extend to cover these areas before the sediments become more widely dispersed. Such an accumulation would need to be persistent and long-term, which is unlikely to be the case in the exposed channel area beyond the outer edge of the mangroves. However, more persistent sedimentation in the mangroves, while likely, is expected to be of limited aerial extent.

10.5.6.3 Conclusion and recommendations

It is the large anchorage chamber structures that result in the greatest potential impacts on benthic habitats. The extent of benthic modification around the individual bridge piers and piles is relatively modest. The scoured sediments, initially will be deposited within a distance 2 to 3 times that of the scour footprint, but thereafter will be widely dispersed resulting in minimal long-term benthic changes beyond the areas impacted by scour. It is recommended that any further design modifications focus on reducing the “footprints” of the anchorage chambers, particularly those in close proximity to the mangroves.

10.6 HERITAGE IMPACT ASSESSMENT

Heritage Contracts and Archaeological Consulting CC (HCAC) was appointed to conduct a Heritage Impact Assessment, while Prof Marion Bamford undertook a Palaeontological Impact Assessment for the proposed project area.

10.6.1 APPROACH & METHOD

- Literature review: A brief survey of available literature was conducted to extract data and information on the area to provide general heritage context into which the proposed development would be set.
- Google Earth and 1:50 000 maps of the area were utilised to identify possible places where sites of heritage significance might be located; these locations were marked and visited during the fieldwork phase.
- The database of the Genealogical Society was consulted to collect data on any known graves in the area.
- The site survey was undertaken in February 2021 with the aim to:
    - Survey the proposed project area to locate, identify, record, photograph and describe sites of archaeological, historical or cultural interest;
    - Record GPS points of sites/areas identified as significant areas; and,
    - Determine the levels of significance of the various types of heritage resources recorded in the project area.
- The following criteria were used to establish site significance with cognisance of Section 3 of NHRA:
    - The unique nature of a site;
    - The integrity of the archaeological/cultural heritage deposits;
    - The wider historic, archaeological and geographic context of the site;
    - The location of the site in relation to other similar sites or features;
    - The depth of the archaeological deposit (when it can be determined/is known);
    - The preservation condition of the sites; and,
    - Potential to answer present research questions.

- In addition to this criterion, field ratings prescribed by SAHRA (2006), and acknowledged by ASAPA for the SADC region, were used for the purpose of this report.

10.6.1.1 Limitations & Constraints

- The authors acknowledge that the brief literature review is not exhaustive on the literature of the area.
- Due to the nature of heritage resources and pedestrian surveys in an area characterised by very dense vegetation, the possibility exists that some features or artefacts may not have been discovered/recorded during the survey and the possible occurrence of graves and other cultural material cannot be excluded.
- Similarly, the depth of the deposit of heritage sites cannot be accurately determined due its subsurface nature. It is assumed that the spatial data available to the author for known sites are accurate and up to date.
- This report only consisted of non-intrusive surface surveys.
- This study did not assess the impact on medicinal plants and intangible heritage as it is assumed that these components would have been highlighted through the public consultation process, if relevant.
- It is possible that new information could come to light in future, which might change the results of this impact assessment.

10.6.2 SPECIALIST FINDING

The current area under investigation was assessed as part of the 2009 study conducted by Anderson and Anderson and again in 2013 by Van Schalkwyk & Wahl. The Van Schalkwyk & Wahl (2013) study was desktop only and did not record any sites. The 2009 study included a survey that recorded nine sites dating from the Cretaceous (paleontological) to the Late Iron Age as well as Stone Age scatters. One of these sites falls within the current study area – RBP 03 and another site is on record at the Pietermaritzburg Museum Archaeological Database (2823CC 001), originally also located within the study area (Figure 98). The second site (2823CC 001) known as Bhizele Halt, was recorded by O. Davies from the Natal Museum in December of 1974. The location description of the site and co-ordinates derived from a 1:50 000 map in 1974 do not correlate and it could be that the current location is not exactly where the site was recorded. According to the database of the Genealogical Society, no known grave sites are indicated in the study area.

10.6.2.1 Field Observations

The locations of the two known heritage sites were visited. The first site recorded in 1974, Bhizele Halt -2832CC 001 is located where the Gypsum dam was in 1983 (Figure 98) that was subsequently excavated and would have destroyed the site. No surface remains of the site were noted. An ephemeral shell scatter was noticed in this area (Figure 98) where excavations have taken place. From surface observations it was not found in a stratified context and was in all probability brought into the area together with construction material. The other site (RBP 03) is in a powerline servitude in an area disturbed by roads and earth works. The area is characterised by dense vegetation. The site was recorded as a low significant site in 2009 and erosion and subsequent disturbance of the area has meant that the ephemeral surface remains are no longer visible. The remains of modern cement slabs were noted in the Aquarius substation footprint (Figure 98), these are of no heritage significance.

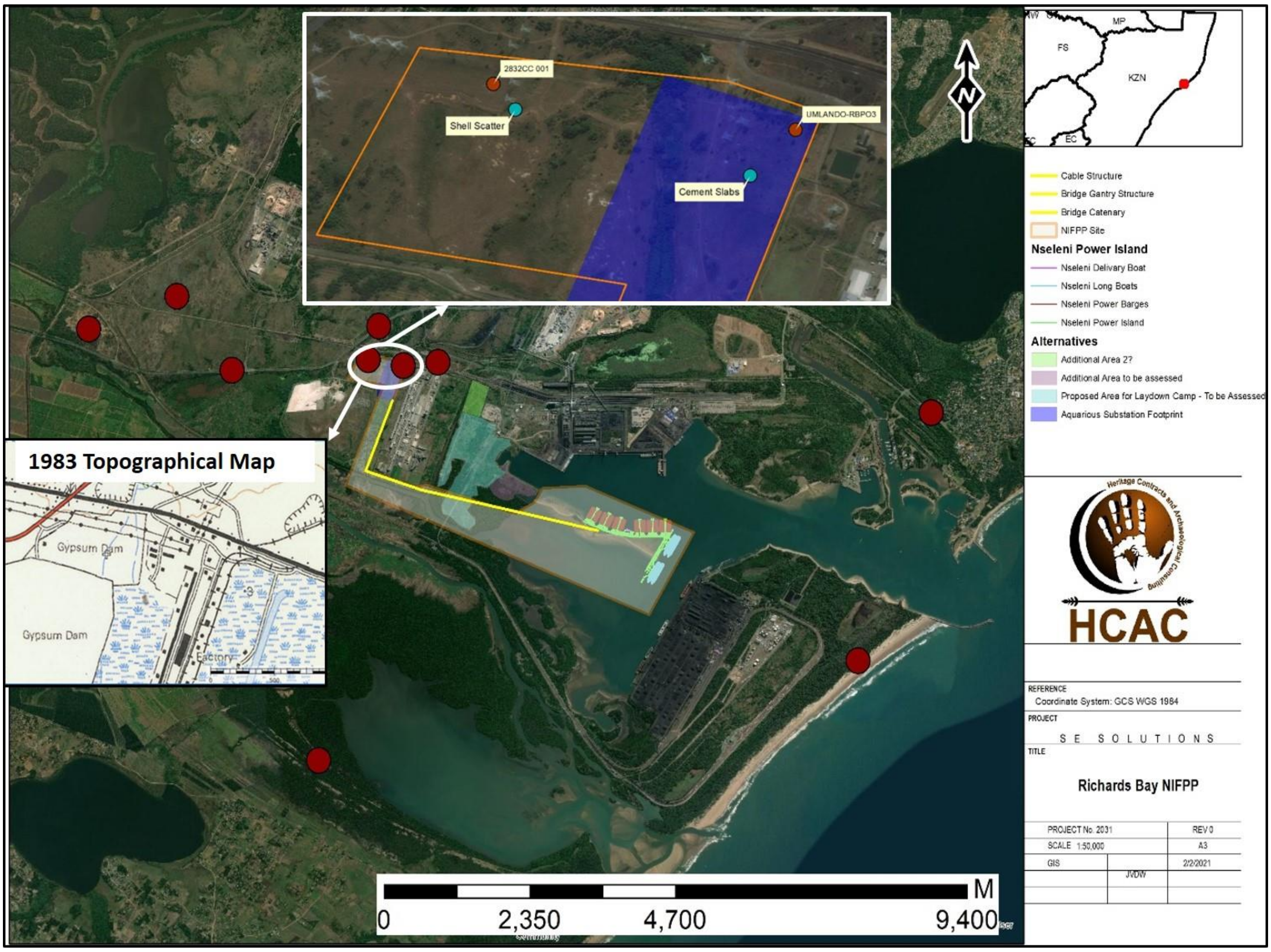


Figure 98: Known heritage sites in relation to the project study area. The inset shows the Gypsum Dam that was present in 1983 (no longer shown on the 1997 topographical maps) which would have destroyed site: Bhizele Halt - 2832CC 001.

10.6.2.2 Paleontological significance

The conclusion of the study is that it is extremely unlikely that any fossils would be preserved in the Holocene aged Sibayi Formation sands. The sands are wind and water transported so the particles have been very well sorted and, even if fossils fragments have been incorporated into the sands, they would not be recognizable and therefore there is no chance that fossils may occur in the dune sands of the estuary.

10.6.2.3 Cultural landscape

The landscape is characteristic of an industrial area, significantly altered after 1970 by Port construction. Prior to this the area consisted of natural vegetation with little human interference. Areas not developed are now covered by marshes and mangroves with dense vegetation because of the altered character of the area. The long-term impact on the cultural landscape is considered to be low as the proposed project is in line with the surrounding land use. Visual impacts to scenic routes and sense of place are also considered to be low.

Figure 99: 1977 orthophoto of the approximate study area (yellow polygon). Note the existence of the Gypsum dam in the north western portion of the study area and extensive transformation of the landscape to the east.

Figure 100: 1997 orthophoto of the approximate study area (yellow polygon). Note the extensive transformation of the landscape surrounding the port.

10.7 QUANTITATIVE RISK ASSESSMENT FOR MAJOR HAZARD INSTALLATIONS

RISCOM (PTY) LTD was appointed to conduct a Quantitative Risk Assessment (QRA) of hazards to neighbouring facilities and the general public that may result from the proposed Project. Please refer to Appendix 6 for the full report. This risk assessment is not intended to replace a Major Hazard Installation (MHI) Risk Assessment nor any other legal requirement in terms of the Occupation Health and Safety Act, 1993 (Act No. 85 of 1993) [OHSA], as amended.

10.7.1 MAIN HAZARDS DUE TO SUBSTANCE & PROCESS

The main hazards that would occur with a loss of containment of hazardous components (principally LNG) at the proposed Project include exposure to:

- Thermal radiation from fires; and,
- Overpressure from explosions.

10.7.2 BULK MATERIALS TO BE STORED ON SITE

	Component	CAS-No.	Inventory
LNG storage per Floating Power Barge	LNG	74-82-8 (methane)	4 x 1 000 m^3
LNG Supply Vessel (Ship)	LNG	74-82-8 (methane)	2 x 1 000 000 t

Nitrogen is typically used for purging of lines, however, due to usage of Nitrogen not being defined at the time of the assessment and that its only risk/ effect is that of a localised asphyxiant, it was excluded from the assessment.

10.7.3 METHOD OF ASSESSMENT

The evaluation methodology is based on the assumption that the facility will perform as designed in the absence of unintended events, such as: component and material failures of equipment, human errors, external events and process unknowns. Due to the absence of South African legislation regarding determination methodology for QRA, the methodology of this assessment is based on the legal requirements of the Netherlands, outlined in CPR 18E (Purple Book; 1999) and RIVM (2009). The evaluation of the acceptability of the risks is done in accordance with the UK Health and Safety Executive (HSE) ALARP[21] criteria that clearly cover land use, based on determined risks. The following steps constitute a QRA:

1. Identification of components/ hazards that are flammable, toxic, reactive or corrosive and that have potential to result in a major incident from fires, explosions or toxic releases. The following are taken into account:
    - Chemical identities;
    - Location of on-site installations that use, produce, process, transport or store hazardous components;
    - Type and design of containers, vessels or pipelines;
    - Quantity of material that could be involved in an airborne release; and,
    - Nature of the hazard most likely to accompany hazardous materials spills or releases (e.g. airborne toxic vapours or mists, fires or explosions, large quantities to be stored and certain handling conditions of processed components).
2. Assess significant components/ hazards in terms of risk to employees and the neighbouring community through the development of accidental Loss Of Containment (LOC) scenarios for equipment containing hazardous components (including release rate, location and orientation of release).
3. For each incident developed in Step 2, determination of consequences (such as thermal radiation, domino effects, toxic-cloud formation and so forth); and,

[21] As low as reasonably practical

4. For scenarios with off-site consequences (greater than 1% fatality off-site), calculation of Maximum Individual Risk (MIR), taking into account all generic failure rates, initiating events (such as ignition), meteorological conditions and lethality.

Scenarios included in the QRA have impacts external to the proposed Project. The 1% fatality from acute affects (thermal radiation, blast overpressure and toxic exposure) is determined as the endpoint (RIVM 2009). Thus, a scenario producing a fatality of less than 1% at the Project boundary under worst-case meteorological conditions would be excluded from the QRA.

This risk assessment included the consequences of fires and explosions at the NIFPP facility in the Port of Richards Bay. A number of well-known sources of incident data were consulted and applied to determine the likelihood of an incident to occur. This QRA assumed that the site would be maintained to an acceptable level and that all statutory regulations would be applied. It was also assumed that the detailed engineering designs would be done by competent persons and that equipment, structures or storage containers would be correctly specified for the intended duty.

10.7.4 NOTIFIABLE SUBSTANCES

In accordance with OSHA and its General Machinery Regulation 8 and its Schedule A on notifiable substances, any employer who has a substance equal to or exceeding the quantity listed in the regulation is required to notify the divisional director of the Department of Employment and Labour. A site is classified as a MHI if it contains one or more notifiable substances, or if the off-site risk is sufficiently high. The latter can only be determined from a quantitative risk assessment.

Methane (compressed) is listed as a notifiable substance at a threshold value of 15t stored in a single vessel. For land-based facilities, this would normally classify LNG as a notifiable gas and thus the facility classified as a MHI. However, as the LNG storage is within the Port and (technically) offshore, the OSHA would only be applicable under certain circumstances. This study will assume the facility would be classified as a MHI. However, there is sufficient ambiguity regarding the legal application of the OSHA regarding structures offshore and the application of the MHI classification. RISCOM recommends a legal opinion be obtained on the MHI classification on offshore facilities/ structures, the required notifications and confirm the regulator (Department of Employment and Labour of Ports Authority).

10.8 CLIMATE CHANGE IMPACT ASSESSMENT

The Climate Neutral Group was appointed to conduct a Climate Change Impact Assessment. Please refer to Appendix 6 for the full report.

Climate change differs fundamentally from other potential environmental considerations in that it has global impacts that cannot be directly linked to one specific source. Climate change is a cumulative effect caused by the combined impact of past, present and future human and natural processes. As per the Task Force on Climate-related Financial Disclosures, impacts on climate change can be measured in terms of the amount of Greenhouse Gas (GHG) emissions from a project or activity as well as through its emissions intensity (emissions per output). For the purpose of this study, the annual and total emissions of the Project have been estimated and compared with a rating scale derived from internationally recognised risk assessment procedures. In addition, the emissions intensity of the Project has been compared with relevant indicators which adds perspective to the ascribed significance based on scale only.

The Method applied for assessing the Project’s impact on climate change requires quantification of its GHG emissions during its operational lifetime. The methodology for the estimation of GHG emissions associated with the Project was guided by the following reference documents:

- The Greenhouse Gas Protocol's "A Corporate Accounting and Reporting Standard" (Revised Edition (Greenhouse Gas Protocol, 2015)
- The Department of Environment, Forestry and Fisheries' "Technical Guidelines for Monitoring, Reporting and Verification of Greenhouse Gas Emissions by Industry" (Version TG-2016.1)
- UK Government GHG Conversion Factors for Company Reporting (DEFRA, 2019)

Guided by the Greenhouse Gas Protocol, the following steps were applied:

1. Identification of boundaries
2. Identification of relevant GHG emissions sources
3. Selection of quantification method
4. Calculation of expected GHG emissions

10.8.1 IDENTIFICATION OF BOUNDARIES

The first phase of construction comprises the delivery and installation of the first 4 power barges (4 X 1350MW = 5 400 MW). The operational commissioning of these 4 power barges is expected to start in Q4 of 2023. Subsequently, the project will expand by 1 power barge every three months per the following schedule:

Barge 5: Q1 2024	Barge 9: Q1 2025
Barge 6: Q2 2024	Barge 10: Q2 2025
Barge 7: Q3 2024	Barge 11: Q3 2025
Barge 8: Q4 2024	Barge 12: Q4 2025

The total operational lifetime is estimated to be 25 years being the normal schedule for a Gas Combined Cycle Base Load project.

10.8.2 IDENTIFICATION OF GHG EMISSION SOURCES

The contribution of the project to climate change occurs through direct (Scope 1) emissions, resulting from the combustion of LNG to generate electricity (Figure 101). The associated upstream and downstream emissions (Scope 3, Figure 101) consist of the following:

- Purchased goods and services (fuel used by contractors, concrete, steel, etc.);
- Capital goods (material for docking stations, quays, LNG storage tanks, power barge terminal, floating power barges, CCGT equipment, transformers, transmission lines, etc.);
- Other fuel and energy-related activities (diesel and electricity);
- Transportation and distribution of LNG by vessels but also of materials for infrastructure such as concrete, steel, etc. during construction;
- Waste generated during construction and operation (e.g. dredged material);
- Employee commuting; and,
- Transmission of generated electricity.

Scope 3 emissions are excluded from the impact assessment because they are, firstly, deemed insignificant in comparison to the Scope 1 emissions (based on a DEFRA emission factor of 0.01155 kgCO_2e per tonne.km and a distance of ca. 5 000 km between Angola and Richards Bay, the emissions attributable to the transportation of the gas would be around 5500 tCO_2e per vessel (1 x 100 000 tonne vessel per week). Which is less than 2% of the total Scope 1 emissions) and, secondly, because of the lack of information regarding the activity data associated with these emissions. Moreover, from the perspective of the Equator Principles, the area of focus of this study comprises of Scope 1 and Scope 2 emissions only. The project will generate its own power supply; hence Scope 2 emissions are zero.

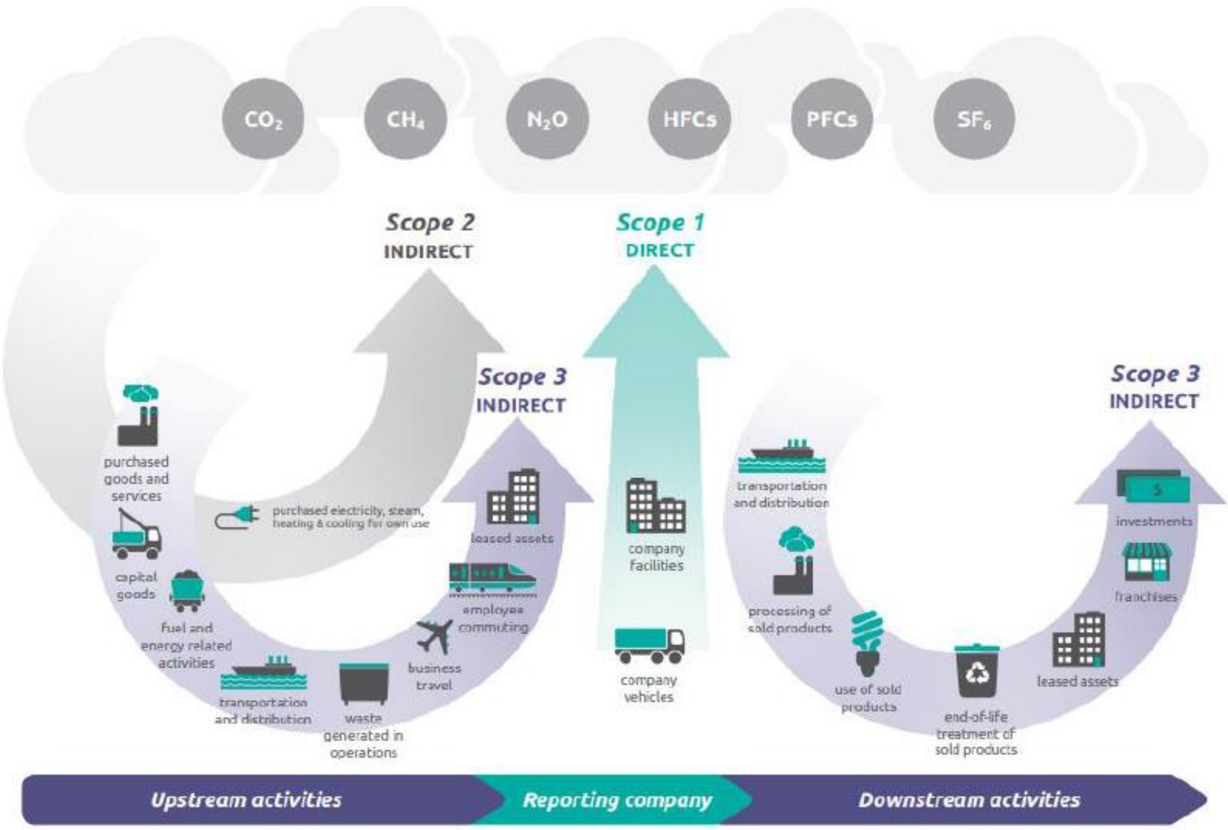


Figure 101: GHG Protocol: Different Scopes of GHG emissions sources

10.8.3 SELECTION OF QUANTIFICATION METHOD

For the calculations of the GHG emissions from the proposed Project, the activity data has been multiplied by the emission factor for LNG (Table 68) based on GHG Protocol and Technical Guidelines.

Table 68: Emissions Factor

Parameter	Description	Value	Unit	Source
EF_{CO2e}	Emission Factor	2550.04	kgCO2e/tonne LNG	DEFRA, 2019

10.8.4 CALCULATION OF EXPECTED GHG EMISSIONS

The outcome is that the Project will generate an average of 32,095,196 tCO_2e or 33 $MtCO_2e$ per year (based on the combustion of 90 000 tonne LNG per power barge, taking into account the phased implementation of the envisaged total 16 200 MW (12 barges)) and a total of 834,475,090 tCO_2e (834$MtCO_2e$) (based on a 25-year operational lifetime of the project).

10.8.5 MAGNITUDE OF GHG EMISSIONS

A rating scale has been derived from several international lender organisations, including the IFC and the EBRD as well as the Equator Principles. The scale is based on reporting thresholds that trigger requirements for quantification, reporting and mitigation of a project's GHG emissions. The magnitude-scale derived from these organisations and applied in the context of this Project is demonstrated in Table 69 below:

Table 69: Rating scale from project wide GHG emissions based on wider standards

Project-wide GHG Emissions/annum	Magnitude Rating
> 1 000 000 tCO_2e	Very large
100 000 – 1 000 000 tCO_2e	Large
25 000 – 100 000 tCO_2e	Medium
5 000 – 25 000 tCO_2e	Small
< 5 000 tCO_2e	Negligible

Due to the nature of climate change, the assessment of the magnitude of the GHG emissions (very large for this project - Table 69 must be accompanied by a contextual assessment considering the Project's alignment to South Africa's local climate change policy projections. The latter is a qualitative contribution to the impact assessment applied.

10.9 SOCIO-ECONOMIC IMPACT ASSESSMENT

ACER (Africa) Environmental Consultants in collaboration with Urban-Econ Development Economists was appointed to conduct a socio-economic impact assessment for the proposed Project. The description of the receiving socio-economic environment initially presented in the Scoping Report has been updated with additional information derived from the specialist assessment and has already been presented in Section 6.2. This section of the report only details the method/ approach to the assessment as well as the assessment findings. Please refer to Appendix 6 for the full report.

10.9.1 METHOD AND APPROACH

As the assessment was essentially conducted as two separate assessments viz. a social impact assessment and an economic impact assessment, the methodology employed for each assessment is detailed separately.

10.9.1.1 Social Impact Assessment Method

Social Impact Assessment (SIA) is based on analysing, monitoring and managing the social consequences of development. SIA is a methodology used to assess the social impacts of planned developments or events, and to develop strategies for the on-going monitoring and management of those impacts. Two types of social impacts can be distinguished:

- Objective social impacts: impacts that can be quantified and verified by independent observers, such as changes in population size or composition, in employment patterns, in standards of living or in health and safety; and,
- Subjective social impacts: these are mentally or emotionally related impacts of people, such as negative public attitudes, psychological stress or reduced quality of life and are less easy to quantify than objective social impacts.

Both qualitative and quantitative research techniques and data were used, with a combination of both primary and secondary data. Primary data were generated through the attendance of public meetings (performed via video conference) as well as through semi-structured interviews (undertaken telephonically) with key stakeholders. Secondary data in the form of aerial imagery, statistical publications from Statistics South Africa (StatsSA) and municipal documents (including Integrated Development Plans (IDPs)) were reviewed in order to develop an understanding of the socio-economic climate prevailing in the study area. Through developing an understanding of the socio-economic environment potential social change processes, potential social impacts can be anticipated and contextualised.

Existing social and socio-economic studies undertaken for previous projects within Richards Bay and the Port of Richards Bay were also consulted. As a number of these studies were undertaken by ACER a review of meeting notes, comments and findings from previously conducted semi-structured interviews and questionnaires was also undertaken. Potential social change processes and associated impacts were identified by applying the social baseline conditions and findings to an indicative list of processes. In addition, experiences from past projects of a similar nature and within a similar socio-economic environment assisted in identifying possible social change processes and associated social impacts.

10.9.1.2 Economic Impact Assessment Method

Typically, economic impact studies use financial and economic data to generate estimates of output, GDP, employment, and tax revenues associated with changes in the level of economic activity resulting from the project being assessed. In general, economic impacts can be estimated as direct, indirect, and induced. An Economic Impact Assessment seeks to:

- Provide a method/approach to determine the after effect of a particular decision on the functioning of the economy; and,
- Measure the results of external stimuli on the economy.

To quantify the economic impacts of the project an Input-Output Multiplier Model (IO Model) is developed to quantify the economic impacts. This method is most commonly used for estimating the impacts of positive or negative economic shocks and analysing the ripple effects throughout an economy. The model uses a series of multipliers to quantify the supply chain for sectors of the economy. Relevant multipliers are then applied to the shock (expenditure) to determine gross value added (GVA), new business sales, income contribution and employment creation. Underlying data to the input-output tables are based on industry averages.

The direct impacts are the changes in the economy occurring as a direct result or consequence of public or private sector capital expenditure. Direct impacts are changes that occur in “front-end” businesses that would initially receive expenditures and revenue as a direct consequence of the operations and activities of a project. The indirect economic effects occur when the suppliers of new goods and services to the project’s contractors (first round suppliers) experience larger markets and potential to expand. Indirect multipliers measure indirect impacts arising from changes in activity for suppliers of the “front-end” businesses. Indirect multipliers create the “ripple effect” in the economy. Induced economic spending results in changes in goods and services demanded due to increased expenditure by households from income earned due to the project.

Induced impacts are those arising from changes in spending on goods and services as due to payroll changes of directly and indirectly affected businesses. The IO Model used for this assessment is based on the National StatsSA 2013 IO Model adjusted to 2019 figures (by Urban-Econ). The 2013 IO Model is the most recent national SA model available. The National IO Model is the best model to use in assessing the economic impact of the project due to the nature of the project whose impacts are envisaged to be mainly at a national scale. Due to the size and nature of the project it is likely that during the construction phases, although local labour is likely to be used, there will be both regional (district municipality and province level) and national impacts through ripple multiplier effects. The operations of this large-scale project require a high skill level and the application of sophisticated technology and hence most of the economic impacts will also be at a national scale.

10.9.1.3 Limitations and gaps in knowledge

- Socio-economic data from StatsSA was only available at a Ward level for 2001 and 2011 National Census. Data from the 2016 Community Survey was not available at a Ward level; and,
- It is not yet known how infrastructure will be transported to site and thus the estimated number of ships, trucks and/or trains is unknown.

10.9.2 IDENTIFIED POTENTIAL SOCIO-ECONOMIC IMPACTS

How the proposed Project change existing socio-economic processes is based on the following questions:

1. What nuisance impacts are likely to be associated with the proposed project during construction and operation?
2. Will there be an influx of workers and job seekers into the study area, and if so, what impacts are likely to occur as a result?

3. How will the project impact on the health and safety of the surrounding community during construction and operation?
4. What economic impacts is the project likely to have during construction and operation?

1. What nuisance impacts are likely to be associated with the proposed project during construction and operation?

Construction Phase	Operational Phase
Potential Noise Impacts – assessed by an independent noise specialist – refer to Section 10.2.	
• The proposed Project falls within a Port & area already characterised by industrial activities and associated noise. • No sensitive receptors within close proximity. • Therefore, increase in noise during construction will not be a significant nuisance.	• The proposed Project will implement noise abatement measures to comply with international best practice standards and guidelines. • Previous studies indicate that current activities within the Port do not impact on sensitive receptors within 1km of the Port. • Therefore, it is unlikely that increased noise during operations will be a concern.
Potential Visual Impacts	
• The proposed Project site is within an area characterised by industrial activity & large construction related equipment. • No sensitive receptors within close proximity. • Therefore, visual impacts during construction are not considered significant.	• While altering the visual nature of the immediate area, the impact is not considered significant as the proposed Project site is already characterised by industrial activity and large industrial infrastructure.

2. Will there be an influx of workers and job seekers into the study area, and if so, what impacts are likely to occur as a result?

According to the World Bank (2001), the induced population increase associated with a development initiative is estimated to equal the number of people employed on the project. This movement of people can be attributed to people searching for both direct and indirect economic opportunities associated with the proposed development as well as employees brought into the area to conduct the work. However, the geographical location, social and socio-economic conditions of surrounding areas as well as the type of development taking place should all be considered when anticipating the possible immigration of people.

Considering the size of the proposed Project in terms of the expected capital expenditure and the medium- to long-term nature of construction (24-30 months), it is likely that there will be an influx of people into the City of uMhlathuze LM prior to and during construction. In addition, it is likely that there will be the temporary movement of skilled labourers into the LM during construction. As a result, various social impacts are likely which would need to be mitigated.

Construction Phase	Operational Phase
Potential increase in criminal activity	
• An increase in crime may extent to job seekers, who after moving into an area & being unable to find work, resort to criminal activities in order to support themselves. However, due to existing security & police presence in the Richards Bay area, any likely impacts associated with an increase in criminal activity is considered negligible. • Of greater concern, and more likely, are job seekers & criminal opportunists moving into less formal areas (in the secondary study area) and taking advance of less security and policing. • Interview with Business Against Crime, Zululand: the potential for increased employment may reduce petty crime.	• Unlikely in its own right to result in an increase in criminal activity in the area. • Employment opportunities created may result in a reduction in crime over the longer term.
Potential increase in the spread of disease	
• Any development which causes the migration of people has the potential to lead to the spread of disease; in particular, Sexually Transmitted Infections (STIs) including HIV and AIDS. • The potential for the spread of disease that may cause epidemics should also be noted especially considering the current COVID-19 pandemic and the lessons learned from and during this outbreak. Ports of entry into a country are an important risk	• The delivery of LNG from outside of SA may increase the potential for the spread of disease. However, vessels will unload LNG within 48hrs and there is no direct link to land, thus there will be no

source and considering that a significant portion of Project infrastructure will be delivered by shipping vessels from outside of SA there will be an increased risk of the spread of diseases.	significant contact between crew and land-based residents.
Potential increase in informal dwellers and/or destitute people	
• It is likely that the majority of job seekers will migrate from the surrounding rural areas, characterised by high levels of unemployment and poverty. It is common in such cases that job seekers do not have the financial capability to return to their place of residence in the event of not finding work. This was confirmed as a trend by the Zululand Business Against Crime organisation in 2014. • This leads to increased spread of informal settlements and further indirect social impacts such as: increased petty crime, reduced property value, health concerns, and ultimately an increased financial burden for local government.	• Informal dwellers and/or destitute people that moved to the Richards Bay area as a result of the proposed Project may continue to reside in the area during operation, however it is not anticipated that operation of the Project itself, will result in a significant increase in informal dwellers and/or destitute people.

3. How will the project impact on the health and safety of the surrounding community during construction and operation?

Construction Phase	**Operational Phase**
Perceived safety concerns with the proposed Project	
• While the LNG industry adheres to various international codes and standards that specify technologies, materials and designs for the safe construction and operation of facilities, it is anticipated that prior to the Project commencing concerns will be raised regarding safety and are likely to include the potential for fire, explosions and the environmental implications of an LNG spill.	• During public & key stakeholder consultation, the issue of disaster management was raised and the need to consider the ability of the Port of Richards Bay and the LM to deal with disasters. • The proposed Project will comply with all industry standards including the provision of the necessary disaster management personnel and equipment.
Potential protest action and community unrest	
• Considering the anticipated rise in unemployment in the coming months as a result of COVID-19 and the already high levels of disparity that exist in the project area the occurrence of protest action is likely to become more common. • The potential for protest action is exacerbated when contractors from outside of the project area are employed and are seen to be taking employment opportunities away from local residents. • While the proposed Project will be constructed within an access-controlled area (the Richards Bay Port), protest action may include disrupting vehicles and trucks perceived to be linked to the project, targeting accommodation facilities used by project personnel, protesting outside of port access points and prohibiting access to the port for other parties, etc. • Protest action can result in costly project delays due to lost days, violent confrontation, destruction of project and non-project related infrastructure and equipment and ultimately injuries and/or fatalities. Thus, it is imperative that measures are taken to mitigate the potential of this occurring.	• It is not anticipated that there will be protest action or community unrest as a result of the NIFPP or associated infrastructure during operation.
Potential impacts on community health due to reduced air quality - assessed by an independent air quality specialist – refer to Section 10.1.	
• Past studies undertaken for the expansion of the Port of Richards Bay have indicated that the impact from an increase in ships entering the port is unlikely to have a significant impact on air quality, especially in the context of the air quality profile of Richards Bay. • Therefore, it is not anticipated that there will be an impact on community health (either perceived or actual) during construction.	• While the proposed Project will meet the MES in terms of NEMAQA, considering the sensitivity surrounding air pollution in Richards Bay, the cumulative impact on air quality and the resultant health implications (either perceived or actual) will be a significant concern raised by stakeholders.
Potential increase in road traffic and reduced road safety	
• The majority of the required infrastructure for the proposed Project will be transported to site by ship and the number of heavy-duty trucks accessing the project site will be limited and sporadic. • Considering this, and the already high volumes of heavy-duty trucks in Richards Bay and the Port of Richards Bay the impact is not believed to be significant.	• There is not expected to be an increase in traffic following the completion of construction and the operational life of the proposed Project.

4. What economic impacts is the project likely to have during construction and operation?

It is important to note that this economic impact assessment only addresses the SA component, that is, expenditure taking place in SA. The expenditure associated with the barges and other capital equipment that will be imported are not included in this assessment. The economic benefits of the imported plant and equipment will accrue to those countries from which they are imported or manufactured. This assessment only addresses the construction spend for harbour infrastructure as well as the associated infrastructure (transmission line and sub-station).

The total capital investment, within South Africa, for the proposed Project is R 16.42 billion. The total operational costs are R 2.76 billion during the first year. Projected over an operation period of 20 years the annual operation cost amounts to R55.1 billion during the first phase of operation in constant 2020 prices. Operational expenses have been used selectively to determine impacts on the economy, in that only real expenditure has been taken into account (e.g. only actual transactions to other economic parties were used).

Potential production impacts

Construction Phase

- Production refers to the value of all inter & intra sectoral business sales generated. This accounts for all direct & indirect sales benefits. This figure indicates the value of every additional sale transaction as a result of the Capex implementation injected into the economy by the proposed Project. The table below outlines the proposed Project's impact on production.

Economic Impact	Direct	Indirect	Induced	Total
Production (R Billions)	16.426	19.002	23.057	58.485
Percentage Accrual	28%	32%	39%	100%

Source: Urban-Econ Calculations, 2020

- A total of R 58.485 billion will be generated in Production within the economy, with ≈28% of this accruing to first round suppliers (direct benefits) and 32% accruing to secondary suppliers (indirect benefits).

Operational Phase

- The impact of the proposed Project's Operating Expenditure (OPEX) on production is indicated in the table below. This figure indicates the value of every additional sale transaction as a result of the operating expenditure injected into the economy by the operation of the power plant.
- Total OPEX spend amounts to R 58.485 billion which breaks down into R16.42 billion in direct production and R 19 billion indirect production in the economy.

Economic Impact	Direct	Indirect	Induced	Total
Production (R Billions)	16.426	19.002	23.057	58.485
Percentage Accrual	31%	33%	36%	100%

Source: Urban-Econ Calculations, 2020

- ≈31% accrues to first round suppliers (direct benefits) & 33% accrues to secondary suppliers (indirect benefits).

Potential Gross Value Added (GVA) impacts

- The economic scale at which the GVA impact is likely to be felt will be a function of the location of the companies appointed as service providers. It is expected that the majority of these services will be secured within the LM in order to capture the full impact on the LM economy.
- GVA is a proxy for Gross Domestic Product (GDP) at a scale smaller than a whole country. GVA provides a Rand value for goods and services that have been produced, less the cost of all inputs and raw materials that are directly attributable to that production.

Construction Phase

- A significant injection as the impact on GVA is projected to be R 27.68 billion. 30% of which will accrue directly to the building & construction sector through direct benefits and a further 42% of induced benefits mainly to the financial intermediation sector through the multiplier effect.

Economic Impact	Direct	Indirect	Induced	Total
GVA (R Billion)	8.187	7.901	11.597	27.685
Percentage Accrual	30%	28%	42%	100%

Source: Urban-Econ Calculations, 2020

Operational Phase

- The impact on GVA is projected to be R 71.32 billion during operation, about 31% of which will accrue through direct benefits & a further 38% through induced benefits.

Economic Impact	Direct	Indirect	Induced	Total
GVA (R Billions)	21.913	21.905	27.500	71.317
Percentage Accrual	31%	31%	38%	100%

Source: Urban-Econ Calculations, 2020

- The most directly affected sectors are the electricity, gas & water (17%), electrical machinery sector (16%), financial intermediation sector (14%) and the insurance sector (33%), all comprising 80% of operational expenditure's total contribution to GVA. In particular, the largest operational expenditure occurs in the insurance sector due to the specialised mechanised nature of the power plant and the sensitivity of its operation.

Potential impacts business income

Business Income refers to the income that the new economic activity retains within the economy

- The businesses that are anticipated to benefit from the CAPEX investment of the development are expected to see a cumulative increase in their income levels in the order of R13.34 billion.

Economic Impact	Direct	Indirect	Induced	Total
Income Contribution	3.910	3.824	5.606	13.340
Percentage Accrual	29%	29%	42%	100%

Source: Urban-Econ Calculations, 2020

- The second-round business income benefits for secondary suppliers are larger than those for direct contractors at 42%. This can be attributed to the fact that while the multiplier analysis is calculated on the premise that all impacts are contained within a regional economic context (uMhlathuze), the impacts are likely to extend as far as the supply chain of the power plant's development for the construction phase, as the location of the impacts is dependent on from where goods and services are sourced.

- A total contribution of R 32.1 billion increase in business income is expected and is a result of the effect of annual OPEX spend as reported in the cost estimations provided.

Economic Impact	Direct	Indirect	Induced	Total
Income Contribution	9.528	10.263	12.399	32.19
Percentage Accrual	29%	29%	42%	100%

Source: Urban-Econ Calculations, 2020

Potential impacts on employment

- The nature and scale of the development will impact the economy through the creation of employment opportunities. This is based on the number of jobs created in each sector as a result of the expenditure in the construction phase.
- Total employment contribution reflects the number of jobs created by economic growth as a result of the construction of the proposed Project.
- These opportunities are only for the duration of construction period, thus temporary.
- The geographic spread of these employment opportunities will be a function of the location of the companies appointed as service providers.
- While a project of this nature is anticipated to create employment opportunities in the local area & surrounding LM communities, the supply chains of the service providers will determine the localisation of these opportunities.

Economic Impact	Direct	Indirect	Induced	Total
Employment Creation	757	1,079	1,037	2,873

Source: Urban-Econ Calculations, 2020

- The total employment benefits of the development are 2,873 Full Time Equivalent Jobs (FTEJ) of which 757 is expected to be direct jobs, for the duration of the construction period. These figures will be realised over the entire construction period of the project. The employment figures presented are significant in comparison to the employed persons in the LM. These employment benefits will be realised over the entire construction period of the project.
- During consultation with key stakeholders the need to prioritise local employment opportunities was noted. It was added that the required skills should be communicated to organisations such as the Zululand Chamber of Commerce and Industry prior to the project commencing to identify skills that can be sourced locally.

- The proposed Project's employment contribution in 2018/19 is outlined in the table below. This reflects the number of jobs created in the economy as a result of every rand spent by the Project. Using the IO matrix, relevant multipliers are applied to the OPEX figure to generate the direct and indirect employment contribution by the proposed Project.

Economic Impact	Direct	Indirect	Induced	Total
Employment Creation	142	225	363	730

Source: Urban-Econ Calculations, 2020

- The impact of the OPEX spend is the development of 142 direct job opportunities in the economy. This breaks down into 122 full time employees and 20 part time employees annually which converts to 10 FTEJs pa.
- Indirect job opportunities created amount to about 730 jobs over 20 years that are created as the result of the Project's transactional trade with other businesses, new business sales, increased production & economic growth. This is based on a typical average number of jobs created in each sector, as a result of every rand spent in the operational phase. The power plant is anticipated to create employment opportunities in the local area and surrounding LM communities, the supply chains of service providers and trading linkages will determine the localisation of these opportunities.

Potential trade impacts

- The operation of the power plant is expected to have a positive economic impact on not only the local economy of the City of uMhlathuze LM, but also on the national economy (SA). The technology proposed has the twofold benefit of providing quick to market electricity desperately needed to meet the power demands in the RSA and secondly, in assisting with the stabilisation of the national grid to allow for some industries to reopen and grow.

- The power plant will feed into the national power supply electric grid which would help stabilise power supply and increase capacity. This would significantly reduce demand pressure on ESKOM, thus alleviating load shedding. Further, with the improved power supply and energy efficiency, this may help bring down the cost of power allowing some industries to reopen with reduced costs.
- Energy provision is crucial to overall development. The SA economy uses a large amount of energy, is highly energy-intensive, and heavily dominated by the extraction of raw materials and primary processing. The energy sector is therefore crucial for fuelling the country's economic growth and development. The expected benefits of the power plant include greater energy efficiency which would make industry (in LM and nationally) more internationally competitive and able to trade globally contributing to balance of trade.

Potential tax impacts

- The operation of the power plant will also have positive tax implications in terms of Value Added Tax (VAT) paid as well as through payroll taxes and corporate tax. These will contribute towards government revenue.
- This increase in the tax base will be spent in the economy to improve the welfare of society. The tax income resulting from the Project can, therefore, be viewed as a benefit to society.

Tax Benefits, Current 2020 values over the 20-year lifecycle (Source: Urban-Econ Calculations, 2020)

	VAT	Payroll Taxes	Total Tax Income
OPEX (R Billions)	6.6 pa	0.71	8.11
CAPEX (R Billions)	2.46	0.08	2.54

- The VAT generates significantly more tax income compared to business income tax and payroll taxes.
- In total, tax income should increase by at least R 8.11 billion as a result of the power plant development.

Potential impacts on property values

- The proposed Project will have no negative impact on surrounding property values due to its location within the Port of Richards Bay.
- The development is in line with both the function & aesthetic appeal of the area. The development will further add to the industrialisation of the area leading to further benefits in terms of higher commercial & industrial property values.
- It is expected that the development will initially lead to an increase in demand for housing during the construction phase leading to higher residential rents in the area. The increased employment opportunities created by operations may also lead to slightly higher residential rents as the NIFPP attracts higher demand for housing.
- The general positive impact in uMhlathuze is likely to have a positive investor impact in the LM area in general. Such a positive investor perception of the area & the additional growth that it implies may lead to indirect increases in property values.

Benchmarking of economic impacts

This section compares the total proposed NIFPP development contribution and economic impacts against the national and City of uMhlathuze LM economies to highlight the extent of the economic impacts of the proposed development. It gives the parameters against which the impacts can be benchmarked in order to interpret and understand the economic impacts.

A total gain of R 235.8 billion for both the CAPEX and OPEX impacts over 20-years is likely to be experienced within the economy in terms of increased production and output as a result of the CAPEX and OPEX spend of the Project (Table 70). Total GVA contribution of the Project is about R99 billion which comprises of R27.7 billion contribution to GVA in the construction phase and R71.3 billion over the operational phase (Table 70). This is a significant injection into the City of uMhlathuze LM economy considering the annual GVA for the local economy in 2018 was about R36.1 billion (Table 70). This will further result in a contribution towards the business income retained within the local economy amounting to R 45.5 billion (Table 70).

Unemployment continues to be one of the key risks to social and economic stability in SA with an unemployment rate 6 times higher than the global average. Due to the resilience risks posed by the COVID-19 global pandemic, unemployment is likely to worsen over the next few years as many industries contract and face job losses due to prolonged disruption. The City of uMhlathuze's LM rate of unemployment is 24.6% as per the recent Global insight statistics (City of uMhlathuze IDP, 2019/2020). The employment creation opportunities, therefore, of the Project are increasingly crucial over the next few years as the economy recovers. In terms of employment, 142 direct jobs are expected to be created in the local economy due to the Project's operation and a total of 3,603 full time equivalent jobs are expected to be created through the indirect and induced multiplier effects of both the construction and operational phases. This accounts for 3.5% of the current employment within the City of uMhlathuze LM. The operation of the proposed Project will also have positive fiscal impacts. At least R10.6 billion will be generated as tax revenue in terms of VAT and Payroll taxes.

Table 70: Summary NIFPP total contribution benchmarked against SA and LM economies

	South Africa pa 2018	City of uMhlathuze pa 2018	NIFPP Total Contribution over 20 years
Production Output (R Millions)	R9,327,062	R87,357	R235,800
GVA (R Millions)	R4,341,282	R36,122	R99,000
Income (R Millions)	R489,703,95	R3,603.45	R45,500
Employment (No of persons)	16,126,895	102,700	3,603
CIT and VAT tax (R Millions)	R725,994.43	R5,156.51	R10,680

11 SUMMARY OF SPECIALIST INVESTIGATIONS: IMPACT ASSESSMENT & CONCLUDING STATEMENTS

The specialist assessments presented in the previous chapter have defined the impacts that are likely to occur as a result of construction and operations of the proposed NIFPP with the impacts being presented as the changes to the environment. In this chapter the significance of those changes is presented using the method described in Section 9 together with concluding statements and/or recommendations. ***Note that specialists assessed the potential impacts associated with the Original and/or Amended (Sandspit Mangroves) power evacuation route alignment and substation location north-west of the Bayside Aluminium smelter site (Figure 111).*** Refer to the specialist reports in Appendix 6.

11.1 AIR QUALITY IMPACT ASSESSMENT

11.1.1 EMISSIONS' IMPACT ON THE ENVIRONMENT

In the absence of a prescribed methodology (in the Regulations Prescribing the Format of the Atmospheric Impact Report, Government Gazette No. 36904, Notice Number 747 of 2013; 11 October 2013), the impact of emissions from the proposed NIFPP on the environment was assessed using the pollutant critical concentrations that may affect human health and vegetative productivity. National ambient air quality standards (NAAQS) define limit concentrations for the protection of human health but there are no such limits in South Africa for impacts on vegetation. The assessment is based accordingly on comparing simulated annual NO_2 concentrations for the operational phase against the critical levels for vegetation, which are 30 µg/m³ (annual average and Half-year mean (winter)), as defined by the United Nations Economic Commission for Europe (UNECE) Convention on Long Range Trans-Boundary Air Pollution Limits (CLRTAP, 2015). Predicted off-site NO_2 concentrations are below the critical levels for all vegetation types across the modelling domain.

11.1.2 CONSTRUCTION PHASE

The construction phase is likely to have a "medium" impact rating if unmitigated. However, suggested mitigation measures could reduce the incremental impact of construction to "low" (Table 71).

Table 71: Impact significance ranking for possible adverse human health risks as a result of atmospheric emissions from the proposed project during construction of the substation

Activity	Construction of new substation and switching yard (north-west of Bayside)
Environmental/ Social Aspect	Atmospheric Emissions (PM)
Nature of the Impact	Adverse human health effects brought about by a change (deterioration) in the ambient air quality from atmospheric emissions of the construction phase.
Extent/ Scale	Local
Duration & Reversibility	Construction period only
Irreplaceable loss of a resource	Low
Consequence Inherent risk	High
Causes of impacts / Event	**Likelihood of the consequence:**
Emissions of PM (TSP, PM_{30}, PM_{10}, $PM_{2.5}$) result in ambient concentrations that exceed defined health-based limits (i.e. NAAQS)	Highly unlikely given the very limited extent of vegetation clearing.
Presence of communities within the 'exposure area/ zone' that may be exposed to ambient concentrations that exceed health-based limits (i.e. NAAQS)	Highly unlikely given the very limited emissions that would occur during the construction phase.
Residual risk	Moderate

Extrinsic/ additional mitigation measures	• Wet suppression at key handling points or cleared areas, and on unpaved roads. • Haul trucks to be restricted to specified haul roads and using the most direct route. • Reduce unnecessary traffic. • Strict on-site speed control (40km/hr for haul trucks). • Reduction of extent of open areas to minimise the time between clearing and infrastructure construction, and/or use of wind breaks and water suppression to reduce emissions from open areas. • Restriction of disturbance to periods of low wind speeds (less than 5 m/s) • Stabilisation of disturbed soil (for example, chemical, rock cladding, or vegetation). • Re-vegetation of cleared areas as soon as practically feasible.
Residual risk after mitigation	Low

11.1.3 OPERATIONAL PHASE

The low simulated concentrations for PM and NO_2 resulted in a "low" impact significance rating for both health impacts as well as damage to vegetation (Table 72 and Table 73). Cumulative impacts were rated on the basis of the proposed facility in the context of the existing baseline air quality. A moderate rating was assigned to the cumulative impact due to elevated baseline simulated PM concentrations (Table 74).

Table 72: Impact significance ranking for possible adverse human health risks as a result of atmospheric emissions from the proposed project during operation of the CCGT floating power barges

Activity	Combustion of natural gas to generate power
Environmental/ Social Aspect	Atmospheric Emissions (NO_x PM and SO_2)
Nature of the Impact	Adverse human health effects brought about by a change (deterioration) in the ambient air quality from atmospheric emissions of the power plant.
Extent/ Scale	Local
Duration & Reversibility	Long-term & reversible
Irreplaceable loss of a resource	Low
Consequence Inherent risk	High
Planned risk mitigation/management	• Low sulphur content natural gas. • Use of dry low-NO_X combustors for combustion turbines burning natural gas. • NOx emissions monitoring.
Causes of impacts / Event	**Likelihood of the consequence:**
Increased ambient NOx concentrations	Highly unlikely given the simulated ambient concentrations which are seen to comply with the NAAQS even for the worst case-assumption of all NO converting to NO_2.
Increased ambient PM (TSP, PM_{30}, PM_{10}, $PM_{2.5}$) concentrations	Highly unlikely given the simulated ambient concentrations which are seen to comply with the NAAQS.
Increased ambient SO_2 concentrations	Highly unlikely given the very low sulphur content of the natural gas.
Increased exposure to air pollution in communities	Highly unlikely given the distance to sensitive residential receptors, schools, and medical facilities and the fact that no exceedances of NAAQS limit values are predicted.
Residual risk	Moderate
Additional mitigation	None required.
Residual risk after mitigation	Moderate

Table 73: Impact significance ranking for possible damage to vegetation and reduced habitat risks as a result of atmospheric emissions from the proposed project during operation of the CCGT floating power barges

Activity	Combustion of natural gas to generate power
Environmental/ Social Aspect	Atmospheric Emissions (NO_x and PM)
Nature of the Impact	Damage to vegetation and reduced habitat brought about by a change (deterioration) in the ambient air quality from atmospheric emissions of the power plant.
Extent/ Scale	Local
Duration & Reversibility	Long-term & reversible
Irreplaceable loss of a resource	Low
Consequence Inherent risk	Moderate
Planned risk mitigation/management	• Use of dry low-NO_X combustors for combustion turbines burning natural gas. • NOx emissions monitoring.
Causes of impacts / Event	**Likelihood of the consequence:**
Changes in ambient NOx concentrations	Highly unlikely as vegetation damage would typically only occur with longer term exposure to elevated pollution concentrations which is not predicted by the dispersion model.
Increased exposure of sensitive vegetation/ habitat to air pollution	Highly unlikely given the generally small, longer term averaging period ambient concentrations even over the immediate project area.
Residual risk	Low
Extrinsic/ additional mitigation measures	None required.
Residual risk after mitigation	Low

Table 74: Impact significance ranking for possible adverse human health risks as a result of cumulative atmospheric emissions from the proposed project during operation

Activity	Combustion of natural gas to generate power
Environmental/ Social Aspect	Atmospheric Emissions (NO_x PM and SO_2)
Nature of the Impact	Adverse human health effects brought about by a change (deterioration) in the ambient air quality from atmospheric emissions of the power plant as well as existing baseline concentrations.
Extent/ Scale	Regional
Duration & Reversibility	Long-term & reversible
Irreplaceable loss of a resource	Low
Consequence Inherent risk	High
Planned risk mitigation/management	• Low sulphur content natural gas. • Use of dry low-NO_X combustors for combustion turbines burning natural gas. • NOx emissions monitoring.
Causes of impacts / Event	**Likelihood of the consequence:**
Increased ambient NOx concentrations	Highly unlikely as predicted concentrations comply with health-based limits (NAAQS), even for worst case-assumptions of all NO converting to NO_2.
Increased ambient PM (TSP, PM_{30}, PM_{10}, $PM_{2.5}$) concentrations	Likely, but strictly as a function of the elevated PM concentrations in the port area (due to coal handling activities). The contribution from the proposed power plant is however very small.
Increased ambient SO_2 concentrations	Unlikely given negligible SO_2 emissions from the NIFPP but elevated background concentrations of SO_2.
Increased community exposure to air pollution	Highly unlikely that communities would experience changes in exposure as a result of the proposed project but note elevated background concentrations.
Residual risk	Moderate
Extrinsic/ additional mitigation measures	As the proposed project has a small PM impact the mitigation measures needed are for the other background sources.
Residual risk after mitigation	Moderate

11.1.4 IMPACT STATEMENT & RECOMMENDATIONS

Overall effects on air quality during the project's construction and operation phase are not expected to be significant. The project will comply with ambient air quality standards. The project will use equipment that will conform to industry emissions standards. In addition, the primary fuel source for combustion is natural gas; which is a much cleaner burning fuel than other potential options. From an air quality perspective, it is recommended that the project go ahead, on condition that:

- Emissions due to construction activities be mitigated using good practise guidelines; and,
- NO_X emissions to be within MES.

11.2 QUALITATIVE NOISE IMPACT STATEMENT

11.2.1 CONSTRUCTION PHASE

Due to the overall types of activity and distance between the main work sites and nearest sensitive receptors, there is a low likelihood of the noise levels exceeding 70 dB LAeq, and if so, this will be of short duration. The negative noise impacts are therefore considered to be of low significance at the nearest receptors.

Table 75: Significance rating for potential noise impacts due to the construction phase of the project

Activity	Construction activities for the Combined Cycle Gas Turbine (CCGT) technology project
Environmental/ Social Aspect	Noise emissions
Nature of the Impact	Increased noise levels due to project activities results in a disturbance at sensitive receptors
Extent/ Scale	Local
Duration & Reversibility	Short-term & reversible
Irreplaceable loss of a resource	Low
Consequence Inherent risk	Moderate - Low
Causes of impacts / Event	**Likelihood of the consequence:**
Increased noise levels	Unlikely due to the distance of sensitive receptors from project activities.
Residual risk	Low
Extrinsic/ additional mitigation measures	• Use temporary noise barriers and use 'low noise' equipment (including alternative reversing alarms), where possible; • Train construction staff on noise control plan during health & safety briefings; • Select 'low noise' equipment, or methods of work; • Use most effective mufflers, enclosures and low-noise tool bits and blades; • Investigate use of alternatives to audible reversing alarms (such as broadband noise emitting models) or configure to maximise forward movements of mobile plant; • Use alternatives to diesel/petrol engines and pneumatic units, such as hydraulic or electric-controlled units, where feasible and reasonable; • Use temporary noise barriers for small equipment, where required; • Reduce throttle settings and turn off equipment when not used; • Avoid dropping from heights and metal-to-metal contact; • Avoid clustering of mobile plant near receptors and enforce rest periods for unavoidable maximum noise events; • Ensure periods of respite are provided in the case of unavoidable maximum noise level events; • Regular inspection and maintenance of all plant and equipment.
Residual risk after mitigation	Low

11.2.2 OPERATIONAL PHASE

With regard to noise emissions, there are no specific positive impacts relating to the operation of the proposed project. Noise during operation is expected to be generated by various components, including the turbines and associated coolers, the high-voltage and power station transformers and switchyard, and ancillary facilities such as the water treatment plant. Given the distance of sensitive receptors, the potential noise impacts from the project are likely to remain below the IFC Guideline Noise Levels, both during the day and night. The overall noise impacts are therefore deemed to be negative and of low significance prior to mitigation.

Table 76: Significance rating for potential noise impacts due to the operation phase of the project

Activity	Power Generation by way of Combined Cycle Gas Turbine (CCGT) technology
Environmental/ Social Aspect	Noise emissions
Nature of the Impact	Increased noise levels due to project activities results in a disturbance at sensitive receptors
Extent/ Scale	Local
Duration & Reversibility	Long-term & reversible
Irreplaceable loss of a resource	Low
Consequence Inherent risk	Moderate - Low
Causes of impacts / Event	**Likelihood of the consequence:**
Increased noise levels	Unlikely due to the distance of sensitive receptors from project activities.
Residual risk	Low
Extrinsic/ additional mitigation measures	• Air flow requirements shall be designed to take account of noise breakout; • Design an acoustic enclosure for the CCGT to meet the specifications for 85 dBA at 1 m from the source; • Establish a complaint register.
Residual risk after mitigation	Low

11.3 TERRESTRIAL BIODIVERSITY & WETLAND IMPACT ASSESSMENT

11.3.1 LIMITATIONS & ASSUMPTIONS

Site visits were conducted during June 2020 (for the wetland assessment) and July 2020 (for the terrestrial biodiversity assessment) covering the western portion of the site, followed by a second site visit in January 2021 to assess both wetlands and terrestrial biodiversity in the eastern portion of the study site. It is possible that important taxa would not have been observed, in particular plants, in the western portion due to the absence of floral or propagule organs and/or species entering a dormant phase. The main fauna species of concern are typically secretive and/or nocturnal and would require focused sampling efforts over longer periods of time to ascertain their presence.

The modifications within the landscape associated with the Port and surrounds have modified wetland systems (i.e. from floodplain and estuarine systems historically) to their current form, which are strongly influenced by lateral water from the surrounding landscape. As such, an assessment of their historical condition would not be a true reflection of their current context within the landscape.

The aquatic ecosystems located near the harbour have been excluded from this report, as these systems are considered to be dominated by estuarine processes, and as such beyond the scope of this study. Estuarine components fall within the ambit of the Estuarine Ecological Specialist Assessment.

11.3.2 IDENTIFIED IMPACTS BASED ON PROJECT ACTIVITIES

Wetland impacts:

- Introduction of foreign materials (e.g. construction material, oil, fuel, etc.);
- Destruction/degradation of wetland habitat, including soil disturbance and compaction, particularly during construction of the power evacuation line, substation and laydown area;
- Direct infilling of portions of the freshwater ecosystems (e.g. construction of the substation and/or inspection/access points);
- In-system impoundments and the creation of sub-surface drainage as a result of poorly constructed trenches;
- Removal of vegetation, increasing the opportunity for the spread of IAPs;
- Loss of ecosystem services associated with the wetland habitat;
- Habitat transformation through the removal and/or fragmentation of wetland vegetation;
- Erosion due to soil modifications associated with the construction and operational activities, which could lead to further channel incision, bed scouring, bank collapse, particularly in relation to crossings where the longitudinal slope of wetland systems is not maintained; and,
- Water quality issues associated with the development (e.g. fuel/oil spills, application of herbicides during maintenance, and so forth).

Terrestrial biodiversity impacts:

- Direct loss and transformation of terrestrial vegetation and habitat supporting biodiversity, including features of biodiversity importance (i.e. Critical Biodiversity Areas or CBAs, Critically Endangered Kwambonambi Hygrophilous Grassland, Critically Endangered Mangrove Forest, and Critically Endangered Swamp Forest);
- Physical disturbance to soils and subterranean habitat supporting fossorial fauna (e.g. Spotted Shovel-nosed Frog, Natal Black Snake, and Hottentot Golden Mole);
- Disturbance and displacement of fauna;
- Direct disturbance to protected vegetation and plants (e.g. forest vegetation, *Ficus tricopoda* trees, other protected plants, etc.); and,
- Establishment and spread of IAPs.

11.3.3 SPECIALIST IMPACT STATEMENT

Activities to be strictly managed during both the construction and operational phases to minimise off-site changes to the biophysical environment. Mitigation measures presented in Table 77 to Table 82 would assist in meeting that requirement. The residual significance of impacts, i.e. the assessment that considers implementation of mitigation measures, suggests a decrease in significance of various associated activities. However, where impacts cannot be suitably reduced to a 'low' (or even a 'moderate-low') risk category, then additional measures will need to be considered to offset the residual impacts.

The extensive mangrove forests located within the estuarine areas represent another highly sensitive biodiversity feature that will need to be carefully considered in terms of the project planning and development, but these fall outside of the scope of this study. However, the proposed plan to develop the power evacuation line will ensure that the main mangrove forests are completely avoided by suspending the GILs within a box structure above the canopy.

Table 77: Characteristics and significance of key impacts to freshwater ecosystems from the proposed NIFPP project due to the development of the proposed substation

DEVELOPMENT OF THE NIFPP SUBSTATION				
Environmental aspect	Direct loss, fragmentation and/or degradation of wetland habitat, including loss of system functions/process and ecological services			
Nature of the impact	Infilling of wetland habitat (particularly VB2 and parts of VB Corridor) to accommodate the substation platform, potentially resulting in the additional introduction of foreign materials (e.g. subsoil, cement, etc.)	Hydrological alteration due to uncontrolled runoff (from increased hardened surfaces onsite) into the receiving environment leading to impacts such as soil erosion and channel incision, as well as interrupted surface and/or subsurface water flows	Hydrological alteration linked to the loss of VB2 and the connectivity to VB2 corridor via VB 1 and VB2	Establishment and spread of IAPs in and around disturbed areas
Consequence / Inherent risk	**Moderate High**	**Moderate High**	**Moderate High**	**Moderate-high**
Extent / Scale	Site	Site	Site	Site
Duration & Reversibility	Permanent & irreversible	Permanent & irreversible	Permanent & irreversible	Short-term & reversible
Irreplaceability	High	High	High	Medium
Causes of impacts / Event	**Likelihood of the Consequence**			
Construction Phase of the substation and associated infrastructure	Definite: a large portion (~6ha) of the platform comprises subtropical wetland habitat (including swamp forest, papyrus reedbeds, and grassy/sedge wetland) some of which are former relics of an extensive historic wetland system	Definite: clearing of vegetation and as such the buffering of flows into the wetland	Definite: platform constructed over a large portion of VB2	Definite: given the high probability of disturbance associated with the development in proximity to wetland areas and the existing IAP infestations in close proximity to proposed development areas
Operational Phase of the substation and associated infrastructure	Definite: as a continuation of the construction phase, but in perpetuity	Definite: the substation site will comprise of impervious materials	Definite: as a continuation of the construction phase, but in perpetuity	Definite: as a continuation of the construction phase, but in perpetuity
Residual risk	**High**	**High**	**High**	**High**
Mitigation measures	• **Placement of platform outside of wetland areas (specifically VB 1, VB 2, HSS 1 and HSS 2), including the adoption of a minimum of a 15m buffer surrounding these listed wetlands.** • Develop and implement a sound stormwater management plan to ensure adequate and controlled surface water flows down the entire western wetland system. • Use of impervious surfaces in the design and construction of the substation. • Construction should take place during the dry/winter season to minimise impacts that are associated with rainfall (e.g. soil erosion), otherwise strict stormwater management and erosion control measures will be required for wet/summer season construction. • Maintain strict supervision by an onsite Environmental Control Officer (ECO). • Vehicles, machinery, personnel, construction materials, cement, fuel, oil or waste are not allowed in wetland environments (including the 15m buffer). • Construction camps, toilets, temporary laydown areas and access roads should be located outside of wetlands and recommended buffer (15m) areas around wetlands. • All disturbed areas to be rehabilitated according to a sound rehabilitation plan. • Develop and implement a comprehensive IAP control programme to manage problematic plant species, and prevent further spread and establishment.			
Residual risk after mitigation	**Moderate-high**	**Moderate-low**	**Moderate-high**	**Moderate-low**

Table 78: Characteristics and significance of key impacts to freshwater ecosystems from the proposed NIFPP project due to the development of the proposed laydown area

DEVELOPMENT OF THE LAYDOWN AREA			
Environmental aspect	Direct loss, fragmentation and/or degradation of wetland habitat, including loss of system functions/process and ecological services		
Nature of the impact	Infilling of wetland habitat to accommodate the laydown area, potentially resulting in the additional introduction of foreign materials (e.g. subsoil, cement, etc.)	Hydrological alteration due to uncontrolled runoff (from increased hardened surfaces onsite) into the receiving environment leading to impacts such as soil erosion and channel incision, as well as interrupted surface and/or subsurface water flows	Establishment and spread of IAPs in and around disturbed areas
Consequence / Inherent risk	**Moderate-high**		
Extent / Scale	Site	Site	Site
Duration & Reversibility	Short-term & reversible	Short-term & reversible	Short-term & reversible
Irreplaceability	High	High	Medium
Causes of impacts / Event	**Likelihood of the Consequence**		
Construction Phase of the laydown area	The proposed laydown site has to be defined. The wetlands to the east of the Harbour Arterial Road are considered to be artificial whilst VB3 to the west is considered to be a combination of reedbed and grassy wetland habitat	Definite: clearing of vegetation and as such the buffering of flows into the wetland	Definite given the high probability of disturbance associated with the development in proximity to wetland areas and the existing IAP infestations in close proximity to proposed development areas
Operational Phase of the laydown area		N/A	
Residual risk	**Moderate**		
Mitigation measures	• **Placement of the laydown area outside of wetland habitat (specifically and importantly VB3 and the 15m buffer).** • Develop and implement a sound stormwater management plan to control surface water runoff, particularly when directed into VB 3. • Construction should take place during the dry/winter season to minimise impacts that are associated with rainfall (e.g. soil erosion), otherwise strict stormwater management and erosion control measures will be required for wet/summer season construction. • Maintain strict supervision by an onsite Environmental Control Officer (ECO) • Vehicles, machinery, personnel, construction materials, cement, fuel, oil or waste are not allowed in wetland environments (including the 15m buffer for VB 3). • Construction camps, toilets, temporary laydown areas and access roads should be located outside of wetlands and recommended buffer (15m) areas around wetlands. • All disturbed areas to be rehabilitated according to a sound rehabilitation plan. • Develop and implement a comprehensive IAP control programme to manage problematic plant species, and prevent further spread and establishment.		
Residual risk after mitigation	**Moderate-low**		

Table 79: Characteristics and significance of key impacts to freshwater ecosystems from the proposed NIFPP project due to the development of the proposed evacuation line

DEVELOPMENT OF THE POWER EVACUATION LINE			
Environmental aspect	Direct loss, fragmentation and/or degradation of wetland habitat, including loss of system functions/process and ecological services		
Nature of the impact	Infilling of wetlands to accommodate the power evacuation structure and the associated access/haul road), with added introduction of foreign materials (e.g. subsoil, cement, etc.)	Hydrological alteration due interrupted surface and/or subsurface water flows	Establishment and spread of IAPs in and around disturbed areas
Consequence / Inherent risk	**Moderate-high**	**Moderate-high**	**Moderate-high**
Extent / Scale	Site	Site	Site
Duration & Reversibility	Permanent & irreversible	Permanent & irreversible	Short-term & reversible
Irreplaceability	High	High	Medium
Causes of impacts / Event	**Likelihood of the Consequence**		
Construction Phase of the power evacuation line and access/haul road Operational Phase of the power evacuation line and access/haul road	Definite as the area has a very high proportion of wetland habitat that will need to be traversed by the power evacuation structure, which may require placement of piles within and/or immediately adjacent to wetlands and its associated access road.	Highly likely: the placement of the access/haul road will influence the flows through the wetland system	Definite given the high probability of disturbance associated with the development in proximity to wetland areas and the existing IAP infestations in close proximity to proposed development areas
Residual risk	**Moderate**	**Moderate**	**Moderate**
Mitigation measures	• Avoid road access/crossings through wetlands for construction access and maintenance. • Placement of support piles and access roads outside of wetland areas, ensuring these do not impact of flows in the system – piles should be placed at the greatest possible distance apart from each other. • Construction should take place during the dry/winter season to minimise impacts that are associated with rainfall (e.g. soil erosion), otherwise strict stormwater management and erosion control measures will be required for wet/summer season construction. • Maintain strict supervision by an onsite Environmental Control Officer (ECO). • Vehicles, machinery, personnel, construction materials, cement, fuel, oil or waste not allowed in wetlands. • Construction camps, toilets, temporary laydown areas and access roads should be located outside of wetlands and recommended buffer areas around wetlands. • All disturbed areas to be rehabilitated according to a sound rehabilitation. • Develop and implement a comprehensive IAP control programme to manage problematic plant species, and prevent further spread and establishment.		
Residual risk after mitigation	**Moderate**	**Moderate-low**	**Moderate-low**

Table 80: Characteristics and significance of key impacts to terrestrial biodiversity from the proposed NIFPP project due to the development of the proposed substation

DEVELOPMENT OF THE NIFPP SUBSTATION			
Environmental aspect	Direct loss, fragmentation and/or degradation of terrestrial habitats, including loss of associated biodiversity patterns (e.g. sensitive fauna and flora) and processes (e.g. habitat connectivity)		
Nature of the impact	Clearing of up to 10ha of natural vegetation comprising Maputaland Coastal Belt grassland and associated habitats supporting biodiversity, including highly sensitive features such as CBAs, and swamp forest	Physical disturbance of soils and fauna and flora, including species of conservation concern	Establishment and spread of invasive alien plants in and around disturbed areas
Consequence / Inherent risk	**Moderate-high**	**Moderate-high**	**Moderate-high**
Extent / Scale	Site	Local	Local
Duration & Reversibility	Permanent & irreversible	Permanent & irreversible	Short-term & reversible
Irreplaceability	High	High	Medium
Causes of impacts / Event	**Likelihood of the Consequence**		
Construction Phase of the substation and associated infrastructure	Definite as the area where the substation is to be located is a CBA with elements of (Endangered) Maputaland Coastal Belt grassland in poor to moderate condition supporting associated fauna and flora, *albeit* in low diversity/abundance	Highly likely given the occurrence of grassland and wetland of reasonable condition and associated biodiversity, potentially including species of conservation concern/importance (e.g. Spotted Shovel-nosed Frog, Hottentot Golden Mole, Swamp Figs, Orchids, etc.)	Definite given the high probability of disturbance associated with the development and the existing IAP infestations in close proximity to proposed development areas
Operational Phase of the substation and associated infrastructure	Definite: as a continuation of the construction phase, but in perpetuity	Highly likely given the loss in available habitat, reduced connectivity for dispersal and movement of species, and increase in light/noise pollution.	Definite: as a continuation of the construction phase, but in perpetuity
Residual risk	**High**	**High**	**High**
Mitigation measures	• Avoid highly sensitive areas west of VB 2 which contains Kwambonambi hygrophilous grassland, as well as Maputaland Coastal Belt grassland in moderate condition. • Avoid disturbance to swamp forest patches containing *Ficus tricopoda* trees. • Avoid unnecessary vegetation clearing, and minimise development footprint as much as possible, particularly access routes for vehicles and machines around the edges of the substation site. • Design and implement a plant rescue plan where avoidance of sensitive plants is not possible, and obtain the necessary permits from DEFF and EZNW if protected plants are to be affected. • Restrict and control the movement of people and vehicles during all stages of development, and ensure that prohibited access areas are clearly demarcated. • Topsoil from cleared areas should be stockpiled using appropriately designated areas for re-use during revegetation/rehabilitation onsite and off-site. • All construction materials and solid/liquid waste should be disposed in an appropriate and sensible manner. • Maintain strict supervision by an onsite Environmental Control Officer (ECO). • All disturbed areas to be rehabilitated according to a sound rehabilitation plan. • Develop and implement a comprehensive IAP control programme to manage problematic plant species, and prevent further spread and establishment.		
Residual risk after mitigation	**Moderate**	**Moderate-low**	**Moderate-low**

Table 81: Characteristics and significance of key impacts to terrestrial biodiversity from the proposed NIFPP project due to the development of the proposed laydown area

DEVELOPMENT OF THE LAYDOWN AREA			
Environmental aspect	Direct loss, fragmentation and/or degradation of terrestrial habitats, including loss of associated biodiversity patterns (e.g. sensitive fauna and flora) and processes (e.g. habitat connectivity)		
Nature of the impact	Clearing of natural vegetation and associated habitats supporting biodiversity associated with secondary grassland, thicket and seral forest, with isolated patches of swamp forest (it is assumed all Mangrove Forest will be avoided entirely)	Physical disturbance of soils and fauna and flora, including species of conservation concern, *albeit* in low numbers	Establishment and spread of IAPs in and around disturbed areas
Consequence / Inherent risk	**Moderate**	**Moderate**	**Moderate-high**
Extent / Scale	Site	Site	Local
Duration & Reversibility	Short-term & reversible	Short-term & reversible	Medium-term & reversible
Irreplaceability	Medium	Medium to low	High
Causes of impacts / Event	**Likelihood of the Consequence**		
Construction Phase of the laydown area	Highly likely, but only for secondary/degraded vegetation types. The proposed laydown site still has to be defined, but this will be guided by the wetland and terrestrial assessments to avoid some of the more important/sensitive areas.	Likely to occur, but only for a small, insignificant number of *Ficus trichopoda* (Protected) trees and *Eulophia speciosa* (Protected) orchid. Permits would be required. No other notable species / species of conservation concern such as *Asclepias gordon-grayae* (Endangered herb) were observed in the eastern portion	Definite given the high probability of disturbance associated with the development and the existing IAP infestations in close proximity to proposed development areas
Operational Phase of the laydown area		Highly unlikely as the area will already be disturbed, other than incidental killing of snakes and other small fauna by personnel and vehicles/machinery	
Residual risk	**Moderate**	**Moderate**	**High**
Mitigation measures	• Reduce the footprint of the laydown facility as much as possible, and minimise areas requiring hardened/impervious and more permanent infrastructure. • Avoid, some of the more sensitive vegetation such as older patches of seral forest highly sensitive areas by making use of the highly disturbed areas (**Figure 4-9**). • Design and implement a plant rescue plan, and obtain the necessary permits from DEFF and EZNW if protected plants are to be affected. • Limit the removal of mature, indigenous trees. • Develop and implement a comprehensive alien plant control programme to manage problematic plant species, and prevent further spread and establishment. • Restrict and control the movement of people and vehicles, and ensure that natural areas are avoided. • Topsoil from the laydown area must be stockpiled using appropriately designated areas for re-use during revegetation/rehabilitation of the laydown area post closure. • All construction materials and solid/liquid waste should be disposed in an appropriate and sensible manner. • Maintain strict supervision by an onsite Environmental Control Officer (ECO). • Post closure, rehabilitate the laydown area according to a sound rehabilitation plan.		
Residual risk after mitigation	**Low**	**Low**	**Moderate-low**

Table 82: Characteristics and significance of key impacts to terrestrial biodiversity from the proposed NIFPP project due to the development of the proposed evacuation line

DEVELOPMENT OF THE POWER EVACUATION LINE			
Environmental aspect	Direct loss, fragmentation and/or degradation of terrestrial habitats, including loss of associated biodiversity patterns (e.g. sensitive fauna and flora) and processes (e.g. habitat connectivity)		
Nature of the impact	Clearing of natural vegetation for two towers (up to 0.2ha), as well as for access to construct the towers. In addition, the structure along the southern boundary will impact on a small area comprising largely of lawn grasses (all Mangrove Forest will be avoided entirely)	Physical disturbance of soils and fauna and flora, including species of conservation concern, *albeit* in low numbers	Establishment and spread of IAPs in and around disturbed areas
Consequence / Inherent risk	**Moderate**	**Moderate-high**	**Moderate-high**
Extent / Scale	Local	Local	Local
Duration & Reversibility	Permanent & irreversible	Short-term & reversible	Medium-term & reversible
Irreplaceability	Medium to low	Medium	High
Causes of impacts / Event	**Likelihood of the Consequence**		
Construction Phase of the power evacuation line and access/haul road Operational Phase of the power evacuation line and access/haul road	Likely as the area where the power evacuation line needs to traverse seral forest containing old/mature trees (mostly *Acacia* karroo), which will require access for vehicles/machinery. However, there are good opportunities to position towers on highly disturbed sites with IAPs (Figure 5-4), and access can be easily routed along existing tracks through the seral forest. Impacts on terrestrial vegetation from the overhead structure will be negligible.	Unlikely given the approach of avoiding most of the more notable terrestrial vegetation, as well as due to the unlikelihood of notable species occurring within the terrestrial areas through which the power evacuation line passes.	Definite given the high probability of disturbance associated with the development and the existing IAP infestations in close proximity to proposed development areas
Residual risk	**Moderate**	**Moderate**	**High**
Mitigation measures	• Avoid impacts to seral forest when developing the towers for the power evacuation line by considering the positions shown in **Figure 5-4**. • Avoid unnecessary vegetation clearing, as much as possible, particularly access routes for vehicles and machines through seral forests in the eastern areas. • Use existing access tracks through seral forest to minimise impacts on natural vegetation. • Limit the removal of mature, indigenous trees (particularly in the seral forest areas) during the construction of the power evacuation line (indigenous trees should be clearly marked to avoid accidental removal/damage). • Restrict and control the movement of people and vehicles during all stages of development, and ensure that prohibited access areas are clearly demarcated. • Topsoil from cleared areas should be stockpiled using appropriately designated areas for re-use during revegetation of tower sites. • All construction materials and solid/liquid waste should be disposed in an appropriate and sensible manner. • Maintain strict supervision by an onsite Environmental Control Officer (ECO). • Develop and implement a comprehensive IAP control programme to manage problematic plant species, and prevent further spread and establishment.		
Residual risk after mitigation	**Low**	**Low**	**Moderate-low**

Whilst the power evacuation line supporting the suspended GILs is expected to result in the loss of some natural vegetation and increase the vulnerability of the area to further invasion by IAP, these impacts would be largely dependent on final alignment. However, should mitigation measures be correctly followed (including recommendations for positioning towers and aligning access roads), then vegetation clearing and habitat loss would be significantly reduced and potentially avoided.

In the case of the 400kV substation, a trade-off will need to be made that will either result in the loss of Maputaland Coastal Belt grassland in moderate condition and/or wetland habitat (VB1 and VB2). In both instances, a considerable effort will be required to assess and evaluate offset requirements (as discussed in the following section), which will then need to be implemented before the development can be authorised. Thus, it is important to note that offsets should always be the last resort, and that the mitigation hierarchy should be exhausted before any offsetting processes are even considered. If the proposed substation footprint can be moved eastwards and therefore not impact on the VB1 and/or VB2 buffered wetland systems and only result in the loss of secondary Maputaland Coastal Belt Grasslands (refer to Figure 83), then biodiversity offsetting would not be required

11.4 ESTUARINE IMPACT ASSESSMENT

11.4.1 DREDGING

An estimated 514 000 m^3 of sediment will be removed from the study area, through dredging, with spoil material to be disposed of in pre-approved dredge disposal sites. The details of the proposed dredging are:

- Power Barge infrastructure areas: An estimated 168 000 m^3 of sediment, comprising predominantly sands, will be dredged from the area to the north of the Sandspit using a backhoe dredger. Being sandy material, the dredge spoil will be disposed onto the beaches to the north of the port entrance (Alkanstrand Beach) through the existing maintenance dredging infrastructure and beach nourishment programme.
- LNG berths: An estimated 346 000 m^3 of sediment, comprising mainly silt, will be dredged from the area to the east of the sandspit to accommodate the LNG vessel berths, using a trailing suction hopper dredger. This material will be disposed of at the approved existing offshore dredge disposal site.

The following impacts were identified with dredging proposed for the NIFPP development:

- Loss of benthic habitat:
    - The initial loss of benthic habitat will be restricted to the dredged areas.
    - Dredged areas not affected by permanent piles will gradually recover, with biotic communities becoming re-established over time as the habitability of the substrate improves.
    - Loss of benthic habitat will directly affect benthic dwelling organisms such as meio- and macrobenthic fauna. Based on the status quo assessment findings, the areas to be dredged showed relatively low species diversity and habitat quality. This was particularly evident in the deeper muddy habitat along the RBCT canal.
    - Loss of benthic habitat from dredging will have a limited effect on other biotic components, such as the macrocrustacea and fish communities. Even though the deep-water sites along the RBCT channel were not sampled for prawns and fish, it is not expected that this habitat will support a diverse community of these biotic groups. The shallow subtidal habitat north of the sandspit will, however provide habitat for some fish and prawn species, although the results from the ecological survey indicated a generally low diversity.
    - **Habitat loss due to dredging: The ecological risk associated with habitat loss due to dredging will not be high, as loss of benthic habitat will be mostly temporary and restricted to the dredged area. In addition, the two dredging zones are characterized by relatively low species diversity and habitat quality, compared to the more sensitive intertidal and subtidal sand-and mudflat habitat.**

- Resettling of disturbed sediment:
    - In summary, the hydrodynamic modelling study showed that the resettling of disturbed sediments from dredging was predicted to have a negligible effect on the benthic habitat in deep-water basin areas (<10mm) and have a very limited (<5mm) and localized effect (north-eastern corner) on the intertidal and subtidal Kabeljous Flats habitat.
    - Benthic dwelling biota are sensitive to the effects of re-settling of disturbed sediments, due to the smothering affect. The extent (volume in mm) and the rate of settling are both important factors in assessing the risk associated with the impact.
        - **The limited extent of the re-settling in both areas suggest that the ecological risk associated with the sediment resettling will be negligible to low.** In this regard, the rate of re-settling is also expected to be low, which will allow benthic organisms to adjust. This is due to the fact that dredging will last in the order of 3 months, suggesting gradual re-settling of disturbed sediment on adjacent benthic habitat. In addition, maintenance dredging activities in the harbour are ongoing and the biota associated with the deep-water basins are, generally, exposed to a steady rate of sediment re-settling from disturbed sediments during Port maintenance dredging.
- Water quality: TSS and turbidity:
    - The hydrodynamic modelling revealed that: TSS concentrations are expected to always remain below 5 mg/ℓ in the surface waters and below 20 mg/ℓ in bottom waters, which are far below the threshold of concern. The results suggest a low ecological risk associated with TSS concentrations due to dredging. TSS levels are not predicted to increase on the Kabeljous Flats due to dredging, other than in the immediate vicinity of the LNG berths, typically ranging between 1.5 mg/ℓ and 2.0 mg/ℓ, but always below 4 mg/ℓ.
    - **The results from the modelling study suggest that the predicted TSS concentrations will not exceed threshold levels and as such, dredging during this project will not pose an unacceptable environmental risk.**
- Ecotoxicological effects:
    - Metal concentrations in port sediments, particularly of metals such as copper and chromium, have been shown to exceed sediment quality guidelines, presenting a high ecological risk to biota. The bulk terminal basin was singled out as the area with the highest level of contaminated sediments. Dredging for the proposed development will involve dredging along the southern edge of the bulk terminal basin, which implies a high risk of re-suspension of contaminated sediment.
    - **The estuarine status quo assessment found that none of the metals measured exceeded the Level I South African SQG threshold values implying that re-suspended contaminants from dredging during the NIFPP development represents a low risk for environmental contamination. Similarly, the dredged sediment is suitable for unconfined open water disposal.**
    - Earlier studies strongly suggested that sediments in the series 600 and 700 basin (bulk and break-bulk terminals) showed high levels of Cd, Cu, Cr and Zn enrichment. The fact that sediment metals during the present study did not exceed Level I threshold concentrations, suggests a steep gradient in sediment Cu and Cr concentrations across the bulk terminal basin, decreasing from the series 600 and 700 Berth towards the sandspit. It is therefore imperative that dredging for the NIFPP be restricted to the proposed footprint of the development, as dredging to the north of this area could potentially result in re-suspension of contaminated sediments that exceed the Level I or even Level II threshold concentrations.

11.4.2 WATER QUALITY, GRANULOMETRY & ORGANIC CONTENT

Table 83: Impact significance of the proposed NIFPP and associated infrastructure on the Water Quality, Granulometry and Organic Content of the estuarine environment.

Activity	**Dredging and Marine piling in order to establish the physical infrastructure required for receiving and storing LNG, power generation by way of CCGT floating power barges, and the evacuation of power to the on-land substation.**	
Estuarine Component (Environmental Aspect)	**WATER QUALITY, GRANULOMETRY & ORGANIC CONTENT**	
CONSTRUCTION PHASE		
Power Generation Facility and Gas Quay & Terminal Component		
Nature of the Impact	• Dredging and marine piling along the northern and eastern extent of the sandspit as well as piling across the Kabeljous Flats will result in the disturbance of sediments with elevated TSS and turbidity in the water column as well as changes in granulometry and organic content of sediment in impacted areas resulting in the loss of benthic habitat and potential smothering of benthic fauna and flora. • Localised scouring and re-settlement of suspended sediment would increase TSS & turbidity and result in changes in granulometry and organic content of sediments in the immediate areas surrounding the impacted area resulting in the loss of benthic habitat and potential smothering of benthic fauna & flora.	
Power Evacuation		
Nature of Impact	• Marine piling across the Kabeljous Flats will result in the disturbance of sediments with elevated TSS and turbidity in the water column as well as changes in granulometry and organic content of sediment in impacted areas resulting in the loss of benthic habitat and potential smothering of benthic fauna and flora. • Localised scouring and re-settlement of suspended sediment would increase TSS and turbidity and result in changes in granulometry and organic content of sediments in the immediate areas surrounding the impacted area resulting in the loss of benthic habitat and potential smothering of benthic fauna and flora	
OPERATIONAL PHASE		
Power Generation Facility & Gas Quay and Terminal Component		
Nature of Impact	• Construction of the infrastructure along the northern and eastern extent of the sandspit will lead to a permanent reduction in habitat for benthic communities.	
Power Evacuation		
Nature of Impact	• The piles and bridge base structures will lead to change in hydrodynamics of tidal flow patterns and sediment dynamics across the Kabeljous Flats. • The piles and bridge base structures will lead to a reduction in benthic habitat on Kabeljous Flats.	
Phase	**Construction Phase**	**Operational Phase**
Consequence / Inherent Risk	**Moderate**	**Moderate**
Status of the Impact	Negative	Negative
Scale / Extent of the Impact	Local	Local
Duration & Reversibility of the Impact	Short Term & Reversible	Long Term & Reversible
Irreplaceable Loss of Resource	Low	Low
Causes of Impact/ Events	**Likelihood of the consequence**	
Piling and dredging results in increased TSS and turbidity that exceeds defined ecological limits.	Unlikely but possible, dredging was shown to not exceed TSS and turbidity limits. Although piling was not assessed directly, it is likely to be less severe than the proposed dredging.	
Sediment resuspension and resettlement from dredging and piling may smother benthic fauna and flora.	Unlikely but possible, the limited extent of the re-settling associated with dredging means that the ecological risk associated with the sediment resettling would be negligible to low. Resettlement is shown to be local, with limited extension beyond development footprint.	

Scouring and resettlement of sediments during construction results in the loss of benthic habitat.	Definite, but limited to the immediate surrounding areas.	
Infrastructure will replace benthic habitat for benthic communities across the development site.	Definite, but limited, across the footprint of the infrastructure the benthic habitat will be transformed.	
Change in Hydrodynamics across Kabeljous Flats from LNG jetties and power evacuation infrastructure, which will affect sediment distribution.	Definite but limited, change in the hydrodynamics around piles across the development and the bridge structures on the Kabeljous Flats has been shown to affect localised changes to sediment distribution.	
Residual Risk	**Moderate**	**Moderate**
Extrinsic / Additional Mitigation Measures	• Minimize the footprint of the catenary bridge anchorage chambers/ platforms by not extending the pile caps all the way to the estuary bed/substrata. • Maximise span distances between marine piles across the Kabeljou Flats to reduce the number of impact points and scouring of the substrata. • Piling activities within the Kabeljous Flats should be, as far as practicably possible, restricted to high tide only.	
Residual Risk after Mitigation	**Moderate**	**Moderate**
Confidence	**Moderate**	**Moderate**

Results show that RBH is a marine dominated estuarine system, which is reflected in the high salinity and low turbidity levels throughout. The biggest potential threat to the ecosystem is associated with the effects of dredging and piling, which will potentially increase TSS and turbidity levels during construction. Habitat loss and change in hydrodynamics and sediment distribution, and the cumulative effect of these factors on benthic habitat quality, are potential concerns after construction. Hydrodynamic modelling showed that the likelihood of elevated TSS and turbidity levels above threshold values are low. Similarly, due to the limited volume of dredging for this project, the residual risk associated with smothering of adjacent benthic habitat is low-moderate, as settlement of >5mm of sediments is unlikely. Due to the benthic habitat loss associated with the project and the change in sediment dynamics and flows due to new infrastructure, the overall residual risk remains moderate.

11.4.3 WATER & SEDIMENT METALS, PAH CONCENTRATIONS & WHOLE EFFLUENT TOXICITY

Table 84: Impact significance of the proposed NIFPP and associated infrastructure on the PAHs in water; sediment quality and whole effluent toxicity of the estuarine environment.

Activity	**Dredging and Marine piling in order to establish the physical infrastructure required for receiving and storing LNG, power generation by way of CCGT floating power barges, and the evacuation of power to the on-land substation.**
Estuarine Component (Environmental Aspect)	**PAH IN WATER & SEDIMENT & WHOLE EFFLUENT TOXICITY**
CONSTRUCTION PHASE	
Power Generation Facility and Gas Quay & Terminal Component	
Nature of the Impact	• Dredging and marine piling along the northern and eastern extent of the sandspit will result in the resuspension of contaminants adsorbed to sediments, notably metals. • Resuspension of contaminants adsorbed to sediments will lead to bioaccumulation of contaminants by biota which will affect all trophic levels through bioconcentration of contaminants.
Power Extraction	
Nature of Impact	• Marine piling across the Kabeljous Flats will result in the resuspension of contaminants adsorbed to sediments, notably metals.

	• Resuspension of contaminants adsorbed to sediments will lead to bioaccumulation of contaminants by biota which will affect all tropic levels through bioconcentration of contaminants.	
OPERATIONAL PHASE		
Power Generation Facility & Gas Quay and Terminal Component		
Nature of Impact	• None	
Power Extraction		
Nature of Impact	• None	
Phase	**Construction Phase**	**Operational Phase**
Consequence / Inherent Risk	**Moderate - Low**	**Moderate – Low**
Status of the Impact	Negative	None
Scale / Extent of the Impact	Site	-
Duration & Reversibility of the Impact	Short Term & Reversible	-
Irreplaceable Loss of Resource	Low	-
Causes of Impact/Events	**Likelihood of the consequence**	
Dredging and piling lead to disturbance and resuspension of contaminated sediments and subsequent bioaccumulation and bioconcentration of contaminants adsorbed to sediments, notably metals, during dredging.	Unlikely but possible, sediment across the area to be dredged (and piled) was shown not to exceed sediment quality guideline and therefore safe for dredge disposal. Deepwater areas was however shown to contain sediment enriched with metals of concern (Cu, Cr and Zn).	
Resuspension of contaminated sediments leads to bioaccumulation & bioconcentration of contaminants in benthic & pelagic organisms.	Unlikely but possible, sediment across the area to be dredged (and piled) was shown not to exceed sediment quality guideline and therefore safe for dredge disposal. Deepwater areas was however shown to contain sediment enriched with metals of concern (Cu, Cr and Zn).	
Residual Risk	**Low**	**Low**
Low	• No know mitigation measures if dredging is a requirement.	
Residual Risk after Mitigation	**Low**	**Low**
Confidence	**High**	**Low**

Recent assessments (CSIR 2019, Izegaegbe 2020, Cyrus and Vivier 2021) raised concerns about elevated concentrations of sediment metals such as Cr, Cu and Zn in the port, particularly in proximity to the bulk and break-bulk terminals. These reports indicated that highest metal concentration were observed in the bulk basin, which borders the northern aspect of the sandspit. The potential environmental risk associated with these high metal concentrations were raised as a concern. Van Ballengooyen and Jacobs (2020) reviewed the concentrations of these sediment against DEA (2012) sediment quality guidelines and concluded that none of the metals exceeded the Level I threshold and as such, did not pose any unacceptable risk during dredging and dredge disposal for the proposed NIFPP.

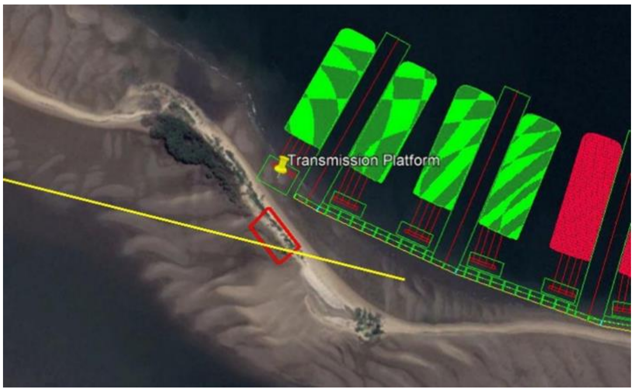
11.4.4 AQUATIC MACROPHYTES

Table 85: Impact significance of the proposed NIFPP and associated infrastructure on the Macrophytes associated with the estuarine environment.

Activity	**Dredging and Marine piling in order to establish the physical infrastructure required for receiving and storing LNG, power generation by way of CCGT floating power barges, and the evacuation of power to the on-land substation.**	
Estuarine Component (Environmental Aspect)	**MACROPHYTES**	
CONSTRUCTION PHASE		
Power Barge Terminal and LNG Terminal Components		
Nature of the Impact	• None currently perceived	
Power Evacuation Facility		
Nature of the Impact	• Localised impact on the mangroves at the Sandspit if the crossing point of Power Evacuation Route is not aligned to avoid them. • Piling and construction of the 2nd catenary support structure, which is in close proximity of the mangroves, has the potential to impact on the mangrove through sediment deposition in the stand, along the shoreline or as a result of the scour action from piling and general construction activities. • Potential impact on the mangrove trees by the pipe and cabling bridge over the main stand if it is not set at a height of 20m above ground. • Potential impact on the mangrove trees if it becomes necessary to put a cutline, of a minimum of 3m width, through the swamp below the proposed evacuation structure. • Potential disturbance to mangroves due to the creation of temporary access roads to the three land-based bridge support towers.	
OPERATIONAL PHASE		
Power Barge Terminal and LNG Terminal Components		
Nature of the Impact	• None currently perceived.	
Power Evacuation Facility		
Nature of the Impact	• If the construction of the Power Evacuation Route requires a cutline through the mangroves there is the potential for causing localised effects to the mangroves. • Potential long-term impacts on the main mangrove stand if the pipe and cabling bridge over mangroves is lower than 20m as the trees will have to be cut back each time they reach the height of the bridge. • If the natural flow and sedimentation patterns are in anyway disrupted by the presence of the large anchor platform, 2nd catenary support structure and the multiple piles inserted for the platform section of the pipe and cabling bridge this has the potential to cause long-term impacts on the mangrove stand particularly on the edge of the mudflats and inside the stand. • The presence of the large anchor platform and 2nd catenary support structure of the pipe and cabling bridge will result in localised scour and deposition taking place. Depending on the amount of deposition this could result in an outward colonisation by the trees and loss of intertidal mudflat habitat, whilst deposition within the forest could lead to mangrove die-offs. • If temporary access roads to the three land-based anchor platforms are not constructed and removed in an environmentally sensitive manner these activities could have long-term impacts on the hydrology of the surrounding substrata and the adjacent mangroves.	
Phase	**Construction Phase**	**Operational Phase**
Consequence / Inherent Risk	**Moderate**	**Moderate**
Status of the Impact	Negative	Negative
Scale / Extent of the Impact	Site	Site

Duration & Reversibility of the Impact	Long Term (Some Components) & Reversible in Long Term	Long Term (Some Components) Reversible in Long Term
Irreplaceable Loss of Resource	Low	Low
Causes of Impact/Events	**Likelihood of the Consequence**	
Power Evacuation through the Sandspit mangroves will impact on the stand.	Definite, damage to the trees will impact on the mangrove ecosystem.	
Mangrove growth affecting the pipe and cabling bridge structure.	Definite, dependant on height of pipe and cabling bridge over mangroves. If lower than 20m it will impact on the trees which will have to be cut back.	
Placing a cutline through the mangroves.	Definite, dependant on whether or not the pipe and cabling bridge over mangroves can be constructed without resulting in a cutline being needed.	
Roads to the three land-based anchor platforms for construction of bridge support towers	Likely, if temporary access roads to the three land-based anchor platforms are not constructed and removed in an environmentally sensitive manner they will impact on the hydrology of the surrounding substrates and the adjacent mangroves to the three land-based anchor platforms to be constructed.	
Establishment of a construction site at the western end of the pipe and cabling bridge	Likely, if the construction area is placed in the position indicated on Figure 1.9 there will be an impact on wetlands in the immediate vicinity.	
The long-term presence of 70 piled supports and support structures for the pipe and cabling bridge on the Kabeljous Flats along with the predicted scour and deposition that will occur.	Unlikely but possible, if the natural tidal hydrodynamics and sedimentation patterns across the Kabeljous Flats are altered by the physical presence of new infrastructure. Sediment deposition on the mangrove edge could result in outward colonisation and subsequent loss of intertidal mudflats habitat, whilst deposition within the forest could lead to die-offs.	
Residual Risk	**Moderate**	**Moderate**
Extrinsic / Additional Mitigation Measures	• Avoiding the sandspit mangroves when placing the power evacuation platform and aligning the power evacuation structure from the north of the sandspit across the Sandspit to the south. • Sensible and environmentally friendly management of construction sites and temporary access roads. • Obtaining necessary permits for the destruction and, possible trimming, of the mangroves for construction and/or maintenance purposes.	
Residual Risk after Mitigation	**Moderate**	**Moderate**
Confidence of the Assessment	**High**	**Moderate**

The recommended point of crossing is through the Sandspit is the Red Box in the adjacent figure. The zone is 66m wide and should be adequate to accommodate the 10m wide platform. The positioning may not be beyond the north east boundary of the Red Box boundary as it will start to impinge on the Sandspit mangroves. The Platform should also not be positioned beyond the south west boundary of the Red Box as otherwise it will start to impinge on the tidal over-wash zone to the right. This is an area that should not be impacted on at any cost due to the potential destabilizing affect it might have on the Sandspit.



Regarding the on-land footprint of each of the three towers of the pipe and cabling bridge structure, it is recommended that all construction activities are limited in extent as far as practicably possible and that impacts are limited to already disturbed areas, and/or areas dominated by stands of alien invasive plants. Auxiliary building preparation activities should be restricted to transformed terrestrial vegetation types.

It is concluded that some of the impacts can be managed during and after construction, however, cutting through the Sandspit mangroves and the possible need for a cutline through the main Mangrove stand will result in moderate negative impacts. The issue of altered hydrodynamics and sediment deposition from the presence of the pipe and cabling bridge structure across the Kabeljous Flats, particularly along the outer mangrove edge and inside the forest, remains an unknown factor in terms of associated risk. However, it could be significant in the long term if deposition is more (>10 cm) than predicted (1-3 cm), this would result in the mangroves starting to colonise the intertidal mudflats. Conversely, sediment deposition (>10 cm) inside the mangroves could result in die-back of mangroves inside the forest. The net result is that the Residual Risk is determined as Moderate for both the construction and operational phases.

11.4.5 MACROBENTHOS, NEMATODA AND MICROPHYTOBENTHOS

Table 86: Impact significance of the proposed NIFPP and associated infrastructure on the microbenthic, nematode and microphytobenthic fauna of the estuarine environment.

<table>
<tr><td>Activity</td><td colspan="2">Dredging and Marine piling in order to establish the physical infrastructure required for receiving and storing LNG, power generation by way of CCGT floating power barges, and the evacuation of power to the on-land substation.</td></tr>
<tr><td>Estuarine Component (Environmental Aspect)</td><td colspan="2">MACROBENTHIC, NEMATODE AND MICROPHYTOBENTHIC FAUNA</td></tr>
<tr><td colspan="3">CONSTRUCTION PHASE</td></tr>
<tr><td colspan="3">Power Barge Terminal and LNG Terminal Components</td></tr>
<tr><td>Nature of the Impact</td><td colspan="2">• Dredging, marine piling, construction of the terminals and other infrastructure will result in loss of benthic biodiversity by causing:
o noise transmitted into the sediment from piling,
o loss of habitat in the intertidal shallows due to sediment deposition,
o extensive shading of benthic habitat,
o increased water turbidity,
o deposition of sediment across the eastern half of the Sandspit,
o alteration of the benthic food resources.</td></tr>
<tr><td colspan="3">Power Evacuation Facility</td></tr>
<tr><td>Nature of Impact</td><td colspan="2">• Marine piling both temporary construction and permanent support structures will result in loss of benthic biodiversity by causing:
o noise transmitted into the sediment from piling,
o loss of habitat in the intertidal shallows due to sediment deposition,
o loss of primary productivity by shading of their habitat,
o potential for increased water turbidity due to fine sediments being lifted into the water column during piling and bridge support construction affecting pelagic macrobenthic larvae.</td></tr>
<tr><td colspan="3">OPERATIONAL PHASE</td></tr>
<tr><td colspan="3">Power Barge Terminal and LNG Terminal Components</td></tr>
<tr><td>Nature of Impact</td><td colspan="2">• The infrastructure will lead to shading of 0.30 km^2 of the water column and the substrata, affecting benthic productivity and biodiversity.
• Maintenance dredging will lead to sediment disturbance.</td></tr>
<tr><td colspan="3">Power Evacuation Facility</td></tr>
<tr><td>Nature of Impact</td><td colspan="2">• Piles and supports for the Power Evacuation Structure will cause localised changes to the natural tidal hydrodynamics and sediment distribution across the Kabeljous Flats, leading to a shift in species composition during the post-construction period in areas where sediment composition changed.</td></tr>
<tr><td>Phase</td><td>Construction Phase</td><td>Operational Phase</td></tr>
<tr><td>Consequence / Inherent Risk</td><td>Moderate-high</td><td>Moderate</td></tr>
<tr><td>Status of the Impact</td><td>Negative</td><td>Negative</td></tr>
<tr><td>Scale / Extent of the Impact</td><td>Site</td><td>Site</td></tr>
</table>

Duration & Reversibility of the Impact	Short Term (Some Components) & Reversible in Long Term	Long Term (Some Components) & Not reversible
Irreplaceable Loss of Resource	Low	Low
Causes of Impact	**Likelihood of the consequence**	
Piling & Dredging will reduce habitat for benthic biota, causing loss of benthic biodiversity.	Definite, across the footprint of the infrastructure, the benthic habitat will be transformed	
Sediment resuspension and deposition from dredging and piling will lead to increased turbidity and faunal smothering, causing loss of phytoplankton, zooplankton and benthic biodiversity.	Definite, the extent of suspension and re-settling associated with dredging will be limited. Resettlement is shown to be local, with limited extension beyond the development footprint of the terminals. However, piling for the terminals, Power Evacuation support structures and permanent structures, could result is substantial amounts of fine sediment being lifted into suspension (increased turbidity) and the settling on the substrata (potential smothering of the benthos) resulting in a high ecological risk.	
Noise from piling activities will affect benthic faunal behaviour and lead to behavioural avoidance, change in species composition and loss of biodiversity.	Definite, but limited, across the footprint of the infrastructure, the benthic habitat will be transformed.	
Infrastructure will shade 0.30 km^2 of benthic habitat, causing loss of primary productivity, reduced food resources, change in species composition and loss of benthic biodiversity.	Definite, but limited, across the footprint of the infrastructure, the benthic habitat will be transformed by shading.	
Residual Risk	**High**	**Moderate**
Extrinsic / Additional Mitigation Measures	• None	
Residual Risk after Mitigation	**High**	**Moderate**
Confidence	**High**	**Moderate**

The Residual Risk associated with habitat and biodiversity loss will remain High across the development area during construction. The Residual Risk during the operational phase will be Moderate and will be largely associated with habitat loss due to the physical presence of infrastructure.

11.4.6 MACROCRUSTACEA (PRAWNS)

Table 87: Impact significance of the proposed NIFPP and associated infrastructure on the macrocrustacea associated with the estuarine environment.

Activity	**Dredging and Marine piling in order to establish the physical infrastructure required for receiving and storing LNG, power generation by way of CCGT floating power barges, and the evacuation of power to the on-land substation.**
Estuarine Component (Environmental Aspect)	**MACROCRUSTACEA**
CONSTRUCTION PHASE	
Power Barge Terminal and LNG Terminal Components	
Nature of the Impact	• Dredging, marine piling, construction of the terminals and other infrastructure over a 27-month period will result in a change in species composition and loss of prawn habitat by causing; ○ noise transmitted through the water and into the sediment from piling and terminal construction, ○ increased water turbidity, ○ behavioural changes and habitat avoidance, ○ loss of feeding habitat in the intertidal shallows, ○ re-suspension and deposition of sediment and smothering of prawn subtidal habitat ○ shading of habitat, and ○ reduced availability of macrocrustacean food resources.

Power Evacuation Facility		
Nature of Impact	• Marine piling over a 30-month period will result in a change in species composition and loss of prawn habitat by causing; o disturbance of the macrocrustacean habitat and food resources, o noise transmitted through the water column and into the sediment from piling and platform and bridge construction, and o increased water turbidity due to re-suspension of fine sediments during piling activities and bridge support construction.	
OPERATIONAL PHASE		
Power Barge Terminal and LNG Terminal Components		
Nature of Impact	• The infrastructure associated with the terminals will lead to shading of 0.30 km^2 of the water column and the substrata, affecting primary productivity, food availability and prawn biodiversity. • Maintenance dredging will lead to sediment disturbance.	
Power Evacuation Facility		
Nature of Impact	• Piles and supports for the Power Evacuation Structure will cause localised changes in the natural tidal hydrodynamics and sediment distribution across the Kabeljous Flats, leading to a shift in species composition during the post-construction period in areas where sediment composition changed.	
Phase	**Construction Phase**	**Operational Phase**
Status of the Impact	Negative	Negative
Consequence of Inherent Risk	**Moderate-High**	**Moderate**
Scale / Extent of the Impact	Site	Site
Duration & Reversibility of the Impact	Short Term & Reversible	Long Term & Not reversible
Irreplaceable Loss of Resource	Low	Low
Causes of Impact	**Likelihood of Consequence**	
Piling & Dredging will reduce habitat for macrocrustacean fauna, causing loss of biodiversity.	Definite, but limited across the footprint of the infrastructure, the benthic habitat will be transformed	
Sediment deposition from dredging and piling will lead to faunal smothering, causing loss of biodiversity.	Likely, the extent of the re-settling associated with dredging & piling means that there will be some ecological risk associated with the sediment resettling. Resettlement has been shown to be of limited extension beyond the development footprint.	
Noise from piling activities will affect behaviour and leads to behavioural avoidance of affected habitat and loss of biodiversity.	Definite, but limited across the footprint of the infrastructure, the macrocrustacean habitat will be transformed.	
Infrastructure will shade 0.30 km^2 of macrocrustacean habitat, causing loss of primary productivity, reduced food resources, change in species composition & loss of biodiversity.	Definite, but limited across the footprint of the infrastructure, the benthic habitat will be transformed by shading.	
Residual Risk	**High**	**Moderate**
Extrinsic / Additional Mitigation Measures	• None	
Residual Risk after Mitigation	**High**	**Moderate**
Confidence	High	Moderate

The Residual Risk associated with habitat and biodiversity loss will be High across the development area during construction. During the operational phase the Residual Risk is considered Moderate and largely associated with habitat loss due to the physical presence of infrastructure, however the confidence related to this is only Moderate.

11.4.7 ICHTHYOFAUNA (FISH)

Table 88: Impact significance of the proposed NIFPP and associated infrastructure on the ichthyofauna associated with the estuarine environment.

Activity	**Dredging and Marine piling in order to establish the physical infrastructure required for receiving and storing LNG, power generation by way of CCGT floating power barges, and the evacuation of power to the on-land substation.**
Estuarine Component (Environmental Aspect)	**ICHTHYOFAUNA**
CONSTRUCTION PHASE	
Power Barge Terminal and LNG Terminal Components	
Nature of the Impact	• Marine piling and to a lesser extent dredging along the northern and eastern extent of the Sandspit for the Power Barge and LNG Terminals will have the following impacts on the Ichthyofauna over the 27-month construction period: ○ Behavioural changes in fish due to noise being transmitted through the water from piling, ○ Possible movement of fish away from the impact area due to noise, thus creating competition for resources in other areas, ○ Loss of feeding areas in some intertidal shallows due to dredging, ○ Increased water turbidity will have the potential to change the species composition present (a biodiversity impact), ○ The potential deposition of fine sediment and muds across the eastern half of the intertidal sandflats could impact on benthic food resources.
Power Evacuation Facility	
Nature of the Impact	• The piling and construction methods to be used along the route to build a pipe and cabling bridge will result in an impact on the ichthyofauna due to the presence of the construction equipment (barges, piling equipment, catenary construction equipment, etc.) which are ongoing in the area for ~30 months. • There will be major disturbance of the substrata, through piling, bridge support construction and general construction on the intertidal sandflats, subtidal shallows and intertidal mudflats which will result in increased water turbidity as well as impacting directly on these important feeding and nursery areas for estuarine fish. These activities also have the potential to impact on food resources which create a knock-on effect through the ecosystem. • Noise impacts through the water column from piling will also occur over the duration of the 36-month construction period.
OPERATIONAL PHASE	
Power Barge Terminal and LNG Terminal Components	
Nature of the Impact	• There will be a permanent loss of some small areas of intertidal habit due to the dredging. • The presence of the terminals will result in the permanent shading of an area of some 0,30km² (286,604m²). It is known that fish utilise shaded area for resting and possible safety, but the long-term impacts of shading of such a large area is not known. Such an activity could also have a knock-on effect through the ecosystem. • Maintenance dredging will result in short term impacts as discussed above for the Construction Phase.
Power Evacuation Facility	
Nature of the Impact	• Piles and supports for the Power Evacuation Structure will cause localised changes in the natural tidal hydrodynamics and sediment distribution across the Kabeljous Flats, which could lead to shifts in species composition during the post-construction period in areas where sediment composition changed. • Sediment deposition inside the mangroves would affect mangrove distribution and as a result, the fish feeding and resting areas.

Phase	Construction Phase	Operational Phase
Consequence of Inherent Risk	Moderate-high	Moderate
Status of the Impact	Negative	Negative
Scale / Extent of the Impact	Site	Site
Duration & Reversibility of the Impact	Short Term/Reversible?	Long Term/Reversible?
Irreplaceable Loss of Resource	Low	Low
Causes of Impact/Events	Likelihood of Causes	
Permanent loss of some localised areas of intertidal habit.	Definite, due to the dredging activities for the LNG and Power Barge Terminals habitat will be lost.	
Dredging and piling activities during construction result in increased turbidity.	Highly likely, due to the length of the construction period, increased turbidity can lead to changes in species composition, due to species preferences.	
Dredging & piling activities during construction will result in re-suspension and dispersal of fine sediment across the site which may smother benthic fauna in the sandy intertidal zone leading to a loss of food resources for the fish.	Likely, due to the length of the construction period, localised re-suspension of fine sediment during dredging and piling will affect the fish feeding habitat on the sandy intertidal and subtidal areas of the eastern half of the Sandspit.	
Dredging and particularly piling activities will result in noise creation that will be transmitted through the water column.	Highly likely, due to the length of the construction period, noise detection by fish over great distances results in behavioural changes as well as causing internal physical damage to the fish up to 300m from source.	
Localised scouring of sediment around the piles & bridge support structures after construction will change sediment distribution across the Kabeljous Flats, which could result in outward expansion of the mangroves and a loss of feeding habitat for fish.	Unlikely but possible, piles and supports for the Power Evacuation Structure will cause localised changes in the natural tidal hydrodynamics and sediment distribution across the Kabeljous Flats, leading to a shift in species composition during the post-construction period in areas where sediment composition changed.	
Residual Risk	High	Moderate
Extrinsic / Additional Mitigation Measures	None	
Residual Risk after Mitigation	High	Moderate
Confidence of the Assessment	High	Moderate

The impact assessment indicates that there will be a basket of impacts caused during construction which will result in a High Residual Risk for the ichthyofauna. During the post-construction period, most of these risks are likely still to be on going but may only result in a Moderate Residual Risk, however the confidence related to this is only moderate.

11.4.8 AVIFAUNA (BIRDS)

Several components of the proposed development will potentially contribute to an impact on the waders, terns and gulls that utilise the Sandspit. These are summarised at a high level, please refer to the specialist assessment in Appendix 6.

- Construction activities are substantial and will result in noise disturbance across some two thirds the length of the Sandspit, if not more. This will have a major impact on the feeding routine of waders as well as on birds that roost on the sandspit during the day and night.
- During the operational phase, noise will be substantial and ongoing with the result that the birds will almost certainly abandon the site.
- The project will result in an estimated 40% loss of access to available feeding habitat due to the physical presence of infrastructure, the associated noise and to a lesser extent direct habitat loss due to dredging. The net result of this is that even if the waders do not abandon the Sandspit due to the noise, the remaining food resources (on the remaining 60%) would not be enough to accommodate the population that currently utilises the area.
- The pipe and cabling bridge construction activities are adjacent to the spring low tide feeding grounds utilised by the waders. In addition, food resources of the waders (i.e. macrocrustacea and fish) that feed in the muddy substrata will also be impacted.

- The physical presence of the proposed pipe and cabling bridge during the operational phase will probably continue to influence the avifaunal community of the intertidal mudflats and shallow subtidal areas. For example, the wading bird's ability to utilise the spring low tide feeding grounds with such a structure in place is unknown.
- The 80m high pipe and cabling bridge structure across the Kabeljous Flats could be a hazard to flying birds and which may influence avian flyways between Lake Mzingazi and uMhlathuze Estuary. *Note: Currently no information is available on the flight pathways used by birds in or moving through the area.*

Avifauna responses to increased noise levels:

- Shannon *et al.* (2016) undertook a synthesis of research documenting the effects of noise on wildlife. In terms of birds and industrial noise, they found research reporting a decline in occupancy and abundance at averages of 48 dBA (Bayne *et al.* 2008), 55 dBA (Blickley *et al.* 2012) and 45 dBA (Francis *et al.* 2011). Community changes and species interactions from industrial noise were found to occur at 60 dBC (Francis *et al.* 2009) as well as at an average of 50 dBC (Francis and Blickely 2012).
- Dawe and Goosem (2008) stated that anthropogenic noise levels ranging from 65–85 dB(A) can trigger flight and alert responses in birds and altered behaviour after the noise disturbance, which can lead to reduced breeding success. Complete habituation to such disturbance does not always occur, even in less noise-sensitive species.
- No information on the impacts of noise on the fauna of Richards Bay or RBH is available. As a consequence, comparisons have been made with international studies. SLR Consulting (2015) indicated that the scientific and published literature is inconclusive with respect to the thresholds or threshold criteria for terrestrial fauna with respect to noise impacts. They state that the thresholds identified in Table 89 involve a combination of published information, personal observations, and extrapolation.

Table 89: Likely Effects on Terrestrial Fauna as a Result of Project Activities, after SLR Consulting (2015).

Disturbance Effect	Steady or continuous noise sources LAeq (15min) (dBA)	Episodic (single event or short-term) noise sources LAmax (dBA)	Typical bird activities potentially impacted
Typical bird activities potentially impacted	50 to 65	45 to 60	Nesting
Frequent (Alarm or Flight) – moderate impacts on habitat use	65 to 85	60 to 80	Nesting Roosting
Avoidance of area – by most of the population of some species	≥85	≥80	Nesting Roosting Foraging

- Whilst the ambient noise levels on the Sandspit (value unknown) appear to be acceptable to the birds that currently utilise the site, increases above this will adversely affect avifaunal habitat utilization in this area. Steady or continuous noise sources at levels ≥85 dBA are predicted to result in avoidance of the area by most waders, gulls and terns and its abandonment as a Breeding, Roosting or Feeding site (Table 89). In addition, Episodic (single event or short-term) Noise Sources of ≥80 dBA are considered to have the same effect (Table 89). Based on the above it is highly likely that the birds will abandon the Sandspit if the development goes ahead, representing a major habitat loss for waders, gulls and terns.

Table 90: Impact significance of the proposed NIFPP and associated infrastructure on the avifauna associated with the estuarine environment.

Activity	**Dredging and Marine piling in order to establish the physical infrastructure required for receiving and storing LNG, power generation by way of CCGT floating power barges, and the evacuation of power to the on-land substation.**
Estuarine Component (Environmental Aspect)	**AVIFAUNA**
CONSTRUCTION PHASE	
Power Barge Terminal and LNG Terminal Components	
Nature of the Impact	• Dredging, marine piling (in the order of 2,139 piles), other construction work and the presence of project infrastructure for construction of the Terminals and associated infrastructure will result in disturbance over some 75% of the intertidal sandflat habitat which is utilised by wading birds who feed on the Sandspit and the waders, terns and gulls which currently roost there (see Figure 102 & Figure 103). • The length of construction time required for this component is estimated to be in the order of 27 months. This means that for over a two-year period the migrant waders, terns and gull that utilise the Sandspit will be faced with disturbance on the site. The likelihood of site abandonment by the birds will be extremely high. **Such an action, based on ecological principals, would mean that mortality would increase due to competition for food where displaced birds attempt to access alternative resources**.
Power Evacuation Facility	
Nature of Impact	• The methods to be used in the construction of the pipe and cabling bridge will have an impact on the avifauna due to the presence of the construction equipment close to the spring low tide feeding grounds. • Disturbance of the substrate, increased turbidity and noise generation, through piling, bridge support construction and general construction, in the intertidal mudflats will also occur. This could impact the benthic fauna, in the spring low tide area, which are fed on by the birds. • The form of the pipe and cabling bridge, reaching up to 80m in places, with the platform being some 10-20m above water level, and the distance covered by the structure (approximately 2.35km) will potentially be a flight hazard for birds in and passing through the area. Details of bird flyways in the area are currently unknown. • The above impacts will all be exacerbated by the length of time, estimated to be 30 months. This will mean that for at least three summers the migrant waders will be faced with continuous disturbance in the area they inhabit during the non-breeding season.
OPERATIONAL PHASE	
Power Barge Terminal and LNG Terminal Components	
Nature of Impact	• The power transfer towers between each of the 12 barges and the jetty (27 to 30m high) and the barge stacks (40-60m) will be a flight hazard to birds. • The permanent proximity of the LNG Terminal will result in activity and noise at the eastern end of the Sandspit. • The permanent proximity of the Power Barge Terminal infrastructure, in conjunction with the LNG Terminal, will result in noise across 75% of the Sandspit at levels that are considered above the disturbance threshold of birds (Figure 104). • It is already considered that the birds may abandon the site during the lengthy, 24 month, construction phase. However, the continued presence of the facility, now operational, along with its associated noise levels will almost certainly result in permanent abandonment of the site by the majority of the waders. **Such an action based on ecological principals would mean that mortality would occur due to competition for food where displaced birds attempt to access other resources.** In addition, the terns and gulls will also abandon the Sandspit as a roosting site.
Power Evacuation Facility	

Nature of Impact	• The presence of the initial section of the pipe and cabling platform on the Sandspit, which will effectively cut the spit in half, will be a hazard to flying birds. • Piles and supports for the Power Evacuation Structure will cause localised changes in the natural tidal hydrodynamics and sediment distribution across the Kabeljous Flats, leading to a shift in species composition through altered availability and distribution of feeding and resting habitat during the post-construction period in areas where sediment composition changed. • Limited deposition of scoured sediments on the mangrove edge after construction of bridge supports could result in some outward colonisation of mangroves and subsequent loss of intertidal feeding habitat for waders. • The height of the Power Evacuation Structure, reaching up to 80m in places with the platform being some 10-20 m above water levels, and the distance covered by the structure (approximately 2.35km) will potentially make it a flight hazard for birds in and passing through the area. **Note:** Details of bird flyways used by birds in the area or those passing through are currently unknown.	
Phase	**Construction Phase**	**Operational Phase**
Consequence / Inherent Risk	**Moderate – High**	**Moderate - High**
Status of the Impact	Negative	Negative
Scale / Extent of the Impact	Regional/National	Regional/National
Duration & Reversibility of the Impact	Duration of Construction & Reversible	Permanent & Irreversible
Irreplaceable Loss of Resource	High	High
Causes of Impact	**Likelihood of Causes**	
The length of the construction period (up to 30 months or more) coupled with all the other activities mentioned below will result in a sustained impact on the avifauna and almost certainly result in the birds abandoning the site.	Highly likely, based on the information provided regarding the project construction, length of construction time and operation it is considered that over the three-year construction period the migrant waders will abandon the Sandspit. Further, that once the project is operational, they will not return, causing a net loss to the population through mortality. **From an ecological principal perspective all niches are already occupied therefore any birds displaced will end up competing for other already occupied niches, particularly for feeding. The result will be that there will be a net loss from the population in the form of mortality.**	
Noise disturbance during the Construction and Operational phases of the plant will impact on the avifauna and result on site abandonment.	Highly likely due to the length of the construction period (some 30 months) and permanent nature of the development during operations. Information provided in the Noise Impact Statement for the project (von Greunewaldt 2020) as well as published research discussed in Section 3.9.3 above, clearly indicates (based on specialist interpretation) that the predicted noise levels of the plant when operational will have a negative effect on the birds across most of the Sandspit (Figure 104).	
Loss of critical feeding areas associated with the Sandspit at low tide due to proximity of the development (noise & operational activity).	Highly likely due to the length of the construction period (some 30 months) and permanent nature of the development during operations, as shown in Figure 104 construction and operational activities (irrespective of noise) will result in a loss of access (through disturbance) of some 40% of the primary intertidal feeding grounds for the waders.	
Loss of roosting habitat for waders, terns and gulls on the Sandspit due to proximity of the proposed development (noise & operational activity).	Highly likely, the activities of dredging, piling and general construction for the project over a three-year period will cause the terns and gulls that use the Sandspit as a roosting site to seek out an alternative locality, of which there are none in the harbour which are as protected as their current roosting site.	
Reduced access to the spring low tide feeding areas.	Likely, the presence of the pipe and cabling bridge structure so close to the spring low tide feeding grounds may cause the birds to avoid taking this feeding opportunity thus reducing access to a food source.	
The anchor chamber & major catenary support structure of the pipe & cabling bridge positioned within the mudflats area of the Kabeljous Flats will result in	Unlikely but possible, this action has the potential to cause changes in the natural flow and sedimentation patterns currently present which could affect the adjacent spring low tide mudflats and impact on the benthic fauna which are an important spring low tide food source for the birds. van Ballegooyen *et al.* (2020) predicted that the presence of	

scour taking place around their bases & the development of a sediment deposition area around the scour point which could result in an impact on the fauna of the intertidal and spring low tide mudflats utilized by the waders.	these structures will "result in fairly extensive impacts in the shallow waters to the eastern side of the deeper channel".	
The resultant scour taking place around the bases of the bridge supports & the development of a sediment deposition area around the scour point (Figure could result in sedimentation & subsequent mangrove expansion along the stand at the western edge of the Kabeljous Flats and result in a loss of intertidal feeding habitat.	Highly likely, although localised and limited to area of sediment modification. Van Ballegooyen *et al.* (2020) has indicated that, "the only exception to this possibly being where the mangroves 'trap' these sediments and then grow and extend to cover these sedimented areas before the sediments become more widely dispersed. Such an accumulation would need to be persistent and long-term, which is unlikely to be the case in exposed channel area beyond the outer edge of the mangroves. However, such more persistent sedimentation in the mangroves, while likely, is expected to be of limited aerial extent". Prof Janine Adams (*pers com*) has indicated that if deposited sediments are in position for six months or more then the potential for colonisation exist.	
The presence of the Evacuation Bridge structure will be a hazard to birds in the area as well as those using flyways to traverse the area.	Highly likely, the nature of the bridge structure with all its cabling, the height above the water of the bottom of the bridge (10-20m) and its length, stretching across the Kabeljous Flats and the western Mangrove stand (2,350m) will constitute a hazard for birds flying in the area, particularly larger birds such as eagles, pelicans, storks and cormorants.	
All the activities associated with the proposed development, having been assessed in above indicate that the birds will abandon the site during the construction phase. If the bulk of them have not left during this phase, then they will leave during the operational phase.	Highly likely, there will be mortality due to the abandonment of the Sandspit by the birds. **Such an action based on ecological principals would mean that mortality would occur due to competition, for food where displaced birds attempt to access alternative resources away from the Sandspit.**	
Residual Risk	**High**	**High**
Extrinsic / Additional Mitigation Measures	• None. • The possibility of Offsets may exist, but these would need to be implemented and have been proven successful prior to activities taking place on the site of the proposed development.	
Residual Risk after Mitigation	**High**	**High**
Confidence of the Assessment	**High**	**High**

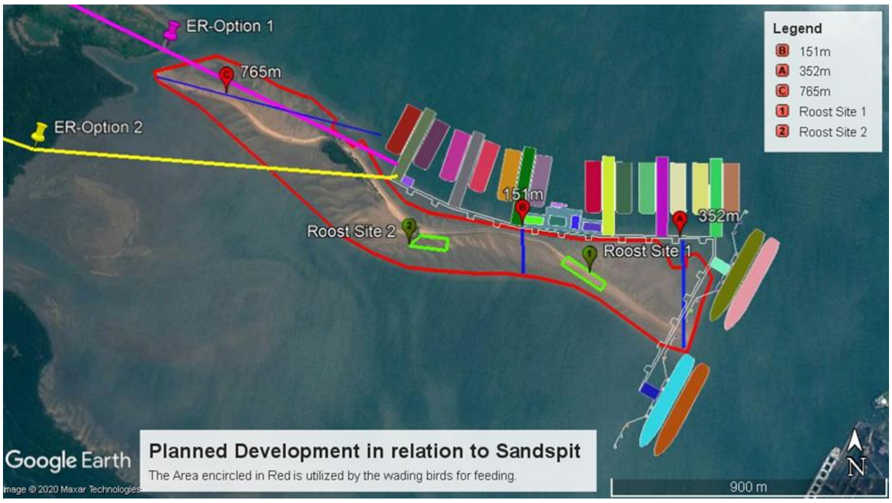


Figure 102: Proposed positioning of the NIFPP in relation to the exposed area of the Sandspit utilised by wading birds for feeding on falling and rising tides (outlined in Red) as well as the position of the two major roosting sites utilized by waders, terns & gulls (outlined in Green).

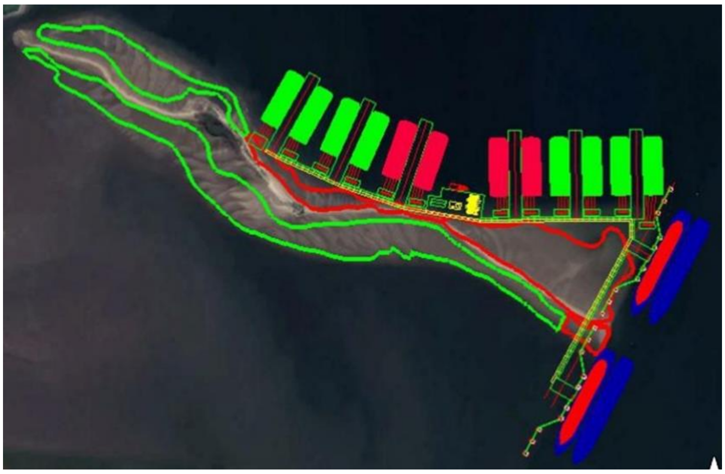


Figure 103: Intertidal Sandflat areas utilized by wading birds on the Sandspit. Areas outlined in Red are those that will potentially be lost due to dredging or presence and operational activity of the plant (40%). Areas outlined in Green indicate those areas which may still be available as feeding areas for the waders. Note: This does not take into account the area where plant noise may also have an influence on waders accessing parts of the Sandspit during the operational phase.

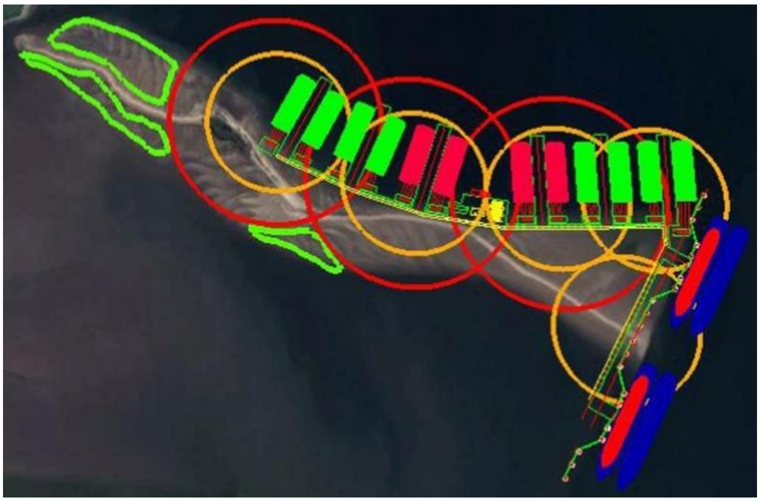


Figure 104: Predicted remaining Intertidal Sandflat habitat (encircled in Green - 25%) for wading birds for feeding & for terns and gulls for roosting after dredging, development of project and the impact of noise once operational (Orange = 200m, Red = 300m noise radii).

The impacts of the proposed development on wading birds that currently utilise the Sandspit and Kabeljous Flats intertidal sandflats and mudflats for feeding on falling and rising tides and the waders, gulls and terns that roost there during either the day or night are made up of several components. The dominant of these are the dredging, piling and construction activities, proximity of the development and the impact of noise across the Sandspit. Based on this assessment these impacts collectively will combine to result in a loss of the area for the avifauna due to abandonment by the birds as well as leading to mortality in the population taking place. As a result, the proposed development is considered to be a High negative impact (based on the impact assessment method stipulated).

The method stipulated appears to have a flaw, in that the potential mortality of the entire wader population inhabiting the Sandspit, only ranks as a High Residual Risk. Based on the methodology, an entire species has to be lost for the Residual Risk to be Fatally Flawed, yet human mortality meets the High Residual Risk criteria. The potential total loss (mortality) of the Sandspit wader population and the third most important coastal wader habitat in KZN, goes against South Africa's commitment to the Bonn Convention to "protect migratory species, their habitats and migratory routes" cannot simply be considered a High Residual Risk. In our professional opinion the Residual Risk should be ranked as Fatally Flawed from an avifauna perspective.

A loss of such magnitude is unacceptable for several additional reasons particularly from a Provincial and National Conservation perspective.

- The Port of Richards Bay along with the uMhlathuze Estuary has been ranked 3rd nationally in terms of importance as a coastal waterbird habitat, after the St Lucia and Berg River Systems.
- The coastal wader bird habitats have already been severely reduced, down the length of KwaZulu-Natal coastline, over the past decades.
- The original extensive wader habitat in Durban Harbour has been reduced to such an extent that the number of birds it is able to accommodate is virtually insignificant.
- The wader bird habitats available in the St Lucia Estuarine Lake System, the most important nationally in terms of waterbird populations, are at an all-time low due to the degraded ecological state of that system from many years of mouth closure.
- The wader habitats within RBH itself have been reduced over the past 30 years due to port expansion (D.P.Cyrus *pers obs*).
- The Sandspit and Kabeljous Flats is the last wader habitat of any importance/ significance within RBH. The importance of this last large area of wader habitat in the port has repeatedly been emphasised in several previous studies.
- It is unknown what the national impact will be due to the loss of the Sandspit habitat for wading birds. However, these remaining isolated intertidal habitats along the KwaZulu-Natal coastal areas also provide stopping over and feeding points for wading bird populations that spend the summer in the south and then migrate northwards from the coastal areas of the Western and Eastern Cape. These birds breed in the Palearctic (northern hemisphere) and use the coastal stop over points, such as the Sandspit, as part of their migration route to move to and from their breeding grounds each year.
- Whilst the estimated contribution of the Sandspit area to the Kabeljous Flats & Sandspit/ uMhlathuze Estuary Complex wader populations is ~25%, there is no recent data (post 2009) on wader numbers in the uMhlathuze Estuary. This area is known as the Richards Bay Sanctuary and includes the Richards Bay Game Reserve, a protected area. During the last 10 years control over this ‘conservation’ area by the provincial conservation authority, based on local newspaper reports of illegal poaching of both fish and macrocrustacea as well as harvesting of other natural resources, appears to have been extremely reduced. This would tend to indicate the possibility that the wader habitats and populations may have declined in the uMhlathuze Estuary over the past years 10 years. However, without current data it would be presumptuous to make such an assumption, but the possibility exists that the importance of the Sandspit and Kabeljous Flats to wading birds is now greater than the 25% contribution estimated in this study.

Given the extremely high importance rating for avifauna given to the Kabeljous Flats/Sandspit by various authors and its high conservation value, the ‘loss’ of this habitat due to the birds abandoning it as a result of the development of the proposed project, will be a loss of National Significance. This is confirmed by Dr David Allan, Curator of Birds, Durban Natural Science Museum who has provided the following statement:
“*The waterbird populations in the Richards Bay area, of which the migratory waders are a key component, have been regarded as of Global Importance. The most recent assessment though suggested that this significance should be regarded as only of National Importance as there is some indication of a reduction in waterbird numbers in recent times. This most recent assessment though was conducted over only a single late-summer season (and as long ago as 2013) and, as the authors of the assessment admit, requires further confirmation. These waterbird populations and their sustaining habitat are centered on the Mhlathuze Estuary (Richard Bay Game Reserve) which is an Important Bird Area (Barnes et al, 2001) and the directly adjacent Kabeljous Flats/Sandspit area. Only a narrow berm wall separates these two areas, and the waterbirds move freely between the two sites. Of particular significance is that a large proportion of the birds that feed*

on both the Mhlathuze and Kabeljou Flats areas utilize the Sandspit as a key roosting area at high tide/overnight. This complex of habitats should be considered as a single unit relevant to waterbird populations, especially the migratory waders. It follows that this complex has always been regarded as of National Importance and in the past of Global Importance (and confirmation is required that the latter does not still apply) – the complex is certainly of greater than just Provincial Importance and has always been so regarded. Information presented on the following webpage provides further background and references relevant to the discussion presented here: https://www.birdlife.org.za/iba-directory/richards-bay-game-reserve/."

In addition to the above, Pillay and Weerts (2008) undertook an identification of major environmental issues associated with the long-term development of the Port based on the then 'Preferred Development Plan. They identified that the Sandspit was a critical bird roosting area because of its relative isolation. They further stated that:
"*The loss of this habitat, together with other impacts to bird forage grounds (shallows of mudflats and sandbanks = Kabeljous Flats), will probably have a significant impact on bird populations in the area. South Africa is a signatory to United Nations Convention on Migratory Species (the Bonn Convention) and as such has an obligation to protect migratory species their habitats and migratory routes*".

From the perspective of ecological principals all niches are already occupied, therefore any birds displaced will end up moving to and competing for already occupied resources and space, in this case for feeding and roosting. The result will be a net loss from the population as competitive exclusion will cause the losers to move to sub-optimal habitats where they are unlikely to survive resulting in mortality in the population. As a result, based on all the discussion and assessments above, in our opinion, it is considered that impacts from the proposed project will result in a Residual Risk of Fatally Flawed for both construction and operational phases. The confidence of this assessment is rated as High. This despite the impact assessment method only allowing a result of the Residual Risk being a High negative impact from an avifauna perspective for both the construction and operational phases.

11.4.9 PHYTOPLANKTON & ZOOPLANKTON

Table 91: Impact significance of the proposed NIFPP and associated infrastructure on the phyto- and zoo-plankton associated with the estuarine environment.

Activity	**Dredging and Marine piling in order to establish the physical infrastructure required for receiving and storing LNG, power generation by way of CCGT floating power barges, and the evacuation of power to the on-land substation.**
Estuarine Component (Environmental Aspect)	**PHYTOPLANKTON AND ZOOPLANKTON**
CONSTRUCTION PHASE	
Power Generation Facility and Gas Quay & Terminal Component	
Nature of the Impact	• Increased turbidities over an extensive period of time during construction (dredging & pile driving) will impact on both Phytoplankton & Zooplankton. • Ongoing transmission of noise through the water column will have an impact although the actual levels are unknown.
Power Extraction	
Nature of Impact	• Increased turbidities over an extensive period of time during construction caused by pile driving will impact on both Phytoplankton and Zooplankton. • Ongoing transmission of noise through the water column will have an impact although the actual levels are unknown.
OPERATIONAL PHASE	
Power Generation Facility & Gas Quay and Terminal Component	
Nature of Impact	• The shading of a large area of the water column by the development once it is in place will also create some impact, however the actual extent of the impact is currently unknown.

	• Ongoing maintenance dredging will also result in localised impacts.	
Power Extraction		
Nature of Impact	• The long-term presence of the structure is predicted to result in some scouring & sediment movement (albeit to a lesser degree than the initial impact during construction) which could influence turbidity levels on an ongoing basis in the water column, potentially causing an impact on Phytoplankton & Zooplankton.	
Phase	**Construction Phase**	**Operational Phase**
Consequence / Inherent Risk	**Moderate**	**Moderate-Low**
Status of the Impact	Negative	Negative
Scale / Extent of the Impact	Local	Local
Duration & Reversibility of the Impact	Duration of Construction, Unknown	Unknown
Irreplaceable Loss of Resource	No	No
Causes of Impact	**Likelihood of Causes**	
Increased turbidity from dredging and pile driving over a long period of time,	Definite, the length of time for construction and piling will result in ongoing localised increases in turbidity which will affect the activity patterns of the fauna and may result in a decline in species density and diversity in the area.	
Noise transmitted into the water column, particularly from piling and dredging.	Highly likely, the noise from piling transmitted through the water column has the potential to disrupt the feeding patterns and cause physical damage.	
Shading of a large area of the water column	Highly likely, shading has the potential to result in changes in species activities and may result in a decline in species density and diversity in the shaded area.	
Residual Risk	**Moderate**	**Low**
Extrinsic / Additional Mitigation Measures	• Unknown	
Residual Risk after Mitigation	**Moderate**	**Low**
Confidence of the Assessment	**Low**	**Low**

Despite the fact that there is limited information on the Phytoplankton and Zooplankton diversity across the study area or in the harbour, they are considered important components of the food chain as well as contributing to the functioning of estuarine ecosystems. As such the proposed development is expected to have some localised impacts on these components, with the Residual Risk during construction considered to be Moderate and during operation Low. However, the confidence associated with these assessments is rated a Low for both.

11.4.10 CUMULATIVE IMPACT STATEMENT

It is the specialist's considered opinion that there are very limited, if not no, options for mitigation actions for the proposed NIFPP and associated infrastructure. The issue of offsets has not been considered. The assessed levels of impact, based on the prescribed methodology, during the construction and operational phases, related to each of the biotic and abiotic components considered important to the functioning of the Kabeljous Flats/ Sandspit estuarine ecosystem are summarised in Table 92. The specialist's reasoned opinion is that the Residual Risk associated with the avifauna should be considered as Fatally Flawed and not restricted to a High negative based on the impact assessment method prescribed.

Estuarine ecosystems are extremely complex with numerous routes and levels in the food chain. Figure 105 attempts to illustrate both the complexity of these systems as well as the knock-on effects of the proposed NIFPP and associated infrastructure construction activities on the entire estuarine ecosystem.

Table 92: Summary of estuarine ecological impact assessment results

Aspect	Nature of the Impact	Consequence Inherent Risk	Likelihood of the Consequence	Residual Risk	Mitigation Measures	Residual Risk after Mitigation
Construction Phase						
Water Quality, Granulometry & Organic Content	• Dredging & marine piling; and, • Localised scouring and re-settlement of suspended sediment, would increase TSS & turbidity and result in changes in granulometry & organic content of sediments in the immediate areas surrounding the impacted area resulting in the loss of benthic habitat & potential smothering of benthic fauna & flora.	Moderate	Unlikely but possible through to Definite	Moderate	• Minimize footprints by not extending the pile caps all the way to the estuary bed. • Maximise spans between piles across the Kabeljou Flats. • Piling activities within the Kabeljous Flats should be, as far as practicably possible, restricted to high tide only.	Moderate
Metals & PAH in Water & Sediment and Whole Effluent Toxicity	• Dredging & marine piling will result in the resuspension of contaminants adsorbed to sediments, notably metals. • Resuspension of contaminants adsorbed to sediments will lead to bioaccumulation of contaminants by biota, affecting all trophic levels through bio-concentration of contaminants.	Moderate – Low	Unlikely but possible	Low	• None.	Low
Macrophytes (Mangroves)	• Localised impact on the Sandspit mangroves. • Piling & construction of Tower 3 may have an impact through sediment deposition or from the scour action from piling & construction activities. • Potential impact if the pipe & cabling bridge is not set at a height of 20m above ground. • Potential impact if a cutline is required. • Potential disturbance due to temporary access roads to the 3 land-based Towers.	Moderate	Unlikely but possible through to Definite	Moderate	• Avoid the sandspit mangroves. • Sensible & environmentally friendly management of construction sites & temporary access roads. • Obtaining necessary permits for the destruction and, possible trimming, of mangroves	Moderate
Phyto- & Zoo-plankton	• Increased turbidity will have impacts • Ongoing transmission of noise through the water column will have an impact although the actual levels are unknown.	Moderate	Highly likely through to Definite	Moderate	• Unknown	Moderate
Macrobenthos, Nematode, Microphytobenthos	• Dredging, marine piling & construction activities will result in loss of benthic biodiversity through: ○ noise transmitted into the sediment ○ loss of habitat due to sediment deposition ○ extensive shading of benthic habitat ○ loss of primary productivity by shading ○ increased water turbidity ○ deposition of sediment ○ alteration of the benthic food resources ○ potential for increased water turbidity affecting pelagic macrobenthic larvae	Moderate – High	Definite, but limited in extent	High	• None	High

Macrocrustacea	• Dredging, marine piling & construction activities will result in a change in species composition & loss of prawn habitat through: o noise transmitted through the water & into the sediment o increased water turbidity o behavioural changes & habitat avoidance o loss of feeding habitat o re-suspension & deposition of sediment & smothering of prawn subtidal habitat o shading of habitat o reduced availability of food resources	Moderate – High	Definite, but limited in extent	High	•	High
Ichthyofauna	• Marine piling & to a lesser extent dredging will have the following impacts: o Behavioural changes due to noise o Possible movement away from the area due to noise, thus creating competition for resources in other areas o Loss of feeding areas in some intertidal shallows due to dredging o Loss of nursery areas due to the Pipe & Cabling Bridge o Increased water turbidity has the potential to change the species composition o Potential deposition of fine sediment & muds could impact on benthic food resources	Moderate – High	Unlikely but possible through to Definite	High	• None.	High
Avifauna	• Dredging, marine piling & construction activities will result in disturbance over some 75% of the intertidal sandflat habitat utilised by wading birds who feed on the Sandspit & the waders, terns & gulls who roost there • Over 2yrs the migrant waders, terns & gulls will be faced with disturbance during the non-breeding season. The likelihood of site abandonment will be extremely high. Therefore, mortality would increase due to competition for food where displaced birds attempt to access alternative resources • Impacts due to close proximity of activities to the spring low tide feeding grounds • Disturbance of the substrate, increased turbidity and noise could impact the benthic fauna, in the spring low tide area, which are fed on by birds • The Pipe & Cabling Bridge is a potential flight hazard. Details of bird flyways in the area are currently unknown	Moderate – High High (Specialist Opinion)	Unlikely but possible through to Highly Likely	High Fatally Flawed (Specialist Opinion)	• None. • The possibility of Offsets may exist, but these would need to be implemented and have been proven successful prior to activities taking place on the site of the proposed development.	High Fatally Flawed (Specialist Opinion)

Aspect	Nature of the Impact	Consequence Inherent Risk	Likelihood of the Consequence	Residual Risk	Mitigation Measures	Residual Risk after Mitigation
Operational Phase						
Water Quality, Granulometry & Organic Content	• Power island = permanent reduction in habitat for benthic communities. • The piles & bridge base structures will lead to change in hydrodynamics of tidal flow patterns & sediment dynamics across the Kabeljous Flats. • The piles & bridge base structures will lead to a reduction in benthic habitat on Kabeljous Flats.	Moderate	Unlikely but possible through to Definite	Moderate	• None.	Moderate
Macrophytes (Mangroves)	• If a cutline was required, there is the potential for causing localised effects. • If the pipe & cabling bridge is lower than 20m trees will have to be cut back if they reach the height of the bridge. • If the natural flow & sedimentation patterns are disrupted this has the potential to cause long-term impacts particularly on the edge of the mudflats and inside the stand. • Localised scour and deposition taking place due to the main anchorage chamber & Tower 3. Depending on the volume of deposition this could result in outward colonisation & loss of intertidal mudflat habitat, whilst deposition within the forest could lead to die-offs. • If access roads to land-based Towers are not rehabilitated there could be long-term impacts on the hydrology of the surrounding substrata & adjacent mangroves.	Moderate	Unlikely but possible through to Definite	Moderate	• Obtaining necessary permits for the destruction and, possible trimming, of mangroves for maintenance purposes.	Moderate
Phyto- & Zoo-plankton	• The shading of a large area of the water column will also create some impact, however the actual extent of the impact is currently unknown. • Maintenance dredging may result in localised impacts. • The long-term presence of the structures are predicted to result in some scouring & sediment movement which could influence turbidity levels potentially causing an impact.	Moderate – Low	Highly likely through to Definite	Low	• Unknown	Low
Macrobenthos, Nematode, Microphytobenthos	• Shading of 0.30km^2 of the water column & substrata, affecting benthic productivity & biodiversity. • Maintenance dredging will lead to sediment disturbance. • Piles & supports for the Pipe & Cabling Bridge will cause localised changes to the natural tidal hydrodynamics & sediment distribution across the Kabeljous Flats, leading to a shift in species composition during the post-construction period in areas where sediment composition changed.	Moderate	Definite	Moderate	• None	Moderate

Macrocrustacea	• Shading of 0.30km² of the water column & substrata, affecting primary productivity, food availability & prawn biodiversity. • Maintenance dredging will lead to sediment disturbance. • Piles & supports for the Pipe & Cabling Bridge will cause localised changes to the natural tidal hydrodynamics & sediment distribution across the Kabeljous Flats, leading to a shift in species composition during the post-construction period in areas where sediment composition changed.	Moderate	Definite, but limited in extent	Moderate	•	Moderate
Ichthyofauna	• Permanent loss of small areas of habit due to dredging • Shading of 0,30km². Fish utilise shaded area for resting & possible safety, but the long-term impacts of shading are not known. Such an activity could also have a knock-on effect through the ecosystem • Maintenance dredging will result in short term impacts • Localised changes in the natural tidal hydrodynamics & sediment distribution across the Kabeljous Flats, which could lead to shifts in species composition in areas where sediment composition changed • Sediment deposition in the mangroves could affect tree distribution & therefore fish feeding & resting areas	Moderate	Unlikely but possible through to Definite	Moderate	• None.	Moderate
Avifauna	• The NIFPP power island & Pipe & Cabling Bridge may be a flight hazard to birds • The NIFPP power island will result in noise across 75% of the Sandspit at levels that are considered above the disturbance threshold of birds • Permanent abandonment of site by the majority of waders. Thus, mortality would occur due to competition for food where displaced birds attempt to access other resources. • Terns & gulls will abandon the Sandspit as a roosting site • The presence of the initial section of the pipe & cabling bridge on the Sandspit effectively cuts the spit in half, thus a hazard to flying birds • Localised changes in the natural tidal hydrodynamics & sediment distribution across the Kabeljous Flats, leading to a shift in species composition through altered availability & distribution of feeding & resting habitat in areas where sediment composition changed. • Limited deposition of scoured sediments could result in some outward colonisation of mangroves and subsequent loss of intertidal feeding habitat • The Pipe & Cabling Bridge is a potential flight hazard. Details of bird flyways in the area are currently unknown	Moderate – High High (Specialist Opinion)	Unlikely but possible through to Highly Likely	High Fatally Flawed (Specialist Opinion)	• None. • The possibility of Offsets may exist, but these would need to be implemented and have been proven successful prior to activities taking place on the site of the proposed development.	High Fatally Flawed (Specialist Opinion)

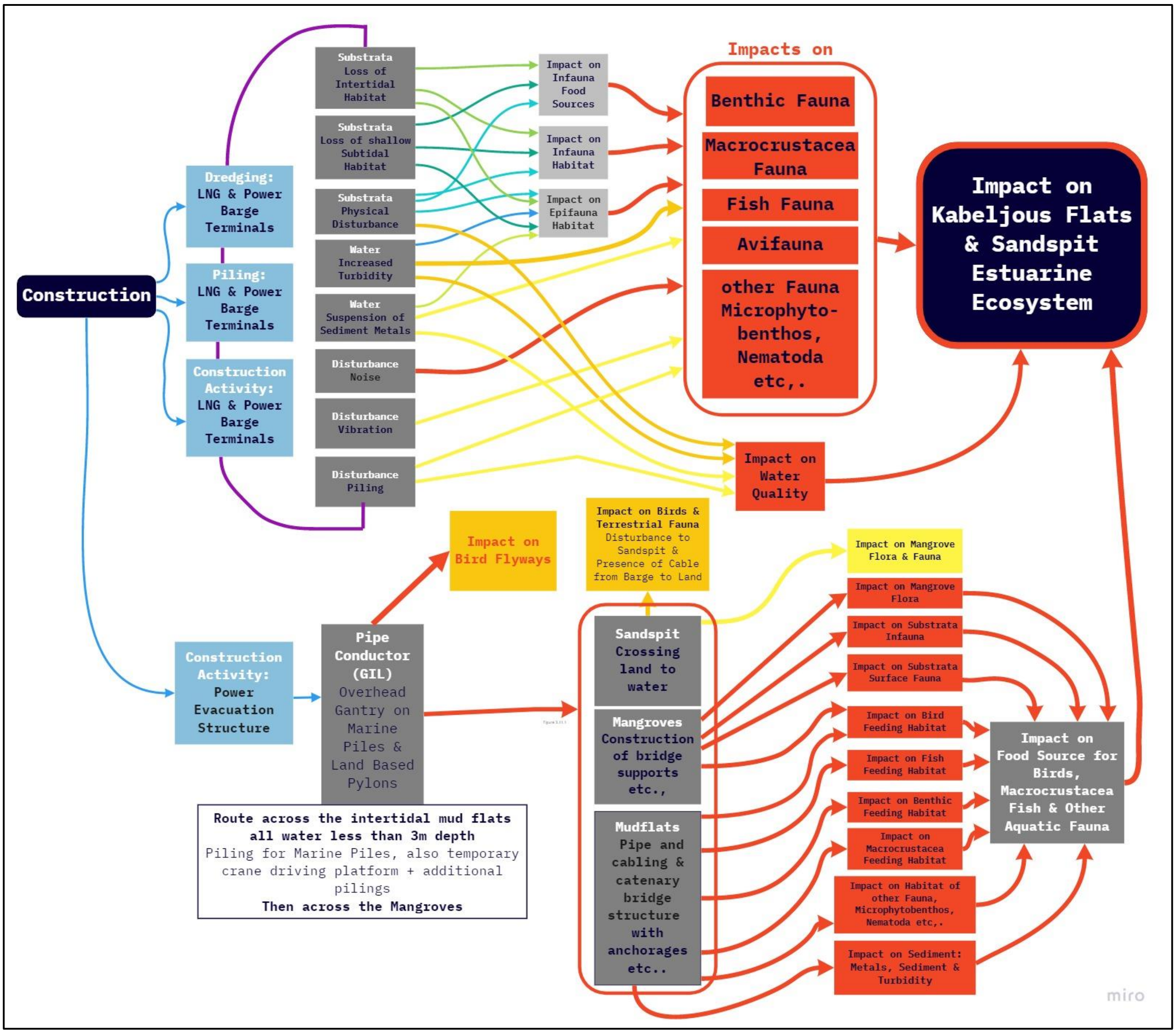


Figure 105: Impact Map for the estuarine environment based on the four major construction components of the proposed NIFPP and associated infrastructure development.

Figure 106 shows the cumulative sensitivity rating related to the contribution of the major habitat types (Figure 107), across the entire NIFPP project area, to the functioning of the Kabeljous Flats/ Sandspit Estuarine Ecosystem. The areas in Orange and Red are the most sensitive and any loss of, or major impact on them would potentially affect the ecosystems functionality and therefore its ability to meet any Resource Quality Objectives that are to be set for the Richards Bay Estuary to ensure protection of important aquatic resources as directed in the Draft Richards Bay Estuary Management Plan. From a cumulative impact assessment point of view the impacts are significant.

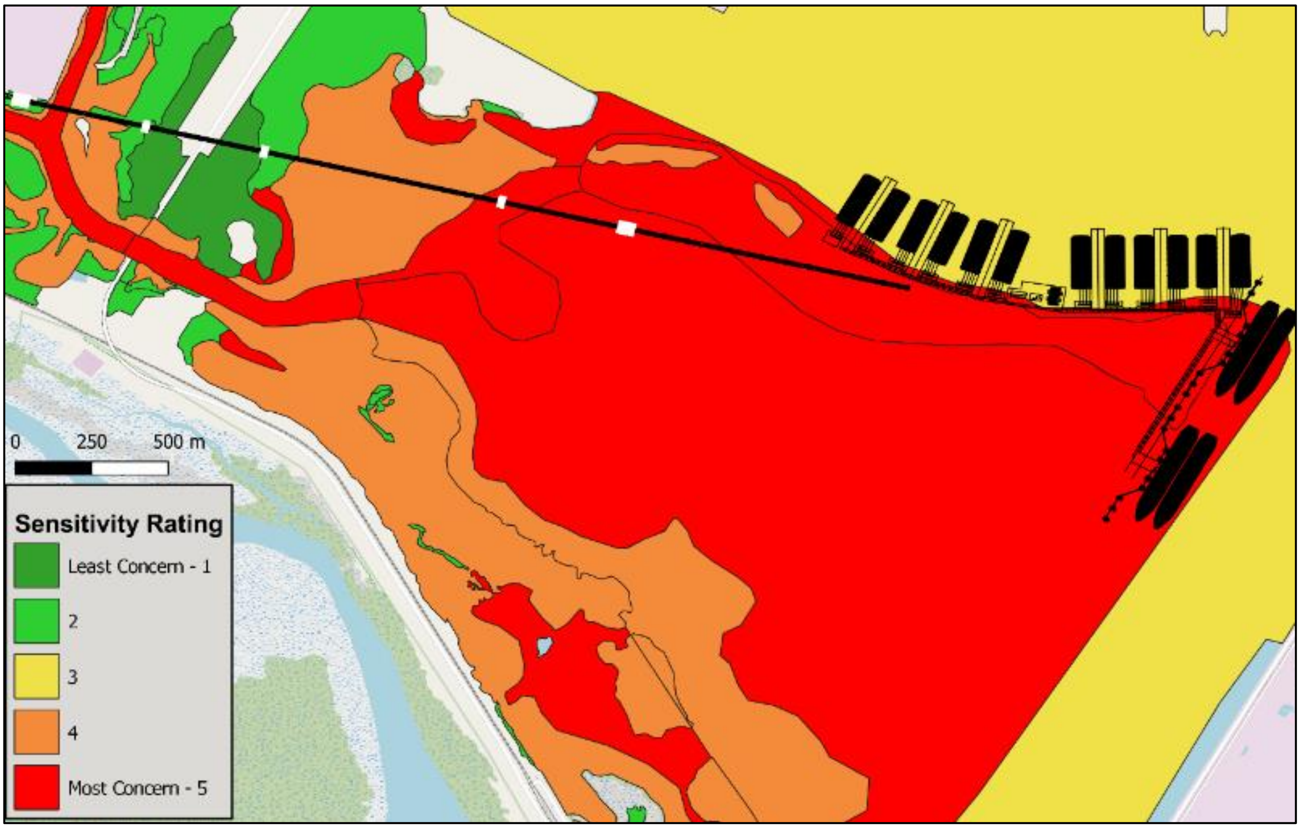


Figure 106: Sensitivity rating of the contribution of habitat types to the functioning of the Kabeljous Flats/ Sandspit Estuarine Ecosystem.

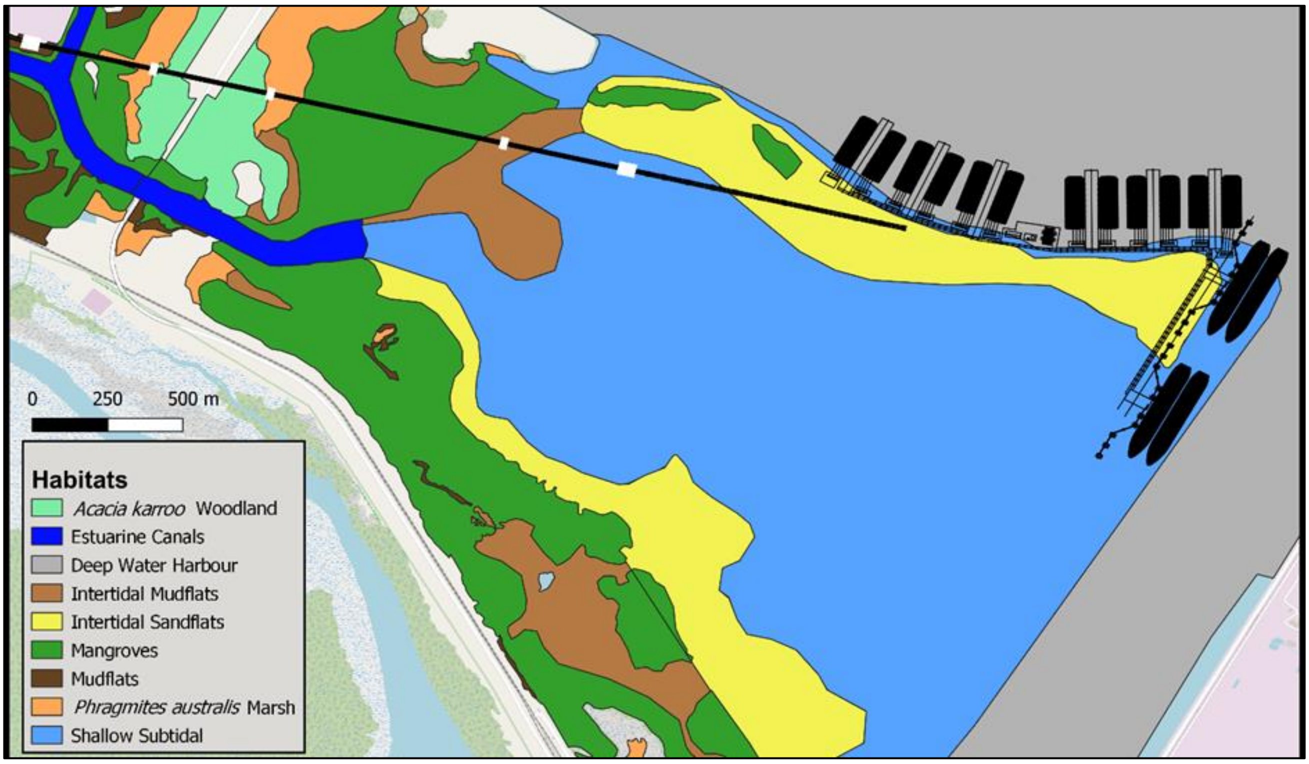


Figure 107: Position of the proposed NIFPP in relation to the dominant habitats within the Kabeljous Flats/ Sandspit estuarine ecosystem.

11.4.11 IMPACT STATEMENT

Based on all the investigations and assessments that have been undertaken as part of the estuarine impact assessment for the proposed NIFPP and associated infrastructure located adjacent to the Sandspit and the Power Evacuation Route across the Kabeljous Flats and the Mangroves it is concluded that:

- There will be High impacts on 7 of the faunal components and Moderate impacts on another 6 during construction. This will be in part due to the extensive construction period (~30 months) which will result in on-going impacts as it will extend over three breeding seasons.
- There will be a High impact on one of the faunal components (avifauna, based on the methodology provided) and Moderate impacts on another 9 during the Operations phase.
- **There will be immediate and long-term impacts on the avifauna of the Kabeljous Flats/ Sandspit which is of national importance, and these have an extremely high likelihood of causing avian mortality resulting in the project being rated as High negative based on the assessment method provided, but is considered (professional opinion of the specialist) to be Fatally Flawed, for both the Construction and Operational components.**
- Such impacts on the avifauna will also impact on South Africa's obligations as a signatory to the United Nations Bonn Convention on Migratory Species which is to "*protect migratory species their habitats and migratory routes*". The proposed development would impact on the following migratory birds: 11 wader and 7 tern species as well as 1 piscivorous raptor.
- **Overall, the Cumulative Impacts of the project are considered to be significant.**
- Given that the Kabeljous Flats/ Sandspit Estuarine Ecosystem is ecologically of such significance both provincially and nationally and has been unofficially 'protected', due to TNPA's closed access policy for more than 32 years, it should be allocated conservation status.
- The creation and implementation of Resource Quality Objectives, to ensure the protection of important aquatic resources as laid out in the Environmental Management Plan for the Richards Bay Estuary is a legal requirement that must be met. Giving the Kabeljous Flats/Sandspit area conservation status would be a positive step to meeting these requirements of the National Water Act.

The above, in conjunction with all other issues and impacts raised and evaluated in the Estuarine Ecosystem Current Status Assessment and the Impact Assessment Report, have led the conclusion, that **from an estuarine ecosystem perspective, the project should not be allowed to proceed.** It is therefore recommended that investigations be focused on looking for an alternative site within the Port where the environmental impacts of the development will not be as significant.

11.4.12 SPECIALIST RECOMMENDATIONS

Should the proposed NIFPP and associated infrastructure be accepted for development, there will be an urgent need for an Estuarine Monitoring Program to be put in place. This will require before, during and after construction monitoring of the proposed project.

11.4.12.1 Test Drilling for Founding Depths

Prior to the project getting underway there is a requirement for test drilling to be undertaken in order to establish the piling depths that will have to be met for the construction of the LNG and Power Barge Terminals as well as the Power Evacuation Structure. Project actions involving drilling for piling depth requirements should only take place on and around the Sandspit, within the Kabeljous Flats and the mangroves during the winter period. This would be when most of the waterbirds (which are primarily summer, non-breeding migratory waders and terns to southern Africa, that either roost on the sand spit (at high tide) or feed on the surrounding intertidal sandflats and intertidal mudflats (at low tide)) are absent from the region. The 'winter' period when such project actions would be appropriate can be defined as the four months 1 May to 31 August. It is recommended that the project actions should not go ahead on the sandspit if this requirement cannot be stringently met and adhered to.

In terms of monitoring actions during this period a full count of the study area should be undertaken on two spring low tide days before drilling starts. Depending on the length of time required to complete the drilling a second set of counts should be undertaken. On completion of the drilling activities a final two spring low tide day counts should be undertaken. Project actions should not cause the destruction of any mangrove trees on the Sandspit or in the Mangrove stand to be crossed by the route to be followed by the Power Evacuation structure.

11.4.12.2 Monitoring Before, During and After Construction

Should the project be approved for development, then monitoring must be undertaken as follows:

- Two sets of Summer and Winter samples should be collected before construction starts;
- Twice annual (Summer and Winter) sampling should be undertaken throughout the construction period;
- Two further sets of Summer and Winter samples should be collected after construction has been completed and the project is operational; and,
- The exception will be the Avifauna which will require high and low tide counts every second month across the study area for two years before construction starts, during the entire construction period and for two years after construction has been completed.

Site selection for sampling will be based on current information and sites previously sampled. However, for the Macrocrustacea, additional sites will be selected along the mangrove edge to be comparable with the samples collected by Weerts *et al.* (2003).

The following includes some of the components that will need to be monitored:

- Abiotic Elements
  - Water Quality Components;
  - Sediment Grain Size & Organic Content;
  - Water and sediment metal and PAH concentrations; and,
  - Sediment toxicity testing using a suite of standardized estuarine toxicity tests.
- Biotic Elements
  - Microphytobenthos;
  - Phytoplankton;
  - Zooplankton;
  - Macrobenthos;
  - Macrocrustacea;
  - Ichthyofauna; and,
  - Avifauna

The number of sites and samples to be collected will have to be determined once the EA has been issued and its conditions interrogated. Location of sample sites, techniques to be used, and number of replicates to be collected will all be based on standard practices following established guidelines for estuarine monitoring.

11.5 HYDRODYNAMIC MODELLING IMPACT ASSESSMENT

11.5.1 IMPACT STATEMENT

The model does not predict any major exceedances of thresholds of concern (visual or ecological) at recognised sensitive sites within the Port as the effects of dredging within the Port are largely confined to the areas to be dredged. The exceedance of thresholds of concern at the offshore dredge spoil disposal site is largely confined to elevated TSS concentrations in bottom waters that do not extend appreciably beyond the confines of the dredge spoil disposal site. This is also true for the accumulation of sediments on the seabed. It is only the dredge spoil disposal onto the northern beaches that is of potential concern. However, the dredge spoil disposal quantities for the proposed Project are significantly less than those due to Port maintenance dredging activities. Options exist to mitigate these potential impacts. This could include the disposal of all dredged material at the offshore dredge spoil disposal site, should it be required.

A key factor is that the proposed dredge quantities are significantly less than those for previous capital dredging projects in the Port, the as well as for on-going maintenance dredging. This limits the potential impacts of the dredging activities proposed for the Project.

11.5.2 SPECIALIST RECOMMENDATIONS

Given the fact that:

- The sediments to be dredged are not contaminated;
- The dredge volumes are relatively small; and that
- Any impacts will be modest compared to previous capital dredging and on-going maintenance dredging,

no specific mitigation measurements are proposed for the offshore disposal of dredge spoil.

The disposal of dredge spoil along the northern shoreline is expected to result in a degree of both visual and ecological impacts. The only mitigation measure possible is to slow the rate of dredging and therefore the rate of discharge of dredge spoil onto these northern beaches. As noted, if local dredge technology is used, it is in any case likely that the dredge rate will be significantly less than those modelled in this study. However, should the impacts of elevated TSS concentrations still be deemed unacceptable, it is always possible to discharge the dredge spoil from the dredging of the power barge berths at the offshore dredge spoil disposal site. This can be done without significantly increasing the impacts at the dredge spoil disposal site, except for perhaps increased changes in the water depth at the offshore dredge spoil disposal site due to the increased sediment loading and accumulation at the site. However, this can easily be mitigated by distributing the dredge spoil more widely over the dredge spoil disposal site to limit the depth of accumulation of dredge spoil, should this be required. Note that in the modelling study only one third of the aerial extent of the dredge spoil disposal site was utilised.

The only other substantive requirement is that the compliance monitoring procedures and management options be followed diligently and to adhere to the normal due diligence measures associated with dredging. These are expected to include standard ballast water management practices, supplemented by dredger-specific operational procedures should local dredging vessels not be utilised for the proposed dredging. Such dredger-specific operational procedures are expected to include procedures at the port of origin, such as the washing of the hopper, flushing the discharge pipes, and inspection of the hopper, pipes and dredge head to ensure no material is retained that may transport organisms to location of the proposed dredging and dredge spoil disposal activities.

11.5.2.1 Monitoring Programme

The monitoring programme developed (summarised in Table 93) and to be followed allows primarily for the monitoring for compliance and verification of impact assessments associated with dredging and dredge spoil disposal activities. This includes:

- Compliance monitoring based on TSS concentration thresholds of concern;
- Monitoring of physical changes in benthic habitats;
- Monitoring of potential shoreline changes; and,
- Monitoring to verify impact assessments and associated modelling activities.

Table 93: Monitoring requirements during dredging and dredge disposal activities

Monitoring Description	Location	Comment
Turbidity Profiling and sampling to determine TSS concentrations	Northern Shoreline	Recommended but not essential given the comparatively small volumes to be disposed of
Dredging spoil disposal records for the NIFPP	Offshore dredge spoil disposal site	Essential
	Northern Shoreline	Essential
Turbidity and TSS concentration compliance monitoring (other variables to be included in the profiling, if possible)	Potentially impacted areas within the Port (Figure 108)	Initial monitoring required. Reduced or stopped once compliance is established.
	Northern Shoreline	Recommended but not essential given the comparatively small volumes to be disposed of
Physical and biogeochemical changes in benthic habitats	Potentially impacted areas within the Port (Figure 108)	Recommended, to be advised by the Estuarine specialists (contaminant (metals) characterisation of the sediments not essential)
Detailed records of dredging operations	NIFPP dredging footprint	Detailed dredging records are essential Frequency of reporting = weekly.
	Offshore dredge spoil disposal site	
	Northern Shoreline	

The following sampling location are proposed (Figure 108) together with warning and intervention thresholds stipulated (Table 94).

Table 94: Recommended warning and intervention thresholds provided as turbidity (NTU) or equivalent TSS concentrations (mg/ℓ) for sampling undertaken during dredging activities

Monitoring Station	Warning Threshold		Intervention Threshold	
	Surface	Bottom	Surface	Bottom
M1	38 NTU / 57 mg/ℓ		93 NTU / 142 mg/ℓ	
M2 – M8	28 NTU / 43 mg/ℓ		93 NTU / 142 mg/ℓ	
B1 – B5	22 NTU / 33 mg/ℓ	26 NTU / 39 mg/ℓ	66 NTU / 100 mg/ℓ	

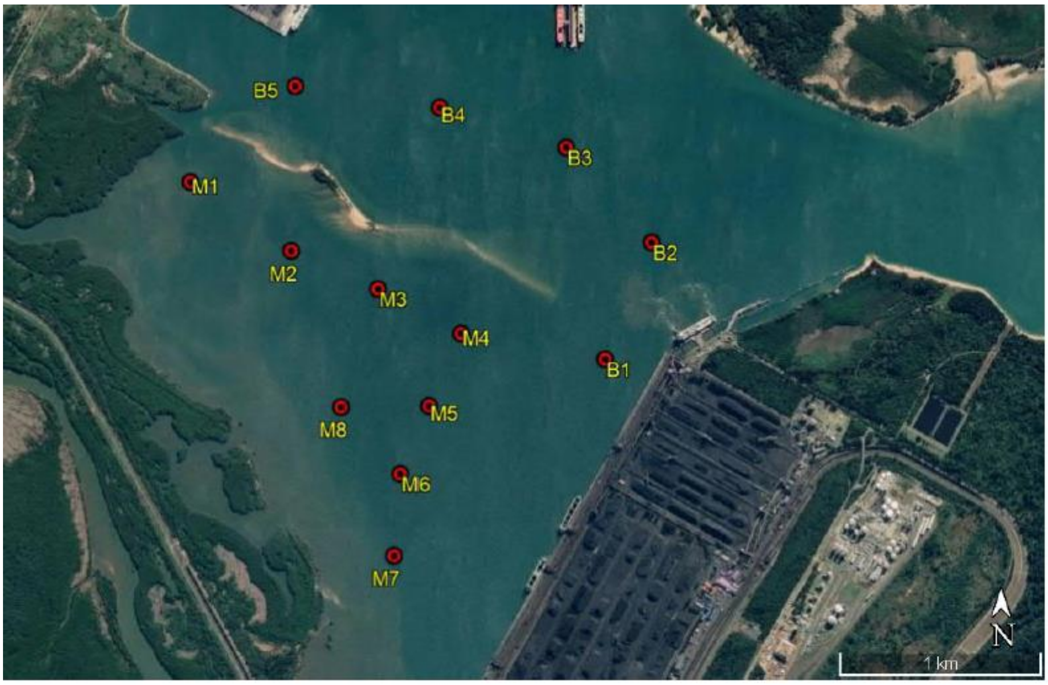


Figure 108: Recommended sampling locations for TSS and Turbidity sampling during dredging activities

A detailed monitoring protocol for the offshore dredge spoil disposal site was proposed for the Port of Richards Bay Capacity Expansion dredging and dredge spoil disposal activities where the dredging volumes were almost an order of magnitude greater than envisaged for the present NIFPP dredging activities. It is felt that any requirement to undertake monitoring of the offshore dredge spoil disposal site for the NIFPP would be too onerous given the scale of dredge spoil disposal from the NIFPP project compared to that of ongoing maintenance dredging activities. Furthermore, such monitoring would not be able to readily discern the impacts from the NIFPP dredging and the on-going maintenance dredging activities.

11.5.2.2 Monitoring Protocol

Monitoring within the Port is to:

- Commence approximately one month prior to the commencement of dredging activities.
- Upon commencement of dredging activities, it is proposed that the profiling within the Port be executed daily for approximately 5 - 7 days, such monitoring commencing after approximately 10 days of dredging and disposal activities.
- Thereafter the monitoring can take place once every one or two weeks; reducing to monthly or even a less regular basis should the results of the initial monitoring indicate this is acceptable.
- Should the “warning” thresholds be exceeded then the monitoring should be undertaken on a more regular basis (e.g. daily) until the threshold is no longer exceeded. Furthermore, should the “warning” thresholds be exceeded for more than 4 days then high-level intervention would be required.
- Similarly, should the “intervention” thresholds be exceeded at any stage then immediate high-level intervention would be required to reduce the turbidity and TSS concentrations to below relevant thresholds. This could include dredging at a different location, reduced dredging rates or possibly even the deployment of silt curtains.

Monitoring along the northern shoreline is more difficult but should in principle follow a simple, but perhaps more pragmatic monitoring protocol. The monitoring within the port is deemed essential while that along the northern shoreline is strongly recommended but not deemed essential. Monitoring of the offshore dredge spoil disposal site is not required.

11.6 HERITAGE IMPACT ASSESSMENT

Table 95: Assessment of construction phase impacts (largely associated with the substation site located to the north-west of Bayside) on existing heritage resources

Activity	Construction of project infrastructure
Environmental/ Social Aspect	Heritage resources
Nature of the Impact	Construction phase activities could result in disturbance of surfaces and/or sub-surfaces and may destroy, damage, alter, or remove from its original position archaeological and paleontological material or objects.
Consequence Inherent risk	Moderate-Low
Extent/ Scale	Local
Duration & Reversibility	Long-term & irreversible
Irreplaceable loss of a resource	Medium
Causes of impacts / Event	**Likelihood of the consequence:**
Construction activities cause accidental destruction of heritage resources.	Unlikely but possible: although surface sites can be avoided or mitigated, there is a chance that completely buried sites would still be impacted on.
Residual risk	Low
Extrinsic/ additional mitigation measures	• Implementation of a chance find procedure for the project. • As the exact location of the Bhizele Halt-2823 CC 001 site is not certain this area should be monitored during construction to ensure that no subsurface features are impacted on. • If site RBP03 is impacted on the area must be monitored by an archaeologist during construction to ensure that subsurface heritage resources are not impacted on.
Residual risk after mitigation	Low

11.6.1 CONCLUSIONS & RECOMMENDATIONS

In terms of the national estate as defined by the NHRA the following key findings apply:

- In terms of the built environment of the area (Section 34 of NHRA), no standing structures older than 60 years occur within the project area;
- Regarding the archaeological component of Section 35: two previously recorded features were visited. Both features have been destroyed by developments and erosion in the area and no surface indicators of these features were noted during the survey;
- During the survey two observations were made: an ephemeral shell scatter and the modern remains of cement slabs. Neither of the features are of heritage significance;
- The study area is of moderate paleontological sensitivity and an independent desktop paleontological study was conducted and concluded that there would be no impact on the fossil heritage and the project can proceed without further work during the impact assessment phase;
- In terms of Section 36 of NHRA no formal burial sites were recorded; and,
- During the public participation process conducted for the Scoping Phase no heritage concerns were raised.

It is recommended that the proposed project can commence on the condition that the following recommendations are implemented as part of the EMPr and based on approval from AMAFA:

- Implementation of a chance find procedure for the project;
- If sites RBP 03 or Bhizele Halt - 2823CC 001 are impacted, these areas must be monitored by an archaeologist during the construction phase.

11.7 QUANTITATIVE RISK ASSESSMENT FOR MAJOR HAZARD INSTALLATIONS – IMPACT ASSESSMENT

11.7.1 BRIEF HISTORY OF THE LNG INDUSTRY

Ocean-going tanker transportation of LNG has a long record of safe operation. According to the US Department of Energy (2002) over the life of the industry eight marine incidents worldwide have resulted in spillage of LNG, with some hulls damaged due to cold fracture, but no cargo fires have occurred. Seven incidents were recorded not involving spillage, with two from groundings, but none of these had significant cargo loss. Furthermore, there have been no LNG fatalities related to shipping. The LNG industry has an excellent safety record compared to refineries and other petrochemical plants (University of Houston Law Centre 2003). As of 2014, LNG has been safely delivered across the ocean for over 40 years. In that time there have been over 33 000 LNG carrier voyages, covering more than 60 million miles, without major accidents or safety problems either in port or on the high seas. Furthermore, LNG carriers frequently transit high traffic density areas.

Due to the properties of LNG, explosions are highly unlikely. According to the US Federal Energy Regulatory Commission (FERC), although a large amount of energy is stored in LNG, it cannot be released rapidly enough to cause the overpressures associated with an explosion. LNG vapours consisting mainly of methane mixed with air are not explosive in an unconfined environment.

It should be noted that the safety of LNG facilities and marine transport vessels over the decades has been a product of advanced technology, well-trained professionals, a thorough understanding of LNG risks, virtually fail-safe safety systems and procedures and rigidly adhered to standards, codes and regulations.

11.7.2 SCENARIO-BASED RISK ASSESSMENTS

A risk assessment was done of each processing unit by firstly selecting a scenario and then completing consequence and outflow modelling. Consequences with possible impacts beyond the site boundary were retained for risk analysis of the unit. Finally, the risk of the entire facility is determined as a combination of the risk calculated for each unit. Table 96 summarises the findings of the risk assessment.

Table 96: Scenarios modelled and risk assessment findings

Processing Unit	Scenario	Scenario Assumptions	Findings	MIR*
LNG Vessel (Tanker) & LNG offloading	Loss of containment of LNG from the LNG vessel/ ship	• Release of 126 m^3 over 30 minutes	• Max distances from the point of release to the 1% fatality = 263m • The release forms a pool on the water surface that evaporates very rapidly resulting in the flammable cloud and the vapour cloud explosion (VCE) • The impacts would be limited to the immediate area, and not expected to impact other ships within the port or extend to the occupied areas	A
	Loss of containment of LNG from Offloading Arm failure	• 4 loading arms operating at a maximum of 3000 t/d for each hose • Ships pumps operate at a pressure of 6 bar & will operate continuously until the LNG carrier is empty	• Max distances from the point of release to the 1% fatality = 106m (full bore rapture) • Max distances from the point of release to the 1% fatality = 62m (30mm hole) • The impacts would be limited to the immediate area, and not expected to impact other marine activity within the port or extend to the onshore facilities	A
CCGT Floating Power Barges	Loss of containment of a single LNG Storage Tank	• 1 000m^3 storage tank	• Max distances from the point of release to the 1% fatality: overfill = 45m; 10mm hole = 27m; catastrophic = 1399m; fixed duration (empty in 10min) = 262m • The worst meteorological weather was from a low wind speed at night • Under worst case conditions, the potential impacts could reach the land within the Port area. Due to the limited confinement, the overpressures would not develop into high overpressures with serious consequences. Some damage may occur, such as broken glass and damage to non-brick structures. The damage to ships would be limited.	
	Single vaporiser (Regasification Plant) failure	• Release of 3000 t/day at a pressure of 6-bar	• Max distances from the point of release to the 1% fatality = 147m • Resulting impacts were pool fires and jet fires • Flash fires were limited due to the turbulent free jet. The impacts from fires could damage equipment at the CCGT, depending on the release position & orientation, but should not impact marine operations	
CCGT Floating Power Barges	Flare	• Release point to be 45m above grade	• No reference level impacts	
	Loss of containment from a single compressor	• Operate at 10-bars	• Max distances from the point of release to the 1% fatality = 25m • The impacts would be limited to the immediate vicinity and could impact surrounding equipment on the Floating Power Barge, but would not extend to marine operations	
LNG pipeline network	Loss of containment	• Transport at 3000 t/d	• Impacts would be limited to a small area and could impact equipment in the vicinity, impacts beyond the Power Barge terminal/platforms/ quays would be minimal	A
NIFPP as a whole	Combined site risk	• As above for individual process units	• Individually the risk of $3x10^{-7}$ fatalities per person per year isopleths remain within vicinity of the Project and does not impact on any marine activity outside of the Project area nor impacts on any other Port operations	A

* MIR: Maximum Individual Risk - is the probability that in one year a person will become a victim of an accident if the person remains permanently and unprotected in a certain location. Often the probability of occurrence in one year is replaced by the frequency of occurrence per year.
A = Acceptable (<$1x10^{-6}$ fatalities per person per year); T = Trivial (<$3x10^{-7}$ fatalities per person per year)

11.7.3 CUMULATIVE IMPACT ASSESSMENT

Table 97: Cumulative impact assessment of the NIFPP hazardous installation

Activity	Power Generation by way of Combined Cycle Gas Turbine (CCGT) technology
Environmental/ Social Aspect	Health and safety of workers and the public
Nature of the Impact	Injuries (or fatalities) to workers and the public
Extent/ Scale	Local
Duration & Reversibility	Long-term & irreversible
Irreplaceable loss of a resource	High
Consequence Inherent risk	Low
Causes of impacts / Event	**Likelihood of the consequence:**
Loss of containment from the LNG carrier from collisions or failure of the LNG storage tanks on the carrier resulting in fires and explosions	Highly unlikely
Loss of containment of the LNG storage tanks related to the CCGT barge resulting in fires and explosions	Highly unlikely
Loss of containment from the vaporiser related to the CCGT barge, resulting in fires and explosions	Highly unlikely
Loss of containment from the compressor related to the CCGT barge, resulting in fires and explosions	Highly unlikely
Impacts from releases at the flare related to the CCGT barge	No injuries were simulated. Injuries would be highly unlikely.
Residual risk	Low
Extrinsic/ additional mitigation measures	None required.
Residual risk after mitigation	Low

11.7.4 IMPACT STATEMENT

Natural gas is an extremely flammable component with a fire and explosion hazard. It is not toxic, but can replace oxygen resulting in an asphyxiant. At low temperature, natural gas can result in frostbite injuries. Should additional hazardous substances be identified, as a result of more detailed engineering, these substances would require further investigation. The risk assessment was based on conceptual designs and pipeline routing. This study is not intended to replace the MHI risk assessment, which should be completed prior to the commencement of construction activities.

The QRA conducted for the proposed Project did not find any events that would interfere with current marine operations nor would impact any onshore facility, or public areas. As a result, RISCOM did not find any fatal flaws that would prevent the proposed Project from proceeding to the detailed engineering phase of the project.

11.7.5 SPECIALIST RECOMMENDATIONS

The following recommendations were stipulated within the specialist assessment:

- Compliance with all statutory requirements (i.e. pressure vessel designs);
- Compliance with applicable SANS codes: SANS 10087, SANS 10089, SANS 10108, etc.;
- Incorporation of applicable guidelines or equivalent international recognised codes of good design and practice into engineering designs;
- Completion of a recognised process hazard analysis (such as a HAZOP study, FMEA, etc.) on the proposed Project prior to construction to ensure design and operational hazards have been identified and adequate mitigation put in place;

- Full compliance with IEC 61508 and IEC 61511 (Safety Instrument Systems) standards or equivalent to ensure that adequate protective instrumentation is included in the design and would remain valid for the full life cycle of the tank farm:
    - Including demonstration from the designer that sufficient and reliable instrumentation would be specified and installed at the facility;
- Preparation and issue of a safety document detailing safety and design features reducing the impacts from fires, explosions and flammable atmospheres to the MHI assessment body at the time of the MHI assessment:
    - Including compliance to statutory laws, applicable codes and standards and world's best practice;
    - Including the listing of statutory and non-statutory inspections, giving frequency of inspections;
    - Including the auditing of the built facility against the safety document; and,
    - Noting that codes such as IEC 61511 can be used to achieve these requirements;
- Demonstration by the Developer or their Contractors that the final designs would reduce the risks posed by the installation to internationally acceptable guidelines;
- Signature of all terminal designs by a professional engineer registered in South Africa in accordance with the Professional Engineers Act, who takes responsibility for suitable designs;
- Completion of an Emergency Preparedness and Response Plan (EPRP) for on-site and off-site scenarios prior to initiating the MHI risk assessment (with input from local authorities);
- Permission not being granted for increases to the product list or product inventories without redoing part of or the full EIA;
- Obtain legal opinion if the OSHA is applicable for offshore structures and classification of the facility as a MHI; and,
- Final acceptance of the Project's risks with an MHI risk assessment that must be completed in accordance to the MHI regulations. Basing such a risk assessment on the final design and including engineering mitigation.

11.8 CLIMATE CHANGE IMPACT ASSESSMENT

The impact of the Project on climate change has two perspectives:

1) An absolute impact which is the total contribution of GHG emissions to the global atmosphere;
2) A contextual impact, based on the political, historical and economic circumstances of the location of the project (South Africa) and a comparison of the Project's emissions intensity to other power plants and indicators.

11.8.1 ABSOLUTE IMPACT

The difficulty with assessing the significance of GHG emissions is being able to assign directly, some level of impact to the emissions. Stated differently, the scale of global GHG emissions and the scale of the overall effects make it almost impossible to assign a level of impact, say sea level rise, change in global average temperature or ice loss to a specific industrial activity and the associated emissions. As such the assessment is based largely on simply comparing the mass of emissions from (in this case) the NIFPP to emissions from other activities. Thus, the absolute impact is an inappropriate tool to ascertain the significance of the Project in terms of climate change impacts, and a more appropriate assessment is to consider the impact in the context of its political, historical and economic circumstances, described below.

11.8.2 CONTEXTUAL IMPACT

The following contextual elements are important to consider:

- GHG emissions from the proposed Project in relation to the output (the emissions intensity of the project) and compared to alternatives; and,
- Alignment of the Project to South Africa's climate policy, international GHG emissions reduction commitments and economic challenges, including a growing demand for electricity and the challenge of shifting to a least-cost mix of energy-sources.

Assuming the Project would be deployed as a baseload power plant (load factor of 85%) and a nameplate capacity of 16 200 MW, the emissions intensity is 0.274 tCO_2e/MWh. This is compared with grid emission factors and emissions intensities of other power plants, which is illustrated in the table below.

Table 98: Emission intensities of grids and power plants

Power plant/technology	Emissions intensity	Reference
NIFPP	0.274 tCO_2e/MWh	Own calculations
UK Grid	0.2556 tCO_2e/MWh	Defra, 2019
SAPP Grid	0.9481 tCO_2e/MWh	CDM Standardized Baseline
US coal-fired plant	1.0 tCO_2/MWh	EIA, 2018
US natural gas-plant	0.42 tCO_2/MWh	EIA, 2018
US petroleum-plant	0.96 tCO_2/MWh	EIA, 2018
Eskom Power Plants	1.05 tCO_2e/MWh	GHG Impact report Thabametsi[viii]

The result from the above benchmarking exercise demonstrates that the GHG intensity of the proposed Project is low compared to conventional coal-fired plants as well as when compared to the regional (Southern African Power Pool - SAPP) grid. This is due to 2 factors:

- Natural gas is the cleanest fossil fuel and is a highly efficient form of energy; and,
- CCGT technology improves the efficiency even further through the combined use of both a gas and a steam turbine, thus generating up to 50% more electricity from the same fuel than a traditional simple-cycle plant. The waste heat from the gas turbine is routed to the nearby steam turbine, which generates extra power.

The energy sector contributes close to 80% towards South Africa's total GHG emissions. Therefore, the energy and climate change policies must be analysed in conjunction when assessing the Project's alignment to South Africa's development plans. Based on the analysis, the Project is aligned to South Africa's electricity demand and supply trajectory, as stipulated in the IRP, and at the same time able to play a crucial role enabling the shift from coal-dominated electricity-mix towards a less carbon-intensive blend of energy sources. The Project, therefore, responds to the country's energy needs and policies.

11.8.3 IMPACT STATEMENT

The Project's design enables the supply of baseload-demand because of its size and its reliability. This means that the Project would be an ideal means to displace the electricity that is currently supplied by ageing coal-fired power stations. Given its low emissions intensity when compared to coal-based electricity, this could result in a reduction of nearly 93 $MtCO_2e$ for every year that the same amount of output is supplied by the Project instead of through the conventional ageing coal-fired plants. Thus, this can be interpreted to be a **positive impact of very large magnitude**, thus **contributing to a significant reduction of GHG emissions globally**.

11.8.4 EQUATOR PRINCIPLE #2 – ALTERNTIVES ANALYSIS

Projects seeking finance from Equator Principles Financial Institutions (EPFIs) are required to conduct a lower GHG-intensive alternatives analysis if combined Scope 1 and Scope 2 Emissions are expected to exceed 100,000 tCO_2e annually. South Africa's GHG inventory is dominated by emissions related to the combustion of fossil fuels in the energy sector. Efforts to reduce the National inventory should, therefore, focus on activities in the Country's energy sector. Interventions to reduce South Africa's GHG from the generation of energy should be focussing on generation technologies. Although energy efficiency solutions will contribute to the sustainability of the national power supply network, the resulting reduction in GHG emissions will be difficult to quantify due to South Africa's current situation of so-called 'suppressed demand'. Therefore, the alternatives analysis takes into consideration only alternative technologies for the generation of power.

Informed by the IRP, gas-powered power generation is competing with coal-fired-, renewable energy-, hydro-, nuclear- and diesel-generation technologies. Provision is made for the take-up of both gas and renewable energy, in line with the long-term objective to move away from a coal dominated energy-mix to a least-cost energy mix established by renewable energy and gas. However, due to long implementation lead times for various generation technologies, in the short term, coal-fired power stations and diesel-generators (Peakers) shall be the main source of power generation. The table below presents an analysis of relevant alternatives to the proposed Project.

Table 99: Alternatives analysis with regards to power generation technologies

Alternative Technology	Advantages	Disadvantages
No development option	• No GHG emissions	• Continuation of rolling blackouts & load shedding and insufficient access to reliable energy for all • GHG emissions will be generated by another plant which is likely to be a coal-fired or diesel-fired plant and consequently larger amounts of GHG emissions per power-unit than the proposed Project • Investing in more polluting power generation technologies is not in line with the IRP and therefore financially unsustainable.
Displacing the project with hydroelectric power	• No combustion emissions • Power is a flexible source and could, therefore, displace Peakers (diesel-powered power stations): At times where demand is low, water flow is reduced, and dam levels are being conserved for times when the power consumption is high • Much safer. There is no fuel involved (other than water that is).	• Although no GHG emissions from the combustion of fossil fuel, hydroelectric dams produce significant amounts of GHG emissions, sometimes in the order of magnitude as those from fossil fuel-fired power-plants • Long lead-time, exceeding that of the proposed Project. Moreover, the evacuation of power from the Grand Inga Hydropower Project, is stagnating due to the political instability of the host-country (DRC) • Less reliable than the proposed Project, as droughts – which are likely to occur more frequently as a result of climate change – directly impact the availability of this source of power
Displacing the Project with zero-emissions technology (wind, solar)	• No GHG emissions	• Weather dependent: on its own not suitable as a supply of baseload power. Back-up required by other (often more carbon-intensive) power-generation technologies • Wind and solar power plants require space and can be a threat to habitats, and fauna, specifically birds and bats
Displacing the Project with a nuclear power plant	• Zero GHG emissions during operations	• Long lead-time, exceeding that of the proposed Project • The consequence of failure, due to whatever cause, is severe (Chernobyl 1986, Fukushima 2011) • Expensive • Radioactive waste
Displacing the Project with diesel-fired power plants	• A diesel-power plant is less expensive than e.g. a natural gas-fired power plant or a coal-fired power plant • Compact, thus less space is required thus reduced impact on the environment • Ideal as a back-up to supply power during peak demand • Requires less water for cooling	• More GHG emissions from the combustion of diesel (higher emission factor than natural gas) • Diesel is costly • Potentially severe health impacts associated with NOx and SO_2 emissions

Displacing the Project with coal-fired power plants	• Reliability, very suitable for meeting baseload demand • Affordability: energy produced from coal-fired plants is cheaper than from other energy sources, due to the abundance of coal being available • Safer than nuclear plants	• More GHG emissions from the combustion of coal (higher emission factor than natural gas) • Destruction of habitat & scenery due to mining activities • Large quantities of waste • Potentially severe health impacts associated with NOx and SO_2 emissions

The IRP is the responsibility of the Department of Energy and determines how much electricity will be generated and from which fuel or energy source. The choice for an alternative to the Project is therefore limited by the IRP. This implies that attempts to mitigate the emissions from the Project by choosing an alternative source for the generation of electricity should be directed at a restatement of the IRP. The IRP is setting course towards an energy mix consisting of wind, solar and backed-up by gas for the baseload demand, therefore the implementation of the Project is considered to be the most logical alternative which is in line with South Africa's Peak Plateau Decline model of national GHG emissions.

11.8.5 SPECIALIST RECOMMENDATIONS

The opinion from a climate change impact perspective is therefore, that the Project should be granted EA even though its impact on climate change is very large. This is based on the Project's low emissions intensity in the context of the outcomes of the Alternatives Analysis and its alignment to South Africa's energy and climate change policies.

11.9 SOCIO-ECONOMIC IMPACT ASSESSMENT

A summary of the impact assessment findings, as well as proposed recommended mitigation measures – where applicable, are presented in Table 100. Please refer to the specialist report in Appendix 6 for the detailed assessment.

11.9.1 IMPACT STATEMENT

As a result of ESKOM being unable to meet the growing demand, load shedding has been implemented to ensure the entire national electrical grid does not collapse. The unreliable and constrained national grid has contributed to the slow and stagnating economic growth being experienced in SA which in turn has numerous socio-economic implications. Added to this, ESKOM is currently reliant on aging coal-fired power stations which have significant environmental concerns and will require decommissioning in the near future. Nseleni Power Corporation (Pty) Ltd and Anchor Energy LNG (Pty) Ltd are proposing the construction NIFPP and associated infrastructure in the Port of Richards Bay as a means of alleviating the current shortfall and offering a cleaner source of energy than coal.

After taking into considering that nature of the receiving environment, the current need for a reliable energy source and the nature of the proposed project it can be concluded that from a socio-economic perspective there are no fatal flaws that should prevent the project from being authorised.

Indeed, while there are various social sensitivities, largely as the result of an anticipated influx of job seekers, the project is likely to have significant economic benefits (and resultant social benefits) for both the immediate area as well as the country as a whole. Beyond the economic impacts quantified in the report, there are other positive economic impacts stemming from the broader strategic importance of the NIFPP. The operation of the NIFPP will feed into the national power supply electric grid which would help stabilise power supply and increase power supply capacity. This would significantly reduce demand pressure on ESKOM thus alleviating load shedding. Further, with the improved power supply and energy efficiency, this may help bring down the cost of power allowing some industries to reopen with reduced costs. It is also expected that the supply chain stemming from the development of the NIFPP will deepen and grow resulting in new business opportunities, increased production and output.

Table 100: Summary of socio-economic impact assessment results

Aspect	Nature of the Impact	Consequence Inherent Risk	Likelihood of the Consequence	Residual Risk	Mitigation Measures	Residual Risk after Mitigation
Construction Phase						
Social: Visual	Negative impact: presence of construction equipment and activities on the visual nature/ aesthetics of the area	Low	Definite	Low	• Good housekeeping	Low
Social: Criminal Activity	Negative impact: increased criminal activity with movement of criminal opportunists into the area	Moderate	Likely	Moderate	• Ensure that the number of unskilled job opportunities are not overstated, articulate clearly that unskilled jobs will be provided to members of the local community so that unrealistic employment expectations are not created. • Engage SAPS, local security forums, business organisations, ward councillors & community leaders regarding the potential for population influx & criminal opportunism. • Together with SAPS undertake a monthly review of crime statistics to monitor potential increases during construction. • In the event of a noticeable increase in crime engage with SAPS & security forums to determine what assistance can be reasonably provided.	Moderate
Social: Spread of Disease	Negative impact: increase in the incidence of disease: • Increased spread of disease through migrant construction workers and people transporting project infrastructure. • Spread of disease that may cause epidemics	High	• Likely • Unlikely but possible	High	• An HIV & AIDS awareness/education should be included in the induction programme for all personnel (including contractors) working on the proposed project and evidence of training provided to all staff. • Ensure easy access to HIV & AIDS information & condoms for all workers. • Encourage voluntary HIV & AIDS counselling & testing. • Ensure contractor housing is well ventilated & that rooms are not crowded. • Ensure employees & contractors make use of all necessary COVID-19 PPE & hygiene facilities are available as required. Ensure daily COVID-19 screening of all project staff. • Ensure stringent medical screening of all crew members arriving via ship from outside SA.	High
Social: Informal Dwellers/	Negative impact: jobseekers moving into the area unable to find employment or following the end of a	Moderate	Unlikely but possible.	Moderate	• Provide clarity on the available number of jobs (in particular unskilled jobs) so that there are not raised expectations and stress that unskilled jobs will be provided to members of the existing local community.	Moderate

Destitute People	contract are unable or unwilling to return to their place of residence.				• Engage with local SAPS, community security forums & business forums of the possibility of an increase in informal dwellers and destitute people.	
Social: Safety	Negative impact due to perceived safety concerns	Low	Highly likely	Low	• Communicate with key stakeholders regarding Emergency Response Plans.	Low
Social: Protest action & Unrest	Negative impact: dissatisfaction over employment opportunities offered to local residents & the perception that contractors from outside the area are taking jobs	Moderate – High	Likely	High	• Ensure that as far as possible local contractors are favoured over contractors from outside of the project area. • Ensure all unskilled employment opportunities are provided to people from the local communities (people within the City of uMhlathuze LM).	Moderate
Social: Traffic Safety	Negative impact due to road traffic & reduced road safety	Moderate – Low	Likely	Low	• None	Low
Economic: Production	**Positive impact** due to greater demand for goods and services	Moderate	Definite	Moderate	• None	Moderate
Economic: Gross Value Add (GVA)	**Positive impact** due to greater economic activity in the region.	Moderate	Definite	Moderate	• None	Moderate
Economic: Business Income	**Positive impact** on business income is an economic impact that can be expected to arise as businesses benefit from increased production & GVA stimulation	Moderate	Likely	Moderate	• None	Moderate
Economic: Employment	**Positive impact:** creation of short-term opportunities in the local community	Moderate – Low	Definite	Moderate	• Communicate with locally based organisations as well as local government to identify skills/jobs that can be sourced locally.	Moderate
Economic: Property Values	**Positive impact** due to the new asset within the economy of the LM which leads to the generation of further business activity that, in turn, leads to new demand for property developments	Moderate	Highly – Likely	Moderate	• None	Moderate
Operational Phase						
Social: Visual	Negative impact: the presence of the NIFPP & associated infrastructure on the visual nature/ aesthetics of the area	Low	Definite	Low	• Good housekeeping	Low
Social: Spread of Disease	Negative impact: increase in the incidence of disease through crew from shipping vessels	High	Unlikely but possible	High	• Ensure stringent medical screening of all crew members arriving on shipping vessels from outside of SA and mandatory quarantine for any infected persons	Moderate

Social: Safety	Negative impact: perceived safety concerns regarding accidents and/or human error leading to risk of fire, explosion or LNG spill	High	Highly unlikely	Moderate	• Ensure all relevant international code and standards are implemented	Moderate
Economic: Production	**Positive impact** as the operation of the NIFPP will free up current electricity demand and this could result in the provision of more affordable electricity supply. Therefore, producers will be able to generate greater output from their resources which will add to national GDP	Moderate	Definite	Moderate	• None	Moderate
Economic: Gross Value Add (GVA)	**Positive impact** that will result in greater economic activity in the region which will largely have a national impact as the power will connect into the ESKOM Grid	Moderate	Definite	Moderate	• None	Moderate
Economic: Business Income	**Positive impact**: business income is an economic impact that can be expected to arise as businesses benefit from increased production & GVA stimulation	Moderate	Likely	Moderate	• None	Moderate
Economic: Employment	**Positive impact** that will result in the creation of long-term job opportunities in the local community	Moderate – Low	Definite	Low	• Where possible prioritise the employment of locally based personnel.	Low
Economic: Tax	**Positive impact** that will result in the creation of long-term job opportunities in the local community. The operation of the NIFPP will have tax implications in the form of VAT & payroll tax revenue for the South African Revenue Services (SARS)	Moderate	Definite	Moderate	• None	Moderate
Economic: Property Values	**Positive impact** due to the new asset within the economy of the LM which leads to the generation of further business activity that, in turn, leads to new demand for property developments	Moderate	Highly – Likely	Moderate	• None	Moderate

12 COMPARATIVE ASSESSMENT OF ALTERNATIVES

The 2017 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 it is proposed to undertake the activity;
b) Type of activity to be undertaken;
c) Design or layout of the activity;
d) Technology to be used in the activity;
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 (with the primary purpose being ways to reduce negative or enhance positive impacts) in terms of the proposed activities must be identified and assessed in the S&EIR process. The following alternatives were highlighted within the Scoping Phase, those underlined are additional alternatives identified through detailed specialist investigations and engineering designs:

- Heat flux exchange method for cooling within the CCGT power plants to maximise energy efficiency within the NIFPP (Nseleni Power Corporation (Pty) Ltd: 14/12/16/3/3/2/2032);
- Exact siting of marine piles and quays for the construction of the LNG and Power Barge Terminals within the ambit of layout 3 (Anchor Energy LNG (Pty) Ltd: 14/12/16/3/3/2/2033);
- Exact siting of the land-based transmission substation within the proposed study area, north-west of the Bayside Aluminium smelter site, for easy connection to the existing electrical Grid (Nseleni Power Corporation (Pty) Ltd: 14/12/16/3/3/2/2032);
- Routing of the transmission powerline from the NIFPP to the on-land transmission substation (Nseleni Power Corporation (Pty) Ltd: 14/12/16/3/3/2/2032);
- Type of the transmission powerline from the NIFPP to the on-land substation (Nseleni Power Corporation (Pty) Ltd: 14/12/16/3/3/2/2032);
- Disposal of dredged material (Anchor Energy LNG (Pty) Ltd: 14/12/16/3/3/2/2033); and,
- No-Development (no-go) option for the proposed development as a whole.

12.1 ENERGY USE EFFICIENCY – HEAT FLUX EXCHANGE METHOD

As was described in the project description (Section 2.3.4.2) the technology presented here (which is a CCGT) optimises the heat balance (heating requirements) for the NIFPP in the following ways, which ultimately serve to decrease the use of alternative energy sources:

- Heat generated from the combustion of natural gas (i.e. hot exhaust gas/air) provides heating to generate steam for the steam turbines;
- The residual heat (after the above process) in the exhaust gas/ air is used to regasify the LNG in the regasification plants; and/or,
- The exhaust gas/ air is released to atmosphere (with minimal heat energy).

In addition to the heating required in the heat balance, cooling is also required within the closed-loop steam turbine circuit to condense the steam back into water phase. The following alternatives were investigated (Nseleni Power Corporation (Pty) Ltd: 14/12/16/3/3/2/2032):

- Air cooling system, using ambient air, where heated air will then be released to atmosphere;
- Water cooling system, either closed loop or flow through, using ambient estuarine water abstracted from the Port/ Estuary, and where heated water is then re-integrated back into the Port/ Estuary or cooled using a refrigerant or possibly even the LNG; or possibly a system where;
- LNG (at -162°C) is used through a suitable heat exchange medium to condense the steam into liquid form (the LNG will then be heated to a gas phase and sent to the regasification plants for further heating in the gaseous form).

The cooling medium required for the CCGT Power Barges is required to condense steam back into a liquid phase. Seawater is often used for such cooling because of its availability and large thermal inertia. Alternatively, the latent heat characteristics of either ambient air or refrigerant gasses (through an appropriate heat exchange medium) to condense the steam back into liquid phase could be applied. The following table highlights the advantages and disadvantages of the cooling alternatives for the steam condensers considered.

Table 101: Comparative assessment of the cooling alternatives for the steam condensers within the CCGT technology of the Floating Power Barges

Alternatives	Advantages	Disadvantages
Ambient Air Cooling	• The ambient air temperature within Richards Bay during winter is always above the operating requirement of 4.4°C, thus no heating of ambient air is required.	• Not as efficient a cooling system as flow through water cooling hence the efficiency of the power generation equipment is reduced which increases generation cost.
Flow through water cooling	• The NIFPP is located within a Port environment, thus water for flow through is readily available.	• Large volumes of water, in the order of 528km^3 for 12 barges, will be required for flow through water systems. Heated water would be discharged back into the Port environment, thus raising the overall ambient water temperature of the estuary with knock-on negative ecological impacts on fauna and flora within the Port. The effect was not modelled as it was clear that a delta of +3°C was inevitable, therefore the change to alternate cooling systems was initiated.
LNG cooling	• Easily accessible as LNG is the required fuel source for the gas turbines. • LNG is stored in liquid form at -162°C.	• The available cooling power in the LNG represents 10% of the thermal heat load required to be removed from the steam.

Based on the above assessment, it was decided that a closed-loop water cooling system using ambient air as the cooling medium be implemented, as described in Section 2.3.4.1 and Section 2.3.4.2 of the Project Description.

12.2 EXACT SITING OF THE PREFERRED LAYOUT (NSELENI: 14/12/16/3/3/2/2032)

Layout Alternative 3 (the preferred alternative north and east of the sandspit) has largely remain unchanged (Figure 7). However, the power evacuation pipe and cabling bridge structure's connection point (i.e. transformer platform) to the power barge terminal shifted location from the far western end of the power barge terminal (Figure 109) to the east to avoid the sensitive Mangrove Forest stand on the sandspit (Figure 110) and then disappeared altogether as the power evacuation bridge structure could then connect directly to the power barge terminal, largely due to the change in the proposed location of the on-land substation and switching yard (refer to Section 12.3 below) and one of two roosting sites for waders, terns and gulls on the sandspit. This resulted in approximately 30 less piles being required in close proximity to the sandspit.

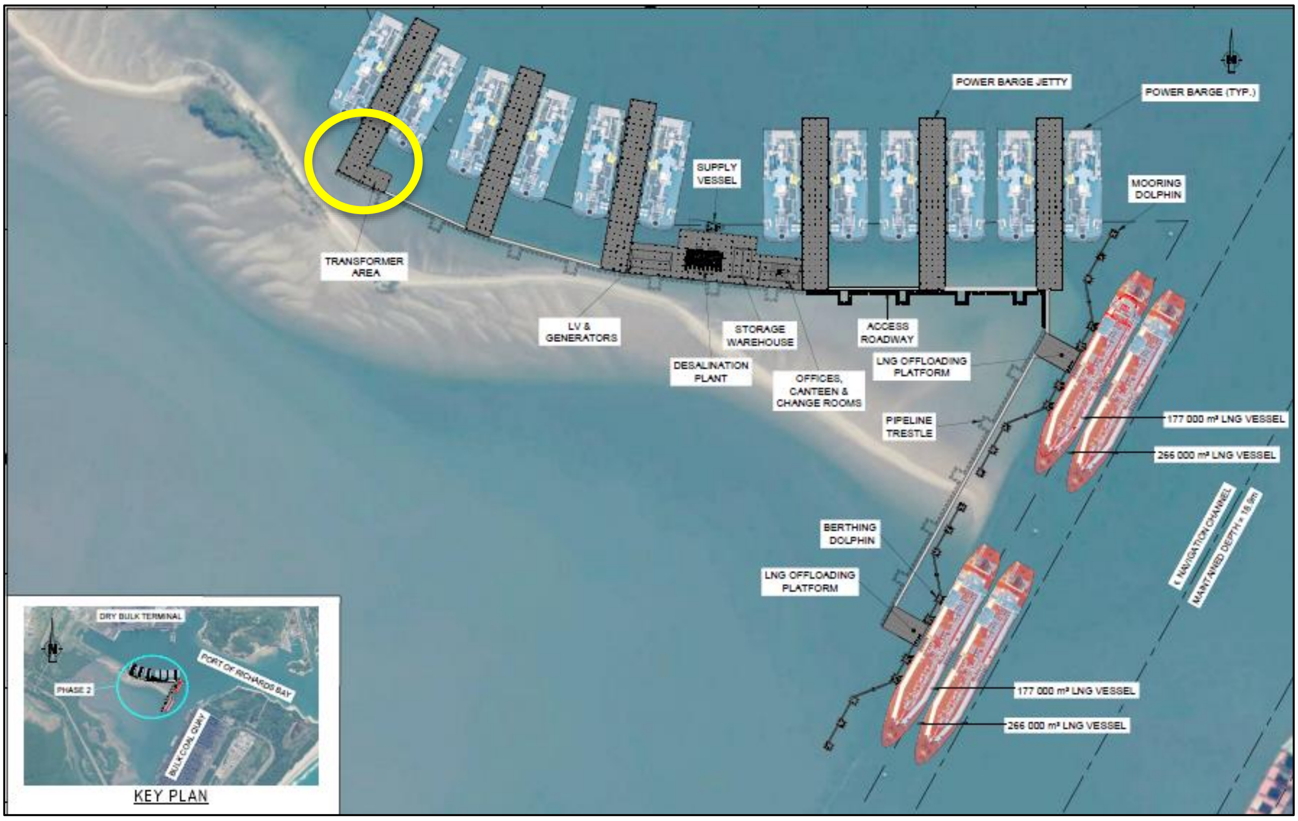


Figure 109: Original Layout 3 at Scoping Phase (transformer platform located on the far western corner of the Power Barge Terminal – highlighted by the yellow circle) of the NIFPP.

Figure 110: Revised Layout with the transformer platform shifted more to the east (highlighted by the yellow circle) along the Power Barge Terminal to avoid the sandspit Mangrove Forest patch (as per specialist recommendation).

12.3 LOCATION ALTERNATIVES FOR THE PROPOSED SUBSTATION AND SWITCHING YARD (NSELENI: 14/12/16/3/3/2/2032)

12.3.1.1 Original location North-West of Bayside (A)

Due to the presence of existing Eskom servitudes and powerlines to the north-west of the study area, it was initially proposed that the new on-land substation and switching yard be located north-west of Bayside (Figure 111) to facilitate the supply connections into the National Grid. However, the wetland delineation and functional assessment as well as the terrestrial biodiversity assessment of the study area revealed sensitive valley-bottom wetland systems (Figure 77), Critically Endangered (CE) (Kwambonambi hygrophilous grassland) and Endangered (E) (Maputaland Coastal Belt) vegetation types within the north-western portion of the study area (Figure 83). The negative impact of the proposed substation on these sensitive wetland and terrestrial grasslands (i.e. loss of these ecosystems) was deemed to be highly significant (Table 102) requiring biodiversity and wetland offsetting if the substation could not be moved further east onto South32's Bayside Aluminium smelter property or into a different area entirely.

12.3.1.2 Preferred location within the built-up footprint of the "to-be" decommissioned Bayside site (B)

Through negotiations with the RBIDZ and South32 an environmentally benign area on the Bayside Aluminium smelter site was identified for the proposed new substation and switching yard (Figure 111). This area is already developed, it falls within the industrial urban edge and has no important environmental sensitivities. The alternative site not only avoids the sensitive wetland and terrestrial habitats to the north-west of the study area (the 1st tier of the mitigation hierarchy), but also contributes to the end land-use vision of the decommissioned Bayside smelter site to add value to the industrial growth of the Richards Bay area through the provision of reliable electricity.

Table 102: High-level impact assessment of the key considerations for the location alternatives for the proposed substation and switching yard.

Aspect	**Wetlands**								**Terrestrial Biodiversity**					
Nature of the Impact	**Infilling/ loss of wetland habitat**		**Hydrological alternation – runoff**		**Hydrological alternation – connectivity**		**Spread of IAPs**		**Clearing CE & E vegetation types & protected trees**		**Disturbance of flora & fauna including species of conservation concern**		**Spread of IAPs**	
Route Alignment	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**
Consequence (Inherent Risk)	M-H	-	M-H	-	M-H	-	M-H	M-H	M-H	-	M-H	-	M-H	M-H
Duration	Permanent	-	Permanent	-	Permanent	-	Short-Term		Permanent	-	Permanent	-	Short-Term	
Reversibility	Irreversible	-	Irreversible	-	Irreversible	-	Reversible		Irreversible	-	Irreversible	-	Reversible	
Irreplaceable Loss of a Resource	H	-	H	-	H	-	M	M	H	-	H	-	M	M
Likelihood	Definite	-	Definite	-	Definite	-	Definite	Highly Unlikely	Definite	-	Highly-Likely	-	Definite	Highly Unlikely
Residual Risk	H**	-	H**	-	H**	-	H**	L	M	-	M**	-	M**	L

M = Moderate; M-H = Moderate-High; H = High; M-L = Moderate-Low; L = Low

* Extent/ Scale = Site in all instances.

** Specialist applied the incorrect risk category, so the EAP has rather reference the higher risk category.

12.4 ROUTING ALTERNATIVES FOR THE TRANSMISSION POWERLINE FROM THE NIFPP TO THE ON-LALND TRANSMISSION SUBSTATION (NSELENI: 14/12/16/3/3/2/2032)

12.4.1.1 Original route alignment (A)

Initially the shortest route from the NIFPP power island to the on-land substation and switching yard was planned to reduce the costs of construction. With the specific environmental requirement to span the mangrove forest patches to the west of the Port, the narrowest section of the mangroves was the preferred alignment for crossing over the mangroves (Figure 111). This alignment would have impacted a small stand of mangroves located on the sand-spit.

On land, the proposed route of the pipe and cabling bridge structure would have run parallel to Bayside's southern and western boundary to the on-land substation (Figure 111). The proposed alignment to the west of Bayside would impact (moderate to high inherent risk - Table 103) the valley-bottom corridor wetland located between Bayside and the Foskor Gypsum Dump. Numerous protected plant species, such as swamp figs, are also located within this wetland system and the impact to flora and fauna was deemed to range from moderate to moderate-low inherent risk (Table 103).

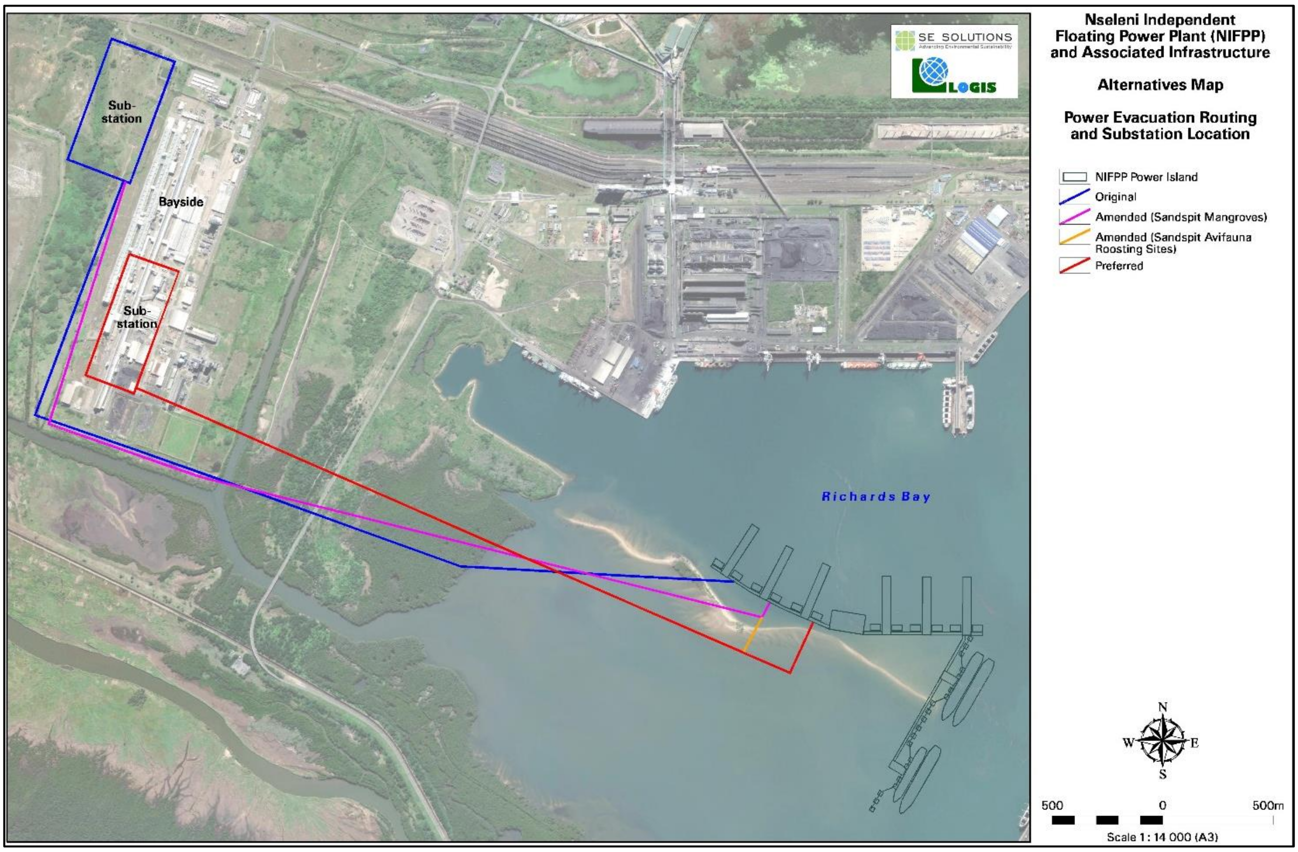


Figure 111: Substation site alternatives and routing alternatives for the power evacuation pipe and cabling bridge structure from the NIFPP power island to the on-land substation.

12.4.1.2 Amended route alignment due to sandspit Mangrove Forest Patch (B)

The estuarine assessment indicated that the power evacuation structure be shifted southwards (Figure 111) to avoid impacting the sensitive and protected mangrove tree stand located on the sand-spit. The power evacuation structure must be straight as changes in direction significantly increase the cost and impact of the structure as more anchor points are required to support the change in direction. An alternative alignment was therefore proposed for the east west component of the structure. The EAP advised that in addition, the north south section of the be moved eastwards, closer to Bayside's fence-line (Figure 111) in order to decrease the direct impacts on delineated wetlands and associated patches of swamp forest trees (protected). That realignment did not materially change the significance of the impacts on wetland and terrestrial biodiversity from the original alignment (Table 103).

12.4.1.3 Amended route alignment due to change in Substation location (clash with bird roosting site) (C)

With the change in the location of the on-land substation and switching yard to within Bayside, the pipe and cabling bridge structure had to be realigned again (Figure 111). The initial realignment would then have impacted one of two avifaunal roosting sites located on the sand-spit. The alignment would also have impacted (albeit to limited extent) seral indigenous forest for the construction of Tower 2 (Table 103). The benefit of the new alignment though was avoiding the potential wetland and terrestrial biodiversity impacts south and west of Bayside.

12.4.1.4 Preferred route alignment taking all sensitivities and design constraints into account (D)

Based on the estuarine impact assessment report (refer to Appendix 6), the EAP then advised that the alignment of the pipe and cabling bridge structure be shifted further east to avoid direct impacts on the avifaunal roosting site resulting in a preferred alignment for the proposed pipe and cabling bridge structure that minimises impact on ecologically sensitive environments, specifically wetlands and terrestrial biodiversity.

12.4.1.5 Comparative Assessment of power evacuation routing alternatives

While all power evacuation routing alignments have a significant negative impact on the sensitive ecological habitat of the Kabeljous Flats (refer to Section 10.4), the negative impacts on terrestrial habitats, species of conservation concern and wetland habitats differs markedly between alternatives investigated. The original and amended alternative alignments (associated with the original location of the proposed substation and switching yard to the north-west of the Bayside site) impacted significantly (High negative residual impact) on existing wetland habitats west of Bayside, with medium to medium-low negative residual impacts on terrestrial habitats and species of conservation concern (refer to Table 103 and Section 11.3.3 for more details). Realigning the power evacuation pipe and cabling bridge structure removed many of the impacts on sensitive wetland and terrestrial habitats and reduced the alien invasive plant risk by restricting the majority of construction (and indeed operational) activities to already disturbed and developed areas.

For avifaunal impacts, specifically impacts on wading birds and other estuarine-linked species that utilise the sandspit for feeding and roosting, the original and preferred routing alternatives represent the least impact on avifauna, but still have a moderate negative impact. The subsequent changes to address layout and other environmental sensitivities which resulted in a change from the original layout impacted more significantly (high negative residual impact) on avifauna in that one of two roosting sites (preferred by birds on the sandspit) would be directly impacted, thus a further change was advised by the EAP, resulting in the preferred alignment.

Cumulatively, the preferred alignment avoids the majority of the sensitive wetland, terrestrial biodiversity but only slightly reduces the direct impacts on avifaunal communities that utilise the sandspit for roosting.

Table 103: High-level impact assessment of the key considerations for each power evacuation routing alternative*

Aspect	Wetlands						Terrestrial Biodiversity						Avifauna			
Nature of the Impact	Infilling/ loss of wetland habitat		Hydrological alternation – runoff		Spread of IAPs		Clearing CE & E vegetation types & protected trees		Disturbance of flora & fauna including species of conservation concern		Spread of IAPs		Disturbance of avifauna at preferred roosting sites on the sand-spit			
Route Alignment	A & B	C & D	A & B	C & D	A & B	C & D	A & B	C & D	A & B	C & D	A & B	C & D	A	B	C	D
Consequence (Inherent Risk)	M-H	-	M-H	-	M-H	M-H	M	-	M-H	M-H	M-H	L	M	M-H	M-H	M
Duration	Permanent	-	Permanent	-	Short-Term		Permanent	-	Permanent		Short-Term		Permanent			
Reversibility	Irreversible	-	Irreversible	-	Reversible		Irreversible	-	Irreversible		Reversible		Irreversible			
Irreplaceable Loss of a Resource	H	-	H	-	M	L	M-L	-	M	H	H	L	L	M	H	M
Likelihood	Definite	-	Definite	-	Definite	Highly Unlikely	Likely	-	Unlikely	Highly Unlikely	Definite	Highly Unlikely	Definite			
Residual Risk	M	-	M**	-	M**	L	L	-	L	L	M**	L	M	H	H	M

M = Moderate; M-H = Moderate-High

* Destruction and/or disturbance of ecologically sensitive estuarine habitat types within the Kabeljous Flats is common to all alternatives assessed and not a distinguishing factor in determining the preferred alternative from an environmental and engineering alignment design point of view).

** Specialist applied the incorrect risk category, so the EAP has rather reference the higher risk category.

12.5 TYPE OF TRANSMISSION POWERLINE FROM THE NIFPP TO THE ON-LAND TRANSMISSION SUBSTATION (NSELENI: 14/12/16/3/3/2/2032)

12.5.1.1 Preferred Type: Gas-Insulated Transmission Lines (GIL)[22]

Gas-insulated transmission lines consist of two concentric aluminium tubes. The inner conductor rests on cast-resin insulators, which centre it within the outer sheath. This casing is formed from a stable aluminium tube, which ensures a solid mechanical and electro-technical encapsulation for the system (Figure 112). GIL systems are filled with an insulating gas mixture consisting mainly of nitrogen and a smaller proportion of SF_6 (sulphur hexafluoride). The tubes are made of a corrosion-resistant aluminium alloy, and are provided with an additional coating if they are laid directly in the ground.

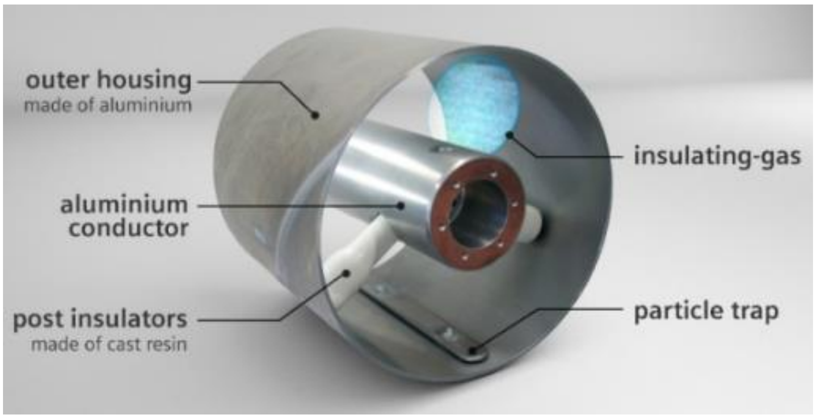


Figure 112: Typical GIL Structure

GIL reportedly provide a safe and flexible alternative to overhead lines and require less space for equivalent power transmission. Since GIL have a small footprint, and minimal electromagnetic radiation they can also be used close to, or even within buildings. GIL are suitable for providing a continuation for overhead lines underground, connecting power stations to the power network, or as a space-saving way to connect major industrial plants to the public grid.

Reported advantages of GIL include:

- Low losses: Resistance losses with GIL are less than with cables or overhead lines. The dielectric losses with GIL are negligible, reducing operating costs. Heat emissions are better than with cables, because of the larger external diameter. With GIL, there is normally no need for highly refined cooling systems.
- No electrical compensation: The low capacitance of GIL systems means that they only need phase angle compensation devices (complex facilities) once the system length exceeds about 70 kilometres.
- Low electromagnetic fields: The phase current induces an almost identical reverse current in the enclosure. This means the magnetic field outside the GIL is negligible. Even in EMC-sensitive areas (such as close to residential areas or hospitals), there is generally no need for special shielding.
- Greater safety: With an internal insulation failure, the internal arc would be safely enclosed within the outer housing minimising fire risk
- High reliability: GIL technology has proven its reliability in more than 40 years of operation, with no failures to date.
- No aging: The GIL insulation system is not prone to either electrical or thermal aging. GIL systems are almost maintenance-free.
- Used in the same way as overhead lines: GIL systems can complement overhead lines. The high transmission capacity offered by GIL makes it possible to provide a continuation for overhead lines underground, with one

[22] Information sourced from: https://new.siemens.com/global/en/products/energy/high-voltage/power-transmission-lines/gas-insulated-lines.html. Accessed: 10 February 2020.

GIL tube per phase, which minimizes space consumption. GILs allow automatic reclosure, hence do not require major changes of operation and protection schemes of the grid.

- Maintenance-free design: The physical properties and the use of high-quality materials make this an almost maintenance-free product. Routine maintenance is limited to an external inspection, and the line can remain in operation during inspection activities.

The alternatives proposed during Scoping to evacuate power from the NIFPP to the on-land substation and switching yard were to either:

- Lay cables on- or bury them under-ground (within the estuary substrate or underground on land); or,
- To construct an overhead “gantry” (now termed pipe and cabling bridge) structure supported by marine piles (over water) and land-based pylons (over land) which houses the GILs.

Table 104 and Table 39 provides the impact significance of the two alternatives considered. Thereafter, a brief impact statement is provided as to why the overhead pipe and cabling bridge structure was preferred and carried forward into the detailed project description for authorisation.

Table 104: Impact significance for on-ground or buried GILs for the evacuation of power from the NIFPP to the land-based substation and switching yard.

Activity	Installation of cables on the surface of the ground or buried underground from the NIFPP within the Port to the on-land substation & switching yard. Activities include possible excavations, laying cables, backfilling, compaction and rehabilitation of disturbed areas during the construction phase and then similar activities for carrying out any maintenance on the infrastructure during the operational phase.
Environmental/ Social Aspect	Land Transformation – estuary bed/substrate; wetlands and terrestrial vegetation and associated biodiversity features and ecological functionality.
Nature of the Impact	Direct disturbance, destruction, removal of sensitive fauna and flora due to construction and operational activities as well as indirect knock-on effects on upper trophic levels and ecosystem services within the greater landscape.
Consequence/ Inherent risk	Moderate-High
Extent/ Scale	Regional (National in some instances)
Duration & Reversibility	Long-term & irreversible (due to ongoing impacts associated within maintenance during the operational phase)
Irreplaceable loss of a resource	High
Causes of impacts / Event	**Likelihood of the consequence:**
Disturbance & destruction of sensitive habitats.	Definite given that a 24-38m wide corridor of the Kabeljous Flats will be directly impacted with construction and/or maintenance activities as well as associated with scouring and indirectly through resettlement of suspended sediments within the greater Kabeljous Flats and surrounding areas. Definite given that 24 – 38m wide corridor of critically endangered and protected Mangrove Forest would be destroyed. Definite given the land-take requirements and numerous wetlands (and associated protected trees, such as Swamp Figs) and estuarine habitats south and west of South32’s Bayside Aluminium smelter site.
Periodic disturbance during the operational phase disrupting the succession/ natural rehabilitation of the area resulting in the slow and gradual loss/ degradation of ecosystem functionality over time.	Highly-likely given the sensitivity of the estuarine environment of the Kabeljous Flats and the already noticeable diversity and abundance of tolerant species (i.e. species tolerant of disturbance or changes, in contrast to those intolerant, highly sensitive to disturbance species found in pristine or near pristine environments).
Presence of sensitive fauna restricted to specific habitat types that may be destroyed/ disturbed by activities.	Definite – the Kabeljous Flats provide a unique selection of estuarine habitats that support specific species and/or life-stages of species not supported within other areas of the Port.

Residual risk	High
Extrinsic/ additional mitigation measures	The only mitigation that will reduce the residual risk is a change in the type of conduit (name from cables to GILs) and the placement of the GILs – from on-ground or underground to an overhead structure supported by marine piles and/or land piles/ pylons. This overhead structure serves to reduce the residual impact by principally reducing the extent of the impact, while the likelihood remains largely unchanged. • Destruction and disturbance of sensitive habitats are restricted to directly impacted footprint areas of the piles that will support the overhead pipe and cabling bridge structure – this in turn is a smaller footprint resulting in a less severe indirect impact associated with scouring and the resettlement of suspended sediments. • The sensitive Mangrove Forest will not be impacted as the bridge structure is able to span over these forests at a height of approximately 20m. • Sensitive wetland areas and Swamp Figs and other indigenous flora can be "spanned" to avoid direct impacts. • Maintenance activities during the operational phase are unlikely to impact on sensitive areas as maintenance will be undertaken on the structure and very limited, if any, on-ground activities are required.
Residual risk after mitigation	Moderate (due largely to the ecological sensitivity of the Kabeljous Flats, refer to Table 105).

Table 105: Impact significance for the aerial evacuation of power in the form of a pipe and cabling bridge structure that supports the GILs from the NIFPP to the land-based substation and switching yard.

Activity	Construction of the pipe and cabling bridge supported on marine driven piles and on-land piles/pylons. Activities include piling (marine), excavations for tower and main anchorage platform foundations on land, construction activities from jack-up barges (marine) and deck construction (at height over water and over forest stands).
Environmental/ Social Aspect	Land Transformation – estuary bed/substrate; wetlands and terrestrial vegetation and associated biodiversity features and ecological functionality.
Nature of the Impact	Direct disturbance, destruction, removal of sensitive fauna and flora due to construction activities as well as indirect knock-on effects on upper trophic levels and ecosystem services within the greater landscape.
Consequence/ Inherent risk	Moderate-High
Extent/ Scale	Site
Duration & Reversibility	Long-term & reversible (Irreversible only for the reduced impact on the Kabeljous Flat)
Irreplaceable loss of a resource	Low Medium for the impact on the Kabeljous Flat
Causes of impacts / Event	**Likelihood of the consequence:**
Disturbance & destruction of sensitive habitats.	Definite, albeit for a significantly reduce area limited to the footprint of piles and supporting structures and associated scouring (refer to Section 13.2) and indirect impacts of resettlement of suspended sediments within the immediate area of the Kabeljous Flats. Highly-unlikely that Mangroves will be impacted on as the structure spans over the sensitive forest stands. Highly-unlikely given the bridge structure can span over sensitive wetland and terrestrial biodiversity features and footprint location on land can be carefully positioned to avoid protected trees/ plants.
Periodic disturbance during the operational phase disrupting and disturbing the succession/ natural rehabilitation of the area resulting	Highly-unlikely as all maintenance would be conducted at height on the pipe and cabling bridge.

in the slow and gradual loss/ degradation of ecosystem functionality over time.	
Presence of sensitive fauna restricted to specific habitat types that may be destroyed/ disturbed by activities.	Definite, albeit a significantly reduced area as the Kabeljous Flats provides a unique selection of estuarine habitats that support specific species and/or life-stages of species not supported within other areas of the Port.
Residual risk	Moderate
Extrinsic/ additional mitigation measures	• Turbidity is the be measured regularly during the construction phase, if prescribed limits are exceeded, then additional measures are to be implemented to reduce turbidity levels. • The temporary access causeway is only to extend from the power island to the main anchorage chamber (AB) and not across the western channel of the Kabeljous Flats to Tower 3. • Construction at Tower 3 is to use jack-up barges. • The main anchorage chamber (AB) and Tower 3 support structures are not to extend all the way to the substrate (stop short at ≈0.5m). Please refer to the attached EMPr in Appendix 5.
Residual risk after mitigation	Moderate

12.5.1.2 Transmission Line Support Structures/ Towers

Another alternative to the GIL, considered during Scoping, was the existing technology of an overhead transmission powerline from the NIFPP transformer area located on the Power Barge Terminal to the new on-land transmission substation located adjacent (north-west corner) to the Bayside Aluminium smelter site. These powerlines are typically supported by structures in accordance with ESKOM standard designs. Each structure must be individually designed, depending on the line angle and the underlying soil and rock conditions, to withstand the pull of the wires in different directions. It was proposed these tower structures would be erected on dedicated marine piles within the estuary and then as per the adjacent figure when on land.

Given the engineering challenges faced with erecting such structures on pile caps on marine or land-based piles, and the significant cost implications, this alternative was discarded and attention focused on the other more feasible and workable options.

12.5.1.3 Aluminium armoured insulated cables

Another alternative to GILs, considered during Scoping, was the existing technology of aluminium armoured insulated transmission cables within an overhead roofed/ covered bridge structure, with sufficient space for a walkway, supported by marine piles (over water) and land-based pylons. GILs were preferred over aluminium armoured insulated cables due to the following disadvantages associated with aluminium armoured insulated cables for this particular development:

- The downtime of cables when any faults occur are significantly longer than on GIL as cable joints at 400 kV takes several days to be effected, whilst a GIL repair would take mere hours;
- Cable's lifetime is significantly shorter than that of GIL;
- Electromagnetic fields on cables are significantly higher than that of GIL. Electromagnetic Interference can cause equipment on the bridge, used for monitoring of the LNG and other equipment, to malfunction;
- The cable cross-bonding is also complicated and would require additional maintenance with a higher chance of failures; and,
- GIL can provide redundancy for the connections between the substation and the power barges that is more complicated when using cables.

12.6 DISPOSAL OF DREDGED MATERIAL (ANCHOR ENERGY LNG (PTY) LTD: 14/12/16/3/3/2/2033)

Based on the Hydrodynamic Modelling Assessment (Appendix 6) for dredging and dredge spoil disposal, both disposal at sea and beach nourishment at Alkantstrand are proposed. The dredged material from the power barge berthing areas comprises predominantly sands and can therefore be discharged via the Ports existing maintenance dredging facilities onto the northern beaches (i.e. Alkantstrand), while the dredged material (mainly silts and muds) from the LNG berthing areas is to be disposed of at the existing offshore dredge spoil disposal site. Disposal offshore will require a "Dumping at Sea Permit" in terms of the NEMICMA and will be applied for prior to the commencement of dredging activities, as the application can only be submitted once EA has been received in terms of NEMA. The toxicological assessment of sediments within the study area revealed that all sediments to be dredged are considered safe and suitable for offshore unconfined open water disposal (refer to Section 10.4.2.1).

12.7 NO-DEVELOPMENT ALTERNATIVE

The no-development alternative is one that is feasible given the fatal flaw identified for potential impacts on avifauna. Clearly if the proposed NIFPP was not implemented (no development) then the risks associated with the development, especially those posed to the highly sensitive Kabeljous Flats and the associate sandspit would be obviated. The sensitivity of that areas has been highlighted a number of times in this EIA and the protection of that area is highly important for conservation. It also stands to reason that none of the benefits would accrue, such as the increased economic growth in Richards Bay as a result of the increased spending and employment creation and the regional and even national benefits. At the same time the additional electricity supply for a country that is currently severely constrained in that respect, would not materialise. The REIPP programme that was recently concluded may see the lost benefit (of increased electricity supply) offset by other generation programmes although not at the scale of the proposed NIFPP. The critical issue here is ensuring that if the NIFPP does not go ahead that the measures needed to protect the Kabeljous Flats and the associated sandspit ARE implemented. It would be a veritable travesty were the NIFPP to be disqualified on the basis of potential impacts on the mudflats and sandspit but the area allowed to degrade to the point of losing its ecological function anyway.

13 EAP IMPACT ASSESSMENT

This chapter serves to integrate the specialist investigations, present additional investigations undertaken by the EAP in response to specialist findings, assessments and/or recommendations (such as those undertaken in Section 12: Assessment of Alternatives) and seeks to provide a holistic assessment of the preferred development alternative in the context of the Richards Bay receiving environment and other gas-to-power projects currently being assessed. Before presenting that assessment, the outcomes of the alternatives assessment are summarised.

In essence the key change brought about by the alternatives assessment was to move the substation and switching yard from its originally proposed position on the north-western side of Bayside, to a position on the Bayside site thereby obviating the complexities and direct terrestrial biodiversity and wetland risks associated with the originally proposed site. The change in position also meant that the pipe and cabling bridge could be changed to a more direct alignment, avoiding the need for an alignment along the southern and western sides of Bayside. At the same time the connection of the pipe and cabling bridge to the power barge terminal (or power island) disappeared (i.e. the large transformer platform) which obviated direct impacts on the Sandspit Mangrove patch as well as one of two avifaunal roosting sites within the greater Kabeljous Flats (Figure 113).

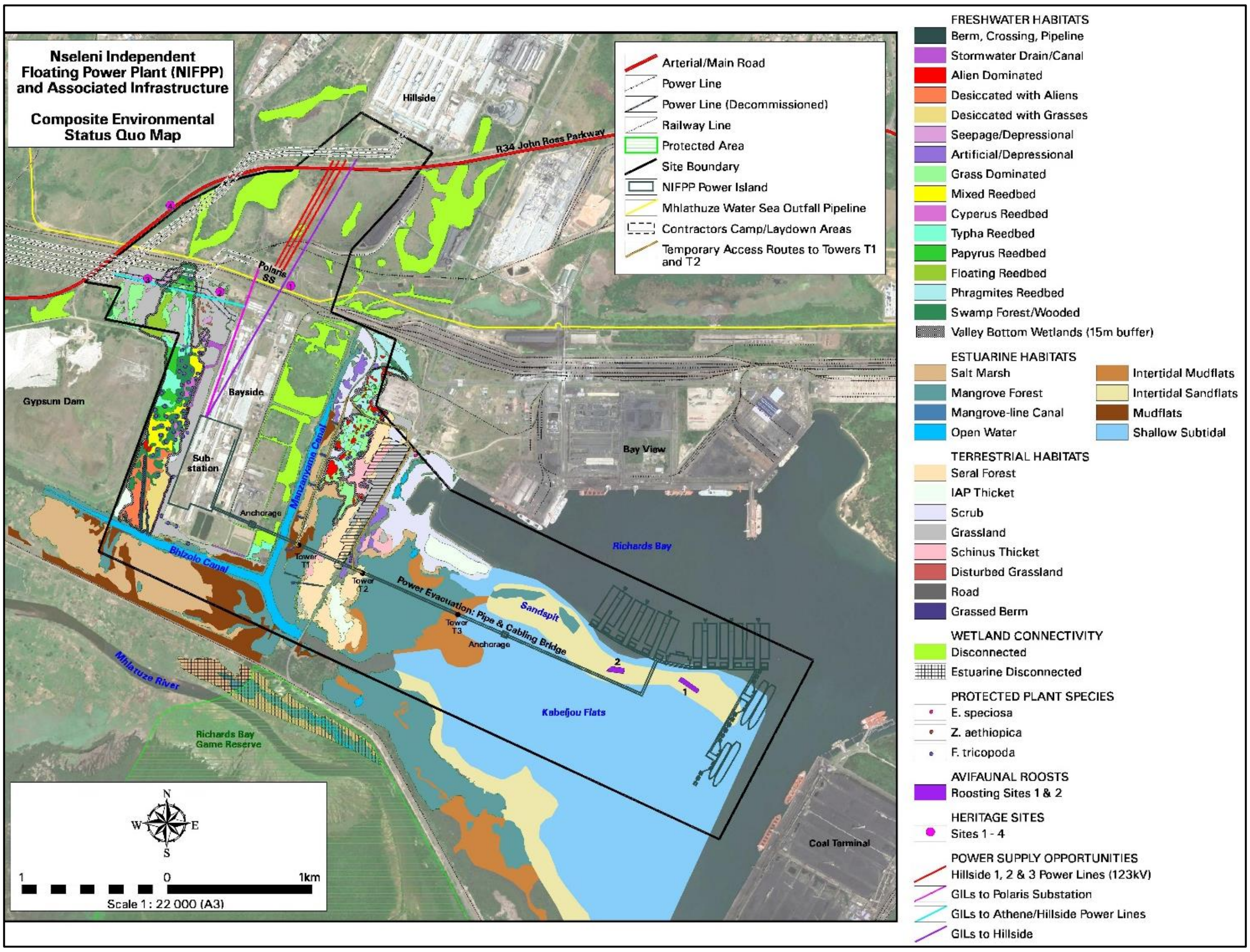


Figure 113: Composite Environmental Status Quo Map for the study area associated with the NIFPP and its associated infrastructure.

13.1 WETLAND AND TERRESTRIAL BIODIVERSITY

Based on the wetland and terrestrial biodiversity impact assessments undertaken, the residual risks for the preferred alternative are limited to the potential spread of IAPs and possibly direct impacts on protected plants and/or species of conservation concern. The latter risk is only applicable to the temporary access road to, and construction area for, Tower 2 of the pipe and cabling bridge structure, as Tower 1 is located within estuarine salt marsh habitat where few to no mangrove trees would be impacted (necessary NFA Permits will be applied for, if required). Access to Tower 1 is via the existing railway line reserve/ track. The power supply GIL gantry and/or overhead powerline alignments from the new proposed substation to existing ESKOM/Municipal/Third Party User infrastructure may have a limited impact on sensitive vegetation units/ habitats, as a function of the footprints of the gantry support piles/pylons. Discussions with the terrestrial specialist from GroundTruth revealed that with careful placement of the support structures, based on a site walk-through, would result in minimal impacts to sensitive Endangered and Critically Endangered vegetation units as the vegetation in the area is patchy with many opportunities to avoid sensitive areas. Wetlands and their associated 15m buffers can be spanned with no direct or indirect impacts. Thus, wetland and terrestrial biodiversity impacts can be reduced to low significance with judicious placing of the support structures (Table 112).

13.2 ESTUARINE ECOLOGY

In respect of the estuarine impact assessment, the EAP fully supports the specialist assessment findings on the sensitivity of and the significant ecosystem services provided by, the Kabeljous Flats and the Sandspit. Following a first draft of the specialist report, various project design alternatives were investigated to ascertain whether or not there was some way of reducing the anticipated scale of the potential impact on that valuable ecosystem as follows:

- *Cut line through the Mangrove forests may be required for the stringing of the initial steel cable for the proposed catenary bridge structure suspending the pipe and cabling bridge structure approximately 20m above ground over the top of the Mangrove forests.*
    - Such a cut line can be avoided. A thin steel cable/ line can be strung using either a helicopter or drone. The suspension cables are then “spun” around this thin cable/ line to create the final cable required to hold the pipe and cabling bridge.
    - Thus, direct impacts on mangroves can be avoided and stated as such, as a condition of authorisation.
- *Mis-alignment of the transformer platform and power evacuation pipe and cabling bridge structure*.
    - The original pipe and cabling bridge alignment connected to the NIFPP power island on the far western corner (Figure 111), however this changed slightly to allow for a routing without corners/ bends (i.e. a straight line, Figure 111), hence the mismatch with the original placement of the transformer (or power evacuation link) platform.
    - This initial change in routing/ alignment of the pipe and cabling bridge resulted in the complete avoidance of the Sandspit Mangrove stand (i.e. alignment shifted south into the area highlighted as more appropriate for the sandspit crossing by the Macrophyte specialist – refer to Section 10.4.4 and Section 11.4.1.2).
- *Impact of temporary construction phase access roads to the on-land Towers 1 and 2 supporting the pipe and cabling bridge on hydrology of the surrounding substrate and potential impacts on the structure and floristic composition of the vegetation and nearby mangroves if not managed properly.*
    - Based on the wetland delineation assessment, no wetlands are located in close proximity to the on-land Tower locations. Thus, the potential impacts associated with hydrology must relate to estuarine systems. Tower footprints are 300m^2 (10m x 30m) in extent.
    - Both Tower 1 and 2 have shifted north-wards into areas that are less dense in terms of the mapped seral indigenous forest patches and based on discussions with GroundTruth, are more favourably located in that Tower 2’s footprint is located towards the edge of the indigenous forest with heavy infestation of Brazilian Peppers (an IAP). Minimal impacts on individual trees are expected. Tower 1

has moved completely out of the seral forest patch and into the open estuarine salt marsh habitat with scattered mangrove trees. Should a few individual mangrove trees be impacted on, the necessary Protected Tree permits will be in place prior to construction activities commencing for Tower 1.

In addition to the above, the following should also be noted. The Estuarine Impact Assessment was based on the worst-case scenario of the main anchorage chamber and Tower 3 (within the Kabeljous Flats) pile caps extending all the way down to the sea/ estuary bed/ substrate. This would result in greater impacts associated with scouring (and associated sediment deposition/ resettlement) based on a 75m wide main anchorage chamber (east of the Kabeljous Flats main channel) and a smaller 30m wide Tower (near the eastern edge of the Mangrove Forest stand) footprint (Table 67). However, if the pile caps do not extend all the way to the sea bed, then the extent of the impact of scouring and resettlement of sediment is predicted to be around 70% less (Table 67). Based on this specialist insight, the design of the main anchorage chamber and Tower 3 support structure has changed to ensure that the solid platform base does not extend all the way into the substrate, it will be approximately 0.5m above substrate level.

In order to construct the preferred pipe and cabling bridge structure on marine piles/ piers with a span width of between 64 – 72m, a temporary access causeway/ jetty would need to be constructed from the power barge terminal to the main anchorage chamber AB (refer to Section 2.5.2 for details). Based on the Hydrodynamic Modelling specialist's professional opinion on the preferred power evacuation bridge structure (refer to Appendix 6), and applying the same scour and resettlement parameters used for the permanent structure (although the piles are much smaller in diameter and not piled as deep, thus by implication a smaller scour and resettlement area), **the worst-case (all inclusive) *direct* impact on the estuarine bed/ substrate due to sediment scouring and resettlement is estimated to be 9ha in extent** (Figure 114). Thus, the total construction phase extent of direct modification of the estuarine bed/ substrate is estimated to be **2.7% of the habitat of the Kabeljous Flats** (made up of the shallow subtidal; intertidal mudflats; and intertidal sandflats, as per the delineation in Figure 50). It is envisaged that the temporary access causeway would remain for approximately 2.5 years during the construction phase (refer to Section 2.5.2). Thereafter, the temporary access causeway would be removed allowing the impacted areas to recover and biotic communities to re-establish as the habitability of the substrate improves.

Within the Estuarine Impact Assessment Report (Chapter 3.6: Impact Assessment: Macrobethos, Nematoda and Microphytobenthos), the following is highlighted with regards to the potential impacts associated with pilling on estuarine fauna:

- *Negative response to pilling disturbance was limited to <5m from the piling area and that recovery typically occurred over a period of 1-2 years.*

Thus, to further place the extent of the likely impacts on the Kabeljous Flats into perspective, increasing the directly impacted area (i.e. permanent and temporary piled platforms including the scour & resettlement areas) with a 5m zone of impact (based on quoted historical studies), this would bring the predicted **realistic worst-case directly impacted area within the Kabeljous Flats to approximately 10.81ha which constitutes 3.2% of the total Kabeljous Flats' habitat** (Figure 114). The loss of habitat associated directly with dredging is approximately 7.52ha. The impact of the proposed development on Macrobenthos, Nematodes, Microphytobenthos, Macrocrustacea, Ichthyofauna and avifauna is already stated as a High negative, and as such the impact significant has not changed.

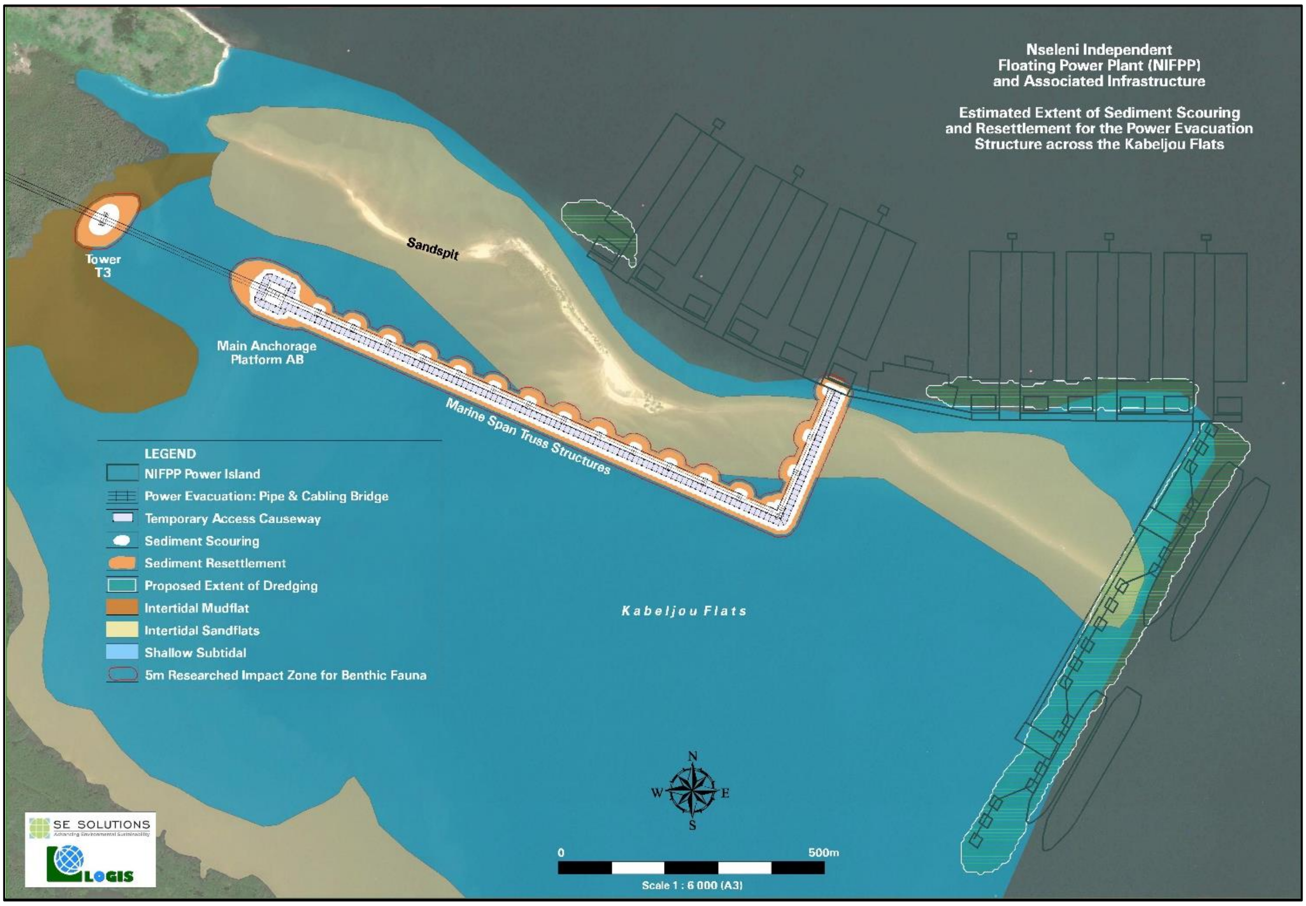


Figure 114: Scour (white) hole and resettlement of sediment (deposition – orange) and 5m impact zone associated with the initial impact of the construction of the Pipe and Cabling Bridge (including temporary works) within the Kabeljous Flats.

Also, the possible and largely unknown impact of sedimentation within the Mangrove Forest (west of Tower 3) is also perceived to be less severe than initially assessed by the Macrophyte specialist, as the predicted impact area around Tower 3 will be smaller (as the pile cap does not extend all the way to the substrate) and the fact that resettlement of suspended scoured material will be in the order of 1-3cm deep (initially and then the scour hole persists and does not result in an on-going impact of 1-3cm deposition) within close proximity of the Tower, it is highly-unlikely that Mangrove colonisation will take place, given the "*10-20cm of sediment deposition would be required*" and that "i*t would depend on inundation frequency rather than a specific amount of sediment required*" stated by Prof Janine Adams, as the deposition of scoured material at a depth of 1-3cm would be "initial", i.e. once off, as explained by the Hydrodynamic Modelling specialist. In addition, Tower 3's location has shifted slightly further away (≈13m eastward) from the Mangrove edge compared to the location assessed by the Macrophyte specialist.

13.3 NOISE & AVIFAUNA

The concern regarding noise impacts on migratory birds during the construction and operational phases of the proposed development by the estuarine specialist resulted in a more detailed noise modelling and impact assessment investigation tailored to specifically address the estuarine specialist's concerns. The specialist method, findings and impact assessment are presented below and thereafter, a discussion on the potential noise impacts on avifauna within the Kabeljous Flats, taking both the estuarine and noise specialist's assessments into account.

13.3.1 NOISE IMPACT ASSESSMENT

Airshed Planning Professionals (Pty) Ltd (Airshed) was appointed to undertake a noise impact assessment for the NIFPP. The report complies with the requirements of the NEMA EIA Regulations for specialist studies as well as the protocols for the assessment and minimum report content in terms of sections 24(5)(a), (h) and 44 of NEMA (Government Gazette No. 43110) published on 20 March 2020.

In South Africa, provision is made for the regulation of noise under NEMAQA, but environmental noise limits have yet to be set. SANS 10103 of 2008 '*The measurement and rating of environmental noise with respect to annoyance and to speech communication*' is the standard widely applied in South Africa and is frequently used by local authorities when investigating noise complaints. These guidelines, which are in line with those published by the IFC in their General EHS Guidelines (IFC 2007) and World Health Organisation (WHO) Guidelines for Community Noise (WHO 1999), were considered in the assessment (Table 3) although it is of course recognised that the key concern is avifauna. The findings are summarised here and the full report is provided in Appendix 6.

13.3.1.1 Approach & Method

Study on the receiving environment

The following applies to the study on the receiving environment.

- Noise Sensitive Receptors (NSRs) generally include private residences, community buildings such as schools, hospitals and any publicly accessible areas outside an industrial facility's property;
- The ability of the environment to attenuate noise as it travels through the air was studied by considering local meteorology, land use and terrain; and,
- Readily available terrain data was obtained from the United States Geological Survey (USGS) web site (https://earthexplorer.usgs.gov/) accessed in April 2020. A study was made of Shuttle Radar Topography Mission (STRM) 1 arc-sec data.

Noise survey

The extent of noise impacts as a result of an intruding noise depends largely on existing noise levels in an area. A baseline noise survey was conducted on 18 and 19 March 2021 to determine current noise levels on site. The survey methodology applied, which closely followed guidance provided by the IFC (2007) and SANS 10103 (2008), is briefly summarised here:

- The survey was designed and conducted by a trained noise specialist;
- Sampling was carried out using a Type 1 Sound Level Meter (SLM) that meets all appropriate International Electrotechnical Commission (IEC) standards and calibrated by an accredited laboratory;
- The acoustic sensitivity of the SLM was tested with a portable acoustic calibrator before and after each sampling session;
- Samples, 30 to 90 minutes in duration, representative and sufficient for statistical analysis, were taken with the use of the portable SLM capable of logging data continuously over the sampling time period. Samples representative of the day- and night-time acoustic environment were taken. SANS 10103 defines day-time as between 06:00 and 22:00 and night-time between 22:00 and 06:00 (SANS 10103, 2008);
- L_{AIeq} (T), L_{Aeq} (T); L_{AFmax}; L_{AFmin}; L_{Zeq} (T), L_{90} and 3rd octave frequency spectra were recorded;
- The SLM was located approximately 1.5 m above the ground and no closer than 3m to any reflecting surface;
- SANS 10103 states that one must ensure (as far as possible) that the measurements are not affected by the residual noise and extraneous influences, e.g. wind, electrical interference and any other non-acoustic interference, and that the instrument is operated under the conditions specified by the manufacturer; and,
- A detailed log and record were kept. Records included site details, weather conditions during sampling and observations made regarding the acoustic environment of each site.

Noise source inventory

The source power levels for the construction activities (i.e. piling and dredging) were obtained from the 2014 BSI Standards Publication for the code of practice for noise and vibration control on construction and open sites (Table 106). The source power levels for the operations (i.e. barges) were provided (Table 107).

Table 106: Sound level data for the construction equipment

Equipment	Octave band sound pressure levels at 10 m, Hz								A-weighted sound pressure level, L_{Aeq}, dB at 10 m
	63	125	250	500	1000	2000	4000	8000	
Dredging harbour Grab hopper dredging ship	83	91	80	78	78	73	66	58	82
Tubular steel piling	80	74	70	65	61	57	49	43	68

Table 107: Sound level data for the operating barges

Equipment	Octave band sound power levels, Hz									A-weighted sound power level, LAeq, dBA
		63	125	250	500	1000	2000	4000	8000	
Operating barge	89	105	110	113	117	120	119	117	113	125

Noise Propagation Simulations

The propagation of noise from proposed activities was simulated with the DataKustic CadnaA software. Use was made of the International Organisation for Standardization's (ISO) 9613 module for outdoor noise propagation from industrial noise sources. To apply the method of ISO 9613, several parameters need to be known with respect to the geometry of the source and of the environment, the ground surface characteristics, and the source strength in terms of octave-band sound power levels for directions relevant to the propagation.

If the dimensions of a noise source are small compared with the distance to the listener, it is called a point source. All sources for the proposed project are point sources or areas/lines represented by point sources. The sound energy from a point source spreads out spherically, so that the sound pressure level is the same for all points at the same distance from the source and decreases by 6 dB per doubling of distance. This holds true until ground and air attenuation noticeably affect the level. The impact of an intruding industrial noise on the environment will therefore rarely extend over more than 5 km from the source and is therefore always considered "local" in extent.

The propagation of noise was calculated over an area of 11.3 km east-west by 10.5 km north-south and encompasses the proposed project site. The area was divided into a grid matrix with a 10 m resolution. The model was set to calculate L_P's at each grid and discrete receptor point at a height of 1.5 m above ground level.

13.3.1.2 Limitations & Assumptions

The following limitations and assumptions should be noted:

- The quantification of sources of noise was limited to the construction and operational phase of the project. Closure phase activities are expected to be similar or less significant and its impacts only assessed qualitatively. Noise impacts will cease post-closure.
- The source power levels for the barge were provided by SE Solutions. The assumption is that this information is correct and reflects the routine operational phase of the project.
- Construction activities were assumed to be during day-time hours only.
- Process activities were assumed to be 24 hours per day, 7 days per week.
- Although other existing sources of noise within the area were identified during the survey, such sources were not quantified but were taken into account during the baseline sampling.
- The environmental noise assessment focuses on the evaluation of impacts for humans.

13.3.1.3 Specialist findings

Ambient Noise

Please refer to Section 5.1.8 for a description of the ambient noise conditions on site. Based on the noise survey and to illustrate the increase in ambient noise levels as a result of the project, the following representative background noise levels were used:

- $L_{Req,d}$ – 52.7 dBA; and,
- $L_{Req,n}$ – 53.7 dBA.

Construction Phase: Simulated Noise Levels

Site specific acoustic parameters along with source data (Table 106) were applied in the model. It was assumed that construction activities would only take place during the day-time and that all construction related activities occurred at the same time in all areas in order to determine the maximum noise impacts at any phase. The following details the results of the modelling:

- The simulated equivalent continuous day-time rating level ($L_{Req,d}$) due to project construction activities of 55 dBA (IFC guideline level) extends ~150 m from the operations (Figure 115);
- The proposed construction phase related noise due to the project is predicted to be in compliance with the IFC guidelines at all sensitive receptors off-site;
- The predicted increase in noise levels of 3 dBA above baseline (i.e. notable increase in noise, largely not detectable by a person with average hearing acuity) due to the project construction are expected up to a distance of ~200m from the operations (Figure 116). The closest potential NSR (i.e. industry) is ~800m from the construction activities; and,
- The 1992 Noise Control Regulations defines a "disturbing noise" as a noise level which exceeds the zone sound level or, if no zone sound level has been designated, a noise level which exceeds the ambient sound level at the same measuring point by 7 dBA or more. The predicted increase in noise levels due to project construction operations at all NSRs are below 7 dBA (Figure 116).

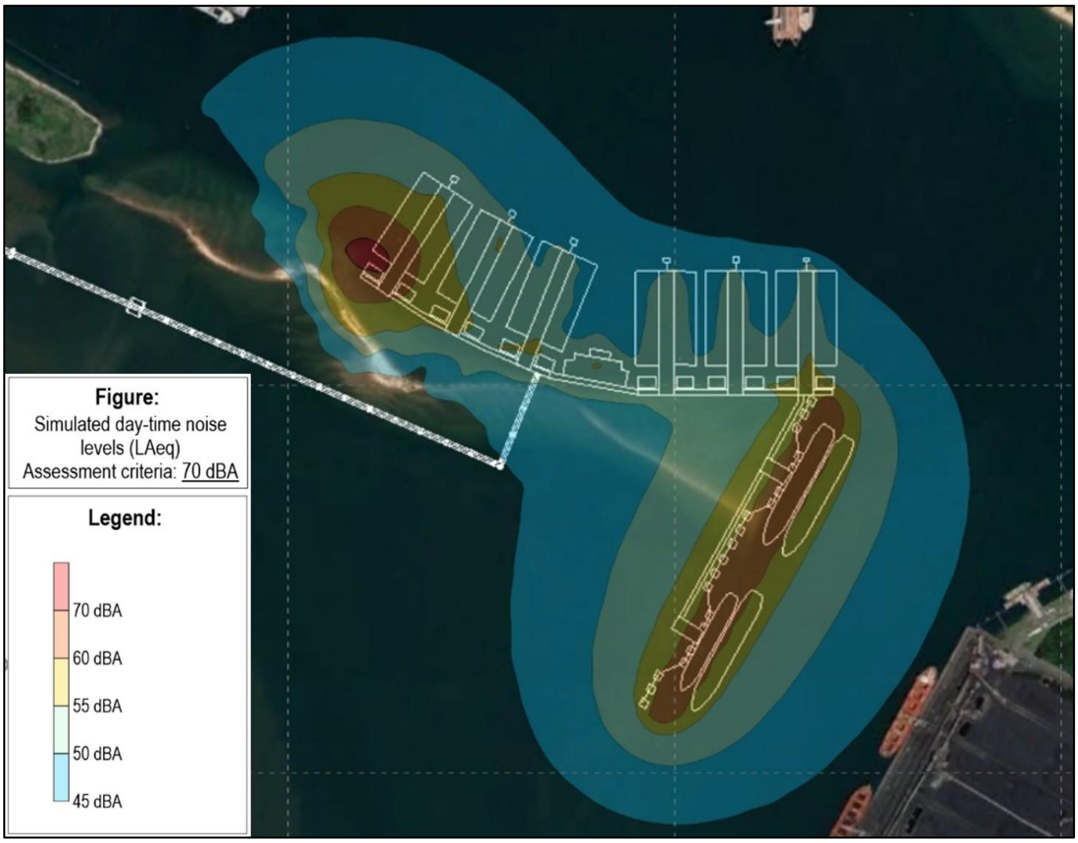


Figure 115: Simulated equivalent continuous day-time rating level ($L_{Req,d}$) for construction activities

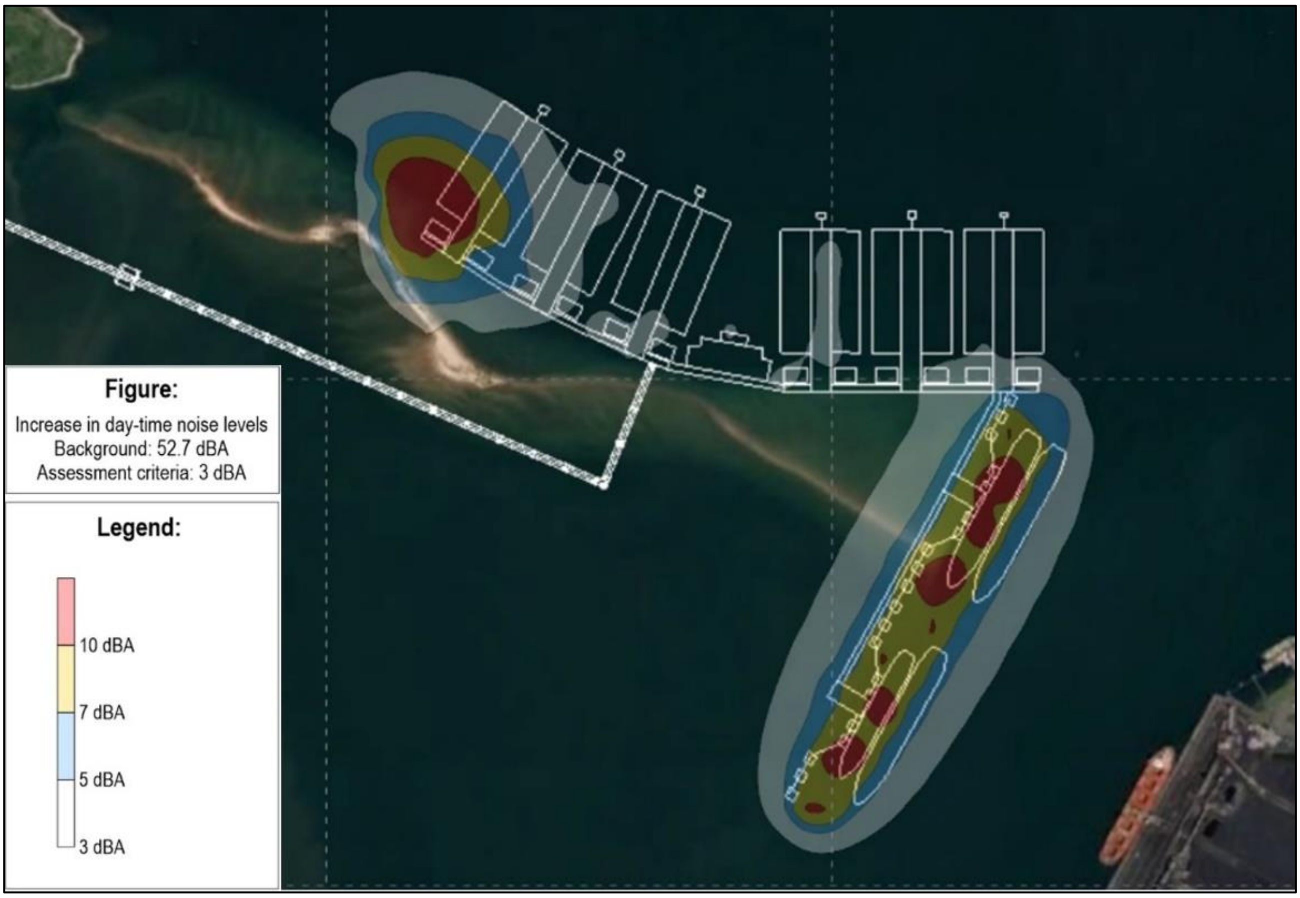


Figure 116: Simulated increase in equivalent continuous day-time rating level ($\Delta L_{Req,d}$) above the baseline (i.e. 52.7 dBA)

Operational Phase: Simulated Noise Levels

Site specific acoustic parameters along with source data (Table 107) were applied in the model. The following details the results of the modelling:

- The simulated equivalent continuous day-time rating level ($L_{Req,d}$) due to project operations of 55 dBA (IFC guideline level) extends ~1 km from the barges (Figure 117);
- The simulated equivalent continuous night-time rating level ($L_{Req,n}$) of 45 dBA (IFC guideline level) due to project operations extends ~1.8 km from the barges (Figure 118);
- The proposed operational phase related noise is predicted to be in compliance with the IFC guidelines at all sensitive receptors off-site;
- The predicted increase in noise levels of 3 dBA above baseline are expected up to a distance of ~1 km from the barges (Figure 119 and Figure 120). The closest industrial NSR is ~1 km to the north and ~800 m to the southeast of the project. The closest residential NSR is ~4 km northeast of the barges;
- The predicted increase in noise levels at all NSRs are below 7 dBA (1992 Noise Control Regulations definition for "disturbing noise") (Figure 119 and Figure 120).

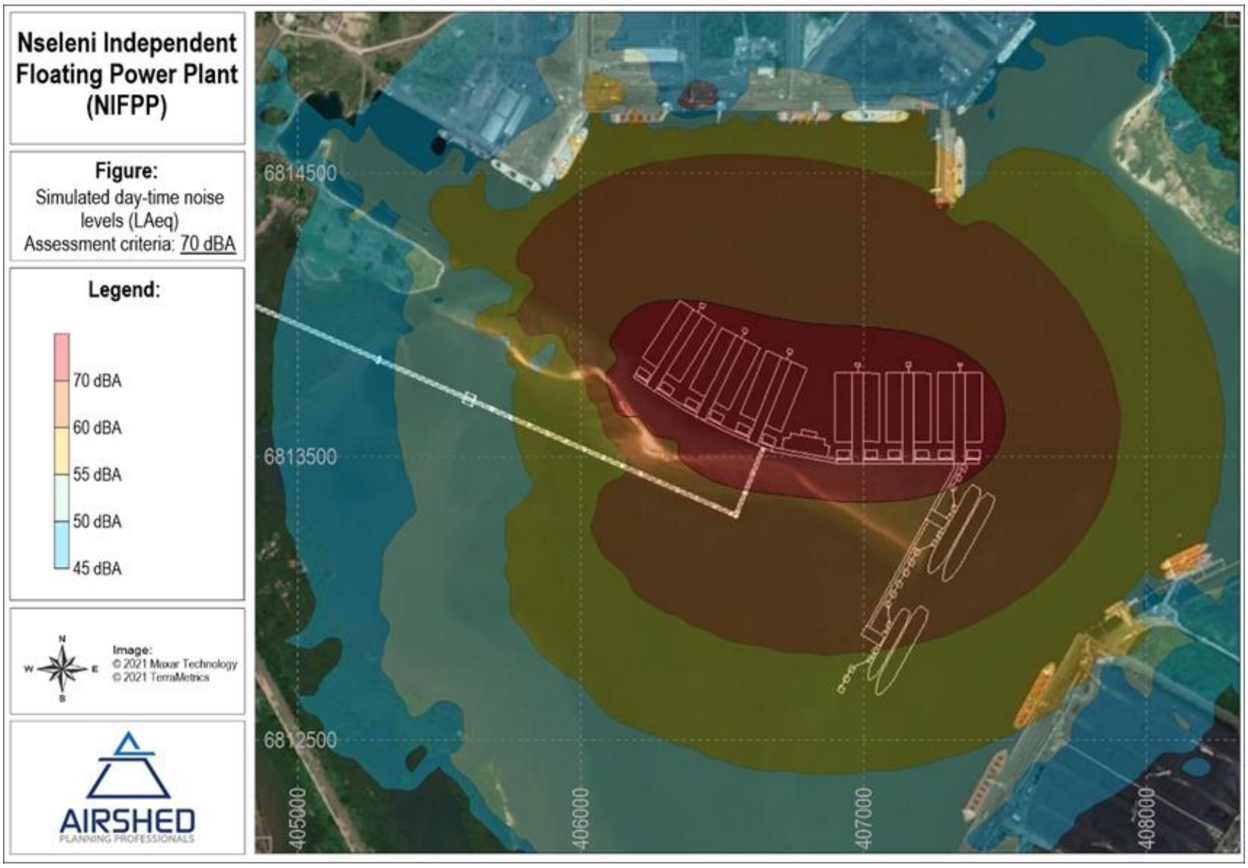


Figure 117: Simulated equivalent continuous day-time rating level (LReq,d) for operational activities in relation to industrial areas

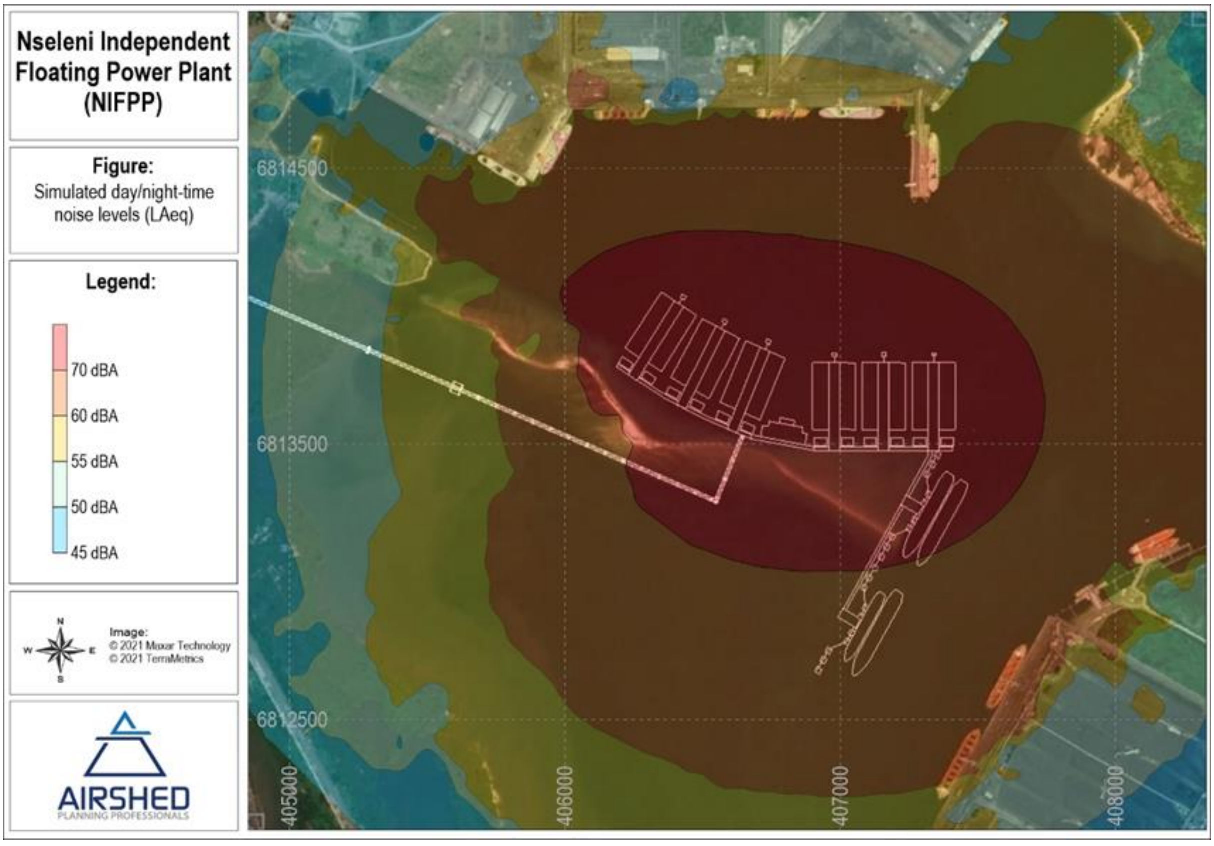


Figure 118: Simulated equivalent continuous night-time rating level ($L_{Req,n}$) for operational activities in relation to industrial areas

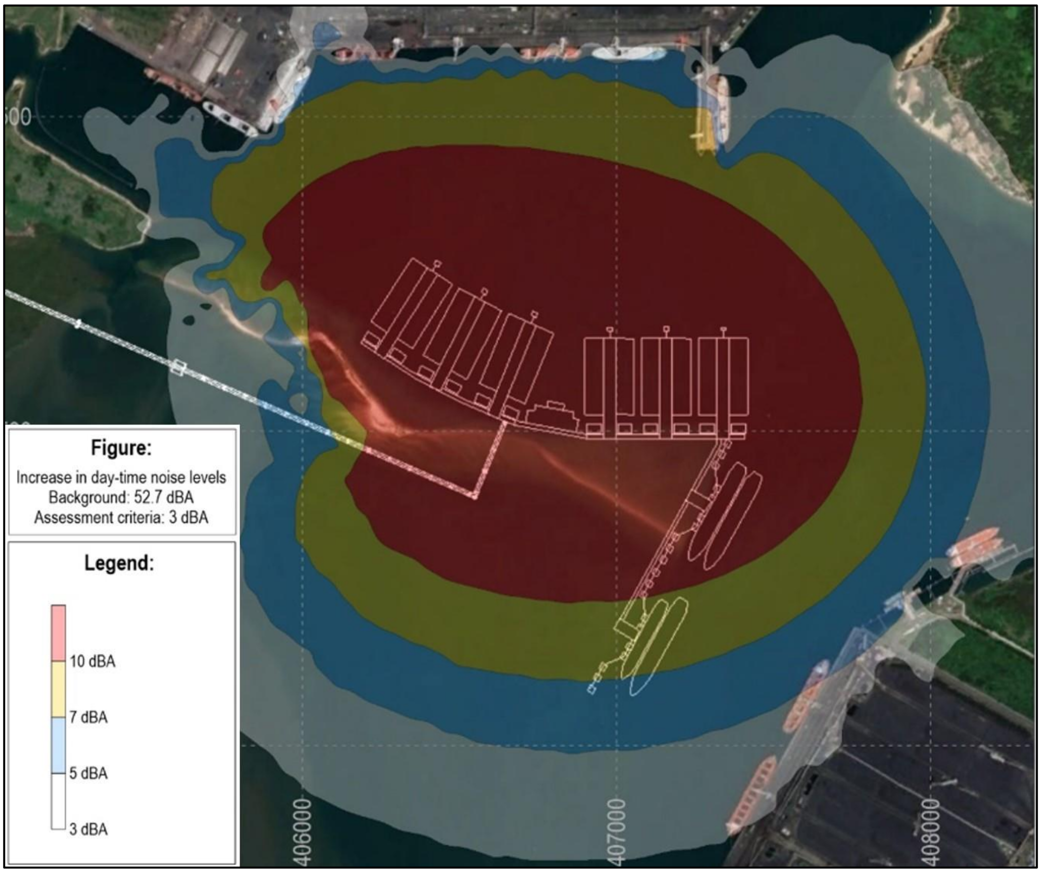


Figure 119: Simulated increase in equivalent continuous day-time rating level ($\Delta L_{Req,d}$) above the baseline in relation to industrial areas

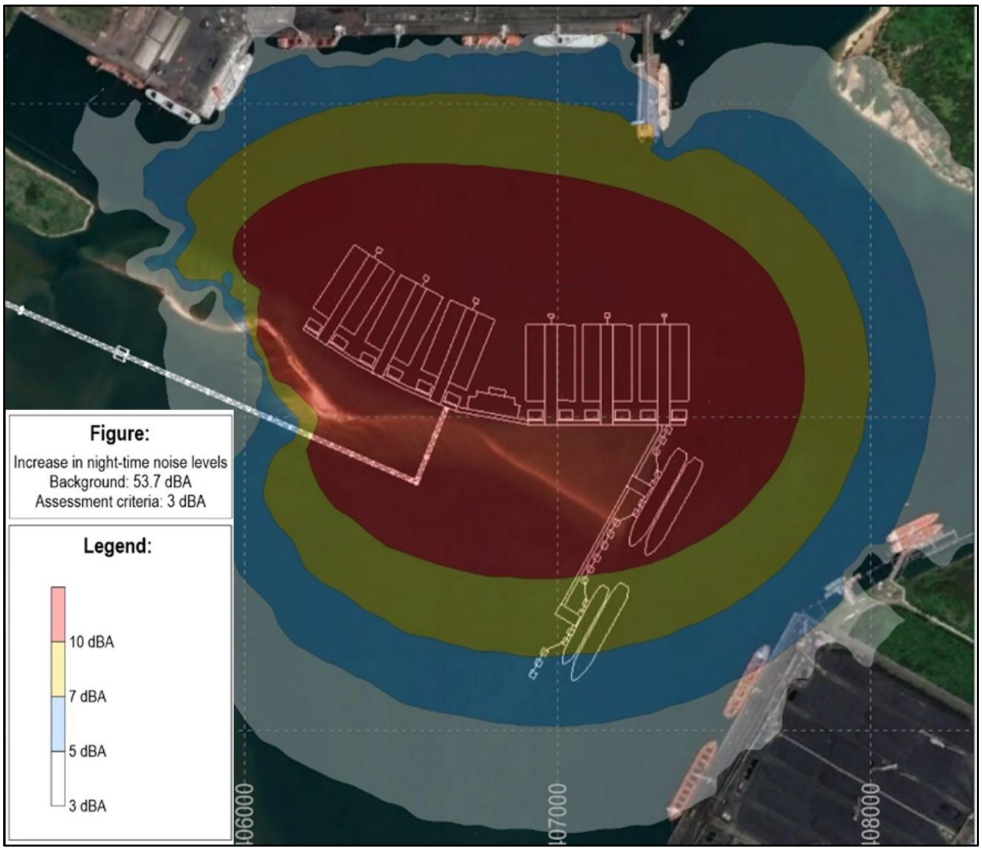


Figure 120: Simulated increase in equivalent continuous night-time rating level ($\Delta L_{Req,n}$) above the baseline in relation to industrial areas

Potential noise impacts on avifauna

The environmental noise assessment is focussed principally on human impact. It is important to note that the applicability of environmental noise assessments to wildlife is limited as it is not possible simply to infer the impacts of anthropogenic noise on wildlife from the human literature. Because of their reliance on acoustic communication, birds have been viewed as especially vulnerable to the acoustics of noise.

A study conducted by Brown (1990), however, saw sea birds exposed to acoustic stimuli simulating aircraft overflights (with peak overflight levels of 65 dBA to 95 dBA) to nesting sea bird colonies. Results of a trial of this experimental procedure for one species, the Crested Tern (Sterna bergii), indicate that the maximum responses observed, preparing to fly or flying off, were restricted to exposures greater than 85 dBA. Using this experiment as reference, the simulated noise levels at the roosting sites due to project activities is provided in Table 108. The noise levels due to project activities is below 85 dBA at both nesting grounds. It should be noted that the bird response due to the Brown (1990) study was for intermittent noise exposure and may vary due to a continuous noise exposure (as would be the case for the operational NIFPP) which might disrupt acoustic communication, interfere with detection of warning signals, and elevate stress levels.

Table 108: Measured and simulated noise levels at the roosting sites

Roosting Site	Day-time or Night-time	Measured Baseline Noise Levels (dBA)	Simulated Construction Noise Levels at Roosting Site (dBA)	Cumulative* Construction Noise Levels at Roosting Site (dBA)	Simulated Operational Noise Levels at Roosting Site (dBA)	Cumulative* Operational Noise Levels at Roosting Site (dBA)
1	Day-time	52.7	49.6	54.4	71.3	71.4
	Night-time	53.7	-	-	70.9	71.0
2	Day-time	52.7	45.8	53.5	71.9	72.0
	Night-time	53.7	-	-	72.1	72.2

* Cumulative refers to baseline and project activities

13.3.1.4 Specialist Impact Assessment

Construction Phase

Although construction noise may be noticeable during civil works such as the use of pile drivers and dredgers, the noise levels do not exceed IFC noise guidelines of 70 dBA at industrial areas and 55 dBA (day-time) and 45 dBA (night-time) at residential areas. The negative noise impacts are therefore considered to be of low significance at the nearest receptors (Table 109).

Table 109: Significance rating for potential noise impacts due to the construction phase of the project

Activity	Construction activities for the Combined Cycle Gas Turbine (CCGT) technology project
Environmental/ Social Aspect	Noise emissions
Nature of the Impact	Increased noise levels due to activities results in a disturbance at sensitive receptors
Extent/ Scale	Local
Duration & Reversibility	Short-term & reversible
Irreplaceable loss of a resource	Low
Consequence Inherent risk	Moderate - Low
Planned risk mitigation/ management	**GIIP**
Causes of impacts / Event	**Likelihood of the consequence:**
Increased noise levels	Unlikely due to the distance of sensitive receptors from project activities.
Residual risk	Low

Additional mitigation measures	• Train construction staff on noise control plan during health & safety briefings; • Select 'low noise' equipment, or methods of work; • Use most effective mufflers, enclosures and low-noise tool bits; • Avoid clustering of mobile plant near receptors and enforce rest periods for unavoidable maximum noise events; • Ensure periods of respite are provided in the case of unavoidable maximum noise level events; • Regular inspection and maintenance of all plant and equipment.
Residual risk after mitigation	Low

Operational Phase

Given the distance of sensitive receptors, the potential noise impacts from the project are likely to remain below the IFC noise guidelines of 70 dBA at industrial areas and 55 dBA (day-time) and 45 dBA (night-time) at residential areas. The overall noise impacts are therefore deemed to be negative and of low significance prior to mitigation (Table 110).

Table 110: Significance rating for potential noise impacts due to the operation phase of the project

Activity	Power Generation by way of Combined Cycle Gas Turbine (CCGT) technology
Environmental/ Social Aspect	Noise emissions
Nature of the Impact	Increased noise levels due to activities results in a disturbance at sensitive receptors
Extent/ Scale	Local
Duration & Reversibility	Long-term & reversible
Irreplaceable loss of a resource	Low
Consequence Inherent risk	Moderate - Low
Planned risk mitigation/ management	**GIIP**
Causes of impacts / Event	**Likelihood of the consequence:**
Increased noise levels	Unlikely due to the distance of sensitive receptors from project activities.
Residual risk	Low
Extrinsic/ additional mitigation measures	• Air flow requirements shall be designed to take account of noise breakout; • Design an acoustic enclosure for the CCGT to meet the specifications for 85 dBA at 1 m from the source; and, • Establish a complaint register.
Residual risk after mitigation	Low

13.3.2 DISCUSSION: NOISE & AVIFAUNA

The assessments presented by both the Estuarine (refer to Section 10.4.8) and Noise specialist (refer to Section 13.3) – where noise measurements were stated and linked to reactions in avifauna – are summarised here.

- Averages of 45 – 55 dBA = decline in occupancy and abundance;
- Averages of 50 – 65 dBA = community and species interaction changes;
- Range of 50 – 65 dBA (LA_{eq} (15min)) & 45 – 60 dBA (LA_{max} episodic) = typical bird activities (nesting) potentially impacted;
- Range from 65 – 85 dBA = triggered flight and alert responses & altered behaviour post disturbance;
- Range of 65 – 85 dBA (LA_{eq} (15min)) & 60 – 80 dBA (LA_{max} episodic) = typical bird activities (nesting & roosting) potentially impacted with frequent alarm/ flight – moderate impacts on habitat use;
- ≥ 85 dBA (LA_{eq} (15min)) & ≥ 80 dBA (LA_{max} episodic) = typical bird activities (nesting, roosting & foraging) potentially impacted with avoidance of area by most of the population of some species; and
- ≥ 85 dBA = Crested Tern (*Sterna bergii*) preparing to fly or flying off.

The ambient noise level on the sandspit is higher than expected at 52.7 dBA (day) and 53.7 dBA (night). Based on the simulated noise levels presented by the Noise specialist in Table 108 above, the cumulative construction noise levels at the roosting sites increase to 54.4 and 53.5 dBA which results in a change of only 1.7 and 0.8 dBA for roosting sites 1 and

2, respectively during the day. Therefore, noise was concluded by the EAP as unlikely to be the most significant contributor to avifaunal impacts during the construction phase.

The avifaunal impacts based on operational noise levels, is however, significantly different with cumulative noise levels at Roosting sites 1 and 2 increasing to 71.4 – 72.0 dBA during the day and 71.0 – 72.2 dBA during the night. Thus, based on the research provided by the specialists the noise from the NIFPP and associated infrastructure during the operational phase will result in flight and/or alert/alarm responses as well as changes in habitat use and behaviour. However, the complete avoidance of the area and subsequent abandonment of the sandspit and Kabeljous Flats for roosting, feeding and breeding activities based principally on increased noise levels is simply unknown.

13.4 CONVENTION ON THE CONSERVATION OF MIGRATORY SPECIES OF WILD ANIMALS (AKA BONN CONVENTION)

The contracting parties (of which South Africa is one):

- RECOGNIZING that wild animals in their innumerable forms are an irreplaceable part of the earth's natural system which must be conserved for the good of mankind;
- AWARE that each generation of man holds the resources of the earth for future generations and has an obligation to ensure that this legacy is conserved and, where utilized, is used wisely;
- CONSCIOUS of the ever-growing value of wild animals from environmental, ecological, genetic, scientific, aesthetic, recreational, cultural, educational, social and economic points of view;
- CONCERNED particularly with those species of wild animals that migrate across or outside national jurisdictional boundaries;
- RECOGNIZING that the States are and must be the protectors of the migratory species of wild animals that live within or pass through their national jurisdictional boundaries;
- CONVINCED that conservation and effective management of migratory species of wild animals require the concerted action of all States within the national jurisdictional boundaries of which such species spend any part of their life cycle;
- RECALLING Recommendation 32 of the Action Plan adopted by the United Nations Conference on the Human Environment (Stockholm,1972) and noted with satisfaction at the Twenty-seventh Session of the General Assembly of the United Nations,

Have agreed to the following fundamental principles of the BONN Convention:

1. The Parties acknowledge the importance of migratory species being conserved and of Range States agreeing to
2. take action to this end whenever possible and appropriate, paying special attention to migratory species the conservation status of which is unfavourable, and taking individually or in co-operation appropriate and necessary steps to conserve such species and their habitat.
3. The Parties acknowledge the need to take action to avoid any migratory species becoming endangered.
4. In particular, the Parties:
    a) should promote, co-operate in and support research relating to migratory species;
    b) shall endeavour to provide immediate protection for migratory species included in Appendix I; and,
    c) shall endeavour to conclude AGREEMENTS covering the conservation and management of migratory species included in Appendix II.

South Africa has also entered into the following agreement with other contracting parties: Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA), as amended at the 7th Session of the Meeting of the Parties to AEWA on 4 - 8 December 2018, Durban, South Africa. This agreement provides for the development of an Action Plan for contracting parties for specific species listed therein. The avifaunal species of relevant to the proposed NIFPP and associated infrastructure, as listed in Table 1 of the Agreement, are provided in Table 111. Thereafter, the relevant keys to classification are provided.

Table 111: Status of the populations of migratory waterbirds recorded within the study area (AEWA, amended 2018)

Populations	A	B	C
Caspian Tern [C]	1c		
Curlew Sandpiper [D]	4		
Eurasian Curlew [D]	4		
Great White Pelican [A,B]		1	

A Only Palearctic populations are listed in Appendix I of the BONN Convention.
B Only Western Palearctic populations are listed in Appendix II of the BONN Convention.
C Only West Eurasian and African populations are listed in Appendix II of the BONN Convention.
D Listed in Appendix II of the BONN Convention.

Column A

Category 1:

(a) Species, which are included in Appendix I to the Convention on the Conservation of Migratory species of Wild Animals;
(b) Species, which are listed as threatened on the IUCN Red list of Threatened Species, as reported in the most recent summary by BirdLife International; or
(c) Populations, which number less than around 10,000 individuals.

Category 2: Populations numbering between around 10,000 and around 25,000 individuals.

Category 3: Populations numbering between around 25,000 and around 100,000 individuals and considered to be at risk as a result of:

(a) Concentration onto a small number of sites at any stage of their annual cycle;
(b) Dependence on a habitat type, which is under severe threat;
(c) Showing long-term decline;
(d) Showing large fluctuations in population size or trend; or
(e) Showing rapid short-term decline.

Category 4: Species, which are listed as Near Threatened on the IUCN Red List of Threatened species, as reported in the most recent summary by BirdLife International, but do not fulfil the conditions in respect of Category 1, 2 or 3, as described above, and which are pertinent for international action.

For species listed in Categories 2, 3 and 4 above, see paragraph 2.1.1 of the Action Plan contained in Annex 3 to the Agreement. *Paragraph 2.1.1 of the Action Plan only applies to Endangered Migratory Species listed in Appendix I of the BONN Convention, thus not applicable to the species listed in Table 111.*

Column B

Category 1: Populations numbering between around 25,000 and around 100,000 individuals and which do not fulfil the conditions in respect of Column A, as described above.

Category 2: Populations numbering more than around 100,000 individuals, which do not fulfil the conditions in respect of Column A, and considered to be in need of special attention as a result of:

(a) Concentration onto a small number of sites at any stage of their annual cycle;
(b) Dependence on a habitat type, which is under severe threat;
(c) Showing long-term decline;
(d) Showing large fluctuations in population size or trend; or
(e) Showing rapid short-term decline.

The AEWA further emphasis the following, as relevant to those species listed in Table 111 above:

- Parties shall cooperate with a view to developing and implementing international single species action plans for populations listed in Category 1 of Column A as a priority.
- Parties shall prepare and implement national single species action plans for the populations listed in Column A with a view to improving their overall conservation status.

- Parties shall endeavour to continue establishing protected areas to conserve habitats important for the populations listed, and to develop and implement management plans for these areas.
- Parties shall endeavour to develop strategies, according to an ecosystem approach, for the conservation of the habitats of all populations listed, including the habitats of those populations that are dispersed.
- Parties shall assess the impact of proposed projects which are likely to lead to conflicts between populations listed that are in important habitats and human interests, and shall make the results of the assessment publicly available.
- In cases where human disturbance threatens the conservation status of waterbird populations listed in Table 1, Parties should endeavour to take measures to limit the level of threat. Special attention should be given to the problem of human disturbance at breeding colonies of colonially-nesting waterbirds, especially when they are situated in the areas which are popular for outdoor recreation. Appropriate measures might include, inter alia, the establishment of disturbance-free zones in protected areas where public access is not permitted.

Under AEWA and to give effect to developing action plans, BirdLife South Africa compiled an International Multi-species Action Plan for the Conservation of Benguela Current Upwelling System Coastal Seabirds (AEWA Technical Series No. 60, November 2015). This Multi-Species Action Plan (MSAP) includes the Caspian Tern. The purpose of this plan is to "*stop further declines and maintain current population size and breeding distribution area of species covered by this Action Plan by 2025*".

The MSAP highlights the following with regards to the Caspian Tern:

- Least Threatened in terms of 2014 IUCN Red List Category;
- Global population trend = increasing;
- Breeding season in KwaZulu-Natal = March – September (known breeding site at Lake St. Lucia);
- Threats to each species were ranked based on the scope, severity and irreversibility of the threat. The threat of human disturbance was rated as low;
- Protected Area Status: Breeding sites on islands largely protected, while mainland sites are not;
- Global International Bird Areas (IBAs) include: Lake St Lucia and Mkuze Swamps, Lower Berg River Wetlands, Saldanha Bay islands, West Coast National Park; and,
- Current status of the population is rated as good at more than 500 breeding pairs (Good = indicator within acceptable range of variation, some human intervention may be needed to maintain this status).

13.5 SUMMARY & CUMULATIVE IMPACT OF THE PROPOSED PROJECT

Based on the specialist investigations and subsequent additional information presented in the sections above (i.e. Sections 12.1 – 12.3), the residual risk after mitigation for the construction and operational phases are summarised in Table 112. Those impacts that are not relevant to either the construction or operational phase are indicated as N/A (Not Applicable).

Table 112: Residual risk after mitigation for Construction and Operational Phase impacts associated with the preferred alternative of NIFPP and associated infrastructure

Aspect	Impacts	Construction Phase	Operational Phase
		Residual Risk after Mitigation	
Wetland Ecology*	Spread of IAPs	Low	Low
Terrestrial Biodiversity*	Spread of IAPs	Low	Low
	Disturbance of protected plants and/or species of conservation concern	Low	N/A
Estuarine Ecology	Water quality, granulometry and organic content	Moderate	Moderate
	Metals & PAH in water and sediment, and whole effluent toxicity	Low	Low
	Macrophytes (Mangroves) – indirect impacts due to scouring and sedimentation	Moderate	Moderate
	Phyto- and Zoo-plankton	Moderate	Low
	Macrobenthos, Nematode and Microphytobenthos	High	High
	Macrocrustacea (Prawns)	High	High
	Ichthyofauna (Fish)	High	High
	Avifauna (Birds)	Fatally flawed	Fatally flawed
Heritage	Destruction of heritage resources	Low	N/A
Air Emissions	Human health impacts due to deterioration of ambient air quality (PM)	Low	N/A
	Human health impacts due to deterioration of ambient air quality (NOx & PM)	N/A	Low
	Damage to vegetation due to deterioration of ambient air quality (NOx & PM)	N/A	Low
Noise Emissions	Deterioration in ambient noise quality at sensitive receptors (i.e. humans)	Low	Low
Human Health & Safety	Injuries (or fatalities) to staff and public based on a major hazard installation	N/A	Low
Social	Visual impacts	Low	Low
	Criminal Activity	Moderate	N/A
	Spread of Disease	High	Moderate
	Informal dwellers/ destitute people	Moderate	N/A
	Safety	Low	Moderate
	Protest action and unrest	Moderate	N/A
	Traffic Safety	Low	N/A
Economic	Production	Moderate Benefit	Moderate Benefit
	Gross Value Add (GVA)	Moderate Benefit	Moderate Benefit
	Business Income	Moderate Benefit	Moderate Benefit
	Employment	Moderate Benefit	Low Benefit
	Property Values	Moderate Benefit	Moderate Benefit
	Tax	N/A	Moderate Benefit

* EAPs impact assessment based on changes to the layout as detailed in Section: 12.

Based on the summary above, cumulatively, the construction phase of the NIFPP and associated infrastructure is predicted to have a high to medium negative impact on the estuarine environment of the Kabeljous Flats and sandspit within the Port of Richards Bay, with a high negative potential impact of the spread of disease given the current COVID-19 pandemic facing the world at large. Other social concerns rated as moderately negative relate to the potential increase in criminal activity, informal dwellers/ destitute people looking for employment and protest action/ unrest associated largely with construction related employment opportunities. All other impacts from a wetland, terrestrial biodiversity, heritage, ambient air and noise quality, social point of view is rated as having low negative impacts with moderate benefits from the project due to its positive impacts associated with economic stimulation at both a local and national scale. Overall, the project is regarded as having a high negative impact on estuarine ecology which will require strict conditions and high levels of compliance and enforcement during the construction phase; with moderate negative to moderate positive impacts associated with socio-economic activities.

Cumulatively, from an operational point of view, the proposed NIFPP and associated infrastructure project will continue to have a high negative impact on the estuarine ecology of the Kabeljous Flats and sandspit, albeit from slightly different potential consequences to activities taking place on site. Given the extremely sensitive ecosystem of the intertidal and subtidal estuarine environment, nothing less than a high negative residual impact with strict conditions and high levels of compliance and enforcement during operations can reasonably be argued. Most other impacts are low negative to positive impacts, except for perceived safety associated with LNG and the spread of disease given the COVID-19 pandemic and the populations sensitivity to disease and the spread thereof.

13.6 CUMULATIVE IMPACT ASSESSMENT WITHIN THE RICHARDS BAY CONTEXT

The following cumulative impacts are relevant to the preferred and final proposed NIFPP and associated infrastructure development layout and design:

- Increased disturbance within the greater surrounding estuarine sensitive environment;
- Increase in air emissions and an overall potential decrease in air quality; and,
- Increased power generation capacity and supply of electricity into the local and national Grid with associated knock-on benefits to the socio-economic environment of Richards Bay and the Country as a whole.

13.6.1 ESTUARINE ECOSYSTEM

The construction and operation of the proposed NIFPP was assessed as having a generally significant negative impact on the estuarine ecosystems in the harbour. Impacts on the individual components of the system range from low to high with impacts on habitat quality (water quality, granulometry, organic content; metals & PAH in water and sediment, and whole effluent toxicity) being lower than for the biota (macrobenthos, nematode, microphytobenthos, macrocrustacea and ichthyofauna all being assessed as having high impact significance). The assessment is based on the high sensitivity of the Kabeljous Flats and its regional and national importance in providing a nursery function and thus directly supporting off-shore prawn and line finishing industries (for example). It is the noise (and light) impact on avifauna that utilise the intertidal and subtidal areas for roosting, feeding/ foraging and breeding, that is deemed of highest significance, however, and which has accordingly been deemed to be a fatal flaw. No mitigation has been identified beyond the alternative project sites investigated, that might otherwise have reduced the potential impact. The full specialist study is available in Appendix 6.

13.6.2 AIR QUALITY

Given the importance of air quality management in Richards Bay (due to the large industrial sources of emissions), the RBCAA requested a cumulative assessment of the combined effect of the multiple gas to power projects being proposed for Richards Bay. A realistic worst-case scenario was defined that included the proposed NIFPP, the authorised 400MW gas-to-power project, the authorised Eskom combined cycle power plant, the not-yet authorised 320 MW gas-to-power project as well as existing industrial sources within Richards Bay. Although it was not possible to model these combined emissions, maximum possible short term concentrations were extrapolated from assessments contained in EIA reports. The cumulative impact estimation predicts SO_2 and NO_2 would still comply with the NAAQS (however, the potential exists for the upper end of the NO_2 cumulative hourly concentration to exceed the NAAQ limit in some areas of the modelling domain associated with existing developments). Cumulative daily and annual PM_{10} predictions do not comply with the NAAQS, most fundamentally due to the large baseline concentrations. The contribution to ambient PM_{10} concentrations from emissions from the gas-to-power projects is predicted to be relatively small (less than 20%). The full specialist study is available in Appendix 6.

13.6.3 CLIMATE CHANGE

In addition to the emissions of criteria pollutants, the proposed NIFPP will be a significant source of greenhouse gas emissions. The initial climate change assessment was based on the initially planned full generation capacity of 16 200MW. With that power output the project would emit some 834 MtCO_2e over a 25-year operational lifetime or 0.274 tCO_2e/MWh. When compared to conventional coal-fired plants and the regional electricity grid, the GHG intensity of the proposed project is relatively small although in absolute terms the emissions are very large. Provided the power generated by the NIFPP replaced conventional coal fired power generation the proposed NIFPP would contribute significantly to reduced GHG emissions per unit of energy generated. While the maximum generation capacity has reduced to a nominal 8 400MW (just more than half of the original generation capacity), the reduction in GHG emissions compared to traditional coal-fired power stations is still significant as are the GHG emissions in absolute terms which are still large. The full specialist study is available in Appendix 6.

13.6.4 PROVISION OF ELECTRICITY AND ASSOCIATED SOCIO-ECONOMIC IMPACTS

South Africa urgently requires additional power generation capabilities so that electricity can be provided securely and reliably, providing enough reserve capacity to stop the rolling black-outs/ load shedding currently plaguing the country and its economy. Such electricity provision is highly significant to the local, regional and national economy of South Africa. The direct economic benefits that will accrue due to the construction and operation of the proposed NIFPP and associated infrastructure, excluding the benefits associated with the supply of electricity, are deemed moderately significant as are the knock-on social benefits that would be associated with the spending and job creation of the project. When the economic impacts of the additional secure power supply are considered, these would result in a broad array of additional benefits, significantly reducing power demand pressure on Eskom, and providing direct growth opportunities for a variety of industry types. It is difficult to quantify the exact economic and social benefits that will accrue, but when the direct economic costs of load shedding are considered, which run into tens of billions of rand per annum, the additional power supply can be deemed to have to a significant positive benefit to both the economy and society. Please refer to the Need and Desirability Chapter of this report (Chapter 3) as well as the socio-economic impact assessment (Appendix 6) for a more detailed assessment.

14 CONCLUSIONS AND RECOMMENDATIONS

14.1 ENVIRONMENTAL IMPACT STATEMENT

Based on specialist investigations and numerous alternatives considered and assessed, the overall environmental sensitivity of the study area within which the proposed NIFPP and associated infrastructure is to be located can be described as highly sensitive (Figure 121) predominantly due to the Kabeljous Flats (and associated sandspit) and protected Mangrove forests (very high ecological sensitivity) as well as natural seral forest patches and wetlands, landside of the study area.

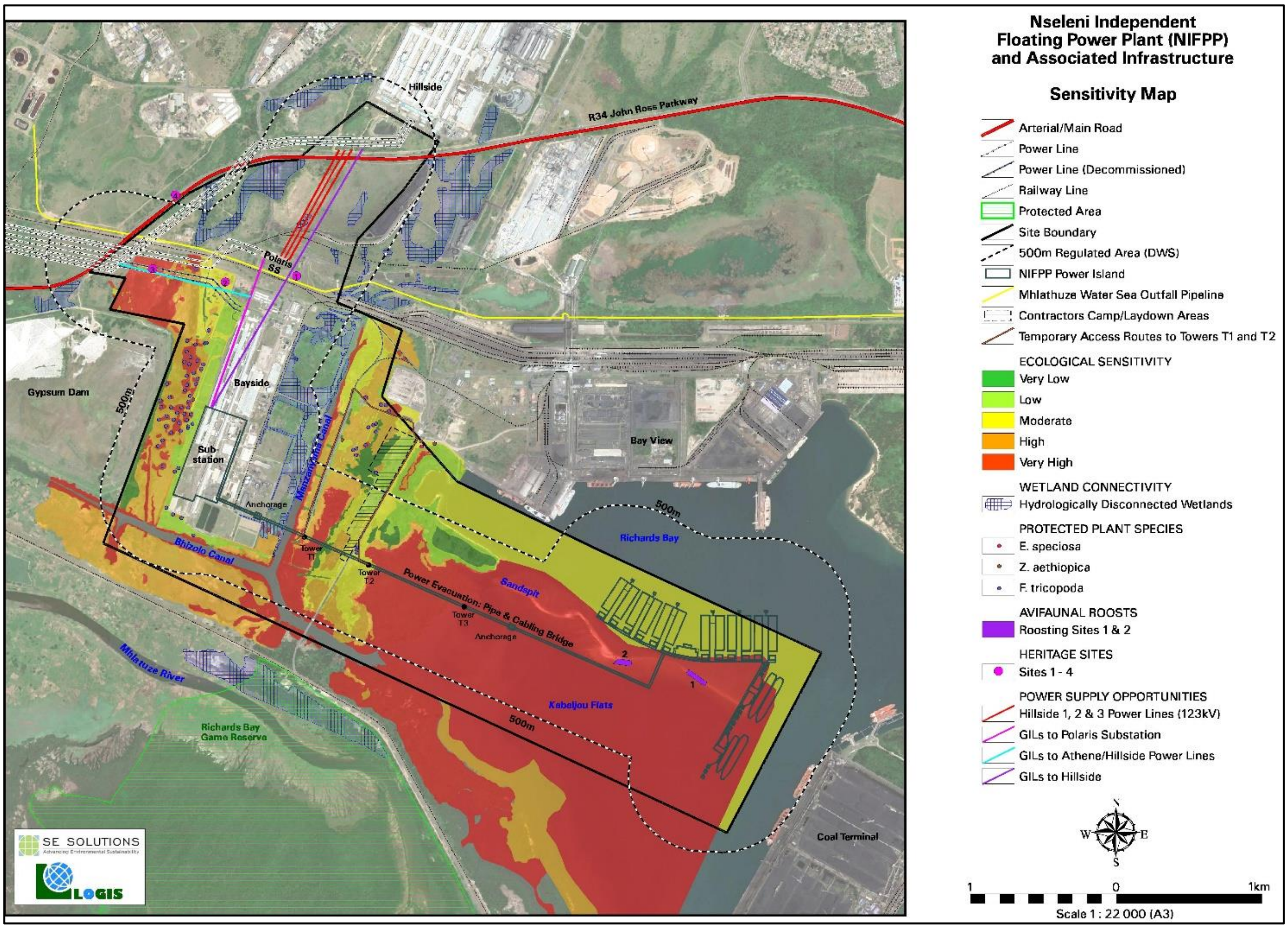


Figure 121: Composite Environmental Sensitivity Map for the study area within which the NIFPP and associated infrastructure is proposed.

The residual risks after mitigation for the construction and operational phases of the preferred layout and design of the proposed NIFPP and associated infrastructure are summarised in Table 111. Kindly refer to Section 11 for the assessment of alternatives considered and ultimately culminated in the preferred layout and design. The key findings of the EIA can be summarised as follows:

- Low negative impacts on terrestrial biodiversity and wetlands;
- Low negative impacts on air quality within Richards Bay;
- Low negative impacts on noise levels within Richards Bay (as they pertain to human hearing);
- Low negative impacts on heritage resources;
- Low negative impact in terms of human health and safety;
- Low to moderate negative social impacts, with the spread of disease highlighted as a potentially high negative impact;

- Low to moderate POSITIVE economic benefits; and,
- Low to high negative impacts in terms of estuarine ecology, with the implementation of the precautionary principle highlighting the impacts to avifauna (particularly migratory birds) as fatally flawed based on current knowledge.

There can be no disputing the ecological importance and significance of the Kabeljous Flats and associated Sandspit and the views of the estuarine specialists who were appointed to conduct the impact assessment. The specific reason that CRUZ Environmental was appointed for the estuarine status quo and impact assessments was due to their extensive (and arguably, unparalleled) knowledge of the uMhlathuze and Richards Bay estuarine systems. Although not formally assessed, the Kabeljous Flats and Sandspit would be classified as natural habitat (in respect of the IFC PS) and probably as critical habitat given the sensitivity of the area and the importance of the area to migratory bird species. The estuarine specialists conclude that because of the perceived risks posed by the proposed project activities, to especially the areas used by migratory birds, that the project is 'Fatally Flawed'. That conclusion is accepted without reservation by the EAP, on the basis of current knowledge of the ecological function and significance of the Kabeljous Flats and Sandspit.

As has been detailed in the alternatives section, multiple alternatives were investigated during the assessment process to try and reduce the overall impact of the project on sensitive environments. The footprint required for the NIFPP and associated infrastructure within the Port anticipated future Port developments, required safety distances, and the movement of vessels meant that the proposed location (north and east of the Sandspit) is the only available area within the Port. At the same time, the existing Eskom transmission infrastructure in Richards Bay is key to the overall project objectives. It is this proximity and associated predicted impacts on the Sandspit and Kabeljous Flats (specifically on migratory bird species) that is deemed by the estuarine specialist to be fatally flawed.

In addition to the investigation of alternatives, the estuarine specialists were also tasked with identifying mitigation that would serve to reduce the impacts on especially the migratory bird species on the Sandpit. The specialists concluded that there was no obvious mitigation that could be applied that would result in a material reduction in the significance of the residual impact. In addition, the specialists conveyed that offsetting was not possible due to the very unique nature of the Kabeljous Flats and Sandspit area. The estuarine specialists were then requested to detail acceptability criteria; however, they declined (entirely reasonably) to specify such criteria, largely based on the argument that such criteria could not be defined specifically enough to guarantee tolerable impact on the Kabeljous Flats and Sandspit, especially the avifaunal utilization of these areas. The estuarine specialists also argued (again, entirely reasonably) that if they specified such criteria and it proved to be incorrect, that they would be *de facto* responsible for the demise of the area. The use of a precautionary approach is advocated by NEMA and it is the precautionary approach, in this case, to disqualify the project from an estuarine impact perspective. It is accordingly concluded that it is the uncertainty of the assumed manifestation of predicted impacts on the sensitive estuarine environment that is the foundation of the fatal flaw conclusion.

At the same time, there are various threats to the Kabeljous Flats and Sandspit area regardless of whether the NIFPP and its associated infrastructure goes ahead. Such threats, as detailed within the uMhalthuze/ Richards Bay Estuarine Management Plan (refer to Table 13 in Section 4.8.9) include, but are not limited to:

- Loss and destruction of habitat due to dredging activities in the Port and new Port infrastructure development;
- Exploitation of resources through illegal gill netting & poaching of fish, illegal harvesting of mangroves, and sand mining;
- Deterioration of water quality through ballast water discharges and brine discharges from desalination projects; and,
- Inappropriate governance in terms of non-compliance and lack of enforcement and lack of trust and collaboration among stakeholders.

The worst possible outcome, to the S&EIR application process, would be to disqualify the proposed NIFPP and its associated infrastructure without establishing robust conservation mechanisms beyond the current TNPA indirect approach of preventing external party access to the area. The question is then, whether the NIFPP could be developed in such a way as to not only ensure that predicted impacts on the estuarine environment are tolerable, but at the same time provide long-term protection to the Kabeljous Flats and sandspit. This protection would be seen to include:

- Limiting any future new Port infrastructure development within the immediate area of the Kabeljous Flats and sandspit;
- Policing/ patrolling of the immediate area to curb the illegal exploitation of resources (i.e. poaching); and,
- Collaboration with key stakeholders in terms of ensuring compliance with EA conditions and/or good governance of the area.

In addition to the above, the uMhalthuze/ Richards Bay Estuarine Management Plan also highlighted the following limitations (refer to Section 4.8.9), where it is believed the proposed NIFPP project could assist greatly in terms of research and monitoring:

- Detailed surveys of aquatic associated avifauna, specifically to distinguish between the relative contribution of the uMhalthuze estuary and the Richards Bay estuary; and,
- Long-term ecological monitoring of the Richards Bay estuary and sharing this information with key stakeholders and responsible agents.

The potential benefits to the local, provincial and national economy due to the proposed NIFPP are significant too. Leave alone the direct and indirect economic impact of the project, the supply of electricity is in itself a key economic enabler. For example, Economist Professor Jannie Rossouw estimated that South Africa's economy could have been 25% larger if it was not for load-shedding. The CSIR Energy Centre reported that South Africa had the worst year of load-shedding on record in 2019, costing the economy between R60 billion and R120 billion in that year alone. The total economic impact of load shedding in South Africa could be as high as R338 billion over the past 10 years. The CSIR report by Jarrad Wright and Joanne Calitz shows that South Africa experienced 530 hours of load-shedding in 2019, amounting to 1,352GWh. These circumstances alone warrant, in the view of the EAP, every possible effort to facilitate the proposed NIFPP, but only if the ecological functionality of the Kablejous Flats and the sandspit can be protected and conserved as part of the project.

The EIA process is, unfortunately, severely constrained as a mechanism for effectively resolving the above. Not only are the prescribed time limits too narrow, the Environmental Authorisation (EA) is a critical enabler of other licenses and permits that are essential for further project development. The EAP's opinion is thus that an EA should be granted for this project to allow the further development of the potential win-win circumstance for both the Kabeljou Flats (and associated sandspit) and the South African economy. That EA must, however, be conditional on the establishment of a scientific and key stakeholder panel appointed by the applicant. The purpose of the panel is to define tolerance criteria that can be used to address the uncertainty that has led to the conclusion of a fatal flaw. Once such criteria are established the assessment can be revisited to determine whether or not the fatal flaw remains or whether in fact mitigation could be introduced to reduce that impact. A key role in the panel would be that of a noise expert tasked with ensuring that the likely noise profiles (both pressure levels and frequencies) from the NIFPP are well enough defined to assess possible impacts. Ornithological expertise would obviously also be required for the panel.

The EAP fully supports the precautionary principle that effectively underpins the fatal flaw assessment namely that a lack of scientific certainty is a major concern and that great care needs to be taken to ensure that a decision does not get made that 'takes a chance' on the potential for environmental degradation. The condition proposed above is based purely on examining whether more definitive sensitivity criteria could not be established for determining the acceptability of the proposed NIFPP.

14.2 RECOMMENDATIONS FOR AUTHORISATION

Note that, in the spirit of the above suggested approach, these conditions of authorisation will be refined based on the comments and inputs from key stakeholders and/or I&APs received during the mandatory review and commenting period on this Draft EIR.

The following conditions of EA are, therefore, applicable to both Applicants.

1. The Applicant is to establish a scientific and key stakeholder panel with the following outcomes central to its mandate:
    - Develop and implement a Conservation Management Plan for the Kabeljous Flats (including the associated sandspit and mangroves), to manage potential impacts of the NIFPP and its associated infrastructure, as identified in the EIR;
    - Direct additional research to address information shortfalls for the development of suitable mitigation; and,
    - Input into the design and construction methods, as appropriate to limit potential impacts of the NIFPP and its associated infrastructure, on the sensitive estuarine environment of the Kabeljous Flats and sandspit.

2. The attached Environmental Management Programmes (EMPrs) are approved. Compliance must be audited on a monthly basis by an independent Environmental Control Officer (ECO) and final audit reports are to be submitted to DFFE as well as the scientific & key stakeholder panel to be established.

The following additional conditions of EA are applicable to Anchor Energy LNG (Pty) Ltd:

- All necessary protected tree and/or species of conservation concern permits (specifically, for Mangroves) must be in place prior to activities impacting on protected flora and/or fauna.
- Daily turbidity sampling during dredging operations and then weekly during the construction phase once dredging activities have ceased.
- Detailed estuarine ecological monitoring, as outlined by the specialist and summarised within the EMPr, must be undertaken during summer and winter during the construction phase.
- Avifauna counts are to be undertaken every second month (for both low tide and high tide) throughout the construction period at the prescribed within the EMPr.

The following additional conditions of EA are applicable to Nseleni Power Corporation (Pty) Ltd:

- Prior to establishing the preferred route alignment for overhead GIL gantries and/or powerlines in terms of the power supply opportunities assessed within the EIA, the Applicant and/or Engineers are to walk the proposed route alignment with a biodiversity specialist to ensure that pylon/ pile footprints do not impact on in-tact sensitive vegetation units and/or wetlands and their associated buffers.
- All necessary protected tree and/or species of conservation concern permits must be in place prior to activities impacting on protected fauna and/or flora.
- Detailed estuarine ecological monitoring, as outlined by the specialists and summarised within the EMPr, must be undertaken during summer and winter for at least 2 years once construction activities have ceased and the development is operational.
- Noise monitoring is to be undertaken during the summer and winter for two years once construction activities have ceased and the development is operational. Thereafter, noise monitoring is to continue annually.
- Avifauna counts are to be undertaken every summer and winter season (for both low tide and high tide) for two years once construction activities have ceased and the development is operational.

15 EAP DECLARATION AND UNDERTAKING

I, Sean O'Beirne, hereby confirm that the information provided in this report is correct at the time of compilation and the report was compiled with inputs provided by the applicant and the specialists appointed for the project. I hereby also confirm that:

- All relevant information pertaining to the project will be submitted to potential interested and affected parties;
- All comments received from I&APs and communications to and from I&APs are included in this Draft Environmental Impact Report (EIR), in the form of a Comments and Response Report (CRR) submitted to DFFE; and,
- A record will be kept of any subsequent comments and/or communications and submitted with the Final EIR Report.

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Signature of EAP

15 April 2021

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Date

Kindly refer to the Declaration of Interests and Undertaking under Oath attached in Appendix 1.

I, Victoria Napier, hereby confirm that the information provided in this report is correct at the time of compilation and the report was compiled with inputs provided by the applicant and some of the specialists appointed for the project. I hereby also confirm that:

- All relevant information pertaining to the project will be submitted to potential interested and affected parties;
- All comments received from I&APs and communications to and from I&APs are included in this Draft Environmental Impact Report (EIR), in the form of a Comments and Response Report (CRR) submitted to DFFE; and,
- A record will be kept of any subsequent comments and/or communications and submitted with the Final EIR Report.

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Signature of EAP

15 April 2021

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Date

Kindly refer to the Declaration of Interests and Undertaking under Oath attached in Appendix 1.