DRAFT ENVIRONMENTAL IMPACT ASSESSSMENT

DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT:

The Proposed Gas to Power Powership Project at the Port of Ngqura within the Coega SEZ, Nelson Mandela Bay Metropolitan Municipality, Eastern Cape

DEFF REF NO: 14/12/16/3/3/2/2005
A Project of Karpowership SA (PTY) Ltd)

February 2021

KARPOWERSHIP

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sustainable solutions

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EXECUTIVE SUMMARY

The proposed Gas to Power Powership Project at the Port of Ngqura has been formulated in response to the Request for Proposals (RFP) for New Generation Capacity under the Risk Mitigation IPP Procurement Programme issued by the Department of Mineral Resources and Energy to alleviate the immediate and future capacity deficit as well as the limited, unreliable and poorly diversified provision of power generating technology with its adverse environmental and economic impacts. The "Emergency/Risk Mitigation Power Purchase Procurement Programme (2000MW): National" has also been designated the status of a Strategic Integrated Project (SIP) under the Infrastructure Development Act, 2014 by the Presidential Infrastructure Coordinating Commission. SIPs are considered to be projects of significant economic or social importance to South Africa as a whole or regionally that give effect to the national infrastructure plan and for this reason, can be expeditiously implemented through the provisions of the enabling Act. At the time of this report, the preferred bidder status had not been confirmed.

The Karpowership project will generate electricity from two floating mobile Powerships moored in the Port of Ngqura. Three ships will be berthed at any one time, during the project's 20 year lifespan (as per the RMIPPPP requirements) - a Floating Storage Regasification Unit (FSRU) and two Powerships. A Liquefied Natural Gas Carrier will supply the Liquefied Natural Gas (LNG) to the FSRU over a one-to-two day period approximately every 20 to 30 days. The LNG is then converted to Natural Gas (NG) and pumped from the FSRU to the Powership via a gas pipeline. The proposed design capacity for the Powerships is 540MW, which comprises 27 gas reciprocating engines having an approximate heat input of over 10MW each. The three steam turbines have a heat input of 15.45MW each. The power that is generated is then converted by the on-board High Voltage substation and the electricity evacuated via a 132kV transmission line over a distance of approximately 7.5km to Eskom Dedisa Substation which feeds into the national grid.

Two alternative mooring sites are being considered. The first option is to position the two Powerships in a closer position to the transmission line on land. The second is to position the two Powerships further away from the land and the connection to the transmission line. The depth of the water in which the ships will be positioned is approximately 14m. The gas pipeline that connects from the FSRU to the Powerships will be routed along small portions of the seabed but predominantly on the eastern side of the breakwater. From one of the Powerships, an electricity tower and lines will connect to a sub-station and into the national grid.

The Project triggers a number of activities listed under the National Environmental Management Act 107 of 1998 (NEMA) which require environmental authorisation prior to commencement. Because these listed activities include activities described in the Environmental Impact Assessment (EIA) Regulations Listing Notice 2 of 2014 (as amended), the process that is required to be applied to the application for environmental authorisation is Scoping and Environmental Impact Reporting (S&EIR). The procedural requirements for S&EIR are set out in the EIA Regulations, 2014 (as amended).

Scoping has already been concluded with the acceptance of the Scoping Report, including the plan of study for the EIA by the competent authority, namely the Department of Environment, Forestry and Fisheries (DEFF) on 6

January 2021. This draft EIA Report is part of the EIR phase and has been distributed for comment for a 30-day period as part of the public participation process.

The objectives of the EIA process is, through a consultative process with Interested and Affected Parties (I&APs), including relevant organs of state, to:

determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;

describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the development footprint on the approved site as contemplated in the accepted scoping report;

identify the location of the development footprint within the approved site as contemplated in the accepted scoping report based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the biophysical, social, economic, heritage and cultural aspects of the environment;

determine the-

nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and

degree to which these impacts can be reversed; may cause irreplaceable loss of resources, and can be avoided, managed or mitigated;

identify the most ideal location for the activity within the development footprint of the approved site as contemplated in the accepted scoping report based on the lowest level of environmental sensitivity identified during the assessment;

identify, assess, and rank the impacts the activity will impose on the development footprint on the approved site as contemplated in the accepted scoping report through the life of the activity;

identify suitable measures to avoid, manage or mitigate identified impacts; and

identify residual risks that need to be managed and monitored.

The EIA process, including public participation, and findings are reported on in the draft EIA Report, in particular, Chapters 7, 8 and 9.

Once the public participation process has been concluded, the draft report will be revised taking into consideration the I&APs' comments. The Final EIA Report will then be submitted to DEFF for consideration, and a decision either to grant or refuse environmental authorisation will be made. All registered I&APs will be notified of this decision and of their opportunity to appeal.

The following issues and potential impacts have been identified and assessed in respect of the various alternatives in the EIA:

Powerships and FSRU and Liquefied Natural Gas Carrier (LNGC)

Disturbance to marine habitat;

Disturbance to the sediment from mooring infrastructure;

Reduction in ambient air quality from increased atmospheric emissions;

Safety risk from potential leakage of LNG;

Safety risk of storage of NG within the Port;

Increase in noise pollution;

Change in water temperature

Provision of additional electricity;
Contributions to climate change;
Socio-economic impacts;
Marine traffic congestion and accidents;
Visual Impacts
Gas Pipeline
Disturbance to marine and estuarine habitat;
Impact on coastal environment; and
Potential leakage of LNG.
Transmission Line, Switching Station and Temporary laydown area for gas pipeline installation
Impacts on indigenous vegetation and species of conservation concern;
Disturbance to the terrestrial ecosystem;
Impacts on fauna and avifauna;
Altered hydrology and geohydrology;
Impact on aquatic system;
Increase in noise pollution;
Change in hydropedological processes;
Destruction of wetlands, watercourses, estuarine areas;
Destruction of cultural heritage and palaeontological resources;
Disturbance to properties and existing services; and
Provision of additional electricity.
Visual Impact

The assessment was conducted with specialists' input, and includes the identification of mitigation measures and an evaluation of their effectiveness. These assessment findings are used to determine the preferred alternatives and provides the basis for the EAP's opinion as to whether the proposed activity should be authorised or not, and if so, the conditions that should be made in respect of such authorisation. Should authorisation be granted, the applicant will need to comply with the Environmental Management Programme (EMPr) when implementing the project, which contains inter alia the proposed impact assessment outcomes and actions (mitigation measures) and monitoring and auditing requirements.

For ease of reference:
The EIA process, methodology and findings are contained in Chapter 8.
The specialist reports are contained in Appendix I:
Terrestrial Ecology Assessment
Heritage and Palaeontology Impact Assessment
Wetland Rehabilitation Plan
Wetland Delineation and Functional Assessment
Geohydrological Assessment
Hydrological and 1:100 year Floodline Assessment
Aquatic Assessment
Hydropedology Assessment
Avifaunal Assessment
Estuarine and Coastal Assessment
Marine Ecology Assessment

Atmospheric Impact Assessment
Climate Change Impact Assessment
Major Hazard Installation Risk Assessment
Socio-Economic Assessment
Noise Impact Assessment
Visual Impact
Further technical reports are contained in Appendix J.
The EAP's opinion is provided in Chapter 9.2.
The Environmental Management Programme is contained in Appendix G

The Powerships and FSRU are to be moored in the protected waters within the Port of Ngqura. The operational requirements at the Port cannot accommodate the use of existing berthing infrastructure and therefore the vessels will be positioned in unused areas of the Port and will utilise their own mooring system. No marine structures are planned and the mooring system for the vessels will generally be heavy chain lying on the seabed attached to anchors which will become buried in a very short time.

A gas line is required between the FSRU and Powerships to ensure gas supply for power generation. The subsea pipeline from the FSRU will be installed on the seabed and through the existing revetment. The first leg of the overland pipeline will be installed on plinths above ground between the paved area of the admin craft basin and the crest of the breakwater.

The remainder of the overland pipeline will be trenched alongside the existing access road and crossing the existing entrance to the Admin Craft Basin. The subsea pipeline will be buried through the shore crossing and laid on the seabed connecting the overland pipeline to the Powerships. The horizontal and vertical alignment of the overland pipeline will take existing structures and services as well as safety aspects into consideration.

The gas pipeline connecting the FSRU to the Powerships will be routed along the edge of the existing eastern breakwater and will connect to the vessels via a flexible marine hose. The gas pipeline will likely be mounted on small footings requiring minor civil works to be constructed and installed. There are two proposed alternative routes for the gas pipeline, and these are directly influenced by the selected positions of the Powerships in relation to the position of the FSRU.

The power generated by the Powerships is converted by a high voltage substation on board the Powerships and transmitted along a 132kV double circuit twin Tern overhead transmission line, approximately 7.5 km in length from Port to the Dedisa Substation, situated within both the Coega SEZ and Transnet properties.

Two transmission line alternatives were initially proposed during the Accepted Final Scoping which took into consideration engineering and Port requirements.

This preferred route as presented in the Accepted Scoping Report has been adjusted slightly in order to avoid a section of Bontveld set aside as conservation open space in which development is prohibited. One monopole structure is present in a small area of disturbance within this habitat type.

This option utilises overhead lines to connect the Powerships' plant to Dedisa substation at 132 kV voltage level using Twin Tern conductors at higher templating temperature rated @ 350 MVA each.

This alternative comprises:
Extending the Dedisa132 kV busbar to accommodate an additional 132 kV feeder bay;
Installing 2 x 132 kV feeder bays at Dedisa;
Constructing the Saltpan 132 kV switching station onshore to connect to the HV yard in the Khan Powership via overhead lines;
Installing 4 x 132 kV feeder bays at Saltpan switching station (approx. 105m x 105m);
Connecting 2 x 132 kV overhead lines (about 1 km) from the Powership 132 kV yard to the Saltpan switching station; and
Constructing 2 x 7.5 km of 132 kV double circuit Twin Tern conductor lines from Saltpan switching station to Dedisa substation.

This alternative route begins in an FEPA wetland (as per the NFEPA dataset; Nel et al, 2011), thereafter this route heads in a north-easterly direction and finally a north-westerly direction before reaching its end point at the Dedisa substation. With respect to the FEPA wetland, while the dataset indicates that this is a FEPA wetland, a site verification by the wetland specialists has determined that this wetland no longer exists.

The route is the preferred overhead transmission line from the Powership to the proposed switching station, as it offers a shorter route to the end point (approximately 7.5km in length with 28 monopoles). The majority of the preferred route is located in areas of low to moderate sensitivity with the location of a single monopole structure within a degraded area inside of the Bontveld set-aside within the SEZ.

Overall, this route is located in low to moderate sensitivity areas, mainly due to its location in transformed areas or in highly degraded areas adjacent to transformed areas, and a large portion of this alternative follows the route of the existing powerline servitude. Furthermore, the Wetland specialist supports the construction and operational activities that will occur along this route. The specialist further indicates that the transmission line will not impact on the estuarine environment or the FEPA wetland.

While the no-go alternative will not result in any negative environmental impacts, it will also not result in any positive socio-economic benefits. It will also not assist government in addressing its set target for a sustainable energy supply mix, nor will it assist in supplying the increasing electricity demand within the country and will not contribute further to the local economy by provide employments opportunities. From the environmental perspective, the specialists hadn't identified any fatal flaws in authorising the proposed project, and mitigation measures were provided to manage identified impacts.

From a socio-economic perspective, when compared with the no-go option – which entails the Powerships and their associated infrastructure not being deployed, and none of the positive or negative impacts identified arising– the proposed project is associated with greater socio-economic benefits and should be authorised, hence the "no-go" alternative is not the preferred alternative.

Based on the findings of the independent specialist studies, the proposed project will not result in significant negative environmental or social impacts provided the mitigation measure recommended by the EAP and specialists, as contained in Section 8 of the draft EIA report and the Environmental Management Programme (EMPr) are implemented. The proposed project will also have significant positive socio-economic impacts. It is thus the reasoned opinion of the EAP that the proposed 540MW Gas to Power Powership Project, should be authorised subject to the conditions proposed in Section 9.2, which include compliance with the EMPr.

The same EIA process meets the requirements for an application for an atmospheric emission licence (AEL) required for a Listed Activity under GN 893 of 22 November 2013 (as amended) in terms of Section 21 of the National Environmental Management: Air Quality Act 39 of 2004: Sub-category 1.5: Reciprocating Engines. The Powerships will have in total 27 gas reciprocating engines each with an approximate heat input of over 10MW. The findings in the EIA Report will be used by the licensing authority, also DEFF, to decide on the application for the AEL. Again, registered I&APs will be notified of DEFF's decision on the AEL and their opportunity to appeal.

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List Of Abbreviations

BID	Background Information Document
BOG	Boil of Gas
CBAs	Critical Biodiversity Areas
CWDP	Coastal Waters Discharge Permit
dB	Decibel
DAFF	Department of Agriculture, Forestry and Fisheries
DEDEAT	Department of Economic Development, Environmental Affairs and Tourism
DEFF	Department of Environment, Forestry and Fisheries
DFP	Development Framework Plan
DWA	Department of Water Affairs
DWS	Department of Water and Sanitation
DOT	Department of Transnet
DWAF	Department of Water Affairs and Forestry
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECA	Environment Conservation Act
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EMP	Environmental Management Plan
EMPr	Environmental Management Programme
EMS	Environmental Management Systems
G2P	Gas to Power
GG	Government Gazette
GN	Government Notice
I&APs	Interested and Affected Parties
IDP	Integrated Development Plan
IDZ	Industrial Development Zone
IEP	Integrated Energy Planning
IUCN	International Union for Conservation of Nature
IRT	Issues and Response Trail
MPA	Marine Protected Area
MBM	Multi-Buoy Mooring
NEMA	National Environmental Management Act
NEM:BA	National Environmental Management: Biodiversity Act
NEM:ICMA	National Environmental Management: Integrated Coastal Management Act
NERSA	National Energy Regulator South Africa
NGO	Non-Governmental Organisations
NFEPA	National Freshwater Ecosystems Priority Areas
NIRP	National Integrated Resource Planning
NWA	National Water Act
PoS	Plan of Study
PPP	Public Participation Process
SANBI	South African National Biodiversity Institute

SANS	South African National Standards
SCC	Species of Conservation Concern
SDF	Spatial Development Framework
SEA	Strategic Environmental Assessment
SEZ	Special Economic Zone
TOR	Terms of Reference
TNPA	Transnet National Ports Authority

THIS REPORT WAS COMPILED BY TRIPLO4 SUSTAINABLE SOLUTIONS (PTY) LTD IN TERMS OF APPENDIX 3 OF THE EIA REGULATIONS, 2014 (GNR 982 (AS AMENDED))

1 INTRODUCTION

1.1 Project Title

The draft Environmental Impact Assessment Report for the Proposed Gas to Power Powership Project at the Port of Ngqura and Coega SEZ, Nelson Mandela Bay Metropolitan Municipality, Eastern Cape.

1.2 Background

Triplo4 Sustainable Solutions (Pty) Ltd has been appointed by Karpowership SA (Pty) Ltd (Karpowership) to undertake the environmental impact assessment (EIA) and manage the application for Environmental Authorisation as well the Atmospheric Emission Licence for the proposed Gas to Power Powership Project at the Port of Ngqura and Coega Special Economic Zone (SEZ), located within ward 53 of the Nelson Mandela Bay Metropolitan Municipality, Eastern Cape. The Competent Authority responsible for evaluating and deciding on the application for environmental authorisation is the Department of Environment, Forestry & Fisheries (DEFF). The same EIA will inform Karpowership's application for an atmospheric emission licence (AEL). The licensing authority for the AEL is also DEFF, although a different branch within the Department. The respective landowners of the Port and SEZ are Transnet National Ports Authority (TNPA) and Coega Development Corporation (CDC).

The proposed Project has been formulated in response to the Request for Proposals (RFP) for New Generation Capacity under the Risk Mitigation IPP Procurement Programme issued by the Department of Mineral Resources and Energy to alleviate the immediate and future capacity deficit as well as the limited, unreliable and poorly diversified provision of power generating technology with its adverse environmental and economic impacts. The RFP stipulates stringent environmental, social and economic criteria, for example, the shift from coal and LPG to NG as a cleaner and more cost-effective resource, BBBEE criteria and skills development. The "Emergency/Risk Mitigation Power Purchase Procurement Programme (2000MW) (ERMPPPP): National" has also been designated the status of a Strategic Integrated Project (SIP) under the Infrastructure Development Act 23 of 2014 by the Presidential Infrastructure Coordinating Commission Council on 24 July under SIP 20. SIPs are considered to be projects of significant economic or social importance to South Africa as a whole or regionally that give effect to the national infrastructure plan and for this reason, can be expeditiously implemented through the provisions of the enabling Act. At the time of this report, the preferred bidder status had not been confirmed.

Karpowership proposes to locate the Powership project in the Ngqura Port to generate electricity from natural gas which will be evacuated by means of a double circuit twin Tern conductor 132kV line. This line will interconnect the Powership to the National Grid utilising the existing Dedisa Substation via a new 132kV on shore switching station. Three ships will be berthed at any one time - a Floating Storage Regasification Unit (FSRU) and two Powerships. A gas pipeline will be connected from the FSRU to the Powerships. The Liquefied Natural Gas Carrier (LNGC) will supply the FSRU over a one-to-two-day period approximately every 20-30 days. The proposed design capacity for the Powership is 540MW, which comprises a total of 27 gas reciprocating engines and 3 steam turbines. There are two types of Powership models that are likely to be used for the project, namely the Khan Class and Shark Class.

The applicant is Karpowership SA Pty Ltd, a South African company with 51% owned by Karpowership, a member of Karadeniz Energy Group, Istanbul, Turkey which owns, operates and builds Powerships (floating power plants). Since 2010, 25 Powerships have been completed with total installed capacity exceeding 4,100 MW globally and an additional 4,400 MW of Powerships either under construction or in the pipeline.

The proposed technology for the production of electricity through natural gas-fired reciprocating engines and steam engines is designed to improve efficiency of energy generation. Construction is limited to transmission and gas supply lines as the ships are built internationally and arrive fully equipped in the port ready for operation.

The proposed Port based activities (Powership, FSRU, gas pipeline, temporary LNG carrier) are situated within the Port of Ngqura managed by Transnet Port National Authority (TNPA) and the Coega Development Corporation (CDC) and the proposed transmission line from the Port to the Eskom Dedisa substation traverses various properties owned by Transnet.

In terms of where Karpowership is in the EIA process, Scoping which was the first phase, has already been concluded with the acceptance of the Scoping Report, including the plan of study for the EIA by DEFF on 6 January 2021. This draft EIA Report is part of the second phase, the EIA (also referred to as the EIR) and has been distributed for comment as part of the public participation process.

Once the public participation process has been concluded, the draft EIA report will be revised taking into consideration I&APs' comments. The Final EIA Report will then be submitted to DEFF for consideration, and a decision either to grant or refuse environmental authorisation will be made. All registered I&APs will be notified of this decision and their opportunity to appeal.

1.3 Summary of Environmental Authorisation Requirements

Prior to the commencement of the proposed Gas to Power Project at Port of Ngqura and Coega SEZ Project, the following key "environmental licences" are required from the following competent authorities, namely:

- Environmental authorisation from the Department of Environment, Forestry & Fisheries (DEFF) in terms of the National Environmental Management Act 107 of 1998 (NEMA), the EIA Regulations, 2014 (as amended) and the EIA Regulations Listing Notices 1, 2 and 3 (as amended).
- An atmospheric emission licence (AEL) in terms of the National Environmental Management: Air Quality Act 39 of 2004) (NEM:AQA). The licensing authority is also DEFF, but a separate Branch within the same Department.
- A General Authorisation (GA) from the Department of Water and Sanitation (DWS) in terms of the National Water Act 36 of 1998 (NWA) and the Water Use Licence Applications and Appeals Regulations, 2017. A GA has already been granted.

The draft EIA Report (this report) supports the applications for environmental authorisation and an AEL. A separate application and reporting process is followed for a GA in terms of the NWA.

1.4 Purpose of this Report

2014 NEMA EIA Regulations (as amended), Appendix 3.2: the objective of the environmental impact assessment process is to, "through a consultative process:

a) determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;
b) describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the development footprint on the approved site as contemplated in the accepted scoping report;
c) identify the location of the development footprint within the approved site as contemplated in the accepted scoping report based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;
d) determine the –
    i. nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and
    ii. degree to which these impacts—
        aa) can be reversed;
        bb) may cause irreplaceable loss, of resources, and
        cc) can be avoided, managed or mitigated;
e) identify the most ideal location for the activity within the development footprint of the approved site as contemplated in the accepted scoping report based on the lowest level of environmental sensitivity identified during the assessment;
f) identify assess, and rank the impacts the activity will impose on the development footprint on the approved site as contemplated in the accepted scoping report through the life of the activity;
g) identify suitable measures to avoid, manage or mitigate identified impacts; and
h) identify residual risks that need to be managed and monitored.

The draft EIA Report documents the findings of the EIA as per the reporting requirements of the EIA Regulations, 2014.

1.5 Independent Environmental Assessment Practitioner

2014 NEMA EIA Regulations (as amended), Appendix 3. 3. (1) (a) An environmental impact assessment report must contain the information that is necessary for the competent authority to consider and come to a decision on the application, and must include— (a) details of—(i) the EAP who prepared the report; and (ii) the expertise of the EAP, including a curriculum vitae;

Please see Appendix E for EAP Declaration and full Curriculum Vitae.

Table 1-1: Independent EAP Details

EAP	Triplo4 Sustainable Solutions
EAP	Mrs. Hantie Plomp

EAP	Triplo4 Sustainable Solutions
Educational qualifications	Masters in Environmental Management
Professional Registrations	EAPASA; SACNASP; AP with GBCSA
Voluntary Memberships	IAIAsa; IWMSA; IODSA, WISA
Experience at environmental assessments (yrs.)	> 20 Years
Postal Address	P.O. Box 6595 Zimbali, 4418
Telephone Number	032 946 3213
Cell Number	083 308 8003
Fax Number	032 946 0826
Email Address	pppcoega.triplo4@gmail.com
Assisted by:	Mrs. Naadira Nadasen
Educational qualifications	Masters in Environmental Management
Professional Registrations	*EAPASA;*
Voluntary Memberships	IAIAsa;
Experience at environmental assessments (yrs.)	>7 years
Assisted by:	Ms. Shanice Singh
Educational qualifications	Honours in Environmental Management
Professional Registrations	*EAPASA*
Voluntary Memberships	IAIAsa
Experience at environmental assessments (yrs.)	>5 years
Assisted by:	Zayd Hoosen
Educational qualifications	MSc Environmental Sciences
Professional Registrations	SACNASP (*Pri.Sci.Nat*)
Voluntary Memberships	IAIAsa
Experience at environmental assessments (yrs.)	>6 years

1.6 Specialist Studies

Specialist studies have been undertaken to inform the EIA process. The specialist studies involved the gathering of baseline data (desktop and site visit, where applicable) relevant to identifying and assessing environmental, socio-economic and heritage impacts that may occur as a result of the proposed project. Specialists have also recommended mitigation measures to minimise potential impacts or optimisation measures to enhance potential benefits as well as monitoring requirements, where necessary. These findings and recommendations have been incorporated into the assessment (Chapter 8) and the EMPr. The methodologies applied to each specialist study are described in the specialist reports attached as appendices to this EIA and EMPr. The specialists and technical experts who provided input to the EIA process are listed in the Table 1-2 and Table 1-3 respectively.

Table 1-2: Details of Specialist Assessments and Technical Team.

Specialist Field	Company & Specialist
Wetland Delineation and Functionality	*Triplo4 - Mr. Suheil M Hoosen*
Terrestrial Ecology (Transmission Lines)	*Ms Leigh Anne de Wet, Ecologist*
Heritage & Palaeontology	*Agency for Cultural Resource Management (ACRM)- Mr. Jonathan Kaplan*
Estuarine	*GroundTruth - Ms Catherine Meyer & CoastwiseConsulting -Ms Tandi Breetzke*
Coastal and Climate Change	Themis - Mr. Luke Moore & Coastwise- Ms Tandi Breetzke
Geohydrology, Hydrology & Hydropedology	*GCS Water and Environmental Consultants - Mr. Henri Botha & Mr. Gareth Preen*
Hydrology & 1:100 Year Floodline	*GCS Water and Environmental Consultants - Mr. Henri Botha & Mr. Gareth Preen*
Aquatic	*GCS Water and Environmental Consultants - Ms Karin Loukes & Mr. Gareth Preen*
Major Hazardous Assessment	*Occutech cc - Mr. Harold Gaze*
Marine Ecology	*Lwandle - Dr Robin Carter & Ms Laura Weston*
Air Quality	*uMoya-Nilu - Dr Mark Zunckel*
Socio-Economic	*Lumec - Mr. Paul Jones*
Noise	*Safetech - Dr Brett Williams*
Avifauna	*Dr Paul Martin*
Visual Impact Assessment	*Environmental Planning and Design – Mr Jon Marshall*

Table 1-3: Details of Technical Reports and Technical Team.

Specialist Field	Company & Specialist
Thermal Plume & Marine Traffic	*PRDW – Mr Warwick Donaldson & Mr Derek Paul*
Power Evacuation Routes	*SIRIS – Dr. Kishoor Pitamber*
Water Balance	*GCS Water and Environmental Consultants - Mr. Henri Botha & Mr. Gareth Preen*
Greenhouse Gas Emissions	*Southern Cross Capacitating Corporation (Pty) Ltd*
Geotechnical	*Geosure – Mr A. Ramroop*

1.7 EIA Report Requirements as per EIA Regulations 2014 (as amended)

Table 1-4 outlines the reporting requirements of the Environmental Impact Assessment Report as per the NEMA EIA Regulations,2014 (as amended). Appendix 3 (3) requires that *“[a]n environmental impact assessment report must contain the information that is necessary for the competent authority to consider and come to a decision on the application, and must include…”* the information outlined in Table 1-4 below. This includes the information elicited through the Public Participation Process (PPP) prescribed by Regulations 39 to 44 of the EIA Regulations, 2014 (as amended) and described in Chapter 7 of the EIA Report.

Table 1-4: Prescribed contents of the Environmental Impact Assessment Report (Appendix 3 of the EIA Regulations, 2014).

Relevant section in GNR. 982	Requirement description	Relevant section in this report
(a) Details of-	(i) The EAP who prepared the report; and	Section 1.5
	(ii) The expertise of the EAP, including a curriculum vitae;	Appendix E
(b) The location of the development footprint of the activity on the approved site as contemplated in the accepted scoping report, including -	(i) The 21 digit Surveyor General code of each cadastral land parcel;	Section 2.3
	(ii) Where available, the physical address and farm name;	
	(iii) Where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;	
c) A plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale	(i) A linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or	Section 2.3 & Appendix A and B
	(ii) On land where the property has not been defined, the coordinates within which the activity is to be undertaken;	
(d) A description of the scope of the proposed activity, including	(i) All listed and specified activities triggered and being applied for;	Section 2.2
	(ii) A description of the activities to be undertaken, including associated structures and infrastructure;	Section 2.1
(e)	A description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context;	Section 5
(f)	A motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred development footprint within the approved site as contemplated in the accepted scoping report	Section 6
(g)	motivation for the preferred development footprint within the approved site as contemplated in the accepted scoping report;	
(h) a full description of the process	(i) details of the development footprint alternatives considered;	Section 3

Relevant section in GNR. 982	Requirement description	Relevant section in this report
followed to reach the proposed development footprint within the approved site as contemplated in the accepted scoping report, including:	(ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;	Section 7 and Appendix D
	(iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them;	Section 7 and Appendix D
	(iv) the environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section 4
	(v) the impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts— (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated;	Section 8.4
	(vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks;	Section 8 2
	(vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section 8.4
	(viii) the possible mitigation measures that could be applied and level of residual risk;	Section 8.4 and Appendix G
	(ix) if no alternative development footprints for the activity were investigated, the motivation for not considering such; and	Not Applicable
	(x) a concluding statement indicating the location of the preferred alternative development footprint within the approved site as contemplated in the accepted scoping report	Section 9

Relevant section in GNR. 982	Requirement description	Relevant section in this report
(i) a full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred development footprint on the approved site as contemplated in the accepted scoping report through the life of the activity, including	(i) a description of all environmental issues and risks that were identified during the environmental impact assessment process; and	Section 8 and Appendix I
	(ii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures	
(j) an assessment of each identified potentially significant impact and risk, including—	(i)cumulative impacts;	Section 8.4 and Appendix I
	(ii) the nature, significance and consequences of the impact and risk;	
	(iii) the extent and duration of the impact and risk;	
	(iv) the probability of the impact and risk occurring;	
	(v) the degree to which the impact and risk can be reversed;	
	(vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and	
	vii) the degree to which the impact and risk can be mitigated;	
(k)	where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report	Section 8 and Appendix I
(l) an environmental impact statement which contains	(i) a summary of the key findings of the environmental impact assessment	Section 8 and 9
	(ii) a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred development footprint on the approved site	Appendix A – Site Plans

Relevant section in GNR. 982	Requirement description	Relevant section in this report
	as contemplated in the accepted scoping report indicating any areas that should be avoided, including buffers; and	
	(iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;	Section 8.4
(m)	based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation	Section 8.6
(n)	the final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment;	Section 9
(o)	any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation;	Section 9
(p)	a description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed;	Section 8.8
(q)	a reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;	Section 9
(r)	where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised;	Not Applicable
(s) An undertaking under oath or affirmation by the EAP in relation to -	(i) The correctness of the information provided in the report;	Appendix E - Declaration
	(ii) The inclusion of comments and inputs from stakeholders and interested and affected parties; and	
	(iii) Any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties;	
(t)	where applicable, details of any financial provision for the rehabilitation, closure, and ongoing post	Not applicable

Relevant section in GNR. 982	Requirement description	Relevant section in this report
	decommissioning management of negative environmental impacts	
(u) an indication of any deviation from the approved scoping report, including the plan of study, including	(i) any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and	Section 8.7
	(ii) a motivation for the deviation	
(v)	any specific information that may be required by the competent authority; and	Appendix F - DEFF Correspondence
(w)	any other matters required in terms of section 24(4)(a) and (b) of the Act.	Not applicable
(2)	Where a government notice *gazetted* by the Minister provides for any protocol or minimum information requirement to be applied to an environmental impact assessment report the requirements as indicated in such notice will apply.	Appendix I – Specialists considered relevant Environmental Themes. Appendix G – Transmission Line EMPr.

1.8 Report Structure

The EIA Report has been structured as follows –

- Executive Summary.
- Chapter 1 – Introduction
- Chapter 2 – Project Description: Provides a description of the proposed development, the properties on which the development is to be undertaken and the location of the development on the property. The technical details of the project are also provided in this Chapter.
- Chapter 3 – Alternatives.
- Chapter 4 – Description of Environment: Provides a brief overview of the biophysical, heritage and socio-economic characteristics of the site and its environs that may be affected by the proposed development, compiled largely from published information, but supplemented by information from site visits.
- Chapter 5 – Policy and Legislative Framework: Identifies all the legislation and guidelines that have been considered in the preparation of the EIR and project compliance.
- Chapter 6 – Motivation, Need and Desirability.
- Chapter 7 – Public Participation Process
- Chapter 8 – Environmental Impact Assessment
- Chapter 9 – Concluding Statement and Recommendations
- Chapter 10 - References: Cites any texts referred to during preparation of this report.
- Appendices: Containing all supporting information, including specialist studies, public participation record and EMPr.

2 DESCRIPTION OF THE PROPOSED ACTIVITY

2014 EIA Regulations (as amended), Appendix 3 - 3(d) (ii) a description of the activities to be undertaken, including associated structures and infrastructure.

2.1 Description of the Activities to be Undertaken Including Associated Structure and Infrastructure

The Karpowership project will generate electricity from two floating mobile Powerships moored in the Port of Ngqura. Three ships will be berthed at any one time, during the project's 20 year lifespan (as per the RMIPPPP requirements) - a Floating Storage Regasification Unit (FSRU) and two Powerships. A Liquefied Natural Gas Carrier will supply the Liquefied Natural Gas (LNG) to the FSRU over a one-to-two-day period approximately every 20 to30 days. The natural gas once degasified is pumped from the FSRU to the Powerships via a gas pipeline. The proposed design capacity for the Powerships is 540MW, which comprises 27 gas reciprocating engines having an approximate heat input of over 10MW each. The 3 steam turbines have a heat input of 15.45MW each. The power from the Powerships will be evacuated by means of a double circuit twin Tern conductor 132kV line. This line will interconnect the Powerships to the National Grid utilising the existing Dedisa Substation (approximately 6.8km) via a new 132kV on shore switching station, which will feed into the national grid.

The project is anticipated to make a notable contribution towards the national and local economy. There will be a significant number of local employees for both the construction and operation period which will exceed the Economic Development criteria that must be reached under the terms of the RMIPPPP. Please refer to Section 8 of this report for further details on the findings from the Socio-Economic study.

The two Powerships and FSRU will be moored within the Port of Ngqura, more specifically, the two Powerships at existing docking structures, which form part of the break-water[1] and the FSRU, against the break-water[2]. The key criteria for the mooring sites are sufficient space for turning the LNG carrier as well as the approach channel shared with the container terminal to allow the safe passing of other traffic including container vessels, cargo vessels and tugs, and maintain the safety exclusion zone required for the ship-to-ship transfer of the LNG to the FSRU. No marine structures are planned, and the mooring system for the vessels will be heavy chains lying on the seabed attached to anchors (anchor piles or vertical load anchors) which will become buried in a very short time. The vertical load anchors are by design buried during the installation and the intention is to install the anchor piles such they are flush or below the surrounding sea bed. The gas pipeline that connects from the FSRU to the Powerships will be routed along the seabed. From one of the Powerships, an electricity tower and lines will connect to a sub-station and into the national grid.

The Ship-to-Ship transfer of LNG will be managed under an international accredited process via trained personnel to ensure compliance and within clear quality, health and safety regulations. The fuel lines between the FSRU and the Powerships will be via double walled with annular space being inerted and continuously purged with Nitrogen "N2" gas. A gas detector in circuit will identify a leak, so that the fuel gas can be immediately isolated and shut off, the leak identified, and the necessary repairs or replacements made.

Two alternative mooring sites are being considered. The first option is to position the two Powerships adjacent to the admin craft basin and the FSRU along the eastern breakwater. The second is to position the two Powerships closer to the liquid bulk terminal and the FSRU along the curved portion of the eastern breakwater. The locations selected for the mooring of the FSRU and the Powerships are existing areas of the Port that are maintained at the advertised depth by the Port Authority. The depth of the water in which the ships will be positioned is approximately 14m. There are no technical concerns around the project site topography as the elevation changes and distances are minor and there are no notable high points or depressions on the route. The main risk for the project relates to the water depth but the Port maintained water depths are deemed sufficient for the project vessels and therefore no project specific dredging is required. The fuel/gas pipeline that connects from the FSRU to the Powerships will be routed along the break water. From one of the Powerships, an electricity tower and lines will connect to the Dedisa sub-station operated by Eskom on land which will provide electricity.

As the Powerships, FSRU and LNG carrier arrive in South African waters fully equipped and ready for operation, construction is limited to the transmission and gas supply lines.

2.1.1 **Powership, FSRU and LNG carrier**

The Powerships are assembled off-site and will be delivered fully equipped and functional to the Port of Ngqura. They are essentially ships which have been fitted with the necessary equipment, including reciprocating engines, steam turbines, and a high voltage substation to generate and transmit electricity using natural gas as a fuel.

Powerships with their modular generation capability, allow for greater technical flexibility for load cycling and shedding. The Powerships are approximately 289m in length with an approximate breadth of 45m. Because the Powerships are equipped with reciprocating engines for power generation, they allow for a reliable supply of electricity with minimal impacts from load profile and number of starts and stops.

The fuel is supplied by a separate vessel, a Floating Storage Regasification Unit (FSRU) which stores the liquefied natural gas (LNG) and converts it to a gaseous state for delivery to the Powerships through a gas pipeline. The FSRU with an overall length of approximately 272m with a breadth of 47m is made up of a series of pressurised containers. A LNG carrier shall periodically supply LNG to the FSRU and will temporarily moor over a one-to-two-day period approximately every 20 to30 days while offloading its LNG cargo.

The proposed combined design capacity for the Port of Ngqura Powerships (classes Khan and Shark) are 540MW, which comprises of 27 gas reciprocating engines having an approximate heat input of over 10MW each. The 3 steam turbines have a heat input of 15.45MW each. The Powerships are equipped with reciprocating engines for power generation, allowing reliable supply of electricity with minimal impacts from load profile and number of starts and stops. Powerships, with their modular generation capability, allow for greater technical flexibility for load cycling and shedding.

The ship to ship (STS) transfer of LNG will be managed under an international accredited process ((i.e. the Ship to Ship Transfer Guide (Liquefied Gases) - 2nd edition, OCIMF / SIGTTO) via trained personnel to ensure compliance and within clear quality, health and safety regulations. The fuel lines between the FSRU and the Powership will be via double walled with annular space being inerted and continuously purged with Nitrogen "N2" gas. A gas detector in circuit will identify a leak, so that the fuel gas can be immediately isolated and shut off, the leak identified, and the necessary repairs or replacements made.

Refer to images below, showing the types of Powerships, FSRU and Project Concept.

Table 2-1: Images of Various Powerships

Image 1: Powership – Khan Class

Image 2: Powership – Khan Class

Image 3: Floating Storage & Regasification Unit (FSRU)

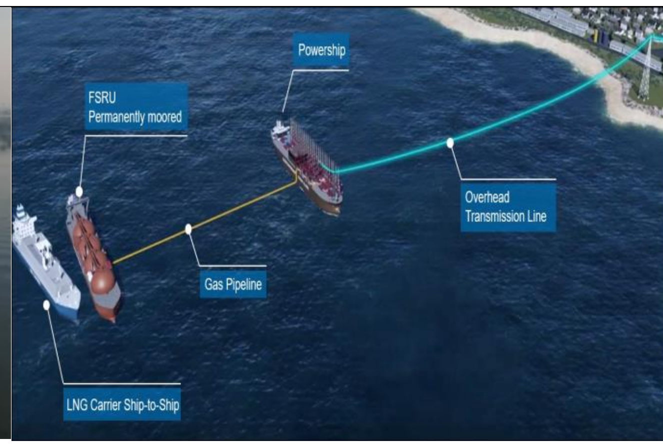


Image 4: Project Concept

The Powerships' Charge Air Systems are designed and equipped with both wet and dry filtration systems, so that Powerships can continue to operate in extreme environments, including the locations where high levels of organic or inorganic dusts exist. Charge air filtering system day-to-day workmanship or its maintenance intervals may be affected by the pollutant intensity, but operations can continue. The Charge Air Filtering system has proved itself at other locations, for example at Guinea Conakry, where the Applicant is operating next to an iron ore exporting harbour.

The FSRU regasifies the required amount of LNG and sends this to the Powership in gaseous form (NG) continuously through a connecting pipeline. The FSRU is specifically designed, constructed and equipped to supply the fuel gas required for the power generator engines installed on the Powerships.

Natural gas boil off of LNG on board the FSRU is not flared or vented. The natural Boil Off Gas (BOG) is used as fuel for the operation of the FSRU and if in excess, is prioritised for export to the Powership for use in the generation of electrical power. In the event that BOG is in excess of the base load demand, then arrangements are provided on-board the FSRU for this excess BOG to be burnt in a specialised internal process. Under normal operations it is anticipated that the demand for gas will be significantly in excess of the natural boil off resulting in liquid LNG being re-gassified for export to the Powership.

The project's marine activities require limited construction facilities. The Contractor's marine (floating) equipment will use the Port's existing infrastructure and operational systems as defined by the Port Authority. A pipe stringing yard is required, which will be established near the installation site. The specialist nature of marine construction means that only large experienced national contractors are able to provide the main works. However, around the Port there is good local industry support and local ready-mix, steel fixing, welding, diving and support subcontractors will be utilised as much as possible.

<u>Operational Processes and Associated Measures</u>

- ***Technology***

The Powerships that will be employed for this project will be equipped with dual-fuel reciprocating engines and guarantee electricity at the highest fuel efficiency. Although the technology provides for dual fuel use (i.e. capable of utilizing both Liquid Natural Gas and Heavy Fuel Oils as primary fuel sources), the project proposes the use of LNG only. The choice of modular medium speed, reciprocating engines for power generation enables reliable supply of electricity with minimal impacts from load profile and number of starts and stops. Powerships with their modular generation capability, allow for greater technical flexibility for load cycling and shedding. For all practical purposes, Powerships do not have minimum load limitations and can maintain the same high efficiency even at partial loads due to modularity of design.

In addition to this, Powerships, through the use of reciprocating engine technology, provide the shortest response times for load variations, presenting the most suitable technology to be paired with the increasing renewable energy generation capabilities of South Africa.

A key operational advantage of the Powerships is that, with the multiple engine technology and built in redundancy systems throughout the balance of the plant, operations can continue at over 98% availability with ongoing maintenance programs without down time for the whole or a significant part of the generation capacity thus not affecting the power output.

This significant advantage over other technologies like Open Cycle Gas Turbine or large coal plants is that the Powerships remain online at all times with live maintenance ongoing delivering output power at the same efficiency whereas large scale plants as described above must shut down operations for maintenance programs to be carried out.

The engine automation system takes care of the following major tasks and functions:

- Local interface to the operator, including a local display which indicates all important engine measurements.
- Engine start/stop management, including start block handling and slow-turning, load reduction, waste-gate control, and the Low Temperature /High Temperature -thermostatic valve control.

- Engine safety (alarms, shutdowns, emergency stops, load reductions) including hard wired safety for engine over speed, lube oil pressure, cooling water temperature, and external shutdowns.
- Electronic speed/load control with various operation modes.

The technology proposed entails the production of electricity through natural gas-fired Combined Cycle Gas Turbine (CCGT) technology.

Refer to Figure 2-1 and Figure 2-2 below provide the flow diagram for power generation with engines and a bank of engines connected in series, as well as schematic presentation of a Typical CCGT Process.

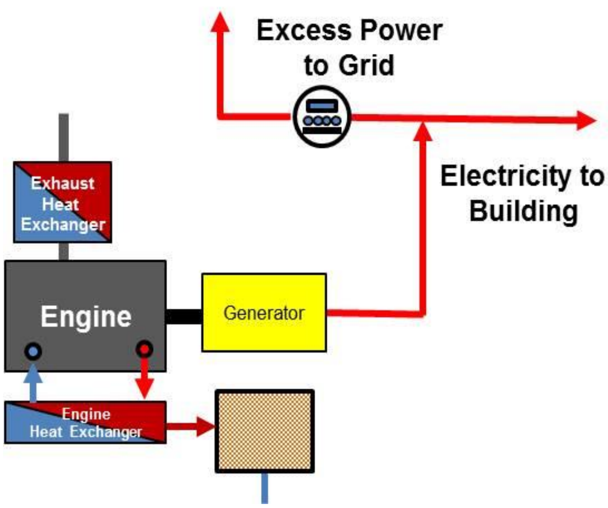


Figure 2-1: A flow diagram for power generation with engines (left), and a bank of engines connected in series.

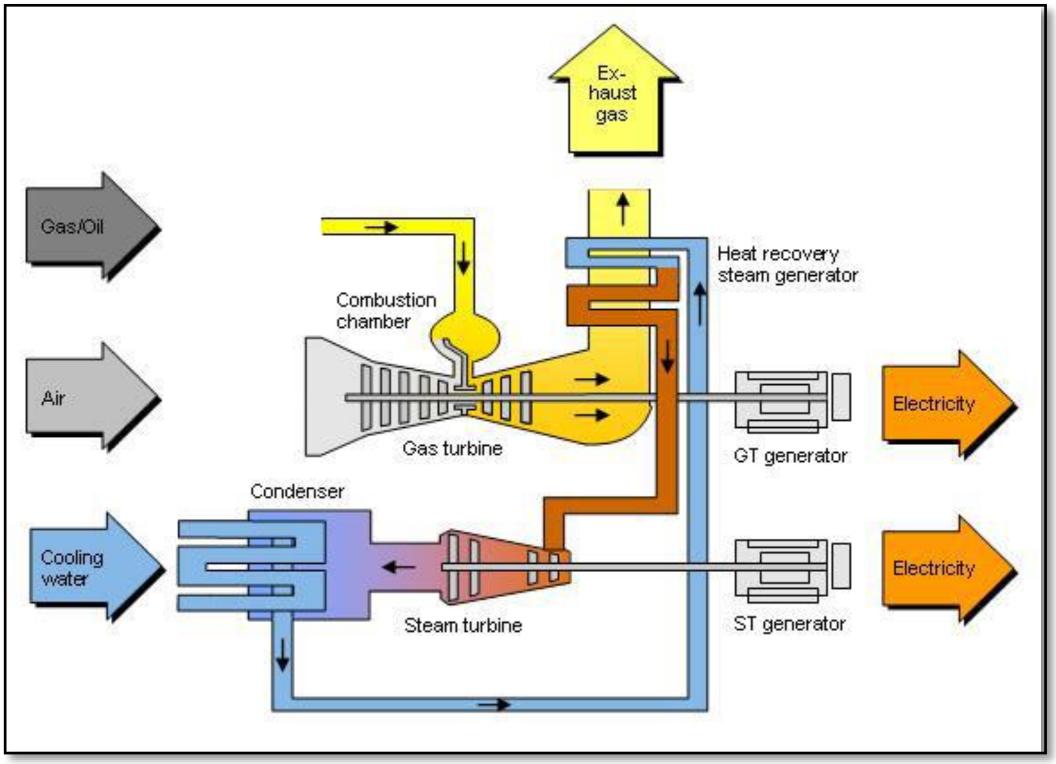


Figure 2-2: Schematic Presentation of a Typical CCGT Process

The preferred Gas Reciprocating Engines technology option will ensure higher efficiency and reliability in electricity generation with overall improved environmental performance compared to traditional coal fired technology.

In terms of construction and footprint, the Powerships are considered to be a complete pre-constructed, purpose-built, offshore power solution, offering several advantages over land-based solutions of similar energy generating capacity, e.g. in terms of development footprint and terrestrial impacts.

Please refer to Appendix J for technical information

- ***Water Usage***

Seawater is generally used for the outer cooling systems, while a portion of seawater is treated for distribution into the freshwater supply to be used in the inner cooling systems (i.e. the low-temperature cooling, generator cooling, condensate cooling systems etc.) and for domestic use. Sub-systems are sensitive to saline water. The vessels operate via a continuous sea water feed system, where only a small volume of seawater is used in the generation of electricity (i.e. losses to steam, condensers and treatment). This means that large volumes of seawater are discharged back to the ocean (termed seawater overboard discharge).

Seawater is attained via several sea chest intakes and distributed to the seawater cooling systems [external use on generators (GN), low-temperature (LT) coolers, alternators, turbine stacks]. An excess amount of seawater is flushed through the system, and the water volumes used by the GN and LT coolers are very low. A portion of the seawater intake is treated at onboard water treatment plants (WTPs) including evaporator, seawater reverse osmosis system and distributed to freshwater, collection and technical water tanks, to supplement freshwater supply to the dedicated sub-systems and cooling systems.

Process seawater (i.e. water which has already gone through the cooling system) is either discharged back to the ocean or used to replenish the sea chests via antifouling anode treatment tanks. Wastewater effluent is collected in the onboard dedicated waste storage tanks for temporary storage. The freshwater system is interconnected throughout the vessels, and that recirculation of the water takes place (i.e. water from the engines and steam turbines is redistributed to the mixed cooling units and LT cooling systems) and water is “topped up” as required to ensure adequate pressure and flow in the cooling system. Only evaporation losses and operational losses of fresh are anticipated for the cooling system. As such, there are fresh water closed loop circuits for cooling system of engines, water circulates from/to expansion tanks of the engines. The only consumption on this system is evaporation due to heat of Engines.

In terms of domestic water use, both treated seawater (i.e. desalinated) and drinking water will be used for domestic purposes. Potable (drinking water) will further be supplemented by stocking bottled water. All grey and blackwater generated on the vessels will be stored in a waste storage tank to be taken off-site by an accredited service provider. No discharge of grey or blackwater will take place into the ocean.

The conceptual process flow diagram (PFD) for the generation of 540MW of electricity for the Port of Ngqura Karpowership Project is shown in Figure 2-3 below. Further details are captured in the Water Balance Report, attached as Appendix I.

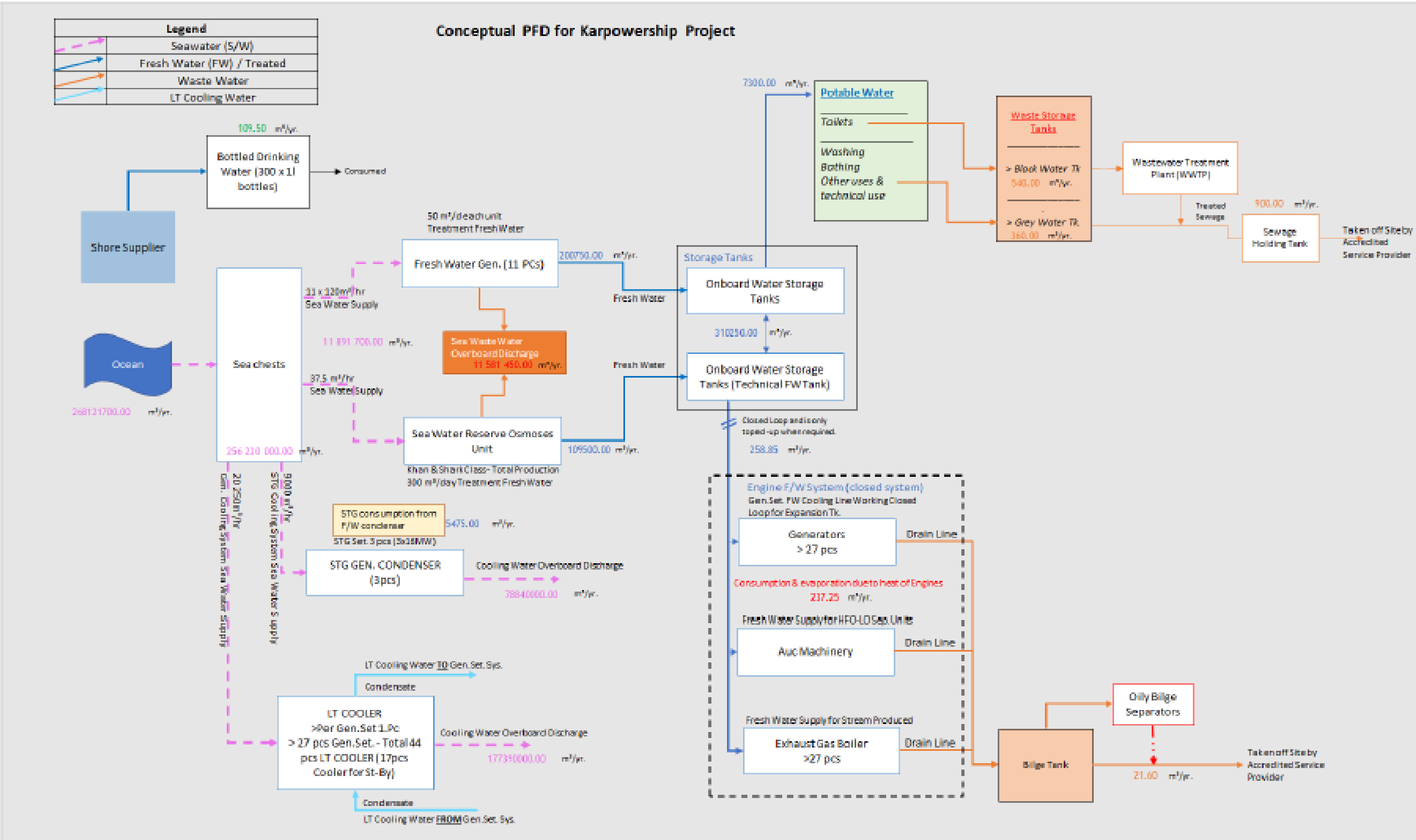


Figure 2-3: Schematic Presentation of a Typical CCGT Process.

- **Water Temperature**

The Powerships will use seawater for cooling the gen-sets and optionally the steam turbine generators and fresh water generators. The total intake/outlet flow rates range from 2.4 m3/s to 11.4 m3/s and the increase in temperature (ΔT) range from 4°C to 15°C. No chemicals such as chlorine are discharged with the cooling water.

The dispersion of the resulting thermal plume depends on the flow rate, ΔT, discharge geometry, bathymetry, currents, winds and water column stratification. In confined water bodies with low water exchange there can be a build-up of temperature including recirculation from the intake to the outlet.

Typical ecological thresholds include ΔT = 3°C at 100 m from the discharge point (World Bank), ΔT = 1°C at sensitive receptors or the edge of the mixing zone, which for discharges beyond the surf-zone can be assumed as 300 m from the discharge point, according to the South African Marine Water Quality Guidelines (DWAF, 1995).

The results show that a smaller footprint of ΔT is achieved when discharging at a deeper depth below the water surface. Discharging at a deeper depth allows the thermal plume to entrain colder sub-surface ambient water as it rises to the surface, reducing the temperature of the plume. In can be concluded that the thermal plume meets the World Bank guideline and the generic South African Marine Water Quality Guideline when the cooling water is discharged 8 m below the water surface.

A calibrated 3D hydrodynamic model was used to predict the extent of the thermal plume generated by the Powerships considered at Port of Ngqura running at 100% load. The results show that a smaller footprint of ΔT is achieved when discharging at a deeper depth below the water surface. Discharging at a deeper depth allows the thermal plume to entrain colder subsurface ambient water as it rises to the surface, reducing the temperature of the plume.

It was concluded that when the cooling water is discharged 8 m below the water surface the thermal plume meets the World Bank guideline and the generic South African Marine Water Quality Guideline. To reduce the risk of recirculation of the discharge back to the intakes, it was recommended that the discharge pipeline running down the vessel hull has a second elbow to discharge horizontally away from the vessel, and that the discharge pipes be positioned as far from the intakes as possible.

- **Air Emissions**

Although the reciprocating engines are designed to run on dual fuels (i.e. Liquid Natural Gas and Heavy Fuel Oils), only Natural Gas (NG) will be the fuel used for the generation of electricity in the proposed Karpowership project. The ambient air pollutants associated with natural gas are SO_2, NO_2 and PM_{10}. The maximum predicted annual SO_2, NO_2 and PM_{10} concentrations and the 99th percentile concentration of the 24-hour and 1-hour predicted concentrations emitted from the combustion of natural gas are very low relative to the National Ambient Air Quality Standards (NAAQS).

Table 2-2: SO_2, NO_2 and PM_{10} concentrations predicted to be emitted by the proposed project in relation to the ambient concentrations in the Port of Ngqura area and the respective South African National Ambient Air Quality Standards (NAAQS).

	SO_2		
Description	**Annual**	**24-hour**	**1-hour**
Predicted maximum SO_2	0.09	0.74	1.7
NAAQS	50	180	350
	NO_2		
Predicted maximum NO_2	1.75		33.6
NAAQS	40		200
	PM_{10}		
Predicted maximum PM_{10}	0.43	3.65	
NAAQS	40	75	

The international standard is to express greenhouse gases in carbon dioxide equivalents (CO_2e). Emissions of gases other than CO_2 are translated into CO_2e using global warming potentials. Natural gas is an efficient and relatively widely available alternative to other fossil fuels and produces roughly half of the amount of carbon dioxide (CO_2) per unit energy as coal. This scenario makes natural gas attractive as a potential 'bridge' or transitional fuel in the shift toward renewable energy. Nonetheless, natural gas is primarily composed of methane (CH_4), a greenhouse gas with climate change adaptation risks associated 21 times the warming potential of CO_2.

From an emissions perspective, the Powership performs most efficiently when operating at full capacity. The fuel efficiency of the generators will be based on several factors including temperature/cooling, revolutions per minute (RPM), generating capacity, and load capacity. What becomes evident is the increased fuel efficiency of larger generators operating at full load capacity, as opposed to the smaller generators, or operating at lower load. GHG emissions per MW (CO_{2e}/MWh) at Ngqura are lowest when operating at 100% contracted capacity (0.504 t/MWh net). There is a stepwise increase in emissions per MWh at decreasing capacity. At 65-55%, the emissions are estimated at 0.506 t/MWh. The efficiency is further decreased to 0.509 t/MWh at 30-25% capacity. This decrease in efficiency will increase the CO2 emission factors of the released GHG. Given the 540MW generation capacity of the ships located at Ngqura, the emissions from 100% capacity are 272.16 t CO_{2e}. The reduction of efficiency from lowering contracted capacity will have negative emission implications per.

The 540MW-capacity Powerships at Ngqura are expected to emit ~857 Gg CO2e annually, equivalent to ~0.17% of the annual CO2e emissions of South Africa's gross greenhouse gas emissions in 2017. Over the 20-year project lifespan, emissions will be ~19 000Gg CO2e, comprised of C02 (85.9%), followed by CH4 (13.5%) and N20 (0.6%). However, the abovementioned calculation of GHG emissions only includes emissions generated by the Powership, not for the entire value chain which would include the emissions generated by the extraction and transport of the LNG. The project will undoubtedly produce greenhouse gas emissions with varying degrees of global warming potential that contribute to anthropogenic climate change and its resultant impacts. The significance of the quantified emissions therefore warrants the implementation of mitigation options where possible, particularly options related to carbon storage, offsets and drawdown. If the additional emissions from LNG extraction and transport are found to be of High significance, more substantive mitigation options, such as cleaner extraction technology at source, will need to be considered to bring emissions-related impacts into acceptable levels of significance.

Refer to Appendix I and J for further details on air quality and GHG emissions / Climate Change Assessment.

- ***Safety and Security***

Safety performance is focused on risk and on the safe operation of the vessel as well as the containment of the LNG within the containment systems, including the pipeline. The main risk contributing part of the operation is the possible rupture of one of the gas transfer hoses. This may result in a discharge of LNG into the marine environment due to pipeline bursting leading to a flash and pool fire, considered as a High impact. According to the Major Hazard Assessment (MHA) Risk Assessment (Attached as Appendix I), risks were found to be acceptable for the Gas to Power Operations. Due to the nature of LNG, should there be a minor leakage of LNG it will disperse quickly and rise into the atmosphere very quickly. For an explosion to occur one requires a loss of containment (e.g. a hose rupture) and an ignition source. The calculations are based on a 30% possibility of an ignition source being present. Therefore, if the risk of a hose rupture is 5.0e-007 then the risk of an explosion is 1.5e-007.' These risks with be further assessed during the MHI application. The MHI application can only be made upon completion of the EIA process, once the EA has been granted. Please refer to the MHI Risk Assessment (Appendix I) for further details.

In the event of a lightning strike, the high conductivity of the large quantities of metal, with hundreds of square yards of hull in direct contact with the water, causes rapid dissipation of the electrical charge. The Powerships, FSRU and LNG carriers are designed to meet stringent lightning protection standards required by the Ship Classification Society. FSRU operations are safeguarded through 100% containment with no LNG interface with the atmosphere. Lightning strikes are easily dissipated by the steel structures without affecting the normal operational aspects of the FSRU, however, in such situations, it is normal practice to cease STS operations and make safe the transfer hoses through inerting and also maintaining the cargo containment without oxygen.

Fire can be extinguished in Powerships by means of various methods which include permanently installed systems in the Powership that are able to fill the affected area with CO^2 or Hot foam and portable extinguishing systems. Each chamber in the Powership is also equipped with fire detection and alarm equipment (fire detectors, manual call points, alarms, sounders, and bells) in order to detect & locate the origin of the fire.

In addition to using the fixed firefighting systems, portable firefighting equipment and personnel protection equipment are to be used throughout Powership to ensure maximum protection from fire related accidents. Approved drawings on firefighting plans are located throughout the Powership in fireboxes and hung in different locations. In the event of fire drills or actual fire these plans are to be carried out.

All maintenance and operation will be managed by the Karpowership in-house Operational & Maintenance team on board 24/7. Highly experienced personnel in the Powerships observe and control all systems remotely. In addition to state-of-the-art automatic supervision and control arrangements, experienced engineers take readings, measurements, and perform other inspection routines. All systems are to be inspected regularly for leaks, and any leak is repaired immediately. The pressure and temperature readings in all systems are checked frequently.

The Operation and Maintenance procedures for each system and equipment are defined in manufacturers operating manuals. The quality and efficiency of operation and maintenance tasks onboard are planned and monitored by the enterprise resource planning system (SAP). Each Powership is implemented with a computer-based maintenance, quality, and material resource planning system (SAP PM-QM-MM), including all individual procedures with intervals, job descriptions, Health, Safety and Environment (HSE) precautions, spare parts, tools and manpower.

Karpowership applies predictive and preventive maintenance procedures according to equipment manufacturers' instructions. The preventive maintenance measures ensure high availability, reliability, quality, and increase in equipment lifetime. Maintenance of the engines is performed according to the maintenance schedule. Regular maintenance helps to avoid malfunction of the engine and increases its lifespan.

The operations and maintenance of the FSRU, gas pipeline, the 132 kV distribution line and associated equipment will be managed by an Operations and Maintenance contractor that will be appointed by Karpowership.

In terms of Emergency Plans, the Major Hazard Installation (MHI) Risk Assessor had recommended that an Emergency Plan be developed and sent to the Municipality's Disaster Management officials for them to comment and formulate action plans during the MHI application. The MHI application will be made to the District Municipality, and be assessed based on their disaster management capacity. This MHI application can only be made upon completion of the EIA process, once the EA has been granted (refer to the Major Hazard Installation Risk Assessment, Appendix I).

Powerships are equipped with advanced CCTV systems monitoring all areas, inside and out, in addition to surrounding fencing and razor wires to protect against unauthorized entry to the project site from land. Dedicated professional security team personnel are responsible for monitoring and constantly patrolling the vessels to prevent any unauthorized entry or attacks. In addition, prior to deployment of the Powerships to their operating location, an independent security risk assessor visits the location, meets local authorities including port authorities and armed security forces, and provides detailed advice on any additional security measures that should be implemented before or during the operation over and above the proposed Security Plan specific to that project site.

The same independent security advisors visit the vessels shortly after their arrival, immediately after mooring arrangements are completed, to follow up and assess actual operation of the security systems and team. Regular follow up visits and assessments continue, and adaptation of systems and protocols would be made if the project site security risk status is deemed by them to have changed in the area over time.

In addition, a Floating Storage Vessel can be moved relatively quickly in the event that South Africa becomes exposed to terrorist activities. Access to these facilities is also more easily controlled than land-based facilities.

2.1.2 **Berthing and Mooring of the Powerships and FSRU**

Berthing and mooring will be conducted as per the Ports' approved maintenance plans, procedures and requirements, and ships will be located where adequate depths exist.

The Powerships and FSRU are to be moored in the waters within the Port of Ngqura. The locations selected for the mooring of the FSRU and the Powerships are existing areas of the Port that are maintained at the advertised depth by the Port Authority. The depth of the water in which the ships will be positioned is approximately 14m. The metocean conditions at the mooring sites are were deemed to be suitable for the safe mooring and operation of the FSRU and Powerships.

The operational requirements at the Port cannot accommodate the use of existing berthing infrastructure, and therefore the vessels will be positioned in unused areas of the Port and will utilise their own mooring system comprising catenary mooring chains and anchors on the seabed.

No dredging will be required as the mooring locations are positioned in sufficient water depth to safely accommodate the moored vessels. In the process of identification of the potential sites, the existing cargo facilities and the Port's future short-term developments were avoided.

Key considerations for a feasible position are the turning circle for the LNG carrier as well as that the approach channel to be shared with the container terminal, i.e. traffic in basin from container vessels, cargo vessels and tugs.

Marine conditions derived for all design return periods include an allowance for potential climate change impacts (increases) on wind speeds, water levels and wave heights over the design life of the infrastructure.

2.1.3 **Refuelling**

The FSRU is refuelled through vessels specially fitted for the purpose of carrying LNG and fuelling the Powerships. Refuelling would be required approximately every 20 to 30 days, depending on the power generation capacity and output of the Powerships.

The location of the LNGC, when re-fuelling, will be immediately adjacent to the FSRU. The LNGC will stay in this location within the Port only during the re-fuelling which takes one to two days, and thereafter will leave the Port.

The FSRU can hold enough LNG to allow the Powerships to operate for approximately 40 days. Expected arrival dates of the LNG Carriers transporting the LNG from the overseas market will be aligned (taking account of the prevailing weather conditions) with the expected usage profile, whilst ensuring that sufficient reserves are maintained in the FSRU in case of any short notice delays. This is to avoid interrupting the supply of LNG to the Powerships and thus, power generation.

<u>Fuel Source – LNG</u>

The Powership is designed to use Natural Gas, a cleaner burning fuel for the cost effective generation of power, as opposed to coal-fired power stations. In addition, coal-fired power technology is associated with significant air pollution as a result of the coal-fired combustion. Natural gas emits between 45 and 55% fewer greenhouse gas emissions and less than one-tenth of the air pollutants than coal when used to generate electricity (Shell SA, Media Release, 2020).

According to Shell SA, "*Natural gas is the cleanest-burning hydrocarbon, producing around half the carbon dioxide (CO2) and just one tenth of the air pollutants of coal when burnt to generate electricity.*

If consumption remained at today's levels, there would be enough recoverable gas resources to last around 230 years. It is versatile. A gas-fired power station takes much less time to start and stop than a coal-fired plant. This flexibility makes natural gas a good partner to renewable energy sources like solar and wind power, which are only available when the sun shines and the wind blows." (https://www.shell.co.za/energy-and-innovation/natural-gas.html).

The benefits of running the engine on NG include emission reductions of NOx, SOx, CO_2, particulates, no smoke, reduced waste streams to meet the requirements of local or international legislations.

Global LNG Market

The market for Liquified Natural Gas has existed since 1958 when the first tanker shipment of LNG took place from Lake Charles, USA bound for Canvey Island in the UK aboard the Methane Pioneer.

Today, more than 40 countries import LNG from 21 exporting nations around the world. Imports are dominated by the Asia Pacific region, with Japan, China and South Korea dominating demand, as shown in the diagram below.

On the supply side, Qatar has been the world's largest supplier of LNG for a number of years. However, both Australia and the USA are expected to surpass Qatar as the world's largest LNG suppliers since both nations have rapidly expanded their liquefaction capacity in recent years.

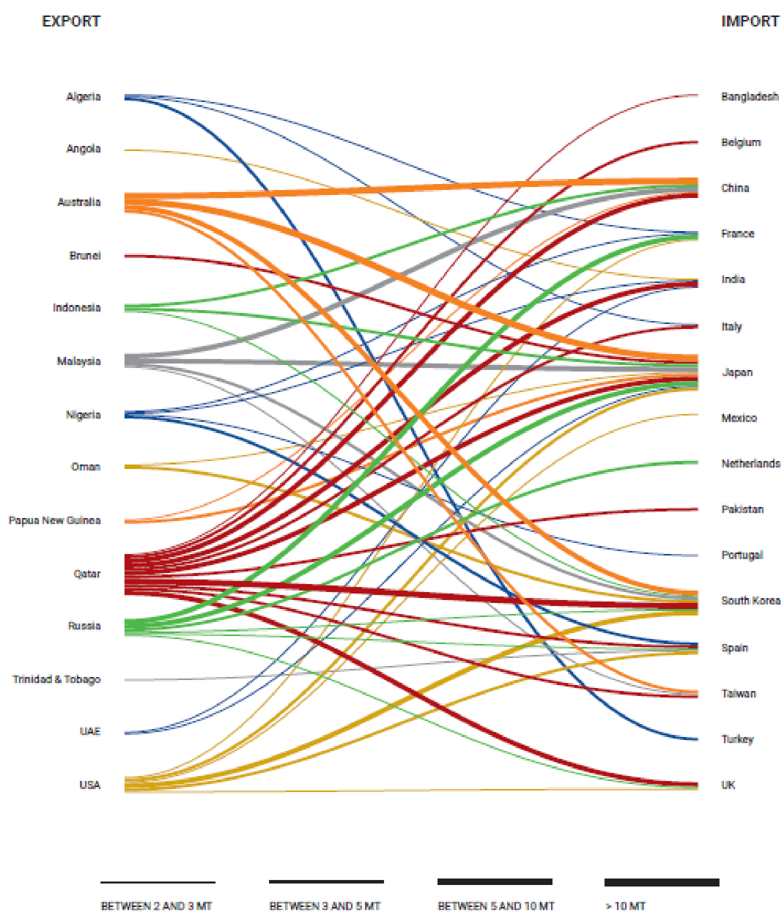


Figure 2-4: Representation of the Global LNG Supply.

LNG Supply Sources

Given the complexity of different sources of LNG and different customers for LNG and the fact that demand for LNG in a country can change from year to year as well as within the market, this market is suited to very large companies who can manage the complexity of changing import demand combined with the requirement to serve the customers' demands.

LNG Supply is a mature market with approximately 30 larger companies, capable of supplying LNG to the project. Well–established companies will have to supply LNG from within their total global portfolio. Therefore, the LNG will not be sourced from a dedicated source(s).

The market for the supply of LNG will continue to grow for the next 40 years, and therefore there is no risk associated with the physical supply of this fuel for the term of the project.

LNG Procurement for the Project

Fuel Company started the process for procurement of LNG during September 2020 by running an Expression of Interest ("EOI") for LNG supply to the proposed Project. The EOI was sent to thirty (30) well established LNG suppliers. A robust LNG supply chain was secured.

Upon receiving the Preferred Bidder status, Karpowership will enter into an agreement for 6 years extendable up to a 20-year term with the preferred supplier(s).

2.1.4 Gas Lines

A gas line is required between the FSRU and Powership to ensure gas supply for power generation. The pipelines used for natural gas transmission will be made of steel engineered to meet the standards for natural gas pipelines with a diameter of approximately 60cm (600mm). The gas pipeline will likely need to be mounted on small footings requiring minor civil works to construct and install.

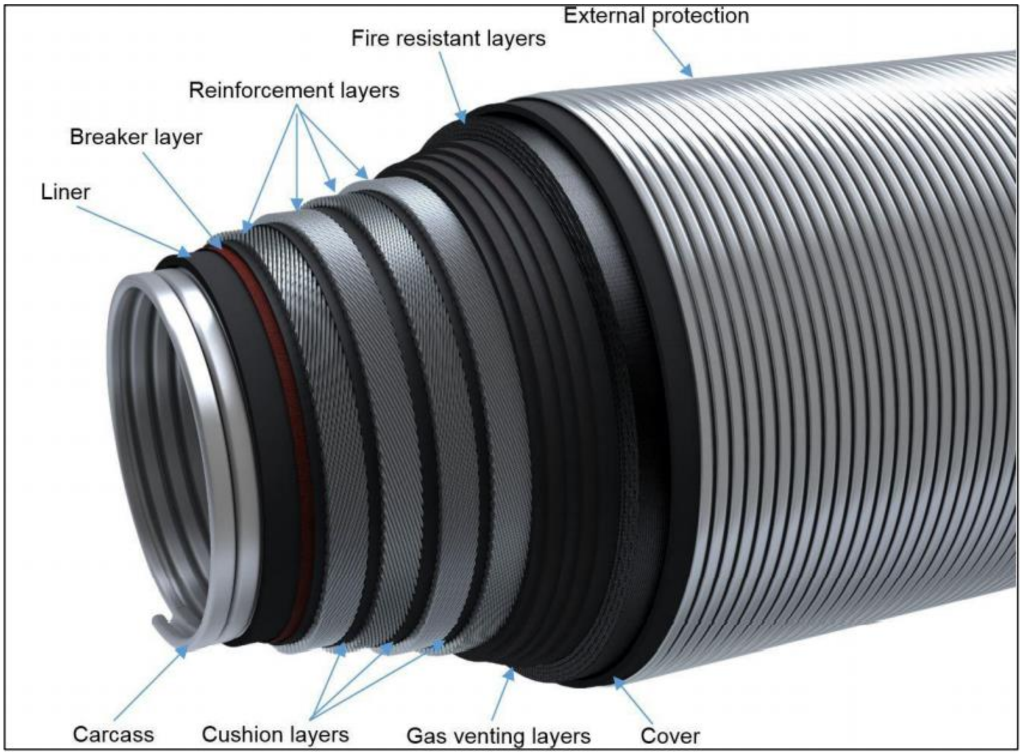


Figure 2-5: Riser / flexible hose.

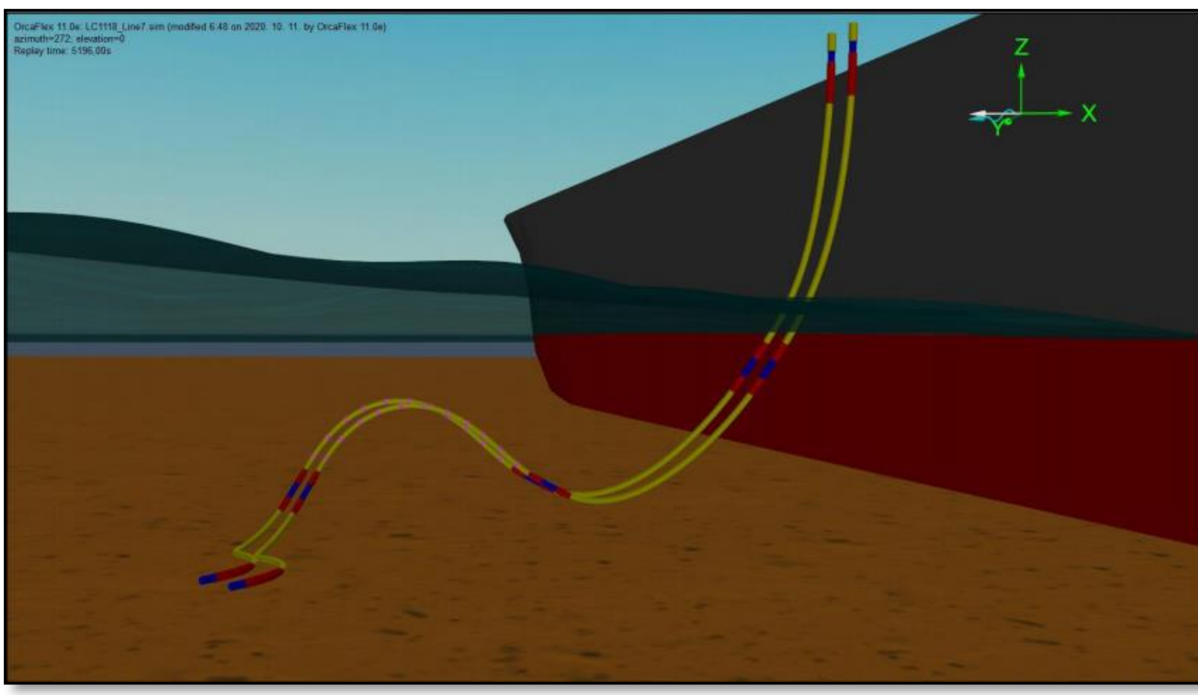


Figure 2-6: Illustration of riser hose application.

For the gas pipeline, including the pipeline end manifolds (PLEM), there may need to be minor route rectification along the subsea pipe route to limit the free span length of any section of the pipeline. This will comprise flattening high spots or building up support under the pipe at low points. Due to the minor nature of this work, it will likely be undertaken by divers as the pipeline is installed. The onshore pipeline will be buried along its route. The pipeline trench will be opened for the placing of the pipeline and then filled over.

There are two alternative routes for the gas pipeline:

- Alternative 1 of the gas pipeline route (approx. 1.6km in length) is preferred from an engineering perspective, as it is in line with the preferred position (from an engineering design perspective). This route is routed along the edge of the existing eastern breakwater towards the craft basin connecting to the vessels via a flexible marine hose.

- Alternative 2 of the gas pipeline route (approx. 0.7km in length) is along the edge of the existing eastern breakwater and existing roads and connecting to the vessels via a flexible marine hose.

The Applicant is currently investigating the procurement of natural gas from global suppliers. As already mentioned, the gas will be shipped into the Port on a specialised carrier and offloaded to the FSRU.

Further description and figures of these alternatives are provided in Section 3.

<u>Pipeline Installation</u>

The methodology used to install the subsea gas pipeline will be dependent on the specific expertise and experience of the Marine Contractor appointed to undertake the construction works. The various possible methods are however all very similar, depending on the site and the marine plant that is available to the marine contractor. The actual detailed methodology that will be used will only become available once the marine contract has been awarded.

The most likely construction methodology associated with the installation of the subsea pipes is as follows:

The submarine pipeline is to be brought onto site in sections, typically 18m long. The pipeline is likely to be delivered to the site by road truck and welded together in a pipe stringing yard near the launch site. The trucks used to deliver the pipeline sections will therefore require road access to the stringing yard within the construction site / laydown area.

Sufficient space for a temporary onshore construction site / laydown area near the launch site will therefore be required to undertake the assembly of the pipeline. An area within the Port previously disturbed and with sufficient space near the launch site will be selected in order to reduce new impacts. Estimated size for the temporary assembly/ laydown area for the installation of the gas pipeline is 5463m^2.

The launchway will be constructed on the west side of the stringing yard continuing down onto the beach. The final selection of the site will only be finalised once a preferred marine contractor has been selected. At this stage it is estimated that an area of 100 m x 150 m would be required. The pipe stringing and fabrication yard will be set up to assemble 7 x 18m pipe joints into a 126m string. Therefore 12.7 strings will make up the required 1,600m pipeline length. A launchway will be constructed with rollers to transfer the pipeline from the stringing yard to the sea. It may be necessary to cross the existing caisson construction basin using a piled structure to support the launchway. The launchway typically will consist of concrete or steel pedestals supporting rollers at approximately 10 to 20m centres, over which the pipeline will move, allowing the completed pipeline to be pulled into the sea.

The pipeline is likely to be installed by pulling it from the shore into position using a winch mounted on the deck of an anchor handling tug (AHT), moored offshore. Due to the low pulling forces, no added buoyancy will be required. The AHT will be positioned at the furthest end of the pipeline. A large diameter (approx.76mm dia) pulling wire will be laid from the end of the pipeline on the launchway to the AHT pulling position. A reaction anchor will be laid offshore of the pull position and will be connected to the AHT with a wire mooring pennant. As the pipeline is pulled, additional pipe strings are welded on in the stringing yard. The pipeline is placed on the seabed with minimal disturbance to the seabed and weighted with concrete to ensure the on-bottom stability of the pipeline during operation. Where necessary the pipeline will be covered with crushed rock to protect the pipeline. Although no dredging is required prior to installation of the pipeline, some seabed preparation in the form of levelling of high spots or placing of crushed stone founding material in low spots may be necessary prior to installing the pipeline.

There are 3 PLEMs on this site, connected to the pipeline with in-line spools. For pipe pulling, dummy spools will be inserted at the PLEM locations. Once the pipeline is in position, the spools will be removed for PLEM installation and hook-up of the permanent spools.

The subsea pipeline from the FSRU will be installed on the seabed and through the existing revetment. The first leg of the overland pipeline will be installed on plinths above ground between the paved area of the admin craft basin and the crest of the breakwater.

The remainder of the overland pipeline will be trenched alongside the existing access road and crossing the existing entrance to the admin craft basin. The subsea pipeline will be buried through the shore crossing and laid on the seabed connecting the overland pipeline to the Powerships. The horizontal and vertical alignment of the overland pipeline will take existing structures and services as well as safety aspects into consideration.

Gas from the FSRU will be distributed via a standard subsea gas pipeline to the Powerships. The gas pipeline will be 24" seam welded API 5L Grade X42 (min) with a design pressure of 15 Bar and designed in accordance with ASME B31.8.

The pipeline has been specified with a wall thickness of 15.88mm to assist with installation stresses and to provide additional weight of on-bottom stability. The pipeline will also receive a 50mm thick concrete weight coating to provide permanent on bottom stability in accordance with DNV-RP-F109.

The shore crossing will be buried 1m deep and up to the -5m contour. Based on the engineer's experience from similar projects and the engineers are comfortable that this depth is sufficient for storm erosion. It is anticipated that the 50mm concrete coating will be sufficient for small-dropped object protection. The pipeline will also be in an exclusion zone controlled by the Port.

<u>Removal of pipe route high spots to pipe span corrections</u>
High spots along the pipeline route are envisaged to be encountered at the shoulders of existing dredged slopes and where sediments have accumulated. These need to be removed or ameliorated by excavation by divers using pumps and hydraulic spades in case the material is stiff mud or clay.

The support vessel will be set up to support the divers with a dive spread, pumps and hydraulic power pack for the spades. A spread mooring will be laid over the high spots for the vessel to moor securely, so that the divers will have a stable platform to work from. The material will be side cast out of the pipeline corridor by the pump discharge pipeline.

For the pipeline span corrections, the field surveyor will identify spans greater than 20m long for treatment. The deck of a barge will be loaded at the quayside with crushed stone. A knuckle boom crane will be fitted with a grab bucket, which will be used to place the stone onto the seabed at the pipeline span points. Divers will ensure that the stone is correctly located under the pipeline at span points. Where grout bags are required to support the pipeline, the grout bags will be installed by divers. The dive barge deck crew will manage the grouting operation. Communications between diver and deck supervisor will ensure that the grout bags are properly placed and filled with grout.

Seabed preparation for PLEM installations

Each of the three Pipeline End Manifold (PLEM) needs to be set down on a stable and level foundation. The seabed surface layer needs to be excavated and levelled to achieve this. Divers will excavate and level a 10m x 10m foundation area on the seabed at the pre-surveyed PLEM position. The excavation will be done using hydraulic spades and 6” pumps, to create a 10m x 10m foundation. The divers will lay out a geotextile and peg it to the bottom of the excavation, followed by placing of the 53mm stone to a depth of about 250mm. The stone will be placed off the deck of the barge using a grab bucket fitted to the knuckle boom crane. Once stone is placed the divers will level it using wash water from the pump discharge hose.

PLEM installation

The PLEMs will be loaded onto the deck of the AHT at the quayside. The same method as described above for the blocks will be applied to the installation of the PLEMs, using the AHT A-frame, observation divers and observation ROV. The PLEMs will be placed on the prepared stone foundation bed. Once it is properly set down on the seabed, the positioning surveyors will fix the PLEM’s positions for the as-built records. Three PLEMs will be installed this way, one for the FSRU and one for each of the two Powerships.

Precast Concrete Ballast Blocks

The installation of ballast blocks in each of the PLEMs is required to ensure the on-bottom stability of the PLEM. The ballast blocks will be loaded onto the deck of the AHT which will be set up in a pre-laid spread mooring over the PLEM. The positioning surveyor will locate the A-frame at the stern of the vessel over the target ballast block receiving brackets, and the blocks will be lifted into position using the A-frame crane. Divers on the seabed will confirm the correct seating of the block in the receiving brackets of the PLEM frame. A light observation ROV could also be used to assist the divers.

Spool installation

The installation of the pipe spool pieces is carried out after pipelay and PLEM installation. The initial activity is diver metrology to measure the in-situ distances and directions between the PLEM and pipeline flanges. This data is then provided to fabricate the spools and apply the corrosion coating and concrete weight coat. The spools are then delivered to the quayside for collection and installation on the seabed. The AHT and her crane or A-frame will be used to lower the spools to the seabed. From there, divers will use lifting bags to manoeuvre the spools into position between PLEM and pipeline. The gaskets and bolts and nuts will be inserted and the divers will use bolt tensioning tools to set the bolt tensions to the correct tension. This activity will be directed by the ASME PCC-1 subcontractor specialists, communicating with the divers via the dive supervisor on deck.

Once the pipeline installation is complete, the laydown site will be rehabilitated to reinstate it to the topographical and environmental condition as was prior to the disturbance during the construction phase of this project.

Pipeline Maintenance

The gas pipeline infrastructure is designed to require little to no maintenance during its design life. Furthermore, the maintenance of the gas pipeline will be managed by the Operation and Maintenance Contractor that will be appointed by Karpower. Relevant design features include the following:

- the subsea pipeline will be protected with a factory applied external coating as well as sacrificial anodes;
- the external coating will be protected by a concrete weight coating which is designed to provide abrasion resistance, which is especially important during pipeline installation; and
- the pipeline is designed to remain stable on the seabed, thereby mitigating against seabed abrasion and material fatigue.

2.1.5 **Transmission Line**

The power generated on the ship will be converted by the on-board High Voltage substation and transmitted along 132kV twin tern conductor overhead transmission line. A transmission line (approx. 7.5km) will be erected as part of the project from the Port through the Coega SEZ to the existing Dedisa Substation, which is also situated within the Coega SEZ). The Powership will be connected to a new Saltpan switching station onshore that will be constructed to be located near the Powerships. The Saltpan switching station (approx.105m x 105m) will be connected to Dedisa substation by means of 2 x 7.5 km Double circuit twin tern 132 kV lines. The proposed transmission line includes:

- Extending the Dedisa132 kV busbar to accommodate an additional 132 kV feeder bay;
- Installing 2 x 132 kV feeder bays at Dedisa;
- Constructing the Saltpan 132 kV switching station onshore to connect to the HV yard in the Khan Powership via overhead lines;
- Installing 4 x 132 kV feeder bays at Saltpan switching station;
- Connecting 2 x 132 kV overhead lines (about 1 km) from the Powership 132 kV yard to the Saltpan switching station; and
- Constructing 2 x 7.5 km of 132 kV double circuit Twin Tern conductor lines from Saltpan switching station to Dedisa substation.

There will be approximately 28 monopoles located along the transmission line. Each monopole will cover a maximum footprint of 15m by 15m and the footprint of the monopole will be 0.6m x 0.6m to a maximum of 2.5m x 2.5m, both of which will necessitate the clearing of vegetation to allow for the steel monopole to be erected. The servitude, stretching the transmission line from the Port to the substation, will have a width of 30m as per Eskom safety specifications. The monopole structures require small excavations for their foundations. The overhead line route is in currently undeveloped land controlled by the Coega SEZ. A survey of the exact excavation sites will be conducted during the construction phase. The preferred route for the powerline was chosen to follow the path of the existing road within the Coega SEZ. Within the Coega SEZ the overhead line route is parallel to existing overhead lines and within an existing powerline servitude.

The preferred transmission line begins in a Fresh Ecosystem Priority Areas (FEPA) wetland, as per Section 4, (NFEPA dataset; Nel et al, 2011), thereafter this route heads in a north-easterly direction and finally a north-westerly direction before reaching its end point at the Dedisa substation. This may require the infilling or depositing or excavation, removal or moving of more than 10 cubic metres of material into, or from a watercourse and removal of more than 5 cubic metres of sand, within 100 metres inland of the high-water mark as well as removal of indigenous vegetation.

Regarding the visual impact relating to the monopoles, this will be minimised as the proposed transmission route will follow the existing service corridor that is already disturbed with already existing towers that have been constructed. The monopoles are being considered as they are visually more appealing.

Routes options for the transmission lines are presented in the layout alternatives, Section 3 of this report.

2.1.6 Storage of Hazardous Goods

The Liquid Natural Gas stored on the FSRU at any given time will not exceed 175 000m^3. The FSRU is made up of a series of pressurised containers. The storage of NG on the Powerships is of small quantities and can be assumed as zero. The reason for this is because as the gas is produced it is used to produce electricity. Health and Safety protocols and requirements are ensured for the storage of hazardous goods such as small quantities of lubricating oil stored for equipment maintenance purposes.

2.1.7 Waste generation and Management

Due to daily operational activities and the regular repair and maintenance of the Powerships and FSRU, waste will be generated. All effluent and solid (general and hazardous) waste will be removed by authorised service providers in terms of legislation and TNPA and MARPOL requirements.

Sewage from on-board ablution facilities and bilge water will be produced by the Powerships. Approximately 75m^3 of sewage (black water) will be generated per month, as well as grey water (washing and kitchen).

Pursuant to the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78 or “MARPOL Convention” in short) (Annexes I, II and IV), discharge of oil, noxious liquid substances, and sewage from vessels into marine environment is prohibited. All black and grey wastewater generated during operation of Powership facilities will be removed by authorised service providers for appropriate off-site treatment and disposal.

In terms of energy waste, Powerships operate with a lean waste philosophy. Every type of energy generated from the fuel is used in a specific way to reduce waste energy. While engines burn fuel, heat is carried out to atmosphere by exhaust gasses. In order to utilise the waste heat, Powerships use Exhaust Gas Boiler Equipment to convert waste heat to superheated steam and redirect the steam to the Steam Turbine Generators to generate electricity.

2.2 All Listed and Specified Activities Triggered in terms of NEMA and NEM: AQA

2014 EIA Regulations (as amended), Appendix 3 - 3(d) (i) all listed and specified activities triggered

The table below indicates activities that are deemed applicable to the proposed project, based on Triplo4's assessment:

NEMA

Table 2-3: Applicable Listed Activities

LISTED NOTICES		
LISTING NOTICE 1		
Activity No.	Activity Description	Applicability
Activity 11	*The development of facilities or infrastructure for the transmission and distribution of electricity—* *(i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts; or* *(ii) inside urban areas or industrial complexes with a capacity of 275 kilovolts or more;* *excluding the development of bypass infrastructure for the transmission and distribution of electricity where such bypass infrastructure is —* *(a) temporarily required to allow for maintenance of existing infrastructure;* *(b) 2 kilometres or shorter in length;* *(c) within an existing transmission line servitude; and* *will be removed within 18 months of the commencement of development.*	The power generated on the ship will be converted by the on-board High Voltage substation (110kV-170kV) and transmitted along the 132kV twin conductor overhead transmission line. However, the transmission line will be located within the Coega Industrial Development Zone and Port of Ngqura (Transnet) and its capacity falls below the threshold of 275 kV. **DEFF to confirm that this listed activity can be removed.**
Activity 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 watercourse* *(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse* Excluding: (dd) where such development occurs within an urban area.	The preferred route of the transmission line on the Eastern side of the services servitude, the locations of the proposed switching station and the temporary laydown area for the gas pipeline installation, is outside 32m of a watercourse. The FEPA wetland that is indicated on maps, no longer exists. The CDC is still to confirm a potential preferred route on the Western side of the services

LISTED NOTICES		
LISTING NOTICE 1		
Activity No.	Activity Description	Applicability
		servitude. This route will be within a watercourse and within 32m of a watercourse. However, these project components may fall within an area considered to be "urban" by the competent authority, thereby triggering the exclusion . **DEFF to confirm the applicability of the listed activity given its location within the Port and CDC and advised whether it can be removed or must remain.**
Activity 15	*The development of structures in the coastal public property where the development footprint is bigger than 50 square metres, excluding—* *(i)* ***the development of structures within existing ports or harbours that will not increase the development footprint of the port or harbour****;* *(ii) the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies;* *(iii) the development of temporary structures within the beach zone where such structures will be removed within 6 weeks of the commencement of development and where coral or indigenous vegetation will not be cleared; or* *(iv)* ***activities listed in activity 14 in Listing Notice 2 of 2014, in which case that activity applies.***	Structures in the coastal public property exceeding 50 square meters include the: gas pipeline, transmission line and the laydown areas for the gas pipeline and transmission line installations. The development of these structures and infrastructure will occur within the Port of Ngqura. A part of the gas pipeline will be established overland to connect to the Powership. Activity 14 in Listing Notice 2 of 2014 is applied for in terms of the gas pipeline and mooring structures within the sea /along the seabed. **DEFF to confirm the applicability of this listed activity given the potential exclusions of (i) and (iv).**
Activity 17	*Development—* *(i) in the sea*	The Powerships and FSRU are not being developed. However, the

LISTED NOTICES		
LISTING NOTICE 1		
Activity No.	Activity Description	Applicability
	(ii)in an estuary; *(iii)* within the littoral active zone; *in respect of—* *(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;* *(dd) where such development occurs within an urban area.*	mooring system, the gas pipeline, the proposed towers for the transmission line, the switching station and the temporary laydown area for the gas pipeline installation will cumulatively exceed a footprint of 50 square meters within the sea, and littoral active zone. As these project components fall within an established Port, DEFF's guidance is sought on whether the activities are included or excluded in terms of (aa). In addition, these structures and infrastructure are proposed within the existing Port of Ngqura and Transnet property, which could be interpreted as urban, in which case the exclusion (dd) would apply and the activity not triggered. **DEFF to confirm the applicability of this listed activity given the possible exclusions of (aa) and/or (dd).**
Activity 18	*The planting of vegetation or placing of any material on dunes or exposed sand surfaces of more than 10 square metres, within the littoral active zone, for the purpose of preventing the free movement of sand, erosion or accretion.*	Sections of the gas pipeline and transmission line, where it comes on shore, need to be stabilised to prevent erosion on the substrate where the pipeline and transmission line is established. Furthermore, rehabilitation for the land-based portion will be required. Although the area has already been transformed due to port activity, it will require the planting of vegetation on exposed sand

LISTED NOTICES		
LISTING NOTICE 1		
Activity No.	Activity Description	Applicability
		surfaces of more than 10 square meters to ensure environmental management.
Activity 19	*The infilling 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* *but excluding where such infilling, depositing, dredging, excavation, removal or moving—*	The construction of the CDC's potential preferred transmission line situated on the Western Side of the services servitude require the infilling or depositing of material of more than 10 cubic meters into, and the excavation, removal or moving of soil or sand of more than 10 cubic meters from a watercourse.
Activity 19A	*The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from—* *(i) the seashore;* *(ii) the littoral active zone, an estuary or a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever distance is the greater; or* *(iii) the sea; —* *but excluding where such infilling, depositing, dredging, excavation, removal or moving—* *(e) will occur behind a development setback;* *(f) is for maintenance purposes undertaken in accordance with a maintenance management plan;* *(g) falls within the ambit of activity 21 in this Notice, in which case that activity applies;* *(h) occurs within existing ports or harbours that will not increase the development footprint of the port or harbour; or* *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*	The Powership mooring system, the gas pipeline, the erection of the towers for the transmission line, and the temporary laydown area for the gas pipeline installation will require the removal of more than 5 cubic metres of soil or sand from the littoral active zone, a distance of 100 meters inland of the high water mark and the sea. Installation of the subsea as well as land based portions of the pipeline will require excavation, levelling infilling and compaction. It is uncertain whether the infilling, depositing, dredging, excavation, removal or moving are deemed to increase the development footprint of the port. ***DEFF to confirm the applicability of this listed activity given the potential exclusion of (h).***

LISTED NOTICES		
LISTING NOTICE 1		
Activity No.	Activity Description	Applicability
Activity 27	*The clearance of an area of 1 hectare or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for—* *(i) the undertaking of a linear activity; or* *maintenance purposes undertaken in accordance with a maintenance management plan.*	The transmission line, its servitude and the switching station (approx. 1,1 ha footprint) will cumulatively require clearance of more than 1 hectares of indigenous vegetation. The switching station with a footprint of approximately 1,1 ha, will require the clearance of approximately 1 ha of indigenous vegetation. DEFF IQ desk has confirmed that the transmission line comprising of towers / pylons and 132kV lines is not triggered by the project. The switching station was not specifically addressed in the enquiry to DEFF IQ. It must be noted that without the transmission line, no switching station will be established. **DEFF to confirm that the switching station is included within the linear activity and confirm whether this listed activity can indeed be removed for the transmission line and associated switching station, or not.**

Activity No.	Activity Description	Applicability
LISTING NOTICE 2		
Activity 2	*The development and related operation of facilities or infrastructure for the generation of electricity from a*	The two Powerships and FSRU are assembled off-site and will be delivered fully equipped and ready

Activity No.	Activity Description	Applicability
LISTING NOTICE 2		
	non-renewable resource where the electricity output is 20 megawatts or more.	to operate to the Port of Ngqura where they will be moored. The proposed design capacity for the two Powerships is approximately 540MW, which comprises of 27 gas reciprocating engines having heat input of over 10MW each. The 3 steam turbines have a heat input of 15.45MW each. The gas pipeline from the FSRU to the Powerships and the transmission line from the Powerships to the Substation trigger separately listed activities as does the need for an AEL which if issued, will regulate the atmospheric emissions during commissioning and operation of the project.
Activity 4	*he 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*	Storage of LNG on the FSRU will exceed 500 cubic meters (maximum estimated storage is 175000 cubic meters at any given time).
Activity 6	*The development of facilities or infrastructure for any process or activity which requires a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent, excluding—* *(i) activities which are identified and included in Listing Notice 1 of 2014;* *(ii) activities which are included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the National Environmental Management: Waste Act, 2008 applies;*	The engines used for electricity generation are a Listed Activity under GN 893 of 22 November 2013 (as amended) in terms of Section 21 of the NEM: AQA Sub-Category 1.5: Reciprocating Engines. In the case of the proposed project, the Powership will have a combined sum of 27 engines that all have a heat input capacity of more than 10 MW each. The two steam turbines have a heat input capacity of less than 50 MW, but more than 10 MW. These units

Activity No.	Activity Description	Applicability
LISTING NOTICE 2		
		are therefore declared Controlled Emitters and they will be regulated in terms of GN 831 of 1 November 2013 for Small Boilers.
Activity 7	*The development and related operation of facilities or infrastructure for the bulk transportation of dangerous goods—* *(i) in gas form, outside an industrial complex, using pipelines, exceeding 1 000 metres in length, with a throughput capacity of more than 700 tons per day;* *(ii) in liquid form, outside an industrial complex, using pipelines, exceeding 1 000 metres in length, with a throughput capacity of more than 50 cubic metres per day; or* *(iii) in solid form, outside an industrial complex, using funiculars or conveyors with a throughput capacity of more than 50 tons per day.*	A subsea gas pipeline for transportation of gas in gas form is proposed, exceeding 1000 meters, however the proposed location is within industrial complex (harbour land use). As this activity is within the Port boundaries which potentially is within an industrial complex. DEFF to confirm the applicability of this listed activity.
Activity 14	*The development and related operation of—* *(ii) an anchored platform; or* *(iii) any other structure or infrastructure —* *on, below or along the sea bed;* *excluding —* *(a) development of facilities, infrastructure or structures for aquaculture purposes; or* *(b) the development of temporary structures or infrastructure where such structures will be removed within 6 weeks of the commencement of development and where coral or indigenous vegetation will not be cleared.*	The ships will be anchored and moored in existing port operational areas utilising the vessel's anchoring system. The transmission of the NG gas will flow via a gas pipeline from the moored ship along the seabed to the main ship for processing. The subsea gas pipeline is proposed to be installed, operate and maintained along the toe of the existing dredged slopes between the floating storage regasification unit (FSRU) and Powership to ensure gas supply for power generation.

Activity No.	Activity Description	Applicability
LISTING NOTICE 3		
Activity 10	*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 30 but not exceeding 80 cubic metres.* *a. Eastern Cape*	The storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic metres.

Activity No.	Activity Description	Applicability
LISTING NOTICE 3		
	i. Outside urban areas: *(aa) A protected area identified in terms of NEMPAA, excluding conservancies;* *(bb) National Protected Area Expansion Strategy Focus areas;* *(cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;* *(dd) Sites or areas identified in terms of an international convention;* *(ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;* *(ff) Core areas in biosphere reserves;* *(gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve;* *(hh) Areas seawards of the development setback line or within1 kilometre from the high-water mark of the sea if no such development setback line is determined;* *(ii) Areas on the watercourse side of the development setback line or within 100 metres from the edge of a watercourse where no such setback line has been determined;* *(jj) Within 500 metres of an estuarine functional zone, excluding areas falling behind the development setback line;* *(kk) In an estuarine functional zone, excluding areas falling behind the development setback line; or* *(ll) Within a watercourse; or* *ii. Inside urban areas:* *(aa) Areas zoned for use as public open space;* *(bb) Areas designated for conservation use in Spatial Development Frameworks adopted by the competent authority or zoned for a conservation purpose; or* ***(cc)Within 500metres of an estuarine function zone excluding areas falling behind the development setback line.***	The FSRU with a storage capacity not exceeding 175 000 cubic metres of LNG at any time, will be situated approximately 500 metres from the shoreline, adjacent to the breakwater structure, within the Port of Ngqura will be situated further than 500m from the estuarine functional zone.. The Jahleel Island is approximately 1km away whereas the St Croix and Brenton Islands are situated approximately 6,5km away. from the FSRU. These islands are situated within the Greater Addo National Elephant Park Marine Protected Area, which is situated immediately adjacent to the breakwater structure within the Port. As this activity is within the Port boundaries which potentially an urban area, DEFF to confirm the applicability of this listed activity.

Activity No.	Activity Description	Applicability
LISTING NOTICE 3		
Activity 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.* *Eastern Cape* *i. 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;* *ii.Within critical biodiversity areas identified in bioregional plans;* *iii.Within the littoral active zone or 100 metres inland from the high water mark of the sea, whichever distance is the greater, excluding where such removal will occur behind the development setback line on erven in urban areas;* *iv.Outside urban areas, within 100 metres inland from an estuarine functional zone; or* *v.On land, where, at the time of the coming into effect of this Notice or thereafter such land was zoned open space, conservation or had an equivalent zoning.*	This activity will be triggered because of the clearance of vegetation exceeding 300 square metres for the establishment of the transmission line towers and switching station within the littoral active zone and 100 metres inland from the highwater mark of the sea and estuarine functional zone.
Activity 14	*The development of—* *(i) dams or weirs, where the dam or weir, including infrastructure and water surface area exceeds 10 square metres; or* *(ii) infrastructure or structures with a physical footprint of 10 square metres or more;* *where such development occurs—* *(a) within a watercourse;* *(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.*	Infrastructure or structures with a footprint of more than 10 square meters will be developed within the Port of Ngqura and the CDC. The CDC's potentially preferred alignment of the transmission line will occur within 32m of a watercourse. It is uncertain whether the development of infrastructure and structure are deemed to increase the development footprint of the port. The Port and CDC urban status to be confirmed by DEFF.

Activity No.	Activity Description	Applicability
LISTING NOTICE 3		
	Eastern Cape *i. Outside urban areas:* *(aa) A protected area identified in terms of NEMPAA, excluding conservancies;* *(bb) National Protected Area Expansion Strategy Focus areas;* *(cc) World Heritage Sites;* *(dd) Sensitive areas as identified in an environmental management framework as* *contemplated in chapter 5 of the Act and as adopted by the competent* *authority;* *(ee) Sites or areas identified in terms of an international convention;* *(ff) Critical biodiversity areas or ecosystem service areas as identified in* *systematic biodiversity plans adopted by the competent authority or in* *bioregional plans;* *(gg) Core areas in biosphere reserves;* *(hh) Areas within 10 kilometres from national parks or world heritage sites or 5* *kilometres from any other protected area identified in terms of NEMPAA or* *from the core area of a biosphere reserve;* *(ii) 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;*	***DEFF decision on the applicability of this listing notice to be confirmed given explanation above and the potential exclusions.***

<u>NEM:AQA</u>

In terms of Section 21 of the National Environmental Management: Air Quality Act, 2004 (NEM:AQA), the Minister published a 'list of activities which result in atmospheric emissions and which the Minister or MEC reasonably believes have or may have a significant detrimental effect on the environment, including health, social conditions, economic conditions, ecological conditions or cultural heritage'. The consequences of listing an activity are set out in Section 22:

*'No person may **without a provisional atmospheric emission licence or an atmospheric emission licence** conduct an activity—*

(a) listed on the national list anywhere in the Republic; or

(b) listed on the list applicable in a province anywhere in that province.'

Table 2-4: Applicable Listed Activities under NEM:AQA for the proposed Gas to Power Powership Project (GN 893 in GG No. 37054 of 22 November 2013, as amended).

Category of Listed Activity	Sub-category of the Listed Activity	Application
Category 1: Combustion Installations	Sub-category 1.5: Liquid and gas fuel stationary engines used for electricity generation	All installations with design capacity equal to or greater than 10 MW heat input per unit, based on the lower calorific value of the fuel use

The applicability of this listed activity has been investigated by the EAP upon advice of the air quality specialist and will be confirmed in consultation with the licensing authority, also DEFF, but a separate Branch within the Department.

The minimum emission standards prescribed for Activity 1.5 are presented in Table 2-5 below:

Table 2-5: Minimum Emission Standards in mg/Nm3 for Subcategory 1.5: Reciprocating Engines (Gas Fired).

Substance or mixture of substances		MES for sub-category 1.5
Common name	**Chemical symbol**	**MES under normal conditions of 15% O_2, 273 Kelvin and 101.3 kPa**
Particulate matter	N/A	50
Oxides of nitrogen (Expressed NO_2)	NO_X	400
Sulphur dioxide	SO_2	N/A

2.3 Project Locality

2014 EIA Regulations (as amended), Appendix 3 - 3 (1) an environmental impact assessment report must include (b) the location of the development footprint of the activity on the approved site as contemplated in the accepted scoping report, including: (i) the 21 digit Surveyor General code of each cadastral land parcel; (ii) where available, the physical address and farm name; and (iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties; (c) a plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale.

2.3.1 Location of the activity

Table 2-6: Location of the proposed activity.

Description	Location of the Activity
Metropolitan Municipality	Nelson Mandela Bay Municipality (NMBM)
Municipal Ward	Ward 53 (borders Ward 60)

Area / Town / Village	Port of Ngqura and Coega Special Economic Zone, situated near Port Elizabeth
Property Description & 21 Digit SG Code	See Table 2-6 below

Figures 2-6 to 2-10 below present the, locality map, Site Plan Map, the preferred gas pipeline route, preferred transmission line in relation to the Powerships and FSRU, site access and laydown areas.

2.3.2 Locality Plan of Activity

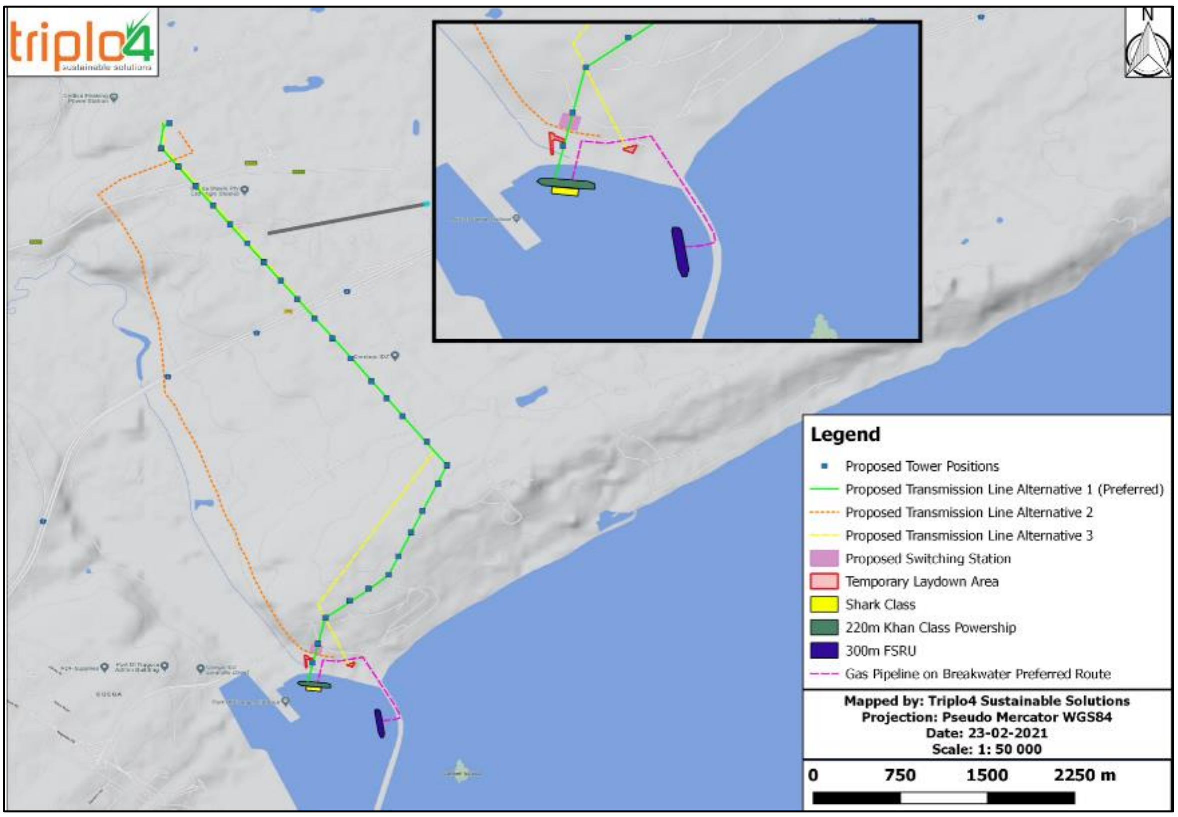


Figure 2-7: Locality Map.

The locality Map- Figure 2-6 can be located in Appendix A1. The Site Plan below provides further additional information regarding the location of the ships, gas pipeline and the transmission line. The site plan can also be located in Appendix A4.

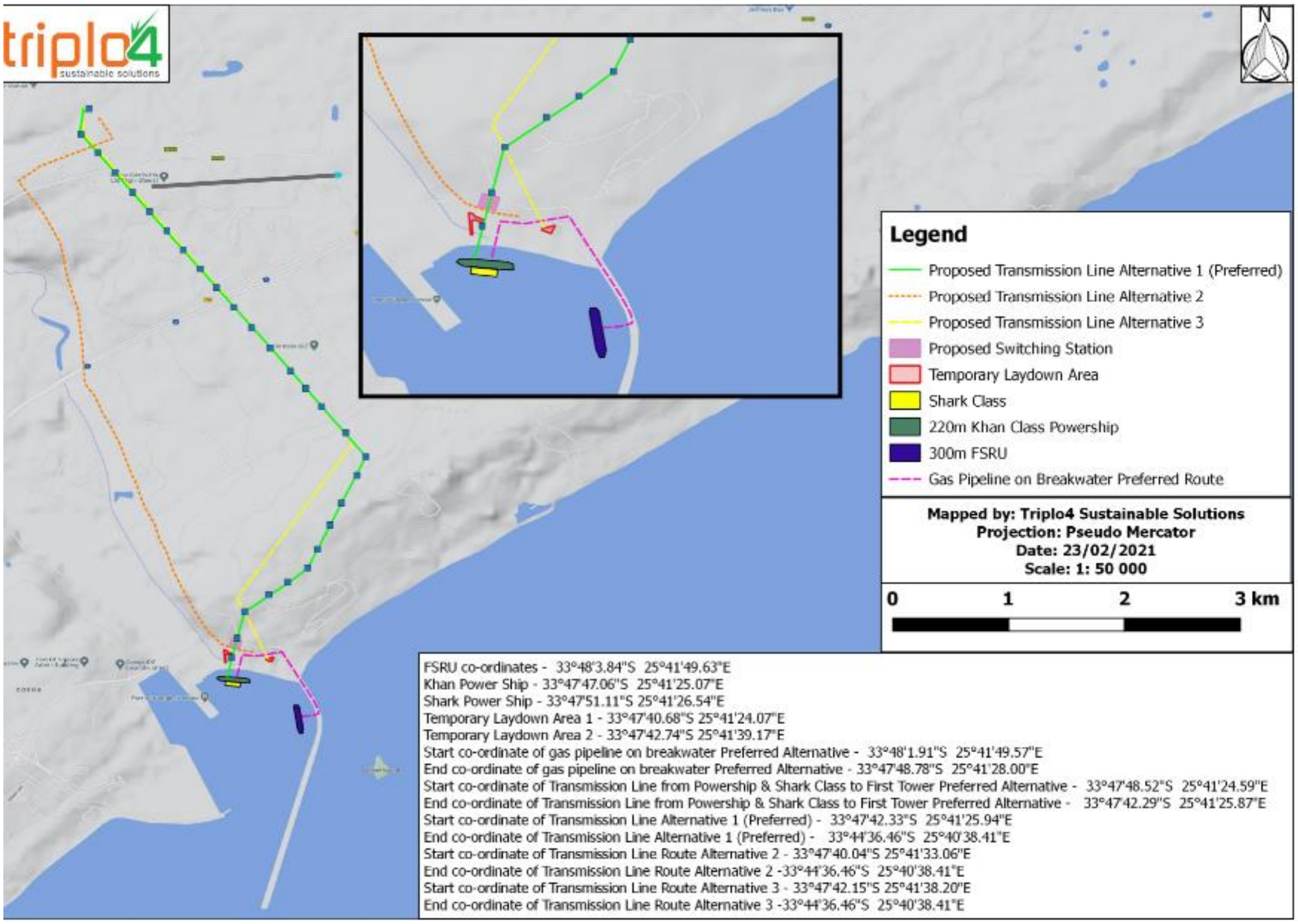


Figure 2-8: Site Plan Map.

The FSRU will be mooring against the break-water at geographical co-ordinates 33°48'3.84"S 25°41'49.63"E. The Powerships will be mooring at existing docking structures, which forms part of a minor extension of the break-water at geographical co-ordinates 33°47'47.06"S 25°41'25.07"E (Alternative 1-Preferred).

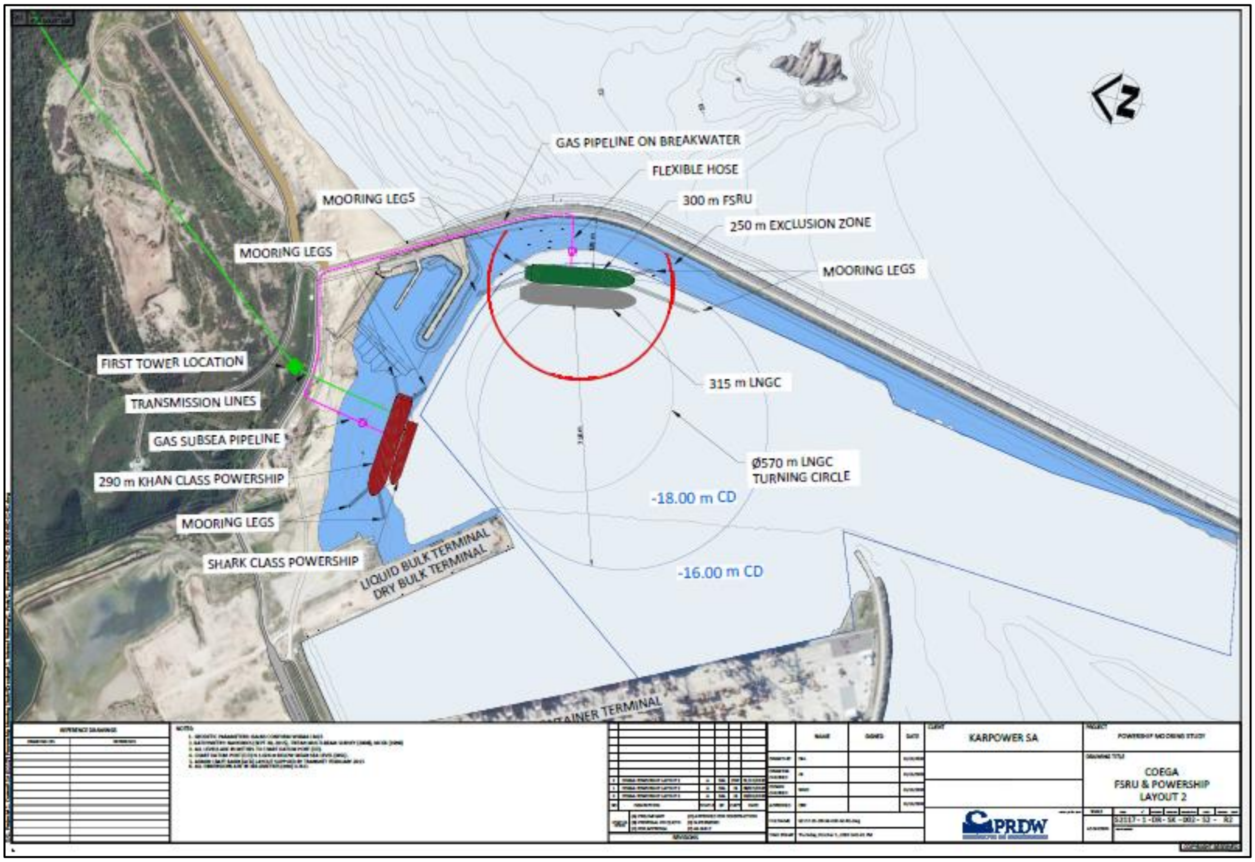


Figure 2-9: The Preferred Location and gas line route (Alternative 1).

The preferred location is situated in excess of 1km from Jahleel Island.

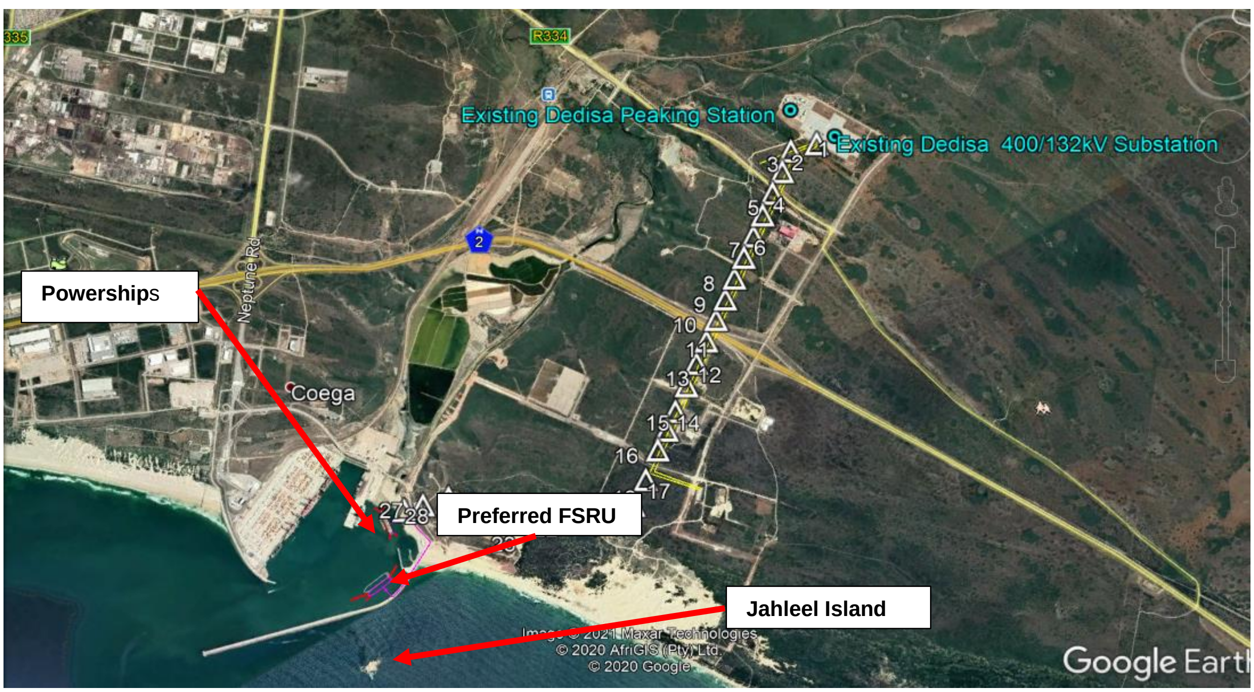


Figure 2-10: Preferred Power Evacuation Route.

Table 2-7: below show the properties description, the 21 SG codes and the central coordinates.

Properties	21 SG CODES	CENTRAL GPS-COORDINATE	
		Longitude	Latitude
RE/255	C07600230000025500000	25.699503	-33.791463
312	C07600230000031200000	25.689283	-33.778180
329	C07600230000032900000	25.693462	-33.731429
RE/342	C07600230000034200000	25.673136	-33.758690
344	C07600230000034400000	25.676882	-33.767851
351	C07600230000035100000	25.713104	-33.759756

A detailed Layout Plan, providing further additional information regarding the location of the ships, gas pipeline and the transmission line, as well as existing infrastructure within the study area, is attached as Appendix A1, in addition to alternatives maps, sensitivity map and cumulative map, all attached in Appendix A.

Refer to Chapter 3 for detailed description of the alternatives.

2.3.3 Site Access

The proposed location of the Project is situated within the existing and operational Port of Ngqura and Coega IDZ, and therefore the existing access roads network from the N2 will be used to access the Powerships site. The position of the access road is indicated in Figure 2-10 below.

Figure 2-11: Google Image showing existing access roads system to the Ngqura Port.

Figure 2.11 below show assembly area and construction site for storage of construction materials and equipment, utilizing the existing harbour arterial, past the entrance to the port.

Figure 2-12: Google map laydown areas.

<u>Coordinates for the laydown areas (approx. 5 463m^2):</u>
Temporary Laydown Area 1 - 33°47'40.68"S 25°41'24.07"E
Temporary Laydown Area 2 - 33°47'42.74"S 25°41'39.17"E

3 ALTERNATIVES

3.1 Approved site and Alternatives assessed in EIA

2014 EIA Regulations (as amended), Appendix 3 - 3(h) a full description of the process followed to reach the proposed development footprint within the approved site as contemplated in the accepted scoping report, including: (i) details of the development footprint alternatives considered;

3.1.1 The approved site

Being a ship-based power generating operation (as opposed to land-based) with transmission of energy to land-based transmission connection points, only locations that provide infrastructure associated with the proposed technology were identified.

The bulk of the Project is to be located in the Port of Ngqura which is adjacent to the Coega Special Economic Zone, originally established as an Industrial Development Zone in 1999. It falls within the Nelson Mandela Bay Metropolitan Municipality (NMBM) in the Eastern Cape Province. The Coega SEZ, is managed by the Coega Development Corporation (CDC) and the Port of Ngqura, falls under the jurisdiction of by the Transnet National Ports Authority (TNPA).

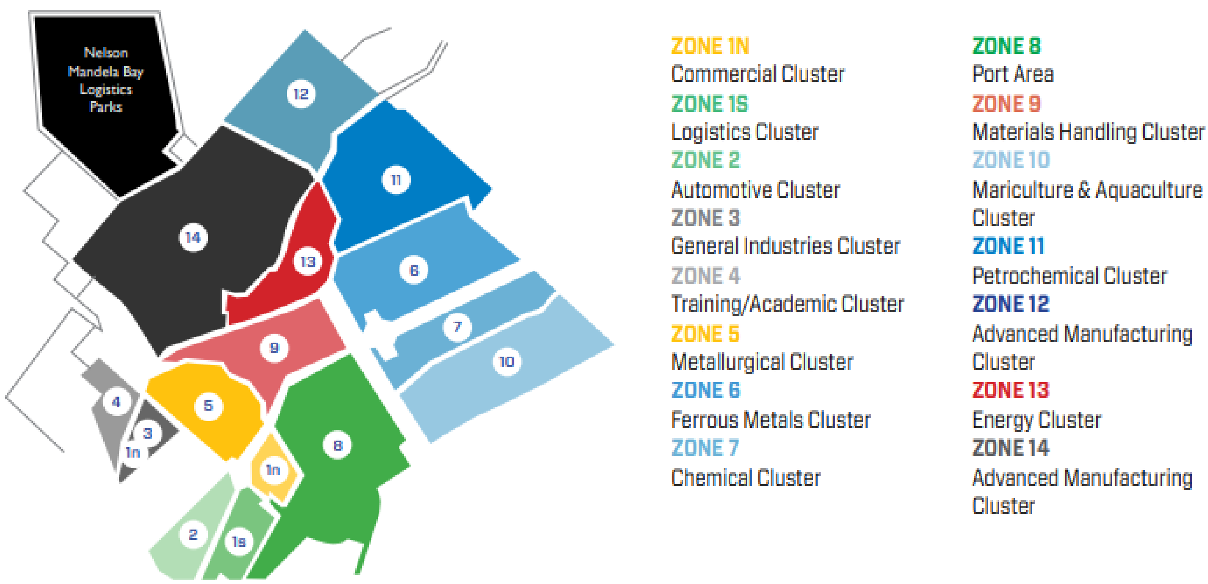


Figure 3-1: Coega SEZ Zones.

The Port and Coega SEZ create opportunities through clusters that facilitate synergy and supply chain integration. Zone 8 Port Area and Zone 13 – Energy Cluster enable the location of the proposed project as per the lay-out and provisions of the Energy Cluster.

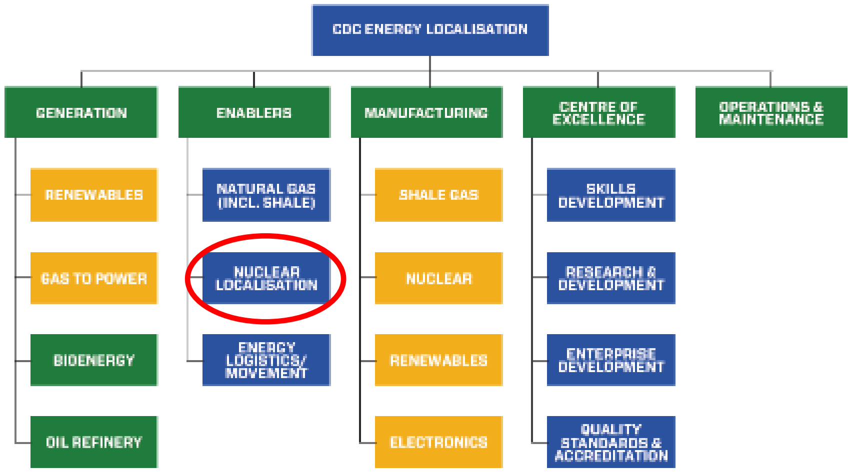


Figure 3-2: Coega IDZ Cluster Zones.

As the Coega SEZ and Ngqura Port meet the requirements for the proposed Powership Project, this is the preferred location, and no other sites within this region are proposed for this project. Other ports such as Port Elizabeth were considered and evaluated as a potential site, however it was not selected as there were navigational issues associated and for this reason the Port of Ngqura was considered. This site has been approved by DEFF in Scoping.

The following alternatives have been assessed as part of the EIA as per the plan of study for EIA accepted by DEFF at the end of the Scoping phase.

3.2 Development footprint (layout) alternatives assessed in EIA

3.2.1 Powership position alternatives within the Port

Feasible locations for the mooring of the Powerships and the FSRU were identified and assessed. The Powerships and FSRU are to be moored in the waters within the Port of Ngqura. The operational requirements at the Port cannot accommodate the use of existing berthing infrastructure and therefore the vessels will be positioned in unused areas of the port and will utilise their own mooring system comprising catenary mooring chains and anchors. The key criteria for the mooring site are sufficient space for turning the LNG carrier as well as the approach channel shared with the container terminal to allow the safe passing of other traffic including container vessels, cargo vessels and tugs, and maintain the safety exclusion zone required for the ship-to-ship transfer of the LNG to the FSRU.

Figure 3-3: Powership mooring system.

The locations selected for the mooring of the FSRU and the Powerships are existing areas of the Port that are maintained at the advertised depth by the Port Authority. The depth of the water in which the ships will be positioned is approximately 14m. There are no technical or engineering concerns around the project site topography as the elevation changes and distances are minor and there are no notable high points or depressions on the route. The main risk for the project relates to the water depth but the Port maintained water depths are deemed sufficient for the project vessels and therefore no project specific dredging is required.

No dredging is required as the mooring locations are positioned in sufficient water depth to safely accommodate the moored vessels. In the process of identification of the potential sites, the existing cargo facilities and the Port's future short-term developments were avoided.

Key factors also requiring consideration are the size of the turning circle for the LNG carrier as well as the approach channel being shared with the container terminal, i.e. traffic in basin from container vessels, cargo vessels and tugs. The Powerships need to be located aft of the approach channel entrance and outside the turning circle so as to not to impede vessel traffic movement in the port. This will keep the safety exclusion zones required for the ship-to-ship transfer from the LNG to the FSRU.

The following alternatives, with the preferred position to be also agreed with the Port Authorities, were identified and are being assessed:

- **Alternative 1** is deemed the preferred option from an engineering perspective, as the Powerships and FSRU are not located close to each other and are positioned adjacent to the break bulk quay /multi-purpose terminal. This option is to position the two Powerships adjacent to the admin craft basin and the FSRU along the eastern breakwater. Alternative 1- is the preferred as it is in line with the FSRU in the port's long term FSRU berth position plans. Figures 3-4 and 3-5 below show the alternatives for the positioning of the Powerships.
- **Alternative 2** is considered less suitable from an engineering perspective, as the Powerships and the FSRU are located too close together and would be an issue in terms of navigational aspects. This option is

to position the two Powerships closer to the liquid bulk terminal and the FSRU along the curved portion of the eastern breakwater.

The two alternatives, with the preferred position to be agreed with the Port and CDC, are illustrated in the two figures below:

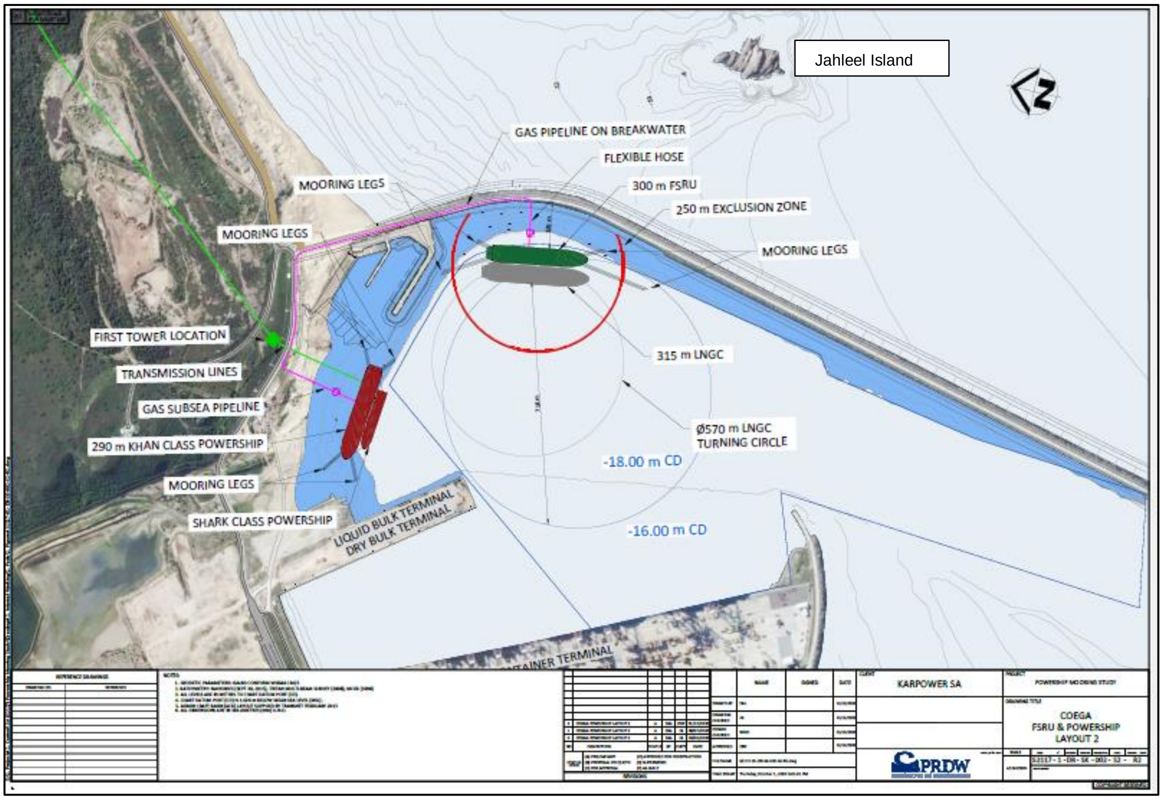


Figure 3-4: Alternative 1- Preferred: position within the port.

The preferred option above is situated in excess of 1km from Jahleel Island.

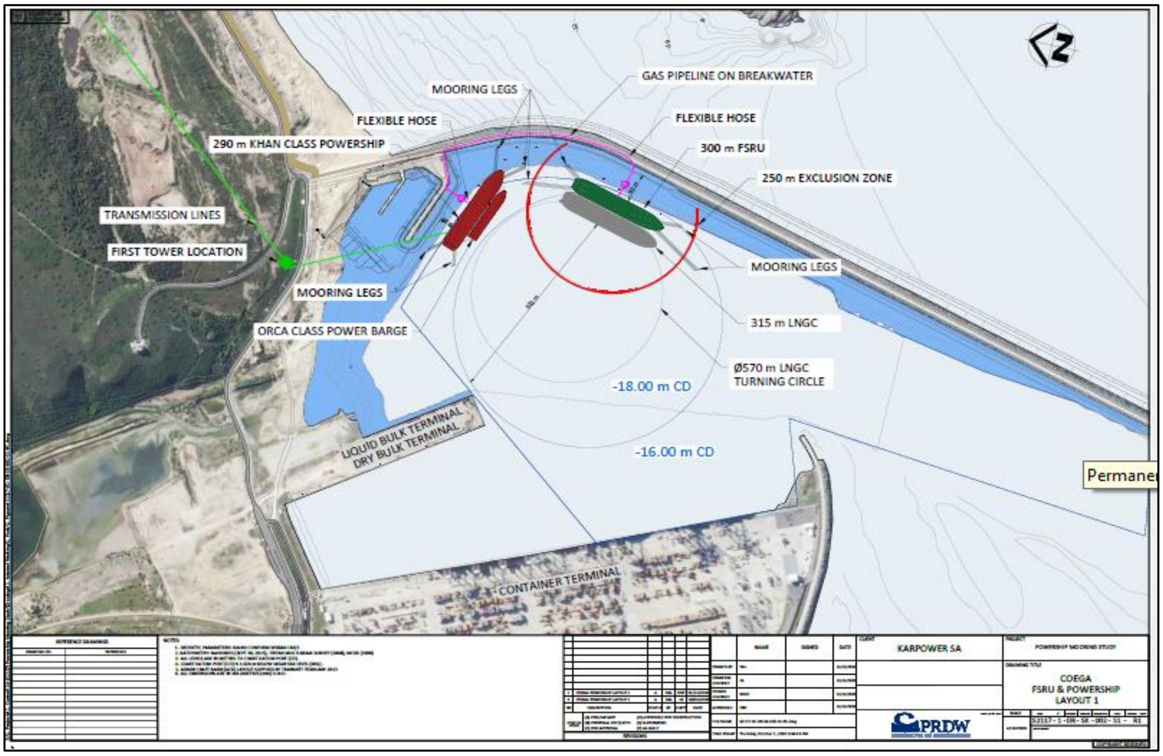


Figure 3-5: Alternative 2: position within the Port.

Size of the Powerships and FSRU:	**Size of the activity:**
Alternative1 (preferred activity alternative) and Alternative 2	Power generation (moored at port within seawater): Powerships: 19 000m² each FSRU: 29 300m²

The following table provides coordinates for the mooring of the FSRU and the Khan and Shark Classes

Table 3-1: Coordinates for the Powerships and FSRU.

Powerships and FSRU	**GPS-COORDINATE**	
	Longitude	**Latitude**
FSRU	33°48'3.84"S	25° 41'49.63"E
Powership Khan and Shark Classes Alternative 1	33°47'47.06"S	25° 41'25.07"E
Powership Khan and Shark Classes Alternative 2	33°47'55.05"S	25° 41'40.04"E

3.2.2 Gas Pipelines Alternatives

A gas line is required between the FSRU and Powerships to ensure gas supply for power generation.

The subsea pipeline from the FSRU will be installed on the seabed and through the existing revetment. The first leg of the overland pipeline will be installed on plinths above ground between the paved area of the admin craft basin and the crest of the breakwater.

The remainder of the overland pipeline will be trenched alongside the existing access road and crossing the existing entrance to the Admin Craft Basin. The subsea pipeline will be buried through the shore crossing and laid on the seabed connecting the overland pipeline to the Powerships. The horizontal and vertical alignment of the overland pipeline will take existing structures and services as well as safety aspects into consideration.

The gas pipeline connecting the FSRU to the Powerships will be routed along the edge of the existing eastern breakwater and will connect to the vessels via a flexible marine hose. The gas pipeline will likely be mounted on small footings requiring minor civil works to be constructed and installed. There are two proposed alternative routes for the gas pipeline, and these are directly influenced by the selected positions of the Powerships in relation to the position of the FSRU.

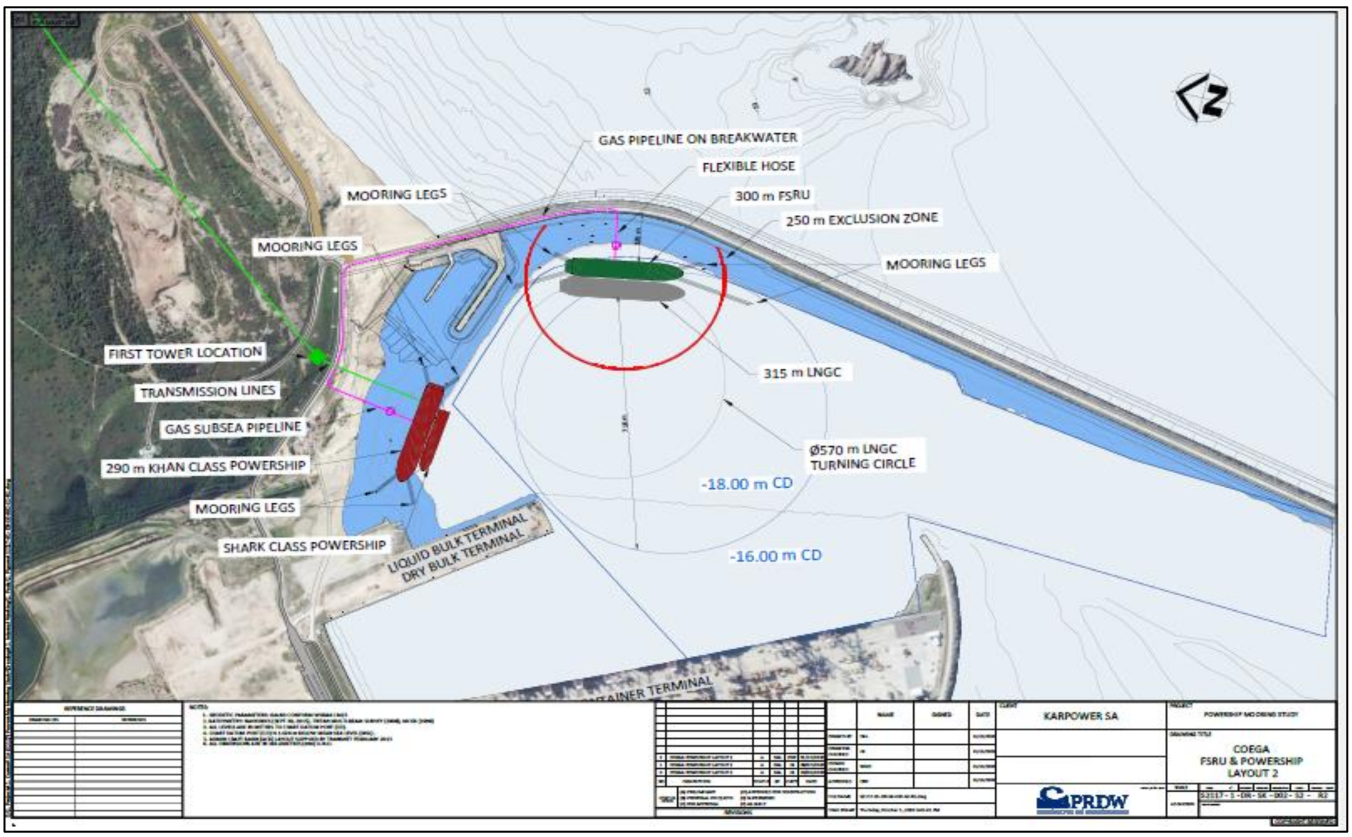


Figure 3-6: Alternative 1 – gas pipeline route (Pink Line) – Preferred.

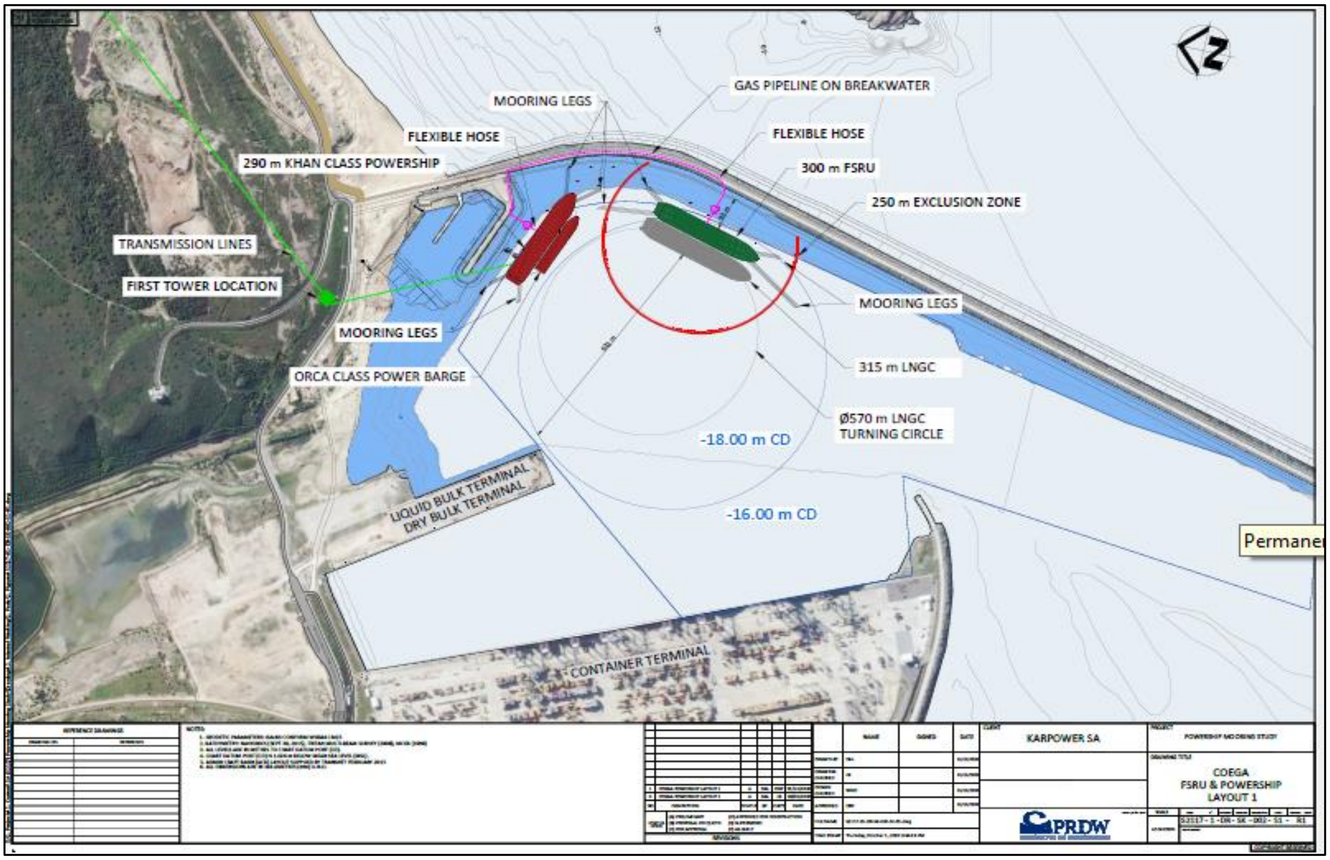


Figure 3-7: **Alternative 2 –gas pipeline (Pink Line).**

Alternative 1 of the gas pipeline route (Figure 3-6) is preferred from an engineering perspective, as it is in line with the preferred position (from an engineering design perspective) of the Powerships and the FSRU within the Port, positioning the Powerships in closer proximity to the land and the transmission line (Powerships position – Alternative 1). Alternative 2 of the gas pipeline route (Figure 3-7) is aligned to the second alternative of the Powerships positions (further from the shore) and the FSRU. Although this alternative presents a shorter gas pipeline, the position of the Powerships in relation to the shore is not supported from an engineering perspective, therefore making this alternative less feasible or preferred from a technical perspective.

Gas Pipeline Route Alternatives:	**Size of the site/servitude:**
Alternative A1 (preferred activity alternative)	1.6 km with 10m servitude= 16 000m^2 (approx.)
Alternative A2 (if any)	0.7 km with 10m servitude= 7 000m^2 (approx.)

(The proposed gas pipeline diameter is 24 inch, equivalent to approx. 60cm (600mm))

Estimated size for the temporary assembly/ laydown area for the installation of the gas pipeline is approximately 5463m^2.

Table 3-2: Coordinates for the gas pipelines' alternatives:

Subsea Gas pipeline	GPS-COORDINATE	
	Longitude	Latitude
Gas pipeline Route Alternative 1 - Start point	33°48'1.86"S	25°41'49.66"E
Gas pipeline Route Alternative 1 - End point	33°47'48.67"S	25°41'27.97"E
Gas pipeline Route Alternative 1 – mid way point	33°47'50.68"S	25°41'49.67"E
Gas pipeline Route Alternative 1 – Bend 1	33°48'1.03"S	25°41'54.95"E
Gas pipeline Route Alternative 1 – Bend 2	33°47'40.33"S	25°41'42.85"E
Gas pipeline Route Alternative 1 – Bend 3	33°47'41.03"S	25°41'29.73"E
Gas pipeline Route Alternative 2 - Start point	33°48'1.86"S	25°41'49.66"E
Gas pipeline Route Alternative 2 – End Point	33°47'53.77"S	25°41'36.68"E
Gas pipeline Route Alternative 2 – Mid way point	33°47'55.49"S	25°41'52.69"E
Gas pipeline Route Alternative 2 – Bend 1	33°48'1.03"S	25°41'54.95"E
Gas pipeline Route Alternative 2 – Bend 2	33°47'49.38"S	25°41'48.88"E
Temporary laydown area 1 (Central)	33°47'40.70"S	25°41'24.41"E
Temporary laydown area 2 (Central)	33°47'42.87"S	25°41'38.93"E

3.2.3 Transmission Lines Alternatives

The power generated by the Powerships is converted by a high voltage substation on board the Powerships and transmitted along a 132kV double circuit twin Tern overhead transmission line, approximately 7.5 km in length from Port to the Dedisa Substation, situated within both the Coega SEZ and Transnet properties.

Two transmission line alternatives were initially proposed during the Accepted Final Scoping which took into consideration engineering and Port requirements.

Alternative 1 (Preferred)

This preferred route as presented in the Accepted Scoping Report has been adjusted slightly in order to avoid a section of Bontveld set aside as conservation open space in which development is prohibited. One monopole structure is present in a small area of disturbance within this habitat type.

This option utilises overhead lines to connect the Powerships' plant to Dedisa substation at 132 kV voltage level using Twin Tern conductors at higher templating temperature rated @ 350 MVA each.

This alternative comprises:

- Extending the Dedisa132 kV busbar to accommodate an additional 132 kV feeder bay;
- Installing 2 x 132 kV feeder bays at Dedisa;
- Constructing the Saltpan 132 kV switching station onshore to connect to the HV yard in the Khan Powership via overhead lines;
- Installing 4 x 132 kV feeder bays at Saltpan switching station (approx. 105m x 105m);
- Connecting 2 x 132 kV overhead lines (about 1 km) from the Powership 132 kV yard to the Saltpan switching station; and
- Constructing 2 x 7.5 km of 132 kV double circuit Twin Tern conductor lines from Saltpan switching station to Dedisa substation.

This alternative route begins in an FEPA wetland (as per the NFEPA dataset; Nel *et al*, 2011), thereafter this route heads in a north-easterly direction and finally a north-westerly direction before reaching its end point at the Dedisa substation. With respect to the FEPA wetland, while the dataset indicates that this is a FEPA wetland, a site verification by the wetland specialists has determined that this wetland no longer exists.

The route is the preferred overhead transmission line from the Powership to the proposed switching station, as it offers a shorter route to the end point (approximately 7.5km in length with 28 monopoles). The majority of the preferred route is located in areas of low to moderate sensitivity with the location of a single monopole structure within a degraded area inside of the Bontveld set-aside within the SEZ.

Overall, this route is located in low to moderate sensitivity areas, mainly due to its location in transformed areas or in highly degraded areas adjacent to transformed areas, and a large portion of this alternative follows the route of the existing powerline servitude (yellow line in Figure 3-8). Furthermore, the Wetland specialist supports the construction and operational activities that will occur along this route. The specialist further indicates that the transmission line will not impact on the estuarine environment or the FEPA wetland. The assessment of the impacts of this alternative are presented in Section 8.

Figure 3-8: Alternative 1: Power Evacuation Route (Preferred).

Figure 3-8 as per the yellow line is the preferred amended option (Alternative 1) from an engineering perspective, therefore making this alternative feasible or preferred from a technical perspective.

Indications are that there are no space constraints around the Dedisa substation and there is sufficient space available to accommodate the required two or three 132 kV feeder bays to connect to the Powerships. However, this information will need to be confirmed by Eskom through a formal Grid Connection Application process. The connection solution to Dedisa at 132 kV voltage level with its lower connection cost and shorter implementation timeframes offers the most practical alternative.

Alternative 2

Alternative 2 as per Accepted Final Scoping Report is not supported as results from the stakeholder and specialist engagements indicated that this option was not an environmentally feasible option. Refer to Figure 3.9 below.

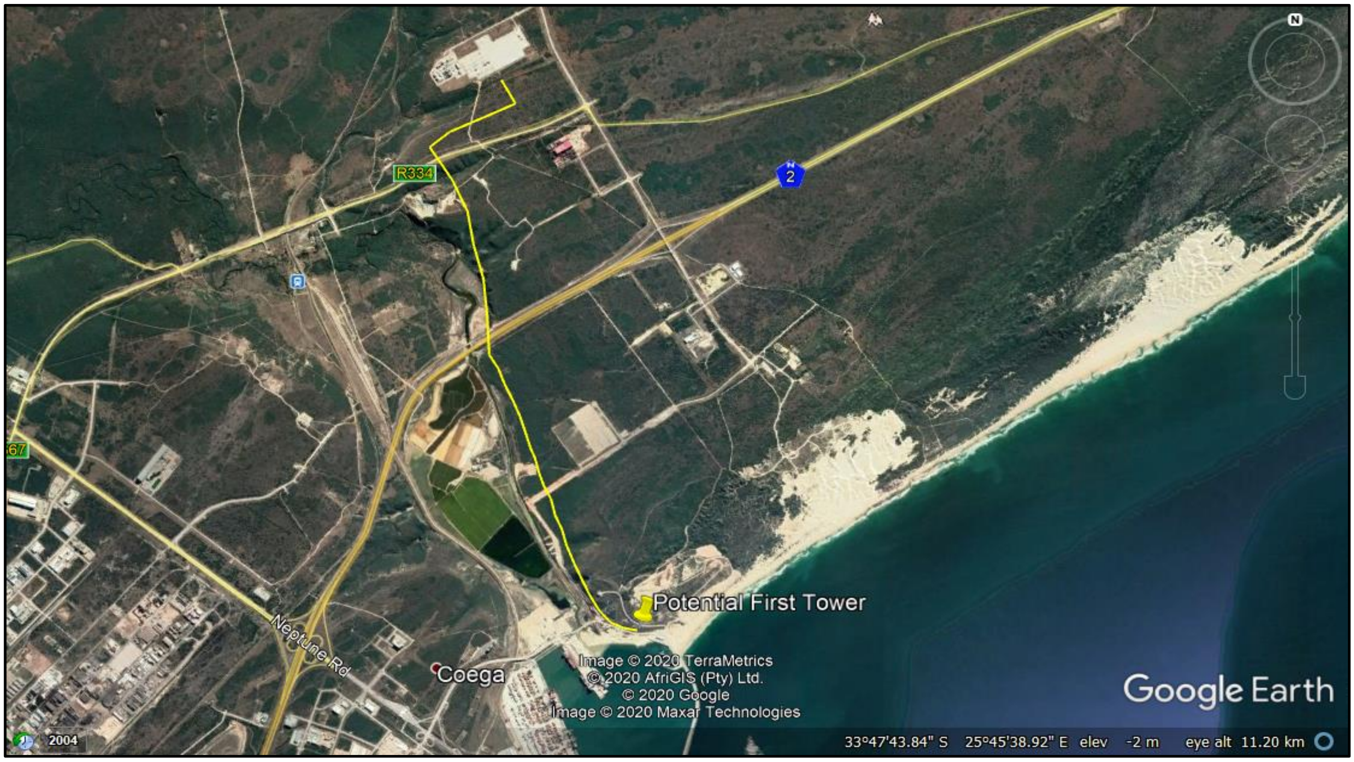


Figure 3-9: **Alternative 2 Power Evacuation Route.**

The route begins approximately 180m away from the Port of Ngqura and heads in a north-westerly direction for most of the length of the route which crosses several watercourses and adjacent to the transformed Ngqura River, thereafter a small stretch heads in a easterly direction and finally continues in a north-westerly direction before reach its end point at the Dedisa substation. The length of this powerline is approximately 6.67km in length. According to the wetland specialist it was determined at a desktop level that the aforementioned route will be detrimental to several watercourses that it will traverse and in close proximity to the FEPA River (Coega River). Thus, the potential impacts on these watercourses were considered to be too detrimental to these systems, it was therefore the wetland specialist opinion that this route to be deemed unacceptable. From an ecological perspective this route is also not favoured as it traverses some undisturbed thicket areas that form important habitats for fauna, many of which are themselves protected species.

Alternative 3

This route was originally the preferred alternative in the Accepted Final Scoping Report and went through the Bontveld set aside as conservation open space. As discussed in Alternative 1, this route was re-aligned to impose less impact on the Bontveld and natural habitats. Refer to Figure 3.10.

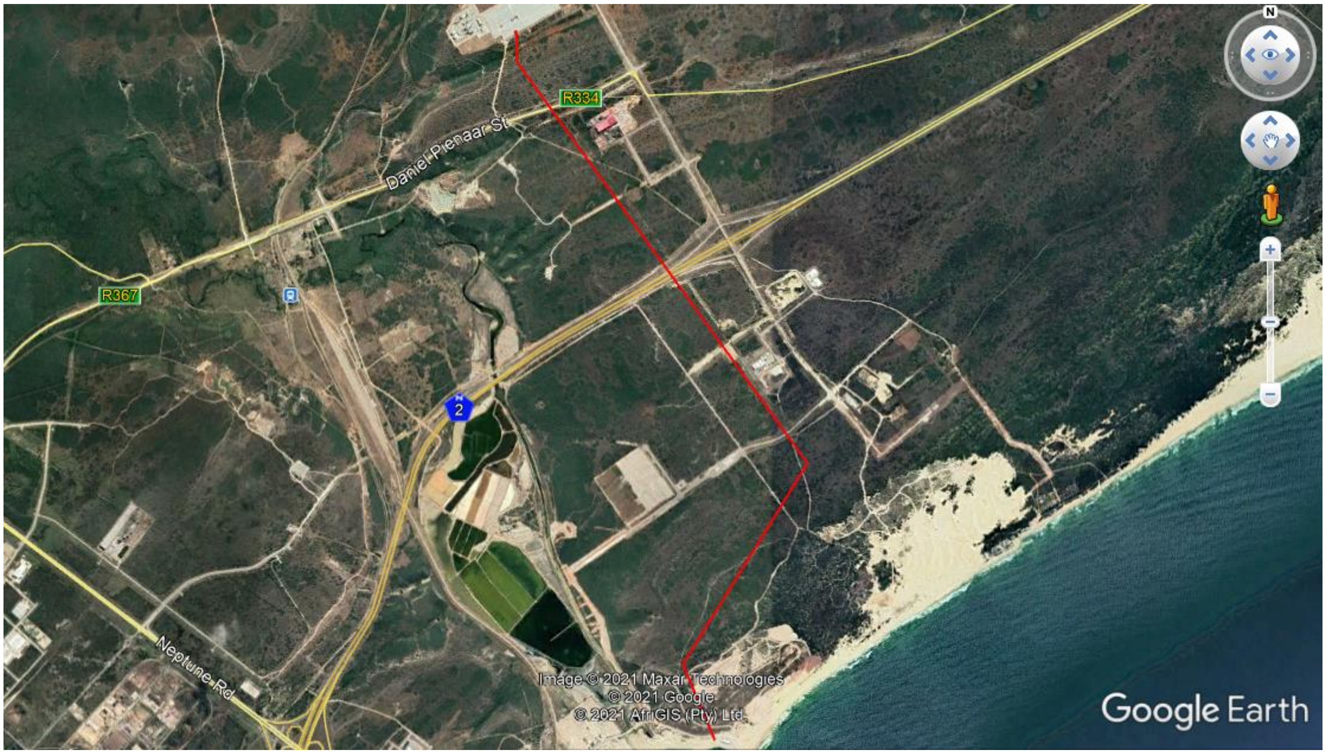


Figure 3-10: **Alternative 3: Power Evacuation Route (Preferred).**

Alternative 4

Discussions with Coega CDC indicated a possible re-routing of the 132KV transmission line to the west of the services servitude from the proposed towers 1 to 18. The CDC had no comments on the section 20 to 28 situated within Transnet's property and being surveyed with Transnet's involvement (Fig 3-11, with the alignment depicted within the red oval outline.

Figure 3-11: **Portion of the Preferred Alternative (18-28).**

The CDC Planning Department confirmed on 18 February 2021 that the alignment of the 132KV, which is the same as that previously indicated in the proposed gas to power project scoping report (2015), is best within the services servitude (towers 1 to 18) depicted on the Eastern side of the services servitude, However, subsequent to the meeting, the CDC re-iterated the preferred alignment to be located on the Western side of the services servitude, at or near the proposed gas pipeline route depicted in blue.

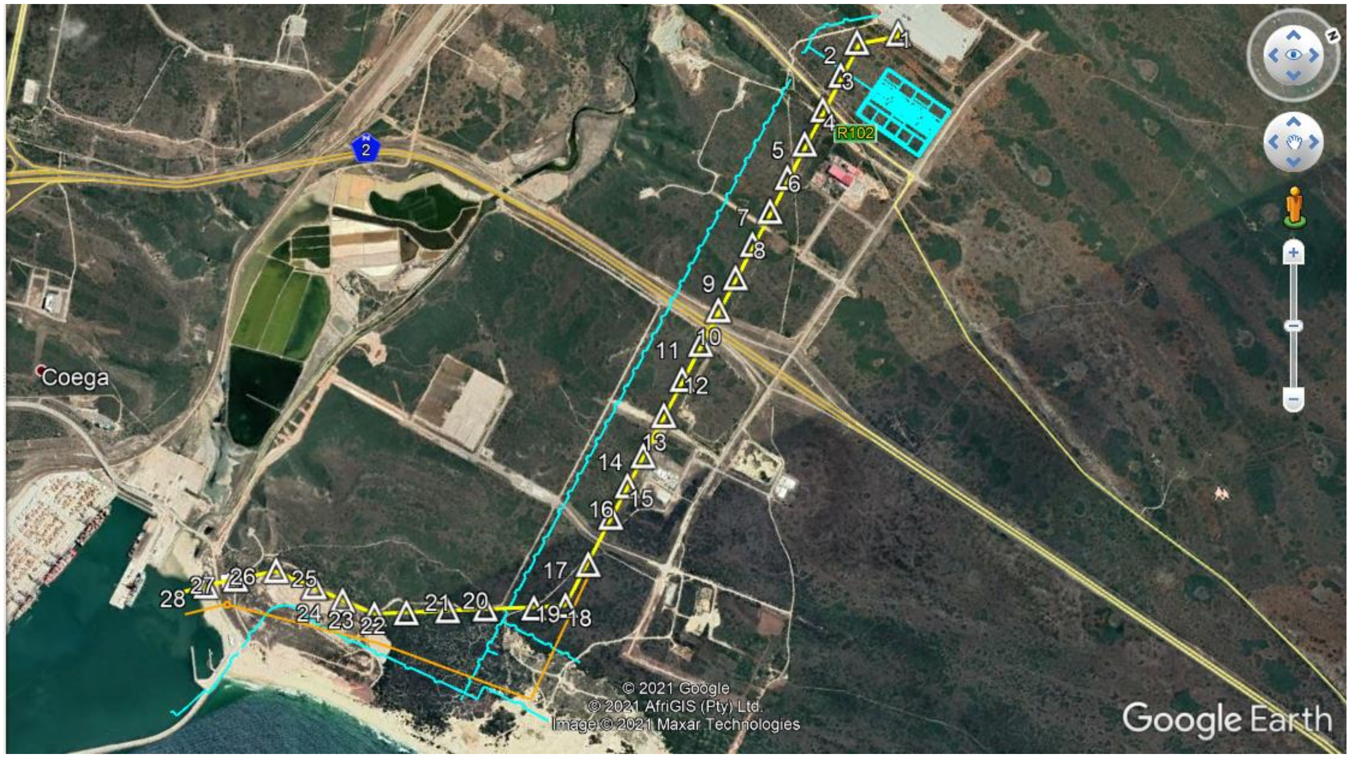


Figure 3-12: **Portion of the Alignment (1-19) requiring final CDC approval (yellow line) or specification (near the blue gas pipeline route).**

Although no specific information was received of this possible re-alignment, engagements with the specialist indicate that:

1. The change will not impact the risks assessed as the route alignment (towers 1 to 19) is either outside the Specialist's area of assessment e.g. maritime, coastal or estuarine or the impacts assessed will remain the same due to similar topographical and environmental aspects e.g. hydrology – site remains outside the 1:100 year floodline.

Hydrology	The line is outside the 1:100year flood line, therefore no risk of flooding is identified and the risk remains the same as assessed.
Geohydrology	No change from the original investigation.
Hydropedology	No expected change to the impact on flow drivers of hydropedology from the original investigation.
Coastal and Estuary	No change on the impacts as the proposed change from tower 19 within CDC is not associated with coastal or estuarine aspects.
Maritime	Change in alignment not relevant in terms of maritime impacts.

2. There will be a slight increase in risk e.g. avifaunal. This can be mitigated and mitigations were provided.

Avifaunal	From an avifauna perspective there is going to be a slight increased risk of collisions along the entire route. There is slightly more flight activity along the top of the E Reclamation / dune ridge than the preferred alternative, but flight paths are parallel to the lines until the Services Corridor. The pigtail flight diverters recommended should be used as mitigation. The new route to Dedisa just adds to the aerial obstacles but it won't change the impact assessment (Med-High to Low) as this was based on the most problematic spans which are still across the beach area. There will also be a little more dune thicket habitat loss and Bontveld fragmentation & loss inland of the N2. So the impact for habitat loss for this alternative will be the same as for Alternative 1 (Med-Low to Low). The CDC specific location will advise the requirement for an additional site assessment to confirm the ratings.
Hydrology	The existing access roads near the non-perennial streams (existing crossings) can be used when installing the pylons and putting up the electricity cables. Being a linear development, the impact in terms of hydrology on the watercourses will be marginal.

3. There will potentially be an increased risk and higher impacts e.g. wetlands and ecological. :

Ecological	The specific location of the proposed transmission route must be assessed onsite to identify the potential for impacts on the intact indigenous vegetation and especially the Coega Bontveld. This vegetation type is range restricted and of conservation concern (despite not being currently listed as a CBA on national and provincial GIS datasets). The likelihood of presence of several Species of Conservation Concern (SCC), particularly South African Red Listed species within this vegetation type is high. The CDC specific location will advise the requirement for an additional site assessment to confirm the impacts.
Wetland	The western alignment will impact more watercourses in the area and a wetland rehabilitation plan will be required for the direct impact to 1 of the water course. The CDC specific location will advise the requirement for an additional site assessment to confirm the impacts.

However, the CDC requirements i.e. establishment of the alignment on the Western Side is a feasible option and no fatal flaws are associated with this location, as the services servitude is an existing approved servitude for electrical services.

Transmission Line Route Alternatives:

	Size of the site/servitude:
Alternative 1 (Preferred Alternative)	7.5km with 30m servitude = 225 000m² (approx.)
Alternative 2	6.67km with 30m servitude= 210 000m² (approx.)
Alternative 3	7.5km with 30m servitude = 225 000m² (approx.)

(Alternative 4 was not considered as no further information has been received from Coega CDC Planning Department)

There will be approximately 28 monopoles located along the transmission line. Each monopole will cover a maximum footprint of 15m by 15m and the footprint of the monopole will be 0.6m x 0.6m to a maximum of 2.5m x 2.5m. In addition, the proposed monopoles towers will include bird friendly measures as part of the designs.

Both alternatives will include the establishment of a switching station, with an approximate footprint of 105m x 105m = 11 025m²

The table below show the GPS co-ordinates for the of the start and end points of the transmission lines – from the powerships (as per Alternative 1,2,3,4) to the start point, as well as from the start point to the end point (Alternative 1, Alternative 2 and Alternative 3).

Table 3-3: Coordinates for the Transmission line, including alternatives.

Transmission line	**GPS-COORDINATE**	
	Longitude	**Latitude**
From powership (Khan Class) to First Tower Alternative 1 – Start point	33°47'48.21"S	25°41'24.57"E
From powership (Khan Class) to First Tower Alternative 1 – End point	33°47'42.26"S	25°41'25.87"E
From powership (Shark Class) to First Tower Alternative 1 – Start point	33°47'51.06"S	25°41'24.89"E
From powership (Shark Class) to First Tower Alternative 1 – End point	33°47'42.26"S	25°41'25.87"E
From powership (Khan Class) to First Tower Alternative 2 – Start point	33°47'48.21"S	25°41'24.57"E
From powership (Khan Class) to First Tower Alternative 2 – End point	33°47'40.03"S	25°41'33.05"E
From powership (Shark Class) to First Tower Alternative 2 – Start point	33°47'51.06"S	25°41'24.89"E
From powership (Shark Class) to First Tower Alternative 2 – End point	33°47'40.03"S	25°41'33.05"E

From powership (Khan Class) to First Tower Alternative 3 – Start point	33°47'48.21"S	25°41'24.57"E
From powership (Khan Class) to First Tower Alternative 3 – End point	33°47'42.23"S	25°41'38.22"E
From powership (Shark Class) to First Tower Alternative 3 – Start point	33°47'51.06"S	25°41'24.89"E
From powership (Shark Class) to First Tower Alternative 3 – End point	33°47'42.23"S	25°41'38.22"E
Transmission Line Route – Alternatives 1– Start point	33°47'48.21"S	25°41'24.57"E
Transmission Line Route – Alternatives 1– End point	33°44'37.16"S	25°40'38.53"E
Transmission Line Route – Alternatives 2– Start point	33°47'40.03"S	25°41'33.05"E
Transmission Line Route – Alternatives 2– End point	33°44'37.16"S	25°40'38.53"E
Transmission Line Route – Alternatives 3– Start point	33°47'42.23"S	25°41'38.22"E
Transmission Line Route – Alternatives 3– End point	33°44'37.16"S	25°40'38.53"E
Transmission Line Route Alternative 1 – mid-way point	33°46'5.74"S	25°41'45.86"E
Transmission Line Route Alternative 2 – mid-way point	33°46'27.55"S	25°40'47.48"E
Transmission Line Route Alternative 3 – mid-way point	33°46'5.74"S	25°41'45.86"E
Transmission Line Route Alternative 1 (bend 1)	33°47'27.01"S	25°41'30.71"E
Transmission Line Route Alternative 1 (bend 2)	33°47'11.85"S	25°41'51.67"E
Transmission Line Route Alternative 1 (bend 3)	33°46'34.50"S	25°42'11.19"E
Transmission Line Route Alternative 1 (bend 4)	33°44'46.24"S	25°40'35.55"E
Transmission Line Route Alternative 2 (bend 1)	33°47'33.66"S	25°41'18.47"E
Transmission Line Route Alternative 2 (bend 2)	33°46'10.40"S	25°40'36.97"E
Transmission Line Route Alternative 2 (bend 3)	33°45'2.15"S	25°40'14.91"E
Transmission Line Route Alternative 2 (bend 4)	33°44'47.51"S	25°40'46.19"E

Transmission Line Route Alternative 3 (bend 1)	33°47'22.42"S	25°41'28.18"E
Transmission Line Route Alternative 3 (bend 2)	33°46'30.27"S	25°42'6.93"E
Transmission Line Route Alternative 3 (bend 3)	33°44'46.24"S	25°40'35.55"E

3.2.4 **No-go option**

The option of not implementing the activity is also referred to as the "No-go" alternative. In respect of the Project, it would mean that the existing status quo would prevail and that no additional power using this particular technology will be generated and transmitted for inclusion into the energy grid in the Nelson Mandela Bay Metropolitan Municipality in particular. Please refer to Chapter 8 for the assessment of the No-go option.

4 DESCRIPTION OF THE ENVIRONMENT

2014 EIA Regulations (as amended), Appendix 3- 3 (1)- (h) (iv) the environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;

4.1 BIOPHYSICAL ENVIRONMENT

4.1.1 Eco-Region

The proposed development falls into the South Eastern Coastal Belt (20) Level 1 Ecoregion (Kleynhans et al., 2005). Level 1 ecoregions are derived primarily from terrain and vegetation, along with altitude, rainfall, runoff variability, air temperature, geology and soil. The description of this ecoregion can be broken down into the following main characteristics:

- Mean annual precipitation: Moderate to high.
- Coefficient of variation of annual precipitation: Low to moderate.
- Drainage density: Low to medium.
- Stream frequency: Low/medium to medium/high in limited areas.
- Slopes <5%: >80% but significant areas <20%.
- Median annual simulated runoff: Moderate to very high.
- Mean annual temperature: Moderate to moderately hot.

Table 4-1: Detailed characteristics of the South Eastern Coastal Belt (20) Level 1 Eco-region

Main Attributes	Description
Terrain Morphology: Broad division (dominant types in bold) (Primary)	Plains; Low Relief (limited); Plains Moderate Relief; Closed Hills; Mountains; Moderate and High Relief
Vegetation types (dominant types in bold) (Secondary)	Dune Thicket; Mesic Succulent Thicket; Valley Thicket; Xeric Succulent Thicket Coastal Grassland; Eastern Thorn Bushveld; Grassy Fynbos (limited); Mountain Fynbos; South and South West Coast Renosterveld; Afromontane Forest;
Altitude (above mean sea level – a.m.s.l)	0-500; 500-1300 limited
MAP (mm)	300 to 1000
Coefficient of Variation (% of annual precipitation)	<20 to 40
Rainfall concentration index	<15 to 30
Rainfall seasonality	All year to very late summer, to winter
Mean annual temp. (°C)	12 to 20

Mean daily max. temp. (°C): February	22 to 30
Mean daily max. temp. (°C): July	12 to 22
Mean daily min. temp. (°C): February	10 to 18
Mean daily min temp. (°C): July	2 to 10
Median annual simulated runoff (mm) for quaternary catchment	10 to >250

(Triplo4 Sustainable Solutions- Wetland Delineation and Functional Assessment, 2020)

4.1.2 Climatic Conditions

Local air and sea temperatures are measured at Port of Ngqura. The monthly maximum mean and minimum values of the air and sea temperatures are tabulated in the table below.

Table 4-2: Monthly air and sea temperatures measured at the Port of Ngqura.

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Water*	Max	16.0	17.9	18.3	19.0	17.7	16.3	16.1	16.3	16.6	16.9	18.2	19.1	17.5
	Mean	14.5	16.9	17.1	18.7	17.4	16.1	15.9	16.2	16.4	16.2	17.5	18.2	16.9
	Min	13.6	16.2	16.3	18.4	17.1	15.9	15.7	16.0	16.3	15.3	16.9	17.4	16.5
Air	Max	25.5	26.2	25.5	24.4	23.1	21.6	21.4	21.3	21.4	22.1	23.6	24.4	23.4
	Mean	21.4	22.0	20.6	18.8	16.9	14.7	14.2	14.6	15.4	17.2	18.9	19.9	17.9
	Min	17.4	17.8	15.6	13.2	10.6	7.8	7.0	7.8	9.3	12.3	14.2	15.4	12.4

The data is also shown graphically below:

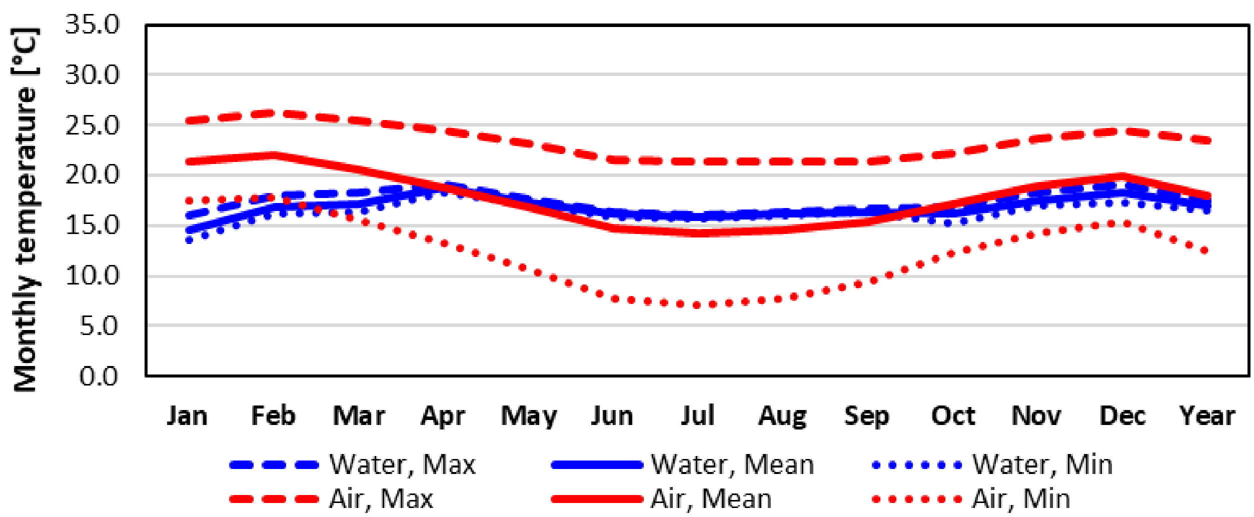
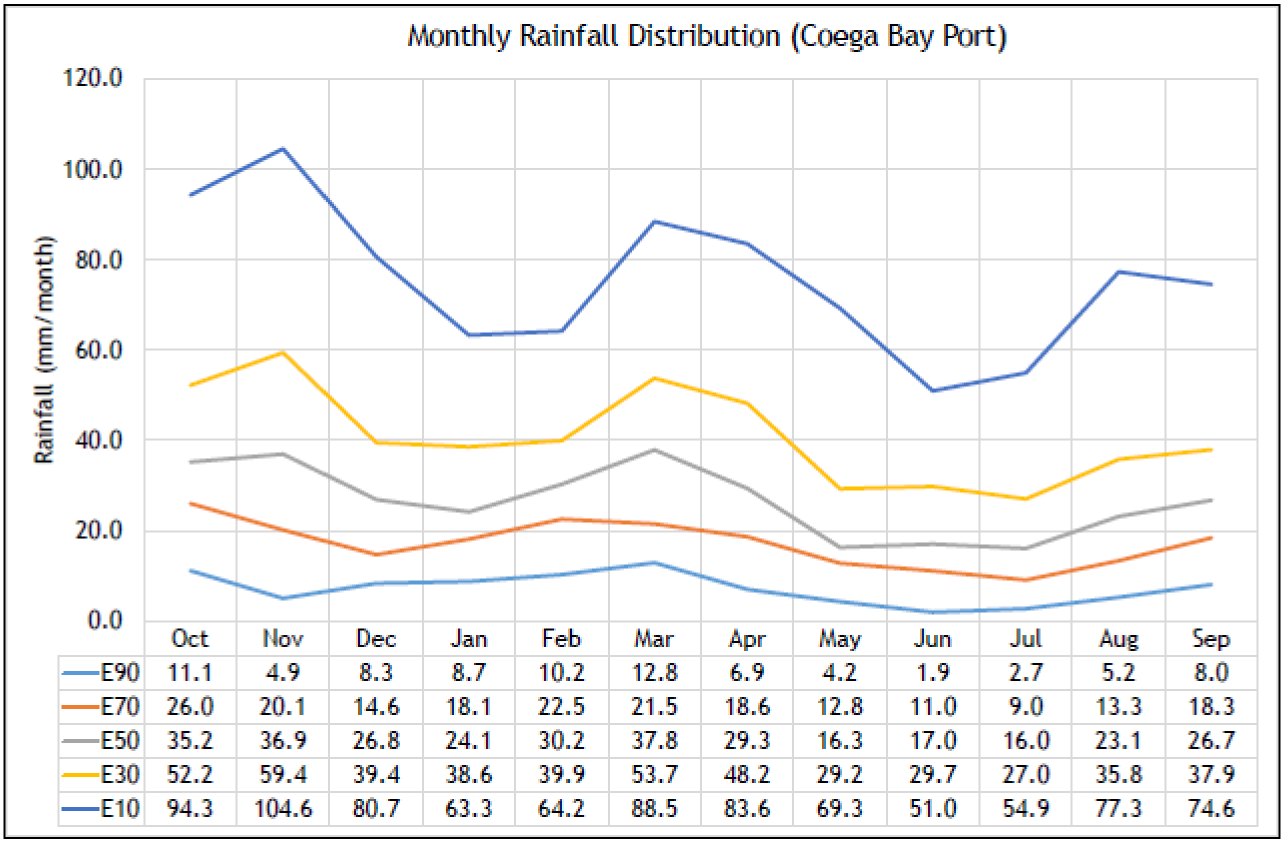


Figure 4-1: Monthly air and sea temperatures measured at Port of Ngqura.

Mean Annual Precipitation (MAP) and Mean Annual Evaporation (MAE) for the study area, obtained from WR2012, are 434 mm and 1 550 mm, respectively. Since evaporation is significantly higher than rainfall, there will be a net loss of water from the surface. The catchment falls within a summer rainfall area where peak rainfall occurs in November (Figure 4-1).



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
E90	11.1	4.9	8.3	8.7	10.2	12.8	6.9	4.2	1.9	2.7	5.2	8.0
E70	26.0	20.1	14.6	18.1	22.5	21.5	18.6	12.8	11.0	9.0	13.3	18.3
E50	35.2	36.9	26.8	24.1	30.2	37.8	29.3	16.3	17.0	16.0	23.1	26.7
E30	52.2	59.4	39.4	38.6	39.9	53.7	48.2	29.2	29.7	27.0	35.8	37.9
E10	94.3	104.6	80.7	63.3	64.2	88.5	83.6	69.3	51.0	54.9	77.3	74.6

Figure 4-2: Monthly rainfall evaporation distribution for the M30B quaternary catchment

(GCS- Hydrology Assessment, 2020)

The wind regime for Algoa Bay in relation to Port of Ngqura is dominated by westerly and north-westerly flow fields representing the pre-frontal conditions, and south-westerly flow fields representing the frontal conditions. The south-easterly and south-westerly wind flow increases during the daytime while westerly and north-westerly wind flow regimes increase during the night.

4.1.3 Geology and Soils

According to 3324 Port Elizabeth-1:250 000 Geological map series (DMEA, 1991) the local geology at the site is characterised by quaternary sands and sandy consolidated sediments associated with the Sondagsriver Group, associated with the Port of Ngqura (refer to Figure 4-3)- The map below can be located in Appendix I4- Geohydrological Assessment.

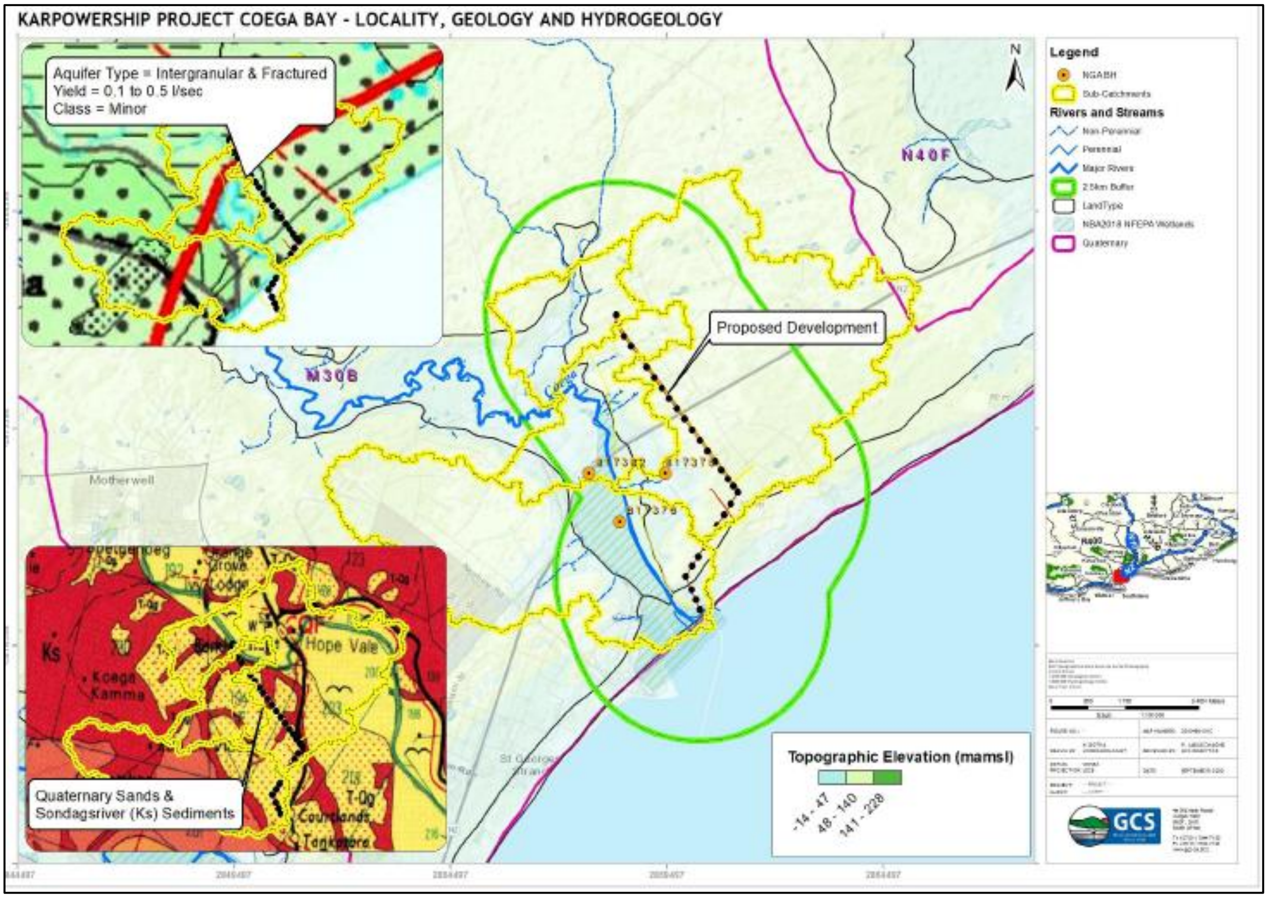


Figure 4-3: Site locality, local geology and hydrogeology.

(GCS- Geohydrological Assessment, 2020)

The soil textures within the study area range from sandy clay in the watercourses to sandy in the catchment areas. The entire study area is recorded to contain soils that display characteristics associated with C class soils (Schultze et al., 2010). These soils are calculated to exhibit a moderately high runoff potential with a slow infiltration rate and restrictive permeability. According to Schultze (1992), soils within the C class have a moderate erosion potential factor of 0.46, indicating that these soils exhibit a moderate level of sand content, are not entirely easily detachable but can encourage high rates of surface runoff, dependent on the surface roughness of the area.

The Algoa Basin is the most complex half-graben basin, with fully developed graben structures, horst blocks and diagonal faults (Coega and Commando Kraal Faults) cutting the horsts (Lourens, 2013). The Sundays River Formation overlies the Kirkwood Formation and attains a maximum thickness of approximately 1 863 m consisting of grey clays, siltstone and sandstone. The sandstones of the Sundays River Formation are fine-to medium-grained and less porous and permeable than the sandstones of the Kirkwood Formation.

According to the Land types of South Africa database (ARC, 2006), the soils in the area predominantly consist of Mispah, Clovelly and Hutton soil forms, associated with the Fc369 land type.

4.1.4 Water Recourses

4.1.4.1 Groundwater

Literature suggests that the electrical conductivity (EC) for the underlying aquifer generally ranges between 70 – 300 mS/m (milli Siemens/metre) and the pH ranges from 6 to 8. This means that groundwater abstracted from the aquifer can generally be used for domestic and recreational use (DWAF, 1998), but maybe slightly saline.

The aquifers underlying the site consist out of unconsolidated and consolidated sand, underlain by competent rock (sandstone) of the Uitenhage Series. The aquifer has a low to medium hydraulic conductivity (K-value) and porosity (n-value). The aquifer present is classified as a Minor Aquifer system (Parsons, 1995). Hence, the aquifer is not targeted for groundwater production. Two (2) aquifer systems are present:

- An unconfined aquifer associated with the unconsolidated sands; and
- A confined and fractured aquifer network associated with deeper and older Uitenhage Series.

The aquifer underlying the terrestrial portion of the site can be considered a low yielding aquifer (King, Maritz, & and Jonck, 1998), with reported yields ranging from 0.1 to 0.5 l/sec (Class-B2 aquifer).

According to DWAF (2006), the groundwater depth on a quaternary scale is in the order of 25.8 mbgl. WRC (2015) and NGA (2015) data suggest that the groundwater table ranges from 1 to 26 mbgl, for the sub-catchment associated with the development site (refer to Figure 4-4 and Table 3-1). Shallower groundwater levels will typically be associated with low lying areas surrounding the Coega River, or areas where clay lenses occur (i.e. perched groundwater). Literature further suggests that the groundwater table mimics the surface topography.

The site is situated in Quaternary Catchment M30B of the Mzimvubu-Tsitsikamma (DWS, 2016) Water Management Area (WMA).

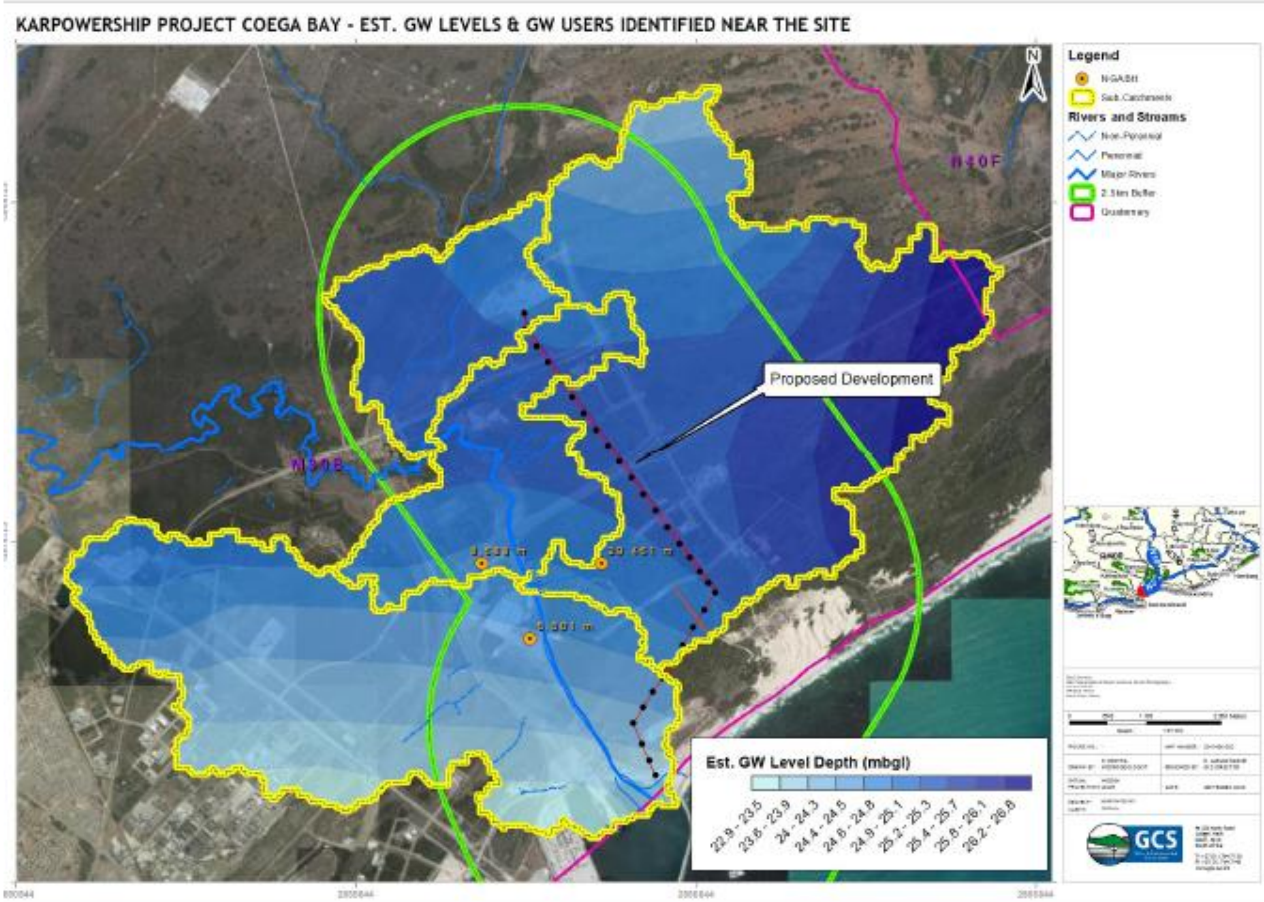


Figure 4-4: Estimated Groundwater Levels & Groundwater Users.

(GCS- Geohydrological Assessment, 2020)

Five (5) NGA boreholes are situated within the combined boundary of the sub-catchments. Assuming a median aquifer yield of 0.1 l/sec, an existing use in the order of 43.2 m³/day is assumed.

The site conceptual geohydrological model for the site is shown in Figure 4-5 below.

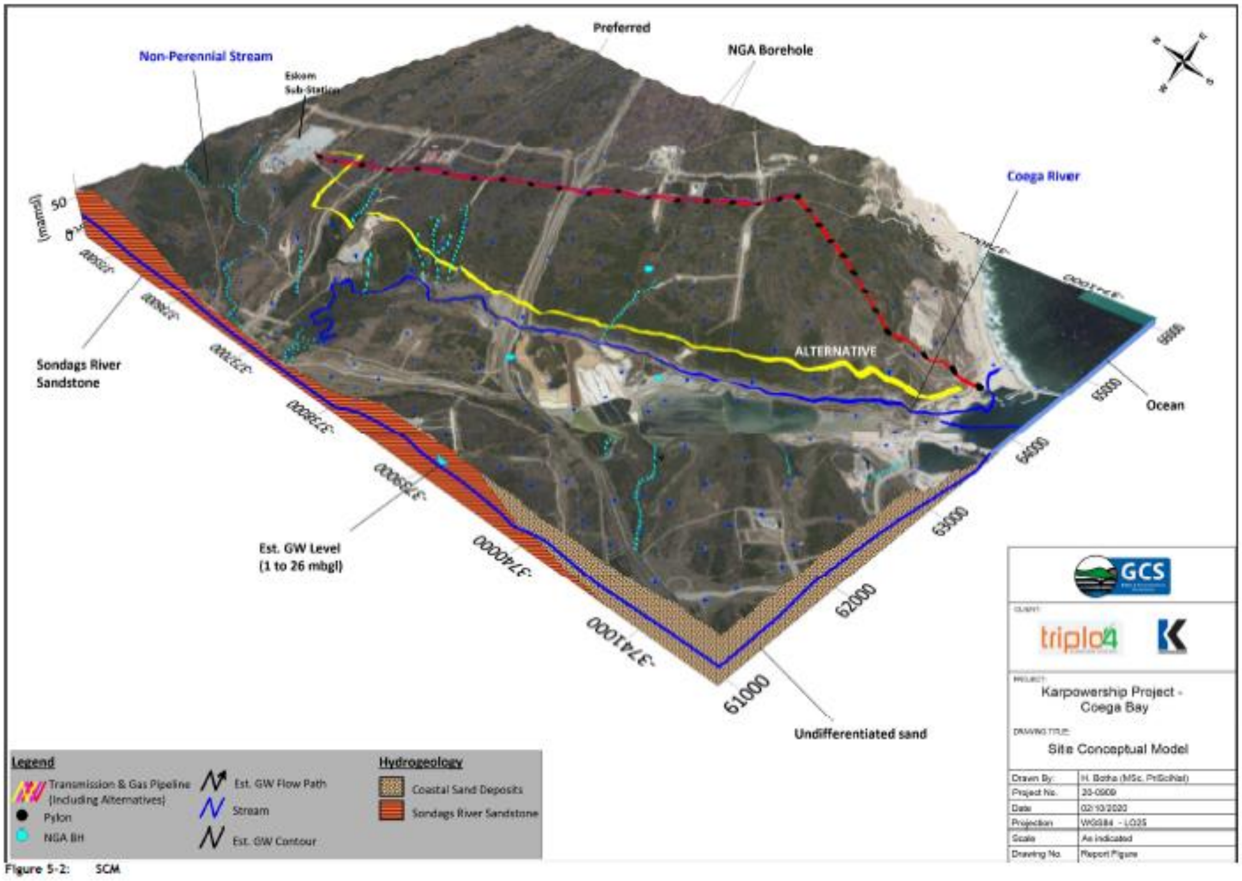


Figure 4-5: Site conceptual geohydrological model for the proposed transmission lines.

(GCS- Geohydrological Assessment, 2020)

4.1.4.2 Water Management Areas

The site is situated in Quaternary Catchment M30B of the Mzimvubu-Tsitsikamma (DWS, 2016) Water Management Area (WMA 7).

Four (4) sub-catchments were delineated for the project area, and describes the natural drainage of the area (i.e. the proposed transmission crosses several drainage lines). The site is bound to the west by the Coega River (approx. 1.5 km downstream). Several non-perennial (ephemeral) streams drain the site (with the preferred transmission line route falling outside these streams). Elevations on the site typically range from 0 to 60 metres above mean sea level (mamsl).

The aforementioned WMA is drained by several parallel rivers which flow in an easterly direction and eventually discharge into the Indian Ocean. The rivers which contribute to the highest flow within this WMA are the Fish, Kowie, Boesmans, Sundays, Gamtoos, Kromme, Tsitsikamma and Groot rivers with several smaller coastal rivers that feed the aforementioned larger rivers (Net el al., 2011). Refer to Figure 4.6 below.

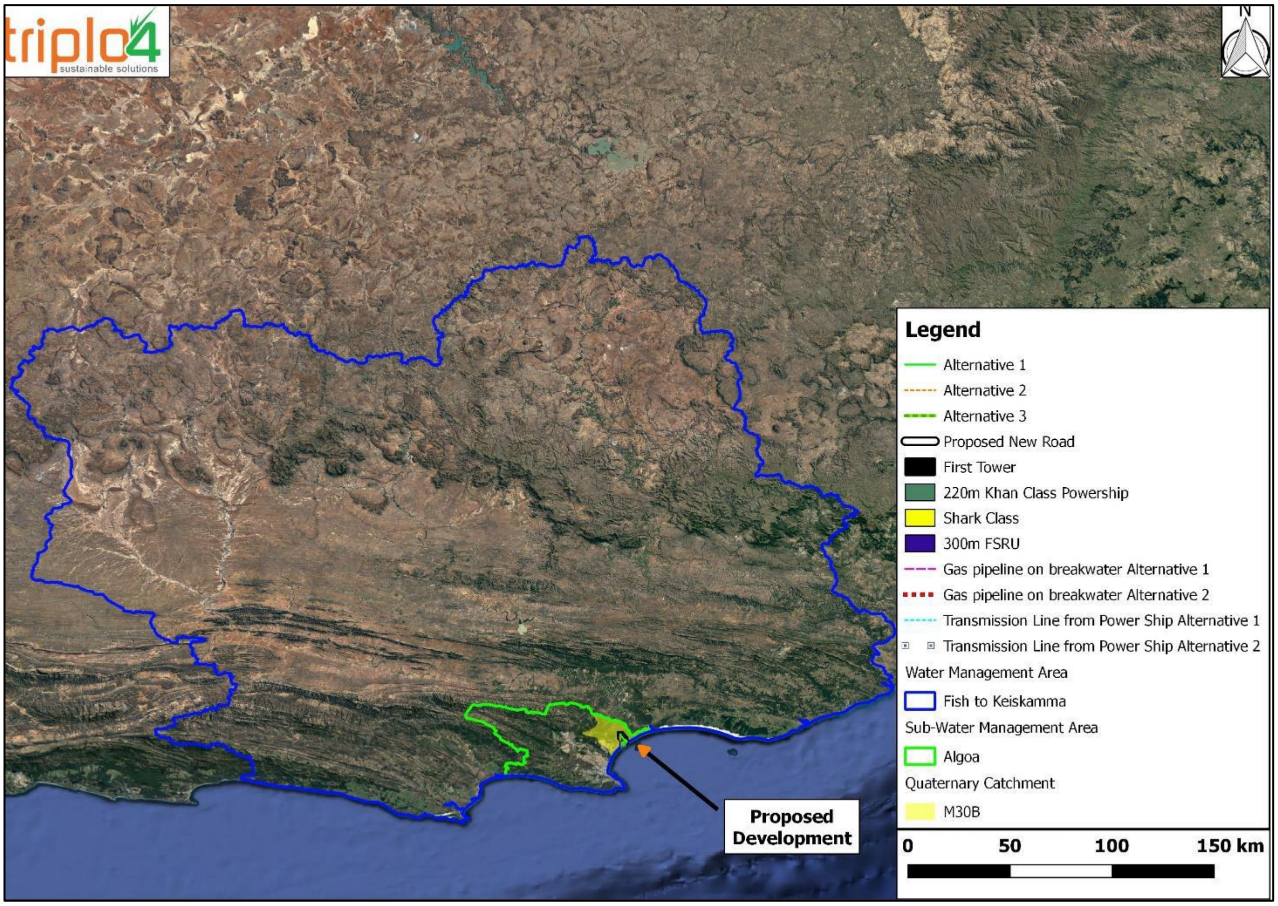


Figure 4-6: Map of the WMA, sub-WMA and Quaternary Catchment that fall within the proposed development.

4.1.4.3 Wetlands and Watercourses

The National Freshwater Ecosystem Priority Areas

The National Freshwater Ecosystem Priority Areas (or NFEPA), are a selection of rivers, wetlands and estuaries which have been identified as systems of strategic importance to the hydrological functioning of South Africa. These systems have been identified using scientific methodologies as well as consensus amongst researchers, government entities and the general public (Nel et al., 2011).

According to the NFEPA dataset, historically a FEPA natural valley floor wetland would have been at risk as a result of the proposed development (Nel et al., 2011). However, due to the construction of the Ngqura Port, the aforementioned wetland does not exist anymore and it is currently dredged Port area. Refer to Figure 4-7 AND THE Wetland Assessment in Appendix I7.

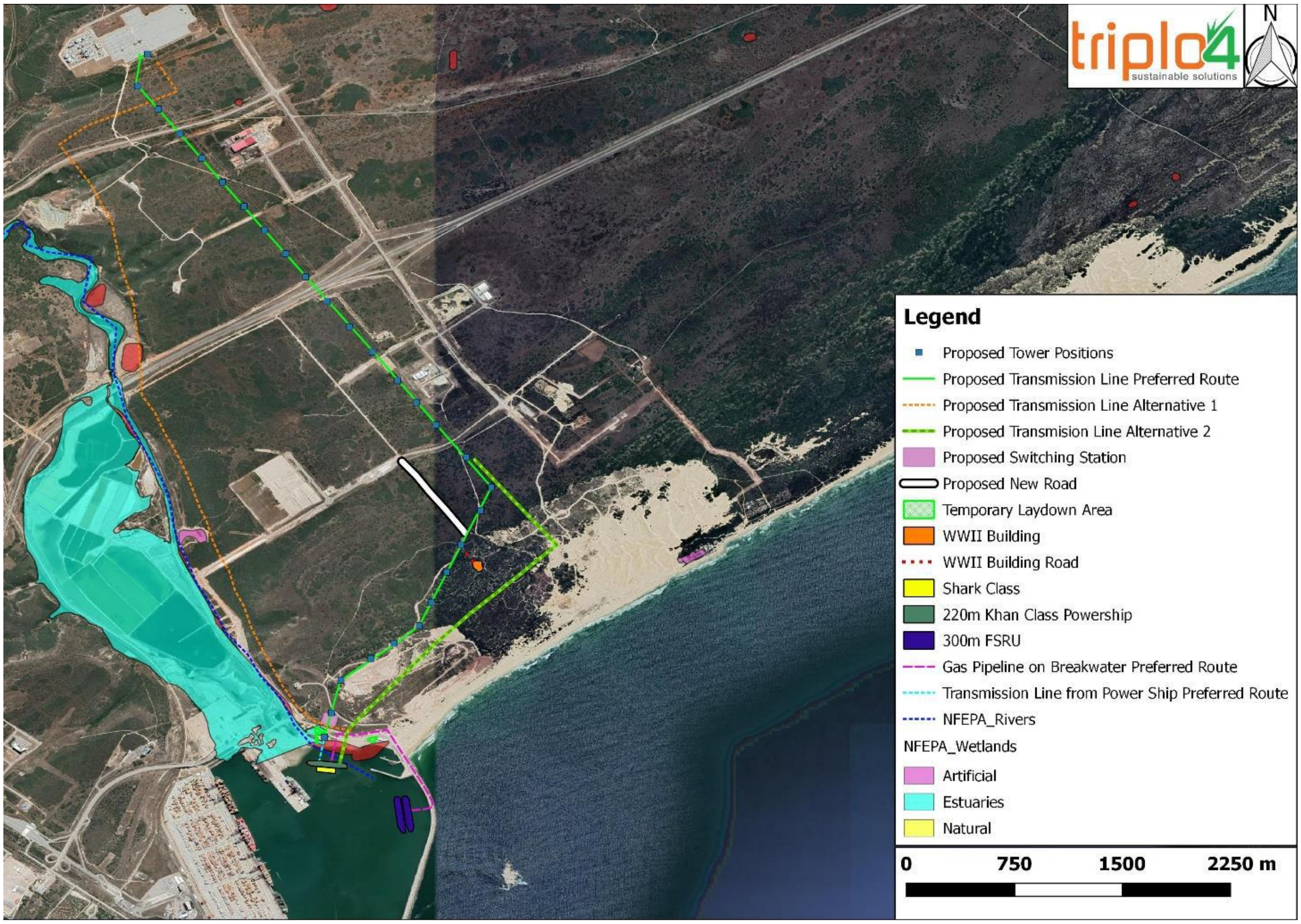


Figure 4-7: Map of the FEPA Rivers and Wetland in relation to the proposed development, from the NFEPA dataset.

Wetland Delineation

The watercourses within the study area were identified at a desktop level, classified and delineated in-field and subsequently mapped utilising GIS (QGIS 2.14 and Google™ Earth Pro) and available spatial data. Figure 4.8 below demonstrate the delineated watercourses identified within the study area during the field assessment.

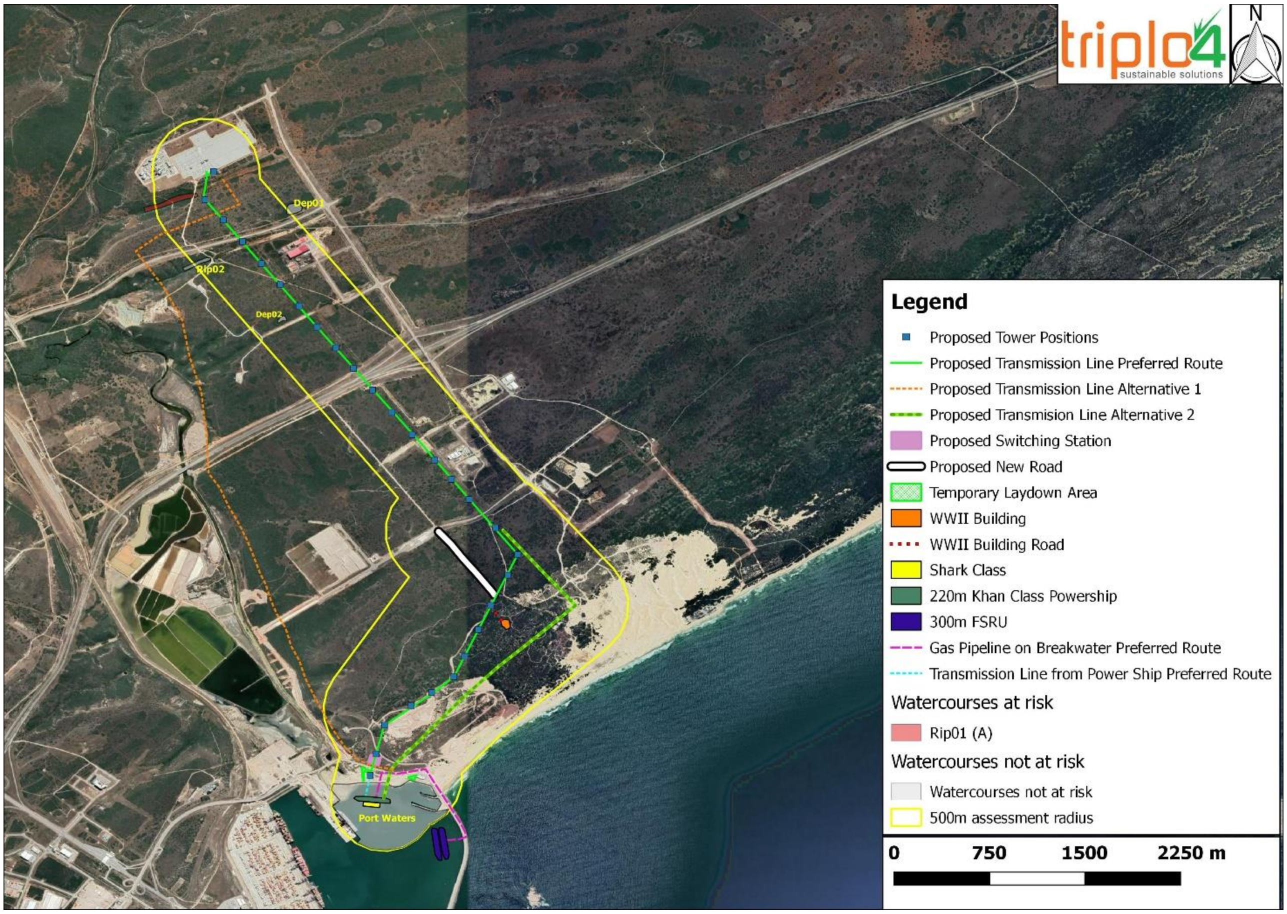


Figure 4-8: Map representing the watercourses and their regulated buffers in relation to the proposed development.

Wetland Delineation (Regulated Buffer around Delineated Watercourses)

As requested by the Eastern Cape regional office of Department of Water and Sanitation regulated buffer around delineated wetlands are required. In order to better understand potential impacts on watercourses within 500m of the proposed development, a regulated buffer as per the National Water Act was placed around each individual watercourse found within 500m of the proposed development and additional watercourses were delineated to better understand the hydrodynamics of these systems. Figure 4-9 below demonstrates the identified watercourses within the proposed development 500m assessment radius and their respective regulated buffers.

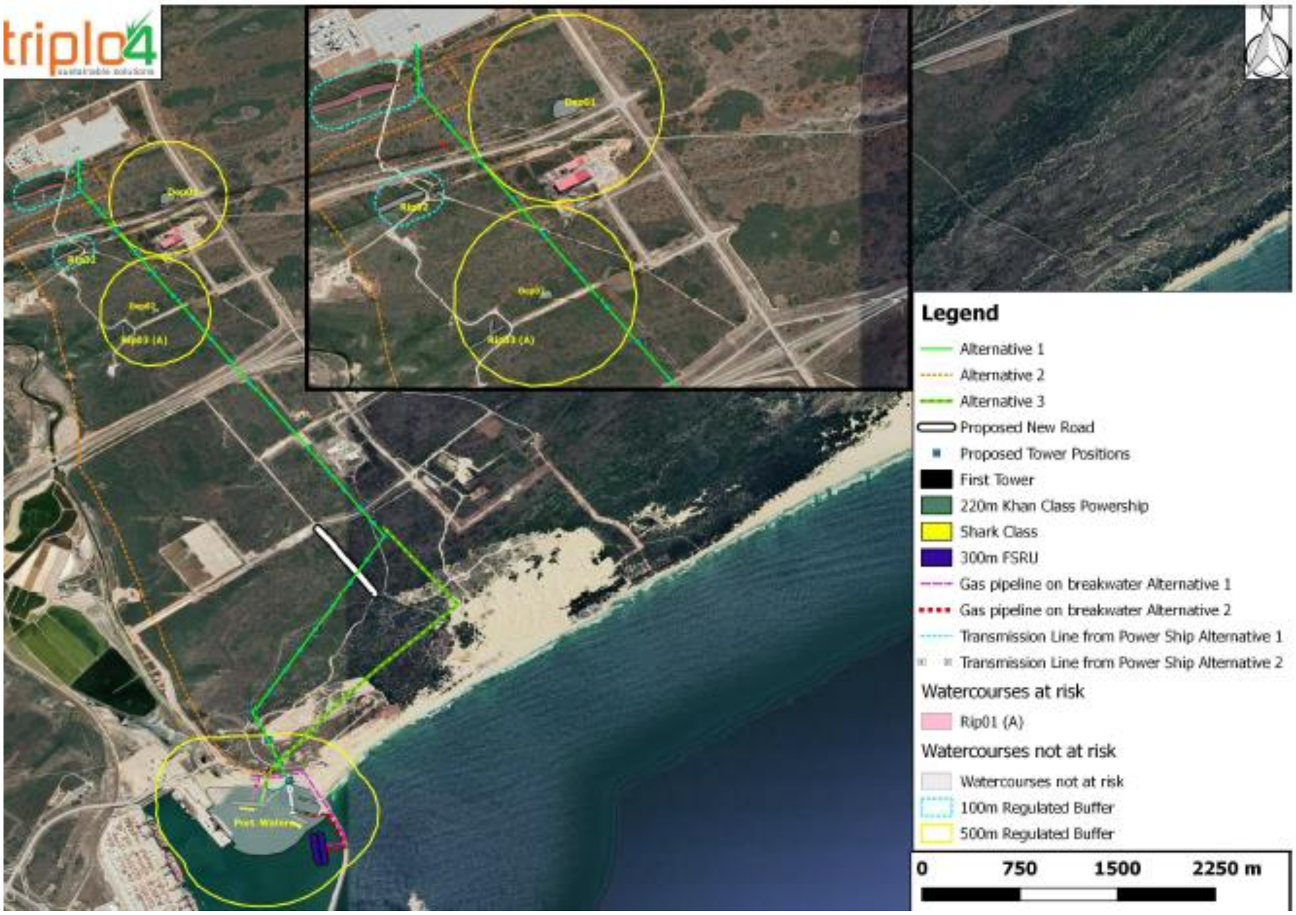


Figure 4-9: Map representing the watercourses and their regulated buffers in relation to the proposed development.

Aquatic Assessment

Desktop information was obtained from DWAF (2013), for the sub quaternary reach (SQR) (M30A-08796) on the Coega River system, which may potentially be affected by the proposed development. The reach spans 72.92 km. The reach is heavily affected by canalization of the river, weirs, roads and bridges which significantly impacted on the instream habitat, water flow, habitat continuity in respect of aquatic invertebrates and fish. Riparian areas have been impacted by agriculture and alien plant infestation. In the lower reaches the estuary has been impacted by salt works, affecting physico-chemical conditions (water quality). Please refer to Table 4-3.

Table 4-3: Present Ecological Status for the Coega River SQR M30A-08796.

Synopsis for SQR M30A-08796 (Coega River)					
Present Ecological State		Ecological Importance		Ecological Sensitivity	
D (Largely Modified)		High		Very High	
Variable	Status	Variable	Status	Variable	Status
Modifications to Instream Habitat Continuity	Large	Fish species per sub quaternary catchment	12	Fish Physicochemical sensitivity description	High

Modifications to Riparian/Wetland Zone Continuity	Serious	Invertebrate taxa per sub quaternary catchment	13	Fish No-flow sensitivity description	High
Modifications to Riparian/Wetland Zones	Serious	Habitat Diversity Class	Very High	Invertebrate Physicochemical sensitivity	High
Potential instream Modifications	Large	Instream Migration Link Class	Moderate	Invertebrate velocity sensitivity	Very High
Potential Flow Modifications	Moderate	Riparian-Wetland Zone Migration Link	Low	Stream size sensitive to modified flow/water level changes description	High
Potential Physicochemical Modifications	Large	Instream Habitat Integrity Class	Moderate	Riparian-wetland Vegetation intolerance to water level changes description	Low

(GCS- Preliminary Aquatic Assessment, 2020)

4.1.5 **Fauna and Flora**

4.1.5.1 Vegetation types

According to Mucina and Rutherford, there are four vegetation types within the Karpowership site: Sundays Thicket (AT 6), Coega Bontveld (AT 7), Algoa Dune Strandveld (AZs 1) and Cape Seashore Vegetation (AZd 3). In this case, the vegetation mapped by Mucina and Rutherford (2018) and STEP is true to the vegetation on the ground. The Coega OSMP also increases the detail of the mapping of the area of mesic succulent thicket and, to a lesser extent, bontveld of the site. Overall, over 150 plant species were recorded from the site, with other species yet to be identified (Terrestrial Ecological Assessment, 2021).

Some Species of Conservation Concern (SCC) recorded from the site include over 35 species of succulent, many of which are protected. There is also a presence of (over 20 individuals) population of Euphorbia obesa. Aliens occur throughout the site, primarily due to disturbance occurring as part of the Industrial Development of the area. Some recorded species include Opuntia ficus-indica and Acacia longifolia.

4.1.5.2 Critical Biodiversity Area

According to the Eastern Cape Biodiversity Conservations Plan (ECBCP), the study site is located primarily within CBA1 or CBA2 (Preliminary Terrestrial Ecological Assessment, 2020). This, according to guidelines, falls within Biodiversity Management Classes (BLMC 2): Near Natural Landscapes and should be managed to maintain biodiversity in near natural state with minimal loss of ecosystem integrity with no transformation of natural habitat permitted (Terrestrial Ecological Assessment, 2021). Subtropical Thicket Ecosystem Programme (STEP) Conservation status shows that most project area and both preferred and alternative routes are situated in a Currently Not Vulnerable area, and this area can withstand some development. However, a portion of both routes is located in a Vulnerable area and a section of the alternative route is located within a Critically Endangered area. Limited development can occur within Vulnerable areas but absolutely no development should be considered in Critically Endangered areas (Terrestrial Ecological Assessment, 2021).

The study area is located outside of any Threatened Ecosystems but Albany Alluvial Vegetation, an Endangered ecosystem is located within 5km of the site (Terrestrial Ecological Assessment, 2021). The closest protected area is the Addo Elephant National Park Marine Protected Area which includes Saint Croix Island off the coast less than 5km away from the study site (Preliminary Terrestrial Ecological Assessment, 2020). The Algoa Bay Islands: Addo Elephant National Park IBA is located within 5km of the site, just offshore (Terrestrial Ecological Assessment, 2021).

Table 4-4: Criteria used to map CBAs and other categories in the ECBCP.

Category	Code	Features used to define categories
Protected Areas:		
Protected Area 1	PA1	Statutory protected areas. They include all national parks and provincial nature reserves.
Protected Area 2	PA2	Non-statutory protected areas: municipal and private conservation areas.
Terrestrial Critical Biodiversity Areas		
Terrestrial CBA 1	T1	Critically endangered vegetation types (ecosystems) identified through ECBCP the systematic conservation assessment
		Critically endangered vegetation types from STEP
		Critically endangered forest patches in terms of the National Forest Assessment
		Areas essential for meeting biodiversity targets for biodiversity features (SA vegetation types, expert mapping priority areas)
		KZN systematic conservation planning priorities
		Forest clusters identified as critical in the forestry planning process.
Terrestrial CBA 2	T2	Endangered vegetation types identified through the ECBCP systematic conservation assessment
		Endangered vegetation types from STEP
		Endangered forest patches in terms of the National Forest Assessment
		All expert-mapped areas less than 25 000ha in size (includes expert data from this project, STEP birds, SKEP, Wild Coast, Pondoland and marine studies)
		All other forest clusters (includes 500m buffers)
		1km coastal buffer strip
	C1	Ecological corridors identified in other studies (e.g. from STEP, Wild Coast, Pondoland, WMA 12 AEA, etc.) and corridors mapped by experts.
	C2	Ecological corridors identified by the ECBCP using an integrated corridor design for he whole province.

4.1.6 Estuarine and Marine Environment

4.1.6.1 Estuarine Environment

The Port of Ngqura was developed at the mouth of the Coega Estuary (33°47'43.58", 25°41'16.47"E) and commenced operations in 2009. The estuary itself has seen extensive modifications and ecological degradation from its natural condition due to its historical conversion into a commercial saltworks, and consequently very little natural estuarine habitat remains. The estuary and the old Coega Saltworks Facility are located on land that falls within the Port of Ngqura and within the IDZ (CSIR, 2015). The facility was vacated in 2008 and in 2015, a Basic Assessment process was undertaken for the demolition of the facility and associated unused infrastructure and structures within the port boundaries (CSIR, 2015). The long-term Port Development Framework Plan (cited in CSIR, 2015) provides for the future development and expansion (dredging/excavating, deepening and widening) of the port up the Coega Estuary channel, as far as the N2 road bridge, with the remaining upper reaches of the system discharging directly into the harbour environment.

The proposed Gas to Power project in the Port of Ngqura will be located at/ in close proximity to the Coega Estuary mouth on the east side of the jetty.

<u>Coastal Environment</u>

The Port of Ngqura in the Coega area is a relatively modern port and is the only port in South Africa to have been subjected to environmental legislation throughout its design, construction and operational phases. The broader area has been subjected to substantial beach erosion in the past, largely due to intentional vegetation of headland bypass dunes at Cape Recife with alien invasive species historically, and by the construction of a sewage works within the dune field. Sediment management aspects were therefore at the forefront of the environmental agenda when the port was designed and authorised (Petterson, 2019).

Like most ports located along relatively straight, sandy coastlines, Ngqura effectively blocks the natural eastward littoral drift causing severe sediment accretion to the west of the port and beach erosion to the east. Beyond the beach impact, dune fields fed by windblown sand from the beaches also exhibit sedimentary changes. In the long term, accretion on the western end of the port will increase along the wall until sediment is bypassed and fills the harbour mouth by wave transport, with sediment supply to the dune field that would naturally run behind/through the port building up until the port was bypassed. Maintenance of this port therefore requires constant removal of dune sands and constant dredging of the harbour mouth.

A condition of the environmental authorisation for construction of the port was for a sediment pump system to be installed that mimics littoral drift. A minimum of 240 000 tonnes of sediment is therefore moved per annum via the pump system from the western side of the port to the eastern side thereby mimicking littoral drift (Petterson, 2019). The proposed infrastructure falls within the port area that is entirely cut off from littoral drift.

<u>Estuarine Delineation</u>

In the context of the Coega Estuary, little remains of the natural connectivity between the critically modified core estuarine area due to the Coega Saltworks and the critically modified coastline as a result of the Port development. The inclusion of a ‘default’ surf zone in the EFZ is thus not representative of the modern state of the system, with hydrological connectivity spatially and temporally restricted to the mouth dynamics.

Figure 4-10: Geographical boundaries of the Coega estuarine functional zone as delineated by the 5m topographical contour in red, and the 10m topographical contour and marine extension in blue (Image source: Google Earth, 2021).

Catchment Characteristics, Surrounding Land-use and Vegetation types

The catchment of the Coega River is predominantly undeveloped and rural in nature, with agriculture activities occurring along the river course. Along the coastal strip, the landscape is highly modified as a result of the historical development of the Coega Saltworks and expansive clearing of natural vegetation for agriculture, the more recent port development, and active development projects taking place within the Coega IDZ. A wind-farm currently consisting of two turbines, and the La Farge Quarry are located eastwards of the estuary, above the N2.

At a regional level, the biodiversity of the NMBM is particularly rich in comparison to other parts of South Africa, as it is located within two globally recognised biodiversity hotspots, namely, the Cape Floristic Region and the Maputaland- Pondoland-Albany Centre of Endemism. The NMBM also contains five of South Africa's nine biomes (SRK, 2014). The Coega Estuary and its surrounds is located within the Albany Thicket Biome.

At a catchment level, the dominant vegetation comprises Sundays Valley Thicket, with Sundays Doringveld and Motherwell Karroid associated with the Coega River valley (SRK, 2014; SANBI, 2018). These vegetation types also characterise the upper reaches of the Coega Estuary, with pockets of dense alien vegetation. Much of the Coega Estuary is surrounded by Sundays Valley Thicket and Grass Ridge Bontveld further afield. Along the coastline, Algoa/ St Francis Dune Thicket and Cape Seashore Vegetation occur on either side of the Port and estuary mouth (SRK, 2014; SANBI, 2018). The Coega Estuary, the drainage lines that flow into the upper reaches, and much of the landscape to the west, is classified as primary Critical Biodiversity Areas (CBA1) and that to the east is classified as secondary Critical Biodiversity Areas (CBA2), for the most part (SRK, 2014). The topography of the area is variable comprising the incised Coega River channel, the level floodplain, which is occupied by the Coega Saltworks, palaeodune ridges located to the west of the estuary and recent dunes along the coastline. Several deeply incised drainage lines enter into the upper reaches along the eastern margin as well as along the western margin below the N2 road bridge.

Estuarine type and functioning

Prior to the 2018 NBA, the estuaries of South Africa were classified into five general types based on various attributes (Whitfield, 1992), and the Coega Estuary was classified as a temporarily open/closed estuary. More recently, the estuarine typologies were revised and South Africa's estuaries have now been reclassified into 12 estuarine types. The Coega Estuary has been reclassified as a large temporarily closed estuary (TCE) within the Warm Temperate coastal biogeographic region (Van Niekerk et al., 2019; Van Niekerk et al., 2020). The main characteristics of large TCEs are provided in Table 4.5.

Table 4-5: Characteristics of Large Temporarily Closed estuaries (Van Niekerk et al., 2019).

Attribute	Description
Estuarine area (ha)	> 15
% time open to the sea	>50
Geomorphology	Linear/funnel with highly restricted outlet
Maximum water level determined by	Mouth state
Average tidal range (m)	0.25 – 0.5
Typical salinity range	0 – 60
Mixing process	Tidal/riverine/wind/seepage
Sediment stability	Mobile (breaching and floods)
Mean Annual Runoff ($x10^6$ m^3)	1 – 280

The size of the EFZ is approximately 270 ha, covering a length of approximately 2.9 km, with 2.3 ha of open water habitat (Van Niekerk *et al.*, 2019). Natural processes within the Coega system have been severely modified by development in the EFZ. The main characteristic of a TCE is the formation of a sand bar, or berm, at the mouth that blocks off connection with the sea for varying amounts of time during the year (**Error! Reference source not found.**). Closure of the Coega mouth is more a product of the ephemeral fluvial input and human modification, than marine sediment processes. The estuary is closed for more than 75% of the year (CSIR, 2015a). Mixing processes are induced by riverine flow and wind. Marine exchange is extremely limited given the highly developed and restricted mouth, and thus tidal amplitude is minimal during open mouth conditions.

Overall, the dynamics of the estuary have been critically altered by through flow modifications (affecting the duration of low flows), canalisation and stabilisation of the estuary mouth through the port development (CSIR, 2015a).

Estuarine habitat and vegetation types

Based on the area of natural remaining habitat, relative to the size of the EFZ, approximately 90 % of the EFZ is developed and completely transformed. This is as a result of the saltworks, roads and bridges, canalisation of the river, and catchment degradation (CSIR, 2015a).

Of the remaining 10 % of natural habitat, approximately 26.3 ha of estuarine habitat remains, including five habitat types, namely supratidal salt marsh, submerged macrophytes (Zostera capensis), reeds and sedges, open water habitat, and sand/mud banks (Table 5) (CES, 2000; Adams, Fernandes and Riddin, 2019; Van Niekerk, J. B. Adams, et al., 2019). The tidal zonation of existing salt marsh community is less distinct than found in more pristine estuaries as a result of the severe modifications, and thus areal coverage of intertidal saltmarsh is inconclusive. Key plant species recorded in the Coega Estuary and the habitat type in which they typically occur are listed in Table 6. Aside from habitat transformation, the absence of extensive salt marsh areas is likely attributed to the narrow intertidal zone, the steepness of the banks and trampling by cattle (CES, 2000). Although artificial, the constructed salt pans of the Saltworks Facility are considered to form part of, and contribute to, the estuarine and wetland environment (CSIR, 2015b). Several macroalgae species have also been recorded in the system in the intertidal zone including Cladophora sp. and Enteromorpha sp. indicative of high nutrient enrichment, low flow, and fluctuating salinities (CSIR, 2013).

Overall, the vegetation characteristics of the system have been altered by flow modification, the mouth state and water levels, changes in the salinity regime, physical habitat degradation and destruction, as well as invasive alien vegetation (CSIR, 2015a). The latter occurs in isolated areas throughout the EFZ; nine species have been recorded (Adams, Fernandes and Riddin, 2019).

Health Status

According to the 2018 National Biodiversity Assessment (NBA) (Van Niekerk, Taljaard, et al., 2019), the Present Ecological State (PES) of the Coega Estuary is a Category E, that is, a severely/critically modified system characterised by the extensive loss of natural habitat, biota and basic ecosystem functions and processes (Van Niekerk, Taljaard, et al., 2019). Consequently, the Coega system is classified as Critically Endangered in the Nelson Mandela Bay Municipality Conservation Assessment and Plan (cited in CSIR, 2013). Refer to Table 4.6 below.

Table 4-6: CBA Descriptions (ECBCP: SANBI, 2007).

COMPONENT	CATEGORY
Hydrology	D
Hydrodynamics and mouth condition	F
Water quality	D
Physical habitat alteration	F
Habitat health score	E
Microalgae	D
Macrophytes	F
Invertebrates	F
Fish	F
Birds	E
Biotic health score	E
PRESENT ECOLOGICAL STATE (PES)	E
2018 CONDITION STATUS	SEVERELY/CRITICALLY MODIFIED

Biodiversity and Conservation Importance

Turpie et al. (2002) first prioritised South African estuaries based on their conservation importance derived from various factors including size, type, biogeographical zone, habitat and biodiversity (plants, invertebrates, fish and birds). The subsequent prioritisation (Turpie & Clark, 2007) ranked the Coega estuarine system as the 140th most important estuary out of 256 systems in South Africa.

The system is currently rated as being of ‘low to average biodiversity importance’, and is not a nationally important fish nursery area. The Coega Estuary is, therefore, not among the priority estuaries identified as requiring formal protection in order to conserve South Africa estuarine biodiversity (van Niekerk, Turpie and Lamberth, 2019). Nonetheless, the Port of Ngqura is located adjacent to the Algoa to Amathole Ecological or Biologically Significant Marine Area (EBSA) (Van Niekerk, J. B. Adams, et al., 2019) and conservation assets of the Greater Addo National Elephant Park MPA, and thus activities within the port could affect the MPA.

Recommended Ecological Category

The Recommended Ecological Category (REC), or desired state, signifies the level of protection assigned to an estuary (generally from a flow perspective). The REC takes into account the estuary biodiversity importance and its conservation importance (protected area status).

The REC for the Coega Estuary remains as a category E (severely modified). Thus, management interventions must aim toward maintaining this state (as a minimum), and preventing further ecological degradation.

Activities to improve the health and productivity of the system include (Van Niekerk, J.B. Adams, Lamberth, Taljaard and Weerts, 2019):

• Restoring/protecting base flow;
• Rehabilitating riparian areas and wetlands; and

• Investigating the eradication of alien fish species.

4.1.6.2 Marine Ecology

Marine ecosystems comprise a range of habitats each supporting a characteristic biological community. The important habitats in the Port include the subtidal benthic zone, the water body itself and the artificial surfaces which mimic intertidal and shallow subtidal rocky shorelines.

<u>Intertidal and Shallow Subtidal Habitats</u>

The Port of Ngqura was developed in the estuary mouth of the Coega River. The estuary itself is characterised by narrow salt marshes with little distinct zonation due to the narrow intertidal region and the steep riverbanks (CES 2000).

The breakwaters in the Port of Ngqura offer a hard substrata habitat which mimics intertidal and shallow subtidal rocky shorelines and contrasts the soft sediment habitat associated with the sandy beaches that occur extensively adjacent to the Port (Dicken 2010). In an earlier study, Klages et al (2006) indicated that the harbour structures supported invertebrate species typical of the region including brown mussel *Perna perna*, rock oyster *Striostrea margaritacea* and barnacles *Tetraclita* spp. and *Chthamalus* spp., as well as attached epiphytic and filamentous algae.

The intertidal and coastal region outside the harbour is characterised by sandy beaches with relatively high wave activity (McLachlan,1983). Molluscs, primarily *Bullia* sp, *Donax serra* and *Donax sordidus* dominate the *macrofauna* in these regions as well as mysid shrimps (CSIR 2013).

<u>Subtidal Benthic Macrofauna</u>

Previous monitoring surveys conducted from 2004 to 2006 in the Port of Ngqura found relatively impoverished macrofaunal communities (9 specimens per 0.25m2) that were not taxonomically distinct from the biological community in sediments adjacent to the harbour. Communities were dominated by polychaetes and crustaceans (Klages et al. 2006). Some changes in community structure were reported over the monitoring period. These were attributed in part to construction activities but were also likely as a result of natural variation (CSIR 2013).

In more recent monitoring surveys conducted in 2016 and 2017, it was found that the benthic macrofauna in the Port and surrounds represented an array of taxa typical of estuarine and marine environments in the warm temperate Agulhas Ecoregion (CSIR 2016, 2017). Findings were similar to the 2004 to 2006 surveys in which macrofauna in the Port during both the 2016 and 2017 surveys predominantly comprised annelid worms and brachyuran crabs.

While disparity was found between the benthic communities occurring in the Port and in the surrounding marine environment, for the most part analyses did not indicate the presence of an abundance of pollution or disturbance tolerant taxa within the former. This is to be expected considering that, during both the 2016 and 2017 surveys, no large-scale contamination of the water or sediment was found. The differences in community composition and lower diversity within the Port were therefore not attributed to anthropogenic activities and rather are likely as a result of hydrodynamic factors and related differences in sediment particle size and total organic content.

During the 2017 survey, at site 25, near the Admin Craft Basin and the proposed FSRU location, macrofaunal abundance was highest of any of the sites sampled (1 803 individuals.m-2). A large proportion of these individuals were small subsurface deposit feeding polychaetes which are generally more opportunistic in nature and are able to proliferate in disturbed environments. The occurrence of these individuals at this site may reflect the disturbance associated with the construction of the Admin Craft Basin and may indicate that the benthic environment in the immediate vicinity of the proposed development location is disturbed (CSIR 2018).

<u>Plankton</u>

Algoa Bay is nutrient limited and thus phytoplankton biomass and production are generally low, with high variability driven by upwelling events. In a study by Klages et al. (2006), chlorophyll-a concentrations (indicative of phytoplankton biomass) in the vicinity of the Port of Ngqura were found to range between 2 and 4 µg.L-1. The Coega River is considered an important contributor of nutrients to the shallow subtidal zone as elevated phytoplankton biomasses have been recorded adjacent to the river mouth (CSIR 2012). Approximately 124 phytoplankton taxa have been identified in Algoa Bay, in waters within and surrounding the Port of Ngqura, with most of these being diatoms or dinoflagellates (Klages et al. 2006; Mbambo 2014). Common diatoms found include species from the genera *Thalassiosira, Chaetoceros, Leptocylindrus* and *Thalassionema*. Species of the genera *Gonyaulax, Protoperidinium* and *Peridinium* were the most common dinoflagellates. It is expected that many of these species groups occur in the Port water body.

Accumulations of the diatom Anaulus australis occur in the surfzone along the eastern sector of Algoa Bay, mainly north east of the Sundays River mouth. Blooms occur near and within the Port of Ngqura, although not in the extreme concentrations found further east (du Preez 1996). Anaulus may account for more than 95% of the total algal production (Campbell and Bate 1988) and consequently this species is a critical component of nearshore foodwebs in the area.

<u>Zooplankton</u>

The zooplankton assemblage within Algoa Bay is dominated by copepods (*Calanus agulhensis, Neocalanus gracilis, Nannocalanus minor, Centrophages* spp.) but *chaetognaths, euphausiids* and a variety of small gelatinous forms including ctenophoran comb jellies also occur (Klages et al. 2006; Dali 2010). These organisms are widely distributed throughout the Indian Ocean (Dali 2010). In shallower waters within the surf zone, swarming mysids (*Gastrosaccus* spp. and *Mesopodopsi* spp.) are abundant and the prawn *Macropetasma africana* is associated with Anaulus swarms (Romer 1986). While there is a high spatial and temporal variability in zooplankton abundance and biomass in Algoa Bay, these species groups are expected to occur within the Port of Ngqura.

<u>Ichthyoplankton</u>

The nearshore environment of Algoa Bay is favourable for the accumulation of *ichthyoplankton*. Beckley (1986) identified larvae of 25 families of teleosts at several nearshore stations in Algoa Bay, with gobies (Gobiidae spp.), anchovy (*Engraulidae* spp.) and sardines (*Clupeidei* spp.) being dominant. Similarly, Pattrick and Strydom (2014) identified larval fishes from 34 families in nearshore waters of the Bay with anchovies dominating the catch. Other species found include tonguefish (*Cynoglossidae* spp.), sea breams (*Sparidae* spp.) and soles (*Soleidae* spp.). Many of these species are important in the surrounding commercial fisheries. In the monitoring study conducted by Klages et al. (2006) in waters within and surrounding the Port of Ngqura, high densities of fish eggs were recorded but the numbers of fish larvae were low.

Fish

The intertidal and shallow subtidal habitat formed by the breakwaters in the Port of Ngqura has the potential of altering the abundance, distribution and diversity of fish species in the marine environment. Indeed, Dicken (2010) found that the Port water body supports a highly diverse fish species assemblage ranging from mainly herbivorous or omnivorous strepie (*Sarpa salpa*) and cape stumpnose (*Rhabdosargus holubi*) to predators such as dusky kob (Argyrosomus japonicus), garrick Lichia amia), ragged tooth (*Carcharias taurus*) and dusky shark (*Carcharhinus* obscurus). Sampling yielded 4 559 fish with 47 species distributed in 27 families. The most abundant species were dusky kob (25.5%), elf (*Pomatomus saltatrix*, 24.9%), garrick (17.7%) and dusky sharks (10.7%). Most fish were marine as opposed to estuarine species and catches were typical of Eastern Cape estuarine and shore-fisheries. The fish caught were mainly juveniles (71.4%) and dusky shark and kob were all juveniles. This and subsequent analyses (Dicken 2011), demonstrated that the Port functions as an important nursery area for many species of fish and is an important habitat and activity zone for juvenile and neonate dusky shark. This is likely due to the relatively calm and sheltered environment provided by the Port in comparison to the surrounding coastline. For adult specimens, the area also acts as a refuge from recreational fisheries. Three distinct habitat types within the port were identified (dolosse, quay wall and sandy beach) with each of these hosting different communities. The dolosse occurring along the edge of the eastern breakwater and in the vicinity of the proposed FSRU location hosted the highest number of fish species and the most diverse community.

A study by Dicken (2011) also highlighted the unexpected abundance and diversity of shark species in the Port. These included bronze whalers (*Carcharhinus brachyurus*), hammerheads (Sphyrna spp.), various cat sharks (*Scyliorhinidae* spp), dusky sharks and gully sharks (*Triakis megalopterus*). The dusky and gully sharks were the most common *chondrichthyans*. In the 2010 study, one white shark (*Carcharodon carcharias*), three whale sharks (*Rhincodon typus*) and one manta ray (*Manta birostris*) were also identified in the Port.

Megafauna

In a study analysing the spatial and temporal habitat preference of cetaceans in Algoa Bay, six species were recorded to occur between June 2008 and May 2011 (Melly et al. 2017). These included the Indo-Pacific bottlenose dolphin (*Tursiops aduncus*), the Indian Ocean humpback dolphin (*Sousa plumbea*), the long-beaked common dolphin (*Delphinus capensis*) and the Bryde's whale (*Balaenoptera brydei*) which were observed year-round, and the southern right whale (*Eubalaena australis*) and the humpback whale (*Megaptera novaeangliae*) which were observed from May to December.

The Indo-Pacific bottlenose dolphin was the most commonly seen species, where individuals were observed throughout the shallower areas of the Bay in waters from 8 to 20 m deep. Most observations were in the south west of the Bay, however, some were observed in the vicinity of the Port of Ngqura. The Indian Ocean humpback dolphin was also observed in shallower waters. According to Wooldridge et al. (1997), before port construction the surf zone off the Coega River mouth and around the St Croix Islands were an important foraging area for the species, however, during the most recent survey by Melly et al. (2017), humpback dolphins were seldom present near designated anthropogenic areas including near the Port of Ngqura. Their possible occurrence within the Port, however, cannot be discounted. Several sightings of southern right whales and Bryde's whales were recorded in shallow waters near the Port of Ngqura with some of these occurring in ship anchoring areas within the Port. Mother-calf southern right whale pairs were observed inshore of St Croix Island. The area surrounding and perhaps within the Port of Ngqura is thus utilised by several marine mammals.

Cape fur seals (Arctocephalus pusillus) breed on the Islands within Algoa Bay, and may, on occasion, occur within the Port of Ngqura. The giant leatherback (Dermochelys coriacea), the loggerhead (Caretta caretta) and the hawksbill turtle (Eretmochelys imbricata) have all been recorded feeding in Algoa Bay (CES 2001). Their occurrence in the Port of Ngqura is possible, however is not likely.

Local Conservation and Biodiversity

The available biological records for Algoa Bay, encompassing the Port of Ngqura, indicate that none of the marine algae, fish and invertebrate species/taxa has either restricted distributions or small population sizes (CSIR 2013). Some of the organisms have extremely wide distributions in South African coastal waters with apparently robust populations. Consequently, none of the recorded species are classifiable as either rare or endangered in terms of their conservation status.

Several fish and megafauna that are known to occur within or near the Port are listed as being threatened by the IUCN Red List (IUCN, 2020). The dusky kob and dusky shark, both of which use the Port as a nursery area, are Endangered, as are the whale shark and the manta ray which have been observed to occur in the Port on occasion (Dickens 2010). The Indian Ocean humpback dolphin is also listed to be Endangered. No records of this species occurring within the Port could be found, however, their occurrence is possible. Elf and ragged tooth sharks, which are common in the Port, are vulnerable, as are bronze whalers and white sharks which were seen occasionally. Indo-Pacific bottlenose dolphins are listed as being threatened.

While not within the confines of the Port, Jahleel Island occurs approximately 1 km away from the proposed FSRU mooring location. The island is part of the Greater Addo Elephant National Park and the Bird Island Marine Protected Area (MPA). It hosts important rocky shores and provides breeding habitat for African penguins.

Local Ecosystem Services

The area within the Port itself provides several important supporting services. Most obviously, it hosts an area in which commercial transport is significant and so conflict with other activities needs to be considered by the Port authority. As discussed above, the Port water body also provides an important nursery area for many fish species, some of which are commercially and recreationally important, and some of which are threatened.

4.1.7 **Ambient Air Quality**

The status of ambient air quality in the Coega SEZ is described here using data from the Saltworks monitoring site. Monitoring data provides accurate measurements at a single point which may not be representative of the entire area of interest.

Ambient monitoring data for 2017 to 2019 at Saltworks is analysed for SO_2, NO_2, and PM_{10}. A relatively coherent dataset was available for the Saltworks site for August 2017 to December 2019. Monitored SO_2 data show ambient levels for the monitoring period, with no exceedances of NAAQS. Monitored NO2 concentrations are elevated with higher concentrations observed in winter (i.e. June to August). Monitored PM10 concentrations are elevated year-round with no exceedances of NAAQS. An estimated background concentration of 10 µg/m3 is observed, increasing in late winter and early spring. This is consistent with inputs from regional biomass burning. An increasing annual trend can also be observed and is suggestive of additional air quality management needs in the area

Natural Gas (NG) will be the only fuel used for the generation of electricity in the proposed project. The associated pollutants that will be emitted include oxides of nitrogen (NOx), sulphur dioxide (SO2) and particulate matter (PM10).

Table 4-7 presents the concentrations of these three pollutants predicted to be emitted by the proposed project in relation to the ambient concentrations in the Coega SEZ and the respective South African National Ambient Air Quality Standards (NAAQS).

Table 4-7: Maximum predicted ambient annual SO2, NO2 and PM10 concentrations in µg/m3 and the predicted 99th percentile concentrations for 24-hour and 1-hour, with the South African NAAQS.

	SO_2		
Description	**Annual**	**24-hour**	**1-hour**
Predicted maximum SO_2	0.09	0.74	1.7
NAAQS	50	180	350
	NO_2		
Predicted maximum NO_2	1.75		33.6
NAAQS	40		200
	PM_{10}		
Predicted maximum PM_{10}	0.43	3.65	
NAAQS	40	75	

The maximum predicted annual SO2, NO2 and PM10 concentrations and the 99th percentile concentration of the 24-hour and 1-hour predicted concentrations of pollutants from the proposed project are very low relative to the NAAQS.

Available monitoring has shown ambient SO_2 concentrations to be relatively low in the Coega SEZ and surrounding areas and below the NAAQS. Ambient PM10 concentrations have been shown to have increased in the Coega SEZ over the last three years, but these remain well below the NAAQS.

Please refer to Appendix I for detailed Atmospheric Impact Report.

4.1.8 Ambient Noise

The proposed project site is within the Port of Ngqura. The site borders a Marine Protected Area that is within the Addo Elephant National Park. The Marine Protected Area could be impacted by the surface noise as well as the underwater noise from the vessel operations (transmission through the hull, propellors, sonar ranging devices etc.). The noise sensitive areas (NSAs) have been identified and illustrated in Table 4-8 and Figure 4-11. The distances are calculated based on the noise source in relation to the noise sensitive area.

Table 4-8: Location of Noise Sensitive Areas.

#	Noise Sensitive Area	Latitude	Longitude	Distance to Project Location (m)
NSA 1	TPT Offices	33°48'29.5" S	25°40'49.1" E	1450
NSA 2	NPA Offices	33°47'27.3" S	25°41'18.2" E	1100
NSA 3	Cerebos Offices	33°46'2.8" S	25°41'52.7" E	3595
NSA 4	CDC Offices	33°47'46.7" S	25°40'37.9" E	1535
NSA 5	Motherwell Township	33°47'58.1" S	25°37'19.5" E	6605
NSA 6	St Georges Houses	33°49'22.1" S	25°39'25.4" E	4190
NSA 7	Jahleel Island	33°48'21.9" S	25°42'16.5" E	1175
NSA 8	St Croix Island	33°47'57.6" S	25°46'1.9" E	6905
NSA 9	Brenton Island	33°49'3.3" S	25°45'52.4" E	6950
NSA 10	Damara Tern Colony	33°46'59.5" S	25°42'51.8" E	2820
NSA 11	Rare Butterfly Habitat 1	33°44'40.2" S	25°39'5.5" E	7300
NSA 12	Rare Butterfly Habitat 2	33°45'26.9" S	25°39'2.5" E	6190
NSA 13	Rare Butterfly Habitat 3	33°47'20.0" S	25°40'3.7" E	2705

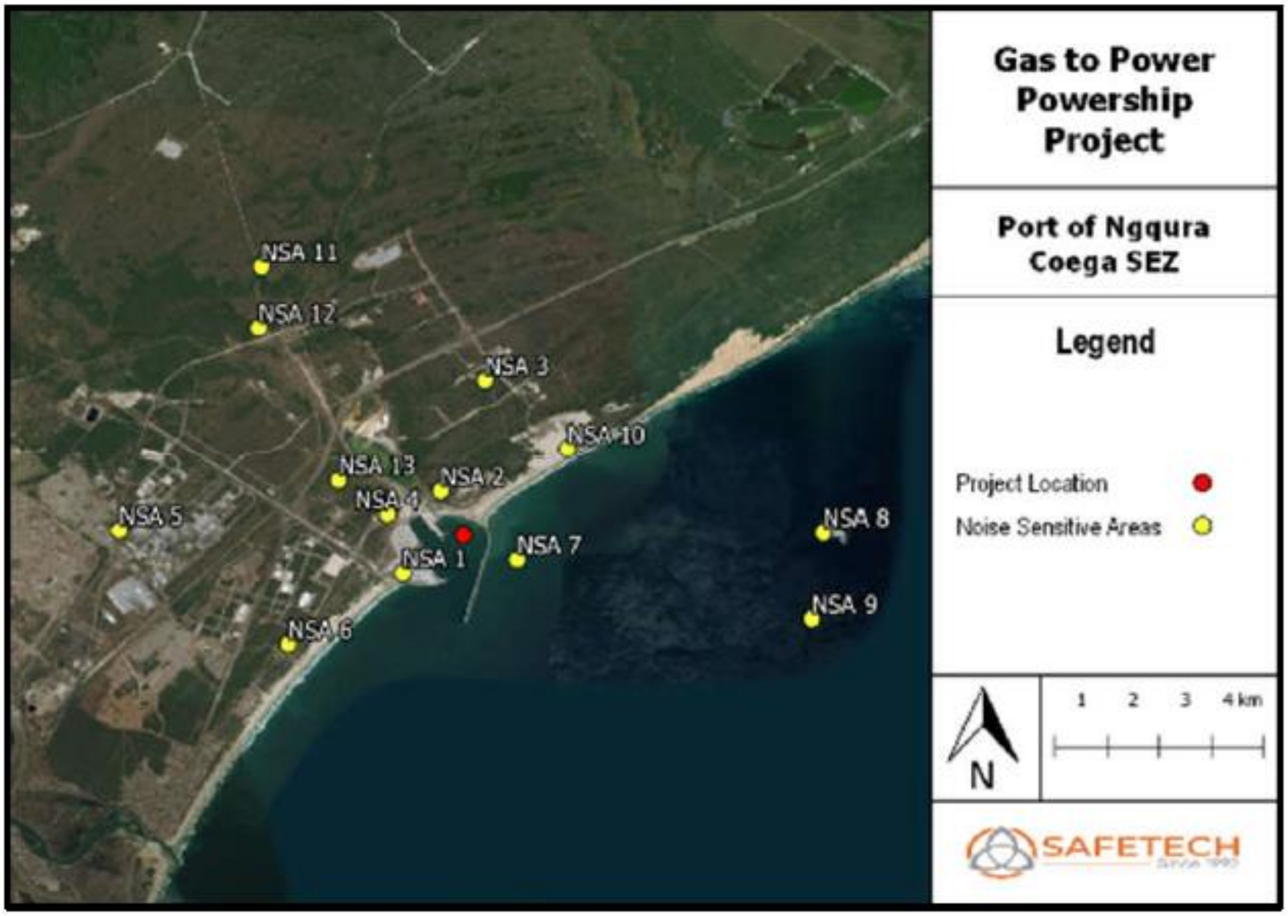


Figure 4-11: Noise Sensitive Areas.

The most sensitive areas from a noise perspective will be Jahleel Island and the Damara Tern Colony. The other sensitive areas are too far away from the noise source to be of concern as is indicated in the results table. This is due to the attenuation of noise by distance.

Access to Jahleel Island was not possible, therefore long-term measurements were taken at the harbour wall, which is close to the location of the proposed project. This point is a proxy for Jahleel Island as it is far enough from the current Port activities to gauge the ambient noise.

Given the strong winds experienced during the field study, it can be inferred that, on a calm day, the ambient noise level will fall below the SANS 10103:2008 night-time limit of 60 dB(A) for industrial districts. This is dependent upon the weather, time of day and any human activity such as shipping etc. in the area.

The most applicable standard for planning purposes used in this study is SANS 10103:2008 which provides typical rating levels for noise in various types of districts. Ideally, in such areas one does not want to experience any anthropogenic noise pollution.

SANS 10103:2008 provides typical rating levels for noise in various types of districts, as described in Table 4-9 below.

Table 4-9: Typical rating level for noise in various district types.

Type of District	Equivalent Continuous Rating Level, LReq.T for Noise					
	Outdoors (dB(A))			Indoors, with open windows (dB(A))		
	Day-night	Daytime	Night-time	Day-night	Daytime	Night-time
Rural Districts	45	45	35	35	35	25
Suburban districts with little road traffic	50	50	40	40	40	30
Urban districts	55	55	45	45	45	35
Urban districts with one or more of the following: Workshops; business premises and main roads	60	60	50	50	50	40
Central business districts	65	65	55	55	55	45
Industrial districts	70	70	60	60	60	50

The rating levels above indicate that in industrial districts (i.e., the Coega SEZ) the noise should not exceed 70 dB(A) during the day and 60 dB(A) at night. There are however no rating levels for protected natural environments. The Addo National Park Marine Protected Area should ideally be free of any anthropogenic noise sources. These rating levels can thus be seen as the target levels for any noise emissions from a nearby industrial facility. As can be seen from the ambient noise monitoring results, the ambient noise is not exceeding the recommended day/night rating levels of industrial districts.

The highlighted red font are the rating limits applicable to this project in the Port of Ngqura (Industrial Districts). The nearest residential areas at Motherwell and Bluewater Bay are possibly too far away to be impacted.

4.2 CULTURAL AND NATURAL HERITAGE

4.2.1 Cultural Heritage

More than 17 Archaeological Impact Assessments (or AIAs) have been undertaken within the Coega IDZ (Binneman 2010a, b, c, 2008, 1999,1994; Binneman & Webley 1996, 1997a, b; Kaplan 2008, 2007a, b; Van Schalkwyk & Wahl 2006, Webley 2007a, b). The, majority of these unpublished reports and notes were found on the South Africa Heritage Resources Information System (or SAHRIS). One or two reports were sourced independently. The archaeologist also consulted with Ms. Celeste Booth, archaeologist at the Albany Museum in Makhanda (Grahamstown).

The most comprehensive survey of the Coega IDZ was conducted by the archaeologist Dr Johan Binneman of the Albany Museum in Grahamstown (Binneman 2010a), which included Zones 1-4, 6, 7, 9, & 10-13. Binneman (2010a:3) brief was `to conduct a survey of possible archaeological sites in the Coega Industrial Development Zone and to establish the range and importance of the heritage sites/materials, the potential impact of the development on these and to make recommendations to minimize possible damage to these sites'.

Large numbers of Later Stone Age1 (LSA) shell middens were recorded in Zone 10 at the coast, while dispersed scatters of Middle Stone Age2 (MSA) tools of low archaeological significance were recorded further inland, behind the backdune area in Zone 7, and on exposed cobbles in Zone 6 and Zone 11 north of the N2. Bush clearing for a road in Zone 7 also exposed a thin layer of dune sand and dispersed scatters of marine shellfish, bone fragments, stone tools and pottery. Bulldozing activities associated with the above road construction also exposed a few MSA tools.

Dispersed scatters of MSA tools were recorded north of the N2 in Zone 6 and Zone 11 on exposed cobbles, and in small animal tracks and footpaths, surrounded by dense invasive vegetation. One weathered ESA flake (Point 033) was also found. Most of the tools comprise triangular shaped flakes with prepared platforms, small chunks, flaked and broken cobbles, and a few irregular shaped cores. Some of the flakes have been retouched/modified, but no formal tools such as points, or scrapers were found. All the tools are in locally available quartzite. The tools most likely comprise flake debris, with the river cobbles being used as a source of raw material for making stone tools, and opportunistic knapping over long periods of time. A few isolated MSA flakes and chunks in quartzite were also found south of the N2 within Zone 7 where cobbles appear to have given way to softer sandy deposits, and a few isolated patches of round pebbles.

Apart from some road construction, the backdune area (i. e. Zone 7) closer to the coast is characterized by extremely dense thicket vegetation. Two round cores (Points 050 & 051), and dispersed, low density scatters of MSA flakes and chunks (Points 052-055) were recorded on exposed beds of quartzite cobbles on north facing slopes, surrounded by dense vegetation. No formal tools such as points, or scrapers were found.
No shell midden deposits, or any other organic remains, such as pottery, ostrich eggshell or bone was found in the backdune area in Zone 7, where such finds have been previously documented (Binneman 2010a).

The small numbers, isolated and disturbed context in which they were found means that the archaeological remains recorded during the survey have been graded as having low (IIIC) significance.

The, majority of tools most likely represent off-site opportunistic knapping over long periods of time. These traces have probably been displaced to some extent by environmental processes including vertical collapsing of stratified sequences through erosion and lateral movement down the gently sloping landscape.
A selection of stone tools recorded during the study and the context in which they were found is illustrated below:

Figure 4-12: Collection of Stone Tools

The proposed 6.8km long overhead transmission line crosses Zones 7, 6 and 11 in the Coega IDZ. According to Binneman (2010a:40) Zone 6 and Zone 11 are the `least archaeologically sensitive’, where dispersed scatters of MSA tools of low archaeological significance are likely to be encountered, while Zone 7 is regarded `as the most sensitive’. Binneman (2010a:19) notes that although recording archaeological resources in Zone 7 was difficult due to the dense grass, bush and alien vegetation occurring across this zone, bush clearing for a road exposed a thin layer of dune sand and dispersed scatters of marine shellfish, bone fragments, stone tools and pottery. According to Binneman (2010), Zone 7 and Zone 10 are considered `the most sensitive’ zones within the entire Coega IDZ, while Zone 11 and Zone 6 north of the N2 are `the least sensitive’. All the AIAs undertaken to date within the Coega IDZ confirm the observations made by Binneman (2010a) during his study.

4.3 SOCIAL AND ECONOMIC CONDITIONS

4.3.1 Socio-Economic Aspects

The area falls within the Nelson Mandela Bay Metro Municipality. The Municipality encompasses towns, as well as the Coega Industrial Development Zone, situated near Port Elizabeth. The Nelson Mandela Bay Metro Municipality covers an area of 1 959 km^2. This makes it the smallest municipality in the Eastern Cape, accounting for only 1.2% of the total surface area of the Eastern Cape. The Municipality is bordered by the Kouga Local Municipality to the west and the Sundays River Valley Local Municipality to the north.

The largest city within the NMBM is Port Elizabeth which services as the administrative centre of the municipality. Other smaller towns and settlements include; Uitenhage, Despatch and Colchester. The urban areas are typical of the spatial patterns of towns throughout South Africa, namely that they are segregated by economic classes and reside in clusters. The municipality is divided into 60 administrative wards. See below image indicating major settlements within Nelson Mandela Bay Municipality.

Figure 4-13: Major settlements within the Nelson Mandel Bay Municipality.

<u>Population, Income and Employment Profile</u>

The NMBM falls within the Eastern Cape and collectively accounts for 18.0% of the population, and 19.7% of the households in the province. The NMBM is the second most populous municipality in the province after the O.R. Tambo District Municipality, although it has a significantly higher population density. Population growth between 2009 and 2019 was 0.7% year-on-year for the NMBM which compared favourably to the Eastern Cape (0.2%) but was lower that the South Arica rate (1.5%) over the same period.

Table 4-10: Overview of the primary & secondary study areas population structure, 2019.

Indicator	NMBM	Eastern Cape	South Africa
Area (km^2)	1 959	168 966	1 220 813
Population	1 207 487	6 712 276	58 775 022
Number of Households	336 495	1 706 942	16 366 369
Population density (km^2)	616.4	39.7	48.1
Average household size	3.6	3.9	3.6
Annual population growth (2009-2019)	0.7%	0.2%	1.5%
Average monthly household income (2011)	R14 553	R9 014	R14 348

(Urban-Econ, 2021)

The disposable average monthly income of households in the NMBM was R14 553 in 2011 (in current 2020 prices). This was significantly higher than that of the Eastern Cape (R9 014; 2020 prices) in the same period, but only marginally higher than that of South Africa (R14 348; 2020 prices). Despite this high average household income, poverty still remains endemic in the NMBM. According to StatsSA (2016) the poverty headcount3 within the NMBM (4.6%) was lower than the provincial figure (12.7%). Despite this, a high proportion of households in the NMBM that earn no income (15.7%) – higher than both the Eastern Cape (15.0%) and South African (14.8%) values.

Table 4-11: Employment profile of the study areas.

Indicator	NMBM	Eastern Cape	South Africa
Employed	366 876	1 233 947	16 259 787
Unemployment Rate	29.9%	34.2%	28.8%
Not Economically Active	281 846	2 068 978	15 516 188
Labour force participation rate	65.0%	47.5%	59.5%

(Urban-Econ, 2021)

A review of the employment profile of NMBM indicates that almost a third of the economically active population within the municipality is formally unemployed (see Table 4.9). The unemployment rate and labour force participation rates in the NMBM were also notably better than the Eastern Cape (Unemployment rate: 34.2%; Labour force participation rate: 47.5%) but slightly worse than South Africa (Unemployment rate: 28.8%; Labour force participation rate: 59.5%).

The relatively low unemployment rate and higher labour force participation relative to the provincial averages further suggests that the NMBM is subject to inward migration from other parts of the Eastern Cape due to the greater number of actual and perceived employment opportunities available within the local municipality.

Education Profile

The level of education provision within an area is one of the main determinants when it comes to a locations ability to achieve long-term, positive economic growth. The provision of education alone, however, does not ensure that this growth will occur. Equally important is ensuring that this education provision is of a sufficient quality to meet both the communities and the broader economy's needs.

Table 4-12: Level of educational attainment in study areas in 2019.

	NMBM	Eastern Cape	South Africa
No schooling	3.8%	11.2%	9.0%
Some Primary	10.0%	17.8%	12.3%
Completed Primary	5.1%	6.3%	4.7%
Some Secondary	41.4%	36.6%	34.2%
Matric	28.3%	19.3%	27.9%
Tertiary	11.4%	8.7%	12.0%

It is evident from Table 4.12 that the skill level of the population, as measured by educational attainment, is notably better in the NMBM than in the rest of the Eastern Cape.

There has also been a marginal improvement in educational attainment since 2009 when only 10.3% of NMBM's population had attained some form of tertiary qualification.

It is evident from Table 4.12, unlike the rest of the Eastern Cape, the NMBM was characterised by high levels of educational attainment, with 11.4% of the population having attainted some form of tertiary qualification in 2019. This is also well above the provincial and likely attributable to the presence of Nelson Mandela University within the municipality as well as several other tertiary colleges. Despite this, almost three fifths (60.3%) of the population of NMBM has not completed high school, lower than the Eastern Cape (72.0%) and similar to the national (60.1%) figure. These levels of educational attainment suggest the need for interventions that targeted low and semi-skilled individuals.

Access to Basic Services

National legislation as well as a municipality's basic services policy recognises the need to prioritise access to basic services (water, sanitation, refuse removal and electricity) to all residents of an area, but particularly the poor and indigent households. The intention of this legislation and policies are to ensure that households enjoy a decent standard of living in line with the requirements of national legislation.

Table 4-13: Access to minimum basic services in 2019.

Area	Total Number of Households	Percentage of Households with access to:			
		Water[4]	Electricity[5]	Sanitation[6]	Refuse Removal[7]
NMBM	336 495	96.3%	90.2%	89.1%	91.4%
Eastern Cape	1 706 942	68.0%	75.1%	46.4%	44.0%
South Africa	16 366 369	85.6%	84.9%	63.5%	64.9%

In 2019, 96.3% of households in the NMBM had access to piped water, well above the provincial average of 68.0%. Accordingly, only 1 144 households in NMBM were dependent on either boreholes or natural sources, such as dams, rivers and streams as their primary water source. The high level of access can be attributed to the emphasis that the municipal government has placed on expanding access in low-income areas. It should be noted that this figure does not speak to the quality and reliability of this access.

Electricity access is exceptionally high in NMBM. This was evident by the fact that most (90.2%) households in the municipality use electricity as their primary means of lighting. This level of access is higher than both the provincial and national figures. The NMBM, however, has only increased access to electricity at an average annual rate of 1.9% between 2009 and 2019 compared to a rate 2.5% for the rest of the Eastern Cape.

Flush and chemical toilets are the most widely used sanitation type in the respective area, with the majority of households in the NMBM (89.1%), having access to this minimum national sanitation standard in 2019. Over the last ten years, the NMBM has made positive strides in improving access to sanitation. Between 2009 and 2019, the number of households that either had no access to sanitation or were dependant on pit and bucket latrines decreased at an average annual rate of 2.7%.

Approximately 91.4% of households in the NMBM have periodic refuse removal services provided by the municipal authority. This was notably higher than the 44.0% of households for the rest of the Eastern Cape.

Accordingly, only 18 377 households (5.5%) in the NMBM had either no refuse removal services (7 314 households; 2.2%) or were dependant on their own refuse dump (11 063 households; 3.3%). Despite this high level of access, the number of households in the NMBM dependant on a communal refuse dump rose by 2.7% year-on-year between 2009 and 2019.

4.3.2 Marine Traffic

The site for the FSRU is located at the base of the eastern breakwater and is seaward of the admin craft basin (ACB). The mooring of the FSRU purposefully avoids using the breakwater directly due to an existing environmental record of decision (RoD) stating that no infrastructure may be constructed along the eastern breakwater. As there is currently no LNG infrastructure within the port, the Powership solution will be fuelled by the FSRU on a separate spread-mooring and connected via a gas pipeline to the Powership and barge. The approach channel and vessel manoeuvring areas will therefore be shared with all the terminals in the port, i.e. vessel traffic in the basin from container vessels, breakbulk vessels, bulk cargo vessels and tugs. It is a criterion for the facility that it is at the end of the approach channel and outside the turning circle so as not to impede vessel traffic movement within the port.

In the process of identification of the potential sites, the existing cargo facilities and the future short term developments were avoided. There is a consideration of a liquid bulk berth (A100) in the site selected for the Powership mooring. As the nature of the Karpower Powership project is considered a short to medium-term emergency power solution and the development of Berth A100 based on commodity demand, the conflict with TNPA’s long term port development framework plans may not be significant. The relocation of the liquid bulk berth from B100 to A100 will have to be justified by commodity demand and this decision has the potential to be delayed indefinitely.

The existing and anticipated vessel traffic in the Port of Ngqura in 2020 is 712 vessels. The current demand for container handling is 980 000 TEUs and is expected to grow to approximately 2 million TEUs by 2051. The liquid bulk terminal in Port Elizabeth is scheduled to move to the Port of Ngqura and is forecast to increase handling of total liquid bulk products from approximately 1 Mtpa in 2021 to approximately 2 Mtpa in 2051. The manganese ore terminal is set to be operational by 2021 and is forecasted to increase to approximately 22 Mtpa by 2051.

CMR data was used to analyse the historic trends of vessel activity at the Port of Ngqura (LTPF, 2015). The annual percentage growth in demand was used to estimate the future vessel traffic for the various cargo handled within the port for the years 2021 to 2051. Container vessel calls are forecasted to increase from 687 in 2021 to 1 497 in 2051. The number of additional vessels contributable to the Powership operations is 7 vessels per annum, increasing to 8 vessels in 2028 and 14 vessels per annum in 2051. This only considers the relatively more frequent LNGC refuelling of the FSRU and excludes the once-off arrival of the Powerships and FSRU upon commissioning within the Port of Ngqura.

All vessel slots, including the LNGC vessels arriving for refueling, were calculated assuming an appropriate slot duration where the navigation channels, pilotage and tug resources of the port are utilised. The assumed slot durations considered a 2.5 hour duration for both berthing and sailing operations of the existing vessel types in the port (i.e. cargo vessels).

The results of the marine vessel traffic assessment, which considers vessel traffic forecasts up to 2051 and an upper limit of LNGC vessel calls, indicate that the LNG vessels, only representing 1% of the 2051 vessel traffic slot durations, are not expected to significantly add to congestion within the port. The Port of Ngqura is forecasted to have approximately 76% and 47% spare slot capacity in 2021 and 2051 respectively.

5 POLICY AND LEGISLATIVE FRAMEWORK

5.1 NATIONAL REGULATORY FRAMEWORK

2014 NEMA EIA Regulations (as amended), Appendix 3 - 3(1)- (e) a description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context.

5.1.1 National legislation

The Constitution, 1996 is the supreme law of the Republic. Any law or conduct inconsistent with it is invalid and the obligations imposed by it must be fulfilled.

- Chapter 2 of the Constitution contains the Bill of Rights, one of which is Section 24: everyone has the right to an environment that is not harmful to their health or well-being; and
- to have the environment protected, for benefit of present and future generations, through reasonable legislative and other measures that:
  - prevent pollution and ecological degradation;
  - promote conservation; and
  - secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

One of the key legislative measures that has been established is the promulgation of the National Environmental Management Act 107 of 1998 (NEMA). NEMA aims to provide for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote co-operative governance and procedures for co-ordinating environmental functions exercised by organs of state; to provide for certain aspects of the administration and enforcement of other environmental management laws; and to provide for matters connected therewith.

NEMA prohibits a person from commencing a listed activity without environmental authorisation. The Project triggers several activities listed in the EIA Regulations Listing Notices 1, 2 and 3 of 2014 (as amended). The procedural requirements for such an application and associated EIA that needs to be undertaken, are prescribed by the EIA Regulations, 2014 (as amended) (the EIA Regulations, 2014) and informed by guidelines published in terms of Section 24J of NEMA as well as applicable protocols and minimum information requirements.

In addition, the Project triggers an activity listed under the National Environmental Management: Air Quality Act 39 of 2004 (NEMAQA) which requires an atmospheric emission licence (AEL). The same EIA process prescribed by the EIA Regulations, 2014 need to be applied to the AEL application, with a number of additional requirements set out in NEMAQA and its Regulations.

As part of the EIA process, the EIA Regulations require that a description of the policy and legislative context within which the development is proposed is reported on in the EIA Report, including an explanation of how the proposed development complies with and responds to such legislation and policy context. This includes an identification of applicable legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments. This section has been prepared to satisfy this requirement.

National Environmental Management Act 107 of 1998

Legislation	Section	Relates to
National Environmental Management Act 107 of 1998	Section 2	Contains sustainable development and other principles that apply throughout South Africa to the actions of all organs of state that may significantly affect the environment.
	Chapter 5	Provides for integrated environmental management including the prohibition, restriction and control of activities which are likely to have a detrimental effect on the environment.
	Section 28	The developer has a general duty to care for the environment and to institute such measures as may be needed to demonstrate such care.
	Section 30	Deals with the control of emergency incidents, including the different types of incidents, persons responsible for the incidents and reporting procedures to the relevant authority.

Relevance to the Proposed Project, compliance and response:

Three sets of listed activities, published 4th of December 2014 (w.e.f 8 December 2014) under Government Notices R.983, R.984, and R.985, and subsequently amended, describe the activities that require either a Basic Assessment (applies to activities in Listing Notices 1 and 3)), or Scoping and Environmental Impact Reporting (S&EIR) (applies to activities in Listing Notice 2)). All listed activities that are triggered in the above listing notices need to be assessed in the assessment report – refer to Section 2.2.

Because the Project triggers activities in Listing Notice 2, the application for environmental authorisation is subject to the S&EIR process for all activities, including those listed under Listing Notice 1 and 3. As set out by Section 24C of the NEMA, the relevant competent authority for this activity is DEFF.

The applicable 24J Guidelines which have been applied to the EIA process include:

- Department of Environmental Affairs (2017), Public Participation guideline in terms of NEMA EIA Regulations, Department of Environmental Affairs, Pretoria, South Africa.
- DEA (2017), Guideline on Need and Desirability, Department of Environmental Affair (DEA), Pretoria, South Africa

The applicable protocols and minimum information requirements which have been applied to this project include the Procedures for the assessment and minimum criteria for reporting on identified environmental themes when applying for environmental authorisation (GN320 in GG 43110 of 20 March 2020; and GN 1150 of GG 43855 of 30 October 2020).

Measures to protect the environment by mitigating impacts and responding to emergency incidents are contained in the EMPr.

National Environmental Management: Waste Act 59 of 2008

<table>
<tr><th>Legislation</th><th>Section</th><th>Relates to</th></tr>
<tr><td rowspan="2">National Environmental Management: Waste Act 59 of 2008</td><td>Sections 16 – 18, 21 – 27, 35 - 41, 60</td><td>Provides for general and specific waste management measures; the remediation of contaminated land and reporting.</td></tr>
<tr><td>Sections 19, 20, 43 – 59</td><td>Requirements for waste management licensing</td></tr>
<tr><td colspan="3">Relevance to the Proposed Project, compliance and response:</td></tr>
<tr><td colspan="3">A number of regulations and standards regulating waste management have been published under NEMWA. including:
List of waste management activities, 2013 (amended)
Waste Classification & Management Regulations, 2013
National Norms & Standards for the Assessment of Waste for Landfill Disposal, 2013
National Norms & Standards for Disposal of Waste to Landfill, 2013
National Norms and Standards for the Remediation of Contaminated Land and Soil Quality, 2014
The EMPr contains a number of impact assessment outcomes and actions that include waste management measures to ensure that:
All reasonable measures must be taken to avoid the generation of waste and where such generation cannot be avoided, minimise the toxicity and amounts of waste that are generated; reduce, re-use, recycle and recover waste; where waste must be disposed of, ensure that the waste is treated and disposed of in an environmentally sound manner;
Manage the waste in such a manner that it does not endanger human health or the environment or cause a nuisance through noise, odour or visual impacts;
Prevent any employee or any person from contravening this Act; and prevent the waste from being used for an unauthorised purpose;
The proposed development does not trigger any listed activities (under Categories A and B) of this Act and as such does not require a Waste Management Licence.</td></tr>
</table>

National Environmental Management: Air Quality Act 39 of 2004

<table>
<tr><th>Legislation</th><th>Section</th><th>Relates to</th></tr>
<tr><td rowspan="6">National Environmental Management: Air Quality Act 39 of 2004</td><td colspan="2">Provides for the protection of the environment by regulating air quality in order to prevent air
Pollution.</td></tr>
<tr><td>Sections 22, 21 22A</td><td>Atmospheric Emission Licensing.</td></tr>
<tr><td>Sections 23-25</td><td>Controlled emitters</td></tr>
<tr><td>Section 32</td><td>Control of dust</td></tr>
<tr><td>Section 34</td><td>Control of noise</td></tr>
<tr><td>Section 35</td><td>Control of offensive odours</td></tr>
<tr><td colspan="3">Relevance to the Proposed Project, compliance and response:</td></tr>
<tr><td colspan="3">A number of regulations and standards regulating air quality have been published under NEMAQA. including:
National Ambient Air Quality Standards, 2009</td></tr>
</table>

▪ National Ambient Air Quality Standard for Particulate Matter of Aerodynamic Diameter less than 2.5 micron metre (PM2.5), 2012 ▪ Declaration of a Small Boiler as a Controlled Emitter and Establishment of Emission Standards, 2013 ▪ National Dust Control Regulations, 2013 ▪ Listed Activities and Associated Minimum Emission Standards 2013 (amended) ▪ Regulations regarding Air Dispersion Modelling, 2014 ▪ National Atmospheric Emission Reporting Regulations, 2015 ▪ National Greenhouse Gas Emissions Reporting Regulations, 2016 ▪ Declaration of greenhouse gases as priority air pollutants, 2017 ▪ National Pollution Prevention Plans Regulations, 2017 (amended) The proposed project requires an Atmospheric Emission Licence. The appointed specialist has applied the air dispersion modelling requirements in air quality specialist study and recommendations made therein will be carried through to the EMPr. GHG emission have also been assessed. It is likely that the steam turbines will be regulated as controlled emitters.

Marine Living Resources Act 18 of 1998

Legislation	Section	Relates to
Marine Living Resources Act (Act 18 of 1998) amended 2000	Regulates the utilization, conservation and management of marine living resources and the need to protect whole ecosystems preserve marine biodiversity and minimize marine pollution.	
Relevance to the Proposed Project:		
The Act requires the sustainable utilisation of marine resources. Due to the project being located in the Port of Ngqura, all reasonable measures must be taken to avoid marine pollution that may affect marine living resources. The findings and recommendations of the relevant specialists, including the marine ecologist will be included in the EMPr.		

National Environmental Management: Integrated Coastal Management Act 24 of 2008

Legislation	Section	Relates to
National Environmental Management: Integrated Coastal Management Act 24 of 2008	Section 2	Provides for the protection and to enhance the status of coastal public property, and secure equitable access to the opportunities and benefits of coastal public property.
	Section 13	Persons right of reasonable access to coastal public property as well as the entitlement to use and enjoy coastal public property.
	Section 58	Duty to avoid causing adverse effects on coastal environment
	Section 69	Stipulate requirements for permits to discharge effluent that originates from a source on land into coastal waters.
Relevance to the Proposed Project, compliance and response:		
The discharge of cooled water from the Powership operations is from the moored Powerships into the sea, i.e. there is no discharge from land-based activities. DEFF has confirmed that a coastal waters discharge permit is not required.		

Measures to protect the coastal environment by mitigating impacts and responding to emergency incidents are contained in the EMPr. Further, discharge temperatures will conform to the current guideline, the South African Water Quality Guidelines for Coastal Marine Waters, Volume 1, Natural Environment (1995), i.e. the maximum acceptable variation in ambient temperature will not exceed + or – 1°C, in terms of the targeted value for the South African coastal zone.

National Water Act 36 of 1998

Legislation	Section	Relates to
National Water Act 36 of 1998		Regulates the protection, use, development, conservation, management and control of water resources.
	Section 19	Prevention and remedying the effects of pollution
	Section 20	Control of emergency incidents
	Section 21	Permissible water use, including discharge & abstraction and development within 500m of a watercourse (including wetlands).
Relevance to the Proposed Project, compliance and response:		
Should the proposed transmission line be constructed within or within close proximity to a watercourse or wetland a water use license may be required for the proposed development. The Department of Water and Sanitation has confirmed that the water uses associated with the project fall under General Authorisation and therefore, a water use licence is not required. Measures to protect water resources by mitigating impacts and responding to emergency incidents are contained in the EMPr.		

National Forest Act 84 of 1998

Legislation	Section	Relates to
National Forest Act 84 of 1998	Section 12	Provides for protection, control and licencing for cutting, disturbing, damaging or destroying protected trees
Relevance to the Proposed Project, compliance and response:		
If any protected trees in terms of this Act occur on site, the developer will require a licence from the DEFF to perform any of the above-listed activities. In addition, CDC has a permit from DAFF for the removal of protected trees in all developable land within the SEZ. This permit is renewed annually.		

National Environmental Management: Biodiversity Act 10 of 2004

Legislation	Section	Relates to
National Environmental Management: Biodiversity Act 10 of 2004: Threatened or Protected Species Regulations and lists (2007 & 2017 (marine)); Alien and Invasive Species Regulations and lists (2020)	Provides for the management and conservation of biodiversity, protection of species and ecosystems, and sustainable use of indigenous biological resources, including threatened and protected species and ecosystems, and invasive and alien species	

Relevance to the Proposed Project, compliance and response:
The EIA, including specialist studies and the EMPr identify impacts and contain mitigation measures to: ▪ avoid or minimise impacts on protected and threatened ecosystems and species to protect biodiversity; ▪ Identify permit requirements without which protected species may not be removed or damaged; ▪ Keep the proposed site and transmission routes clear of alien and invasive vegetation using appropriate means.

National Environmental Management: Protected Areas Act 31 of 2004

Legislation	**Section**	**Relates to**
National Environmental Management: Protected Areas Act (31 of 2004)	Provides for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes. Promotes sustainable utilisation of protected areas for the benefit of people, in a manner that would preserve the ecological character of such areas.	
Relevance to the Proposed Project, compliance and response:		
The gas pipeline connecting the FSRU to the Powerships will be routed along the edge of the existing eastern breakwater and will connect to the vessels via a flexible marine hose. This location is approximately 1.1 km away from the Jahleel Island. The breakwater will act as a natural buffer to operations occurring at the Port in relation to the island.		

National Environmental Management: Protected Areas Act (31 of 2004) - Strategy on Buffer Zones for National Parks (106 of 2012)

Legislation	**Section**	**Relates to**
National Environmental Management: Protected Areas Act (31 of 2004) - Strategy on Buffer Zones for National Parks (106 of 2012)	Defines buffer zones to protect important areas of high value for biodiversity and/or to society where these extend beyond the boundary of the Protected Area; and stipulate legal requirements for developments within formally established buffer zone.	
Relevance to the Proposed Project, compliance and response::		
The strategy states that all development in a formally established buffer zone that requires an environmental authorisation in terms of the NEMA, will be subject to an environmental impact assessment. The proposed project is situated within the Port of Ngqura, approximately 5 km from the Addo Elephant National Park Marine Protected Area and the sensitive marine and estuarine habitats therein.		

National Heritage Resources Act 25 of 1999

Legislation	**Section**	**Relates to**
National Heritage Resources Act (No 25 of 1999) and regulations	Section 34	No person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority.
	Section 35	No person may, without a permit issued by the responsible heritage resources authority destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or paleontological site.

	Section 36	No person may, without a permit issued by the South African Heritage Resource Agency (SAHRA) or a provincial heritage resources authority destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority. "Grave" is widely defined in the Act to include the contents, headstone or other marker of such a place, and any other structure on or associated with such place.
	Section 38	This section provides for Heritage Impact Assessments (HIAs), which are not already covered under the ECA. Where they are covered under the ECA the provincial heritage resources authorities must be notified of a proposed project and must be consulted during the HIA process. The Heritage Impact Assessment (HIA) will be approved by the authorising body of the provincial directorate of environmental affairs, which is required to take the provincial heritage resources authorities' comments into account prior to making a decision on the HIA.
Relevance to the Proposed Project, compliance and response:		
▪ No person may alter or demolish any structure or part of a structure, which is older than 60 years or disturb any archaeological or paleontological site or grave older than 60 years without a permit issued by the relevant provincial heritage resources authority. ▪ No person may, without a permit issued by the responsible heritage resources authority destroy, damage, excavate, alter or deface archaeological or historically significant sites. ▪ Cultural and palaeontological impact assessments have been included as specialist studies in the EIA and any permits required will need to be obtained from the provincial heritage authority.		

Conservation of Agricultural Resources Act 43 of 1983

Legislation	Section	Relates to
Conservation of Agricultural Resources Act 43 of 1983 and Regulations	Prohibition and control of weeds and invader plant species	
	Control measures for erosion	
Relevance to the Proposed Project, compliance and response:		
There are no applicable permit or licence requirements, however cognisance of these requirements is to be taken during vegetation clearance and the maintenance of the existing servitudes, for the entire duration of the project lifecycle. Provision for control of invasive species and soil erosion are contained in the EMPr.		

National Ports Act 12 of 2005

Legislation	Relates to
National Ports Act (12 of 2005)	Provide for the establishment of the National Ports Authority and the Ports Regulator; to provide the administration of certain ports by the National Ports Authority; and to provide for matters connect therewith.

	Prescribes that the National Ports Authority is to prepare and periodically update a Port Development Framework Plan (PDFP) for each port. The creation of new capacity in the ports' system results from the implementation of the Port Development Framework Plans.
Relevance to the Proposed Project, compliance and response:	
TNPA is required by the Act to promote economic development of the Port. Further, a balance between environmental protection and economic development must be achieved. The compatibility of the Project with Port planning is discussed in Section 6.	

Occupational Health and Safety Act 85 of 1993

Legislation	Section	Relates to
Occupational Health and Safety Act 85 of 1993 and Regulations	Section 8	General duties of employers to their employees
	Section 9	General duties of employers and self-employed persons to persons other than their employees
Relevance to the Proposed Project, compliance and response:		
The developer must be mindful of the obligations contained in the OHSA and mitigate any potential impacts. Hazardous Chemical Substances and Major Hazardous Installations are regulated under the Act. The associated requirements have been considered by the risk assessment specialist. Recommendations will be included in the EMPr.		

Hazardous Substances Act 15 of 1973

Legislation	Section	Relates to
Hazardous Substances Act 15 of 1973 and regulations	Provides for the definition, classification, use, operation, modification, disposal or dumping of hazardous substances	
Relevance to the Proposed Project, compliance and response:		
Provision is made in the EMPr to: ▪ Manage the hazardous substances in such a manner that it does not endanger human health or the environment. ▪ Prevent hazardous substances from being used for an unauthorised purpose.		

SANS 10103 (Noise Standard)

Legislation	Section	Relates to
SANS 10103 (Noise Regulations)	The measurement and rating of environmental noise with respect to annoyance and to speech communication, as well as the categories for community responses to excess environmental noise.	
Relevance to the Proposed Project, compliance and response:		
The ambient noise level guidelines in SANS 10103:2008 is 70dBA during the day and 60dBA at night in industrial districts. These levels can be seen as the target levels for any noise emissions within the Port and adjacent industrial area. Furthermore, the South African noise control regulations describe a disturbing noise as any noise that exceeds the ambient noise by more than 7dB. This difference is usually measured at the complainant's location should a noise complaint arise. Therefore, if a new noise source is introduced into the environment, irrespective of the current noise levels, and the new source is louder than the existing ambient environmental noise by more than 7dB, the complainant will have a legitimate complaint. Guidelines for expected community responses to excess environmental noise is reflected in Table 5-2 below.		

Table 5-1: Categories of environmental community / group response (SANS 10103:2008).

Excess Lr dB (A)	Estimated Community/Group Response	
	Category	**Description**
0 -10	Little	Sporadic complaints
5 – 15	Medium	Widespread complaints
10 – 20	Strong	Threats of community / group action
15	Very Strong	Vigorous community / group action

National Road Traffic Act 93 of 1996

Legislation	Section	Relates to
National Road Traffic Act (No 93 of 1996)	Provides for controlling transport of dangerous goods, hazardous substances and general road safety	
Relevance to the Proposed Project, compliance and response:		
The requirements stipulated in the NRTA will need to be complied with during the construction and operational phases of the proposed project and included in the EMPr.		

Gas Act 48 of 2001

Legislation	Section	Relates to
Gas Act 48 of 2001	This Act regulates the development and operation of gas transmission, storage, distribution, liquefaction and re-gasification facilities. No person may construct or operate gas storage facilities without a licence issued by the Gas Regulator (NERSA) except if listed in Schedule 1, in which case, registration may be required. Schedule 1 includes any person engaged in the transmission of gas for that person's exclusive use. Registration with NERSA is also required for the importation of gas.	
Relevance to the Proposed Project, compliance and response:		
As Karpowership will be importing, storing and regasifying natural gas and transporting it between its ships via a pipeline, it will need to comply with the provisions of this Act by applying for the necessary licence and/or registration. These application processes do not form part of the application process for environmental authorisation and AEL.		

Electricity Regulation Act 4 of 2006

Legislation	Section	Relates to
Electricity Regulation Act 4 of 2006; Regulations on New Generation Capacity, 2006; Integrated Resource Plan (IRP) 2019	The Act's main objective is to establish a national regulatory framework for the electricity supply industry and to make the National Energy Regulator of South Africa (NERSA) the custodian and enforcer of the national electricity regulatory framework. The Act empowers the Minister of Mineral Resources and Energy, in consultation with NERSA, to: ▪ determine that new generation capacity is needed to ensure the continued uninterrupted supply of electricity;	

Legislation	Section	Relates to
	▪ determine the types of energy sources from which electricity must be generated, and the percentages of electricity that must be generated from such sources; ▪ determine that electricity thus produced may only be sold to the persons or in the manner set out in such notice; ▪ determine that electricity thus produced must be purchased by the persons set out in such notice; ▪ require that new generation capacity must – o be established through a tendering procedure which is fair, equitable, transparent, competitive and cost-effective; o provide for private sector participation. The Act also gives NERSA various powers to carry out its functions, including the power to consider applications for the licences required and issued under this Act. No person may operate any generation, transmission or distribution facility without a licence issued by NERSA. The objectives of the Regulations published under the Act are to: ▪ to facilitate planning for the establishment of new generation capacity; ▪ the regulation of entry by a buyer and a seller into a power purchase agreement; ▪ to set minimum standards or requirements for power purchase agreements; ▪ the facilitation of the full recovery by the buyer of all costs efficiently incurred by it under or in connection with a power purchase agreement including a reasonable return based on the risks assumed by the buyer thereunder and to ensure transparency and cost reflectivity in the determination of electricity tariffs; and ▪ the provision of a framework for implementation of an IPP procurement programme and the relevant agreements to be concluded. The IRP is South Africa's national electricity infrastructure plan in which the country's energy mix is determined.	
Relevance to the Proposed Project, compliance and response:		
The primary enabling legislation for the Risk Mitigation IPP Procurement Programme is the Electricity Regulation Act, together with the Electricity Regulations on New Generation Capacity and the IRP 2019. Karpowership's proposal for New Generation Capacity through its Powership projects falls under the Risk Mitigation IPP Procurement Programme. In order to generate and transmit electricity, Karpowership will require a generation licence from NERSA. This application is separate to the application process for environmental authorisation and AEL.		

National Energy Regulator Act 40 of 2004

Legislation	Section	Relates to
National Energy Regulator Act 40 of 2004	This Act establishes a single regulator to regulate the electricity, piped-gas and petroleum pipeline industries. The statutory body is the National Energy Regulator of South Africa (NERSA).	

Legislation	Section	Relates to
	This Act requires NERSA inter alia to undertake the functions of the Gas Regulator as set out in section 4 of the Gas Act and the functions set out in section 4 of the Electricity Regulation Act, 2006, which includes the planning for new generation capacity and integrated resource plan.	
Relevance to the Proposed Project, compliance and response:		
NERSA has been identified an organ of state having jurisdiction in respect of an aspect of the activities for which the EIA process is being conducted and thus has been registered as an I&AP as required by the EIA Regulations, 2014.		

Infrastructure Development Act 23 of 2014

Legislation	Section	Relates to
Infrastructure Development Act 23 of 2014	▪ To provide for the facilitation and co-ordination of public infrastructure development which is of significant economic or social importance to the Republic; ▪ to ensure that infrastructure development in the Republic is given priority in planning, approval and implementation; ▪ to ensure that the development goals of the state are promoted through infrastructure development; ▪ to improve the management of such infrastructure during all life-cycle phases, including planning, approval, implementation and operations; and ▪ to provide for matters incidental thereto.	
Relevance to the Proposed Project, compliance and response:		
The Risk Mitigation IPP Procurement Programme has been designated as a Strategic Integrated Project.		

5.1.2 Provincial legislation and planning

Table 5-2: Applicable Provincial Plans, Strategies and Programmes.

Legislation	Relates to
Eastern Cape Vision 2030 – Provincial Development Plan (2014)	Outlines goals, visions, key objectives and strategic actions related to equitable economy, education, empowerment and health for rural and economic developments, including the protection of environment assets and natural resources.
Eastern Cape Biodiversity Conservation Plan	Informs protected area expansion and biodiversity stewardship programmes in the province, indicating areas with conservation needs, including critical biodiversity areas.
Eastern Cape Coastal Management Programme	The Eastern Cape Coastal Management Programme, dated 2013, was developed to meet provincial obligations as stipulated in the ICM Act. The provincial programme (hereafter the Eastern Cape PCMP) situates the importance of integrated coastal management in promoting and achieving sustainable coastal development in the Eastern Cape
Eastern Cape Climate Response Strategy	The Eastern Cape Climate Change Response Strategy is the only pertinent provincial climate change document in respect of the proposed

	project. Similar to the Western Cape Climate Response Strategy, this strategy does not act as a regulatory document. Instead, the strategy acts as a high-level policy document that provides some guidelines for developing appropriate adaptation and mitigation responses and contextualises these guidelines within: i) the context of projected climate change impacts in the Eastern Cape; and ii) the development priorities within the Eastern Cape.
Eastern Cape Biodiversity Conservation Plan (ECBCP)	The Eastern Cape Biodiversity Conservation Plan identifies areas within the Eastern Cape that require conservation, and supplies land use guidelines for the province based on conservation values (Berliner et al 2007). This spatial biodiversity conservation plan looks at the province and defines areas of conservation value based on large numbers of threatened species, large numbers of species or ecosystems or ecological processes that are crucial for the long-term persistence of biodiversity.
Subtropical Thicket Ecosystem Programme (STEP)	The Subtropical Thicket Ecosystem Programme or STEP is a bioregional programme for the area where thicket is the dominant vegetation type, predominantly in the Eastern Cape (Pierce & Mader 2006). The function of STEP is to promote the sustainable management of the biodiversity of the region, as much of it is under pressure from poorly planned development. STEP can be used to identify areas that are crucial to conservation and areas that can withstand some development. It provides land use guidelines for each conservation status as well as for other natural areas and for corridor, to prevent fragmentation (Pierce & Mader 2006).

5.1.3 **Local legislation and planning**

Table 5-3: Applicable– Regional and Local Planning Frameworks.

Legislation	**Relates to**
Nelson Mandela Bay Municipal (NMBM) Integrated Waste Management Plan (2016 – 2020)	Defines the vision, objectives and targets for the provision of solid waste management services, including all aspects of waste management from waste generation to waste reduction, recycling, treatment and disposal in order to reduce waste to landfill.
NMBM IDP (2017/18 – 2021/22)	Serves as a strategic action and informs and guides all relevant planning, management, budgeting and decision-making processes within the institution.
NMBM SDF (2015)	Includes power production, inclusive of investments in the energy sector, with the purpose of feeding into the electrical grid, with the focus on renewable energy, peaking power generation capacity, and other key areas within the energy cluster.
Nelson Mandela Bay Coastal Management Programme	The Nelson Mandela Bay Municipality (NMBM) Municipal CMP, updated in 2015, is proposed as an implementation-based program focussing on three broad priority areas, namely: natural resource management; coastal pollution and coastal development, with the latter including broad coastal management objectives, management recommendations and

	implementation strategies. The NMBM coastal zone is divided into 20 segments with the Port of Ngqura included in segment 2. Coastal development is assessed strategically according to management areas, however the Coega IDZ and Port of Ngqura are excluded as the NMBM does not undertake maintenance activities within these areas (CEN, 2015).
Coega Open Space Management Plan (2014) and Coega IDZ Development Framework (2006)	Provides an overall development strategy for the Coega IDZ, including environmentally sensitive planning approach for linear infrastructure.

5.2 INTERNATIONAL AGREEMENTS

South Africa is a party to a number of international agreements which regulate shipping as well as the protection of marine resources:

- International Convention for the Prevention of Pollution from Ships - MARPOL 73/78
    - The MARPOL Convention regulates pollution from ships – accidental pollution and pollution from the general operations associated with shipping; Preserves the marine environment by eliminating pollution from harmful substances. Ships sailing under the flag of a country that has entered into the MARPOL convention are expected to comply with the regulations. The MARPOL Convention was ratified by South Africa in 1985,

- Convention on Biological Diversity - 1992-1995
- International Convention on Civil Liability for Oil Pollution
- Damage - 1969-1997
- International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties - 1969-1986
- Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention) - 1972-1978
- Protocol to the 1972 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter - 1996-1998
- United Nations Convention on the Law of the Sea (UNCLOS) - 1982-1997
- Protocol relating to intervention on the high seas in cases of pollution by substances other than oil - 1973-1997
- International Convention for the Safety of Life at Sea - 1974-1980
- Convention on the Conservation of Migratory Species of Wild Animals
- Agreement on the Conservation of African-Eurasian Migratory Waterbirds, or African-Eurasian Waterbird Agreement (AEWA)

Also of relevance to the Project is the Framework Convention on Climate Change, 1992 and the Paris Agreement. This is discussed in more detail under Section 6.

6 MOTIVATION, NEED AND DESIRABILITY

2014 EIA Regulations (as amended), Appendix 3 -3(1) (f) a motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred development footprint within the approved site as contemplated in the accepted scoping report; (g) a motivation for the preferred development footprint within the approved site as contemplated in the accepted scoping report;

6.1 PROPOSED DEVELOPMENT

This section contextualises the strategic planning context within which the Project is being proposed.

South African legislation, including the Constitution and NEMA, entrenches the principle of sustainable development as do the various National strategies, policies, programmes and plans, including the National Development Plan 2030 (NDP). The motivation for the need and desirability motivation for the proposed Project thus needs to be assessed within the context of these strategies, policies, programmes and plans by specifically looking at whether the proposed project is ecologically sustainable and socially and economically justifiable..

STRATEGIC OVERVIEW

The United Nations Sustainable Development Goals (SDGs) or Global Goals were adopted by all member states of the United Nations in 2015 in the commitment to end poverty, protect the planet and ensure peace and prosperity for all people by 2030. South Africa was one of these nations.

The provision of electricity falls under the SDG 7: Affordable and Clean Energy. Notably, the goals are integrated and an improvement in one area affects the outcome of the other SDG areas. For example, an improvement in SDG 7: Affordable and Clean Energy is likely to lead to an improvement in the other SDGs such as: 1 (No Poverty); 3 (Good Health and Well-Being); (8 (Decent Work and Economic Growth); 9 (Industry, Innovation and Infrastructure); 11 (Sustainable Cities and Communities) and 13 (Climate Action).

Figure 6-1: United Nations Sustainable Development Goals (Source: UN General Assembly, 21 October 2015).

Environmental

The principles outlined in the National Environmental Management Act 107 of 1998 (NEMA) must be applied to all decision-making that may affect the environment and its biodiversity. The first two principles in Section 2 of NEMA are that, “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” and “development must be socially, environmentally and economically sustainable”.

Given the integrative nature of sustainability, the requirement for and provision of reliable energy will cross cut various environmental, social and economic goals. Various specialist environmental studies were conducted to identify the potential environmental impacts of the proposed project on life below water, life on land and climate change in order to establish required mitigation in terms of alternatives and other mitigation measures. The findings indicate that:

- Ambient air pollutant and Greenhouse Gases emissions, due to the use of natural gas rather than Liquid Petroleum Gas or coal as energy source, are low. Offset for Greenhouse Gas emissions can be implemented to further reduce impacts identified;
- Marine environment impacts such temperature increases will be mitigated to ensure the temperature remains within thresholds. No additives will be added to the cooling water thereby preventing pollution. The effects of underwater noise from the Powerships on marine ecology are unlikely;
- Risk management and the implementation of maritime standards and protocols can be applied to limit potential incidents such as spillage and flash and jet fires. The possibility of pool fires (explosions), due to the nature of LNG is very unlikely. The risk assessment indicated that the risk of fires, as described, are acceptable for the gas to power operations;

- Life on land impacts - indigenous vegetation clearance, aquatic systems and wetlands - are within the limits of acceptable change as the relatively short distance (approx. 7.5km) 132KV transmission line is the only aspect of the project to have a terrestrial impact. The Karpowership with its relatively small footprint will be moored in the port and have no significant footprint typically associated with power stations or solar power plants;
- Abstraction for cooling purposes will be from the coastal waters with an abundant supply being available in the Port. Fresh water resource allocation, protection of the reserve as well as concerns related to water scarcity, usually associated with land-based power stations, will therefore not be a concern.
- Waste management impacts to the marine environment from black and grey water can be avoided in accordance with the MARPOL requirements. All effluent and solid waste will be removed from the ships and treated and disposed of in terms of the applicable legislation by authorised service providers.

The concept of generating power on the ocean has several benefits over land-based power plants, including small footprint (e.g. the same amount of output can be achieved in a much smaller area compared to land based power plants), significantly shorter timeframes for project delivery / adding capacity, as the Powerships arrive already assembled and ready-to-operate, and land-based impacts are limited and of short term, associated with the establishment of the transmission line and the temporary assembly area for the gas pipeline.

More detail of each of these environmental factors is provided in the relevant sections within the draft EIA Report, namely the project scope alternatives (Section 3), baseline environment section (Section 4) as well as impact assessment (Section 8).

These impacts also need to be considered together with the socio-economic-context i.e. the need to improve the economy and job creation, sustaining businesses and industry within a constrained energy sector and ensuring energy provision for a growing population where many are still disadvantaged and have to making a living without energy. The proposed project is likely to have a significant socio-economically benefit locally, provincially and nationally based on the proposed capacity to be generated and supplied to the grid network. Potential negative impacts on the socio-economic conditions also have to be considered such as air pollution, the contribution to climate change; impacts on other economic activities and livelihoods for example fishing and the potential safety risk due to the presence of a major hazardous installation. These issues, positive and negative are expanded in the sections that follow.

Socio-economic

The importance of energy for socio-economic benefit is well documented as early as 2012. The Draft 2012 Integrated Energy Planning Report: Executive Summary (IEPR) stated that "energy access is now widely recognised as a prerequisite for human development". The Draft 2012 Integrated Energy Planning Report: Executive Summary (IEPR) states that "energy access is now widely recognised as a prerequisite for human development". The access to electricity is outlined within the Municipal Services Act 32 of 2000, giving priority to the provision of basic needs to the local community that is "conducive to the prudent, economic, efficient and effective use of available resources". NEMA supports this through the principle of "equitable access to environmental resources, benefits and services to meet basic human needs and ensure human well-being must be pursued and special measures may be taken to ensure access thereto by categories of persons disadvantaged by unfair discrimination", as would be the case for facilities and citizens unable to afford the more expensive countermeasures to stable electricity supply throughout load shedding.

According to the National Development Plan (NDP) (2030), Government is committed to ensure economic growth and development through adequate provision of sustained energy services that are competitively priced, reliable and efficient. This must be ensured to promote sustainable development and to ensure that the living standard of South African citizens is maintained and improved.

South Africa has experienced a progressively worsening energy crisis from 2007 that has resulted in numerous load shedding events including Level 6 load shedding. Eskom, which provides over 90% of power generating capacity in South Africa (Donnelly, 2018; Mthethwa, 2019; Gosling, 2019; Cohen & Vecchiatto, 2019), has been unable to meet the demands of both the private and public sector. The load shedding measures which were implemented to prevent a total blackout has had dire effects on the South African Economy according to Goldberg, 2015 and Makinana, 2019. Load shedding reduced the South African GDP by roughly 0.30% in 2019, which translates to 8.5 billion of real, inflation-adjusted Rand (Writer, 2019).

Government interventions of introducing additional power stations, generators and even tariff increases have proved to be inefficient in terms of addressing the country's electricity shortages. The Integrated Resource Plan (IRP) 2019 stressed a short-term gap in supply to be anticipated between 2019 and 2022 due to the time expected for the new power stations (Medupi and Kusile) and the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) to come online. This may further be delayed by the poor design and planning of the Medupi and Kusile plants and the delayed correction thereof (Hosken, 2020). The IRP specified the need for new energy efficient technology and the diversification of both the supply and nature of energy production to reduce pollution and minimise impacts related to climate change.

The CSIR (*Setting up for the 2020s: Addressing South Africa's electricity crisis and getting ready for the next decade, 2020*) further predicts that load shedding can be expected for the next 2 – 3 years and that an urgent response is required to ensure reliable short-term energy supply.

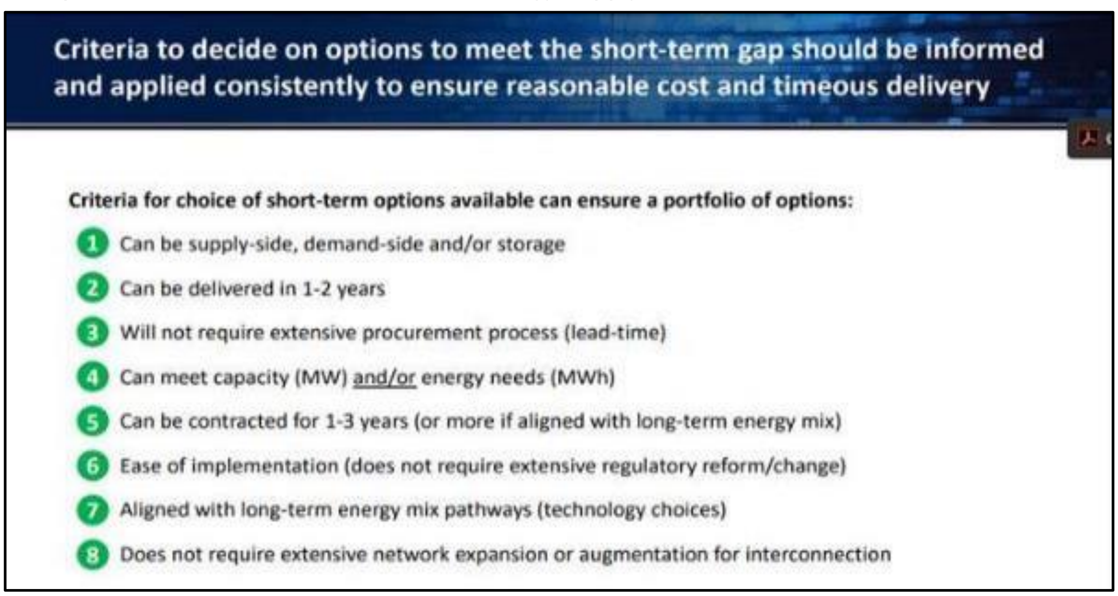


Figure 6-2: **Extract from the CSIR Report (Setting up for the 2020s: Addressing South Africa's electricity crisis and getting ready for the next decade, 2020).**

The Minister of Mineral Resources and Energy published regulations to help address South Africa's ongoing power issues (Staff Writer, 2020 (b)). In addition, the National Development Plan (2030) outlined the need to move the electricity system from Eskom to an independent system and for accelerated procurement of independent power producers on a wide range of alternatives, moving away from the unsustainable use of coal as fuel resource.
The proposed Project, is aligned with National Government initiatives e.g. the "RFI Response Risk Mitigation Power Procurement Programme" and Request for Proposal (RFP) which aims to alleviate the immediate and future capacity deficit as well as the limited, unreliable and poorly diversified provision of power generating technology with its adverse environmental and economic impacts. The RFP stipulated stringent environmental, social and economic criteria inclusive of e.g.:

- the shift from coal and LPG to NG as a cleaner and more cost effective resource;
- BBBEE criteria;
- Skills development.

Karpowership, in submitting applications in terms of the IPP initiatives will comply with sustainable development criteria as these applications are compiled with input from various Government Departments that need to ensure compliance with the Constitution and NEMA principles and meet the country's international obligations.

According to Karpowership, projects will meet and exceed Economic Development qualification criteria stipulated within the RMIPPPP RFP. Karpowership will engage with local businesses and award contracts to local service providers for maintenance aspects as well as waste management, food and other daily consumables. They take pride in their positive impact on local communities through both social responsibility programs, tailored to the specific needs of the community, and the career opportunities that are provided.

Karpowership projects create significant direct and indirect employment, driving knowledge and skills transfer across a broad spectrum of disciplines including some that are unique to floating power plants. Karpowership also emphasizes youth development as the future of our business, industry, and the local economy. As a globally recognized leader with 1,800+ direct employees, they provide an opportunity for South Africans, which will make up the majority of their personnel, to develop specific skills and knowhow which will ultimately benefit the South African economy. They will also be provided with the opportunity to become part of an internationally diverse team, gaining and sharing experience and knowledge either locally or worldwide alongside industry leading colleagues.

There will be a significant number of local employees for both the construction and operation period which will exceed the Economic Development criteria that must be reached under the terms of the RMIPPPP. They also believe that the job creation, including within the power generation function, will be comparatively more than a renewable energy project should the project be selected to proceed.

As per the Socio-Economic Specialist report, aside from the positive impacts though, the project will be creating negative direct, secondary and cumulative impacts on the local communities, specifically areas surrounding the site where the proposed facility is to be built. The main factors that will cause this negative impact are (1) the influx of workers and job seekers from outside of the local community, (2) the impact on the surrounding economic and social infrastructure and (3) the limited visual and noise disturbances that could be created by the construction activities as the footprint of the facility grows.

The project is anticipated to make a notable contribution towards the national and local economy. It is estimated that a total of R653.5 million of new business sales, R186.8 million of GDP and 776 FTE employment positions will be generated by the project in the national economy through multiplier effects. Aside from the above positive effects, the project will contribute to skills development in the country, increase government revenue, as well as raising household earnings. The increase in household earnings is also likely to improve the standards of living of the affected households albeit temporarily.

The operation of the proposed Powerships and their associated infrastructure will generate R528.6 million of new business sales, contribute R321.0 million to GDP and create 288 sustainable FTE employment positions. In addition, government revenue will rise, electricity supply will be increased, and various socio-economic and enterprise development initiatives will be undertaken from the revenue generated by the development. These funds will be allocated towards socio-economic development in the area and are expected to bring a significant benefit to local communities.

NEW GENERATION CAPACITIY AND RISK MITIGATION IPP PROCUREMENT PROGRAMME

The Department of Mineral Resources and Energy (DMRE) issued the Request for Proposals (RFP) to procure new energy generation capacity as per Government Notice 753 (7 July 2020): Determination Under Section 34(1) of the Electricity Regulation Act, 2006 (Act No. 4 of 2006) wherein the Minister, in consultation with the National Energy Regulator of South Africa (NERSA) has determined “that new generation capacity is needed to be procured to contribute towards energy security” and “the electricity must be purchased from independent power producers”.

The Risk Mitigation Independent Power Producer (IPP) Procurement Programme has been identified by the DMRE as the appropriate programme to procure the new generation capacity designated in the above Determination. As such, a call for proposals to IPPs was published by DMRE “to ensure the establishment of this new generation capacity through the Risk Mitigation IPP Procurement Programme:

- The Risk Mitigation IPP Procurement Programme has been designed to procure the target of 2000 MWs of new generation capacity to be derived from different types of dispatchable power generation projects that will enter into public-private agreements with Eskom to provide new generation capacity in compliance with the Performance Requirements, among other things.
- The dispatchable power generation projects may utilise fuel to produce the energy output and may be comprised of more than one facility and project Site.
- Furthermore, the selected projects will contribute towards socio-economic development and sustainable economic growth, while enabling and stimulating the participation of independent power producers in the electricity supply industry in South Africa.”

The updated Integrated Resource Plan (IRP) 2019 was developed as a “co-ordinated schedule for generation expansion and demand-side intervention programmes, taking into consideration multiple criteria to meet electricity demand”. The IRP is a plan for infrastructure development based on a least supply and demand balance approach, taking into account security of supply and minimising negative emissions and water usage impacts on the environment. It has been developed within a context characterised by changes in energy technologies and their associated uncertainty of the impact on the future energy provision system. With this uncertainty expected to continue, a cautionary approach must be adopted when making assumptions and committing for the future in this rapidly changing environment. As such, long-term commitments are to be avoided as much as possible, to eliminate the risk that they might prove costly and ill-advised (IRP, 2019).

The decommissioning of the existing coal fleet (due to end of design life) will provide space for a relatively different energy mix. It must be noted that, in the period preceding 2030, the system requirements are largely for incremental capacity addition (modular) and flexible technology, to complement the existing installed inflexible capacity (IRP, 2019). This is essentially what a system like the Karpowership fleet can provide, ship-based power generating and transmission of energy to land-based transmission connection points. This capacity can be modularly up-scaled on site with a very short lead time to meet additional requirements, should these be required at a later stage.

Also of particular importance is acquiring energy security by developing adequate electricity generation capacity to meet our demand under both the low-growth economic environment as well once the economy improves to the level of 4% growth per annum. Electricity generation capacity must therefore be paced to restore the necessary reserve margin and to be ahead of the economic growth curve at least possible cost (IRP, 2019).

One concern and risk raised during the August 2018 public participation process undertaken for the IRP 2019 update, was related to the capacity provided for and practicality of gas to power and the risks it poses since South Africa does not currently have adequate gas infrastructure. The Karpowership generation process proposes the use of internationally sourced LNG gas supply that will be transported via a LNG carrier to the proposed FSRU location. A gas line will be established between the FSRU and Powerships to provide a secured supply of natural gas. No gas supply is required from local South Africa resources to ensure efficient operations and all other infrastructure will be supplied.

ESKOM POWER RELIABILITY AND GOVERNMENT'S RESPONSE TO THE ENERGY DEMAND

Eskom's existing generation plant Energy Availability Factor (EAF) was assumed to be averaging 86% in the promulgated IRP 2010–2030. The actual EAF at the time (2010) was averaging 85%. Since then, Eskom's EAF declined steadily to a low average of 71% in the 2015/16 financial year before recovering to average around 77% in the 2016/17 financial year. Information as at January 2018 indicated that EAF had regressed further to levels below 70%. This low EAF was the reason for constrained capacity early in December 2018 and January 2019 that resulted in load shedding (IRP, 2019).

Additionally, the IRP (2019) states that there are a number of Eskom coal plants that will reach end of design life from year 2019 and that most of the Eskom plants were designed and constructed for operation for 50 years. Eskom had also submitted a revised plant end of design life (decommissioning) plan. This submission brings forward the shutdown of some units at Grootvlei, Komati and Hendrina. The IRP (2019) showed that approximately 5 400 MW of electricity from coal generation by Eskom will be decommissioned by year 2022, increasing to 10 500 MW by 2030 and 35 000 MW by 2050. The socio-economic impact of the decommissioning of these Eskom plants were not quantified or included in the IRP.

A number of Eskom power plants (Majuba, Tutuka, Duvha, Matla, Kriel and Grootvlei) have been retrofitted with emission abatement technology to ensure compliance with the law (IRP, 2019). In 2014 Eskom applied for postponement of the date for compliance and permission in this regard was granted for a period not exceeding 5 years. According to the IRP (2019), Grootvlei was the only station that has been brought to compliance and failure to undertake abatement retrofits is likely to result in non-compliant plants. It is understood that Eskom has applied to postpone compliance with the minimum emissions standards for air pollution with multiple additional postponement applications for the majority of its powerstations during 2020. Eskom has stated that it will apply for rolling postponement rather than trying to meet the sulphur dioxide standards. Should these not be issued, Eskom maybe required to expedite plans to decommission old polluting stations that cannot meet the MES with potential dire consequences for secured energy supply.

Simulations used to update the IRP (2019) show that there is an immediate risk of energy shortage in the immediate term. Eskom’s early shutdown of non-performing units (Grootvlei, Komati and Hendrina), coupled with the non-compliance status of some plants and the de-rating of Medupi and Kusile to below name-plate rating result in an immediate risk of huge power shortages. The recently experienced load shedding as well frequent alerts of possible shortages corroborate the observations from the power system simulations.

Industrialisation of South Africa has led to increased demand for electricity by an ever-growing population from a strained power service operated by, Eskom. This has led to a number of power shortfalls throughout the country, as supply cannot meet demand. The power shortfalls and the unreliable electricity generation has had major impact on the South African economy (Goldberg, 2015; Makinana, 2019). Furthermore, certain temporary and permanent shut downs of power plants across the country have come with serious impacts to energy supply. These shutdowns directly impact the energy supply to the host community thus directly impact the local economy. This has generated the need for a diversified/ innovative power supply. This is based on national policy and informed by ongoing planning undertaken by the Department of Energy (DoE) and the National Energy Regulator of South Africa.

The National Development Plan 2030 has outlined access to electricity as one of the “Elements of a Decent Standard of Living”. South Africa has faced significant electricity shortages over a number of years and the escalating electricity crises experienced since 2007 has significantly impacted the standard of living of its citizens and resulted in ruinous economic losses.

In order to achieve sustainable and inclusive growth by 2030, South Africa needs to invest in a strong network of economic infrastructure to support the country’s medium- and long-term objectives according to the National Development Plan (NDP) 2030.

The vision of the NDP includes the promotion of economic growth and development though adequate provision of quality energy services that are competitively priced, reliable and efficient. Addressing access to energy will promote sustainable development, encourage economic competition and ensure that living standards are maintained and improved. According to the Integrated Resource Plan 2019, the Minister of Energy determined that 39,730 MW of new generation capacity must be developed. Currently 18,000 MW of the required 39,730 MW has been committed to as follows:

- 6,422 MW new capacity under the REIPPP with a total of 3,876 MW operational on the grid;
- 4,514 MW Eskom build with remaining planned build of 6,418 MW;
- 100 MW of Sere Wind Farm; and
- 1,005 MW from OCGT for peaking.

A key component of the 20-year master-plan is the requirement for new energy generating capacity from a range of technologies like renewables and natural gas. Alternative sources of power generation allow countries to move away from open cycle gas turbines (OCGTs) (South Africa’s- Eskom situation), and use of expensive diesel to generate electricity during peak demand (Siyobi, 2015).

The use of natural gas from LNG in power generation provides a cleaner alternative to coal and other fossil fuels, reducing carbon and other emissions such as SO_2 and PM_{10}, resulting in both immediate and long-term benefits for public health and the environment. LNG shipments allow the environmental benefits of natural gas to be spread around the world and can help reduce global greenhouse gas emissions according to a report by PACE Global LNG and Coal Life Cycle Assessment of Greenhouse Gas Emissions. The ability to burn natural gas for power generation is an ideal complement to renewable energy generation, like wind and solar power, which can be intermittent and inconsistent in their output. Natural gas power plants can be quickly turned on and off or ramped up and down to help provide consistent electricity production when solar or wind resources fluctuate.

As part of his 2020 State of the Nation Address on 13 February 2020, the President announced that government would implement measures to “rapidly and significantly increase generation capacity outside of Eskom”. Established measures include the Section 34 Ministerial Determination that supports the Integrated Resource Plan 2019, which facilitates additional energy generation to the national grid through renewable energy, natural gas, hydro power, battery storage and coal. As per the President’s speech at the 2021 State of the Nation Address on 11 February 2021, in December 2020, government and its social partners signed the historic Eskom Social Compact, which outlines the necessary actions to be taken collectively and as individual constituencies, to meet the country’s energy needs now and into the future. Government have taken action to urgently and substantially increase generation capacity in addition to what Eskom generates. The following actions were highlighted as per the President’s address:

“The Department of Mineral Resources and Energy will soon be announcing the successful bids for 2,000 megawatts of emergency power. Government will soon be initiating the procurement of an additional 11,800 megawatts of power from renewable energy, natural gas, battery storage and coal in line with the Integrated Resource Plan 2019. Despite this work, Eskom estimates that, without additional capacity, there will be an electricity supply shortfall of between 4,000 and 6,000 megawatts over the next 5 years, as old coal-fired power stations reach their end of life.”

The Emergency/Risk Mitigation Power Purchase Procurement Program (2000 MW) (ERMPPPP) has been declared a Strategic Integrated Project (SIP) under the Infrastructure Development Act, 2014 under SIP 20. One of the objects of this Act is “the identification and implementation of strategic integrated projects which are of significant economic or social importance to the Republic or a region in the Republic or which facilitate regional economic integration on the African continent, thereby giving effect to the national infrastructure plan”.

South Africa’s electricity generation capacity shortfall can only be solved by additional generating capacity. Although additional power stations are under construction, there is a lengthy gap of time between the present shortage and the commissioning of all units of these new power stations. In the meantime, the economy suffers from the reduction of productivity and increased costs resulting from power interruptions caused by equipment failure (so-called unplanned maintenance) and load shedding.

Access to cost-effective temporary base-load generation of a significant magnitude will help to solve the problem by supplying the power to meet the load which is often being shed or reduced at present. Reliable power generation facilities are required to address both the immediate power shortfalls, as well as the longer term increasing demand for electricity. Powerships can deliver electricity in a very short timeframes as the normal delays associated with land-based power plants construction are negated as these Powerships have been purpose built prior to deployment.

ECONOMIC RECOVERY AND ENERGY REQUIREMENTS

Sustainable energy provision is also key to ensuring economic recovery. The CSIR reported that in 2019 load shedding reduced the South African economy by between R 60 billion to R 120 billion (Wright and Callitz, 2020). There are estimations that the overall economic loss to the South African economy over the last 10 years is as high as R 338 billion. Energy analysts have determined that every hour of every stage of load shedding costs the economy R 50 million to R 100 million (Hosken, 2020). Energy analysts predict that load-shedding will have a greater detrimental impact to South Africa's failing economy and may drive many businesses into bankruptcy and reduce investment into the country (Hosken, 2020).

IMPORTANCE OF NATIONAL & PROVINCIAL COLLABORATION AND PRIVATE PARTNERSHIPS

The planned economic recovery for the Country will be impossible in the absence of a reliable and adequate power supply to the economic sectors. Therefore, the success of one province impacts on the success of other provinces. The establishment of reliable power in one province has a domino effect on other provinces.

PORT PLANNING

The proposed development of infrastructure for the provision of electricity is in line with the permitted uses within the Harbour land use. The ports of South Africa are hubs of the economy, maintaining crucial connection between sea and land transport as well as imports and exports. Ports are closely associated with the IDZs/ Special Economic Zones (SEZ) in terms of the Special Economic Zones Act 16 of 2014, so called as they are specifically designed to allow for related industries to be based in an Industrial Zone.

Transnet has been actively involved over an extended period of time with the identification of gas to energy options to be established within the Ports e.g. "Transnet preparations for gas infrastructure in South Africa" as part of the South Africa Gas Options Conference held on September 2015 in Cape Town.

The Port of Ngqura is moving towards becoming the primary central port, while the Port of Port Elizabeth is transitioning to providing complementary services to the Port of Ngqura (National Port Plan, 2019). The 2010 gazetted port limits are presented in Figure 6-3 and the layout of the port, indicating the precincts and berth layout, is presented in Figure 6-4.

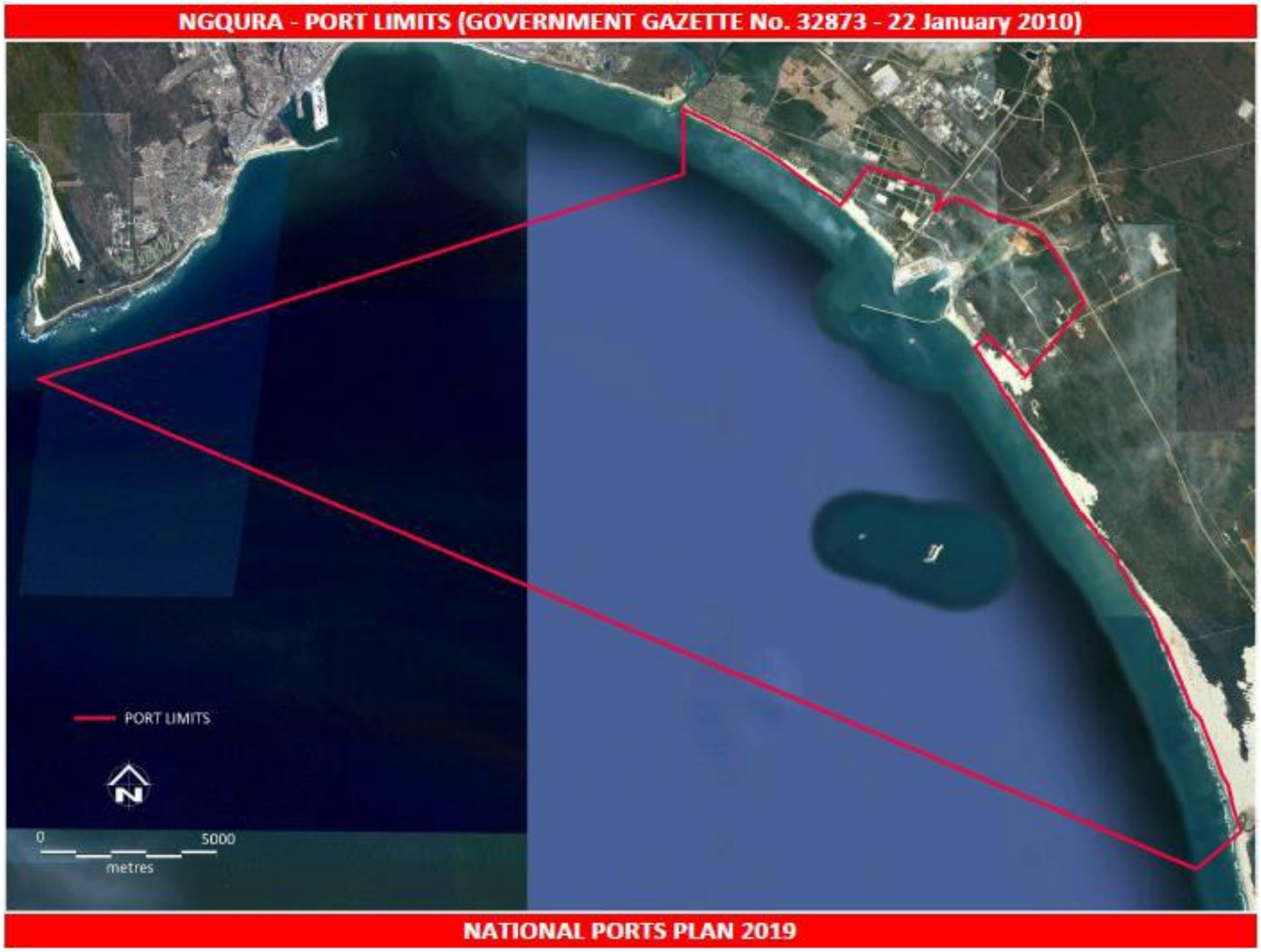


Figure 6-3: Ngqura gazetted port limits (Government Gazette No. 32873 –January 2010).

Figure 6-4: Precincts and berth layout of the Port of Ngqura.

Due to the Port's strategic placement, it is able to economically contribute to the Nelson Mandela Bay Metropolitan Municipality GDP (31 %) which is regarded as a significant weight in the manufacturing sector (National Port Plan, 2019). The strategy of the Port of Ngqura is also strongly aligned with the SEZ taking into account the ecology of the area as well as addressing the socio-economic issues in Eastern Cape Province.

The future planning of the port is steering towards a multi-purpose terminal. The Port is also making provision for Liquid Natural Gas (LNG), which further establishes the Port as an energy hub (National Port Plan, 2019). Leading technological innovation is evident in the implementation of an Integrated Port Monitoring System (IMPS) and Automated Mooring System (AMS) that aim to enhance productivity, safety, and efficiency within the port (National Port Plan, 2019).

Short Term Layout Plan

The planned port layout for the year 2019 to 2028 is shown in Figure 6-5.

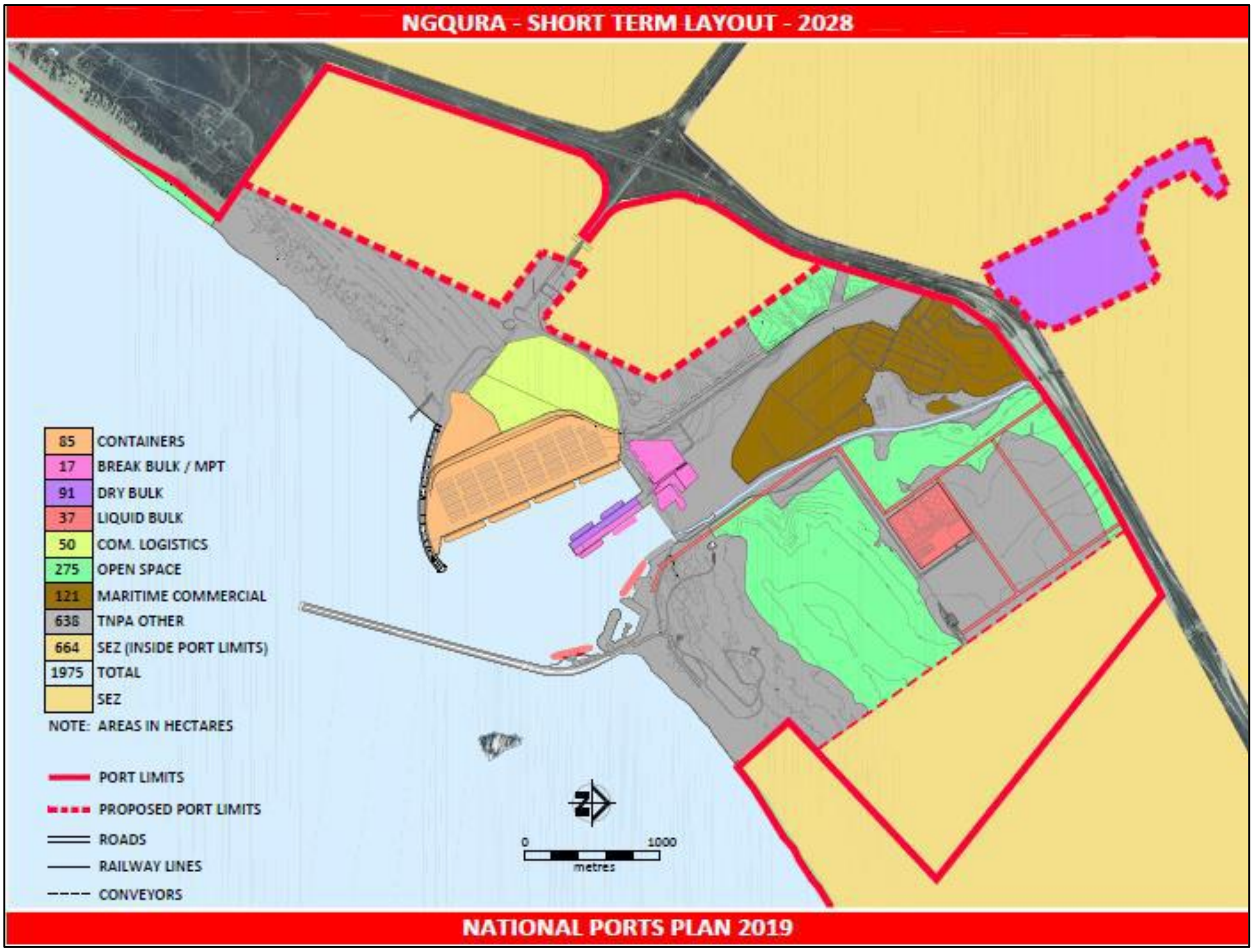


Figure 6-5: Port of Ngqura short-term layout.

The following changes are foreseen for the short-term layout:

- Break bulk berth B100 converts to liquid bulk.
- Break bulk berths C100 and C101 convert to dry bulk.
- A portion of the TNPA other land (37 ha) being reassigned to liquid bulk.
- Proposed port limits to change to accommodate the manganese stockyard (additional 88 ha storage for dry bulk).
- Boundary line changes to proposed port limits.
- TNPA “other” land (36 ha) being reassigned to commercial logistics (Port Logistic Park).
- Liquid bulk terminal at the finger-jetty to be converted back to break bulk.
- Liquid bulk move to a new berth, A100.
- A new LNG berth to be constructed next to the eastern breakwater.
- Construction of a new break bulk berth B101.
- Dig out next to the finger-jetty provides additional quay lengths for two additional berths

Medium-term layout

Illustrated in Figure 6-6 is the planned port layout for the year 2024 to 2046.

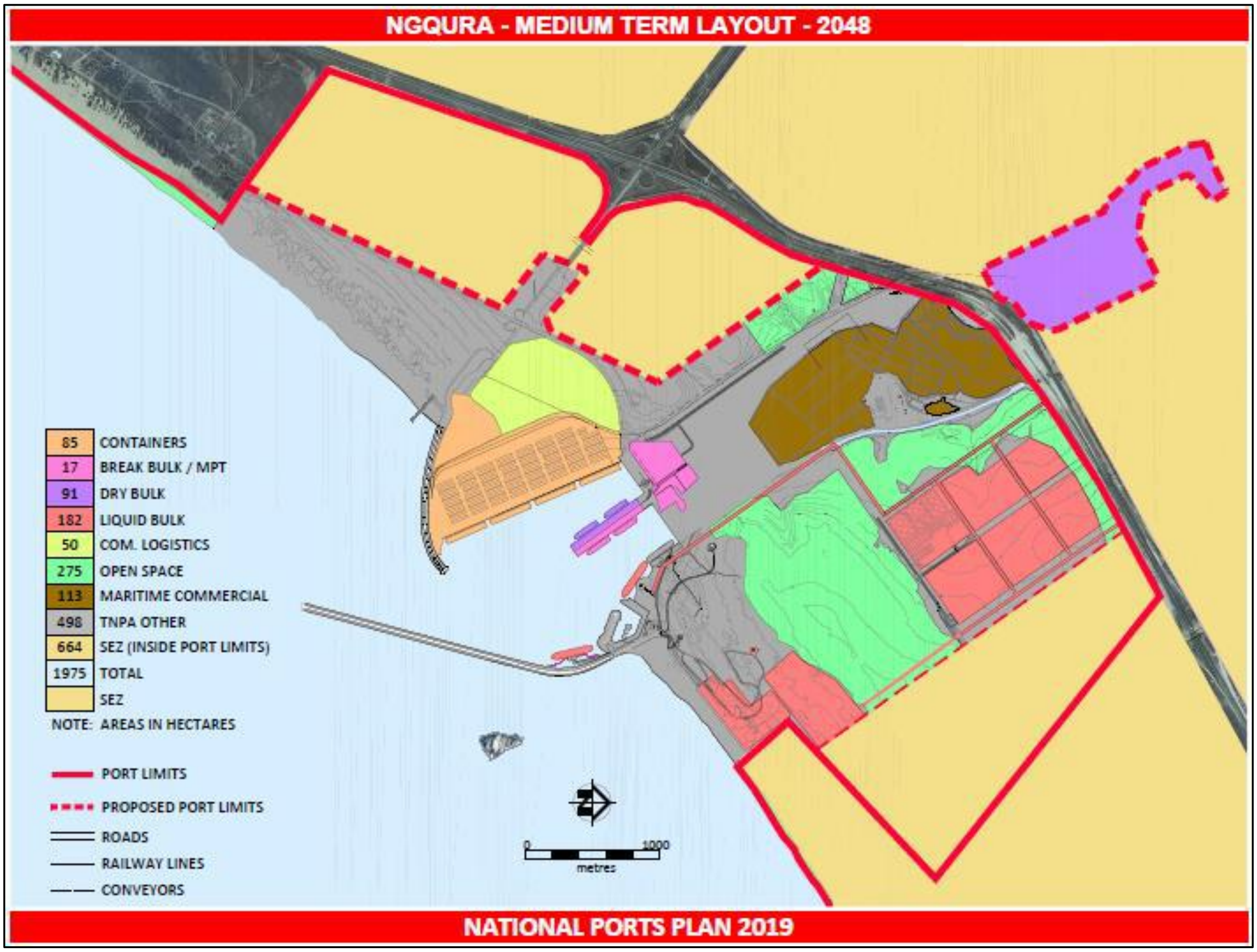


Figure 6-6: Port of Ngqura medium-term layout.

The following changes are predicted from the short-term to the medium-term port layout:

- TNPA other available land (145 ha) to be converted to liquid bulk and LNG storage facilities.

Long-term layout

Figure 6-7 and Figure 6-8 show the planned port layout for the years beyond 2048 for the Port of Ngqura.

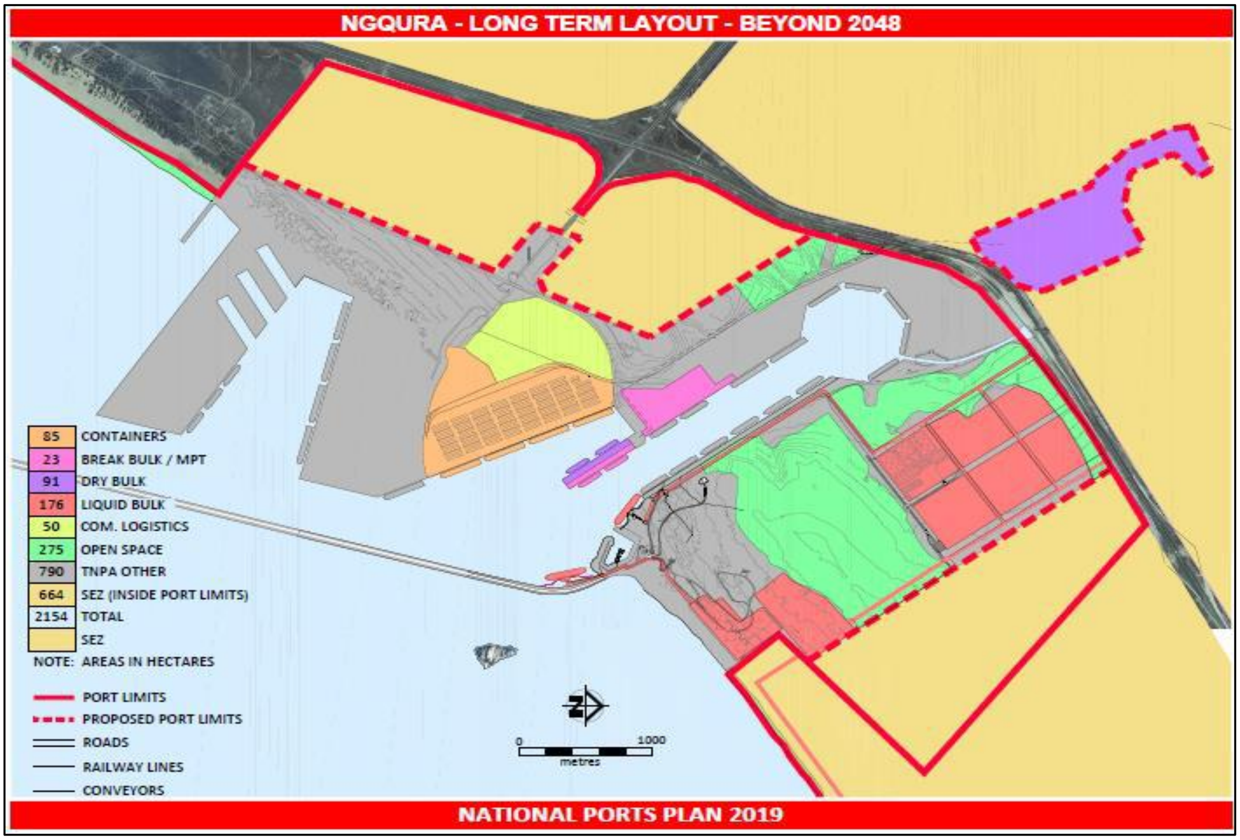


Figure 6-7: Port of Ngqura long-term layout (excl. the new SPM).

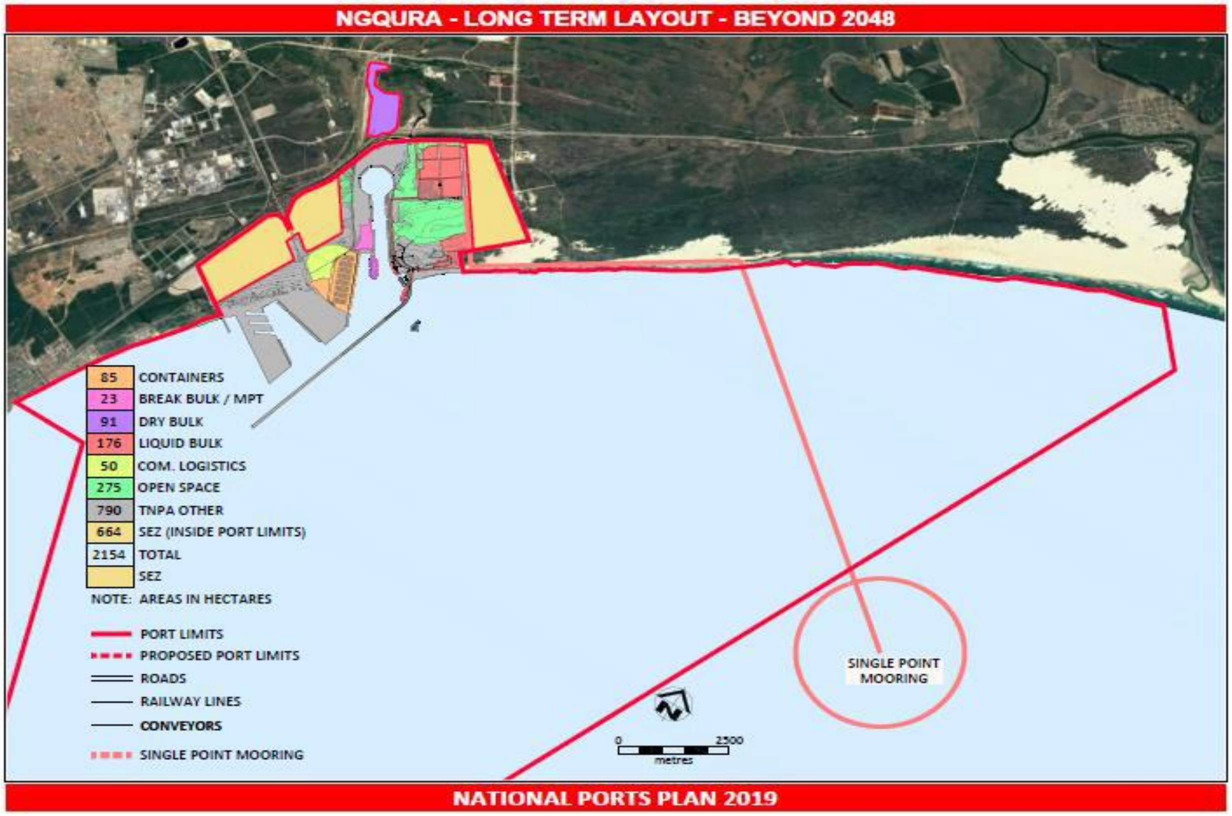


Figure 6-8: Port of Ngqura long-term layout (incl. the new SPM).

The following additional developments are envisioned for the long-term layout:

- Extension of the eastern breakwater
- Port expansion towards the north. Dig-out provides capacity for additional 14 berths.
- Port expansion to the west. Dig-out provides capacity for additional 8 berths. This expansion includes land reclamation to provide additional quay lengths. TNPA other land area increased by 190 ha.
- New Single Point Mooring (SPM) to be constructed.

The above three layouts (short, medium and long-term) align with the Eastern Cape Vision 2030 Provincial Development Plan, Eastern Cape Strategic Plan 2020 – 2025 and the Nelson Mandela Bay Municipality Draft Integrated Development Plan – 2017/18 – 2021/22 which support the expansion of the Port.

The project proposal, having been assessed by PRDW in relation to the proposed Port Plans, is considered to be aligned with the Transnet studies and plans.

As per the National Port Plan (2019), the Port of Ngqura has been earmarked for further development in the port expansion plans, and the proposed development site is situated within the planned expansion area.

COEGA SEZ

The Coega Industrial Development Zone which was established in 1999 at the Nelson Mandela Bay Metropolitan Municipality (NMBM) in the Eastern Cape Province. It was designated as a Special Economic Zone (Coega SEZ) in terms of the Special Economic Zones Act 16 of 2014. The Coega IDZ, managed by the Coega Development Corporation (CDC) is adjacent to the deep water Port of Ngqura SEZ which was developed and is managed by the Transnet National Ports Authority (TNPA)

The Coega SEZ created opportunities through clusters that facilitate synergy and supply chain integration. Zone 8 Port Area and Zone 13 – Energy Cluster enable the location of the proposed project as per the lay-out and provisions of the Energy Cluster. It is anticipated that the proposed project can be accommodated within the Coega IDZ, Energy Cluster layout below.

There are several conservation planning tools that help with guiding proposed developments within the area as well as assessing their ecological sensitivity, each of these was considered and assessed. For example the Coega Open Space Management Plan provides guidelines for development within the Port of Ngqura as well as within the Coega Industrial Development Zone. The OSMP identifies sensitive ecological areas and areas of high biodiversity, ensuring that planning considers the ecological sensitivities. The proposed transmission alignment was re-aligned to ensure adherence to the Coega Open Space Management Plan.

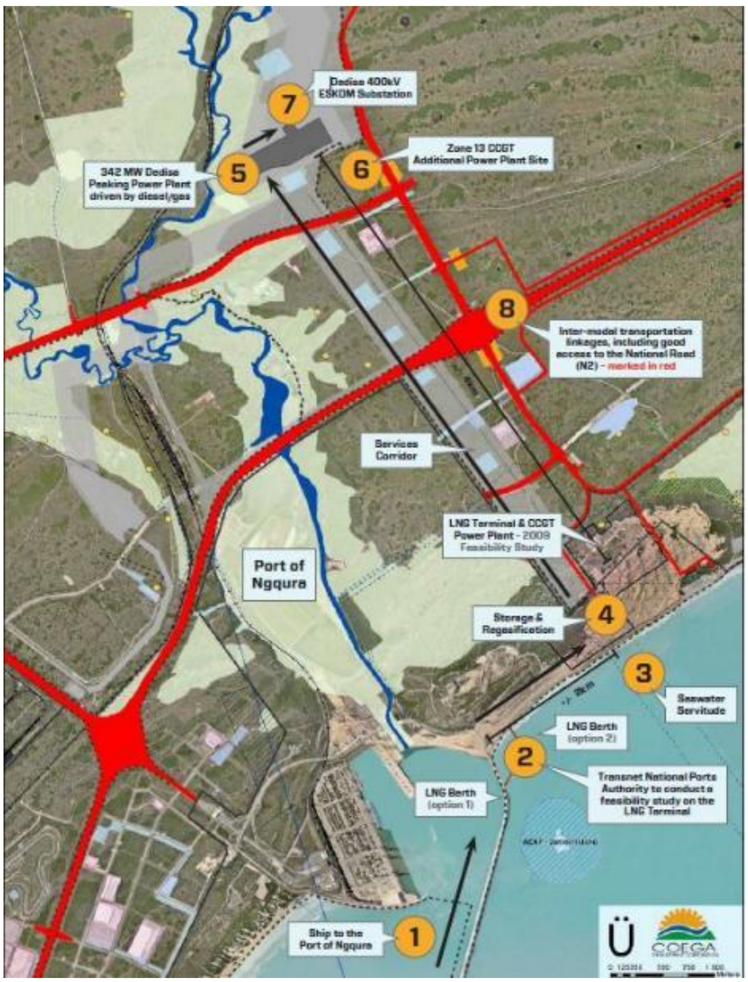


Figure 6-9: Port of Ngqura long-term layout (incl. the new SPM).

MUNICIPAL PLANNING

Nelson Mandela Bay Integrated Development Plan (IDP), 2020

The NMBM IDP sets out a range of sectoral priorities linked to the municipality's respective directorates, one of which is electricity and energy. In terms of its mandate as articulated in the IDP, the NMBM seeks to provide a safe, reliable, environmentally friendly, sustainable, and cost-effective electricity supply to electricity users in the municipality. Pursuant to this, the NMBM is classified as an energy distribution utility and holds a NERSA licence to distribute and trade in energy to end consumers within the defined licenced area. According to the NMBM IDP, the amendments to the Electricity Regulations Act (No. 4 of 2006) make it possible for the municipality to procure electricity directly for Independent Power Producers (IPP's). The IDP, however acknowledges that this needs to be carefully considered and possible utilised to develop the renewable energy economy in the city. The IDP also proposes the development of an Energy Mix Master Plan that will enable to the NMBM to curb its use of fossil fuels as well as reduce its reliance on the Eskom grid. This plan should consider alternative energy sources and the spin-offs will result in decreased cost of energy to consumers. The propose Powerships and its related infrastructure would thus closely align to these objectives, particularly were the managing entity sell directly to the NMBM.

Nelson Mandela Bay Municipality Draft Integrated Development Plan – 2017/18 – 2021/22
The Nelson Mandela Bay Municipality Integrated Development Plan (IDP) cites one of the economic challenges as an unstable electricity grid dominated by coal powered energy. The proposed Powership project aligns to the Nelson Mandela Bay Municipality's Electricity and Energy Directorate mandate of environmentally friendly, sustainable and cost effective electricity supply to the national grid.

The proposed project is proposed within the Strategic Environmental Zone of the Port and immediately adjacent Special Economic Zone at Coega.

Furthermore, in line with the planned expansions on the Port (as per the National Ports Plan, 2019), the port expansion is also captured in the Nelson Mandela Bay Metro Municipality: IDP (2017/18-2021/22) and the Metropolitan Spatial Development Framework (dated 2009).

Nelson Mandela Bay Metropolitan Spatial Development Framework (MSDF), 2015
The NMBM MSDF notes that the Coega SEZ is a critical vehicle for the economic development of the NMBM. It notes that investment in the energy sector, with the purpose of feeding into the electrical grid is an important priority for the SEZ, and that these investments should focus on renewable energy, peaking power generation capacity, base load, and associated beneficiation opportunities. The MSDF also notes, that the Coega SEZ is well positioned to establish a Liquefied Natural Gas handling facility and associated power generation facilities.

PROVINCIAL DEVELOPMENT
Goal 4 of the 2030 Provincial Development Plan envisions vibrant, equitably enabled communities. In particular the universal access to social infrastructure. Within the PDP it is outlined that a potential constraint on economic potential within the Eastern Cape is the high municipal charges (electricity, water, rates) and deteriorating delivery quality.

Strategic action 1.1.6: Position the province as a key investment hub in the energy sector and ensure reliable energy supply to high-potential sectors

The Eastern Cape Province aims to draw in investment for the energy sector (wind farms, imported liquefied natural gas, shale-gas and nuclear energy). The proposed establishment of the Powerships and transmission lines directly supports this strategic action. It is hoped that the attraction of investment could be a great facilitator for economic development.

Strategic action 1.5.8: Grow and develop the ocean economy

The province envisions there to be growth within the port, maximising the Port's potential. The Powerships project will greatly support this initiative.

Eastern Cape Strategic Plan 2020 – 2025

The vision for the Eastern Cape Province is that "By 2030, the Eastern Cape will be an enterprising and connected province where all people reach their potential". The main focus is aligned to the 2030 Provincial Development Plan (PDP). Outcome 2 of the Strategic Plan 2020 - 2025 "An inclusive economy that grows sustainably, created decent jobs and is innovative." From the preceding sections that a sustained energy supply is a foundation for economic growth. The proposed Powership project supports this vision in enabling economic growth and job creation. Outcome 2 ties in with the United Nation's Sustainable Development Goals, South Africa's National Development Plan and the Eastern Cape's Provincial Development Plan all aim to halve poverty, end hunger and reduce inequality by 2030. Energy dependent

Karpowership SA (Pty) Ltd proposes to establish Powerships within the port of Ngqura, feeding energy into the South African national electricity grid. This is in line with the following plans developed for future planning of the area. As per the Eastern Cape Vision 2030 Provincial Development Plan, the 2030 Provincial Development Plan (PDP) outlines the vision for the Eastern Cape Province. The main focus is economic transformation and job creation, education, skills and health, reliable and quality basic services, spatial integration, human settlements and local government, safe communities, a capable as well as an ethical and developmental state. These priorities form the framework for Eastern Cape Socio Economic Consultative Council's (ECSECC) 5-year strategy. The Applicant will prioritise employment of local people wherever possible, as well as develop local skills to make it possible in cases where those skills do not exist in the local workforce.

6.2 THE ACTIVITY IN THE CONTEXT OF THE PREFERRED DEVELOPMENT FOOTPRINT WITHIN THE APPROVED SITE

Location and Land Use Suitability

Being a ship-based power generating operation (as opposed to land-based) with transmission of energy to land-based transmission connection points, the location within the Port of Ngqura, which is adjacent to the Coega Special Economic is suited for the importation of LNG as fuel source, the generation of power and the evacuation to the Dedisa substation situated within the Coega IDZ.

Port Traffic, Navigational Requirements and Extent of Marine Based Infrastructure

The Port provide adequate footprint for the mooring of the Powerships and the FSRU and provides adequate clearance for the delivery of LNG via LNG Carriers.

The gas pipeline to transfer natural gas from the FSRU to the Powerships can be accommodated along the breakwater and overland, minimising potential marine impacts.

Environmental Sensitivities

Numerous independent specialist studies were conducted to assess the potential impact on the environmental and socio-economic aspects related to the proposed gas to Powership project. No fatal flaws were identified during the Specialist assessments and EIA process. The proposed transmission line was re-aligned to avoid the sensitive Bontveld area. The Powership and the cooling water discharge will occur in the Port, West of the breakwater, which is acting as a buffer between the site and the Marine Protected Area.

7 PUBLIC PARTICIPATION PROCESS

2014 EIA Regulations (as amended), Appendix 3: 3(1) (h) (ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs; (iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them.

7.1 PRE-APPLICATION CONSULTATION

A virtual pre-application meeting was held with DEFF on the 17th September 2020 via Microsoft Teams, and the minutes are attached as Appendix H. A public participation plan was subsequently approved by DEFF according to which the public participation process is being conducted. Other points discussed in the meeting and addressed in the report include assessing the compatibility of the proposed project with Port's planning, assessing cumulative impacts, the assessment of the decommissioning phase and the involvement of the DEFF Air Quality Branch.

7.2 REGISTERED INTERESTED AND AFFECTED PARTIES

A proponent or applicant must ensure the opening and maintenance of a register of interested and affected parties and submit such a register to the competent authority, which register must contain the names, contact details and addresses of—

(a) all persons who, as a consequence of the public participation process conducted in respect of that application, have submitted written comments or attended meetings with the proponent, applicant or EAP;

(b) all persons who have requested the proponent or applicant, in writing, for their names to be placed on the register; and

(c) all organs of state which have jurisdiction in respect of the activity to which the application relates.

An I&AP register was opened at the beginning of the scoping phase, and a copy of it up to the end of Scoping, is included in Appendix D7. Contact details of private persons have been omitted in interests of privacy. The register will continue to be updated on an ongoing basis during the rest of the EIA process. A complete version of the I&AP register will be submitted with the final EIA Report to DEFF.

7.3 LANDOWNER NOTIFICATION

The properties that are directly affected by the proposed development are listed in **Table 2-6**. The details of the affected landowners are included in the I&AP database.

According to regulation 39(1) of GN No. R. 982 of 4 December 2014 (as amended), if the proponent is not the owner or person in control of the land on which the activity is to be undertaken, the proponent must, before applying for an environmental authorisation in respect of such activity, obtain the written consent of the landowner or person in control of the land to undertake such activity on that land. This requirement does not apply *inter alia* for linear developments (e.g. pipelines, power lines, roads) or if it is a SIP as contemplated in the Infrastructure Development Act, 2014.

7.4 NOTIFICATION OF INTERESTED AND AFFECTED PARTIES- SCOPING PHASE

7.4.1 Site Notification

(a) *fixing a notice board at a place conspicuous to and accessible by the public at the boundary, on the fence or along the corridor of—*

(i) *the site where the activity to which the application or proposed application relates is or is to be undertaken; and*

(ii) *any alternative site;*

A total of three A2 site notices were placed within the site area, in three languages (English, Afrikaans and iXhosa) were placed on:

Location 1: the electronic noticeboard on CDC main building,

Location 2: site entrance to the Port Registration Office, and

Location 3: at the Port entrance.

Refer to Appendix D4 for photographic evidence of the site notices erected during the Scoping Phase.

(b) *giving written notice, in any of the manners provided for in section 47D of the Act, to—*

(i) *the occupiers of the site and, if the proponent or applicant is not the owner or person in control of the site on which the activity is to be undertaken, the owner or person in control of the site where the activity is or is to be undertaken and to any alternative site where the activity is to be undertaken;*

(ii) *owners, persons in control of, and occupiers of land adjacent to the site where the activity is or is to be undertaken and to any alternative site where the activity is to be undertaken;*

(iii) *the municipal councillor of the ward in which the site and alternative site is situated and any organisation of ratepayers that represent the community in the area;*

(iv) *the municipality which has jurisdiction in the area;*

(v) *any organ of state having jurisdiction in respect of any aspect of the activity; and*

(vi) *any other party as required by the competent authority;*

(i) owners, persons in control of, and occupiers of land adjacent to the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken;

A Background Information Document (BID) and Notice of Application (NOA) was emailed in three languages (English, Afrikaans and Xhosa) to identified Stakeholders and I&APs on 21st September 2020, including landowners, the municipal ward councillor and the Ratepayers Association, and the following organs of state were furnished with the document: Department of Energy, Eskom, Department of Water and Sanitation, Department of Forest, Fisheries and the Environment, Local Municipality, South African Heritage Resource Agency (SAHRA), South Africa Maritime Safety Authority, South African National Roads Agency, National Energy Regulator of South Africa (NERSA), South African National Roads Agency (SANRAL), Eastern Cape Provincial Heritage Resources Authority (ECPHRA), Eastern Cape Parks and Tourism Agency, Department of Economic Development, Environmental Affairs and Tourism (DEDEAT): Cacadu Region, Department of Agriculture, Forestry and Fisheries, Department of Environmental Affairs (DEA) Oceans and Coasts. Refer to Proof in Appendix D7.

Refer to Appendices D3, D4 & D8 – Proof of Notification and copies of BID and NOA.

7.4.2 Advertisements

(c) placing an advertisement in—

(i) one local newspaper; or

(ii) any official Gazette that is published specifically for the purpose of providing public notice of applications or other submissions made in terms of these Regulations;

(d) placing an advertisement in at least one provincial newspaper or national newspaper, if the activity has or may have an impact that extends beyond the boundaries of the metropolitan or district municipality in which it is or will be undertaken: Provided that this paragraph need not be complied with if an advertisement has been placed in an official Gazette referred to in paragraph (c)(ii); and

Advertisements were placed in two newspapers in the following 3 languages on the following dates:

- **Herald Newspaper: English, Afrikaans and isiXhosa- published on 22nd September 2020; and**
- **Daily Dispatch Newspaper: English- published on 21st September 2020 and Afrikaans and isiXhosa- published on 23rd September 2020.**

(Refer to Appendix D5 and Appendix D6 for copies of advertisements and proof of placement)

Ongoing and other communication methods

During the Scoping Phase, an effort to notify I&APs in the surrounding community, A5 flyers were placed at the following locations:

- **CDC;**
- **Transnet Admin Building;**

These flyers had similar text to the Site notices providing I&APs/ Stakeholders with information relating to the project. Refer to Appendix D3 and Appendix D4.

During Scoping, the BID (including registration and comments forms) was made available to I&APs on request. While I&APs were encouraged to submit comments and queries in writing, they were also invited to contact the EAP consultants telephonically if they so wished. These contact details appeared in the advertisements, onsite notices, BID, NOA and flyers.

Additional Media Sources:

Since commencement of the public participation process on the 21st September 2020, the public assisted in expanding the reach through the following methods:

- **https://oceansnotoil.org/2020/10/09/gas-to-power-powership-project-register-as-interested-affected-party/**
- **https://www.egsa.org.za/fossil-fuels/notice-of-ea-and-ael-application-the-proposed-gas-to-power-powership-project-port-of-ngqura-eastern-cape/**
- **https://web.facebook.com/WESSAEastCape/posts/wessa-algoa-bay-branchplease-read-through-the-letter-below-from-triplo4-sustaina/2816169225282489/?_rdc=1&_rdr**
- **https://www.reddit.com/r/southafrica/comments/jk6kjq/turkish_floating_gas_power_ships_applied_for/**
- **https://www.egsa.org.za/?s=triplo4**

- https://www.dailymaverick.co.za/article/2020-10-18-turkish-floating-gas-power-ships-sail-into-public-consultation-process-after-back-door-passage-to-sa-freezes-up/

Refer to Appendix D11 – Additional Media Sources for proofs

7.4.3 Public Meeting:

The primary aims of the public meeting was to:

- provide I&APs and stakeholders with information regarding the proposed project and associated infrastructure;
- provide I&APs and stakeholders with information regarding the EIA process;
- provide an opportunity for I&APs and stakeholders to seek clarity on the project;
- record issues and concerns raised; and
- provide a forum for interaction with the project team.

Phelamanga, an independent public participation specialist was appointed to facilitate the public participation process. The following initiatives were planned and implemented, in order to ensure that all I&APs and Stakeholders are provided with a reasonable opportunity to participate. Recognising that not all stakeholders and I&APs are available at certain times of the day, the online meeting platform enabled Phelamanga to provide a morning and evening meeting options for the relevant Stakeholders and registered I&APs to interact. The same information was to be provided at both sessions and registered I&APs received the minutes of both sessions and the comments and issues trail. The meeting was held via Microsoft Teams and the link was shared to relevant stakeholders and Registered I&APs.

An 'Online Open Week' allowed for active sharing of information with I&APs through the following activities:

- **The draft Scoping Report was made available before the Webinar dates.**
- **All I&APs were encouraged to send through any questions for the EAP and specialists in advance of the webinar dates.**

In terms of a public meeting, an online Q&A webinar was facilitated by Phelamanga, with the attendance and presentations done by the applicant, EAP and specialists. The aim was to encourage questions, comments and engagement instead of passive presentations. The format of the webinars was as follows on 13th October 2020 and 16th October 2020:

- **13 October 2020- Morning: 10h00-12h00; and Evening: 18h00-19h30) in order to allow for all I&APs to participate. (Technical problems experienced during the 10am meeting on 13 October 2020 halted the proceedings half-way and the second half of the meeting had to be rescheduled for the morning of 16 October 2020).**
- **16 October 2020- Morning: 10h00-12h00- was scheduled to accommodate the technical issues experienced during the morning session on 13 October 2020.**

Minutes of the meeting are attached as Appendix D12.

7.4.4 Public Review of the Draft Scoping Report:

The draft Scoping Report was made available for review for a period of 30 days (06 October 2020 – 06 November 2020- extended dates) and hard copies were placed at the following venues, as advertised:

- **Cllr Offices: Corner of Sityhotyholweni Street and Jijana Street, Wells Estate (Proof of Submission is located in Appendix D4)**
- **Triplo4 Ballito Offices: Suite 5, The Circle, Douglas Crowe Drive, Ballito; and**
- **Triplo4 Website: www.triplo4.com.**

No requests or comments were made to view the hardcopy of the draft scoping report at either location.

Refer to Appendix D4 for proof of placement of the Draft Scoping Report at the Councillor's Office.

7.4.5 Comments Received on the Draft Scoping Report:

44. *(1) The applicant must ensure that the comments of interested and affected parties are recorded in reports and plans and that such written comments, including responses to such comments and records of meetings, are attached to the reports and plans that are submitted to the competent authority in terms of these Regulations.*

(2) Where a person desires but is unable to access written comments as contemplated in sub regulation (1) due to—

(a) a lack of skills to read or write;

(b) disability; or

(c) any other disadvantage;

(d) reasonable alternative methods of recording comments must be provided for.

All concerns, comments, viewpoints and questions (collectively referred to as 'issues') submitted or raised by I&APs were documented and responded to in the Comment and Response Report, including an indication of how these issues have been incorporated into the Scoping Report, alternatively the reasons for not including them.

Table 7-1: Table below summarises the main issues raised during the commenting period on the draft Scoping Report PPP to be addressed in the EIA Phase.

MAIN ISSUES RAISED DURING SCOPING PHASE TO BE ADDRESSED IN THE EIA PHASE	SECTIONS ADDRESSING THESE ISSUES IN THE DRAFT EIAR
Source of the LNG	Section 2
Air Pollution	Section 4.1.8.1 – Air Quality Appendix I – Specialists Studies: Atmospheric Impact Report
Visual Imapct Assessment	Appendix I13
Noise Impact	Section 8.3- Specialist Findings and Recommendations Appendix I16- Noise Impact Assessment EMPr

Alternative Route to be identified	Section 3
Thermal Plume	Appendix J2
Detail installation for methodology for the installation of the gas pipeline	Appendix J13
Vessel Traffic	Appendix J1
Disposal of Solid and effluent	Appendix G- EMPr
Appointment of a Control Environemtnal Officer	Appendix G- EMPr
Safety and Security Risks	Section 2.1.1 – Safety and Security Section 8 – Impact Assessment Appendix I – Specialists Studies: Major Hazard Installation Risk Assessment Appendix G - EMPr
Coastal and Climate Change Risks/ Proptection	Section 2.1.2 – Berthing and Mooring Section 8 – Impact Assessment Appendix I12 – Specialists Studies: Climate Change Impact Assessment Appendix G - EMPr
Transmission Alignment	Section 3
Leakage / spill risk from gas pipeline and potential impacts	Section 2.1.1 – Technology and Concept Designs Section 2.1.3 – Gas pipeline maintenance Section 3.1.5 – Fuel Alternatives Section 8 – Impact Assessment Appendix I – Specialists Studies: Marine Ecology Assessment Appendix I – Specialists Studies: Major Hazard Installation Risk Assessment Appendix G - EMPr
Socio-economic benefits and impacts	Section 6 – Motivation, Need and Desirability Section 8 – Impact Assessment Appendix I – Specialists Studies: Socio-Economic Impact Assessment Appendix G - EMPr
Indigent Communities not being able to access information	Section 7- Public Participation- Section 7.5.3. Appendix I15- Socio-economic assessment
Major Hazard Assessment	Appendix I14- Major Hazard Assessment Section 2.1.1 EMPr
Risk of bad weather preventing refuelling	Section 2.1.7 – Refuelling
Carbon Footprint and GHG emissions	Section 6.1 – Motivation, Need and Desirability Section 8 – Impact Assessment Appendix I – Specialists Studies: Greenhouse Gas Emission Report Appendix J – Specialists Studies: Atmospheric Impact Report

Public Participation Process in line with legal requirements	Section 7 – Public Participation Process
Cumulative Assessment	Section 8 – Impact Assessment Appendix I – Specialists Assessment
List of all applicable listed activities	Section 2.2 - All Listed and Specified Activities Triggered in terms of NEMA and NEM: AQA
Layout and Sensitivity Maps	Appendix A Section 2.3
Detailed Ecological Assessment	Appendix I1
Specialist Assessments Requirements	Appendix I- Specialist Assessment
Impacts on Marine Ecology and Avifauna	Appendix 110- Marine Ecology Assessment Appendix I8- Avifauna Assessment Section 8.3- Specialist Findings and Recommendations
Compilation of an EMPr with construction and operational conditions	Appendix G- EMPr
Heritage findings within the proposed laydown area for gas pipeline installation	Appendix I – Specialists Studies: Heritage & Palaeontology Impact
Alternatives assessment, including the option of not implementing the activity and the proposed location for the laydown area for gas pipeline installation	Section 3 – Alternatives Section 8 – Impact Assessment
Mitigation measures to reduce impacts on ocean and coast environment	Section 2.1.1 – Technology and Concept Designs Section 2.1.3 – Gas pipeline maintenance Section 8 – Impact Assessment Appendix I – Specialists Studies: Marine Ecology Assessment Appendix I – Specialists Studies: Coastal and Estuarine Assessment Appendix I – Specialists Studies: Major Hazard Installation Risk Assessment Appendix G - EMPr
Impact on the mixing zone	Section 8 – Impact Assessment Appendix I10 – Specialists Studies: Marine Ecology Assessment Appendix I14 – Specialists Studies: Major Hazard Installation Risk Assessment Appendix G- EMPr
Assessment of potential impacts on the Estuarine Functional Zone	Section 8 – Impact Assessment Appendix I9 – Specialists Studies: Estuarine and Coastal Assessment
Life span of the project	Section 2.1 – Description of the activities
Location of the LNGC	Section 2.17 – Refuelling
Assessment of the City's Disaster Management capacity	Section 2.1.1 – Safety and Security

	Appendix I14 – Specialists Studies: Major Hazard Installation Risk Assessment
Abstraction and Discharge of Water	Section 2

Refer to Appendices D9 Comments and Response Report - which includes the comments received by Stakeholders and I&APs during the PPP, and the associated responses.

7.5 PUBLIC PARTICIPATION DURING EIA PHASE

7.5.1 Requirements of the approved PP Plan

- Registered I&APs will be notified via email of the availability of the Draft EIA Report, inclusive of specialist reports and EMPr for comment. I&APs who don't have email will be notified telephonically or by SMS.
- Flyers announcing the availability of these reports will also be distributed locally and put up on public notice boards with assistance requested from the municipality and ward councilor.
- The Draft EIA Report will be made available to I&APs, including State Departments and DEFF for comment for period of 30 days.
- The report will be available:
  - on the Triplo4 website (www.triplo4.com).
  - electronically available via an online platform such as Dropbox or GoogleDrive, the link to which will be emailed to all registered I&APs.
  - Electronic copies will also be sent to DEFF and organs of state, including State Departments.
  - The public copy venue will be confirmed with the municipality and ward councilor and will depend on what public venues are open under the Covid-19 pandemic. The hard copy will be available at Ward Cllrs Offices (53 and 60).
  - Other arrangements will be made to ensure people have access to the report should they be unable to access the public venue copy or an electronic copy.

7.5.2 Maintenance of I&AP Database

A database of I&APs (refer to Appendix D7), which includes organs of state, stakeholders, landowners, interest groups and members of the general public, will be maintained during the EIA phase.

Since the submission of the Final Scoping Report was submitted to DEFF on 17 November 2020, Triplo4 has continued to receive requests to be added to the database or to be provided with the associated project information.

7.5.3 Notifications to I&APs

I&APs and stakeholders were notified on 25 February 2021 of the availability of the Draft EIA Report, inclusive of specialist reports and EMPr for comment and the date of the public and stakeholders meeting.

The notification was emailed to all registered I&APs, as captured in the I&APs database.

After communication with CDC, site notices in three languages (English, Afrikaans and iXhosa) were placed on the electronic noticeboard on CDC main building, notifying I&APs of the proposed activity and inviting them to register as I&APs. In addition, in an effort to notify I&APs in the surrounding community, A5 flyers were placed at the following locations:

- Eyethu Fishing Pty Ltd
- Cllr Offices (Ward 53): 31736, Buthelezi Street, Kamvelihle, Motherwell; and
- Cllr Offices (Ward 60): Corner of Sityhotyholweni Street and Jijana Street, Wells Estate

(The flyers will be distributed to the above-mentioned individuals on 26/02/2021).

(Please refer to Appendix D3.2- for content of Flyers and Notices)

7.5.4 Public Meeting

The primary aims of the public meeting are to:

- provide I&APs and stakeholders with detailed information regarding the impacts of the proposed project and associated infrastructure;
- provide an opportunity for I&APs and stakeholders to seek clarity on the impacts and mitigations measures identified;
- record issues and concerns raised; and
- provide a forum for interaction with the project team.

Phelamanga, an independent public participation facilitation company, has again been appointed to facilitate the public participation process.

Recognising that not all stakeholders and I&APs are available at certain times of the day, the online meeting platform will be used to allow for participation during the COVID-19 pandemic. The online pla to enable Phelamanga to provide a morning and evening meeting options for the relevant Stakeholders and registered I&APs to interact. The same information will be provided at both sessions and registered I&APs will receive the minutes of both sessions and the comments and issues trail. The meeting will be held via Microsoft Teams and the link will be shared to relevant stakeholders and Registered I&APs.

Date: 17 March 2021
Time: 10h00 and/or 18h00pm
Online Platform: Microsoft Teams

As included in the notification circulated, for I&APs who are unable to participate on such platforms, they were invited to contact Triplo4 in advance so that additional assistance or alternative arrangements to participate can be made.

The draft EIA Report (this document) will be made available before the Webinar date, and Stakeholders and registered I&APs are encouraged to submit questions or comments in advance of the online meeting so that feedback can be provided.

Minutes of the public meetings will be attached to the final EIA report.

7.5.5 I&AP Review of Draft Environmental Impact Assessment Report

The draft Environmental Impact Assessment Report has been made available to I&APs, including organs of state for comment for 30 days within the period **26 February 2021 to 31 March 2021** during which I&APs are afforded the opportunity to raise any further issues and concerns, to be considered and incorporated into the final EIA Report for submission to DEFF.

A hard copy of the report has been made available for comment for 30 days within the period 26th February – 31st March 2021 at the following places:

- Cllr Offices (Ward 53): 31736, Buthelezi Street, Kamvelihle, Motherwell;
- Cllr Offices (Ward 60): Corner of Sityhotyholweni Street and Jijana Street, Wells Estate;
- Triplo4's Ballito office and website: www.triplo4.com; and
- Online Platform to registered Interested and Affected Parties (I&APs).

(Please contact the Triplo4 office if you experience any difficulty in accessing these reports)

Additionally Triplo4 has further requested contact information for any communities that might have issues to access information from local NGOs who raised the issue around access to information in preparation of the Draft EIA Report. Flyers were given to a Eyethu Fishing as a proactive measure to provide local fisherman with information. In addition, a hard copy of the EIA Report were given to the Ward 53 and Ward 60 Councillors to afford the local communities the opportunity to easily access the information. Refer to Comments and Responses- Appendix D9.

7.5.6 Comments and Responses Trail Report

Once the comment period for the draft EIA Report has concluded, the Comments and Response Trail Report will be updated to record all the comments received and responses provided during the EIA process, and submitted to DEFF with the final EIA Report.

7.6 NOTIFICATION OF ENVIRONMENTAL AUTHORISATION

All registered Interested and Affected Parties will be notified within 14 days of DEFF's decision to grant or refuse Environmental Authorisation and their right to appeal such decision.

8 ENVIRONMENTAL IMPACT ASSESSMENT

8.1 OVERVIEW OF EIA PROCESS

The EIA process, including public participation that is required for an application for environmental authorisation and an atmospheric emission licence is prescribed by the EIA Regulations, 2014. Thus, the EIA process for the proposed Gas to Power via Powership project has to comply with these Regulations in order for the application to be valid. The process applicable to Karpowership's application is Scoping & Environmental Impact Reporting (S&EIR).

Subsequent to the application form for environmental authorisation having been submitted to the competent authority, DEFF at the beginning of October 2020, Triplo4, the Environmental Assessment Practitioner (EAP) commenced with the first phase, Scoping. In order to meet the prescribed 44-day timeframe, Triplo4 had already started identifying, notifying and engaging with Interested and Affected Parties (I&APs) in September.

The EAP, with guidance from DEFF, and input from specialists and I&APs, including relevant organs of state identified issues, impacts and risks associated with the proposed activities and their alternatives in context of the receiving environment and regulatory framework. The Scoping Report was made available for a 30-day comment prior to it being submitted for consideration to DEFF on 17 November 2020.The Scoping Report, including the plan of study for EIA contained therein was accepted by DEFF on 6 January 2021. This automatically triggered the commencement of the current phase, the EIA (also referred to as the EIR) for which the applicant and EAP have 106 days to complete.

In preparing this draft EIA Report for I&AP comment, Triplo4 engaged with numerous specialists and detailed studies were conducted and considered. Refer to Table 8-2 and 8-1-3 for the details of Specialist and Technical Team, as well as Appendix I for the full specialists and technical studies. Section 4 of this report contains the baseline descriptions of the environment, based on research conducted by the specialists' in the various field of expertise.

The site layout alternatives assessed during Scoping and considered feasible were brought forward to the EIA phase for further assessment, and are discussed in Section 3 of this report. They all fall within the site approved by DEFF at the end of Scoping, which is the Port of Ngqura. The No-Go Option is also an alternative that is required to be assessed as part of the EIA.

The methodology used to assess the potential impacts is described in Section 8.2. Deviations from approved Scoping Report (including Plan of Study) and the assumptions, uncertainties and gaps in knowledge relating to the assessment and mitigation measures proposed are also presented in within this section 8.

The findings of the assessment of the potential impacts and risks associated with the proposed project and alternatives, as well as identification of mitigation measures, are reported in detail in Section 8. The mitigation measures are also collated into the draft Environmental Management Programme (EMPr). Both the draft EIA Report and EMPr are made available for a 30-day period for I&APs to comment. Their comments will be incorporated into the final EIA Report for submission to DEFF in order for it to make a decision. DEFF will either grant or refuse environmental authorisation, and if granted, a number of conditions of approval will be imposed, including compliance with the approved EMPr.

8.2 IMPACT ASSESSMENT METHODOLOGY

2014 NEMA EIA Regulations (as amended), Appendix 3 - 3(1) (v) the impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts; (vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks; viii) the possible mitigation measures that could be applied and level of residual risk.

This section describes the method used to assess and rank the impacts and risks of the site layout alternatives, including cumulative impacts for all phases of the proposed project, and indicates of the extent to which the issue and risk can be avoided or addressed by the management actions., In the
The following criteria were considered for the assessment of each impact.

The **nature** of an impact is the type of effect that the activity will have on the environment. It includes what is being affected and how.

The **significance** of an impact is determined by a combination of its consequence and likelihood.

The table below describes the scoring of the impacts and how they determine the overall significance.

Table 8-2: Impact Scoring.

Scoring of Impacts	
Consequence	
Severity the degree to which the project affects or changes the environment	1 – Insignificant / Non-harmful 2 – Small / Potentially harmful 3 – Significant / Slightly harmful 4 – Great / Harmful 5 – Disastrous / Extremely harmful
Duration a measure of the lifetime that the impact will be present	1 – Up to 1 month 2 – 1 month to 3 months 3 – 3 months to 1 year 4 – 1 to 10 years 5 – Beyond 10 years / Permanent
Spatial Scale the extent / size of the area that may be affected	1 – Immediate, fully contained area / within the site 2 – Surrounding area (< 2km) 3 – Within farm / town / city 4 – Within municipal area 5 – Regional, National, International
Overall Consequence = (Severity + Duration + Extent) / 3	
Likelihood	

Frequency how often the impact will occur	1 – Once a year or once / more during operation 2 – Once or more in 6 months 3 – Once or more a month 4 – Once or more a week 5 – Daily or hourly
Probability the likelihood or the chances that the impact will occur	1 – Almost never / almost impossible 2 – Very seldom / highly unlikely 3 – Infrequent / unlikely / seldom 4 – Often / regularly / likely / possible 5 – Daily / highly likely / definitely
Overall Likelihood = (Frequency + Probability) / 2	
Overall Environmental Significance = Overall Consequence X Overall Likelihood	
Overall Environmental Significance:	
0 - 2.9	Very Low
3 - 4.9	Low
5 - 6.9	Medium - Low
7 - 8.9	Medium
9 - 10.9	Medium - High
11 and above	High

The impacts identified in the Scoping Report have been expanded on in this EIA Report following receipt of I&AP comments and more information from the various specialist studies. Impacts scoring a higher significance in the Scoping Report, received more attention in this EIA Report. The scoring and assessment of impacts as well as discussion of mitigations in this EIA Report have followed a detailed assessment process.

Refer to Section 8.4 (Impact Assessment) for the impacts and mitigation measures associated with the proposed activity.

Environmental, Cultural and Natural Heritage, and Social and Economic impacts associated with the project were further identified through site visits undertaken by project team and various specialists, consideration of the project description, site layout and the specialist studies. As part of the public participation process, I&APs were given an opportunity to provide input to the project at the public meeting sessions and through the review of the BID, advertisements, site notices and the Draft Scoping Report. I&APs will be given a further opportunity to provide input through the review of the EIA Report. The feedback received from I&APs also provided input into the identification of environmental and socio-economic issues to be assessed.

A description of the assessment methodology used to assess the severity of identified impacts (including the nature of impacts and the degree to which impacts may cause irreplaceable loss of resources), the extent of the impacts, the duration and reversibility of impacts, the probability of the impact occurring, and the degree to which the impacts can be mitigated is provided in Section 8.4.

8.3 SPECIALIST FINDINGS AND RECOMMENDATIONS

A description of the environmental impacts and risks identified during the EIA is described in this section.
The following potential impacts were considered in the EIA Phase for the proposed project. The specialist reports are made available with this draft EIA report for public comment (Appendix I), and take into account the comments submitted by I&APs during Scoping. Recommendations from the specialists for the mitigation of potential impacts were incorporated to the EMPr, attached as Appendix G.

8.3.1 Terrestrial Ecology

This study dealt with the proposed components of the project that are on the land, namely the transmission line, the switching station and the temporary laydown area for the gas pipeline installation. The specialist's recommendations focused on the construction and rehabilitation phases, in line with the Gazetted Generic EMPr for transmission lines. However, mitigations for the potential impacts during the operational phase were included, in line with Section 28 of NEMA and Section 19 of the NWA (general duties to protect the environment/ water resources) being applied throughout the project.

Key Findings

The site is sensitive overall as it has high number of Species of Conservation Concern, primarily succulents. The vegetation ranges from the somewhat degraded Cape Seashore Vegetation to relatively pristine impenetrable thicket and mesic thicket. The bontveld on site is, in places, also largely intact. It is important to note that despite the presence of intact indigenous habitats, the area is located within an Industrial Development Zone, and is thus earmarked for development with the resultant loss of vegetation, flora, and fauna habitat.

An area of bontveld has been set aside by the Coega Development Corporation for conservation and as a No-Go zone. As this protects some of this highly sensitive range-restricted vegetation type a tradeoff has been reached for allowing development within the bontveld elsewhere in the IDZ. Mesic thicket and thicket on the slopes adjacent to the estuary and river are also of high sensitivity and should be avoided where possible. The importance of high numbers of SCC, faunal movement corridors and faunal habitat in addition to ecosystem services provided by the vegetation on these slopes must not be overlooked.

There are some areas that have been previously degraded or transformed, most of which is present adjacent to, beneath or surrounding existing infrastructure. In these areas, sensitivity is low as the sites have little to no natural vegetation structure though they may contain indicator and indigenous species. These areas have also been disturbed and are thus prone to invasion by indigenous ruderal species as well as alien invasive species. The preferred route is recommended as the best route for lowest impacts to terrestrial habitats. The alternative 2 route is not recommended as it impacts on intact habitats in close proximation to an estuary. The alternative 3 route was also recommended as it traversed through the Bontveld which is defined as a No-Go conservation area under the Open Space Management Plan.

Impact 1: Loss of Vegetation.

Loss of vegetation communities will definitely occur as a result of the proposed transmission line route (preferred), vegetation lost will comprise mostly transformed, modified and degraded vegetation for the preferred route. As the project is located within an IDZ, and limited damage to indigenous habitat will occur, it is considered that this loss is acceptable for the preferred transmission line route and is within the limits of acceptable change. It must be noted that one monopole structure is located within a degraded portion of the No-Go bontveld area. If this cannot be moved out of this area, then the construction of the pole should proceed with individual construction and no servitude clearing should occur here.

Loss of Cape Seashore Vegetation

This vegetation occurs on the coast and adjacent to the beach where the transmission line exists the ship, it comprises some dune elements as well as dune thicket, which is particularly dense in some areas. The transmission line route has been located within already impacted vegetation as far as possible in this section (particularly adjacent to existing sand mining activities) however some areas including the construction of three of the monopoles will occur within currently undisturbed indigenous vegetation.

Intact coastal vegetation does conservation value however, the location within the IDZ as well as the likely expansion of the sand mining activities and associated degradation in the area indicate that it is likely to become further degraded in the future.

This impact is rated based on the construction methodology of excavating the area, as well as clearing a servitude and constructing foundations where necessary to host the poles of the transmission lines. It is assumed that this servitude will then be allowed to grow vegetation, which will be mowed on a continual basis to allow for access to the transmission lines.

The impact in the construction phase will be short-term, of local extent and definite, with a moderate severity resulting in a moderate negative overall significance. With mitigation measures, this impact can be reduced to a highly probable minor impact over the short term, with a significance of low negative.

In the operational phase, the impact will be short-term, of local extent and definite, with a moderate severity resulting in a moderate negative overall significance. With mitigation measures, this impact can be reduced to a probable moderate impact over the short term, with a significance of low negative.

Loss of Intact Bontveld

There are some areas of intact Bondveld remaining within the planned line servitude. These include pole locations 2, 3, 4, 5, 17 and 18. Though these are located in Bontveld vegetation that is largely intact, the nearby surrounding vegetation is disturbed and includes infrastructure suck as roads and fences within 50m. This location adjacent to existing infrastructure has resulted in an increase in the disturbance and subsequent decrease in the sensitivity of each of these sites.

Intact Bontveld here is defined as being Bontveld with typical species (*Ficinia truncata* is used as an indicator species) with low levels of invasion. The vegetation structure and species composition in these areas is typical of Bontveld and existing disturbances have not yet drastically reduced plant species diversity.

This impact is assessed based on the assumption that a 30m wide servitude will be excavated and monopole structure erected.

The impact in the construction phase will be short-term, of minor extent and definite, with a high severity resulting in a high negative overall significance. With mitigation measures, this impact can be reduced to a highly probable minor impact over the short term, with a significance of low negative.

In the operational phase, the impact will be short-term, of minor extent and definite, with a moderate severity resulting in a moderate negative overall significance. With mitigation measures, this impact can be reduced to a probable moderate impact over the short term, with a significance of low negative.

Loss of Degraded Bontveld

The majority of the proposed transmission line occurs within degraded Bontveld vegetation. This vegetation can still be described as Bontveld as it maintains some indicator species, as well as the underlying geology and soils typical of Bontveld (Finicina truncata is used as an indicator. However, levels of disturbance are moderate to severe and levels of alien invasion are high (primarily by Acacia longifolia), resulting in a low sensitivity for these areas.

The impact in the construction phase will be short-term, of minor extent and definite, with a low severity resulting in a low negative overall significance. With mitigation measures, this impact can be reduced to a highly probable minor impact over the short term, with a significance of low negative.

Impact 2: Loss of Species of Conservation Concern and Biodiversity

Loss of plant Species of Conservation Concern

The construction of the transmission line, will definitely result in the loss of SSC including, but not limited to several succulent species which are provincially protected. which both occur on site. Permits will be required for the removal of these species, and a search and rescue should be conducted. It is also possible that other protected species will be found in these areas should additional field work be done. It is recommended that prior to any clearance of vegetation comprising indigenous elements, this be walked over by a qualified botanist to ensure no SSC are present. This must be done as removal or destruction of any SSC required permits from the relevant authorities.

The impacts associated with loss of SCC are associated primarily with the construction phase of the development.

The impact in the construction phase will be permanent, of national extent and definite, with a high severity resulting in a high negative overall significance. With mitigation measures, this impact can be reduced to a probable low impact over the short term, with a significance of low negative.

In the operational phase, the impact will be permanent, of national extent and probable, with a moderate severity resulting in a low negative overall significance. With mitigation measures, this impact can be reduced to an improbable low impact over the short term, with a significance of low negative.

Loss of biodiversity in general

As the construction of the transmission line, will result in the loss of areas of habitat, this will result in a loss of the biodiversity within those habitats. This impact includes all species, both fauna and flora that will be lost as a result of the proposed development. The Coega IDZ is rich in both faunal and floral diversity and loss of diversity (vegetation and faunal habitat) will be experienced where a servitude Is excavated through natural vegetation.

The impacts associated with loss of biodiversity are associated primarily with the construction phase of the development.

The impact in the construction phase will be short-term, of regional extent and highly probable, with a moderate severity resulting in a moderate negative overall significance. With mitigation measures, this impact can be reduced to a probable low impact with minor extent, with a significance of low negative.

In the operational phase, the impact will be permanent, of local extent and probable, with a low severity resulting in a low negative overall significance. With mitigation measures, this impact can be reduced to an improbable low impact over the short term, with a significance of low negative.

Impact 3: Ecosystem function and Process

Fragmentation

This site is prone to fragmentation due to its location within the IDZ and the range-restricted habitats (Bontveld) present on site. As such, the loss of the vegetation will result in fragmentation of this already partially fragmented system, ameliorated somewhat by the dominance of alien species in some areas of the site (disturbed areas). The allowance for open space corridors reduces fragmentation risk, and thus, the impact due to fragmentation. Fragmentation can result in the loss of biodiversity due to loss of dispersal, pollination and gene issues, among other considerations. It should be avoided where possible. Where possible, Karpowership should work with the CDC to establish and manage open space within the IDZ to reduce overall fragmentation. The nature of the transmission line is such that if habitats are allowed to recover beneath the line, the majority of fragmentation can be avoided.

The impact in the construction phase will be permanent, of national extent and highly probable, with a moderate severity resulting in a moderate negative overall significance. With mitigation measures, this impact can be reduced to a probable low impact over the short term, with a significance of low negative.

In the operational phase, the impact will be permanent, of national extent and probable, with a moderate severity resulting in a low negative overall significance. With mitigation measures, this impact can be reduced to

Invasion of alien species

The development of the proposed transmission line will result in the influx of seeds and disturbance of existing seedbanks of alien invasive species. Considering the number of alien already recorded from the site, this impact will occur and must be managed.

The impact in the construction phase will be permanent, of national extent and highly probable, with a moderate severity resulting in a moderate negative overall significance. With mitigation measures, this impact can be reduced to a probable low impact over the short term, with a significance of low negative.

In the operational phase, the impact will be permanent, of national extent and probable, with a moderate severity resulting in a low negative overall significance. With mitigation measures, this impact can be reduced to an improbable low impact over the short term, with a significance of low negative.

Recommendations

- A full site walk-through should be conducted in the summer prior to any construction activities to list all SSC and associated permits should be obtained for their removal or transplantation.
- A search and rescue of protected plants must be done prior to construction taking place.
- In areas of modified habitat, construction using excavation and backfilling is acceptable however, this method of construction cannot be used in any other areas.
- In areas of intact Bontveld (where the transmission line is located outside of existing servitude areas), construction methods for the monopoles should be reduced to the least disturbing method. Where possible, each monopole structure should be erected singly with no servitude clearance.
- Construction of the three monopole structures within intact indigenous vegetation (21, 22 and 23) should utilise the method with the least impact. Each pole should be placed individually, with no servitude construction.
- Boundaries should be strictly maintained, and impacts retained within the boundary of the site.
- Areas of indigenous vegetation should be incorporated into the open space management plan of the IDZ in conjunction with the CDC where practicable.
- No construction or storing of materials should be located outside of the defined layout area. These areas should be demarcated prior to any activities commencing and personnel instructed of the rules to stay out of these areas (unless clearing alien invasive plants).
- Development and implementation of an alien invasive plant species management plan, which would remove and control the alien vegetation within and bordering the site.
- Keep the construction footprint as small as possible.
- No use of the surrounding vegetation should be allowed. This includes use as a toilet facility, for hunting, harvesting of indigenous plants, making fires etc.
- Wherever possible, and in conjunction with the Coega CDC, area that will be used for construction but not for operation should be rehabilitated as soon as possible.
- The area of construction and operation should be demarcated, and personnel not allowed to use the surrounding natural vegetation.
- Post-construction clearing of vegetation beneath the transmission line should be restricted to the minimum possible.
- An alien vegetation management plan must be applied to the site to maintain the site free of alien invasions throughout the construction and operational phase of the development.
- Any existing and new alien species must be removed as soon as possible after emergence.
- A rehabilitation plan must be developed and implemented for areas that will be used during construction but not operation, especially within servitudes to reduce the numbers of alien invasive plants and allow recovery of some indigenous vegetation within these areas.

8.3.2 **Avifauna**

This study dealt with several proposed components of the project, namely the transmission line, the temporary laydown area for the gas pipeline installation, as well as the Powerships operations.

Key findings

Within the 12.5km x 4km Project Area of Influence (PAOI),199 bird species have been recorded at least annually, including 20 Species of Conservation Concern. The PAOI includes the islands of St Croix, Brenton and Jahleel that are included in Addo Elephant National Park and its Marine Protected Area and are part of an Important Bird and Biodiversity Area. The St Croix Island group has the largest breeding population (approximately 5663 pairs) of Endangered African Penguins Spheniscus demersus in the world (approximately 32% of the Global and 42% of the South African population). Jahleel Island 530m from the Eastern Breakwater is the most sensitive avifauna receptor with respect to potential impacts from the powerships project and has 232 breeding pairs of African Penguin (1.3% and 1.7% of the Global and South African population respectively.

Algoa Bay holds 85% of the estimated 61 pairs of the Critically Endangered Damara Tern Sterna balaenarum breeding in South Africa. There is a small colony (usually 4 pairs, 7% of the South African population) 2.2km north-east of the Port of Ngqura and they often feed and roost in and around the port during summer.

Jahleel Island 530m from the Eastern Breakwater is the most sensitive avifauna receptor with respect to potential impacts from the Powerships project and has 232 breeding pairs of African Penguin (1.3% and 1.7% of the Global and South African population respectively). The Coega Saltpans are included in the PAOI. They can hold >5000 waterbirds of more than 40 species, including >2000 flamingos that often fly at night and are at risk from collisions with overhead transmission lines.

An area of Grass Ridge Bontveld in good condition north of the Eastern Reclamation is demarcated as a CBA in the Coega OSMP. Several large Species of Conservation Concern, especially Secretarybird, Blue Crane and Denham’s Bustard are found in Bontveld. The Coega OSMP Management Guidelines for CBAs require them to be protected from development.

With preferred Alternative 1 the Powerships are moored in a more sensitive section of the port (close to the Coega River mouth and adjacent hummock dunes) than Alternative 2 (alongside the Admin Craft Basin breakwater). However, there is an existing Environmental Authorisation for future Port of Ngqura Marine Infrastructure developments that will extensively impact and modify the area between the Coega River mouth and Admin Craft Basin.With Alternative 2, the Powerships and FSRU are closer to the very sensitive receptor of Jahleel Island (1000m and 650m from Jahleel respectively) compared to 1400m and 750m for Alternative 1). Consequently the impact ratings for Alternative 2 are Medium–High for noise and light compared to Medium-Low for Alternative 1. The impacts of an Emergency Event are slightly higher for Alternative 2 if there is inadequate mitigation. There is therefore a preference for Alternative 1 (Powerships moored off of the Coega River) over Alternative 2 with respect to potential impacts on avifauna.

For the overhead transmission lines there is a small advantage for Alternative 1 (routed behind the Eastern Reclamation) over Alternative 3 (routed across the Bontveld CBA area) in terms of habitat disturbance and fragmentation (impacts Very Low for Alternative 1 and Low for Alternative 3 after mitigation). Alternative 2 (east bank of the Coega River) is the least preferred alternative with Medium-Low impacts for both habitat disturbance and collisions.

Powerships and FSRU

Physical Disturbance of Important Avifauna Habitat

Physical disturbance will occur due to the establishment and permanent mooring of the powerships and FSRU and the visits by the LNG Carrier when it re-fuels the FSRU. Impacts will include physical disturbance due to anchors

and moorings and the physical presence of large vessels in the Port and an increase in activity. A gas pipeline will be constructed to connect the FSRU to the powerships.
The physical disturbance impacts associated with establishment, operation and closure of the project infrastructure in the Port of Ngqura are similar from an avifauna perspective and are assessed together.

Disturbance to Avifauna by Atmospheric Noise and Light
Mitigation in the EIR for the establishment of the Port of Ngqura (September 2001) require noise and light impacts on Jahleel Island to be kept to a minimum so as not to disturb threatened bird species.

During a light audit along the Eastern Breakwater in March 2013 the maximum light (under the lights at the base of the breakwater) was 7 lux and the minimum 0.4 lux. There will be lighting on the vessels, adding to the already substantial ambient light associated with the Port. Jahleel Island must not be illuminated by lights associated with the project.

The Noise Impact Specialist Study for this project recorded ambient noise on the Eastern Breakwater 1-3 October 2020 in excess of 60dB due to the strong wind conditions at the time (Safetech 2021). Jahleel Island was the only sensitive avifauna area that may be impacted by noise from the project. The Damara Tern colony, St Croix and Brenton Islands are too far away. The greatest noise impact would be during calm conditions when ambient noise (from wind and waves) is low. Under these worst case scenario conditions, the noise at Jahleel Island due to the Powerships at the Alternative 1 position (1175m from Jahleel) was assessed to be 54dB. Noise due to the Alternative 2 position next to the Admin Craft Basin (1000m from Jahleel Island) could reach 60dB (Safetech 2021). These noise levels are at the limits set for Urban and busy Urban areas respectively. There are no legislated noise limits for environmentally sensitive areas.

Anthropogenic noise and light produce physiological and behavioural responses in a wide variety of bird species and can affect breeding and overall fitness. Species living in closed environments (e.g. forests) are generally more affected than those in open environments (Senzaki et al. 2020). In a review of the effects of noise on wildlife, responses of terrestrial species started at 40dB and 20% of studies reported a response at 50dB (Shannon et al. 2015).

The penguin breeding colony on Jahleel Island under natural conditions is subject to high ambient noise (from wind and breaking waves) and relatively high night time light during full moon. The Fog Horn at the end of the breakwater is 120dB at 1m and approximately 55dB at Jahleel Island 1.8km away (Audit reports, Coega / Ngqura Environmental Control Officer (ECO) and has not resulted in the penguins abandoning the island. The successful Boulders Beach African Penguin colony at Simonstown is subjected to a relatively high level of anthropogenic noise and light. Nevertheless, a precautionary approach has been taken in the Impact Assessment - the Confidence Level is Low.

Disturbance to Marine Avifauna and Habitat by Underwater Noise
Underwater noise caused by breaking waves is naturally high along the coast and at islands. The first evidence that seabirds may avoid anthropogenic underwater noise was provided by Pichegru et al. 2017 who showed that African Penguins breeding on St Croix Island avoided their preferred foraging areas in response to the intense (250dB) noise associated with underwater oil and gas seismic surveys, keeping an average of 77km away from the centroid of seismic activity. While many taxa, especially Cetaceans, are known to be affected by or to avoid high intensity underwater noise (Pichegru et al. 2017), there is little evidence to date that pelagic prey fish and seabirds avoid or

are affected by low intensity underwater noise such as that associated with marine traffic and onshore anthropogenic activities. Noise levels to avoid physical injury to fish and cetaceans and to avoid fish behaviour changes are in excess of 200dB. The loudest vessels (e.g. large container ships) produce a maximum of 190dB, mostly due to propeller cavitation, that reduces to a maximum of 127dB at 3km (Lwandle 2021). Gentoo Penguins did not react to underwater sounds less than 100dB and there was no strong response below 115dB. However, at 120dB there was a 60% response to avoid the noise source (Sorensen et al. 2020).

Pichegru et al. 2017 raised a concern that with two operational ports and ship to ship bunkering in Algoa Bay, cumulative effects of underwater noise in Algoa Bay may start to have an impact on African Penguins. The preferred foraging area of penguins breeding on the St Croix Island group is within a 30-40km radius to the south and south-east of the islands (Pichegru et al. 2012). As reduced food availability and regional shifts in the distribution of pelagic fish prey stocks are the main reason for the decrease in the global population of African Penguins (Hagen & Wanless 2015), any impact that increases penguin foraging effort is likely to negatively impact the breeding population (Pichegru et al 2012).

The powerships will have 27 reciprocating engines and 3 steam turbines but the propellers, a major noise source, will not be turning. There is no data available on the magnitude of underwater noise produced by powerships but it is very unlikely to approach the maximum of 190dB produced by a large container ship underway. Noise from the powerships is unlikely to exceed 110dB at the harbour entrance, below the level that Gentoo Penguins showed a strong response (Sorensen et al. 2020). The entrance to the Port of Ngqura faces south, away from the St Croix Island group. The Eastern Breakwater, the end of which is 2.3km from the powerships, shields the islands from the direct impact of sound waves. There should be no difference between Alternatives 1 and 2 with respect to underwater sound impacts. The assessed Cumulative Impact of underwater noise in Algoa Bay targets African Penguins as the most sensitive receptor and a precautionary approach is taken due to the uncertainties with respect to the intensity and impact of underwater noise - the Confidence Level is Low.

Disturbance to Avifauna Habitat due to Change in Water Temperature

The Cooling Water Dispersion Modelling (PRDW 2020) shows that if the cooling waters from the powerships are released at a depth of 2m, the increase in water temperature at 100m and 300m from the vessels is 2.30C and 1.40C respectively. If released at 8m depth the water temperature increases are 1.00C and 0.90C respectively. Releasing the discharge water at 8m depth complies with the World Bank guidelines of less than 30C change at a distance of 100m and the SA Marine Water Quality Guidelines of less than a 10C change at a distance of 300m (PRDW 2020). Further recommended mitigation is to place the discharge pipe away from the water intake to minimize re-circulation (PRDW 2020).

Consequences of increased water temperature may include sub-lethal and lethal effects on organisms unable to escape the area and modification of the biological communities in the affected area (Weston 2020).
Cape Cormorants, Damara and sometimes Caspian Terns are the bird Species of Conservation Concern that fish in the Port of Ngqura. They are not dependent on the Port, also feeding in the adjacent coastal waters and saltpans. If food supply in the Port was not available, they would use another feeding area.

An example of a worst case scenario occurred in January – February 2014 when warm still waters in Algoa Bay resulted in a harmful algal bloom that lasted approximately 2 months (Bornman & Steyn 2014) and resulted in two very large fish die-offs in the Port of Ngqura. This was accompanied by the densest concentration of birds ever recorded in the Port (e.g. >1000 terns, 300 Kelp Gulls and 45 cormorants), feeding on the dead and dying fish (Coega / Ngqura ECO Monthly Report, February 2014). Subsequently bird use of the port returned to normal.

Impact on Avifauna due to Increase in Atmospheric Emissions

The Draft Atmospheric Impact Report for the project concludes that the maximum predicted annual, 24 hour and 1 hour concentrations of SO2, NO2 and PM10 are very low with respect to the National Ambient Air Quality Standards (uMoya-NILU 2020). Cumulative air quality impacts are not expected to exceed the National Ambient Air Quality Standards and the predicted impact of the project on ambient air quality is expected to be Very Low (uMoya-NILU 2020).

Sanderfoot & Holloway (2017) conducted a literature review of air pollution impacts on avian species. Birds have the most efficient respiration system of any terrestrial vertebrates and are therefore likely to be more susceptible to high concentrations of air pollution. Sanderfoot & Holloway (2017) found consistent evidence for adverse health impacts on birds due to gas phase and particulate air pollutants. Responses include respiratory distress and illness, elevated stress levels, immunosuppression, behavioural changes and impaired reproductive success.

SANParks has raised concerns that increases in the incidences of aspergillosis (a fungal lung infection) in the penguin population on St Croix may be related to increases in dust from the Coega SEZ. Currently cement clinker is offloaded and manganese ore is loaded at the Dry Bulk Terminal adjacent to the Coega River mouth, both activities producing fugitive dust.

Although the Draft Atmospheric Impact Report for the powership project assessed Very Low impacts due to atmospheric emissions uMoya-NILU (2020), the presence of the small African Penguin colony on Jahleel Island, 1400m / 1000m from the respective Alternative 1 & 2 positions of the powerships warrants a precautionary approach, especially with respect to cumulative emissions (where confidence limits are low due to the diverse nature of potential emission sources).

Impact on Avifauna due to Emergency Events

The Risk Assessment for the project prepared in terms of the Major Hazardous Installation Regulations concludes that the major hazardous risk during operations would be from a Boiling Liquid Expanding Vapour Explosion with the biggest risk area being the FSRU, especially at the loading / transfer hoses (MHR 2020). The Risk Assessment assesses 1 in 100,000, 1 in 1 million and 1 in 30 million risk areas to be confined to the ships, 130m from the FSRU and 620m from the FSRU respectively.

The proposed positions of the FSRU from Jahleel Island (the most sensitive avifauna receptor in the vicinity) are 750m and 650m for Alternatives 1 & 2 respectively.

MHI (2020) advise that their Risk Assessment is not an Environmental Risk Assessment. Nevertheless the Risk Assessment does provide a good indication of environmental risk due to explosions. Other possible major environmental risks during operations include:

- Gale force winds and high swells. These have previously caused problems with ship moorings in the Port of Ngqura. The FSRU and powerships will be moored permanently and will not be able to quickly exit the harbour ahead of extreme weather events.

- Flooding of the Coega River. This will be mostly applicable to the powerships moored at Alternative 1 and mitigation will be similar to that required for extreme weather events.
- Marine Traffic accidents. Almost all potential impacts can be confined within the Port with adequate planning and mitigation

Overhead Transmission Lines

Impact on Avifauna due to Habitat Disturbance and Fragmentation

Direct impacts on habitat due to the construction of the overhead transmission lines arise from developing access tracks, clearing vegetation to erect the towers and string the cables. Other direct impacts include disturbance of bird breeding sites. There is a small breeding colony of Kelp Gulls (14 pairs, 2020) in the hummock dunes under the first span of the overhead lines from the powerships. No breeding sites of raptors or bird Species of Conservation Concern are known along any of the proposed Alternatives.

Indirect impacts include habitat fragmentation. Fragmentation is greatly increased by clearing all vegetation in transmission line servitudes and by not following the Service Corridors planned as part of the Coega SEZ development planning framework. Increased fire risk due to overhead cables is another indirect impact. The biggest fire risk is if alien vegetation such as Rooikrans Acacia cyclops is not cleared along the 30m wide Eskom specified servitude. Sundays Valley Thicket and Algoa Dune Thicket vegetation is fire retardant – clearing it increases fire risk as alien bushes and grasses then establish in the cleared areas. Bontveld burns occasionally but by keeping the indigenous bushes under cables trimmed to the Minimum Vegetation Clearance Distance the impact on power infrastructure can be minimized.

Impact on Avifauna due to Collisions and Electrocution

a) *Electrocution*: If a bird bridges the air gap between live components or live / earthed components, an electrical short circuit occurs. The clearances on 132kV power lines are generally large enough to prevent electrocutions. Providing bird perches on the top of 132kV monopoles (a standard practice) encourages birds to perch on the pole, a safe area, and not on the cables.

b) *Interference with Quality of Supply*: Birds perching, roosting, nesting and depositing faeces on transmission line infrastructure can affect the quality of supply of electricity. This problem is mostly associated with monopoles. The risk can be minimized by strategic positioning of perch deterrents (bird guards – usually spikes) on the towers, according to the Eskom Bird Perch Guidelines.

c) *Collisions with Earth Wire*: This is the greatest threat to avifauna posed by the 132kV transmission lines. Large birds with limited maneuverability (e.g. Denham's Bustard Blue Crane) and especially those that fly at night (e.g. flamingos) are at greatest risk. Most collisions are with the thin top earth wire. The most usual mitigation measure is to place bird flight diverters on the earth wire on power line spans presenting the greatest risk to avifauna. Static black and white pigtail wire diverters or dynamic bird flappers are generally used (Jenkins *et al.* 2010; Shaw *et al*, 2021). Where there is nocturnal bird activity reflective flappers or flappers with lights are more effective (ESKOM Transmission Bird Collision Prevention Guideline).

The power line spans between the Powerships and the coastal area (to the top of the Eastern Reclamation) are the greatest threat for bird collisions and the impact ratings are based on this risk. This portion of the power line is at right angles to a busy bird flyway along the coast to and from the Coega River Mouth and saltpans. Species of Conservation Concern using this flyway include Damara Terns and night flying flamingos. A small colony of Kelp

Gulls breeds in this area. Ideally dynamic bird flappers that emit flashing lights at night or are highly reflective should be installed on the earth wire in this area.

<u>Recommendations for the Powerships and FSRU</u>

- No operational activities associated with the project to take place on the Eastern Breakwater. If essential (e.g. establishing safe moorings), activities must be minimized (in terms of disturbance) and of short duration (see also EIR for establishment of Port of Ngqura).
- Alternative 1: Once in position off of the Coega River mouth, to reduce impacts due to re-positioning anchors and moorings, the powerships should not be moved unless in an emergency.
- Alternative 1: To avoid disturbance to breeding Kelp Gulls and African Oystercatchers, the gas pipeline should not be constructed over the dune area during the period 1 October to 31 January.
- Comply with TNPA's Construction Environmental Management Programme for the Port of Ngqura and relevant sections of the Environmental Management Programme for the Operation of the Port of Ngqura.
- Ensure that monitoring of the African Penguin colonies on the St Croix Island group continues. Continue annual monitoring of the Kelp Gull breeding colonies in the Port.
- The use of mobile powerships in an operational Port has a much lower physical disturbance footprint than constructing a terrestrial power station.
- All lighting to be down lighting. Lighting to be limited to that required for safe operations.
- No lights to illuminate or be directed towards Jahleel Island or the Coega estuary and shoreline
- Undertake night light and 24 hour noise audits on the Eastern Breakwater at its closest point to Jahleel Island and at the Klub Road causeway crossing the Coega Estuary before operations start to determine the baseline, once operations start and annually thereafter.
- To track any changes on sensitive avifauna receptors, ensure that monitoring of the African Penguin colonies on the St Croix Island group and the nearby Damara Tern colony continues. Continue annual monitoring of the Kelp Gull breeding colonies in the Port and bi-annual Co-ordinated Waterbird Counts on the saltpans.
- Noise can be reduced by reducing the number of reciprocating engines / steam turbines in operation and by implementing recommendations in the Noise Impact Assessment.
- A long-term hydrophone system should be installed at the entrance to the Port of Ngqura before operations start. Data should be analysed and reported on at least annually.
- Ensure that monitoring of the African.
- Discharge water at 8m depth.
- Discharge water away from water intake to prevent re-circulation.
- Reduce the number of power generators in operation.
- Ensure all air quality monitoring stations (e.g. Saltworks and at Port of Ngqura) are operational at all times and data is analysed.
- Have emergency plans in place, to include operational risks (gas explosions, etc), extreme weather events, marine traffic accidents).
- Ensure Standard Operating Procedures for all operations and extra checks for hazardous processes (e.g. hose connections).
- Use suitably qualified and trained people for all operations.
- Ensure adequate emergency equipment is available and maintained and hold regular audits and emergency drills.

- Emergency plans / equipment are to include plans to evacuate and rehabilitate penguins and other injured or at risk birds from the islands / adjacent areas if necessary in conjunction with SANParks.

Recommendations for the Overhead transmission lines

- Comply with the RoD dated 7 Nov 2006 for the transmission line corridor between the coastal area and Dedisa Sub-Station.
- Comply with the Generic EMPr for Substation and Overhead Electricity Transmission and Distribution Infrastructure (GN 435 dated 22 March 2019).
- Comply with Coega OSMP Management Guidelines for Service Corridors.
- Use monopoles in preference to lattice towers to minimize tower footprints and to match the monopoles along the existing transmission lines in the services corridor.
- Use existing access tracks and access tower positions from existing tracks by the shortest / least impact route.
- No clear-felling of indigenous vegetation. Only clear the minimum vegetation required for access for construction of towers and stringing of cables (1m wide path). Trim high bushes under the transmission lines to the Minimum Vegetation Clearing Distance.
- Clear all alien vegetation, especially Rooikrans bushes within at least a 30m wide servitude under the transmission lines. This will reduce fire risk.
- Annually inspect and maintain the transmission line servitude free of alien vegetation and maintain the Minimum Vegetation Clearing Distance for indigenous bushes under the transmission lines.
- Within TNPA areas: Comply with TNPA's Construction Environmental Management Programme for the Port of Ngqura and relevant sections of the Environmental Management Programme for the Operation of the Port of Ngqura.
- Comply with the Generic EMPr for Substation and Overhead Electricity Transmission and Distribution Infrastructure (GN 435 dated 22 March 2019).
- Within CDC areas: Comply with CDC's Standard Environmental Specification for Construction and Standard Vegetation Specification for Construction.
- Use monopoles in preference to lattice towers to match the conductor heights of the existing power lines thereby reducing the vertical risk area to flying birds.
- Provide bird perches on top of the monopoles to encourage them away from perching on the conductors.
- Ideally use dynamic reflective bird flappers, preferably with lights that flash at night, on the most sensitive spans of the transmission line between the Powerships and the top of the Eastern Reclamation and next to the Coega River (Alternative 2).
- Use alternating black and white static pigtail flight diverters on the remaining spans of the power line as per Eskom Guidelines.
- Report any bird casualties to the CDC or TNPA Environmental Officer and the Coega / Ngqura Environmental Control Officer.

8.3.3 Wetland

This study dealt with the proposed components of the project that are on the land, namely the transmission line, the switching station and the temporary laydown area for the gas pipeline installation. The specialist's recommendations focused on the construction and rehabilitation phases, in line with the Gazetted Generic EMPr for transmission lines. However, mitigations for the potential impacts during the operational phase were included, in line with Section

28 of NEMA and Section 19 of the NWA (general duties to protect the environment/ water resources) being applied throughout the project.

Key Findings

A total of five watercourses, in which one was determined to be a transformed estuarine environment/Port waters, two were determined to be wetland and two were determined to be riverine systems. The two wetlands were classified as depressions, whereas the riverine systems were classified as A channel streams. It was determined that Rip01 will be impacted upon by the proposed development. This riverine system that will be impacted upon by the proposed development were determined to be of a moderate risk as a result of their position in the landscape in relation to the proposed development.

The overall PES score for the riverine system was largely natural for Rip01. The aforementioned score for the at-risk riverine system was primarily as a result of a moderate amount of anthropogenic pressures in the catchment extent namely; construction of linear activities (dirt and tar roads; and construction of industry), which lead to increase of hardened surfaces and proliferation of AIPs within the catchment. The instream habitat was observed to be modified by footpaths, exposed bare ground, creation of dirt road through system, sedimentation as a result of increased hardened surfaces and minimal amount of AIPs observed (Acacia longifolia). This indicated that modifications have minimally impacted the riverine system within the study area which has subsequently impacted on the habitat quality, diversity, and size.

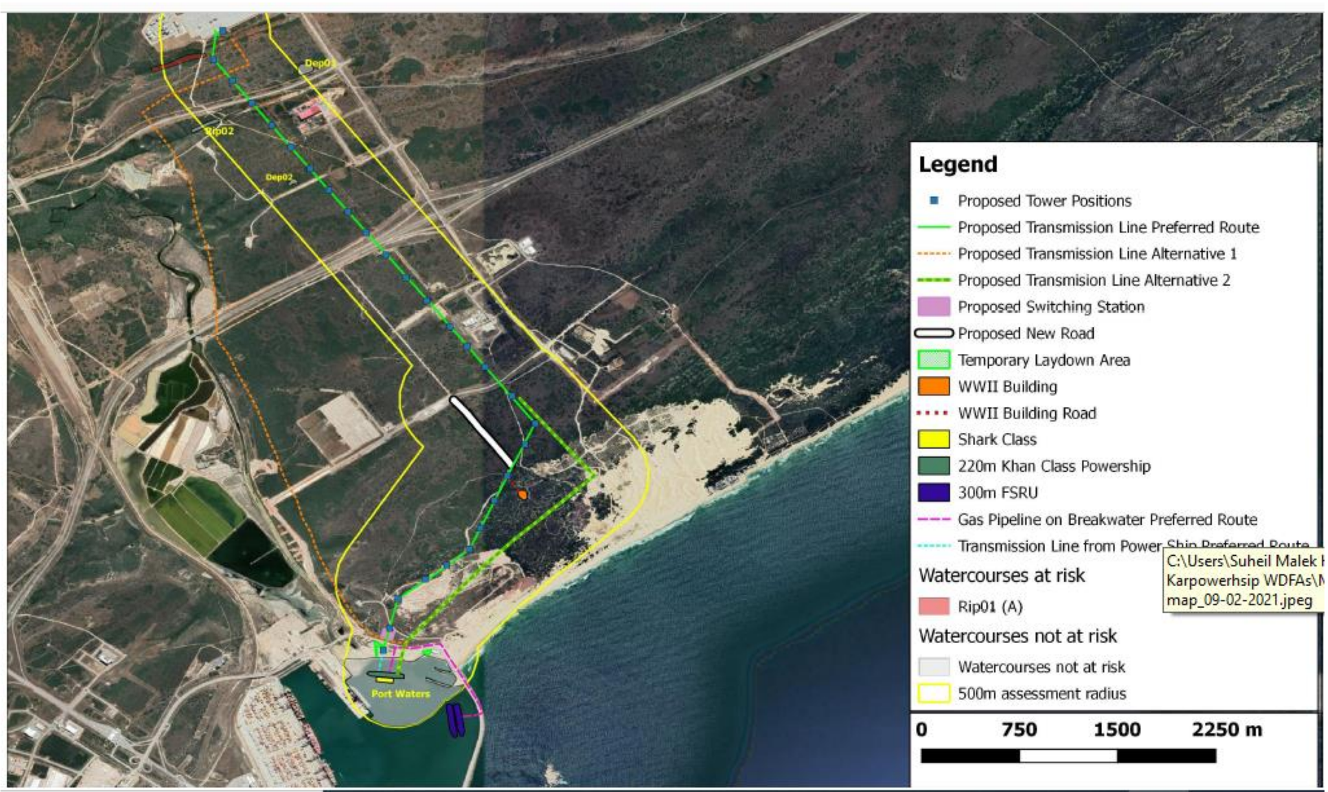


Figure 8-1: Map of the in-field delineations of the watercourses identified at the proposed development and 500m assessment radius.

Certain aspects of the construction activities associated with the proposed development scored a moderate risk rating (Increased risk of pollution and change in watercourse characteristics [Alternative 1-preferred]), however these aspects did have the potential to be mitigated from a moderate to low risk rating. It must be noted that there are not direct impacts from the proposed development for this project.

Construction Phase Impacts

Vegetation removal may potentially result in an increase in exposed surfaces and subsequent potential for decreased soil particle cohesion and soil binding capacity, increasing the potential for erosion and sedimentation. Formation of rills and gullies from increased concentrated runoff is likely to occur. This increase in volume and velocity of runoff increases the particle carrying capacity of the water flowing over the surface and into the impacted freshwater resources resulting in increased rates of erosion and sedimentation within the wetland, riverine and in-stream habitats. Soil compaction resulting in reduced infiltration and increased surface runoff together with the artificial potential creation of preferential flow paths due to construction activities, will result in increased quantities of flow and sediments entering the downslope watercourse. Erosion of certain land cover classes (e.g. bare-ground, shallow-rooted grass species and degraded veld) as a result of increased surface runoff created by the hardened concreted/tarred surfaces. There is the potential for the creation of low light conditions reducing photosynthetic activity and the visual abilities of foraging aquatic biota due to increased sediment deposition.

During construction, there are several potential pollution inputs that can enter into the system. These pollutants alter the water quality parameters such as turbidity (increased suspended solids), nutrient levels, chemical oxygen demand and pH. Consequently, these impact the species composition of the watercourse, especially species sensitive to minor changes in these parameters. Sedimentation of the downslope watercourse, resulting in altered sediment balances, destruction of habitats and the change in water quality (i.e. potential influx of nutrients and inorganic pollutants). Hydrocarbons including petrol/diesel and oils/grease/lubricants associated with construction activities (machinery, maintenance, storage, handling) may potentially enter the system by means of surface runoff or through dumping by construction workers. A negative effect on the instream aquatic habitat within the construction footprint and downstream, particularly aquatic flora and fauna sensitive to changes in turbidity levels, nutrient levels, chemical oxygen demand and toxicants. These impacts were rated as having between Medium and Low impacts on wetland resources, and can all be mitigated to Low and Very Low impact.

Operational Phase Impacts

Potentially increased levels of stormwater flow as a result of the increase in the surface-area of concrete within the catchment areas. Potential decrease in soil permeability and infiltration due to the increased hardening of surfaces. Continued, or increased, soil compaction on the footpath/tracks which have been created by the construction personnel. The transportation of excessive catchment sediment can result in a change in topsoil thus, a change in substrate in turn cause a proliferation of AIPs. If the site camp is not properly rehabilitated in the catchment it could lead to further loss of habitat and topsoil from watercourse as a result of the increased velocity of surface water runoff from the bare surface associated with the site camp.

The current dirt and tar roads are an existing structure and the public are currently utilizing these roads. Thus, the impacts associated with vehicle and human movement are already existing. Continued sedimentation of watercourse as a result of sediment laden runoff entering the features from areas disturbed during construction and ineffectively rehabilitated. With ineffective rehabilitation, sedimentation will continue and will result in an impact on water quality. However, should all the mitigation measures as listed within this report be implemented there is a possibility of reduced risk of contamination due to a decrease in sediment inputs and turbidity, and the free flow as a result of the appropriate stormwater infrastructure allowing regular and almost natural flow into watercourse.

Continued sedimentation of the watercourse as a result of continued erosion of areas disturbed during construction activities. If mitigation measures are ineffective, aeolian processes may cause the erosion and transport of loose, exposed material to downslope watercourses. Maintenance activities during the operational phase will have a medium impact on wetland resources, but can be mitigated to Low impact.

<u>Recommendations</u>

Mitigation Measures - Pre-Construction Phase

- Existing access/haulage routes must be utilised during construction as far as possible.
- Stormwater infrastructure must be positioned at areas where concentrated flows will enter watercourses. The flow from stormwater infrastructure should not enter a watercourse directly but should rather flow into an area of vegetated land, or dissipation area, within the adjacent riverine area.
- All watercourses delineated within this report and their associated buffers must be demarcated and considered as no-go areas. All demarcated areas must be considered no-go areas for the duration of the construction phase. Any construction personnel found working inside the no-go areas should be fined as per fining schedule/system setup for the project.

Mitigation Measures - Construction Phase

- Structures which promote natural diffuse flow such as horizontal gabion structures, dissipation blocks, etc. be utilised during the construction phase to attempt to reduce the flow-velocity through these structures during heavy storm events which will eventually rapidly enter watercourses
- Silt traps must be erected around all excavation, dumping and/or infill activity which may take place at the proposed development site close by to watercourses (especially for Rip01) which are given authorization to be utilised to reduce the siltation to the down slope watercourses in the study area. Furthermore, dust suppression techniques must be applied on all access/haulage roads to reduce dust contamination of the surrounding environment.
- Silt traps must be erected at the base of the slopes leading into the down slope watercourses and around all site camps, spill sites, access roads and temporary structures. Removal of sediment from the erected silt traps must take place on a weekly basis.
- Erosion and sedimentation must be monitored closely. After every heavy rainfall event, the contractor must check the site for erosional damage and rehabilitation must occur immediately if damage is found.
- If the construction activities influence the daily activities of the local residents’ adequate alternatives must be made outside of sensitive environments and preferably within currently degraded areas (e.g. detour routes).
- Topsoil and subsoil which is excavated from the study area must be stockpiled with the topsoil separate from the subsoil and preserved for future rehabilitation. Cleared vegetation and soils which will not be utilised for rehabilitation purposes must be disposed of at a registered waste disposal facility. Stockpiles must be seeded with indigenous grasses or stabilised with geotextiles to reduce erosion potential.
- All stormwater and sheet runoff management infrastructure must divert flow away from areas susceptible to erosion, specifically steep slopes and watercourses (e.g. stormwater flowing into the rivers). Unstable areas associated with the proposed development must be stabilised utilising geotextiles or other appropriate stabilisation techniques.

- All areas of loose sand, which are prone to wind erosion must be sprayed with water or other dust suppression techniques.

Mitigation Measures – Post Construction / Rehabilitation Phase

- Rehabilitation must commence within 30 days from the period when the construction phase has ended.
- All alternative tracks and footpaths created during the construction phase should be appropriately rehabilitated (e.g. tillage and re-vegetation of the affected areas). This rehabilitation should result in improved surface roughness and increased infiltration along with reduced stormwater flow and consequently reduced rill erosion.
- Any haulage or access roads (legal or illegal) which were created must be decommissioned and rehabilitation to reinstate the natural vegetation, increase the surface roughness and resultantly increase infiltration (e.g. tillage and revegetation).
- All construction waste materials must be removed, and temporary structures (e.g. offices, workshops, storage containers, ablution facilities) dismantled, from site and the surrounding environment, this will need to be checked by the ECO and the various contractors.
- All banks where there is exposed soil, with the potential for rill/gully erosion to take place, must be stabilised. Gabion structures or geotextiles must be implemented upslope of the proposed development where necessary.
- The reinstatement of the longitudinal bank profiles, which have been altered, must be rehabilitated if possible. The soil horizons must be reinstated on the correct structural order and the vegetation groundcover over the disturbed area re-vegetated according to the native indigenous species within the area.
- AIPs must be removed manually without further disturbance to the surrounding ecosystems. If manual removal is not possible, seek guidance from a local cooperative extension service or Working for Water. Dispose of the removed AIPs at a registered dumping site or burn the material on a bunded surface.
- Rehabilitation of the sections where AIPs are removed must take place. The appropriate indigenous grass and woody vegetation species seeds must be attained from a registered nursery with the guidance of a botanist who is familiar to the region.

Mitigation Measures – Operational Phase

- The monitoring of the overhead powerlines and associated infrastructure (e.g: base) must be conducted on a bi-annual basis to ensure that structural faults do not result in the unnecessary contamination of the wetlands and downstream wetlands.
- Additional monitoring is required as per the monitoring requirements outlined in the EMPr.

8.3.4 Hydropedology

This study dealt with the proposed components of the project that are on the land, namely the transmission line, the switching station and the temporary laydown area for the gas pipeline installation. The specialist's recommendations focused on the construction and rehabilitation phases, in line with the Gazetted Generic EMPr for transmission lines. However, mitigations for the potential impacts during the operational phase were included, in line with Section 28 of NEMA and Section 19 of the NWA (general duties to protect the environment/ water resources) being applied throughout the project.

Key Findings

Several hydropedological risks were identified for the construction and operational phase of the transmission line. The risk associated with the construction and operational phase is estimated to be low and decrease to marginal after consideration of proposed mitigation measures. Due to the project type (i.e. linear development over a large area, where only a small soil area will be disturbed) no impacts on hydropedological flow drivers are anticipated. In context, this would mean that a 'no change' in the hydropedological processes is predicted to occur for the proposed activities relating in no likely change in PES or EIS. Based on the project type, no hydropedological flow buffers will be required.

Construction Phase Impacts

Site preparation, including placement of contractor laydown areas and storage (i.e. temporary stockpiles, bunded areas etc.) facilities. Disturbing vadose zone during soil excavations / infilling activities. In-situ placement of new soils, altering existing soil-flow processes (i.e. infilling of wetlands and cut-and-fill areas). Vegetation loss could decrease soil infiltration and increase runoff. Soil compaction. Soil & surface water contamination and sedimentation from the following activities:

- Leakages from vehicles, machines, and building materials.
- Erosion and sedimentation of watercourses if excavations are left open due to unforeseen circumstances (i.e. bad weather); and
- Alteration of natural drainage lines which may lead to ponding or increased runoff patterns (i.e. may cause stagnant water levels or increase erosion).

Operational Phase Impacts

Alterations to natural soil flow processes due to excavations and soil stockpiling. Soil & surface water contamination and sedimentation from the following activities:

- Oil & fuel leakages from maintenance and service vehicles.
- Spillages from transformers associated with the project.

Recommendations

Mitigation Measures - Pre-Construction Phase

- All development footprint areas to remain as small as possible and vegetation clearing to be limited to what is essential.
- Existing roads should be used as far as practical to gain access to the site, and crossing watercourses in areas where no existing crossing is apparent should be unnecessary, but if it is essential crossings should be made at right angles.
- Have emergency fuel & oil spill kits on site.

Mitigation Measures - Construction Phase

- Only excavate areas applicable to the project area.
- Backfill the material in the same order it was excavated to reduce contamination of deeper soils with shallow oxidised soils.
- Cover excavated soils with a temporary liner to prevent contamination.

- Keep the site clean of all general and domestic wastes.
- Retain as much indigenous vegetation as possible
- Exposed soils to be protected using a suitable covering or revegetating.
- Soil quality monitoring & visual assessments.
- Place oil drip trays under parked construction vehicles and hydraulic equipment at the site.
- Surface water monitoring.
- Visual soil assessment for signs of contamination at vehicle holding, parking and activity areas.

Mitigation Measures – Operational Phase

- Revegetate areas (with vegetation growing at the site) where heavy machinery was used to excavate the soils to prevent erosion.
- Cover excavated soils to be protected using a suitable covering.
- Have emergency fuel & oil spill kits on site.

8.3.5 River and Riparian (Aquatic)

This study dealt with the proposed components of the project that are on the land, namely the transmission line, the switching station and the temporary laydown area for the gas pipeline installation. The specialist's recommendations focused on the construction and rehabilitation phases, in line with the Gazetted Generic EMPr for transmission lines. However, mitigations for the potential impacts during the operational phase were included, in line with Section 28 of NEMA and Section 19 of the NWA (general duties to protect the environment/ water resources) being applied throughout the project.

Key Findings

Coega Port is situated within a low rainfall region. The Mean Annual Precipitation (MAP) is in the order of 434 mm/annum and the Mean Annual Evapotranspiration (MAE) in the order of 1 550 mm/a (S-Pan) (WRC, 2015). The Powership will be constructed offsite and therefore will not have any impact on the surrounding freshwater features of the study area and thus was not included in this assessment.

Four assessment sites were investigated, to assess the possible impacts associated with the proposed project. Due to the absence of water flow at the site as well as the rest of the study area, the in situ Water Quality, Integrated Habitat Assessment Index, and SASS5 results could not be obtained.

The quality of the instream and riparian habitat has a direct influence on the aquatic community. Evaluating the structure and functioning of an aquatic ecosystem must therefore take into account the physical habitat to assess the ecological integrity. Keeping this in mind and the linear nature of the project it was established that there will not be any impacts on the aquatic environment, and this project can be considered for approval.

Recommendations

- Monitoring Program- The purpose of a monitoring program is to directly measure, assess, and report on the status and trends of the applicable environment. The objective of such a program will be to identify potential impacts emanating from the operational activities on the receiving aquatic ecosystems from the dams. However, the construction and associated impacts of the transmission lines will be once off, and the operational phase will have no further inputs or impacts on the receiving environment. It is therefore not believed necessary to implement a biomonitoring plan in regard to the proposed project.

- Estuarine Impact Assessment.

8.3.6 Hydrology

This study dealt with the proposed components of the project that are on the land, namely the transmission line, the switching station and the temporary laydown area for the gas pipeline installation. The specialist's recommendations focused on the construction and rehabilitation phases, in line with the Gazetted Generic EMPr for transmission lines. However, mitigations for the potential impacts during the operational phase were included, in line with Section 28 of NEMA and Section 19 of the NWA (general duties to protect the environment/ water resources) being applied throughout the project.

Key Findings

The aerial extent of the flood line reveals that there is very little impact to the developments or "permanent" structures along the river course. The proposed development falls outside the 1:100 year flood line. Hence, Section 144 of the National Water Act stipulates that no "permanent" facilities should be placed within the 1:100-year flood line does not apply to the project. Moreover, flooding damage risk is estimated to be zero, based on the flood lines generated. Certain activities occurring during the construction/preparation and operational phases have the potential to impact negatively on surround surface water bodies.

Construction Phase Impacts

The building of relevant surface infrastructure, as well as trench digging and the laying of the pipeline infrastructure. Areas will have to be cleared for construction lay down and to provide storage, ablution, and office space. This would expose bare soil and the soil will be "stockpiled" to be used to backfill the trench. Construction vehicles will be constantly manoeuvring through the area, compacting the soil, and any mishaps or damages could cause leakages of fuel and oil from the vehicles. Water from surface water bodies may be used for the washing of vehicles and other equipment, as well as for ablution purposes. Altering of natural drainage lines which may cause ponding or increased runoff patterns. Any flooding that occurs during this phase is likely to cause surface water contamination as soil and other debris is washed away into watercourses. The impacts from earthworks will have a Medium impact on surface water while leakages from vehicles will have a Medium Low impact. This can be mitigated to a Low impact from both these activities.

Operational Phase Impacts

The flow regime in rivers will be altered due to the offtake of any water needed for the operation of the plant. This could impact on the downstream ecological functioning. There is also the risk of pump or pipe malfunction and the nearby surface water bodies could become contaminated if an oil spill was to occur. Alteration to natural flow processes due to the presence of infrastructure disturbing runoff patterns. Transformer oil spillages (if constructed) will impact on surrounding surface water bodies.

Recommendations

Mitigation Measures – Construction Phase

- Only excavate areas applicable to the project area.
- Cover excavated soils with a temporary liner to prevent contamination.

- Keep the site clean of all general and domestic wastes.
- All development footprint areas to remain as small as possible and vegetation clearing to be limited to what is essential.
- Retain as much indigenous vegetation as possible.
- Exposed soils to be protected by means of a suitable covering.
- Existing roads should be used as far as practical to gain access to the site, and crossing the rivers in areas where no existing crossing is apparent should be unnecessary, but if it is essential crossings should be made at right angles.
- Visual assessment for signs of contamination at vehicle holding, parking and activity areas.
- Place oil drip trays under parked construction vehicles and hydraulic equipment at the site.
- Have oil & fuel spill kits on site.

Mitigation Measures – Operational Phase

- Only excavate areas applicable to the project area.
- Retain as much indigenous vegetation as possible.
- Ensure maintenance of transformers to prevent spillages.
- Water quality monitoring of the nearby river.
- Park vehicles in areas lined with concrete or fitted oil traps.
- Ensure vehicles are in good condition and not leaking fuel or oil when conducting maintenance.
- Have oil & fuel spill kits on site.

8.3.7 Geohydrology

This study dealt with the proposed components of the project that are on the land, namely the transmission line, the switching station and the temporary laydown area for the gas pipeline installation. The specialist's recommendations focused on the construction and rehabilitation phases, in line with the Gazetted Generic EMPr for transmission lines. However, mitigations for the potential impacts during the operational phase were included, in line with Section 28 of NEMA and Section 19 of the NWA (general duties to protect the environment/ water resources) being applied throughout the project.

Key Findings

The proposed development involves several transmission lines (i.e. limited impermeable surface generation), and no groundwater abstraction activities are proposed. Hence, the impact of the proposed development on the groundwater reserve is considered zero.

Based on the risk assessment and project type, the impacts on the groundwater environment is low to marginal. Moreover, it is anticipated that the impact on groundwater is going to be uniform for all of the tower/pylon sites (i.e. there is no need for tower specific mitigation).

Construction Phase Impacts

Impacts to groundwater will primarily occur as a result of earthworks. Waste pollution, excavation of parts of the vadose zone, and seepage and overland runoff from oil/fuel spills from construction vehicles will have Medium impacts on groundwater resources. These can all be mitigated to a Low impact.

Operational Phase Impacts

The main impact is poor quality seepage from sub-station and from parked vehicles servicing the sub-station. Visual soil assessments and water quality monitoring inter alia can mitigate the impact from Medium to Low.

Recommendations

Mitigations- Construction Phase

- Only excavate areas applicable to the project area.
- Backfill the material in the same order it was excavated to reduce contamination of deeper soils with shallow oxidised soils.
- Cover excavated soils with a temporary liner to prevent contamination.
- Retain as much indigenous vegetation as possible.
- Exposed soils to be protected using a suitable covering or revegetating.
- Water quality monitoring of the downstream surface water.
- Park heavy machineries in lined areas and place drip trays under vehicles at the site.
- Visual soil assessments for signs of contamination.
- Installation of piezometric seepage boreholes if pollution is evident. The boreholes can be positioned downstream of the transmission lines.
- Install a temporary cut off trench to contain poor quality runoff.
- Routine inspections of all infrastructure.
- Have appropriate dewatering systems in place.
- Dewater all groundwater to the nearest surface drain/watercourse.

Mitigations- Operational Phase

- Water quality monitoring of the downstream surface water.
- Installation of piezometric seepage boreholes if pollution is evident. The boreholes can be positioned downstream of the transmission lines.
- Park service vehicles in lined areas and place drip trays under vehicles at the site.
- Visual soil assessments for signs of contamination
- Routine inspections of the transmission line, and associated infrastructure.

8.3.8 Climate Change Assessment

This study dealt with all the proposed components of the project, namely the transmission line, the temporary laydown area for the gas pipeline installation, as well as the Powerships, the FSRU, LNGC and the submerged gas pipeline.

Key Findings

- The LNGC is potentially physically at-risk during transportation and mooring/operation from a climate change perspective considering the anticipated increase in frequency and intensity of extreme weather events such as hurricanes and tropical storms (refer to Section 2.2.2 and Section 2.3.3). Depending on the location of the LNG source, the LNGC vessel may suffer damage in the event of a severe storm en route to the Port of Ngqura, or — to a lesser degree — within the port. Given the sheltered and well-defended nature of the port, physical climate change risk to the LNGC is considered of Medium-low significance without mitigation, and of Low significance with mitigation.

- Much like the LNGC, the FSRU is potentially at-risk from the expected increase in frequency and intensity of extreme weather events such as hurricanes and coastal storm surges, i.e., physical risks. The proposed location for the FSRU, which is understood to be permanently moored, is in the lee of the main port and therefore only marginally exposed to extreme wind and wave conditions. Consequently, physical climate change risk to the FSRU is considered to be of Medium-low significance without mitigation, and of Low significance with mitigation.
- During installation of the gas pipeline, a potential direct impact relates to infrastructural and/or equipment damage or failure in the event of a severe storm. The significance of this impact is, however, Low, since it is relatively easily mitigated to a significance rating of Very Low by restricting installation to suitable weather conditions. During operation, a Medium-rated impact may occur if a sufficiently severe storm of marine origin impacts the port, possibly damaging the pipeline and resulting in fugitive GHG emissions. Under storm conditions, it is possible that the structures may lead to localised erosion and accretion on opposite sides of the pipeline fixtures which may endanger the pipeline by undercutting. Similarly, to the construction phase, this impact can be mitigated to a Low significance using the precautionary principle in design and installation of the pipeline.
- Operation of the Powerships is likely to result in impacts during mooring and operation, as well as activities related to connection to the FSRU and gas pipeline. Much like the LNGC and the FSRU, the Powership is potentially exposed to the expected increase in frequency and intensity of extreme weather events and the subsequent physical risks. Given the location of the Powership within the main port area, this impact is rated as Very Low with mitigation measures applied. Similarly, impacts concerning connection with the FSRU and pipeline are also rated Very Low with mitigation. A positive impact — rated High — of the Powership operations is the addition of 540MW of baseload electricity to the national grid.
- Direct climate change impacts concerning the transmission line project component include increased fire risk due to more arid conditions and potential changes in vegetation type/climate zone, as well as increased intensity and frequency of extreme weather events. These impacts are expected during the operational phase and can be mitigated to a Low significance rating relatively easily.
- From a physical risk perspective, installation and construction of the towers is unlikely to have a direct impact of any significance. During operation, climate change-induced extreme weather events such as droughts are likely to raise the risk of wildfires, particularly if a severe storm damages the towers and/or the transmission lines. Drier conditions and subsequent changes in vegetation combustibility could raise the risk of ignition further in this scenario. Nonetheless, the significance rating of the abovementioned impact is Low without mitigation, and Very Low with mitigation. From a climate change perspective, the fire risk of underground option for the transmission line is considered to be lower than the overhead line alternative.
- The primary direct impact of not implementing the proposed project relates to a missed opportunity to align with South Africa's prevailing energy policy, the Integrated Resource Plan.which calls for diversification of electricity supply sources, including natural gas in the transition to an energy mix dominated by renewables in the long-term. The result — a transitional risk — is likely to be that the electricity baseload which would have been provided by the Powerships will be procured elsewhere to stabilize the national grid, potentially from a higher-emitting fuel source such as coal or heavy fuel oil (HFO).
- From an emissions perspective, the Powership performs most efficiently when operating at full capacity. The fuel efficiency of the generators will be based on several factors including temperature/cooling, revolutions per minute (RPM), generating capacity, and load capacity. What becomes evident is the increased fuel efficiency of larger generators operating at full load capacity, as opposed to the smaller

generators, or operating at lower load. GHG emissions per MW (CO2e/MWh) at Ngqura are lowest when operating at 100% contracted capacity (0.504 t/MWh net). There is a stepwise increase in emissions per MWh at decreasing capacity. At 65-55%, the emissions are estimated at 0.506 t/MWh. The efficiency is further decreased to 0.509 t/MWh at 30-25% capacity. This decrease in efficiency will increase the CO2 emission factors of the released GHG. Given the 540MW generation capacity of the ships located at Ngqura, the emissions from 100% capacity are 272.16 t CO_2e.

- Given the 540MW generation capacity of the ships located at Ngqura, the emissions from 100% capacity are 272.16 t CO_2e.
- The 540MW-capacity Powerships at Ngqura are expected to emit ~857 Gg CO2e annually, equivalent to ~0.15% of the annual CO2e emissions of South Africa's gross greenhouse gas emissions in 2017. Over the 20-year project lifespan, emissions will be 17 000Gg CO2e, comprised of C02 (85.9%), followed by CH4 (13.5%) and N20 (0.6%).

Recommendations:

- Utilize existing early-warning systems and international standard operating procedures for vessels operating in inclement weather, including evasive action where appropriate. Adherence to port safety regulations and emergency procedures.
- Implement technical measures to reduce fugitive emissions at source and during transfer to FSRU and consider contributions to appropriate carbon offset/drawdown initiatives.
- Adherence to port safety regulations and emergency procedures during mooring/operation.
- Quality and safety checks undertaken immediately after connection to ensure that connection point is secure. Regular inspection on the quality and integrity of the pipeline and connections to prevent fugitive emissions.
- Adherence to port safety regulations and emergency procedures, particularly during construction/installation.
- The ship-to-ship transfer of LNG will be managed under an internationally-accredited process via trained personnel to ensure compliance and within clear quality, health and safety regulations. The fuel lines between the FSRU and the Powership will be via double walled with annular space being inerted and continuously purged with Nitrogen "N2" gas. A gas detector in-circuit will identify a leak, so that the fuel gas can be immediately isolated and shut off, the leak identified, and the necessary repairs or replacements made.
- Technical measures to reduce emissions at source, contribution to carbon offset/drawdown initiatives.
- Ongoing maintenance of servitude and clearing of alien vegetation as per safety protocols.
- Consider contribution to carbon offset initiative to account for value-chain emissions/embedded carbon
- The project is likely to increase local adaptive capacity, by providing local, on-demand energy generation from a less carbon-intensive source. The anticipated growth in gross geographic product (GGP) is therefore likely to indirectly increase the financial adaptive capacity of the greater Port Elizabeth area, at a Medium-high significance rating.

8.3.9 Coastal and Estuarine

This study dealt with the proposed components of the project that are within the estuarine and coastal environment, namely the transmission line, the temporary laydown area for the gas pipeline installation, as well as the Powerships, the FSRU and the submerged gas pipeline. The specialist's recommendations focused on the construction and rehabilitation phases, in line with the Gazetted Generic EMPr for transmission lines. However, mitigations for the potential impacts during the operational phase were included, in line with Section 28 of NEMA and Section 19 of the NWA (general duties to protect the environment/ water resources) being applied throughout the project.

<u>Key Findings</u>

By virtue of the proposed activities location within the coastal zone and within the Coega Estuaries EFZ, consideration should be given to the direction provided by the ICM Act and its related tools, the socio-economic impacts, the possible impact from dynamic coastal processes and whether the proposed activity is likely to cause irreversible or long-lasting adverse effects on the coastal or estuarine environment that cannot be properly mitigated; will prejudice the achievement of any coastal management objective; or will not be in the interests of the community as a whole.

Although estuarine ecosystems are considered key environmental assets, they are one of the most threatened ecosystems in the country. Within the Port of Ngqura, the proposed Gas to Power project will be located predominantly within the deeper waters of the port, but in close proximity to the mouth of the Coega Estuary.

While the estuary, and the saltworks therein, are earmarked for future port expansion, with major earthworks currently taking place near to the estuary, it is important that potential environmental impacts be assessed in order to minimise further environmental degradation and to formulate and implement appropriate mitigation measures, as part of environmental best practice until the long-term plans are realised. With proactive management, the impacts can be greatly reduced in terms of the extent, duration and overall significance.

Construction Phase

Impact 1: Loss of estuarine habitat as a result of construction within the estuarine functional zone

The proposed project site is located within the modern Port of Ngqura. The area has undergone drastic modifications including infilling, canalisation of the Coega Estuary, quay wall construction, dredging, and industrial infrastructure development. The natural dynamics of the estuary mouth has been significantly altered and what natural habitat remains in the vicinity of the port, is highly disturbed.

The laydown area /stringing yard for the assembly of the gas pipeline and the first land-based connection, that is the terminal tower, will be located in the modified sandy beach environment, some 270 m east of the estuary mouth and in proximity to existing port infrastructure and buildings. Access will be via the existing road that provides access to the eastern breakwater. The location of the terminal tower is the same for both the preferred and alternate layout options for the powerships within the Port basin.

Despite the modified state, the beach provides important roosting habitat to threatened coastal bird species. The habitat within the footprint of the terminal tower will be permanently lost, whilst the footprint of the laydown area/stringing yard will be temporary and could potentially be rehabilitated once assembly of the supporting infrastructure for the powership is complete.

In regards to the transmission lines, the alternate route will traverse a section of the EFZ above the N2 road bridge comprising degraded wetland habitat as well as prominent drainage lines entering the upper estuary. While the utilisation and importance of this specific area for estuarine fauna, particularly threatened water-associated birds, is unknown, some estuarine habitat will be lost as a result of construction of the pylons in the EFZ, further contributing to the overall transformation of the Coega Estuary. These areas are all classified as CBA 1 areas and should be avoided.

Impact 2: Disturbance/mortality of estuarine/beach fauna as a result of construction activities, noise and potential pollution

Disturbance of the intertidal sandy beach zone is expected during the assembly of the gas pipeline and undertaking of other construction related activities for the Gas to Power project. This will involve heavy machinery accessing and moving along the beach in the vicinity of the laydown area. The intertidal zone of sandy beaches is inherently highly dynamic, being exposed to constant daily changes and disturbance by wind and wave action. Therefore, recovery of the intertidal sandy beach infauna due to the disturbance by construction activities will be fairly rapid. By virtue of the ephemeral nature of the Coega River entering the estuary, the fauna occurring in the degraded wetland habitat above the N2 is likely to be extremely limited, and/or transient, with a strong response to flood/high flow conditions. In addition, the degraded state of this area is unlikely to provide favourable feeding and breeding habitat for waterbirds. Disturbance is thus anticipated to be relatively low.

While the proposed project is located within an industrial and commercial port where noise pollution is already prevalent, additional noise and vibrations will be generated through the presence of heavy machinery, vehicles and generators both on the beach and in the upper estuary reaches in respect to the alternate transmission route. The beach environment continues to provide important roosting and nesting habitat to threatened coastal bird species despite its modified state. During open mouth conditions following good seasonal rainfall, increased numbers of palaearctic wading bird species utilise the estuary mouth and the beach environment. Furthermore, threatened bird species have also been recording breeding in the Port environment. The temporary in increase local noise levels will disturb and potentially displace feeding or nesting birds utilising the saltpans and the beach over the construction period. General disturbance to the beach environment could be reduced by assembling and launching the pipeline from the breakwater.

The potential for pollution from shipping (including Spent oil and lubricants, Paint, solvents and waste detergents, Waste from ship maintenance activities, Sewage, Galley waste, Sweepings from hatches and engine rooms, Slops from holds and tanks, Ballast water, General domestic waste, Medicinal/Medical waste, Spent Batteries, discharge of heated wate etc.) as a result of the proposed gas to power process is considered to be high and specific controls will need to be incorporated into the environmental authorisation, if approved.

It should be noted that as such pollution is deemed to not be land-based, and as such it will not be controlled by the ICM Act but rather in terms of International Convention for Prevention of Pollution from Ships Act (Act No. 2 of 1986) (MARPOL Act), the South Africa Maritime Safety Authority Act (Act No. 5 of 1998) (SAMSA Act), the Marine Pollution Act (Act No. 6 of 1981) (Control and Liability Act) as well as the Merchant Shipping Act (Act No. 57 of 1951). It is also primarily the responsibility of the National Department of Transport and the South African Maritime Safety Authority (SAMSA) to manage. Discharges must also be compliant with the South African Water Quality Guidelines for Coastal and Marine Waters (DWAF, 1995; DEA, 2018). The responsibility, in the case of oil pollution from ships and once oil has been released to sea, is the responsibility of DEFF, specifically through their Kuswag Programme, which undertakes regular oil spill surveillance and monitors for potential illegal oil discharges. This includes shoreline protection and clean-up, and at-sea response using dedicated oil response vessels and aircraft and dispersant spraying operations (DEA & RHDHV, 2017).

As the proposed operation of the gas to power process takes place within a port environment, the necessary TNPA environmental management programme and systems, specifically policies and processes relating to waste, dockside maintenance and repairs and comprehensive emergency response plans dealing with all foreseeable environmental emergencies, must be applied. It should be noted that the Polluter Pays principle whereby those responsible for the spill are held liable for the clean-up costs, will apply in any pollution incident.

Impact 3: Solid waste pollution generated during construction period

Solid waste will be generated by construction activities and may include concrete rubble and bricks, metal materials, material off-cuts and surplus, plastic waste and general litter. If not properly managed and contained, these materials may find their way into the marine environment and/or the Coega Estuary through wind transport or direct discarding of waste. Poor management of the laydown area, the stringing yard and its operations (e.g. waste management facilities), and construction areas (e.g. pylons) may also lead to contamination of the surrounding environment.

Waste management during the construction phase, in terms of the handling, storage and disposal of general, construction and hazardous waste, must continue for the duration of the construction phase. There is a definite possibility that the impacts will occur if waste is not properly managed, and the intensity of these impacts may be severe and expensive or time-consuming to mitigate.

Floating or submerged solid waste (especially plastics) in the marine environment can be transported over vast distances through the ocean currents and therefore the area of impact could potentially be extensive. Debris in the oceans may have a lethal impact on marine fauna, with potentially severe consequences for rare and endangered species. It is recommended that intensive awareness training should be done with all staff regarding the impacts of construction waste and litter on the marine and estuarine environments.

Impact 4: Chemical pollution arising from construction related spills of hazardous substances

During the construction period, there is the potential for accidental spills of hydrocarbons, oils from construction vehicles and equipment, and other harmful substances and chemicals used (e.g. concrete). Incorrect handling and improper spill management, will result negative impacts on marine and estuarine sediment and water quality. Considering the sensitive nature of these environments, accidental spills, regardless of volume or concentration, could lead to significant ecological damage.

Operational Phase

Impact 1: Injury / mortality of coastal/estuarine associated birds

Power generated by the powerships will be evacuated and linked to the national powergrid by means of overhead transmissions lines (or potentially underground cables). Two routes are proposed. The preferred route is located approximately 1.7 km east of the Coega saltpans. The alternate route runs adjacent to the estuary, less than 250 m from the eastern margin.

In general, powerlines pose a significant threat to birds, particularly big bodied species such as flamingos, herons, spoonbills etc., which utilise the saltpans, as well as other species flying over the system. The risk of bird collisions are likely to be greater at night, or in poor weather conditions, when visibility is poor. Collisions would be greater for the alternate route, located in closer proximity to the primary bird habitat of the Coega Estuary in comparison to the preferred route further afield. This can be mitigated for the most part by ensuring that the overhead lines are located as far from the estuary as possible (the preferred route), and/or following existing transmission line routes. The populations of Threatened and Near-Threatened species are particularly at risk. Impacts on marine bird species are assessed in the Avifauna Specialist Report.

Impact 2: Disturbance to coastal/estuarine associated birds due to noise and light pollution

The proposed Gas to Power project will be located within the industrial and commercial Port of Ngqura where noise and light pollution is already prevalent. Once in operation, the powerships will operate throughout the day and night, or part thereof, with noise emanating from power generation, supportive activities and other potential sounds (e.g. alarms sirens/bells etc.). According to the noise generation study (Williams, 2021), the estuary mouth and beach environment will be subject to 80-90 dBA, the lower estuary 60-80 dBA, decreasing from 60 dBa moving up the saltpans. The recommended noise mitigation measures will bring noise level within the acceptable limits for industrial areas (70 dBA daytime, 60 dBA night-time). However, any sensitive bird species utilising the estuarine/beach habitat for feeding, roosting or nesting will likely be disturbed by the additional noise and artificial light (specifically during the night) (Adams et al., 2019) due the close proximity of the powership to the shoreline and estuarine environment. The estuary mouth and beach areas may thus become unfavourable for coastal and estuarine-associated birds and the habitat value will thus be diminished in the long term. The populations of Threatened and Near-Threatened species are particularly at risk. Studies have also shown the artificial lighting can disorientate and thus pose a threat to migrating species (Adams et al., 2019).

The impacts of noise and light pollution can be partially mitigated by ensuring low light emission from the powership and relocation of the powership component to a less sensitive location within the port, i.e. away from the shoreline (i.e. the alternate option). Limited alternative options exist for mooring elsewhere within the port.

Impact 3: Change in water quality at the estuary mouth

Natural and artificial sheltered coastal environments, such as estuaries and ports provide important nursery habitat for coastal fishes, which is particularly important for commercially exploited species. Some marine species are dependent on estuaries for various parts of their lifecycle and recruitment into estuaries typically occurs during high flow periods or seasonal breaching of estuary mouths in response to environmental cues. While the overall functioning of the Coega Estuary is severely modified, with limited marine connectivity and little favourable habitat for estuarine-associated marine fish species, such species have been recorded both in the estuary (prior to port development) (James and Harrison, 2010) and within the port (pre-operational) (Dicken, 2010). This indicates that there may well be some residual fish habitat and/or nursery function.

Marine fauna (mainly fish and invertebrate species and their larvae) attempting to enter the estuary or using the intertidal and shallow subtidal areas at the mouth, may be vulnerable to disturbance/mortality as result of the discharge of heated cooling water and resultant change in water quality conditions. Thermal plume modelling under the worst case scenario indicates that water temperatures within the vicinity of the estuary mouth will increase by 0.5°C as a result of the discharge (8 m depth) during both winter summer relative to the current conditions under the preferred layout option (PRDW, 2020b). The dispersion of the thermal plume meets the limits of the South Africa Water Quality Guidelines for Coastal Waters (DWAF, 1995; PRDW, 2020b), and is thus not expected to adversely impact on marine and/or estuarine biota in the region of the Coega Estuary mouth, provided the depth of discharge is maintained. The significance of any potential impact is lower for the alternate layout as it is further from the estuary mouth region. Impact on the estuarine environment would absent during closed mouth conditions.

Impact 8: Mortalities of coastal estuarine associated fauna and habitat destruction due to explosion
Although unlikely and also unpredictable, a gas explosion will result in significant habitat disturbance/ destruction with the potential for numerous mortalities of marine and coastal/estuarine associated fauna.

The risk of explosion on the Coega Estuary and adjacent sandy beach can be partially mitigated by relocation of the powership component to a less sensitive location within the port, i.e. away from the estuary mouth and shoreline (alternate option). Limited alternative options exist for mooring elsewhere within the port. The risk of explosion can also be mitigated to some degree by TNPA's pollution, emergency, and health and safety protocols, MARPOL and other applicable maritime legislation and policies. The significance of any potential impact is slightly lower for the alternate layout as it is further from the estuary mouth region.

Both construction and operational Phases

Impact 1: The impact of dynamic coastal processes
The coastal location of the proposed activity within a Port, and the link into the existing Dedisa Substation located approximately 6 km inland from the Port, means that these activities will be inherently exposed to risks associated with natural and dynamic coastal processes that continually reshape the coastal zone, such as wind, waves and sediment movement. As such, the anticipated key issues identified in the scoping report (Moore and Breetzke, 2020) related to the movement of sediment and wind erosion are collectively included within this assessment of impact and detailed collectively as Dynamic Coastal Processes. This includes climate change vulnerability, which is addressed fully in a separate specialist report (Themis Environmental, 2021).

<u>Movement of sediment/ Wind-blown sand</u>
The Port of Ngqura effectively blocks the natural eastward littoral drift of sand causing severe sediment accretion to the west of the port and beach erosion to the east. Beyond the beach impact, dune fields fed by windblown sand from the beaches also exhibit sedimentary changes. Maintenance of this port therefore requires constant removal of dune sands and constant dredging of the harbour mouth. This impact has been remedied with the construction of a by-pass system that is required to move a minimum of 240 000 t of sediment per annum via the pump system form the western side of the port to the eastern side thereby mimicking littoral drift (Petterson 2019).

It is noted that, and as detailed in (CEN, 2015) and most likely in other reports, the terrestrial habitat surrounding the estuary and the coastal dune field are classified as critical biodiversity areas with the latter being part of a greater sand process corridor stretching from the Sundays to the Swartkops Rivers. This area forms part of one of the largest active dune fields in the world, the greater Alexandria dune field. Any development or hard structures proposed need to take cognisance of this and the potential impacts it may have especially on sediment transport (CEN, 2015). Rehabilitation of currently spoilt and degraded systems is encouraged as is responding to dynamic processes through increasing the resilience of natural and social systems.

Potential impact on these dune systems during the transmission line installation is deemed to be negligible with impacts limited to the construction area. Any increase in wind-blown sand, as a result of construction, can be mitigated through best practice methods. As detailed in the Climate Change specialist report (Themis Environmental, 2021), a trend of increasing aridity (arid, steppe, hot climate category) is likely to alter sediment dynamics and transport regimes as more arid conditions allow for the liberation of dune sediments, increasing the likelihood of aeolian sediment transport as well as increases in the conditions favourable for the development and spread of wildfires. This is of particular relevance to the sand corridor and neighbouring greater Alexandria dune field.

The City proposes that a holistic assessment be undertaken, in conjunction with TNPA, which considers the dune/sand system (erosion, deposition) and includes the determination of a 'sand budget' for the coastal zone. As detailed in (CEN, 2015), "the study should inform best practice methods to protect landward structures and infrastructure from coastal erosion and/or sand inundation, and measures to encourage beach nourishment and dune stabilisation".

Climate change vulnerability

The proposed operation could be susceptible to impacts relating to sea level rise (SLR), which is projected to rise globally by between 60 and 90cm by 2100 according to the Intergovernmental Panel on Climate Change (IPCC). Locating the proposed activity within the Port (safe harbour) and the inland orientation of the transmission line greatly reduces the potential of these impacts. It should be noted that the activity, vide its location within a Port, is not directed by the proposed Coastal Management Line determined by the NMBM.

Impact 2: Restriction of coastal access

The ICM Act as well as all the relevant CMPs developed in terms of it, prioritises the provision of equitable (and safe) public access to the coastal zone and its resources. Such coastal access must, however, not conflict with protected areas, protection of the environment or the interests of the community or be located within a harbour, defence or other strategic area without permission of relevant Minister (DEA, 2014a). The NMBM also requires that any development should allow for safe access and enjoyment of the coastal zone by people. This includes allowing the sustainable utilisation of natural coastal resources by all members of the community, in order to enhance their quality of life (CEN, 2015).

As the majority of the infrastructure is proposed to be installed within the access-controlled Coega IDZ no change in coastal access is expected, as access is already restricted. Neither proposed location of the transmission lines restrict access to the coast and access routes to the coastline. From a mitigation perspective, while access to the coast is considered a right in terms of the ICM Act, restriction of such access in the public interest (for safety and security reasons) and the availability of alternate access to the beach mitigates any impact on coastal users.

Recommendations

Mitigation measures – Construction phase

- Noteworthy vegetated areas must be avoided in the siting and enclosure of the laydown area/stringing yard. During the construction of the transmission lines, the removal of endemic vegetation should be limited, however, invasive alien vegetation invasion in respect to disturbed areas must be removed and controlled.
- Pylons along the alternate route must be located outside of EFZ
- Beach environment to be rehabilitated to pre-establishment conditions as part of decommissioning
- Construction must be undertaken according to a site-specific approved Environmental Management Programme (EMPr) and must be monitored by an on-site environmental officer.
- All solid waste must be removed to an appropriate disposal facility

- In the event of a large-scale marine pollution event, every effort must be made to prevent it reaching and negatively impacting the Coega Estuary, even though the system is ephemeral and often closed.
- Dust or sand suppression should be undertaken by watering down and limiting activity in windy conditions.
- The Gas to Power operation must be aware of TNPA Environmental Management Systems as well as emergency preparedness and response procedures and apply such on an ongoing basis and in the event of emergencies, for example, tidal surge, dust storms and other extreme events.
- The surrounding area must be surveyed prior to construction/camp establishment to determine the presence of nesting birds and these must cordoned off where possibly or be safely relocated if necessary.
- The conservation authority must be contacted for the relocation of birds/ wildlife.
- No animals (birds, reptiles, mammals) are to be disturbed unnecessarily and no animals are allowed to be shot, trapped or caught for any reason.
- Conduct a comprehensive environmental awareness programme amongst contracted construction personnel about sensitive estuarine and coastal habitats and fauna.
- Assembly and launching of the pipeline from the breakwater.
- Restrict access to laydown area/stringing yard only, i.e. keep vehicle access to other beach areas to a minimum.
- Restrict vehicles to clearly demarcated access routes and construction areas only.
- Only allocated access points to the beach be used.
- Construction activities, specifically excavation and moving/transporting of large components, to be restricted to daylight hours to prevent potential disturbance to roosting bird populations, and the core estuarine area
- Construction vehicles, plant and machinery must be well maintained and fitted with silencers.
- Regular maintenance on vehicle and equipment undertaken.
- In response to possible pollution as a result of Shipping activities:
  - Provide an inventory of waste produced and the nature of waste being produced and cooperate with the TNPA in every way.
  - A requirement to report environmental accidents and emergencies immediately they occur, to the port captain.
- Construction workers and operational staff to adopt best practice waste minimisation procedures.
- Implement the correct handling and disposal procedures for general and hazardous waste.
- Reduce the amount of waste generated from the construction phase by means of efficient operations and recycling of general waste.
- Good housekeeping to be done daily.
- No mixing of concrete in the intertidal zone.
- No dumping of construction materials or excess concrete in the intertidal and subtidal zones.
- Wind screening (e.g. fine –mesh shade cloth fencing, or solid fencing) must be installed to prevent excessive wind-blown sand and light-weight solid waste (e.g. litter) entering the Coega Estuary
- Dust or sand suppression should be undertaken by watering down and limiting activity in windy conditions Conduct a comprehensive environmental awareness programme amongst contracted construction personnel about sensitive estuarine/marine habitats and good house-keeping.

- The laydown area must not be established within a high-risk area (i.e. the Coega Estuary or below the high water mark);
- The establishment and operation of the laydown area/site camp must follow a stringent Environmental Management Programme;
- Sufficient ablution facilities must be provided for construction personnel and sited away from high-risk areas. These must be frequently cleared (preferably every two weeks depending on the number of staff);
- The laydown area must be adequately protected against adverse weather conditions, particularly the chemical storage areas, to prevent erosion and run-off of contaminants into the Port;
- A Spill Prevention and Management Plan must be compiled and implemented. In the event of any significant spill the TNPA must be notified;
- A method statement in respect to the use, handling, storage and disposal of all chemicals as well as anticipated generated waste, must be compiled and submitted as part of any Environmental Management Programme;
- Ensure correct handling, storage and disposal procedures followed (e.g. bunded storage areas to contain 110% of volume);
- Maintain vehicles and equipment - no leaking vehicles or equipment to be permitted on site. All vehicles and machinery must be parked or stored on an impervious surface;
- Conduct a comprehensive environmental awareness programme amongst contracted construction personnel about sensitive estuarine and marine habitats and the need for careful handling and management of chemical substances.
- In the event of a spill, a penalty should be issued and the ‘polluter pays’ principle should be applied for clean-up operations and rehabilitation, if necessary.

Mitigations measures- Operational Phase

- All supporting plant and machinery must be well maintained and fitted with silencers
- Acoustic enclosures must be installed around all major noise emitting components to supress the noise emissions from equipment, such as engines
- Powerships and supporting components must be fitted low emission light fittings
- Where possible, lighting (e.g. spotlights) must be diverted away from the shoreline
- Lighting during night-time must be limited to essential lighting only.
- Biannual bird monitoring of species utilising beach and estuary mouth must be undertaken to assess any level of disturbance.
- Discharge of heated cooling water must be maintained at the required depth to reduce adverse thermal effects on marine/estuarine biota in the mouth region during open mouth conditions.
- Powerships must be adequately distanced from the estuary mouth to reduce adverse thermal effects of marine/estuarine biota in the mouth region during open mouth conditions.
- Strict adherence to TNPA pollution, emergency, and health and safety protocols, MARPOL and other applicable maritime legislation and policies for the storage and handling of LNG, and power generation processes.
- Comprehensive safety checks frequently undertaken of all project components and processes.
- Frequent risk assessments and adaptive management where required.

Mitigation measures for both Construction and Operational Phases

- Locate transmission lines along the preferred route – i.e., along existing roads
- During the construction of the transmission lines, the removal of endemic vegetation should be limited, however, invasive alien vegetation invasion in respect to disturbed areas must be removed and controlled.
- Dust or sand suppression should be undertaken by watering down and limiting activity in windy conditions.
- The Gas to Power operation must be aware of TNPA Environmental Management Systems as well as emergency preparedness and response procedures and apply such on an ongoing basis and in the event of emergencies, for example, tidal surge, dust storms and other extreme events.
- Consideration must be taken of sediment transport routes and the impact the construction of the transmission lines will have on this as well as the impact the liberated sand will have on it – innovative design solutions which will avoid the build-up of sand and possible damage to transmission infrastructure should be considered. Any areas disturbed should be rehabilitated.
- Coastal development must be designed to build resilience to the impacts of climate change and sea-level rise
- Environmental quality control and monitoring of construction and operational activities required
- Areas required to be restricted outside of the confines of the Port, as a result of health, safety and security concerns, must be properly cordoned off with signage installed indicating the reason for such restriction.
- The preferred alternative from a coastal access perspective is to follow existing servitudes to minimise disruption to coastal access during the operation phase.
- During construction, the need for coastal access should specifically be taken into consideration in the development of site-specific environmental management programme (EMPr).

8.3.10 Marine Ecology

This study dealt with the proposed components of the project that are within the marine environment, namely the Powerships, the FSRU and the submerged gas pipeline.

It must be highlighted that the specialist had selected a different methodology for the assessment of impacts, as the specialist believes that it reflects the findings of this study more adequately.

Key Findings

The following activities are screened out of this assessment because it is assumed they will be adequately controlled in terms of the Port of Ngqura's existing harbour rules, port reception facilities, vessel management practices, oil spill contingency plans and other relevant domestic law:

- regular discharge of vessel wastes;
- ballast water exchange procedures;
- vessel lighting;
- vessel collisions with marine fauna;
- anchoring (no release of concrete from anchoring blocks); and
- hydrocarbon leakages from vessels.

Furthermore, other constituents' discharge, such as biocides or brine, is not considered in this assessment. None of these will be added to the cooling water, according to the project description.

Given the low density of marine fauna in the littoral zone and the evidence that the area in the vicinity of the proposed FPP facilities is disturbed, ecological damage is predicted to be negligible. The gas pipeline construction and installation and vessel mooring will have a Very Low impact on the benthic community. The predicted impact is deemed to be 'negligible' or will probably be indistinguishable from natural background variations. The uptake of cooling water will have a Low impact on marine organisms in the surrounding water body, as there is no lasting effect on this sensitive receptor. The discharge of cooling water will have a Low impact on the marine ecology in the receiving water body, as it will have no lasting effect on the sensitive receptor i.e. plankton and benthic organisms.

LNG leakage into the surrounding water body is not anticipated to cause harm the marine life or alter water column characteristics, as LNG vaporizes rapidly in air, becoming buoyant at -110°C and disperses quickly. Similarly, the re-gasified NG, used as fuel in the Powerships, is supplied at ambient temperature. As such, should a release occur, natural gas would be much lighter than air and would disperse immediately and not affect marine life. Thus, LNG leakage is not assessed in this study.

Construction and Operational Phase Impacts

Impact 1: The effects of gas pipeline construction and installation and vessel mooring on the benthic community

There will be some temporary resuspension of sediment in the water column during the installation of the pipeline and mooring structures. Turbidity generated by these construction activities may be advected into surrounding areas but, as each turbidity-generating event is spatially constrained, areas affected are likely to be small. This will cumulatively contribute a small amount to suspended sediment from port maintenance dredging activities. Accordingly, combined with natural episodic high turbidity events, the local biological communities should be acclimatised to elevated turbidity levels.

The seabed installations will also result in the disturbance of approximately 5 200 m2 (approx. 500 m pipeline in total on seabed x approx. 10 m servitude + mooring blocks) of benthic habitat within the site-specific area of about 78.5 ha. This will result in the modification of approximately 0.6% of the benthic and intertidal community structure on site. Assuming colonization of hard surfaces by indigenous fauna will represent a minor increase in benthos biodiversity in the project area. Furthermore, the development will likely occur within an already compromised port area due to the admin craft basin's construction. CSIR (2018) reported macrofaunal abundance near the admin craft basin and the proposed FSRU location (detailed in section 2.5.2). However, many of these individuals were small subsurface deposit-feeding polychaetes that are generally more opportunistic in nature and can proliferate in disturbed environments. These individuals' occurrence at this site may indicate that the benthic habitat in the proposed development location's immediate vicinity is disturbed (CSIR 2018).

The sandy beaches where the pipeline will cross into the sea offer a soft sediment habitat associated with sandy beaches (detailed in section 2.5.1). The sand areas support a benthic macrofauna distribution as expected for a nearshore depth gradient, i.e. suspension feeders such as molluscs and mysid shrimps (CSIR 2013). Low biomass levels in the nearshore compared to deeper areas have been reported (CSIR 2013). Additionally, the Coega River mouth and the sandy beach between the mouth and base of the eastern breakwater are essential for marine bird species. Given the low density of marine fauna in the littoral zone and the evidence that the area in the vicinity of the proposed FPP facilities is disturbed, ecological damage is predicted to be negligible.

The impact's spatial scale will be site-specific with a minor intensity as natural ecological functions are hardly altered. The effects will be between 1 and 4 seasons (3 to 12 months) (medium). The frequency of the impact is once-off, i.e. during the installation of the pipeline and mooring systems. The probability of the impact is definite, but lasting damage to the benthic community is predicted to be extremely low due to the minimal spatial scale of disturbance along with low macrofaunal density in the intertidal and likely reasonably rapid recovery. Accordingly, the assigned overall environmental significance rating is Very Low.

Impact 2: The effects of the uptake of cooling water on marine organisms in the surrounding water body
Seawater abstracted by the powerships will entrain small marine organisms such as holoplankton, meroplankton and ichthyoplankton (detailed in section 2.5.3) from the surrounding water body condenser cooling systems. This will be coupled with the impingement or trapping of larger organisms against the screens used to prevent debris from being drawn into the cooling water intake. As entrained organisms pass through the pumps, they are exposed to collective hydrostatic pressure, shear forces, accelerative forces from changes in velocity and direction, and mechanical buffeting and collision against the pump mechanisms' hard surfaces. These can cause physical damage to marine organisms, significantly larger, more fragile species, resulting in death or incapacitation, the latter reducing their ability to escape predators post-discharge. Furthermore, the abstracted seawater receives excess heat and increases in temperature through the cooling process, inducing thermal stress on entrained organisms. Temperatures of the cooling water can be expected to increase by 15°C (ΔT) whilst in the system. Rapid temperature increases above ambient conditions can affect marine organisms' survival, growth, metabolism, morphology, reproduction, and behaviour. No chemical stress on organisms is predicted as no biocides, chemicals, or brine will be discharged.

Algoa Bay is nutrient-limited, and thus phytoplankton biomass and production are generally low, with high variability driven by upwelling events. Chlorophyll-a concentrations (indicative of phytoplankton biomass) in the vicinity of the Port of Ngqura were low (section 2.5.3). However, the Coega River is considered an essential contributor of nutrients to the shallow subtidal zone. Elevated phytoplankton biomasses have been recorded adjacent to the river mouth (CSIR 2012), where the powerships will be located for the proposed first alternative. There is a high spatial and temporal variability in zooplankton abundance and biomass in Algoa Bay, hence the Port of Ngqura. Previous studies have also indicated a high density of fish eggs within and surrounding the Port, although the numbers of fish larvae were low.

Plankton biomass recovers quickly due to short generation times (~0.3/day), and populations are quickly replenished via tidal mixing processes from the wider port water body and the adjacent continental shelf. Accordingly, it is anticipated that the volumes of plankton entrained will not affect broader ecosystem functioning. Additionally, there is a lack of project-specific literature on uptake and entrainment, i.e. plankton mortality data. However, it is reported by Poornima et al. 2005, amongst others, that the mortality rate from thermal and mechanical stress of plankton entrained is not 100%.

The seawater abstraction process also affects other, generally larger, marine organisms such as juvenile fish through impingement on the intake pipes' screens. Dicken (2011) demonstrated that the Port functions as an important nursery area for many fish species and is an important habitat and activity zone for juvenile and neonate dusky shark. Therefore, notable organisms impinged in the Port of Ngqura include juvenile fish and shark species.

Although the cooling water intake velocities are large (2.4 to 11.4 m3/s), in comparison to the approximate total volume of water in the site-specific area (>10million m3; site-specific area x average depth), volume intake per time by the powerships is low. Furthermore, larger organisms will likely swim away from intake pipes so that entrainment will have a negligible impact.

The impact's spatial scale will be site-specific with minor intensity as natural functions are hardly altered. The duration of the marine ecology's effects will be temporary as plankton biomass recovers quickly due to short generation times (~0.3/day). The frequency of the impact is continuous. The probability of the impact occurring is definite, but although some deleterious effects are expected, there will be little impact on natural processes in the context of site-specific scale. Accordingly, the assigned overall environmental significance rating is Low.

Impact 3: The effects of the discharge of cooling water on the marine ecology in the receiving water body

The discharge of warmed cooling water to the surrounding water body causes temperature changes, generating chronic level effects on biota. These include alterations in growth, metabolism, respiration patterns and reproduction, and/ or influence ecosystem-level processes such as alterations of the amount of oxygen dissolved in seawater, which can be detrimental to marine life (Robinson 2013, Anchor 2015).

The sensitive receptors comprise the ‘resident biota’ including plankton communities, sandy shore communities, the invertebrate species on the port structures, fish larvae, juvenile fish and sharks in the water column (that are unable to swim away). Mudflats and sandflats support a high biological diversity level and are considered an important nursery ground for juvenile fish. The Port functions as an important nursery area for many fish species and is a critical habitat and activity zone for juvenile and neonate dusky shark (Dicken 2011). Larger animals (section 2.5.5) that are more mobile are not considered sensitive to these water temperature changes, as they can move away from the thermal plume if they feel discomfort.

The biota in the Port of Ngqura experience water temperatures that are generally warm, ranging in between 15.4 and 16.4°C in winter and 20.3 and 22.6°C in summer (CSIR 2018).

The report had concluded that there is not enough information about underwater noise and vibration levels from floating power plant ships to conduct an assessment. Therefore, general sound levels from commercial vessels were presented and the biological thresholds of sensitive receptors.

However, it was noted that the effects of underwater noise from FPP operations on marine ecology are unlikely.

Recommendations

- The contractors laying the pipes and anchors should minimise the area of seabed disturbed.
- The FPP operator must ensure that water temperatures at 100 m from the discharge points are compliant with the Water Quality guideline ecological threshold. This will confirm the performance of the discharge system and the numerical model predictions.
- All records of discharge volumes and quality are to be kept for auditing purposes.

8.3.11 Air Quality Assessment

Key Findings

Natural gas used for energy generation is primarily methane, with low concentrations of other hydrocarbons, water, carbon dioxide, nitrogen, oxygen and some sulphur compounds. Liquefied Natural Gas (LNG) is natural gas which has been cooled below its boiling point of minus 161 °C in a process known as liquefaction. The process of liquefaction involves extracting most of the impurities in raw natural gas. The remaining natural gas is primarily methane with only small amounts of other hydrocarbons and consequently is widely considered a clean fossil fuel.

The quantity and nature of emissions to the atmosphere from LNG combustion depends on the quality of the fuel, fuel consumption, the combustion device, and the air pollution control devices.

The combustion of LNG results in gaseous emissions of sulphur dioxide (SO2), oxides of nitrogen (NO + NO2 = NOX), carbon monoxide (CO), and some particulate matter (PM). Carbon dioxide (CO2) is the main Greenhouse Gas resulting from LNG combustion.

SO2 is produced from the combustion of sulphur in the LNG. NOX is produced from thermal fixation of atmospheric nitrogen in the combustion flame and from oxidation of nitrogen bound in the LNG. The quantity of NOx produced is directly proportional to the temperature of the flame. The non-combustible portion of the fuel remains as solid waste and emitted as particulates.

Emissions result from the ship manoeuvring from the port entrance to the berth, and during the LNG transfer when berthed alongside the FSRU. Total annual emissions resulting from the Karpowership Project are listed in Table 8-2 below.

Table 8-3: Annual emissions from the Karpowership Project in t/a for LNG.

Source	SO_2	NO_X	PM_{10}
Powership 1 (Khan)	36.7	917.1	183.4
Powership 2 (Shark)	21.0	524.1	104.8
FSRU	7.0	174.7	34.9
LNG vessel	1.1	9.4	0.2
Total	**65.8**	**1625.3**	**323.3**

The maximum predicted annual SO2, NO2 and PM10 concentrations and the 99th percentile concentration of the 24-hour and 1-hour predicted concentrations are very low relative to the NAAQS.

Table 8-4: Maximum predicted ambient annual SO2, NO2 and PM10 concentrations in µg/m3 and the predicted 99th percentile concentrations for 24-hour and 1-hour averaging periods, with the South African NAAQS.

	SO_2		
Description	**Annual**	**24-hour**	**1-hour**
Predicted maximum SO_2	0.09	0.74	1.75
NAAQS	50	180	350
	NO_2		

Predicted maximum NO_2	1.75		33.6
NAAQS	40		200
	PM_{10}		
Predicted maximum PM_{10}	0.43	3.65	
NAAQS	40	75	

Monitoring has shown ambient SO_2, NO_2 and PM_{10} concentrations as relatively low in the Coega SEZ and below the NAAQS. The additive effect of the contribution from the Karpowership Project is predicted to be very small and the potential increase in ambient concentrations is highly unlikely to result in exceedances of the NAAQS. The severity of the additive impact associated with SO_2 and PM is therefore predicted to be insignificant, and small for NO2.

The combustion of gaseous fuel for steam production or electricity in a reciprocating engine with design capacity equal to or greater than 10 MW heat input per unit is a Listed Activity under Category 1: Combustion Installation, and sub-category 1.5: Reciprocating Engines. Minimum Emission Standards (MES) for reciprocating engines using gas are set for NO_X and particulates, but not for SO_2. The MES are shown in Table 8-4 below with the proposed emission concentrations for the Karpowership engines. It appears that emission standards are not prescribed for steam turbines with a capacity of less than 50 MW.

Table 8-5: Minimum Emission Standards in mg/Nm^3 for Reciprocating Engines (Subcategory 1.5) according to GN 248 248 (DEA, 2010) and its revisions (DEA, 2013, 2019), compared with emissions for Karpowership.

Substance or mixture of substances		**Subcategory 1.5**	**Karpowership**
		MES under normal conditions of 15% O_2, 273 Kelvin and 101.3 kPa.	
Common name	**Chemical symbol**		
Particulate matter	N/A	50	≤10
Oxides of nitrogen (expressed as NO_2	NO_X	400	≤ 50
Sulphur dioxide	SO_2	N/A	max 2

With low predicted ambient concentrations for SO2 and PM10 the consequence of impacts is very low. The predicted ambient NO2 are somewhat higher, but the consequence of the impact is low. The likelihood of occurrence of impacts associated with SO2, NO2 and PM10 is very low. Therefore, the significance of impacts resulting from the Karpowership Project is predicted to be very low. The consequence and likelihood scores listed in Table 8-5 for the air quality impact scores for the Karpowership Project with the Project adding to existing ambient concentrations, showing the impact significance.

Table 8-6: Air Quality Impact Scores.

Description	**Pollutants**	**Consequence**	**Likelihood**	**Significance**	
				Score	**Rating**
Karpowership Project	SO_2	2	1	**2**	**Very low**
	NO_2	2.7	1	**2.7**	**Very low**

	PM_{10}	2	1	**2**	**Very low**
Cumulative assessment	SO_2	2	1	**2**	**Very low**
	NO_2	2.7	1	**2.7**	**Very low**
	PM_{10}	2	1	**2**	**Very low**

A quantitative assessment for HFO has not been conducted. In a case where HFO is used rather than LNG, the resultant ambient SO_2, NO_2 and PM_{10} concentrations are likely to be low and well below the NAAQS, although they may be somewhat higher than for LNG. The spatial extent on any air quality impact is likely to be somewhat bigger than for LNG. The significance of any impacts associated with HFO is likely to be low to very low.

Recommendations

No mitigation measures were recommended.

From an air quality perspective, it is the reasoned opinion of the specialist-based on the findings of the Atmospheric Impact Report, that the Karpowership Project should be authorised.

8.3.12 Heritage, Archaeology and Palaeontology

Key Findings

The proposed 6.8km long overhead transmission line crosses Zones 7, 6 and 11 in the Coega IDZ. Zone 6 and Zone 11 are the \`least archaeologically sensitive', where dispersed scatters of MSA tools of low archaeological significance are likely to be encountered, while Zone 7 is regarded \`as the most sensitive'. Although recording archaeological resources in Zone 7 was difficult due to the dense grass, bush and alien vegetation occurring across this zone, bush clearing for a road exposed a thin layer of dune sand and dispersed scatters of marine shellfish, bone fragments, stone tools and pottery.

Construction activities in Zone 6 and Zone 11 will likely impact on MSA resources, but indications are that the significance of the remains are likely to be low. MSA tools (of low archaeological significance), and traces of potentially important Later Stone Age remains such as shell middens may be impacted by vegetation clearing, road construction activities, and excavations for powerline footings, in the backdune area in Zone 7 closer to the coast. The baseline study has identified no significant impacts to pre-colonial archaeological remains that will need to be mitigated prior to construction activities commencing.

The overall impact significance of the proposed Karpowership at the Port of Ngqura on important archaeological heritage is assessed as Low, and therefore there are no objections to the development proceeding.

Construction Phase Impacts

Buried archaeological remains such as stone tools, and shell midden deposits may be uncovered or exposed during vegetation clearing operations, road construction activities, and excavations for powerline footings, but overall, the archaeological risk sources are rated as being Low. Unmarked Khoisan human remains may be exposed or intercepted during construction operations, but the probability of this occurring is rated as being low to moderate.

Operational Phase Impacts

The operational phase impacts will be the same as the construction phase and will be applicable during maintenance and/or if work is required to be undertaken on the foundations.

Recommendations

Mitigations- Pre-Construction Phase

- No archaeological mitigation is required prior to construction operations commencing.

Mitigations- Construction Phase

- Vegetation clearing operations in Zone 7 must be monitored by a professional archaeologist.
- Excavations for new roads, services, and powerline footings must be inspected/monitored by a professional archaeologist.
- If any unmarked human remains are exposed or intercepted during construction operations, these must be immediately reported to the contracted archaeologist.

The above must be implemented in the EMPr.

8.3.13 Major Hazards Assessment

Key Findings

The risks associated with this MHI were found to be acceptable.

The main risk attributed to the operation of the powerships is the possible rupture of one of the transfer hoses. This may result in a discharge of LNG into the marine environment due to pipeline bursting, leading to a flash and pool fire, considered as a High impact. The risks were found to be acceptable for the Gas to Power Operations.

No one within the port area is exposed to a risk greater than 1.0e-06 (one in a million) and ship staff is exposed to a risk of no more than 1.0e-05 (one in a hundred thousand). These risks are acceptable for persons operating in a national port.

Recommendations

The following measures are recommended to reduce the risks associated with the Powership installation on the site:

- Good housekeeping must always be observed on site;
- Inspection on the quality and integrity of the pipeline;
- Only suitably qualified people must be used for all installation work;
- An accredited installer must conduct a pressure test and provide the relevant compliance certificates.
- There must be an operational manual for each operation;
- An Emergency Plan must be developed and sent to the City of uMhlathuze Disaster Management department for comment and the formulation of action plans;
- Risk reduction programmes should continually be investigated to reduce the impact from accidental fires and explosions on surrounding communities.

- The development of land surrounding the site should be done with caution as not to pose unnecessary risks onto the surrounding communities. This caution is aimed at ensuring the adjacent developments are suitable for the risk imposed

8.3.14 Socio-Economic

Key Findings

The proposed Powerships and their associated infrastructure will generate both positive and negative impacts starting from the construction period and ending with the decommissioning phase. The following paragraphs and tables summarise the key socio-economic impacts that were identified to have the potential to occur during the different phases.

Based on the information, it is evident that the net positive impacts associated with the development and operation of the proposed Powerships and their associated infrastructure are expected to outweigh the net negative effects. The project is envisaged to have a positive stimulus on the local economy and employment creation, leading to the economy's diversification and a small reduction in the unemployment rate. The project should therefore be considered for development.

No fatal flaws were identified as part of the socio-economic assessment.

It should, however, be acknowledged some negative impacts may arise and that these will largely be borne by households in proximity to the development. The limited number of such households within close proximity to the development will help to notable reduce this impact.

Equally it needs to be noted that many of the positive impacts will be concentrated in the local and national economies, creating a potential imbalance with the potential negative impacts that would exclusively be concentrated at a local level.

Construction Phase Impacts

During the construction phase, the proposed Powerships and their associated infrastructure will have both positive and negative effects on the socio-economic environment. The project is anticipated to make a notable contribution towards the national and local economy. It is estimated that a total of R653.5 million of new business sales, R186.8 million of GDP and 776 FTE employment positions will be generated by the project in the national economy through multiplier effects. Aside from the above positive effects, the project will contribute to skills development in the country, increase government revenue, as well as raising household earnings. The increase in household earnings is also likely to improve the standards of living of the affected households albeit temporarily.

Aside from the positive impacts though, the project will be creating negative direct, secondary and cumulative impacts on the local communities, specifically areas surrounding the site where the proposed facility is to be built. The main factors that will cause this negative impact are: (1) the influx of workers and job seekers from outside of the local community, (2) the impact on the surrounding economic and social infrastructure and (3) the limited visual and noise disturbances that could be created by the construction activities as the footprint of the facility grows. Potential negative impacts can largely be mitigated, and their significance reduced. The minimal visual impacts anticipated, however, cannot be fully eliminated although it is also possible to reduce their significance.

Operational Phase Impacts

During the operation of the proposed Powerships and their associated infrastructure the socio-economic impacts are likely to last longer when compared to those observed during the construction phase. This is the case for both positive and negative effects. The operation of the proposed Powerships and their associated infrastructure will generate R528.6 million of new business sales, contribute R321.0 million to GDP and create 288 sustainable FTE employment positions. In addition, government revenue will rise, electricity supply will be increased, and various socio-economic and enterprise development initiatives will be undertaken from the revenue generated by the development. These funds will be allocated towards socio-economic development in the area and are expected to bring a significant benefit to local communities.

Negative impacts include the potential changes in the sense of place. These potential losses, if they do occur, are likely to be small, given the industrial nature of the proposed development area. As in the case with the impacts observed during construction, negative effects can be mitigated, and positive impacts enhanced. Mitigation of the negative impacts though will not result in their complete elimination as visual disturbance of the nature inherent to the project are difficult to eradicate entirely. Nevertheless, the significance ratings of the negative impacts are expected to be reduced.

Recommendations

Mitigations- Construction Phase

- The developer should encourage the EPC contractor to increase the local procurement practices and promote the employment of people from local communities, as far as feasible, to maximise the benefits to the local economies.
- The developer should engage with local authorities and business organisations to investigate the possibility of procuring construction materials, goods and products from local suppliers were feasible.
- Organise local community meetings to advise the local labour force about the project that is planned to be established and the jobs that can potentially be applied for.
- Establish a local skills desk (in NMBM) to determine the potential skills that could be sourced in the area.
- Recruit local labour as far as feasible.
- Employment of labour-intensive methods in construction where feasible.
- Sub-contract to local construction companies particularly SMME’s and BBBEE compliant and women-owned enterprises where possible.
- Use local suppliers where feasible and arrange with the local SMME’s to provide transport, catering and other services to the construction crews.
- Facilitate knowledge and skills transfer between foreign technical experts and South African professionals during the pre-establishment and construction phases.
- Set up apprenticeship programmes to build onto existing skill levels or develop new skills amongst construction workers especially those from local communities.
- Set up a recruitment office in the nearby towns (i.e. Port Elizabeth, Uitenhage, and Despatch) and adhere to strict labour recruitment practices that would reduce the desire of potential job seekers to loiter around the properties in the hope of finding temporary employment.

- Control the movement of workers between the site and areas of residence to minimise loitering around the site. This should be achieved through the provision of scheduled transportation services between the construction site and area of residence.
- Establish a management forum comprising key stakeholders to monitor and identify potential problems that may arise due to the influx of job seekers to the area.
- Ensure that any damages or losses to nearby buildings that can be linked to the conduct of construction workers are adequately reimbursed.
- Assign a dedicated person to deal with complaints and concerns of affected parties.
- Provide adequate signage along relevant road networks to warn the motorists of the construction activities taking place on the site.
- Engage with local authorities and inform them of the development as well as discuss with them their ability to meet the additional demands on social and basic services created by the in migration of workers.
- Where feasible, assist the municipality in ensuring that the quality of the local social and economic infrastructure does not deteriorate through the use of social responsibility allocations.
- The mitigation measures proposed by the visual and noise specialists should be adhered to.
- Efforts should also be made to avoid disturbing such people's sense of place during construction.

Mitigations- Operational Phase

- The operator of the Powerships and related infrastructure should be encouraged to, as far as possible, procure materials, goods and products required for the operation of the facility from local suppliers to increase the positive impact in the local economy.
- Where possible, local labour should be considered for employment to increase the positive impact on the local economy.
- As far as possible, local small and medium enterprises should be approached to investigate the opportunities for supply inputs required for the maintenance and operation of the Powerships and related infrastructure.
- The developer should consider establishing vocational training programmes for the local labour force to promote the development of skills required by the Powerships and their related infrastructure and thus provide for the opportunities for these people to be employed in other similar facilities elsewhere.
- A three-year social development and economic development programmes should be devised by the developer throughout the project's lifespan.
- The plan should be developed in consultation with local authorities and local communities to identify community projects that would result in the greatest social benefits.
- These plans should be reviewed on an annual basis and, where necessary, updated.
- When identifying enterprise development initiatives, the focus should be on creating sustainable and self-sufficient enterprises.
- In devising the programmes to be implemented, the developer should take into account the priorities set out in the local IDP.
- The mitigation measures proposed by the visual and noise specialists should be adhered to.
- Efforts should also be made to avoid disturbing such people's sense of place during construction.

8.3.15 Visual

The assessment indicated that the two elements that potentially could have visual implications include the introduction of the proposed Powership and the FSRU into the port, as well as the development of grid connection infrastructure that extends through the Coega SEZ.

Construction Phase Impacts

No visual impacts were identified for the construction phase.

Operational Phase Impacts

Urban areas and particularly the coastal settlements of St George's Strand and Bluewater Bay.

The proposed ships are unlikely to be visible from lower floors of buildings and roads running through these settlements. They may however be visible from upper floors of houses. If the ships are visible, the FSRU is likely to be the most obvious as it will be seen closer to the harbour entrance and away from port cranes and buildings. The Powership will be seen closer to the coastal dune and will be partially screened by port buildings and cranes. It is therefore likely to be less obvious than the FSRU. None of the overhead 132kV powerline alternatives will be visually obvious. The proposed ships will be seen as part of normal port operations. The likely visual impact experienced from coastal settlements is therefore expected to be negligible.

Conservation areas including the Addo Elephant Park and the Swartkops Valley Local Nature Reserve.

The analysis indicates that neither the proposed ships nor the proposed 132kV overhead power line will be visible from these protected areas. There will therefore be no visual impact.

Routes through the area particularly the N2

The analysis indicates that the proposed ships and overhead 132kV power line will be visible from a short section of the N2. In the case of the overhead 132kV powerline, which ever alternative is selected, this element will be seen in the future in the context of industrial development associated with the Coega SEZ. Should Preferred Alternative or Alternative 2 be selected, the crossing of the N2 will be seen in the context of two similar powerline crossings. Should alternative powerline alignment Alternative 1 be selected this will impact a new section of the road. For this reason power line Alternative 1 is not favoured. Both proposed ships will be seen at a distance of approximately 3.3km and in the context of port operations and infrastructure. The FSRU is likely to be visible to a greater extent than the Powership will be located closer to and will be partially screened by the coastal dune. The proposed project is likely to have a negligible visual impact on views from the N2.

Beaches particularly to the south east on the seaward side of the coastal dune close to of St George's Strand and Bluewater Bay

Views of the proposed project from beaches are likely to be similar in character as those from coastal residential areas. The closest section of public beach is approximately 1.9km from the proposed FSRU. The closer the viewer is to this point, the greater screening effect that the southern breakwater is likely to have. From beaches close to the port, powerline Alternative 2 could be highly obvious on the dune slope adjacent to the port. For this reason this alternative is not favoured. Powerline alternative could also be visible on the dune slope, however, it will cross the dune slope in close proximity to the port and will be viewed in the context of port operations and infrastructure. Powerline Alternative 1 is unlikely to be visible from beaches. The proposed Powership will be partially screened by port buildings and tall cranes. The proposed FSRU will be located closer to the port entrance and away from buildings and cranes. It is therefore likely to be more obvious than the Powership. There will however be a degree of screening provided by the southern breakwater particularly for closer viewpoints. Both ships will be seen in the context of port operations and are unlikely to be seen as unusual industrial operations in their own right. Visual impact that may be experienced by beach goers is therefore anticipated as being insignificant.

The analysis did not identify and significant visual impacts and there was no reason for the project not to proceed.

No mitigations measures were implemented.

8.3.16 Noise

The impact of the noise pollution that can be expected from the site during the construction and operational phase will largely depend on the climatic conditions at the site. The prevailing wind is from the South West and South East. The noise impact however will be the most severe during calm meteorological conditions when little wind noise masking will occur, therefore the wind speed and direction was not considered. This is due to the natural environment in the Addo MPA being the most likely to be impacted.

The field study results showed that the ambient noise levels in the area of the proposed development was 61.5 dB(A). NSA 2 is approximately 620m away from the nearest major noise source (The Powership). Taking this distance and Table 8 into consideration, it can be inferred that NSA 2 will experience noise levels of 55.0 dB(A), which is lower than the ambient noise levels. The receptor at NSA 2 will therefore experience no noise impact as the noise from construction will be masked by the ambient noise from the wind, sea, and other port operations.

In summary, for the construction phase it is unlikely that the construction noise will impact on the noise sensitive areas. With the effective implementation of the above recommended mitigation measures, the residual noise impact associated with construction activities are predicted to be of very low significance. It is recommended that the ambient noise around the project and at the closest receptors be monitored during the construction phase.

Construction Impacts

The impact of the noise pollution that can be expected from the site during the construction and operational phase will largely depend on the climatic conditions at the site. The prevailing wind is from the South West and South East. The noise impact will be the most significant during calm meteorological conditions when little wind noise masking will occur, therefore the wind speed and direction was not considered in the modelling.

The field study results showed that the ambient noise levels in the area of the proposed development was 61.5 dB(A). Noise sensitive area (NSA) 2 is approximately 620m away from the nearest major noise source (The Powership). Taking this distance into consideration, it can be inferred that NSA 2 will experience noise levels of 55.0 dB(A), which is lower than the SANS 10103 rating limits. Given that this is an industrial zone, there are several facilities that will also contribute to the ambient noise levels in the area. The receptor at NSA 2 will therefore experience no noise impact as the noise from construction will be masked by the ambient noise from the other port operations.

In summary, for the construction phase it is unlikely that the construction noise will impact on the noise sensitive areas. With the effective implementation of the recommended mitigation measures, the residual noise impact associated with construction activities are predicted to be of very low significance.

Operational Impacts

The operational noise levels of the proposed project are below the SANS 10103:2008 recommended levels for a majority of the human receptors within the Coega SEZ and at the SEZ boundary. The exception to this being the noise levels predicted at the NPA offices (NSA 2), where the levels are expected to be 71.4 dB(A). This value exceeds the limit; however, the receptors are indoors and hence will not experience these noise levels fully as the building structure will act as a barrier between the source and receptors.

The noise impact associated with the operational activities of the proposed project is predicted to be of Medium-Low significance after mitigation on the Port of Ngqura and CDC tenants.

Recommendations

Mitigations- Construction Phase

- As a precautionary measure piling should not occur at night. Piling should only occur during the day to take advantage of unstable atmospheric conditions.
- All construction operations should only occur during daylight hours if possible.
- Construction staff should receive “noise sensitivity” training such as switching off vehicles when not in use,
- location of NSA’s etc.
- An ambient noise survey should be conducted at the noise sensitive receptors during the construction phase.

Mitigations- Operational Phase

- The noise impact from the proposed project should be measured during the operational phase, to ensure that the impact is within the required legal limit.
- An avifauna specialist should be consulted to determine the effects that an increase in noise levels will have on the Damara Tern Colony.
- Install acoustic enclosures around all major noise emitting components to supress the noise emissions from equipment such as engines.
- Install Silencers on equipment such as exhaust stacks and turbo chargers.

Impacts relating to the Critical Biodiversity Areas CBA and Addo Elephant Marine Protected Area

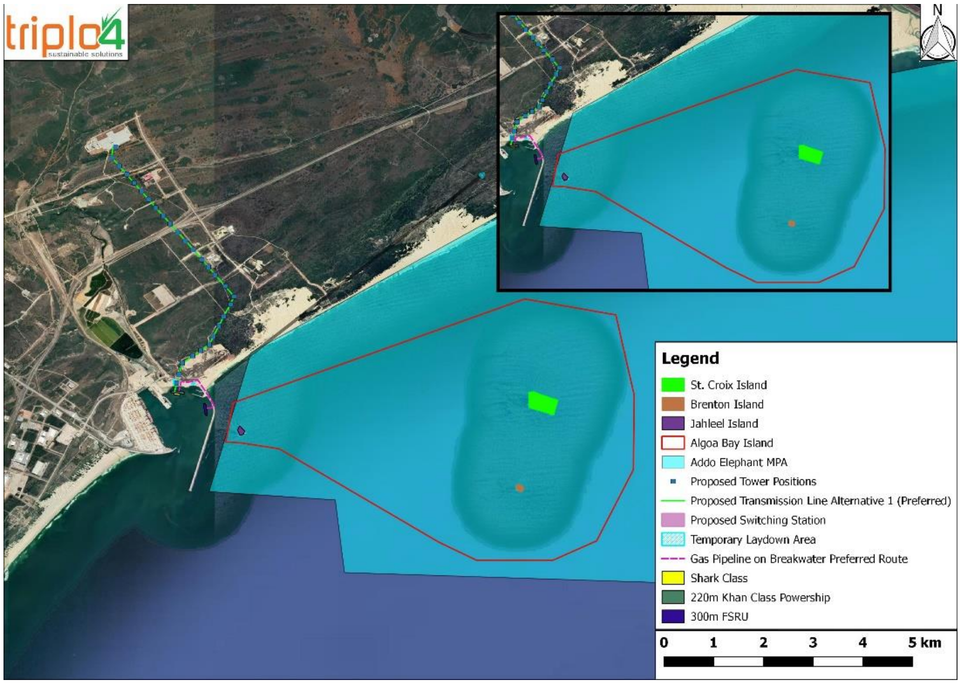


Figure 8-2: CBAs and Addo Elephant Marine Protected Area.

The Algoa Bay area provides a large number of ecosystem services to society. Most of these fall under socio-economic topics and are only briefly mentioned here, but some are directly dependent on ecosystem health and functionality. Provisioning services provided include:

- fisheries (commercial/recreational/subsistence), and
- aquaculture/mariculture (bivalves and finfish). In 2020, authorisation was granted to establish a sea-based Aquaculture Development Zone (ADZ) in Algoa Bay. The ADZ comprises three precincts, one of which, Algoa 7, is located approximately 3 km offshore, 2.5 km from the entrance to the Port of Ngqura. Algoa 7 is approved for the farming of indigenous finfish only (Anchor 2019; TNPA 2020).

According to the Eastern Cape Biodiversity Conservations Plan (ECBCP), the study site is located primarily within CBA1 or CBA2. This, according to guidelines, falls within BLMC 2: Near Natural Landscapes and should be managed to maintain biodiversity in near natural state with minimal loss of ecosystem integrity with no transformation of natural habitat permitted. STEP Conservation status shows that most project area and both preferred and alternative routes are situated in a currently Not Vulnerable area, and this area can withstand some development. However, a portion of both routes is located in a Vulnerable area and a section of the alternative route is located within a Critically Endangered area. Limited development can occur within Vulnerable areas but absolutely no development should be considered in Critically Endangered areas. From a terrestrial perspective, the preferred transmission line route with existing infrastructure wherever possible reduces impacts on the indigenous vegetation and habitats as far as possible. Impacts are High to Moderate negative and can be reduced to low with the recommended mitigation measures. This will have no impact to the Marine protected areas such as the Addo Elephant Park.

The study area is located outside of any Threatened Ecosystems but Albany Alluvial Vegetation, an Endangered ecosystem is located within 5km of the site. The closest protected area is the Addo Elephant National Park Marine Protected Area which includes islands off the coast less than 5km away from the study site. The Algoa Bay Islands: Addo Elephant National Park IBA is located within 5km of the site, just offshore. Included within the Addo Elephant

Park is the St Croix Island, Bretton Island and Jahleel Island. As per the Avifaunal Assessment, Jahleel Island (530m from the Eastern Breakwater) is the most sensitive avifauna receptor with respect to potential impacts from the powerships project and has 232 breeding pairs of African Penguin. Furthermore, as per the findings of the Estuarine Specialist, species from these areas have the potential to utilise the Coega Estuary periodically whilst moving between these areas or during their migrations. Notwithstanding the above, the overall state of the Coega bird community is regarded as poor in comparison to its natural reference state, due to the same disturbances mentioned above for the fish and invertebrate communities (CSIR, 2015a). Subsequently the Noise Specialist indicates that the Addo National Park Marine Protected Area should ideally be free of any anthropogenic noise sources. Furthermore, the ambient noise monitoring results as per the Noise Assessment do not exceed the recommended day/night levels of industrial districts.

Disruption to the seabed will occur on the port's western side, extending from the powerships shoreward (in the second proposed layout only). None of the specialist assessments indicated a fatal flaw or significant impact on the MPA. Impacts are localised within the port boundaries on the Eastern side of the breakwater. The MPA occurs on opposite side of the breakwater to the west.

8.4 IMPACT ASSESSMENT FINDINGS

Assessment of the significance of each impact, risk and an indication of the extent to which the issue and risk can be avoided or addressed by the management actions.

The assessment of the significance of potential impacts, including the extent to which impacts can be avoided or mitigated, is included in this section and Appendix C, the latter containing the detailed workings (severity, duration, extent, frequency, probability and significance ratings) used to determine the overall significance presented in the tables below.

The following potential impacts were considered in the EIA Phase for the proposed project:

8.4.1 Terrestrial Ecological Impacts

According to the Eastern Cape Biodiversity Conservations Plan (ECBCP), the study site is located primarily within CBA1 or CBA2. This, according to guidelines, falls within BLMC 2: Near Natural Landscapes. The site is mostly of high sensitivity due to the presence of intact indigenous vegetation housing several SCC, however, some areas, primarily in existing servitudes or adjacent to existing infrastructure, are of low sensitivity. The alignment of the preferred transmission line route with existing infrastructure wherever possible reduces impacts on the indigenous vegetation and habitats as far as possible. Impacts are Medium negative to High negative and can all be reduced to Low to Very Low negative significance with the recommended mitigation measures.

8.4.1.1 Impact assessment findings (with and without mitigation): Transmission Line Alternative 1: Construction Phase

The impact of the loss of Cape Seashore Vegetation in the construction phase will be short-term within the site extent, with a slightly harmful severity resulting in a Medium-High negative overall significance. With mitigation measures, this impact can be reduced to a significance of Low negative. The loss of Intact Bontveld will be short-term, resulting in a High negative overall significance. With mitigation measures, this impact can be reduced to a significance of Low negative. The loss of Degraded Bontveld will result in a Medium-Low negative overall significance. With mitigation measures, this impact can be reduced to Very Low negative significance. The loss of plant Species of Conservation Concern will result in a High negative overall significance. With mitigation measures, this impact can be reduced to a Low negative significance. The loss of biodiversity in general (Medium negative), fragmentation (Medium-High negative) and invasion of alien species (High negative) can all be mitigated to Very Low negative significance.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Construction of transmission line and laydown areas	Loss of Cape Seashore Vegetation	Medium-High	In areas of modified habitat, construction using excavation and backfilling is acceptable however, this method of construction cannot be used in any other areas. Construction of the three monopole structures within intact indigenous vegetation (21, 22 and 23) should utilise the method with the least impact. Each pole should be placed individually, with no servitude construction. No construction or storing of materials should be located outside of the defined layout area. These areas should be demarcated prior to any activities commencing and personnel instructed of the rules to stay out of these areas (unless clearing alien invasive plants). Development and implementation of an alien invasive plant species management plan, which would remove and control the alien vegetation within and bordering the site. Keep the construction footprint as small as possible. No use of the surrounding vegetation should be allowed. This includes use as a toilet facility, for hunting, harvesting of indigenous plants, making fires etc. A rehabilitation plan must be developed and implemented for areas that will be used during construction but not operation, especially within servitudes to reduce the numbers of alien invasive plants and allow recovery of some indigenous vegetation within these areas.	Low
Construction of transmission line where it crosses natural habitat between the harbour arterial road and the railway line	Loss of Intact Bontveld	High	In areas of intact Bontveld (where the transmission line is located outside of existing servitude areas), construction methods for the monopoles should be reduced to the least disturbing method. Where possible, each monopole structure should be erected singly with no servitude clearance. No construction or storing of materials should be located outside of the defined construction area. These areas should be demarcated prior to any activities commencing and personnel instructed of the rules to stay out of these areas (unless clearing alien invasive plants). Development and implementation of an alien invasive plant species management plan, which would remove and control the alien vegetation within and bordering the site. Keep the construction footprint as small as possible. No use of the surrounding vegetation should be allowed. This includes use as a toilet facility, for hunting, harvesting of indigenous plants, making fires etc. Wherever possible, and in conjunction with the Coega CDC, area that will be used for construction but not for operation should be rehabilitated as soon as possible. Post-construction clearing of vegetation beneath the transmission line should be restricted to the minimum possible.	Low
Construction of transmission line where it crosses natural habitat between the harbour arterial road and the railway line	Loss of Degraded Bontveld	Medium-Low	No construction or storing of materials should be located outside of the defined construction area. These areas should be demarcated prior to any activities commencing and personnel instructed of the rules to stay out of these areas (unless clearing alien invasive plants). Development and implementation of an alien invasive plant species management plan, which would remove and control the alien vegetation within and bordering the site. Keep the construction footprint as small as possible. No use of the surrounding vegetation should be allowed. This includes use as a toilet facility, for hunting, harvesting of indigenous plants, making fires etc.	Very Low

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
Construction of the transmission line, laydown area and switching station	Loss of Species of Conservation Concern	High	Construction measures must consist of the least impactful individual erection of monopole structures in areas of intact indigenous vegetation and all protected species avoided where possible. No use of the surrounding vegetation should be allowed. This includes use as a toilet facility, for hunting, harvesting of indigenous plants, making fires etc. A full site walk-through should be conducted in the summer prior to any construction activities to list all SSC and associated permits should be obtained for their removal or transplantation. A search and rescue of protected plants must be done prior to construction taking place.	Low
INDIRECT IMPACTS				
Construction of the transmission line, laydown area and switching station	Loss of biodiversity in general	Medium	Boundaries should be strictly maintained, and impacts retained within the boundary of the site. Alien species should be controlled. Areas of indigenous vegetation should be incorporated into the open space management plan of the IDZ in conjunction with the CDC where practicable. Construction measures must consist of the least impactful individual erection of monopole structures in areas of intact indigenous vegetation and all protected species avoided where possible.	Very Low
Loss of vegetation during construction	Fragmentation	Medium-High	Boundaries of the site should be adhered to, and no additional loss of vegetation should occur. Alien species within the site should be controlled. The land beneath the transmission line, and any other areas required for construction, but not for the operational phase, should be rehabilitated with indigenous species to retain connectivity within the system.	Very Low
Construction of transmission line, laydown area and switching station	Invasion of alien species	High	The area of construction should be demarcated, and personnel not allowed to use the surrounding natural vegetation. Any existing and new alien species must be removed as soon as possible after emergence. An alien vegetation management plan must be applied to the site to maintain the site free of alien invasions throughout the construction phase of the development.	Very Low

8.4.1.2 Impact assessment findings (with and without mitigation): Transmission Line Alternative 1: Operational Phase

The impact of the loss of Cape Seashore Vegetation will be long-term resulting in a High negative overall significance. With mitigation measures, this impact can be reduced to a probable moderate impact over the short term, with a significance of Low negative. The loss of Intact Bontveld will result in a Medium-High negative overall significance which can be reduced to a significance of low negative. The loss of Degraded Bontveld will result in a Medium-Low negative overall significance. With mitigation measures, this impact can be reduced to Low negative significance. The loss of plant Species of Conservation Concern will result in a Medium negative overall significance, but can be mitigated to a Low negative significance. The loss of biodiversity in general (Medium-Low negative), fragmentation (Medium negative) and invasion of alien species (Medium-Low negative) can all be mitigated to Very Low negative significance.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Construction of transmission line and laydown areas	Loss of Cape Seashore Vegetation	High	In areas of modified habitat, construction using excavation and backfilling is acceptable however, this method of construction cannot be used in any other areas. Construction of the three monopole structures within intact indigenous vegetation (21, 22 and 23) should utilise the method with the least impact. Each pole should be placed individually, with no servitude construction. No construction or storing of materials should be located outside of the defined layout area. These areas should be demarcated prior to any activities commencing and personnel instructed of the rules to stay out of these areas (unless clearing alien invasive plants). Development and implementation of an alien invasive plant species management plan, which would remove and control the alien vegetation within and bordering the site. Keep the construction footprint as small as possible. No use of the surrounding vegetation should be allowed. This includes use as a toilet facility, for hunting, harvesting of indigenous plants, making fires etc. A rehabilitation plan must be developed and implemented for areas that will be used during construction but not operation, especially within servitudes to reduce the numbers of alien invasive plants and allow recovery of some indigenous vegetation within these areas.	Low
Construction of transmission line where it crosses natural habitat between the harbour arterial road and the railway line	Loss of Intact Bontveld	Medium-High	In areas of intact Bontveld (where the transmission line is located outside of existing servitude areas), maintenance methods for the monopoles should be reduced to the least disturbing method. Where possible, each monopole structure should be erected singly with no servitude clearance. No construction or storing of materials should be located outside of the defined maintenance area. These areas should be demarcated prior to any activities commencing and personnel instructed of the rules to stay out of these areas (unless clearing alien invasive plants). Development and implementation of an alien invasive plant species management plan, which would remove and control the alien vegetation within and bordering the site. Keep the maintenance footprint as small as possible. No use of the surrounding vegetation should be allowed. This includes use as a toilet facility, for hunting, harvesting of indigenous plants, making fires etc. Wherever possible, and in conjunction with the Coega CDC, area that will be used for maintenance but not for operation should be rehabilitated as soon as possible. Post-construction clearing of vegetation beneath the transmission line should be restricted to the minimum possible.	Low
Construction of transmission line where it crosses natural habitat between the harbour arterial road and the railway line	Loss of Degraded Bontveld	Medium-Low	No construction or storing of materials should be located outside of the defined maintenance area. These areas should be demarcated prior to any activities commencing and personnel instructed of the rules to stay out of these areas (unless clearing alien invasive plants). Development and implementation of an alien invasive plant species management plan, which would remove and control the alien vegetation within and bordering the site. Keep the maintenance footprint as small as possible. No use of the surrounding vegetation should be allowed. This includes use as a toilet facility, for hunting, harvesting of indigenous plants, making fires etc.	Low
Construction of the transmission	Loss of Species of Conservation Concern	Medium	A full site walk-through should be conducted in the summer prior to any maintenance activities to list all SSC and associated permits should be obtained for their removal or transplantation. A search and rescue of protected plants must be done prior to maintenance taking place.	Low

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
line, laydown area and switching station				
INDIRECT IMPACTS				
Construction of the transmission line, laydown area and switching station	Loss of biodiversity in general	Medium-Low	Boundaries should be strictly maintained, and impacts retained within the boundary of the site. Alien species should be controlled. Areas of indigenous vegetation should be incorporated into the open space management plan of the IDZ in conjunction with the CDC where practicable.	Very Low
Loss of vegetation during construction	Fragmentation	Medium	Boundaries of the site should be adhered to, and no additional loss of vegetation should occur. Alien species within the site should be controlled.	Very Low
Construction of transmission line, laydown area and switching station	Invasion of alien species	Medium-Low	The area of operation should be demarcated, and personnel not allowed to use the surrounding natural vegetation. Any existing and new alien species must be removed as soon as possible after emergence. An alien vegetation management plan must be applied to the site to maintain the site free of alien invasions throughout the operational phase of the development.	Very Low

8.4.1.3 Transmission Line Alternative 2

Although the alternative route does traverse some areas of low sensitivity where it is located adjacent to existing infrastructure, this proposed transmission line traverses some undisturbed thicket areas that form important habitats for fauna, many of which are themselves protected species. The thicket also houses numerous conservation important plant species. This route is also located adjacent to the estuary and river with implications for fragmentation of this important transition zone. The area in general is considered to be of high sensitivity and should be avoided where possible. This route is not recommended.

8.4.2 Avifaunal Impacts

Impacts on Avifauna due to the Powership Project Infrastructure

Alternative 1 (powerships moored near the Coega Estuary) has an advantage over Alternative 2 (powerships moored next to the Admin Craft Basin) as the vessels will be slightly further from the sensitive Jahleel Island breeding colonies of African Penguin and other seabirds. After mitigation, the greatest impacts on avifauna due to the Powerships project are disturbance by noise and light and disturbance due to underwater noise (Medium-Low Impacts).

Lighting on the vessels will add to the ambient light associated with the Port and no artificial light should be allowed to illuminate Jahleel Island. The powerships will have 27 reciprocating engines and 3 steam turbines. The worst case scenario, under calm meteorological conditions, is for atmospheric noise levels due to the powerships of approximately 54dB and 60dB at Jahleel Island for Alternatives 1 and 2 respectively. Ambient noise levels due to strong winds and breaking waves often exceed 60dB so while noise and light due to the powerships may not disturb the penguin colony on Jahleel Island, a precautionary approach has been taken in the assessment.

African Penguins are the most sensitive receptor for underwater noise and avoid areas of very high noise (Pichegru *et al*. 2017). Studies with another penguin species showed strong avoidance responses above 115dB. Large container vessels produce upto 190dB, attenuating to a maximum of 127dB at 3km. It is unlikely that the noise from the powerships will exceed 110dB at the Port entrance, however, any impact that increases penguin foraging effort is likely to negatively impact the breeding population (Pichegru *et al* 2012). Due to the uncertainties with respect to the intensity and impact of underwater noise due to the powerships a precautionary approach has been taken in the assessment. Cumulative underwater noise impacts have been assessed as Medium-High due to the high volume of marine traffic in Algoa Bay.

Impacts due to physical disturbance of habitat due to the infrastructure, change in water temperature and atmospheric emissions (that modelling showed was low and spatially limited for both impacts) was assessed to be Low after mitigation. Impacts due to emergency situations (gas explosions, extreme weather events, marine traffic accidents) were assessed to be Very Low after mitigation due to the improbability that they will occur and the efficacy of mitigation measures.

Impacts on Avifauna and avifauna habitats due to the Overhead Transmission Lines between the Port of Ngqura and Dedisa Sub-station

Potentially the greatest threat to avifauna due to the 132kV overhead transmission lines is the risk of collisions with the cables. This is especially so for the spans between the powership and the Eastern Reclamation as there is a small colony of Kelp Gulls breeding in the hummock dunes under the proposed line and a busy bird flyway along the coast and up the Coega Valley. With mitigation, impacts due to collisions and habitat disturbance are assessed to be Low or Very Low for Alternatives 1 and 3 and Medium-Low for Alternative 2.

8.4.2.1 Transmission Line Alternative 1: Construction Phase

Along Alternative 1, the area behind the Eastern Reclamation is already extensively impacted, with a fence and road under construction and a high density of alien Rooikrans bushes. Construction of the overhead transmission lines include developing access tracks, clearing vegetation to erect the towers and string the cables and will have direct Medium-Low negative impact on habitat and breeding sites. These can be mitigated to Very Low negative impact significance.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Construction of transmission lines	Impact on avifauna due to habitat disturbance and fragmentation	Medium-Low	1. Comply with the RoD dated 7 Nov 2006 for the transmission line corridor between the coastal area and Dedisa Sub-Station. 2. Comply with the Generic EMPr for Substation and Overhead Electricity Transmission and Distribution Infrastructure (GN 435 dated 22 March 2019) 3. Comply with Coega OSMP Management Guidelines for Service Corridors 4. Use monopoles in preference to lattice towers to minimize tower footprints and to match the monopoles along the existing transmission lines in the services corridor. 5. Use existing access tracks and access tower positions from existing tracks by the shortest / least impact route. 6. As per RoD / Generic EMPr / Coega OSMP requirements: No clear-felling of indigenous vegetation. Only clear the minimum vegetation required for access for construction of towers and stringing of cables (1m wide path). Trim high bushes under the transmission lines to the Minimum Vegetation Clearing Distance. 7. Clear all alien vegetation, especially Rooikrans bushes within at least a 30m wide servitude under the transmission lines. This will reduce fire risk. 8. Annually inspect and maintain the transmission line servitude free of alien vegetation and maintain the Minimum Vegetation Clearing Distance for indigenous bushes under the transmission lines. 9. Within TNPA areas: Comply with TNPA's Construction Environmental Management Programme for the Port of Ngqura and relevant sections of the Environmental Management Programme for the Operation of the Port of Ngqura. 10. Within CDC areas: Comply with CDC's Standard Environmental Specification for Construction and Standard Vegetation Specification for Construction.	Very Low

8.4.2.2 Transmission Line Alternative 3: Construction Phase

The 1.3km of Bontveld CBA crossed by Alternative 3 is sometimes used by Species of Conservation Concern such as Blue Cranes, Secretarybirds and Denham's Bustards. Construction of the overhead transmission lines include developing access tracks, clearing vegetation to erect the towers and string the cables and will have direct Medium-Low negative impact on habitat and breeding sites. These can be mitigated to Very Low negative impact significance.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Construction of transmission lines	Impact on avifauna due to habitat disturbance and fragmentation	Medium-Low	1. Comply with the RoD dated 7 Nov 2006 for the transmission line corridor between the coastal area and Dedisa Sub-Station. 2. Comply with the Generic EMPr for Substation and Overhead Electricity Transmission and Distribution Infrastructure (GN 435 dated 22 March 2019) 3. Comply with Coega OSMP Management Guidelines for Service Corridors	Low

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
			4. Use monopoles in preference to lattice towers to minimize tower footprints and to match the monopoles along the existing transmission lines in the services corridor. 5. Use existing access tracks and access tower positions from existing tracks by the shortest / least impact route. 6. As per RoD / Generic EMPr / Coega OSMP requirements: No clear-felling of indigenous vegetation. Only clear the minimum vegetation required for access for construction of towers and stringing of cables (1m wide path). Trim high bushes under the transmission lines to the Minimum Vegetation Clearing Distance. 7. Clear all alien vegetation, especially Rooikrans bushes within at least a 30m wide servitude under the transmission lines. This will reduce fire risk. 8. Annually inspect and maintain the transmission line servitude free of alien vegetation and maintain the Minimum Vegetation Clearing Distance for indigenous bushes under the transmission lines. 9. Within TNPA areas: Comply with TNPA's Construction Environmental Management Programme for the Port of Ngqura and relevant sections of the Environmental Management Programme for the Operation of the Port of Ngqura. 10. Within CDC areas: Comply with CDC's Standard Environmental Specification for Construction and Standard Vegetation Specification for Construction.	

8.4.2.3 Transmission Line Alternative 1: Operational Phase

Along Alternative 1, the area behind the Eastern Reclamation is already extensively impacted, with a fence and road under construction and a high density of alien Rooikrans bushes. Construction of the overhead transmission lines include developing access tracks, clearing vegetation to erect the towers and string the cables and will have direct Medium-Low negative impact on habitat and breeding sites. These can be mitigated to Very Low negative impact significance.

The the impact significance of collisions and electrocution is High negative but can be motivated to Low negative.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
Operation of transmission lines	Impact on avifauna due to habitat disturbance and fragmentation	Medium-Low	1. Comply with the RoD dated 7 Nov 2006 for the transmission line corridor between the coastal area and Dedisa Sub-Station. 2. Comply with the Generic EMPr for Substation and Overhead Electricity Transmission and Distribution Infrastructure (GN 435 dated 22 March 2019) 3. Comply with Coega OSMP Management Guidelines for Service Corridors 4. Use monopoles in preference to lattice towers to minimize tower footprints and to match the monopoles along the existing transmission lines in the services corridor. 5. Use existing access tracks and access tower positions from existing tracks by the shortest / least impact route. 6. As per RoD / Generic EMPr / Coega OSMP requirements: No clear-felling of indigenous vegetation. Only clear the minimum vegetation required for access for construction of towers and stringing of cables (1m wide path). Trim high bushes under the transmission lines to the Minimum Vegetation Clearing Distance. 7. Clear all alien vegetation, especially Rooikrans bushes within at least a 30m wide servitude under the transmission lines. This will reduce fire risk. 8. Annually inspect and maintain the transmission line servitude free of alien vegetation and maintain the Minimum Vegetation Clearing Distance for indigenous bushes under the transmission lines. 9. Within TNPA areas: Comply with TNPA's Construction Environmental Management Programme for the Port of Ngqura and relevant sections of the Environmental Management Programme for the Operation of the Port of Ngqura. 10. Within CDC areas: Comply with CDC's Standard Environmental Specification for Construction and Standard Vegetation Specification for Construction.	Very Low
Operation of transmission lines	Impact on avifauna due to collisions and electrocution	Medium-High	1. Comply with the Generic EMPr for Substation and Overhead Electricity Transmission and Distribution Infrastructure (GN 435 dated 22 March 2019). 2. Use monopoles in preference to lattice towers to match the conductor heights of the existing power lines thereby reducing the vertical risk area to flying birds. 3. Provide bird perches on top of the monopoles to encourage them away from perching on the conductors. 4. Ideally use dynamic reflective bird flappers, preferably with lights that flash at night, on the most sensitive spans of the transmission line between the Powerships and the top of the Eastern Reclamation and next to the Coega River (Alternative 2). 5. Use alternating black and white static pigtail flight diverters on the remaining spans of the power line as per Eskom Guidelines 6. Report any bird casualties to the CDC or TNPA Environmental Officer and the Coega / Ngqura Environmental Control Officer	Low

8.4.2.4 Transmission Line Alternative 3: Operational Phase

The 1.3km of Bontveld CBA crossed by Alternative 3 is sometimes used by Species of Conservation Concern such as Blue Cranes, Secretarybirds and Denham's Bustards. Construction of the overhead transmission lines include developing access tracks, clearing vegetation to erect the towers and string the cables and will have direct Medium-Low negative impact on habitat and breeding sites. These can be mitigated to Very Low negative impact significance.

Less sensitive but still vulnerable portions of the transmission line routes include over the Bontveld CBA section and where the power lines cross the N2 and R102. The impact significance of collisions and electrocution is therefore Medium-High negative and can be motivated to Low negative.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Operation of transmission lines	Impact on avifauna due to habitat disturbance and fragmentation	Medium-Low	1. Comply with the RoD dated 7 Nov 2006 for the transmission line corridor between the coastal area and Dedisa Sub-Station. 2. Comply with the Generic EMPr for Substation and Overhead Electricity Transmission and Distribution Infrastructure (GN 435 dated 22 March 2019) 3. Comply with Coega OSMP Management Guidelines for Service Corridors 4. Use monopoles in preference to lattice towers to minimize tower footprints and to match the monopoles along the existing transmission lines in the services corridor. 5. Use existing access tracks and access tower positions from existing tracks by the shortest / least impact route. 6. As per RoD / Generic EMPr / Coega OSMP requirements: No clear-felling of indigenous vegetation. Only clear the minimum vegetation required for access for construction of towers and stringing of cables (1m wide path). Trim high bushes under the transmission lines to the Minimum Vegetation Clearing Distance. 7. Clear all alien vegetation, especially Rooikrans bushes within at least a 30m wide servitude under the transmission lines. This will reduce fire risk. 8. Annually inspect and maintain the transmission line servitude free of alien vegetation and maintain the Minimum Vegetation Clearing Distance for indigenous bushes under the transmission lines. 9. Within TNPA areas: Comply with TNPA's Construction Environmental Management Programme for the Port of Ngqura and relevant sections of the Environmental Management Programme for the Operation of the Port of Ngqura. 10. Within CDC areas: Comply with CDC's Standard Environmental Specification for Construction and Standard Vegetation Specification for Construction.	Low
Operation of transmission lines	Impact on avifauna due to collisions and electrocution	Medium-High	1. Comply with the Generic EMPr for Substation and Overhead Electricity Transmission and Distribution Infrastructure (GN 435 dated 22 March 2019). 2. Use monopoles in preference to lattice towers to match the conductor heights of the existing power lines thereby reducing the vertical risk area to flying birds. 3. Provide bird perches on top of the monopoles to encourage them away from perching on the conductors. 4. Ideally use dynamic reflective bird flappers, preferably with lights that flash at night, on the most sensitive spans of the transmission line between the Powerships and the top of the Eastern Reclamation and next to the Coega River (Alternative 2). 5. Use alternating black and white static pigtail flight diverters on the remaining spans of the power line as per Eskom Guidelines 6. Report any bird casualties to the CDC or TNPA Environmental Officer and the Coega / Ngqura Environmental Control Officer	Low

8.4.2.5 Powership, FSRU and Gas Pipeline Alternative 1: Operational Phase

The powerships will be moored close to medium sensitive receptors, being the mouth of the Coega River (used as a feeding and roosting area) and adjacent to a small dune area where a small colony of Kelp Gulls breed and the gas pipeline will traverse the dune area. The powerships will be moored approximately 1400m from Jahleel Island, a very high sensitive receptor and the FSRU will be moored approximately 750m from Jahleel Island. However, Jahleel Island will not be impacted by physical infrastructure. The impact significance will therefore be Low negative for both pre- and post-mitigation significance.

There will be lighting on the vessels, adding to the already substantial ambient light associated with the Port. Jahleel Island was the only sensitive avifauna area that may be impacted by noise from the project. The Damara Tern colony, St Croix and Brenton Islands are too far away. The greatest noise impact would be during calm conditions when ambient noise (from wind and waves) is low. The impact of noise and light on avifauna will be of Medium-High negative significance, and can be mitigated to Medium-Low negative significance.

Underwater noise will have a Medium negative impact on the avifauna in the Port of Ngqura. This can be mitigated to Medium-Low negative impact significance. The discharge of cooling water and the increase in atmospheric emissions will both have a Medium-Low negative impact on the avifauna within the Port. Both these impacts can be mitigated to Low negative impact significance. The impact of on avifauna due to emergency events (related to Powerships, FSRU, LNG Carrier, gas pipelines, gales, swells, flooding and marine traffic accidents) will be of Low negative significance and can be mitigated to Very Low negative impact significance.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Establishment and permanent mooring of the powerships and FSRU and the visits by the LNG Carrier	Physical Disturbance of important avifauna habitat by project infrastructure (Powerships, FSRU, LNG Carrier and gas pipelines)	Low	1. No operational activities associated with the project to take place on the Eastern Breakwater. If essential (e.g. establishing safe moorings), activities must be minimized (in terms of disturbance) and of short duration (see also EIR for establishment of Port of Ngqura). 2. Once in position off of the Coega River mouth, to reduce impacts due to re-positioning anchors and moorings, the powerships should not be moved unless in an emergency. 3. To avoid disturbance to breeding Kelp Gulls and African Oystercatchers, the gas pipeline should not be constructed over the dune area during the period 1 October to 31 January. 4. Comply with TNPA's Construction Environmental Management Programme for the Port of Ngqura and relevant sections of the Environmental Management Programme for the Operation of the Port of Ngqura. 5. Ensure that monitoring of the African Penguin colonies on the St Croix Island group continues. Continue annual monitoring of the Kelp Gull breeding colonies in the Port.	Low

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
			6. The use of mobile powerships in an operational Port has a much lower physical disturbance footprint than constructing a terrestrial power station	
Atmospheric noise and light (Powerships, FSRU).	Disturbance to avifauna	Medium-High	1. No operational activities associated with the project to take place on the Eastern Breakwater (see also EIR for establishment of Port of Ngqura). 2. All lighting to be down lighting. Lighting to be limited to that required for safe operations. 3. No lights to illuminate or be directed towards Jahleel Island or the Coega estuary and shoreline 4. Undertake light and noise audits (daytime and nighttime) on the Eastern Breakwater at its closest point to Jahleel Island and at the Klub Road causeway crossing the Coega Estuary before operations start to determine the baseline, once operations start and annually thereafter. 5. To track any changes on sensitive avifauna receptors, ensure that monitoring of the African Penguin colonies on the St Croix Island group and the nearby Damara Tern colony continues. Continue annual monitoring of the Kelp Gull breeding colonies in the Port and bi-annual Co-ordinated Waterbird Counts on the saltpans. 6. Noise can be reduced by reducing the number of reciprocating engines / steam turbines in operation	Medium-Low
Underwater noise (powerships, FSRU).	Disturbance to marine avifauna and habitat	Medium	1. A long-term hydrophone system should be installed at the entrance to the Port of Ngqura before operations start. Data should be analysed and reported on at least annually. 2. Ensure that monitoring of the African Penguin colonies on the St Croix Island group continues 3. Noise can be reduced by reducing the number of reciprocating engines / steam turbines in operation	Medium-Low
Change in water temperature (Powerships).	Disturbance to avifauna habitat	Medium-Low	1. Discharge water at 8m depth 2. Discharge water away from water intake to prevent re-circulation	Low
Increase in atmospheric emissions (Powerships and FSRU)	Impact on avifauna due to increase in atmospheric emissions (Powerships and FSRU).	Medium-Low	1. Reduce the number of power generators in operation 2. Ensure all air quality monitoring stations (e.g. Saltworks and at Port of Ngqura) are operational at all times and data is analysed.	Low
Emergency events (Powerships, FSRU, LNG Carrier, gas pipelines, gales, swells, flooding and marine traffic accidents)	Impact on avifauna	Low	1. Have emergency plans in place, to include operational risks (gas explosions, etc.), extreme weather events, and marine traffic accidents. 2. Ensure Standard Operating Procedures for all operations and extra checks for hazardous processes (e.g. hose connections) 3. Use suitably qualified and trained people for all operations 4. Ensure adequate emergency equipment is available and maintained and hold regular audits and emergency drills 5. Emergency plans / equipment are to include plans to evacuate and rehabilitate penguins and other injured or at risk birds from the islands / adjacent areas if necessary in conjunction with SANParks	Very Low

8.4.2.6 Powership, FSRU and Gas Pipeline Alternative 2: Operational Phase

The powerships will be moored at the Admin Craft Basin breakwater, away from the Coega River but only 1000m from Jahleel Island and the FSRU will be moored further down the Eastern Breakwater, 650m from Jahleel Island. The powerships will have a Low negative impact for both pre-and post-mitigation significance.

There will be lighting on the vessels, adding to the already substantial ambient light associated with the Port. Jahleel Island was the only sensitive avifauna area that may be impacted by noise from the project. The Damara Tern colony, St Croix and Brenton Islands are too far away. The greatest noise impact would be during calm conditions when ambient noise (from wind and waves) is low. The impact of noise and light on avifauna will be of High negative significance, and can be mitigated to Medium-High negative significance.

Underwater noise will have a Medium negative impact on the avifauna in the Port of Ngqura. This can be mitigated to Medium-Low negative impact significance. The discharge of cooling water and the increase in atmospheric emissions will both have a Medium-Low negative impact on the avifauna within the Port. Both these impacts can be mitigated to Low negative impact significance. The impact of on avifauna due to emergency events (related to Powerships, FSRU, LNG Carrier, gas pipelines, gales, swells, flooding and marine traffic accidents) will be of Medium-Low negative significance and can be mitigated to Very Low negative impact significance.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Establishment and permanent mooring of the powerships and FSRU and the visits by the LNG Carrier	Physical Disturbance of important avifauna habitat by project infrastructure (Powerships, FSRU, LNG Carrier and gas pipelines)	Low	1. No operational activities associated with the project to take place on the Eastern Breakwater. If essential (e.g. establishing safe moorings), activities must be minimized (in terms of disturbance) and of short duration (see also EIR for establishment of Port of Ngqura). 2. Comply with TNPA's Construction Environmental Management Programme for the Port of Ngqura and relevant sections of the Environmental Management Programme for the Operation of the Port of Ngqura. 3. Ensure that monitoring of the African Penguin colonies on the St Croix Island group continues. Continue annual monitoring of the Kelp Gull breeding colonies in the Port. 4. The use of mobile powerships in an operational Port has a much lower physical disturbance footprint than constructing a terrestrial power station	Very Low
Atmospheric noise and light (Powerships, FSRU).	Disturbance to avifauna	High	1. No operational activities associated with the project to take place on the Eastern Breakwater (see also EIR for establishment of Port of Ngqura). 2. All lighting to be down lighting. Lighting to be limited to that required for safe operations. 3. No lights to illuminate or be directed towards Jahleel Island or the Coega estuary and shoreline 4. Undertake night light and 24 hour noise audits (daytime and nighttime) on the Eastern Breakwater at its closest point to Jahleel Island and at the Klub Road causeway crossing the Coega Estuary before operations start to determine the baseline, once operations start and annually thereafter. 5. To track any changes on sensitive avifauna receptors, ensure that monitoring of the African Penguin colonies on the St Croix Island group and the nearby Damara Tern colony continues. Continue annual	Medium-High

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
			monitoring of the Kelp Gull breeding colonies in the Port and bi-annual Co-ordinated Waterbird Counts on the saltpans. 6. Noise can be reduced by reducing the number of reciprocating engines / steam turbines in operation and by implementing recommendations in the Noise Impact Assessment.	
Underwater noise (powerships, FSRU).	Disturbance to marine avifauna and habitat	Medium	1. A long-term hydrophone system should be installed at the entrance to the Port of Ngqura before operations start. Data should be analysed and reported on at least annually. 2. Ensure that monitoring of the African Penguin colonies on the St Croix Island group continues 3. Noise can be reduced by reducing the number of reciprocating engines / steam turbines in operation	Medium-Low
Change in water temperature (Powerships).	Disturbance to avifauna habitat	Medium-Low	1. Discharge water at 8m depth 2. Discharge water away from water intake to prevent re-circulation	Low
Increase in atmospheric emissions (Powerships and FSRU)	Impact on avifauna due to increase in atmospheric emissions (Powerships and FSRU).	Medium-Low	1. Reduce the number of power generators in operation 2. Ensure all air quality monitoring stations (e.g. Saltworks and at Port of Ngqura) are operational at all times and data is analysed	Low
Emergency events (Powerships, FSRU, LNG Carrier, gas pipelines, gales, swells, flooding and marine traffic accidents)	Impact on avifauna	Medium-Low	1. Have emergency plans in place, to include operational risks (gas explosions, etc.), extreme weather events, marine traffic accidents) 2. Ensure Standard Operating Procedures for all operations and extra checks for hazardous processes (e.g. hose connections) 3. Use suitably qualified and trained people for all operations 4. Ensure adequate emergency equipment is available and maintained and hold regular audits and emergency drills 5. Emergency plans / equipment are to include plans to evacuate and rehabilitate penguins and other injured or at risk birds from the islands / adjacent areas if necessary in conjunction with SANParks	Very Low

8.4.3 Wetland Impacts

Wetland impacts for the Transmission Line Alternative 1 will be similar to those assessed for Alternative 3. This is due to the similarity in their route alignments and those of the receiving environment both alternatives. Therefore, the assessment table below refers to both alternatives.

8.4.3.1 Transmission Line Alternatives 1 and 3: Construction Phase

The construction phase impacts for Alternative 1 (Preferred Alternative) and Alternative 3 are similar. The reason for this is that the majority of routes follow the same alignment. Construction vehicle movement will have a Medium-Low negative impact on the wetlands by increasing surface runoff and risk of contamination. These can be mitigated to a Low negative impact. The direct destruction of vegetation will have a Medium negative impact on the soil profile and its erodibility, but can be mitigated to a Low negative impact. Construction of the towers can have Medium negative impact on water resources and can be mitigated to a Low negative impact. De-establishment and rehabilitation of the site will have a Medium positive impact by increasing surface roughness and reducing the velocity of the surface runoff; decreasing erosion potential; increasing biodiversity; removing all potential contaminants; and reinstating the natural topography.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Construction vehicle movement during the pre-construction and construction phases.	Increased surface runoff and reduction in soil infiltration/permeability; Potential increase in risk of contamination of downstream watercourses due to oil leakages from construction vehicles; Compaction of topsoil by construction vehicles in the catchment; Potential creation of preferential drainage paths by construction vehicles coupled with heavy rainfall events in the catchment.	Medium-Low	Existing access/haulage routes must be utilised during construction as far as possible. Stormwater infrastructure must be positioned at areas where concentrated flows will enter watercourses. The flow from stormwater infrastructure should not enter a watercourse directly but should rather flow into an area of vegetated land, or dissipation area, within the adjacent riverine area.	Low
Direct destruction of vegetation and topsoil layer within the footprint of the proposed development during the pre-construction and construction phases (Overhead powerlines).	Disruption of the soil profile and thus potential sedimentation of downstream system; Increased risk of erosion due to exposure of bare-ground and reduced soil cohesion; Reduction in infiltration and increased risk of splash and rill erosion developing down the slope.	Medium	Structures which promote natural diffuse flow such as horizontal gabion structures, dissipation blocks, etc. be utilised during the construction phase to attempt to reduce the flow-velocity through these structures during heavy storm events which will eventually rapidly enter watercourses. Silt traps must be erected around all excavation, dumping and/or infill activity which may take place at the proposed development site close by to watercourses (especially for Rip01) which are given authorization to be utilised to reduce the siltation to the down slope watercourses in the study area. Furthermore, dust suppression techniques must be applied on all access/haulage roads to reduce dust contamination of the surrounding environment. Silt traps must be erected at the base of the slopes leading into the down slope watercourses and around all site camps, spill sites, access roads and temporary structures. Removal of sediment from the erected silt traps must take place on a weekly basis. Erosion and sedimentation must be monitored closely. After every heavy rainfall event, the contractor must check the site for erosional damage and rehabilitation must occur immediately if damage is found. If the construction activities influence the daily activities of the local residents' adequate alternatives must be made outside of sensitive environments and preferably within currently degraded areas (e.g. detour routes). Topsoil and subsoil which is excavated from the study area must be stockpiled with the topsoil separate from the subsoil and preserved for future rehabilitation. Cleared	Low

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
			vegetation and soils which will not be utilised for rehabilitation purposes must be disposed of at a registered waste disposal facility. Stockpiles must be seeded with indigenous grasses or stabilised with geotextiles to reduce erosion potential. All stormwater and sheet runoff management infrastructure must divert flow away from areas susceptible to erosion, specifically steep slopes and watercourses (e.g. stormwater flowing into the rivers). Unstable areas associated with the proposed development must be stabilised utilising geotextiles or other appropriate stabilisation techniques. All areas of loose sand, which are prone to wind erosion must be sprayed with water or other dust suppression techniques	
INDIRECT IMPACTS				
Establishment of a construction site camp and erection of ablution facilities within a previously disturbed area, 50m away from any delineated watercourses during the pre-construction and construction phases.	Potential encroachment by AIPs; Potential destruction of native and/or indigenous plant species in the catchment; Disruption to soil profile and consequent creation of excess sediment in the catchment; Compaction of the soil profile in the catchment; Potential alteration to the physcio-chemical properties of the downstream watercourses due to input of foreign material and excess sediment from catchment; Potential pollution of groundwater and surrounding watercourses if erected ablution facilities are poorly maintained.	Low	Existing access/haulage routes must be utilised during construction as far as possible. Stormwater infrastructure must be positioned at areas where concentrated flows will enter watercourses. The flow from stormwater infrastructure should not enter a watercourse directly but should rather flow into an area of vegetated land, or dissipation area, within the adjacent riverine area. Structures which promote natural diffuse flow such as horizontal gabion structures, dissipation blocks, etc. be utilised during the construction phase to attempt to reduce the flow-velocity through these structures during heavy storm events which will eventually rapidly enter watercourses. Silt traps must be erected around all excavation, dumping and/or infill activity which may take place at the proposed development site close by to watercourses (especially for Rip01) which are given authorization to be utilised to reduce the siltation to the down slope watercourses in the study area. Furthermore, dust suppression techniques must be applied on all access/haulage roads to reduce dust contamination of the surrounding environment. Silt traps must be erected at the base of the slopes leading into the down slope watercourses and around all site camps, spill sites, access roads and temporary structures. Removal of sediment from the erected silt traps must take place on a weekly basis. Erosion and sedimentation must be monitored closely. After every heavy rainfall event, the contractor must check the site for erosional damage and rehabilitation must occur immediately if damage is found. Topsoil and subsoil which is excavated from the study area must be stockpiled with the topsoil separate from the subsoil and preserved for future rehabilitation. Cleared vegetation and soils which will not be utilised for rehabilitation purposes must be disposed of at a registered waste disposal facility. Stockpiles must be seeded with indigenous grasses or stabilised with geotextiles to reduce erosion potential. All stormwater and sheet runoff management infrastructure must divert flow away from areas susceptible to erosion, specifically steep slopes and watercourses (e.g. stormwater flowing into the rivers). Unstable areas associated with the proposed development must be stabilised utilising geotextiles or other appropriate stabilisation techniques. All areas of loose sand, which are prone to wind erosion must be sprayed with water or other dust suppression techniques.	Low

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
Demarcation of buffer zones and no-go areas and the allocation/preparation of spoil sites (topsoil separate from subsoil), waste dump sites and construction vehicle routes during the pre-construction and construction phases.	Disruption of the soil profile and thus creation of excess sediment in the catchment; Potential noise and air pollution as a result of onsite waste dump sites; The potential increase of preferential drainage parts as a result of construction vehicles creating unauthorised pathways; Compaction of topsoil as a result of construction vehicles baring excess weight on soil. Removed topsoil and subsoil which will be utilised for rehabilitation purposes contaminated by AIPs and loss due to natural wind mechanism.	Low	All watercourses delineated within the wetland report and their associated buffers must be demarcated and considered as no-go areas. All demarcated areas must be considered no-go areas for the duration of the construction phase. Any construction personnel found working inside the no-go areas should be fined as per fining schedule/system setup for the project. Structures which promote natural diffuse flow such as horizontal gabion structures, dissipation blocks, etc. be utilised during the construction phase to attempt to reduce the flow-velocity through these structures during heavy storm events which will eventually rapidly enter watercourses. Silt traps must be erected around all excavation, dumping and/or infill activity which may take place at the proposed development site close by to watercourses (especially for Rip01) which are given authorization to be utilised to reduce the siltation to the down slope watercourses in the study area. Furthermore, dust suppression techniques must be applied on all access/haulage roads to reduce dust contamination of the surrounding environment. Silt traps must be erected at the base of the slopes leading into the down slope watercourses and around all site camps, spill sites, access roads and temporary structures. Removal of sediment from the erected silt traps must take place on a weekly basis. Erosion and sedimentation must be monitored closely. After every heavy rainfall event, the contractor must check the site for erosional damage and rehabilitation must occur immediately if damage is found. Topsoil and subsoil which is excavated from the study area must be stockpiled with the topsoil separate from the subsoil and preserved for future rehabilitation. Cleared vegetation and soils which will not be utilised for rehabilitation purposes must be disposed of at a registered waste disposal facility. Stockpiles must be seeded with indigenous grasses or stabilised with geotextiles to reduce erosion potential. All stormwater and sheet runoff management infrastructure must divert flow away from areas susceptible to erosion, specifically steep slopes and watercourses (e.g. stormwater flowing into the rivers). Unstable areas associated with the proposed development must be stabilised utilising geotextiles or other appropriate stabilisation techniques. All areas of loose sand, which are prone to wind erosion must be sprayed with water or other dust suppression techniques.	Very Low
Construction of the 132kV Overhead Lattice Steel Structure during the pre-construction and construction phases	Potential contamination of the surrounding terrestrial by concrete mix or hydrocarbons; Potential sedimentation of down slope watercourses; Increased hardened surfaces and thus higher energy surface and stormwater runoff into the down slope watercourses; Loss of habitat for species within the area (especially catchment); Potential contamination of sediment	Medium	Structures which promote natural diffuse flow such as horizontal gabion structures, dissipation blocks, etc. be utilised during the construction phase to attempt to reduce the flow-velocity through these structures during heavy storm events which will eventually rapidly enter watercourses. Silt traps must be erected around all excavation, dumping and/or infill activity which may take place at the proposed development site close by to watercourses (especially for Rip01) which are given authorization to be utilised to reduce the siltation to the down slope watercourses in the study area. Furthermore, dust suppression techniques must be applied on all access/haulage roads to reduce dust contamination of the surrounding environment. Silt traps must be erected at the base of the slopes leading into the down slope watercourses and around all site camps, spill sites, access roads and temporary structures. Removal of sediment from the erected silt traps must take place on a weekly basis. Erosion and sedimentation must be monitored closely. After every heavy rainfall event,	Low

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
	and groundwater due to continuous cement spills and poor construction ethics. Potential diversion of the natural flow of water during rainfall events. Potential loss of water being transported to downstream watercourses.		the contractor must check the site for erosional damage and rehabilitation must occur immediately if damage is found. If the construction activities influence the daily activities of the local residents' adequate alternatives must be made outside of sensitive environments and preferably within currently degraded areas (e.g. detour routes). Topsoil and subsoil which is excavated from the study area must be stockpiled with the topsoil separate from the subsoil and preserved for future rehabilitation. Cleared vegetation and soils which will not be utilised for rehabilitation purposes must be disposed of at a registered waste disposal facility. Stockpiles must be seeded with indigenous grasses or stabilised with geotextiles to reduce erosion potential. All stormwater and sheet runoff management infrastructure must divert flow away from areas susceptible to erosion, specifically steep slopes and watercourses (e.g. stormwater flowing into the rivers). Unstable areas associated with the proposed development must be stabilised utilising geotextiles or other appropriate stabilisation techniques. All areas of loose sand, which are prone to wind erosion must be sprayed with water or other dust suppression techniques	
De-establishment of the site camp, spoil sites, waste dumps etc. and the rehabilitation of the temporary access/haulage roads during the rehabilitation phase.	**Positive impacts:** Increase surface roughness and reduce the velocity of the surface runoff; Decrease erosion potential; Increase biodiversity; Remove all potential contaminants; Reinstate natural topography.	Medium (Positive)	Rehabilitation must commence within 30 days from the period when the construction phase has ended. All alternative tracks and footpaths created during the construction phase should be appropriately rehabilitated (e.g. tillage and re-vegetation of the affected areas). This rehabilitation should result in improved surface roughness and increased infiltration along with reduced stormwater flow and consequently reduced rill erosion. Any haulage or access roads (legal or illegal) which were created must be decommissioned and rehabilitation to reinstate the natural vegetation, increase the surface roughness and resultantly increase infiltration (e.g. tillage and revegetation). All construction waste materials must be removed, and temporary structures (e.g. offices, workshops, storage containers, ablution facilities) dismantled, from site and the surrounding environment, this will need to be checked by the ECO and the various contractors. All banks where there is exposed soil, with the potential for rill/gully erosion to take place, must be stabilised. Gabion structures or geotextiles must be implemented upslope of the proposed development where necessary. The reinstatement of the longitudinal bank profiles, which have been altered, must be rehabilitated if possible. The soil horizons must be reinstated on the correct structural order and the vegetation groundcover over the disturbed area re-vegetated according to the native indigenous species within the area. AIPs must be removed manually without further disturbance to the surrounding ecosystems. If manual removal is not possible, seek guidance from a local cooperative extension service or Working for Water. Dispose of the removed AIPs at a registered dumping site or burn the material on a bunded surface. Rehabilitation of the sections where AIPs are removed must take place. The appropriate indigenous grass and woody vegetation species seeds must be attained from a registered nursery with the guidance of a botanist who is familiar to the region.	Medium (Positive)

8.4.3.2 Transmission Line Alternatives 1 and 3: Operational Phase

Maintenance activities during the operational phase will have a Medium negative impact on wetland resources such as the removal of vegetation, destruction of aquatic and terrestrial habitats and increased erosion potential. These impacts can be mitigated to a Low negative impact.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Utilisation of the Overhead Powerlines during the operational phase	Removal of vegetation cover and loss of biodiversity; Destruction of aquatic and terrestrial habitats and loss of faunal species; Soil compaction and thus increased surface runoff and decreased infiltration/permeability; Increased friction against rainfall and surface runoff with the addition of vegetation; Increased opportunity for groundwater and watercourse contamination as a result of leaks from sewer lines and leakages from residentially vehicles; Increased potential of erosional features if stormwater is not managed in terms of discharge velocity and discharge area.	Medium	Ensure that all areas that have been disturbed in the catchment are adequately rehabilitated. No bare-ground areas should exist after construction. Areas where erosional features have formed (gully or rill erosion) should be reinstated with relevant topsoil immediate and re-vegetated initially with a fast growing indigenous grass native to the area and thereafter replaced with a similar vegetation type of the area. Areas where sedimentation has occurred must be immediately removed to ensure no drowning of indigenous vegetation and opportunity for AIPs to proliferate. AIPs within the area must be removed and replaced with indigenous vegetation native to the area. A monitoring programme must be in place not only to ensure compliance with the EMPr throughout the construction phase, but also to monitor any post-construction environmental issues and impacts during the vegetation establishment phase. Compliance against the EMPr must be monitored during the construction phase monthly by an independent ECO. The period and frequency of monitoring required post-construction must be determined by the competent authorities and implemented by the ECO. Once the initial transplants / plugs are planted, the landscaper must conduct weekly site visits to remove AIPs (in accordance with the latest revised NEM:BA requirements) and address any re-vegetation concerns until re-vegetation is considered successful (i.e. >80% indigenous cover). An accepted monitoring period of re-vegetated areas after this initial period is monitoring every 3 months for the first 12 months and every 6 months thereafter until the vegetation has successfully been established. If the re-vegetated areas have inadequate surface coverage (less than 30% within 9 months after re-vegetation) the area should be prepared and re-vegetated again.	Low

8.4.4 Hydropedological Impacts

Hydropedological impacts for the Alternative 1 will be similar to those assessed for Alternative 3. This is due to the similarity of the route alignment and ground conditions for the two alternatives. Therefore, the assessment table below refers to both alternatives.

8.4.4.1 Transmission Line Alternatives 1 and 3: Construction Phase

Disturbing the vadose zone during excavations will result in the infilling of wetlands, alteration to natural hydropedological flow paths and processes. These Medium-Low negative impacts can be mitigated to Very Low negative impact significance. The Low negative impacts of altering of existing soil flow processes and poor soil quality can both be mitigated to Very Low negative impacts. The degradation of surface water quality will remain a Low negative impact after mitigation. The indirect impacts from soil preparation and vegetation clearing will both have Low negative impacts that can be mitigated to Very Low negative impact significance.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Disturbing vadose zone during soil excavations / infilling activities	Infilling of wetlands and watercourses inducing alternative flow paths. Alteration to natural hydropedological flow paths. Impacts on macro-soil structure. Impacts on the hydropedological processes supporting the watercourses.	Medium-Low	Only excavate areas applicable to the project area. Backfill the material in the same order it was excavated to reduce contamination of deeper soils with shallow oxidised soils. Cover excavated soils with a temporary liner to prevent contamination.	Very Low
In-situ placement of new soils	Altering existing soil-flow processes (i.e. infilling of wetlands). Compaction of soil.	Low	Only excavate areas applicable to the project area. Backfill the material in the same order it was excavated to reduce contamination of deeper soils with shallow oxidised soils. Cover excavated soils with a temporary liner to prevent contamination. Keep the site clean of all general and domestic wastes.	Very Low
Leakages from vehicles and machines	Degradation of surface water (wetland & estuary) quality. Surface water contamination.	Low	Visual soil assessment for signs of contamination at vehicle holding, parking and activity areas. Place oil drip trays under parked construction vehicles and hydraulic equipment at the site. Surface water monitoring.	Low
Oil & fuel spills from vehicles installing the transmission line	Poor soil quality or contamination of soil	Low	Visual soil assessment for signs of contamination at vehicle holding, parking and activity areas. Have emergency fuel & oil spill kits on site.	Very Low
INDIRECT IMPACTS				
Site preparation, including placement of contractor laydown areas and storage (i.e. temporary stockpiles, bunded areas etc.) facilities	Exposure of soils, leading to increased runoff from cleared areas and erosion of the watercourses, and thus increased the potential for sedimentation of the watercourses. Loss of vegetation. Compaction of soils;	Low	All development footprint areas to remain as small as possible and vegetation clearing to be limited to what is essential. Exposed soils to be protected using a suitable covering or revegetating. Have emergency fuel & oil spill kits on site.	Very Low
Vegetation clearing & soil stockpiling	Natural nutrient content decreases due to soil exposure. Loss of natural bio-organisms essential to soil processes.	Low	All development footprint areas to remain as small as possible and vegetation clearing to be limited to what is essential. Retain as much indigenous vegetation as possible.	Very Low

8.4.4.2 Transmission Line Alternatives 1 and 3: Operational Phase

Maintenance activities have the potential to disturb the inner soil architecture resulting in a Medium-Low negative impact on natural flow processes and hydrological flow paths. These impacts can be mitigated to Low negative significance. Stockpiling and hydrocarbon spills from vehicles will both have Low negative impacts that can be mitigated to Very Low impact.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Disturbing the inner-soil architecture of the original soil profile	This will disturb natural flow processes. Alteration to natural hydropedological flow paths. Impact on macro-soil structure. Impact on the hydropedological processes supporting the watercourses.	Medium-Low	Revegetate areas (with vegetation growing at the site) where heavy machinery was used to excavate the soils to prevent erosion.	Low
Oil & fuel spills from vehicles conducting maintenance of the transmission lines	Poor soil quality	Low	Have emergency fuel & oil spill kits on site.	Very Low
INDIRECT IMPACTS				
Excavated soil will be placed in other areas (i.e. on top of other soils)	This will have an impact on the flow dynamics of the soil it is dumped on top of, and may reduce rainfall infiltration and induce runoff.	Low	Cover excavated soils to be protected using a suitable covering.	Very Low

8.4.5 River and Riparian (Aquatic) Impacts

Four assessment sites were investigated, to assess the possible impacts associated with the proposed project. Due to the absence of water flow at the site as well as the rest of the study area, the *in situ* Water Quality, Integrated Habitat Assessment Index, and SASS5 results could not be obtained. Therefore no impact assessment could be undertaken. The specialist recommended that an estuarine impact assessment be undertaken.

8.4.6 Surface Water (Hydrology) Impacts

Hydrological impacts for the Alternative 1 route alignment will be similar to those assessed for the Preferred Alternative. This is due to the similarity of the receiving environment and ground conditions for both alternatives. Therefore, the assessment table below refers to both alternatives.

8.4.6.1 Transmission Line Alternatives 1 and 3: Construction Phase

Earthworks in proximity to water bodies will have a Medium negative impact significance which can be mitigated to Low negative significance. Leakages from vehicles will result in Medium-Low negative impacts to surface water contamination, and can be mitigated to Low negative significance.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Earthworks in proximity to surface water bodies	Exposure of soils, leading to increased runoff from cleared areas and erosion of the watercourses, and thus increased the potential for sedimentation of the watercourses. Soil compaction and soil erosion.	Medium	Only excavate areas applicable to the project area. Cover excavated soils with a temporary liner to prevent contamination. Keep the site clean of all general and domestic wastes. All development footprint areas to remain as small as possible and vegetation clearing to be limited to what is essential. Retain as much indigenous vegetation as possible. Exposed soils to be protected by means of a suitable covering. Existing roads should be used as far as practical to gain access to the site, and crossing the rivers in areas where no existing crossing is apparent should be unnecessary, but if it is essential crossings should be made at right angles.	Low
INDIRECT IMPACTS				
Leakages from vehicles and machines	Surface water contamination	Medium-Low	Water quality assessment for signs of contamination at vehicle holding, parking and activity areas. Place oil drip trays under parked construction vehicles and hydraulic equipment at the site.	Low

8.4.6.2 Transmission Line Alternatives 1 and 3: Operational Phase

Soil disturbance as well as erosion and sedimentation of nearby watercourses are Medium-Low negative impacts that can be mitigated to Very Low significance. Both the spillages from transformers and the poor quality surface runoff or seepage will have Low negative impact significance on water quality degradation. These can be mitigated to Very Low significance.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
Leakages from pipeline and post-earthwork activities	Soil disturbance & erosion and sedimentation of nearby watercourses	Medium-Low	Only excavate areas applicable to the project area. Hydraulic monitoring of the pipeline to ensure that the system operates as per design specifications. If pressure losses are noted, a pipeline survey should be undertaken to look for leaks. Pipe sections wich rupture should be repaired accordingly to prevent possible erosion and land subsidence. Retain as much indigenous vegetation as possible.	Very Low
Spillages from transformers may run off into watercourses or leach through the soil	Water quality degradation of nearby watercourses	Low	Ensure maintenance of transformers to prevent spillages. Water quality monitoring of the nearby river.	Very Low
INDIRECT IMPACTS				
Poor quality overland runoff or seepage from hydrocarbon spills from vehicles parked at the site.	Water quality degradation of nearby watercourses	Low	Park vehicles in areas lined with concrete or fitted oil traps. Ensure vehicles are in good condition and not leaking fuel or oil when conducting maintenance. Have oil & fuel spill kits on site.	Very Low

8.4.7 Groundwater Impacts

Geohydrological impacts for the Alternative 1 route alignment will be similar to those assessed for Alternative 3. This is due to the similarity of the groundwater conditions for the two alternatives. Therefore, the assessment table below refers to both alternatives.

8.4.7.1 Transmission Line Alternatives 1 and 3: Construction Phase

Disturbing vadose zone during soil excavations will be a Medium negative impact that can be mitigated to a Low negative impact significance. Earthworks will also result in Medium negative impacts of poor quality seepage as well as surface water contamination and sedimentation. These can all be mitigated to Low negative impact significance.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
Earthworks	Disturbing vadose zone during soil excavations/construction activities.	Medium	Only excavate areas applicable to the project area. Backfill the material in the same order it was excavated to reduce contamination of deeper soils with shallow oxidised soils. Cover excavated soils with a temporary liner to prevent contamination. Retain as much indigenous vegetation as possible. Exposed soils to be protected using a suitable covering or revegetating.	Low
Earthworks	Temporary dewatering of perched groundwater (if it occurs)	Medium-High	Have appropriate dewatering systems in place. Dewater all groundwater to the nearest surface drain/watercourse.	Low
INDIRECT IMPACTS				
Earthworks	Poor quality seepage from machinery used to excavate soils. Oil, grease and fuel leaks could lead to hydrocarbon contamination of the vadose zone which could percolate to the shallow aquifer.	Medium	Water quality monitoring of the downstream surface water. Park heavy machineries in lined areas and place drip trays under vehicles at the site. Visual soil assessments for signs of contamination.	Low
Earthworks	Surface water contamination and sedimentation from the following activities: o Equipment and vehicles are washed in the water bodies (when there is water); o Erosion and sedimentation of watercourses due to unforeseen circumstances (i.e. bad weather); and o Alteration of natural drainage lines which may lead to ponding or increased runoff patterns (i.e. may cause stagnant water levels or increase erosion).	Medium	Water quality monitoring and visual assessments. Installation of piezometric seepage boreholes if pollution is evident. The boreholes can be positioned downstream of the transmission lines. Install a temporary cut off trench to contain poor quality runoff. Routine inspections of all infrastructure.	Low

8.4.7.2 Transmission Line Alternatives 1 and 3: Operational Phase

Operation of the transmission line can result in poor quality seepage. This Medium negative impact can be mitigated to Low negative impact significance.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Operation of the transmission line	Poor quality seepage from likely sub-stations associated with the transmission line and park service vehicles. Seepage may percolate into the shallow aquifer zone.	Medium	Water quality monitoring of the downstream surface water. Installation of piezometric seepage boreholes if pollution is evident. The boreholes can be positioned downstream of the transmission lines. Park service vehicles in lined areas and place drip trays under vehicles at the site. Visual soil assessments for signs of contamination.	Low

8.4.8 Climate Change Impacts

Climate change impacts for the Alternative 1 will be similar to those assessed for Alternative 3. This is due to the similarity of the route alignment for the two alternatives. Therefore, the assessment table below refers to both alternatives.

8.4.8.1 Powership, FSRU and Gas Pipeline Alternatives 1 and 2: Construction Phase

During installation of the gas pipeline, a potential direct Low negative impact may arise due to infrastructural and/or equipment damage or failure in the event of a severe storm. This can be mitigated to Very Low impact significance.

ASPECT	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
GAS PIPELINE FROM FSRU TO POWERSHIP - SUB-SEA				
DIRECT AND INDIRECT IMPACTS				
Installation/construction	Damage to equipment and infrastructure from extreme climatic/weather events and/or long-term climate trends	Low	Adherence to port safety regulations and emergency procedures, account for extreme events in pipeline design and location	Very Low

8.4.8.2 Powership, FSRU and Gas Pipeline Alternatives 1 and 2: Operational Phase

Given the sheltered and well-defended nature of the port, physical climate change risk to the LNGC is considered of Medium-Low negative significance without mitigation, and of Low negative significance with mitigation. Physical climate change risk to the FSRU is considered to be of Medium-Low negative significance without mitigation, and of Low negative significance with mitigation. During operation, a Medium-rated negative impact may occur if a sufficiently severe storm of marine origin impacts the port, possibly damaging the pipeline and resulting in fugitive GHG emissions but can be mitigated to a Low negative significance. Given the location of the Powership within the main port area, the impacts are rated as Very Low negative with mitigation measures applied. Similarly, impacts concerning the Powership connection with the FSRU and pipeline are also rated Very Low negative with mitigation. A High positive impact of the Powership operations is the addition of 540MW of baseload electricity to the national grid. The 132kV Transmission Lines to Substation impacts expected during the operational phase can be mitigated to a Low negative significance rating relatively easily. The significance rating of the 132kV Steel Lattice Towers impact is Low negative without mitigation, and Very Low negative with mitigation.

ASPECT	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
LNG CARRIER				
DIRECT AND INDIRECT IMPACTS				
Transportation	Damage to equipment and infrastructure from extreme climatic/weather events and/or long-term climate trends during transportation (direct)	Medium-Low	Use of early warning systems and international standard operating procedures for vessels operating in inclement weather, including evasive action	Low
Mooring/operation	Damage to equipment and infrastructure from extreme climatic/weather events and/or long-term climate trends in-port (direct)	Very Low	Adherence to port safety regulations and emergency procedures	Very Low
FSRU				
DIRECT AND INDIRECT IMPACTS				
Mooring/operation	Damage to equipment and infrastructure from extreme climatic/weather events and/or long-term climate trends	Medium-Low	Adherence to port safety regulations and emergency procedures	Low
GAS PIPELINE FROM FSRU TO POWERSHIP - SUB-SEA				
DIRECT AND INDIRECT IMPACTS				
Installation/construction	Damage to equipment and infrastructure from extreme climatic/weather events and/or long-term climate trends	Low	Adherence to port safety regulations and emergency procedures, account for extreme events in pipeline design and location	Very Low
Operation	Damage to equipment and infrastructure from extreme climatic/weather events and/or long-term climate trends	Medium	Implement quality, maintenance and environmental controls.	Low
POWERSHIP				
DIRECT AND INDIRECT IMPACTS				
Mooring/operation	Damage to equipment and infrastructure from extreme climatic/weather events and/or long-term climate trends	Low	Adherence to port safety regulations and emergency procedures	Very Low
Connection to FSRU	Damage to equipment and infrastructure from extreme climatic/weather events and/or long-term climate trends	Low	Adherence to port safety regulations and emergency procedures	Very Low
Electricity generation: 635MW (direct)	Generation of electricity and provision of 635MW into the national grid	High (Positive)	Positive impact on regional and national economy and community from reliable and continuous electricity flow from the Powership.	High (positive)

ASPECT	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
Increased community adaptation/resilience (indirect)	Increased local adaptive capacity through more reliable electricity for the SEZ and resultant growth in gross geographic product (GGP)	Medium-High (Positive)	Community benefits from stable electrical supply and local economic growth	Medium-high (positive)
132KV TRANSMISSION LINES TO SUBSTATION				
DIRECT AND INDIRECT IMPACTS				
Operation	Increased fire risk due to more arid conditions and potential changes in vegetation type/climate zone, as well as increased intensity and frequency of extreme weather events	Low	Underground transmission line is the preferred option from a fire risk perspective. Ongoing maintenance of servitude and clearing of alien vegetation as per safety protocols must be undertaken if overhead line is the preferred alternative.	Very Low
132kV STEEL LATTICE TOWERS				
DIRECT AND INDIRECT IMPACTS				
Operation	Increased fire risk due to more arid conditions and potential changes in vegetation type/climate zone, as well as increased intensity and frequency of extreme weather events	Low	Ongoing maintenance of servitude and clearing of alien vegetation as per safety protocols.	Very Low

8.4.9 Estuarine Impacts

Estuarine impacts for the Transmission Line Alternative 1 will be similar to those assessed for Transmission Line Alternative 3. This is due to the similarity of the route alignment for the two alternatives. Therefore, the assessment table below refers to both transmission line alternatives.

8.4.9.1 Transmission Line Alternative 1 and 3: Construction Phase

The loss of estuarine habitat will have a Medium negative impact that can be mitigated to a Low negative impact. Solid waste pollution from construction activities will have a Medium-High negative impact that can be reduced to Very Low negative impact. The spill of hazardous substances can result in chemical pollution, a High negative impact. This can be safely mitigated to a Low negative impact significance. The coastal location of the proposed activity can have a High negative impact of dynamic coastal processes, but can be mitigated to a Medium-Low negative impact.

It should be noted that while the assessment of the restriction of coastal access indicates a high impact, the restriction of access within Port areas and for the purposes of protecting persons is considered both reasonable and in the interests of the public, and can therefore be excluded from any calculation of impact.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Construction of terminal tower within the estuarine functional zone	Loss of estuarine habitat	Medium	Noteworthy vegetated areas must be avoided in the siting and enclosure of the laydown area/stringing yard. During the construction of the transmission lines, the removal of endemic vegetation should be limited, however, invasive alien vegetation invasion in respect to disturbed areas must be removed and controlled. Pylons along the alternate route must be located outside of EFZ Beach environment to be rehabilitated to pre-establishment conditions as part of decommissioning Construction must be undertaken according to a site-specific approved Environmental Management Programme (EMPr) and must be monitored by an on-site environmental officer. All solid waste must be removed to an appropriate disposal facility In the event of a large-scale marine pollution event, every effort must be made to prevent it reaching and negatively impacting the Coega Estuary, even though the system is ephemeral and often closed. Dust or sand suppression should be undertaken by watering down and limiting activity in windy conditions. The Gas to Power operation must be aware of TNPA Environmental Management Systems as well as emergency preparedness and response procedures and apply such on an ongoing basis and in the event of emergencies, for example, tidal surge, dust storms and other extreme events.	Medium-Low
Construction activities	Solid waste pollution	Medium-High	Construction workers and operational staff to adopt best practice waste minimisation procedures. Implement the correct handling and disposal procedures for general and hazardous waste. Reduce the amount of waste generated from the construction phase by means of efficient operations and recycling of general waste. Good housekeeping to be done daily. No mixing of concrete in the intertidal zone. No dumping of construction materials or excess concrete in the intertidal and subtidal zones. Wind screening (e.g. fine –mesh shade cloth fencing, or solid fencing) must be installed to prevent excessive wind-blown sand and light-weight solid waste (e.g. litter) entering the Coega Estuary Dust or sand suppression should be undertaken by watering down and limiting activity in windy conditions Conduct a comprehensive environmental awareness programme amongst contracted construction personnel about sensitive estuarine/marine habitats and good house-keeping.	Very Low
Spills of hazardous substances	Chemical pollution	High	The laydown area must not be established within a high-risk area (i.e. the Coega Estuary or below the high water mark); The establishment and operation of the laydown area/site camp must follow a stringent Environmental Management Programme; Sufficient ablution facilities must be provided for construction personnel and sited away	Low

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
			from high-risk areas. These must be frequently cleared (preferably every two weeks depending on the number of staff); The laydown area must be adequately protected against adverse weather conditions, particularly the chemical storage areas, to prevent erosion and run-off of contaminants into the Port; A Spill Prevention and Management Plan must be compiled and implemented. In the event of any significant spill the TNPA must be notified; A method statement in respect to the use, handling, storage and disposal of all chemicals as well as anticipated generated waste, must be compiled and submitted as part of any Environmental Management Programme; Ensure correct handling, storage and disposal procedures followed (e.g. bunded storage areas to contain 110% of volume); Maintain vehicles and equipment - no leaking vehicles or equipment to be permitted on site. All vehicles and machinery must be parked or stored on an impervious surface; Conduct a comprehensive environmental awareness programme amongst contracted construction personnel about sensitive estuarine and marine habitats and the need for careful handling and management of chemical substances; and In the event of a spill, a penalty should be issued and the 'polluter pays' principle should be applied for clean-up operations and rehabilitation, if necessary.	
INDIRECT IMPACTS				
Coastal location of the proposed activity within a Port, and the link into the existing Dedisa Substation located approximately 6 km inland from the Port	Impact of dynamic coastal processes	High	Locate transmission lines along the preferred route – i.e., along existing roads During the construction of the transmission lines, the removal of endemic vegetation should be limited, however, invasive alien vegetation invasion in respect to disturbed areas must be removed and controlled. Dust or sand suppression should be undertaken by watering down and limiting activity in windy conditions. The Gas to Power operation must be aware of TNPA Environmental Management Systems as well as emergency preparedness and response procedures and apply such on an ongoing basis and in the event of emergencies, for example, tidal surge, dust storms and other extreme events. Consideration must be taken of sediment transport routes and the impact the construction of the transmission lines will have on this as well as the impact the liberated sand will have on it – innovative design solutions which will avoid the build-up of sand and possible damage to transmission infrastructure should be considered. Any areas disturbed should be rehabilitated. Coastal development must be designed to build resilience to the impacts of climate change and sea-level rise Environmental quality control and monitoring of construction and operational activities required	Medium-Low
Location of the transmission lines	Restriction of coastal access	High	Areas required to be restricted outside of the confines of the Port, as a result of health, safety and security concerns, must be properly cordoned off with signage installed indicating the reason for such restriction. The preferred alternative from a coastal access perspective is to follow existing servitudes to minimise disruption to coastal access during the operation phase. During construction, the need for coastal access should specifically be taken into	High

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
			consideration in the development of site-specific environmental management programme (EMPr).	

8.4.9.2 *Laydown Area and Stringing Yard: Construction Phase*

The construction of laydown area within the estuarine functional zone will result in the loss of estuarine habitat. This Medium negative impact can be mitigated to Low negative impact significance. The disturbance/mortality of estuarine/beach fauna will have High negative impact in terms of significance without mitigation, and Medium negative with mitigation. Solid waste pollution from construction activities will have a Medium-High negative impact that can be reduced to Very Low negative impact. The spill of hazardous substances can result in chemical pollution, a High negative impact. This can be safely mitigated to a Low negative impact significance. The coastal location of the proposed activity can have a High negative impact of dynamic coastal processes, but can be mitigated to a Medium-Low negative impact.

It should be noted that while the assessment of the restriction of coastal access indicates a high impact, the restriction of access within Port areas and for the purposes of protecting persons is considered both reasonable and in the interests of the public, and can therefore be excluded from any calculation of impact.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Construction of laydown area within the estuarine functional zone	Loss of estuarine habitat	Medium	Noteworthy vegetated areas must be avoided in the siting and enclosure of the laydown area/stringing yard. During the construction of the transmission lines, the removal of endemic vegetation should be limited, however, invasive alien vegetation invasion in respect to disturbed areas must be removed and controlled. Pylons along the alternate route must be located outside of EFZ Beach environment to be rehabilitated to pre-establishment conditions as part of decommissioning Construction must be undertaken according to a site-specific approved Environmental Management Programme (EMPr) and must be monitored by an on-site environmental officer. All solid waste must be removed to an appropriate disposal facility In the event of a large-scale marine pollution event, every effort must be made to prevent it reaching and negatively impacting the Coega Estuary, even though the system is ephemeral and often closed. Dust or sand suppression should be undertaken by watering down and limiting activity in windy conditions.	Low

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
			The Gas to Power operation must be aware of TNPA Environmental Management Systems as well as emergency preparedness and response procedures and apply such on an ongoing basis and in the event of emergencies, for example, tidal surge, dust storms and other extreme events.	
Construction activities, noise and potential pollution from laydown area	Disturbance/mortality of estuarine/beach fauna	High	The surrounding area must be surveyed prior to construction/camp establishment to determine the presence of nesting birds and these must cordoned off where possibly or be safely relocated if necessary. The conservation authority must be contacted for the relocation of birds/ wildlife. No animals (birds, reptiles, mammals) are to be disturbed unnecessarily and no animals are allowed to be shot, trapped or caught for any reason. Conduct a comprehensive environmental awareness programme amongst contracted construction personnel about sensitive estuarine and coastal habitats and fauna. Assembly and launching of the pipeline from the breakwater. Restrict access to laydown area/stringing yard only, i.e. keep vehicle access to other beach areas to a minimum. Restrict vehicles to clearly demarcated access routes and construction areas only. Only allocated access points to the beach be used. Construction activities, specifically excavation and moving/transporting of large components, to be restricted to daylight hours to prevent potential disturbance to roosting bird populations, and the core estuarine area Construction vehicles, plant and machinery must be well maintained and fitted with silencers. Regular maintenance on vehicle and equipment undertaken. In response to possible pollution as a result of Shipping activities: o Provide an inventory of waste produced and the nature of waste being produced and cooperate with the TNPA in every way. o A requirement to report environmental accidents and emergencies immediately they occur, to the port captain. o A Formal Failure Analysis (FFA) must be conducted to conclude each incident investigation in order to inform preventative measures to be taken in future. o Training of emergency response teams to deal with environmental implications of an emergency in addition to the safety implications. In the event of a large-scale marine pollution event, every effort must be made to prevent it reaching and negatively impacting the beach and estuarine environment.	Medium
Construction activities	Solid waste pollution	Medium-High	Construction workers and operational staff to adopt best practice waste minimisation procedures. Implement the correct handling and disposal procedures for general and hazardous waste. Reduce the amount of waste generated from the construction phase by means of efficient operations and recycling of general waste. Good housekeeping to be done daily. No mixing of concrete in the intertidal zone. No dumping of construction materials or excess concrete in the intertidal and subtidal zones. Wind screening (e.g. fine –mesh shade cloth fencing, or solid fencing) must be installed to	Very Low

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
			prevent excessive wind-blown sand and light-weight solid waste (e.g. litter) entering the Coega Estuary Dust or sand suppression should be undertaken by watering down and limiting activity in windy conditions Conduct a comprehensive environmental awareness programme amongst contracted construction personnel about sensitive estuarine/marine habitats and good house-keeping.	
Spills of hazardous substances	Chemical pollution	High	The laydown area must not be established within a high-risk area (i.e. the Coega Estuary or below the high water mark); The establishment and operation of the laydown area/site camp must follow a stringent Environmental Management Programme; Sufficient ablution facilities must be provided for construction personnel and sited away from high-risk areas. These must be frequently cleared (preferably every two weeks depending on the number of staff); The laydown area must be adequately protected against adverse weather conditions, particularly the chemical storage areas, to prevent erosion and run-off of contaminants into the Port; A Spill Prevention and Management Plan must be compiled and implemented. In the event of any significant spill the TNPA must be notified; A method statement in respect to the use, handling, storage and disposal of all chemicals as well as anticipated generated waste, must be compiled and submitted as part of any Environmental Management Programme; Ensure correct handling, storage and disposal procedures followed (e.g. bunded storage areas to contain 110% of volume); Maintain vehicles and equipment - no leaking vehicles or equipment to be permitted on site. All vehicles and machinery must be parked or stored on an impervious surface; Conduct a comprehensive environmental awareness programme amongst contracted construction personnel about sensitive estuarine and marine habitats and the need for careful handling and management of chemical substances; and In the event of a spill, a penalty should be issued and the 'polluter pays' principle should be applied for clean-up operations and rehabilitation, if necessary.	Low
INDIRECT IMPACTS				
Coastal location of the proposed activity within a Port, and the link into the existing Dedisa Substation located approximately 6 km inland from the Port	Impact of dynamic coastal processes	High	Dust or sand suppression should be undertaken by watering down and limiting activity in windy conditions. The Gas to Power operation must be aware of TNPA Environmental Management Systems as well as emergency preparedness and response procedures and apply such on an ongoing basis and in the event of emergencies, for example, tidal surge, dust storms and other extreme events. Environmental quality control and monitoring of construction and operational activities required	Medium-Low

8.4.9.3 Powership and Gas Pipeline Alternative 1: Operational Phase

Noise and light pollution will have a High negative impact on the coastal/estuarine birds and cannot be mitigated below a High negative significance. Similarly, the discharge of heated water from the cooling process will have a Medium-High negative impact on the water quality, and cannot be mitigated below Medium-High negative significance. A gas explosion will have Medium-Low impact resulting in fauna mortalities and habitat destruction and can be mitigated to a Low negative impact significance.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Noise and light pollution	Disturbance to coastal/estuarine associated birds	High	All supporting plant and machinery must be well maintained and fitted with silencers Acoustic enclosures must be installed around all major noise emitting components to supress the noise emissions from equipment, such as engines Powerships and supporting components must be fitted low emission light fittings Where possible, lighting (e.g. spotlights) must be diverted away from the shoreline Lighting during night-time must be limited to essential lighting only Biannual bird monitoring of species utilising beach and estuary mouth must be undertaken to assess any level of disturbance	High
Discharge of heated cooling water	Change in water quality at the estuary mouth	Medium-High	Discharge of heated cooling water must be maintained at the required depth to reduce adverse thermal effects on marine/estuarine biota in the mouth region during open mouth conditions Powerships must be adequately distanced from the estuary mouth to reduce adverse thermal effects of marine/estuarine biota in the mouth region during open mouth conditions	Medium-High
Gas explosion	Mortalities of coastal estuarine associated fauna and habitat destruction	Medium-Low	Strict adherence to TNPA pollution, emergency, and health and safety protocols, MARPOL and other applicable maritime legislation and policies for the storage and handling of LNG, and power generation processes. Comprehensive safety checks frequently undertaken of all project components and processes. Frequent risk assessments and adaptive management where required.	Low
INDIRECT IMPACTS				
Location of the transmission lines	Restriction of coastal access	High	Areas required to be restricted outside of the confines of the Port, as a result of health, safety and security concerns, must be properly cordoned off with signage installed indicating the reason for such restriction. The preferred alternative from a coastal access perspective is to follow existing servitudes to minimise disruption to coastal access during the operation phase. During construction, the need for coastal access should specifically be taken into consideration in the development of site-specific environmental management programme (EMPr).	High

8.4.9.4 Powership and Gas Pipeline Alternative 2: Operational Phase

Noise and light pollution will have a High negative impact on the coastal/estuarine birds and can be mitigated to a Medium-High negative significance. The discharge of heated water from the cooling process will have a Medium negative impact on the water quality, and cannot be mitigated below Medium negative significance. A gas explosion will have Medium-Low impact resulting in fauna mortalities and habitat destruction and can be mitigated to a Low negative impact significance.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Noise and light pollution	Disturbance to coastal/estuarine associated birds	High	All supporting plant and machinery must be well maintained and fitted with silencers Acoustic enclosures must be installed around all major noise emitting components to supress the noise emissions from equipment, such as engines Powerships and supporting components must be fitted low emission light fittings Where possible, lighting (e.g. spotlights) must be diverted away from the shoreline Lighting during night-time must be limited to essential lighting only Biannual bird monitoring of species utilising beach and estuary mouth must be undertaken to assess any level of disturbance	Medium-High
Discharge of heated cooling water	Change in water quality at the estuary mouth	Medium	Discharge of heated cooling water must be maintained at the required depth to reduce adverse thermal effects on marine/estuarine biota in the mouth region during open mouth conditions Powerships must be adequately distanced from the estuary mouth to reduce adverse thermal effects of marine/estuarine biota in the mouth region during open mouth conditions	Medium
Gas explosion	Mortalities of coastal estuarine associated fauna and habitat destruction	Medium-Low	Strict adherence to TNPA pollution, emergency, and health and safety protocols, MARPOL and other applicable maritime legislation and policies for the storage and handling of LNG, and power generation processes. Comprehensive safety checks frequently undertaken of all project components and processes. Frequent risk assessments and adaptive management where required.	Low
INDIRECT IMPACTS				
Location of the transmission lines	Restriction of coastal access	High	Areas required to be restricted outside of the confines of the Port, as a result of health, safety and security concerns, must be properly cordoned off with signage installed indicating the reason for such restriction. The preferred alternative from a coastal access perspective is to follow existing servitudes to minimise disruption to coastal access during the operation phase. During construction, the need for coastal access should specifically be taken into consideration in the development of site-specific environmental management programme (EMPr).	High

8.4.10 Marine Impacts

The impacts identified of the alternative powership/FSRU configuration will be identical to those of the preferred alternative, and were not assessed separately. Therefore, the assessment table below refers to both alternatives.

8.4.10.1 Powership and Gas Pipeline Alternatives 1 and 2: Operational Phase

Four potentially significant impacts of the proposed FPP facility on the surrounding marine ecology at the Port of Ngqura were identified, and three of them assessed thus far. No mitigation measures beyond those built into the project design are required, and so the ratings would remain unchanged. The three assessed impacts will have a Low to Very Low impact on the marine ecology. It was also concluded that there is not enough information about underwater noise and vibration levels from floating power plant ships to conduct an assessment. Therefore, general sound levels from commercial vessels were presented as the biological thresholds of sensitive receptors.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Gas pipeline construction and installation and vessel mooring	Disturbance of benthic habitat and modification of the community structure	Very Low	No mitigation proposed.	Very Low
Uptake of cooling water	Ecological damage caused by entrainment	Low	No mitigation proposed.	Low
Discharge of cooling water	Raised water temperatures could affect benthic crustacean families, and fish larvae and juveniles that could not move away from the affected area	Low	No mitigation proposed.	Low

8.4.11 Air Quality Impacts

The impacts to air quality will be identical for both powerships-FSRU alignment alternatives. The spatial distance between the alternatives will not affect the total emissions. Wind effects for both alternatives will be similar and will therefore not change the dispersion of emissions.

8.4.11.1 Powership and Gas Pipeline Alternatives 1 and 2: Operational Phase

The increase in ambient concentrations of SO_2, NO_2 and PM_{10} will have Very Low negative impacts. No mitigation measures are required.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Operation of powerships, the FSRU and the LNG supply vessel.	Increase in ambient concentration of SO_2	Very Low	No mitigation proposed.	Very Low
Operation of powerships, the FSRU and the LNG supply vessel.	Increase in ambient concentration of NO_2	Very Low	No mitigation proposed.	Very Low
Operation of powerships, the FSRU and the LNG supply vessel.	Increase in ambient concentration of PM_{10}	Very Low	No mitigation proposed.	Very Low

8.4.12 Heritage, Archaeology and Palaeontological Impacts

The impacts to heritage resources for the Alternative 3 route alignment will be similar to those assessed for Preferred Alternative. This is due to the similarity in the alignment of the two alternatives. Therefore, the assessment table below refers to both transmission line alternatives.

8.4.12.1 Transmission Line Alternative 1 and 3: Construction Phase

Buried archaeological remains such as stone tools, and shell midden deposits may be uncovered, exposed or destroyed. This Medium-Low negative impact can be mitigated to Low negative impact significance. Exposing, intercepting or destroying unmarked Khoisan human remains will have a Medium negative impact significance which can be mitigated to Low negative significance.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Vegetation clearing operations, road construction activities, and excavations for powerline footings	Buried archaeological remains such as stone tools, and shell midden deposits may be uncovered, exposed or destroyed.	Medium-Low	No archaeological mitigation is required prior to construction operations commencing. Vegetation clearing operations in Zone 7 must be monitored by a professional archaeologist. Excavations for new roads, services, and powerline footings must be inspected/monitored by a professional archaeologist. If any unmarked human remains are exposed or intercepted during construction operations, these must be immediately reported to the contracted archaeologist. The above recommendations must be included in the Environmental Management Plan (EMP) for the proposed development.	Low

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
Earthworks and construction	Unmarked Khoisan human remains may be exposed, intercepted or destroyed.	Medium	No archaeological mitigation is required prior to construction operations commencing. Vegetation clearing operations in Zone 7 must be monitored by a professional archaeologist. Excavations for new roads, services, and powerline footings must be inspected/monitored by a professional archaeologist. If any unmarked human remains are exposed or intercepted during construction operations, these must be immediately reported to the contracted archaeologist. The above recommendations must be included in the Environmental Management Plan (EMP) for the proposed development.	Low

8.4.12.2 Transmission Line Alternative 1 and 3: Operational Phase

Maintenance activities may uncover, expose or destroy buried archaeological remains such as stone tools, and shell midden deposits. This Medium-Low negative impact can be mitigated to Low negative impact significance. Exposing, intercepting or destroying unmarked Khoisan human remains during maintenance will have a Medium negative impact significance which can be mitigated to Low negative significance.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Vegetation clearing operations, road construction activities, and excavations for powerline footings	Buried archaeological remains such as stone tools, and shell midden deposits may be uncovered, exposed or destroyed.	Medium-Low	No archaeological mitigation is required prior to construction operations commencing. Vegetation clearing operations in Zone 7 must be monitored by a professional archaeologist. Excavations for new roads, services, and powerline footings must be inspected/monitored by a professional archaeologist. If any unmarked human remains are exposed or intercepted during construction operations, these must be immediately reported to the contracted archaeologist. The above recommendations must be included in the Environmental Management Plan (EMP) for the proposed development.	Low
Earthworks and construction	Unmarked Khoisan human remains may be exposed, intercepted or destroyed.	Medium	No archaeological mitigation is required prior to construction operations commencing. Vegetation clearing operations in Zone 7 must be monitored by a professional archaeologist. Excavations for new roads, services, and powerline footings must be inspected/monitored by a professional archaeologist. If any unmarked human remains are exposed or intercepted during construction operations, these must be immediately reported to the contracted archaeologist. The above recommendations must be included in the Environmental Management Plan (EMP) for the proposed development.	Low

8.4.13 Material Hazards Impacts

The impacts from MHI will be similar for both powerships-FSRU alignment alternatives. This is because the same ships will used for both alternatives. The only difference will be in the alignment and positioning of the ships.

8.4.13.1 Powership and Gas Pipeline Alternatives 1 and 2: Operational Phase

The rupture of a transfer hose can discharge of LNG into the marine environment leading to a flash and pool fire. This High negative impact can be mitigated to Medium negative significance.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
INDIRECT IMPACTS				
Rupture of one of the transfer hoses	Discharge of LNG into the marine environment leading to a flash and pool fire	High	Good housekeeping always needs to be observed on site; The Emergency Plan must comply with the MHI Regulations; The updated MHI report must be distributed to Local, Provincial and National Government as per MHI Regulations; Only suitably qualified people must be used for all installation work. All applicable certificates of conformance must be on site. There must be an operational manual for each operation.	Medium

8.4.14 Socio-Economic Impacts

Both project alternatives will have identical socio-economic impacts. The alignments and positioning of the elements of the project alternatives will not change their socio-economic impacts. Therefore, the assessment table below refers to both alternatives.

8.4.14.1 Transmission Line Alternatives 1 and 3, Powership and Gas Pipeline Alternatives 1 and 2: Construction Phase

Stimulation of production, employment, government revenue, skills development, household income, increased electricity supply, and socio-economic and enterprise development as a result of the investment in the project and its subsequent operations will have Medium to High positive impacts as a result of the project. These will outweigh the Low negative impacts of possible production, employment and household income losses that could potentially be experienced by local businesses affected by changes in the areas sense of place, social conflicts and deterioration in economic and social infrastructure.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Direct spend within local economies such as trade, accommodation, transport services, personal services, real estate, and insurance	Temporary stimulation of the national and local economy	High (Positive)	The developer should encourage the EPC contractor to increase the local procurement practices and promote the employment of people from local communities, as far as feasible, to maximise the benefits to the local economies. The developer should engage with local authorities and business organisations to investigate the possibility of procuring construction materials, goods and products from local suppliers where feasible.	High (Positive)
Employment during construction of the transmission line	Temporary increase in employment in the national and local economies	High (Positive)	Organise local community meetings to advise the local labour force about the project that is planned to be established and the jobs that can potentially be applied for. Establish a local skills desk (in uMhlathuze LM) to determine the potential skills that could be sourced in the area. Recruit local labour as far as feasible. Employment of labour-intensive methods in construction where feasible. Sub-contract to local construction companies particularly SMME's and BBBEE compliant and women-owned enterprises where possible. Use local suppliers where feasible and arrange with the local SMME's to provide transport, catering and other services to the construction crew	High (Positive)
Skills Development during construction of the transmission line	Contribution to skills development in the country and local economy	Medium-Low (Positive)	Facilitate knowledge and skills transfer between foreign technical experts and South African professionals during the pre-establishment and construction phases. Set up apprenticeship programmes to build onto existing skill levels or develop new skills amongst construction workers especially those from local communities.	Medium (Positive)
Employment during construction of the transmission line	Temporary increase in household earnings	Medium (Positive)	Recruit local labour as far as feasible to increase the benefits to the local households. Employ labour intensive methods in construction where feasible. Sub-contract to local construction companies where possible. Use local suppliers where feasible and arrange with local SMME's and BBBEE compliant enterprises to provide transport, catering and other services to the construction crews.	Medium (Positive)
Combination of personal income tax, VAT, companies' tax, etc. by companies and employees during construction of the transmission line	Temporary increase in government revenue	Medium (Positive)	None suggested.	Medium (Positive)
Influx of construction workers into the area	Temporary increase in social disruptions associated with the influx of people	Medium-Low	Set up a recruitment office in Port of Ngqura and adhere to strict labour recruitment practices that would reduce the desire of potential job seekers to loiter around the properties in the hope of finding temporary employment. Control the movement of workers between the site and areas of residence to minimise loitering around the site. This should be achieved through the provision of scheduled transportation services between the construction site and area of residence. Employ locals as far as feasible through the creation of a local skills database. Establish a management forum comprising key stakeholders to monitor and identify potential problems that may arise due to the influx of job seekers to the area.	Low

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
			Ensure that any damages or losses to nearby buildings that can be linked to the conduct of construction workers are adequately reimbursed. Assign a dedicated person to deal with complaints and concerns of affected parties	
Influx of worker during construction of the transmission line	Impact on economic and social infrastructure	Medium-Low	Provide adequate signage along relevant road networks to warn the motorists of the construction activities taking place on the site. Engage with local authorities and inform them of the development as well as discuss with them their ability to meet the additional demands on social and basic services created by the in migration of workers. Where feasible, assist the municipality in ensuring that the quality of the local social and economic infrastructure does not deteriorate through the use of social responsibility allocations.	Low
Increase in local traffic and in migration of construction workers	Changes to the sense of place	Low	The mitigation measures proposed by the visual and noise specialists should be adhered to Efforts should also be made to avoid disturbing such sites during construction.	Low

8.4.14.2 Transmission Line Alternatives 1 and 3, Powership and Gas Pipeline Alternatives 1 and 2: Operational Phase

Sustainable increase in production and GDP and the creation of sustainable employment are both High positive impact. Skills development will have a Medium positive impact while improved standard of living and sustainable increase in government revenue will have Medium-High impact significance. Provision of electricity for future development will have a High positive impact significance. Local economic and social development benefits will have a Medium-High positive impact. The increase in local traffic and new workers will result in Low negative impact to changes to the sense of place.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Spending on labour and procurement of local goods and services	Sustainable increase in production and GDP nationally and locally	High (Positive)	The operator of the Powerships and related infrastructure should be encouraged to, as far as possible, procure materials, goods and products required for the operation of the facility from local suppliers to increase the positive impact in the local economy.	High (Positive)
Creation of FTE employment positions	Creation of sustainable employment positions nationally and locally	High (Positive)	Where possible, local labour should be considered for employment to increase the positive impact on the local economy. As far as possible, local small and medium enterprises should be approached to investigate the opportunities for supply inputs required for the maintenance and operation of the Powerships and related infrastructure.	High (Positive)
Skills development contributions by Karpowership	Skills development of permanently employed workers	Medium-Low (Positive)	The developer should consider establishing vocational training programmes for the local labour force to promote the development and transfer of skills required by the Powerships and their related infrastructure and thus provide for the opportunities for these people to be employed in other similar facilities elsewhere.	Medium (Positive)

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
Additional personal income for FTE employment positions	Improved standards of living for benefiting households	Medium-High (Positive)	Where possible, the local labour supply should be considered for employment opportunities to increase the positive impact on the area's economy. As far as feasible, local small and medium enterprises should be approached to investigate the opportunities for supply inputs required for the maintenance and operation of the Powerships and their related infrastructure.	Medium - High (Positive)
Salaries and wages payments	Sustainable increase in national and local government revenue	Medium-High (Positive)	None suggested.	Medium - High (Positive)
Increasing of the electricity supply	Provision of electricity for future development	High (Positive)	None suggested.	High (Positive)
Karpowership's involvement in programmes that seek to address the local communities social and economic needs	Local economic and social development benefits derived from the project's operations	Medium (Positive)	A social development and economic development programmes should be devised by the developer throughout the project's lifespan. The plan should be developed in consultation with local authorities and local communities to identify community projects that would result in the greatest social benefits. These plans should be reviewed on an annual basis and, where necessary, updated. When identifying enterprise development initiatives, the focus should be on creating sustainable and self-sufficient enterprises. In devising the programmes to be implemented, the developer should take into account the priorities set out in the local IDP.	Medium - High (Positive)
Increase in local traffic and new workers	Negative changes to the sense of place	Low	The mitigation measures proposed by the visual and noise specialists should be adhered to Efforts should also be made to avoid disturbing such sites during operation.	Low

8.4.15 Visual Impacts

The impacts to visual impacts for the Alternative 3 will be similar to those assessed for Preferred Alternative. This is due to the similarity in the alignment of the two alternatives. Therefore, the assessment table below refers to both transmission line alternatives.

8.4.15.1 Transmission Line Alternative 1 and 3: Operational Phase

The powerships and FSRU obstructing views from urban areas and particularly the coastal settlements of St George's Strand and Bluewater Bay, from conservation areas including the Addo Elephant Park and the Swartkops Valley Local Nature Reserve, from routes through the area particularly the N2 and from beaches particularly to the south east on the seaward side of the coastal dune close to of St George's Strand and Bluewater Bay will all have Very Low negative impact significance.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Viewing from urban areas and particularly the coastal settlements of St George's Strand and Bluewater Bay	Obstruction of view	Very Low	No mitigation proposed.	Very Low
Viewing from conservation areas including the Addo Elephant Park and the Swartkops Valley Local Nature Reserve	Obstruction of view	Very Low	No mitigation proposed.	Very Low
Viewing from routes through the area particularly the N2	Obstruction of view	Very Low	No mitigation proposed.	Very Low
Viewing from beaches particularly to the south east on the seaward side of the coastal dune close to of St George's Strand and Bluewater Bay	Obstruction of view	Very Low	No mitigation proposed.	Very Low

8.4.16 Noise Impacts

The impacts from noise will be similar for both transmission line alternatives in the construction phase and both powerships-FSRU alignment alternatives. This is because the same ships will used for both alternatives. The only difference will be in the alignment and positioning of the ships. Noise impacts for the alternative powership-FSRU layout were therefore not assessed separately. The transmission lines follow a similar route alignment, hence their impacts are anticipated to be similar.

8.4.16.1 Transmission Line Alternative 1 and 3: Construction Phase

With the effective implementation of the recommended mitigation measures, the residual Medium-Low noise impact associated with construction activities are predicted to be of Very Low significance. The noise impact on Jahleel Island could be a concern as there is not enough information currently available to determine what the effect of approximately 54 dB(A) will be on the breeding colonies of African penguins on this island. The ambient noise could not be directly measured to gauge whether the predicted noise levels exceed the current ambient noise. A separate review by an ornithologist should be considered in this regard.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Construction of Transmission Line	Nuisance to surrounding operations or landowners	Medium-Low	• All construction operations should only occur during daylight hours if possible. • No construction piling should occur at night where possible. Piling should only occur during the day to take advantage of unstable atmospheric conditions. • Construction staff should receive "noise sensitivity" training such as switching off vehicles when not in use, location of NSA's etc. • An ambient noise survey should be conducted at the noise sensitive receptors during the construction phase.	Very Low

8.4.16.2 Powership and Gas Pipeline Alternatives 1 and 2: Operational Phase

The Medium-High noise impact associated with the operational activities of the proposed project is predicted to be of Medium-Low significance after mitigation on the Port of Ngqura and CDC tenants.

	RISK/ ASPECT DESCRIPTION	OVERALL SIGNIFICANCE (PRE-)	MITIGATION OF IMPACTS	OVERALL SIGNIFICANCE (POST-)
DIRECT IMPACTS				
Operation of powership, FSRU and LNG carrier	Nuisance disturbance to operations within the port	Medium-High	• The noise impact from the proposed project should be measured during the operational phase, to ensure that the impact is within the required legal limit. • An avifauna specialist should be consulted to determine the effects that an increase in noise levels will have on the Damara Tern Colony. • Install acoustic enclosures around all major noise emitting components to supress the noise emissions from equipment such as engines. • Install Silencers on equipment such as exhaust stacks and turbo chargers.	Medium-Low

8.4.17 NO-GO ALTERNATIVE

Should the Karpowership gas-to-energy project is not implemented, the benefits of the proposed activity will not be realised (with the status quo remaining) and neither will the associated negative impacts/risks. This means that the supply of additional electricity to the national grid will not be supplemented by an IPP. The status quo with regard to the national supplier will remain, i.e. the national grid will continue to be strained as a result of aging and failing systems within the fleet. This will be exacerbated by the time taken for the national supplier to design, assess, receive authorisation, construct and bring online any new power generation facilities. The negative impacts on the physical and social environmental will also not occur. In contrast, any positive impacts or opportunities that will be created by the proposed development, such as job creation or social upliftment, will not be realised.

Table 8-7: Impact of implementing the No-Go Alternative.

Aspect	Impact	Significance
Terrestrial ecology	No loss of Intact Bontveld, Species of Conservation Concern and biodiversity.	Medium-High (Positive)
Avifauna	There will be no disturbance to avifauna on Jahleel Island due to atmospheric noise and lights.	Medium (Positive)
Wetlands	No impact to the wetland units Rip01.	Medium (Positive)
Hydropedology	No impacts on hydropedological flow drivers, soil quality or potential to compromise surface water quality in the nearby watercourse.	Medium-Low (Positive)
River and riparian (aquatic)	Not assessed.	N/A
Hydrology	No impact of sedimentation or contamination of surface water.	Medium-Low (Positive)
Geohydrology	No impacts to the vadose zone or quality of the groundwater resources	Medium (Positive)
Climate Change	The electricity baseload which would have been provided by the Powerships will be procured elsewhere to stabilize the national grid, potentially from a higher-emitting fuel source such as coal or heavy fuel oil (HFO).	High (Negative)
Estuarine	No disturbance/mortality of estuarine/beach fauna or injury / mortality of coastal/estuarine associated birds caused by the overhead transmission lines.	High (Positive)
Marine Ecology	No impacts to the benthic community, the marine ecology or marine organisms.	Low (Positive)
Air quality	No health risks through inhalation of air pollutants	Very Low (Positive)
Heritage, archaeology and palaeontology	No buried archaeological remains such as stone tools, shell midden deposits or unmarked Khoisan human remains may be uncovered, exposed or destroyed.	Medium-Low (Positive)
Major Hazard Risks	No risks of major hazards such as flash and pool fires	Medium (Positive)
Socio-economic	No influx of workers and job seekers from outside of the local community, no increase in impact on the	Medium-Low (Positive)

	surrounding economic and social infrastructure, no limited visual and noise disturbances	
	No contribution towards the national and local economy through new business sales, contribution to GDP or employment.	High (Negative)
Visual	No obstruction of views.	Very Low (Positive)
Noise	Ambient noise levels both above ground and underwater will remain the same and not cause a nuisance or any adverse impacts on sensitive receptors.	Medium-Low (Positive)

The following benefits could occur if the no-go alternative is implemented:

- No loss of Intact Bontveld, Species of Conservation Concern and biodiversity.
- There will be no disturbance to avifauna on Jahleel Island due to atmospheric noise and lights. African Penguins, who are the most sensitive receptor for underwater noise and avoid areas of very high noise will not be impacted on and there will be no negative impact to their breeding population.
- There will be no negative impacts (such as contamination and sedimentation, or destruction of vegetation) on the wetland identified along the transmission line route. This will mean that the wetland will remain in its current state.
- No impacts on hydropedological flow drivers, soil quality or potential to compromise surface water quality in the nearby watercourse.
- No sedimentation or contamination of surface water from construction or operation activities.
- There will be no impacts to the vadose zone or quality of the groundwater resources.
- No impacts to the benthic community, the marine ecology or marine organisms.
- The primary direct impact of not implementing the proposed project relates to a missed opportunity to align with South Africa's prevailing energy policy, the Integrated Resource Plan which calls for diversification of electricity supply sources, including natural gas in the transition to an energy mix dominated by renewables in the long-term. The result — a transitional risk — is likely to be that the electricity baseload which would have been provided by the Powerships will be procured elsewhere to stabilize the national grid, potentially from a higher-emitting fuel source such as coal or heavy fuel oil (HFO).
- No disturbance/mortality of estuarine/beach fauna during construction or injury / mortality of coastal/estuarine associated birds caused by the overhead transmission lines during operations.
- No increase in ambient concentration of SO_2, NO_2 and PM_{10}, resulting in no health risks through inhalation of air pollutants.
- No buried archaeological remains such as stone tools, shell midden deposits or unmarked Khoisan human remains may be uncovered, exposed or destroyed.
- No risks of major hazards such as flash and pool fires.
- No influx of workers and job seekers from outside of the local community, no impact on the surrounding economic and social infrastructure, no limited visual and noise disturbances that could be created by the construction activities as the footprint of the facility grows and no potential changes in the sense of place.
- No obstruction of views when viewing from the coastal settlements of St George's Strand and Bluewater Bay, from conservation areas including the Addo Elephant Park and the Swartkops Valley Local Nature Reserve, from routes through the area particularly the N2, and viewing from beaches particularly to the south east on the seaward side of the coastal dune close to of St George's Strand and Bluewater Bay.

- The ambient noise levels both above ground and underwater will remain the same and not cause a nuisance or any adverse impacts on sensitive receptors.

In contrast to the above, the following implications will occur if the no-go alternative is implemented:

- There will be no notable contribution towards the national and local economy during the construction phase. The estimated total of R653.5 million of new business sales, R186.8 million of GDP and 776 FTE employment positions will not be generated by the project in the national economy through multiplier effects. Aside from the above positive effects, the project will not contribute to skills development in the country, increase government revenue, or raise household earnings by R89.1 million. The no increase in household earnings is also likely to not improve the standards of living of the affected households temporarily during the construction phase.
- The non-operation of the proposed Powerships and their associated infrastructure will not generate R528.6 million of new business sales, contribute R321.0 million to GDP or create 288 sustainable FTE employment positions. In addition, government revenue will not rise, electricity supply will not be increased, and various socio-economic and enterprise development initiatives will not be undertaken from the revenue generated by the development. These funds will not be allocated towards socio-economic development in the area and will not bring a significant benefit to local communities.

While the no-go alternative will not result in any negative environmental impacts, it will also not result in any positive socio-economic benefits. It will also not assist government in addressing its set target for a sustainable energy supply mix, nor will it assist in supplying the increasing electricity demand within the country. Hence the “no-go” alternative is not the preferred alternative.

8.4.18 CUMULATIVE IMPACTS

The preceding impact assessment assessed the impacts associated with the proposed project largely in isolation. As per the legislated requirements, cumulative impacts associated with a proposed development must be assessed.

A cumulative impact, in relation to an activity, is the incremental impact of 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 from similar or diverse activities. Cumulative impacts can take place frequently and over a period of time that the effects cannot be assimilated by the environment over time.

The cumulative impacts have been assessed by identifying other similar project proposals and other applicable projects, such as gas-to-energy or electricity generation, and transmission or distribution facilities within 10 km of the proposed Karpowership gas-to-power project that have either been approved or are currently underway.

Given the similar proposed projects and current operations within close proximity to the study area, cumulative impacts can potentially occur. Anticipated cumulative impacts, based on information available at the time of the assessment, and as relevant to this powership project, were assessed and included in the EIA report.

Regarding other proposed projects in the area, it must be noted that limited information was available. At this stage, the approach of the Independent Power Producer (IPP) Procurement Programme is not clear, and it will have to be further confirmed whether only one bidder or more will be selected for the programme, and as such, will affect the potential cumulative impacts. Furthermore, at this stage, only the proposed scope of projects that are currently underway can be assessed (based on information available), and any changes to the scope as a result of the permitting process and the final project outcome (e.g. authorised alternatives) are unknown and thus cannot be assessed.

8.4.18.1 Identification of Similar Developments

The project site is located within the existing and operational port of Ngqura and the COEGA SEZ. This area is characterised by light and heavy industrial operations, with further planning to expand the port and the operations at the SEZ.

Other gas to power projects identified within the area include:

1. 200 MW Risk Mitigation Power Project in the Coega IDZ. The overall project would broadly involve the following components:
    a. A thermal power generating plant, with a generation capacity of 200 MWe;
    b. Storage of Liquefied Natural Gas (LNG) at the power generating plant;
    c. A dedicated mooring for a Floating Storage unit (FSU) within the Port of Ngqura for unloading of LNG from an LNG Carrier (LNGC);
    d. A floating truck carrier to ferry road tankers to and from the FSU Facilities; and
    e. Transport of LNG by road tanker from the Port of Ngqura to the power plant in the Coega SEZ.

2. A DNG Energy (Pty) Ltd Gas to Power Facility and associated infrastructure in Coega 1 within the Jurisdiction of the Nelson Mandela Bay Metropolitan Municipality. This will involve the implementation of a floating storage regasification unit and associated infrastructure.
3. Proposed Coega 1000 MW Gas-to-Power Plant – Zone 10 South, Zone 10 North and Zone 13, for which the EIA is currently in progress.
4. Coega Power Peaking Plant on Zone 13 (existing).

Cumulative effects associated with these similar types of projects include *inter alia*:

- Marine vessel traffic;
- Avifaunal response to underwater noise and atmospheric emissions;
- Increase in GHG emissions;
- Estuarine pollution;
- Increased air emissions;
- Increased noise disturbance;
- Social upliftment; and
- Upgrade of infrastructure and contribution of energy into the National Grid.

Communication was undertaken with CDC, with an independent contractor assessing the cumulative air quality impact assessments for CDC and with SANPARKS requesting information pertaining to cumulative aspects, however, no information has been received to date.

From the various Environmental Authorisations and EIA documents investigated, other proposed or existing developments identified in the area include various powerlines, a sub-station, a HCRW incinerator, a smelter, marine intake and outfall infrastructure, solid and liquid bulk storage facilities, and an automotive manufacturing plant.

From a cumulative impacts perspective, it is not anticipated that the Karpowership gas-to-energy project will result in unacceptable risks or loss to the environment. This is supported by the fact that the proposed project will be located within the IDZ, an area already earmarked and zoned for industrial use. This means that the site, will at some point be used for an industrial purpose. Furthermore, the location of the powerships and FSRU are within the existing port limits and integrate into the daily port operations.

The cumulative impacts have been further separated according to the aspects and are discussed in detail in the subsequent sections.

8.4.18.2 Potential Cumulative Impacts on Terrestrial Ecology

No cumulative impacts were identified for terrestrial ecology.

8.4.18.3 Potential Cumulative Impacts on Avifauna

The main cumulative impacts are for the impact of Underwater Noise and Atmospheric Emissions on African Penguins breeding on the St Croix Island group, particularly those breeding on Jahleel Island. The assessed impact for both Underwater Noise and Atmospheric Emissions increases from Medium-Low for the powership project alone to Medium-High if all sources and potential sources are included. Marine traffic in Algoa Bay is the main source of underwater noise, the Powership project contribution is expected to be relatively small, however Confidence Levels in the assessment are Low as no underwater sound scape is available for Algoa Bay.

The assessed impact for Atmospheric Emissions increases from Low for the powership project to a Cumulative Medium-Low impact that includes dust producing activities at the Bulk Terminal in the Port of Ngqura. Confidence Levels are Low as the effect of air pollution on breeding penguins has not been studied.

Several Gas to Power projects are currently being proposed for the Port of Ngqura / Coega SEZ. There is not room in the Port of Ngqura to accommodate all of these proposals and it is assumed that only one or at most two projects will be approved. It is not possible to assess the cumulative impacts of these projects until there is clarity on which projects will go ahead. The 2000MW Gas to Power project proposed in Zone 10 of the Coega SEZ is located approximately 350m from the Damara Tern colony at its closest point. The impact of this project on Damara Terns is likely to be very much greater than any impacts due to the Powerships project.

Several Gas to Power projects are currently being proposed for the Port of Ngqura / Coega SEZ. There is not room in the Port of Ngqura to accommodate all of these proposals and it is assumed that only one or at most two projects will be approved. It is not possible to assess the cumulative impacts of these projects until there is clarity on which projects will go ahead.

8.4.18.4 Potential Cumulative Impacts on Wetlands

The cumulative loss of wetlands within the Port of Ngqura and surrounding landscape has been extensive within the Port area and moderate to moderately low within the catchment of the port area (e.g: from the industrial and port activities). The further loss of wetlands within the Port of Ngqura and surrounding landscape would result in a

Moderate Negative Cumulative Impact. In terms of mitigation, avoidance (in terms of destruction of wetlands and adhere to the provided buffers) of wetlands would improve the Present Ecological State and the functionality (important services) of the wetlands.

8.4.18.5 Potential Cumulative Impacts on Hydropedology

No cumulative impacts were identified for hydropedology.

8.4.18.6 Potential Cumulative Impacts on River and Riparian (Aquatic) Resources

No cumulative impacts were identified for river and riparian (aquatic) resources.

8.4.18.7 Potential Cumulative Impacts on Hydrology

No cumulative impacts were identified for hydrology.

8.4.18.8 Potential Cumulative Impacts on Geohydrology

No cumulative impacts were identified for geohydrology.

8.4.18.9 Potential Cumulative Impacts on Climate Change

Cumulative climate change impacts for the LNGC project component relate to the emission of greenhouse gases (GHGs) with varying levels of global warming potential (GWP, refer to **Error! Reference source not found.** on page **Error! Bookmark not defined.**). The significance rating of cumulative GHG emissions from the LNGC component is High without mitigation and Medium with mitigation measures applied.

Cumulative climate change impacts for the FSRU project component relate to the emissions of greenhouse gases (GHGs) with varying levels of global warming potential. There is potential for fugitive emissions during the transfer of LNG between the LNGC and FSRU, as well as during transfer from the FSRU to the Powership via the undersea gas pipeline. Given the localized nature of this impact (i.e., at source/site), emission-related risk is lower since fugitive emissions from a leak in the transfer process will likely be quickly identified and rectified as they will directly impact performance and efficiency of the Powership. The impact is also offset to a certain extent by the design specifications of the gas pipeline and hose, particularly related to its diameter. The overall emissions impact of the FSRU project component is consequently of medium and medium-low significance with and without mitigation, respectively.

Operation of the gas pipeline may result in emissions of greenhouse gases with global warming potential from potential leaks. This impact is described and assessed under the FSRU sub-heading above, and the impact scores are consequently the same. It is important to note that the cumulative impact of fugitive GHG emissions should be considered as part of the entire Powership operation since vessels are connected by linear infrastructure to each other.

The operation of the Powerships at Ngqura will emit ~17.04 MT CO_2e over its 20-year lifespan. This impact is potentially significant and needs to be considered cumulatively alongside the emissions from Powership operations at Saldanha Bay and Richards Bay which will generate 15.6 and 20.27 MT $C0_2e$ in their operational lifetimes, respectively. This means that total emissions for the 20-year lifespan of all three proposed Powerships will be ~56

MT $C0_2e$. The average annual emissions for all three Powerships will therefore be ~18.7 MT $C0_2e$, roughly 0.16% of South Africa's annual GHG emissions in 2017. Technological measures to reduce emissions at source as well as potential contributions to appropriate carbon offset, storage or drawdown initiatives can reduce the impact significance to Medium-high.

Contributions to overall project emissions from the construction phase for the 132kV Transmission Lines and steel lattice towers are both rated as Very Low and easily mitigated.

8.4.18.10 Potential Cumulative Impacts on Estuaries

The ICM Act is clear in its directive to not view development activities in isolation from their local and regional contexts, but rather to consider direct and indirect impacts as well as potential cumulative and synergistic impacts of proposed activities in the coastal zone. Assessing cumulative impacts involves examining the impacts of a proposed activity at a coarser scale, and in relation to adjacent and regional activities.

Should the proposed gas to power activity be approved and go ahead, cumulative impacts that may arise include, but not limited to:

- The project will positively impact on the Port and the economic activities related thereto by providing for short term provision of power to the SEZ when the country is experiencing power shortages. The increased electricity generation capacity, when considered as part of the national Integrated Resources Plan (IRP), from the project will contribute to an enabling environment for economic growth; and
- The project might add to the potential polluting activities in the Algoa bay and Port, especially when combined with other shipping and heavy industrial activities, with resultant negative impacts on the Marine Protected Area, conflict with marine mammals and birds as well as the potential introduction of pathogens which could affect mariculture facilities and operations. Such events must be controlled collectively by the TNPA and SAMSA. While issues relating to pollution are not considered to be of greater threat or significance than current port activities, the risk of cumulative impacts to the sensitive marine and estuarine environments increases as activities within the Port increases;

All efforts should be made to mitigate potential negative cumulative impacts identified by considering the proposed development in both a local and regional context in terms of other current and proposed coastal activities.

8.4.18.11 Potential Cumulative Impacts on Marine Ecology

There will be some temporary resuspension of sediment in the water column during the installation of the pipeline and mooring structures on the seabed. Turbidity generated by these construction activities may be advected into surrounding areas but, as each turbidity-generating event is spatially constrained, areas affected are likely to be small. This will cumulatively contribute a small amount to suspended sediment from port maintenance dredging activities. Accordingly, combined with natural episodic high turbidity events, the local biological communities should be acclimatised to elevated turbidity levels.

8.4.18.12 Potential Cumulative Impacts on Air Quality

A background concentration refers to the portion of the ambient concentration of a pollutant due to sources, both natural and anthropogenic, other than the source being assessed. The annual average ambient concentrations of

SO_2, NO_2 and PM_{10} at Saltworks are used as background concentrations to gauge the potential cumulative effect of the Karpowership Project emissions in the Coega SEZ.

For SO_2, in all these cases the area of maximum predicted concentrations occurs in the Coega SEZ. At the point of the predicted maximum, the Karpowership Project will add less than 1 µg/m^3 to the existing annual and 24-hour ambient concentrations and will add a maximum of 1.7 µg/m^3 to the 1-hour concentrations. The cumulative effect will be less than this elsewhere in the Coega SEZ and the remainder of the modelling domain where predicted ambient concentrations are much lower. The cumulative effect of the emissions from the Karpowership Project on ambient SO_2 concentrations is predicted to be very small and will not result in exceedances of the NAAQS. No meaningful difference is expected in the results if the assessment was conducted at the second potential site at the Ngqura Port. Besides the predicted concentrations being very low, the two site alternatives are relatively close to one another.

The predicted SO_2 concentrations resulting from other potential gas-to-power projects in the Coega SEZ have been shown to be very low relative to the NAAQS, with a very small addition to existing ambient concentrations. These projects included the 3 000 MW Coega Gas-to-Power Project where three 1 000 MW plants and a gas infrastructure were assessed (uMoya-NILU, 2020a, 2020b, 2020c, 2020d), and the proposed 200 MW Engie Power Plant (uMoya-NILU, 2021). The cumulative effect of these project with the Karpowership project to ambient SO_2 concentrations will not be significant.

For NO_2, At the point of predicted maximum concentrations 1.7 µg/m^3 will be added to the existing annual ambient concentrations and a maximum of 33.7 µg/m^3 will be added to the 1-hour concentrations. The cumulative effect will be less than this elsewhere in the Coega SEZ where predicted ambient concentrations are much lower. The cumulative effect of the emissions from the Karpowership Project on ambient NO_2 concentrations is small and will not result in exceedances of the NAAQS. No meaningful difference is expected in the results if the assessment was conducted at the second potential site at the Ngqura Port. Besides the predicted concentrations being very low, the two site alternatives are relatively close to one another.

The predicted NO_2 concentrations resulting from other potential gas-to-power projects in the Coega SEZ have been shown to be very low relative to the NAAQS, with a very small addition to existing ambient concentrations. These projects included the 3 000 MW Coega Gas-to-Power Project where three 1 000 MW plants and a gas infrastructure were assessed (uMoya-NILU, 2020a, 2020b, 2020c, 2020d), and the proposed 200 MW Engie Power Plant (uMoya-NILU, 2021). The cumulative effect of these project with the Karpowership project to ambient NO_2 concentrations will not be significant.

Ambient PM_{10} concentrations have been shown to have increased in the Coega SEZ over the last three years, but these remain well below the NAAQS. At the point of maximum predicted ambient concentrations, the Karpowership Project will add less than 1 µg/m^3 to the existing annual ambient concentrations and will add a maximum of 3.65 µg/m^3 to the 24-hour concentrations. The cumulative effect will be less than this elsewhere in the Coega SEZ and in the remainder of the modelling domain where predicted ambient concentrations are lower. The cumulative effect of the emissions from the Karpowership Project on ambient PM_{10} concentrations is small and will not result in exceedances of the NAAQS. No meaningful difference is expected in the results if the assessment was conducted at the second potential site at the Ngqura Port. Besides the predicted concentrations being very low, the two site alternatives are relatively close to one another.

The predicted PM_{10} concentrations resulting from other potential gas-to-power projects in the Coega SEZ have been shown to be very low relative to the NAAQS, with a very small addition to existing ambient concentrations. These projects included the 3 000 MW Coega Gas-to-Power Project where three 1 000 MW plants and a gas infrastructure were assessed (uMoya-NILU, 2020a, 2020b, 2020c, 2020d), and the proposed 200 MW Engie Power Plant (uMoya-NILU, 2021). The cumulative effect of these project with the Karpowership project to ambient PM_{10} concentrations will not be significant.

The cumulative effect of the contribution from the Karpowership Project is predicted to be very small and the potential increase in ambient concentrations is highly unlikely to result in exceedances of the NAAQS. The severity of the cumulative impact associated with SO_2 and PM_{10} is predicted to be insignificant, and small for NO_2.

8.4.18.13 Potential Cumulative Impacts on Heritage, Archaeology and Palaeontology

No cumulative impacts were identified for heritage, archaeology and palaeontology.

8.4.18.14 Potential Cumulative Impacts on Major Hazards

No cumulative impacts were identified for major hazards.

8.4.18.15 Potential Cumulative Impacts on Socio-Economy

Potential Positive Cumulative Impacts during the Construction Phase

In terms of the temporary increase in the GDP and production of the national and local economies during construction, currently there are no major gas developments proposed for the Eastern Cape, however, should any arise, the demand for goods and services required for the construction of similar facilities would grow. This could provide sufficient economies of scale and thus open up opportunities for the establishment of new industries in the country and new businesses in the local area, specifically in the sectors that are not well represented in the economy.

With regard to the contribution to skills development in the country and in the local economy, there will be improved labour productivity and employability of construction workers for similar projects as well as possible development of local skills and expertise in R&D and manufacturing industries related to the gas industry through partnerships with NMU.

There will be an improved standard of living of the positively affected households. The temporary increase in government revenue will result in lower government debt and servicing costs.

Potential Negative Cumulative Impacts during the Construction Phase

Change in perception of the area due to the construction of the infrastructure linked to similar developments albeit temporarily due to the impact on the sense of place experienced by the local community as a result of visual and noise effects that appear during the operational phase.

Potential Positive Cumulative Impacts during the Operational Phase

Temporary increase in the GDP and production of the national and local economies during construction will result in improved energy supply in the country; reduced carbon emissions in generation of electricity; and sufficient economies of scale could be created to establish new businesses in the local economies. These businesses could then supply the goods and services required for the operation and maintenance of the facility than cannot currently be procured in the area. This would contribute to the local economies' growth and development.

The creation of sustainable employment positions nationally and locally will improve living standards of the directly and indirectly affected households. Development of new skills and expertise in the country to support the development of the gas industry for permanently employed workers.

The improved standard of living for benefitting households will have a knock-on effect of improving the productivity of workers and improving the health and living conditions of the affected households.

The resultant sustainable increase in national and local government revenue will result in a possible improvement in service delivery.

The provision of electricity for future development will increase volume and certainty of the energy supply.

Local community and social development benefits derived from the project's operations will include declining levels of poverty in NMBM, and Eastern Cape, improved standards of living of the members of the community and households that benefit from the various programmes, and possible improvements in access to services and status of local infrastructure.

Potential Negative Cumulative Impacts during the Operational Phase

There will be a change in perception of the area due to the Powerships presence in the port over the operating timeframe due to the impact on the sense of place experienced by the local community as a result of visual and noise effects that appear during the operational phase.

8.4.18.16 Potential Cumulative Impacts on Visual Aesthetics

No cumulative visual impacts were identified.

8.4.18.17 Potential cumulative Impacts on Noise

The cumulative impact from the other noise sources in the Port of Ngqura is extremely difficult to predict. As the noise level at a receptor increases, the "loudest noise" will generally be heard. Therefore, if in future another noise source e.g., a power plant, is located closer to the receptor and it is generating more noise energy, the new noise source will be perceived above the other noise sources.

Currently, several projects pertaining to power generation are being considered within the Coega SEZ and Port of Ngqura. These proposed developments include the CDC Gas to Power Projects (comprised of 3 power plants and auxiliary gas infrastructure) and Engie Gas to Power Project.

8.4.18.18 Potential Cumulative Impacts on Marine Traffic

A marine traffic analysis is being undertaken to ascertain the effect of LNG vessels, calling at the proposed FSRU mooring in the port, on current and future vessel traffic of the Port of Ngqura. The marine traffic analysis is based on the upper LNG demand estimate of 24 vessel calls per annum.

The Port of Ngqura handles mainly containers, but also occasional general cargo. The average number of traffic vessels calling at the Port of Ngqura for a typical calendar year is approximately 750 vessels (or two per day). The largest number of vessel calls are found in the Super Post Panamax range. All of these were container vessels. The Port of Ngqura operates four container berths and the present or existing vessel traffic activity is dominated by container vessel traffic. The current plan is that the Port of Ngqura will handle container cargoes for the local hinterland and be positioned to handle overflow Gauteng cargoes should capacity in Durban be exceeded. A new manganese export terminal and new liquid bulk facilities are planned for the Port of Ngqura, to be operational in the short-term. This vessel traffic may impact the FPP mooring site in the short term. The powership and FSRU will be moored on independent spread-moorings.

The impact on existing vessel traffic as a result of the LNG demand estimate of 24 vessel calls per annum is an increase in vessel traffic by 3%. The vessel call estimate for the short term is being carried out to determine the trends in the increase in vessel traffic over the next seven years and to assess the associated implications for navigational safety. The annual percentage growth in demand is being used to estimate the future vessel traffic for the various cargo handled within the port for the years 2021 to 2028. The effect on future port operations of the LNGC traffic combined with the forecasted future port traffic will then be assessed. Additionally, the effect on current and future port operations with respect to navigation of traffic vessels past the FPP site and FSRU mooring is being assessed.

Table 8-8: Significance of Potential Cumulative Impacts.

Aspect	Cumulative Impact	Cumulative Impact Significance
Terrestrial ecology	No cumulative impacts identified.	N/A
Avifauna	Impact of Underwater Noise and Atmospheric Emissions on African Penguins breeding on the St Croix Island group, particularly those breeding on Jahleel Island.	Medium-High (Negative)
Wetlands	Loss of wetlands within the Port of Ngqura and surrounding landscape	Medium (Negative)
Hydropedology	No cumulative impacts identified.	N/A
River and riparian (aquatic)	No cumulative impacts identified.	N/A
Hydrology	No cumulative impacts identified.	N/A
Geohydrology	No cumulative impacts identified.	N/A
Climate Change	The cumulative GHG emissions from the LNGC component is therefore an estimate only and may need to be refined based on new information.	High (Negative)
	There is potential for fugitive emissions during the transfer of LNG between the LNGC and FSRU, as well	Medium (Negative)

	as during transfer from the FSRU to the Powership via the undersea gas pipeline.	
	The operation of the Powerships at Port of Ngqura will emit ~17.04 MT CO_2e over its 20-year lifespan. When considered cumulatively with the emissions from the powerships proposed at the Ports of Ngqura and Ngqura, total emissions for the 20-year lifespan of all three proposed Powerships will be ~56 MT $C0_2e$.	High (Negative)
Estuarine	Increase in economic activities related to the port and providing for short term provision of power to the SEZ when the country is experiencing power shortages.	High (Positive)
	Addition to the potential polluting activities in the Algoa bay and Port, especially when combined with other shipping and heavy industrial activities, with resultant negative impacts on the Marine Protected Area, conflict with marine mammals and birds as well as the potential introduction of pathogens which could affect mariculture facilities and operations.	High (Negative)
Marine Ecology	Temporary increase in turbidity during the installation of the pipeline and mooring structures on the seabed in conjunction with port maintenance dredging activities.	Low (Negative)
Air quality	Increase in ambient concentrations of SO_2, NO_2 and PM_{10}	Very Low (Negative)
Heritage, archaeology and palaeontology	No cumulative impacts identified.	N/A
Major Hazard Risks	No cumulative impacts identified.	N/A
Socio-economic	Change in perception of the area.	Low (Negative)
	increase in the GDP and production of the national and local economies as well as	High (Positive)
Visual	No cumulative impacts identified.	N/A
Noise	Cumulative impact from the other noise sources in the Port of Ngqura is extremely difficult to predict. As the noise level at a receptor increases, the "loudest noise" will generally be heard. Therefore, if in future another noise source e.g., a power plant, is located closer to the receptor and it is generating more noise energy, the new noise source will be perceived above the other noise sources	N/A
Marine Traffic	Increase in marine traffic.	Low (Negative)

8.4.19 DECOMMISSIONING PHASE IMPACTS

The Karpowership project has a potential lifetime of approximately 20 years. At the end of the Power Purchase Agreement (PPA), the ship will depart the harbour and all pipelines and grid connections which are classified as own built will be decommissioned and the infrastructure subsequently removed. The decommissioning process will begin at the end of the PPA. Prior to commencing decommissioning the Project will be shut down, de-energised and disconnected from the national grid. The Applicant will give landowners sufficient notice prior to the commencement of the decommissioned activities.

It is not anticipated that the proposed Karpowership project will be decommissioned in the foreseeable future. When decommissioning takes place, the legislation applicable at that time should be complied with, and relevant environmental processes and practices implemented. Therefore, an assessment of impacts for this phase is not applicable at this stage.

In the unlikely event that decommissioning occurs in the foreseeable future, the impacts and associated mitigation measures are expected to be similar to those that take place during the construction phase.

8.5 ENVIRONMENTAL IMPACT STATEMENT

2014 NEMA EIA Regulations (as amended), Appendix 3 3(1) (l) an environmental impact statement which contains- (i) a summary of the key findings of the environmental impact assessment: (iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives.

During the EIA, the impact of the Proposed Gas to Power via Powership Development on the biophysical, heritage and socio-economic environments were assessed. Table 8-7 below is a summary of the main findings of the EIA for the proposed project, following proposed mitigation. Detailed information can be found in Sections 8.3, 8.4, Specialists studies (Appendix I), Impact Assessment Matrix (Appendix C), Sensitivity Map (Appendix A2), Cumulative Map (Appendix A3) and the EMPr (Appendix G).

8.5.1 Summary of Findings of Environmental Impact Assessment

Table 8-9: Summary of key findings of EIA, including positive and negative impacts and risks of the and identified alternatives.

Aspect	Finding
Terrestrial Ecological	The site is sensitive overall as it has high number of Species of Conservation Concern, primarily succulents. The vegetation ranges from the somewhat degraded Cape Seashore Vegetation to relatively pristine impenetrable thicket and mesic thicket. The bontveld on site is, in places, also largely intact. It is important to note that despite the presence of intact indigenous habitats, the area is located within an Industrial Development Zone, and is thus earmarked for development with the resultant loss of vegetation, flora, and fauna habitat. There are some areas that have been previously degraded or transformed, most of which is present adjacent to, beneath or surrounding existing infrastructure. In these areas, sensitivity is low as the sites have little to no natural vegetation structure though

Aspect	Finding
	they may contain indicator and indigenous species. These areas have also been disturbed and are thus prone to invasion by indigenous ruderal species as well as alien invasive species. The preferred route is recommended as the best route for lowest impacts to terrestrial habitats. The alternative 2 route is not recommended as it impacts on intact habitats in close proximation to an estuary. The alternative 3 route was also recommended as it traversed through the Bontveld which is defined as a No-Go conservation area under the Open Space Management Plan. The alignment of the preferred transmission line route with existing infrastructure wherever possible reduces impacts on the indigenous vegetation and habitats as far as possible. Impacts are High to Moderate negative and can be reduced to low with the recommended mitigation measures. It is the opinion of the specialist that the proposed development go ahead, provided the mitigation measures are put into place. The recommended mitigations measures were included in the EMPr.
Avifauna	Within the 12.5km x 4km Project Area of Influence (PAOI), 199 bird species have been recorded at least annually, including 20 Species of Conservation Concern. The PAOI includes the islands of St Croix, Brenton and Jahleel that are included in Addo Elephant National Park and its Marine Protected Area and are part of an Important Bird and Biodiversity Area. The St Croix Island group has the largest breeding population (approximately 5663 pairs) of Endangered African Penguins Spheniscus demersus in the world (approximately 32% of the Global and 42% of the South African population). Jahleel Island 530m from the Eastern Breakwater is the most sensitive avifauna receptor with respect to potential impacts from the powerships project and has 232 breeding pairs of African Penguin (1.3% and 1.7% of the Global and South African population respectively. In terms of the mooring, the impact ratings for Alternative 2 are Medium–High for noise and light compared to Medium-Low for Alternative 1. The impacts of an Emergency Event are slightly higher for Alternative 2 if there is inadequate mitigation. There is therefore a preference for Alternative 1 (Powerships moored off of the Coega River) over Alternative 2 with respect to potential impacts on avifauna. For the overhead transmission lines there is a small advantage for Alternative 1 (routed behind the Eastern Reclamation) over Alternative 3 (routed across the Bontveld CBA area) in terms of habitat disturbance and fragmentation (impacts Very Low for Alternative 1 and Low for Alternative 3 after mitigation). Alternative 2 (east bank of the Coega River) is the least preferred alternative with Medium-Low impacts for both habitat disturbance and collisions. In terms of Cumulative Impacts, the impact of the Powerships Project on Damara Terns is very low compared to the proposed 2000MW Gas to Power project proposed

Aspect	Finding
	in Zone 10 of the Coega SEZ that is located approximately 350m from the Damara Tern colony at its closest point. These impacts can be reduced following the specialist's mitigations measures which are included in the EMPr.
Wetland	A total of five watercourses, in which one was determined to be a transformed estuarine environment/Port waters, two were determined to be wetland and two were determined to be riverine systems. The two wetlands were classified as depressions, whereas the riverine systems were classified as A channel streams. It was determined that Rip01 will be impacted upon by the proposed development. This riverine system that will be impacted upon by the proposed development were determined to be of a moderate risk as a result of their position in the landscape in relation to the proposed development. The specialist noted that the preferred Alternative 1 would not pose any risk to the wetlands and was the most preferred route. Alternative 2 was not supported as it would be detrimental to many watercourses. While Alternative 3 was also accepted by the Wetland Specilaist, this route traversed the Bontveld area which is a no-go conservation area. De-establishment and rehabilitation of the site will have a positive Medium impacts by increasing surface roughness and reducing the velocity of the surface runoff; decreasing erosion potential; increasing biodiversity; removing all potential contaminants; and reinstating the natural topography. In terms of the specialist's report, certain aspects of the construction activities associated with the proposed development scored a moderate risk rating (e.g: Increased risk of pollution and change in watercourse characteristics for the Preferred Alternative 1), however these aspects did have the potential to be mitigated from a moderate to low risk rating. These impacts can be reduced following the specialist's mitigations measures which are included in the EMPr.
Hydropedology	Due to the project type (i.e. linear development over a large area, where only a small soil area will be disturbed) no impacts on hydropedological flow drivers are anticipated. In context, this would mean that a 'no change' in the hydropedological processes is predicted to occur for the proposed activities relating in no likely change in the present ecological state or Ecological importance and Sensitivity. The risk associated with the construction and operational phase is estimated to be low and decrease to marginal after consideration of proposed mitigation measures as recommended by the specialist and incorporated to the EMPr. Based on the project type, no hydropedological flow buffers will be required.

Aspect	Finding
Aquatic	Coega Port is situated within a low rainfall region. The Mean Annual Precipitation (MAP) is in the order of 434 mm/annum and the Mean Annual Evapotranspiration (MAE) in the order of 1 550 mm/a (S-Pan) (WRC, 2015). The Powership will be constructed offsite and therefore will not have any impact on the surrounding freshwater features of the study area and thus was not included in this assessment. Four assessment sites were investigated, to assess the possible impacts associated with the proposed project. Due to the absence of water flow at the site as well as the rest of the study area, the in situ Water Quality, Integrated Habitat Assessment Index, and SASS5 results could not be obtained. The specialist recommended that a monitoring program and an estuarine impact assessment be undertaken.
Hydrology	The aerial extent of the flood line reveals that there is very little impact to the developments or “permanent” structures along the river course. The proposed development falls outside the 1:100 year flood line. Hence, Section 144 of the National Water Act stipulates that no “permanent” facilities should be placed within the 1:100-year flood line does not apply to the project. Moreover, flooding damage risk is estimated to be zero, based on the flood lines generated. Certain activities occurring during the construction/preparation and operational phases have the potential to impact negatively on surround surface water bodies (low to moderate risks). These impacts can be further reduced, following the implementation of the mitigation measures, as recommended by the specialist and incorporated to the EMPr.
Groundwater / Geohydrology	No groundwater abstraction activities are proposed, therefore the impact of the proposed development on the groundwater reserve is considered zero. Based on the risk assessment and project type, the impacts on the groundwater environment is low to marginal. Moreover, it is anticipated that the impact on groundwater is going to be uniform for all of the tower/pylon sites (i.e. there is no need for tower specific mitigation). Risks during the construction phase is low, and impacts are anticipated to be low after mitigation for the operational phase.
Climate Change	Given the sheltered and well-defended nature of the port, physical climate change risk to the LNGC is considered of Medium-low significance without mitigation, and of Low significance with mitigation. physical climate change risk to the LNGC is considered of Medium-low significance without mitigation, and of Low significance with mitigation. During installation of the gas pipeline, a potential direct impact relates to infrastructural and/or equipment damage or failure in the event of a severe storm. The significance of this impact is,

Aspect	Finding
	however, Low, since it is relatively easily mitigated to a significance rating of Very Low by restricting installation to suitable weather conditions. During operation, a Medium-rated impact may occur if a sufficiently severe storm of marine origin impacts the port, possibly damaging the pipeline and resulting in fugitive GHG emissions. Under storm conditions, it is possible that the structures may lead to localised erosion and accretion on opposite sides of the pipeline fixtures which may endanger the pipeline by undercutting. Similarly, to the construction phase, this impact can be mitigated to a Low significance using the precautionary principle in design and installation of the pipeline. Given the location of the Powership within the main port area, this impact is rated as Very Low with mitigation measures applied. Similarly, impacts concerning connection with the FSRU and pipeline are also rated Very Low with mitigation. A positive impact — rated High — of the Powership operations is the addition of 540MW of baseload electricity to the national grid. The impacts from the Transmission Line are expected during the operational phase and can be mitigated to a Low significance rating relatively easily. The significance rating of the impact from the towers is Low without mitigation, and Very Low with mitigation. The primary direct impact of not implementing the proposed project relates to a missed opportunity to align with South Africa's prevailing energy policy, the Integrated Resource Plan (IRP, refer to Section 4.1.2) which calls for diversification of electricity supply sources, including natural gas in the transition to an energy mix dominated by renewables in the long-term. The result — a transitional risk — is likely to be that the electricity baseload which would have been provided by the Powerships will be procured elsewhere to stabilize the national grid, potentially from a higher-emitting fuel source such as coal or heavy fuel oil (HFO).
Estuarine and Coastal	By virtue of the proposed activities location within the coastal zone and within the Coega Estuaries EFZ, consideration should be given to the direction provided by the ICM Act and its related tools, the socio-economic impacts, the possible impact from dynamic coastal processes and whether the proposed activity is likely to cause irreversible or long-lasting adverse effects on the coastal or estuarine environment that cannot be properly mitigated; will prejudice the achievement of any coastal management objective; or will not be in the interests of the community as a whole. Although estuarine ecosystems are considered key environmental assets, they are one of the most threatened ecosystems in the country. Within the Port of Ngqura, the proposed Gas to Power project will be located predominantly within the deeper waters of the port, but in close proximity to the mouth of the Coega Estuary. While the estuary, and the saltworks therein, are earmarked for future port expansion, with major earthworks currently taking place near to the estuary, it is important that potential environmental impacts be assessed in order to minimise further environmental degradation and to formulate and implement appropriate mitigation measures, as part of environmental best practice until the long-term plans are

Aspect	Finding
	realised. With proactive management, the impacts can be greatly reduced in terms of the extent, duration and overall significance. The specialist has recommended that during construction, general environmental compliance monitoring must be undertaken by a suitably qualified environmental control office (ECO) on a weekly basis as a minimum to ensure that basic environmental best practices are followed and that conditions of the environmental authorisation are complied with. The presence of an on-site environmental officer is strongly recommended to monitor daily operations. Furthermore, the specialist recommends, that during operation, a comprehensive monitoring programme must be implemented to ensure that operation as well as maintenance of the Gas to Power project and its various components comply with relevant standards and all environmental, health and safety regulations. This monitoring programme must include scheduled / routine inspections of the avifauna utilising the Coega Estuary mouth and beach. In terms of the cumulative impacts the following were indicated by the specialist: • The project will positively impact on the Port and the economic activities related thereto by providing for short term provision of power to the SEZ when the country is experiencing power shortages. The increased electricity generation capacity, when considered as part of the national Integrated Resources Plan (IRP), from the project will contribute to an enabling environment for economic growth; and • The project might add to the potential polluting activities in the Algoa bay and Port, especially when combined with other shipping and heavy industrial activities, with resultant negative impacts on the Marine Protected Area, conflict with marine mammals and birds as well as the potential introduction of pathogens which could affect mariculture facilities and operations. Such events must be controlled collectively by the TNPA and SAMSA. While issues relating to pollution are not considered to be of greater threat or significance than current port activities, the risk of cumulative impacts to the sensitive marine and estuarine environments increases as activities within the Port increases. All efforts should be made to mitigate potential negative cumulative impacts identified by considering the proposed development in both a local and regional context in terms of other current and proposed coastal activities. • The specialist further shows support for the development and indicated that the activity is deemed reasonable as it is proposed within a transformed Port and SEZ which has been specifically set aside for such activities and earmarked for development even prior to the construction of the Port. It is acknowledged that the surrounding coastal environment is dynamic and sensitive, and with the remaining estuarine habitat of the Coega Estuary, still provides habitat for sensitive species, the estuary's health status is critically modified.

Aspect	Finding
Marine Ecology	Four potentially significant impacts of the proposed FPP facility on the surrounding marine ecology at the Port of Ngqura are identified, and three of them assessed thus far. In this assessment, no mitigation measures beyond those built into the project design are required, and so the ratings would remain unchanged. There is a gap on information about underwater noise and vibration levels from floating power plant ships to conduct an assessment, and therefore, general sound levels from commercial vessels were presented and the biological thresholds of sensitive receptors, and the effects of underwater noise from the operations on marine ecology were considered unlikely. The gas pipeline construction and installation and vessel mooring will have a Very Low impact on the benthic community. The predicted impact is deemed to be 'negligible' or will probably be indistinguishable from natural background variations. The uptake of cooling water will have a Low impact on marine organisms in the surrounding water body, as there is no lasting effect on this sensitive receptor. The discharge of cooling water will have a Low impact on the marine ecology in the receiving water body, as it will have no lasting effect on the sensitive receptor i.e. plankton and benthic organisms. There will be some temporary resuspension of sediment in the water column during the installation of the pipeline and mooring structures. Turbidity generated by these construction activities may be advected into surrounding areas but, as each turbidity-generating event is spatially constrained, areas affected are likely to be small. LNG leakage into the surrounding water body is not anticipated to cause harm the marine life or alter water column characteristics, as LNG vaporizes rapidly in air, becoming buoyant at -110°C and disperses quickly. Similarly, the re-gasified NG, used as fuel in the Powerships, is supplied at ambient temperature. As such, should a release occur, natural gas would be much lighter than air and would disperse immediately and not affect marine life. Recommended mitigation measures are included in the EMPr.
Air Quality	With low predicted ambient concentrations for SO_2 and PM_{10} the consequence of impacts is very low. The predicted ambient NO_2 are somewhat higher, but the consequence of the impact is low. The likelihood of occurrence of impacts associated with SO_2, NO_2 and PM_{10} is very low. Therefore, the significance of impacts resulting from the Karpowership Project is predicted to be very low. In terms of cumulative impacts, the annual average ambient concentrations of SO_2, NO_2 and PM_{10} at Saltworks (Figure 6) are used as background concentrations to gauge the potential additive effect of the Karpowership Project emissions in the Coega SEZ.

Aspect	Finding
	The severity of the cumulative impact associated with SO_2 is very low. The severity of the cumulative impact associated with NO_2 is very low. The severity of the cumulative impact associated with PM_{10} is very low. No mitigation measures were recommended. From an air quality perspective, it is the reasoned opinion of the specialist-based on the findings of the Atmospheric Impact Report, that the Karpowership Project should be authorised.
Heritage, Archaeology and Palaeontology	The proposed 6.8km long overhead transmission line crosses Zones 7, 6 and 11 in the Coega IDZ. Zone 6 and Zone 11 are the `least archaeologically sensitive', where dispersed scatters of MSA tools of low archaeological significance are likely to be encountered, while Zone 7 is regarded `as the most sensitive'. Although recording archaeological resources in Zone 7 was difficult due to the dense grass, bush and alien vegetation occurring across this zone, bush clearing for a road exposed a thin layer of dune sand and dispersed scatters of marine shellfish, bone fragments, stone tools and pottery. Construction activities in Zone 6 and Zone 11 will likely impact on MSA resources, but indications are that the significance of the remains are likely to be low. MSA tools (of low archaeological significance), and traces of potentially important Later Stone Age remains such as shell middens may be impacted by vegetation clearing, road construction activities, and excavations for powerline footings, in the backdune area in Zone 7 closer to the coast. The baseline study has identified no significant impacts to pre-colonial archaeological remains that will need to be mitigated prior to construction activities commencing. The overall impact significance of the proposed Karpowership at the Port of Ngqura on important archaeological heritage is assessed as Low, and therefore there are no objections to the development proceeding.
Major Hazard Installation (MHI)	The main risk contributing part of the operation is the possible rupture of one of the transfer hoses. The risks were found to be acceptable for the Port and normal Port operations can continue at the other berths while LNG is being offloaded at the facility. No one within the port area is exposed to a risk greater than 1.0e-06 (one in a million) and ship staff is exposed to a risk of no more than 1.0e-05 (one in a hundred thousand). These risks are acceptable for persons operating in a national port. Recommended mitigation measures are included in the EMPr.
Socio-Economic	The proposed Powerships and their associated infrastructure will generate both positive and negative impacts starting from the construction period and ending with the decommissioning phase.

Aspect	Finding
	During the construction phase, the proposed Powerships and their associated infrastructure will have both positive and negative effects on the socio-economic environment. The project is anticipated to make a notable contribution towards the national and local economy. It is estimated that a total of R653.5 million of new business sales, R186.8 million of GDP and 776 FTE employment positions will be generated by the project in the national economy through multiplier effects. Aside from the above positive effects, the project will contribute to skills development in the country, increase government revenue, as well as raising household earnings. The increase in household earnings is also likely to improve the standards of living of the affected households albeit temporarily. Aside from the positive impacts though, the project will be creating negative direct, secondary and cumulative impacts on the local communities, specifically areas surrounding the site where the proposed facility is to be built. The main factors that will cause this negative impact are: (1) the influx of workers and job seekers from outside of the local community, (2) the impact on the surrounding economic and social infrastructure and (3) the limited visual and noise disturbances that could be created by the construction activities as the footprint of the facility grows. Potential negative impacts can largely be mitigated, and their significance reduced. The minimal visual impacts anticipated, however, cannot be fully eliminated although it is also possible to reduce their significance. During the operation of the proposed Powerships and their associated infrastructure the socio-economic impacts are likely to last longer when compared to those observed during the construction phase. This is the case for both positive and negative effects. The operation of the proposed Powerships and their associated infrastructure will generate R528.6 million of new business sales, contribute R321.0 million to GDP and create 288 sustainable FTE employment positions. In addition, government revenue will rise, electricity supply will be increased, and various socio-economic and enterprise development initiatives will be undertaken from the revenue generated by the development. These funds will be allocated towards socio-economic development in the area and are expected to bring a significant benefit to local communities. Negative impacts include the potential changes in the sense of place. These potential losses, if they do occur, are likely to be small, given the industrial nature of the proposed development area. As in the case with the impacts observed during construction, negative effects can be mitigated, and positive impacts enhanced. Mitigation of the negative impacts though will not result in their complete elimination as visual disturbance of the nature inherent to the project are difficult to eradicate entirely. Nevertheless, the significance ratings of the negative impacts are expected to be reduced.

Aspect	Finding
Visual Aspects	The assessment indicated that the two elements that potentially could have visual implications include the introduction of the proposed Powership and the FSRU into the port, as well as the development of grid connection infrastructure that extends through the Coega SEZ.
Noise	The impact of the noise pollution that can be expected from the site during the construction and operational phase will largely depend on the climatic conditions at the site. It is unlikely that the construction noise will impact on the noise sensitive areas. With the effective implementation of the recommended mitigation measures, the residual noise impact associated with construction activities are predicted to be of very low significance. The noise impact associated with the operational activities of the proposed project is predicted to be of Low significance after mitigation. Recommended mitigation measures are included in the EMPr.

8.6 PROPOSED IMPACT MANAGEMENT OUTCOMES

2014 NEMA EIA Regulations (as amended), Appendix 3 3(1) (m) based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation;

The following outcomes must be considered for this project:

- Impacts relating to site establishment are managed and minimised;
- Impacts on flora and fauna are managed and minimised;
- Impacts on heritage resources are managed and minimised;
- Construction vehicle movement are restricted to approved footprint;
- Construction of fencing and gate of the construction camp / laydown area are managed within sensitive environments;
- Water for construction is compliant with the requirements of the National Water Act (Act No. 36 of 1998);
- Impacts related to storm and waste water are avoided, prevented and managed;
- Impact to watercourses and estuaries are managed in adherence to legislation and specialist recommendations;
- Impacts to marine environment are managed in adherence to legislation and specialist recommendations;
- Vegetation clearance and associated impacts are minimised and managed;
- All precautions are taken to minimise the risk of injury, harm or complaints;
- No pollution or disease arises in terms of poorly maintained ablution / sanitation facilities or lack thereof;
- All necessary precautions linked to the spread of disease are taken;

- Emergency procedures are in place to enable a rapid and effective response to all types of environmental emergencies;
- Safe storage, handling, use and disposal of hazardous substances;
- Spillages and contamination of soil, surface water and groundwater are avoided, minimised and managed;
- Dust prevention measures are applied to minimise the generation of dust;
- Noise management is undertaken in accordance with SANS 10103 and the Occupational Health and Safety Act (Act No. 85 of 1993).
- Fire prevention measures are carried out in accordance with the relevant legislation.
- Erosion and sedimentation as a result of stockpiling are reduced.
- Minimise the risk of environmental impact during periods of site closure;
- Post-construction and rehabilitation activities are undertaken in accordance with EMPR requirements as well as Rehabilitation Plans;
- Socio-economic development is enhanced and job creation and economics in the area are improved;
- Effective awareness and training for all construction staff to minimise environmental impacts;
- Ensuring social and ecological well-being of the site and community;
- Impact on No-Go areas are avoided through effective demarcation and management of these areas;
- Impacts resulting from earthworks are managed and guided by specifications;
- Construction materials are sourced from authorised sites;
- Potential impacts to the environment caused by waste (general and hazardous) are avoided or managed;
- All onsite staff are aware and understands the individual responsibilities in terms of this EMPr.
- Stormwater related impacts are avoided, minimised and managed;
- Dust, emissions and odour impacts are minimised and managed;
- Impact to heritage and palaeontological resources are managed in terms of the National Heritage Act.
- Compliance with all environmental legislative requirements during the operational phase of the project is implemented and managed; and
- Environmental impacts during the Operation and Maintenance Phase are managed in terms of Operational Maintenance Management Plan requirements.

8.7 SCOPING REPORT and POS DEVIATIONS

8.7.1 Deviations

All deviations from the Scoping Phase have been identified and included in this EIA Report. The list of deviations include:

1. The power from the Powership will be evacuated by means of a double circuit twin Tern conductor 132kV line. This line will interconnect the Powership to the National Grid utilising the existing Dedisa Substation via a new 132kV on shore switching station.
2. A subsea pipelines will be installed on the seabed and through the existing revetment. The first leg of the overland pipeline will be installed on plinths above ground between the paved area of the admin craft basin and the crest of the breakwater.
3. The Powership will be connected to new Saltpan switching station onshore that will be located near the Powership. Saltpan switching station (105m x 105m) will be connected to Dedisa substation by means of 2 x 7.5 km Double circuit twin tern 132 kV lines. The proposed transmission line includes:
    a. Extending the Dedisa132 kV busbar to accommodate an additional 132 kV feeder bay;

   b. Installing 2 x 132 kV feeder bays at Dedisa;
   c. Establishing Saltpan 132 kV switching station onshore to connect to the HV yard in the Khan Powership via overhead lines;
   d. Installing 4 x 132 kV feeder bays at Saltpan switching station;
   e. Connecting 2 x 132 kV overhead lines (about 1 km) from the Powership 132 kV yard to the Saltpan switching station; and
   f. Constructing 2 x 7.5 km of 132 kV double circuit Twin Tern conductor lines from Saltpan switching station to Dedisa substation.
4. Laydown Areas introduced with a combined area of 5463m^2
5. The ships will be anchored and moored in existing port operational areas utilising the vessel's anchoring system. The transmission of the NG gas will flow via a gas pipeline from the moored ship along the seabed to the main ship for processing. The subsea gas pipeline is proposed to be installed along the toe of the existing dredged slopes between the floating storage regasification unit (FSRU) and Powership to ensure gas supply for power generation and connected to the vessels via a flexible marine hose riser. A servitude of approximately 3m will be required to allow for mounting and protection. The pipelines will be made of steel, engineered to meet the standards for natural gas pipelines with a diameter of approximately 60cm.
6. There will be approximately 28 monopoles located along the transmission line. Each monopole will cover a maximum footprint of 15m by 15m and the footprint of the monopole will be 0.6m x 0.6m to a maximum of 2.5m x 2.5m, both of which will necessitate the clearing of vegetation to allow for the steel lattice towers/monopole to be erected. The servitude, stretching the transmission line from the port to the substation, will have a width of 30m as per Eskom safety specifications
7. The preferred transmission line begins on an FEPA wetland (as per the NFEPA dataset; Nel *et al*, 2011), thereafter this route heads in a north-easterly direction and finally a north-westerly direction before reaching its end point at the Dedisa substation.
8. The development footprint of the proposed towers for the transmission line, the switching station and the temporary laydown area for the gas pipeline installation will exceed 50 square meters.
9. The rehabilitation of the temporary laydown area for the gas pipeline installation will require the planting of vegetation on exposed sand surfaces of more than 10 square meters.

The risk assessment methodology for Alternative 4 was conducted as per Section 3 due to the constraints explained below.

Discussions with Coega CDC indicated a possible re-routing of the 132KV transmission line to the west of the services servitude from the proposed towers 1 to 18. The CDC had no comments on the section 20 to 28 situated within Transnet's property and being surveyed with Transnet's involvement.

The CDC Planning Department confirmed on 18 February 2021 that the alignment of the 132KV, which is the same as that previously indicated in the proposed gas to power project scoping report (2015), is best within the services servitude (towers 1 to 18) depicted on the Eastern side of the services servitude, However, subsequent to the meeting, the CDC re-iterated the preferred alignment to be located on the Western side of the services servitude, at or near the proposed gas pipeline route.

Although no specific information was received of this possible re-alignment, engagements with the specialist indicate that: 1) the change will not impact the risks assessed (5 out of 9 specialists); 2) there will be a slight increase in risk, that can be mitigated (2 out of 9 specialists); and 3) there will potentially be an increased risk and higher impacts (2 out of 9 specialists).

Following the specialist assessments, the establishment of the alignment on the Western Side is still regarded as a feasible option and no fatal flaws are associated with this location, as the services servitude is an existing approved servitude for electrical services.

8.8 ASSUMPTIONS, UNCERTANITIES AND GAPS IN KNOWLEDGE RELATING TO THE ASSESSMENT AND MITIGATION PROPOSED

8.8.1 Assumptions, Uncertainties and Gaps in Knowledge

The information in this report is based on findings of several specialists' studies. The layouts and engineering drawings of the proposed Gas to Power Project at Port of Ngqura, have been provided to the EAP by the engineer and planner respectfully. During the compilation of this EIA Report, the following assumptions and limitations relating to this assessment were identified by the EAP and specialists:

- The scope of this report is limited to assessing the environmental impacts of the proposed Karpowership gas-to-energy project and its associated infrastructure.
- The information provided by the applicant and specialists are accurate and unbiased.
- Information from secondary sources and I&APs is accurate.
- Assessments of impact significance for social impact often need to be made without quantification. These are based on a consideration of the likely severity of impacts and/or expert judgements, unless otherwise specified or quantified.
- The assessment only considers the impacts of the proposed project and the no-go and does not make comparisons with or assessments of other gas-to-energy projects as there are currently none in the area. Proposed *Risk Mitigation IPP Procurement Programme* projects have been considered under the cumulative impacts section.
- There will be a temporary Right of Way (RoW) of 30m (15m either side of the centre line) of the pipeline during the construction and operational phase of the transmission line.

Wetland Ecologist

- According to the SANBI guidelines, specialist assessments should be performed during the rainfall season of assessed area. In this case, Eastern Cape is a summer rainfall area and therefore assessments should be performed between October and April. Fieldwork for this project was done at the latter end of September 2020, a week away from the rainy season.
- Accessibility to certain portions of the landscape where watercourses were present was difficult due to the dense vegetation in the area which made these areas inaccessible.
- A construction method statement was not provided by the engineer and therefore the potential impacts on the watercourses that may arise as a result of the construction activities were determined using the specialist's knowledge and experience with similar projects.
- Only those wetland/riverine habitats which will be significantly impacted by the proposed development were accurately delineated in the field. The remaining watercourses within a 500m assessment radius were delineated at a desktop level and broadly verified in the field to obtain an extent of the wetland/riverine areas, and to facilitate an understanding of the dynamics of the systems.

- This is a once off assessment (conducted on the 22nd September 2020) which can only take into consideration the current condition as vegetation and habitats may vary both temporally and spatially, there must be recognition of fact that certain aspects or features may be missed if they do not present themselves on the day.
- The site investigation ground truth the Final Alternative 1 and 2 routes, the old Alternative route 2 was not ground truth and was only assessed at a desktop level.
- All delineation verification is done using a GPS system. The precision of such systems is generally limited to 5m and therefore this error must be taken into account when utilising the GPS coordinates.
- Only vegetation which was present within at risk watercourses were assessed in the field, all other systems were assessed at desktop level and visually confirmed on site.
- While the assessment techniques utilised in this report are used in order to standardise and 'objectify' the assessment of the systems' function, potential impacts and services, it must be noted that much of the information is subjectively collected based on the assessor's previous experience and training. The assessor will, if additional information or counter arguments are provided and verified, hold the right to amend the report if need be.
- The assessment of impacts and recommendation of mitigation measures was informed by the site-specific ecological issues identified during the infield assessment and based on the assessor's working knowledge and experience with similar development projects.
- Evaluation of the significance of impacts with mitigation takes into account mitigation measures provided in this report and standard mitigation measures are to be included in the project-specific Environmental Management Programme report (EMPr).

Terrestrial Ecologist

- The field work was conducted over two days on the 29th and 30th of September 2020.
- The site assessment was conducted in early spring (September) during an extended drought in the area and prior to the expected rain for the year.
- A site visit at this time is sufficient to record trees, forests and associated species assemblages but may miss grass species and geophytic plants that flower over spring and summer (typically early November).
- The extended drought for the region at the time of the site visit may have resulted in reduced numbers or plant and animal species recorded from the site.
- The route options were surveyed in a vegetation sampling approach and limited to sites that were accessible. Vegetation communities were extrapolated for the routes based on field data.

Avifaunal Specialist

- While the bird populations in the PAOI are relatively well known, the presence, abundance, movements, breeding and behaviour of birds remain subject to numerous variables such as season, rainfall, weather conditions, anthropogenic influences, or changes in the locations and quantity of food available. Consequently, assessments of the presence, abundance and breeding of bird species will always be subject to some unpredictability.
- Whilst every effort has been made to identify the potential impacts and risks associated with the Powership Project and to identify the bird Species of Conservation Concern that may be impacted, it is possible (though unlikely) that not all impacts that may be of significance have been identified.

Heritage Specialist

- Marine and estuarine shell fossils are likely to be encountered. Although Significant Palaeontological material could be found this material is not common. If encountered, fossil material is likely to be broken and fragmented. Should intact shells be encountered these should be archived and a competent Palaeontologist consulted. A "Chance Find Protocol" has been inserted into the report.

Geohydrologist

- No exploratory drilling or fieldwork was conducted as part of this study. Although data in this assessment is extracted from reliable data sources, the risk assessment is considered preliminary until groundwater data is verified with intrusive site work (i.e. drilling of onsite boreholes, on-site water quality and quantity testing).
- Limited groundwater quality and quantity data are available for the project area. Available groundwater data was extrapolated to conceptualise the best-case hydrochemistry and groundwater conditions of the site.

Estuarine Ecologist

- Having been provided with all the relevant information required;
- Only readily available data and information was used; and
- No physical, chemical or biological sampling was undertaken during this assessment.

Water Balance

- The project will consist out of two (2) components, namely (1) pre-constructed ships moored in the harbour and (2) the development and operation of transmission lines on the land surface.
- Due to the nature of the land development (i.e. the development of transmission lines and pylons over a large area where little to no water will be required) the water balance focused on conceptualising the likely water use and distribution for the Karpowership electricity generation (i.e. water used on the ships will be derived from seawater).
- A water balance for the land component of the project is deemed unnecessary for water quantities used during this process (i.e. for drinking or technical water) will most probably be sourced by local contractors on a very small scale.

Hydropedologist

- This study is desktop-based, and hence no intrusive work was undertaken. It is assumed that literature data evaluated accurately describes the soil and hydropedological occurrences.
- The concepts presented are simplifications of the temporal variability of water transfer functions. Realistically, water transfer functions, such as throughflow and groundwater sources, may take a few months up to several years to recharge streams (Le Roux, et al., 2011) However, hydropedology hillslopes have been effectively applied to simulate runoff response mechanisms (Van Tol, Le Roux, & Lorentz, 2013).

Air Quality Specialist

- No ambient monitoring is done for this assessment, rather available ambient air quality data is used.
- The Model Plan of Study (uMoya-NILU, 2020) describes the dispersion modelling methodology has been accepted by the Licensing Authority.
- The potential air quality impacts in the Coega Special Economic Zone (SEZ) and surrounds are assessed for Karpowership Project with available measured ambient air quality data used to inform the cumulative effect of the project.

- The assessment of potential human health impacts is based on predicted (modelled) ambient concentrations of SO_2, NO_2, and PM_{10} and the health-based National Ambient Air Quality Standards (NAAQS).

Landscape & Visual Impact Specialist

- ***Level of Assessment:*** Because the project is proposed within an active port and an area that is highly industrialised and because the main visible elements of the proposed project include the mooring of ships within a port environment as well as the construction of a 132kV overhead power line within an industrial area, a Level 2 Assessment in accordance with the Western Cape Guidelines has been undertaken.
- A Level 2 Assessment requires the following input:
    - Identification of issues raised in scoping phase and site visit;
    - Description of the receiving environment and the proposed project;
    - Establishment of view catchment area and receptors;
    - Brief indication of potential visual impacts, and possible mitigation measures.
- In accordance with the Western Cape Guidelines, a Level 2 Assessment should be undertaken when minimal visual impact is expected.
- Should un-anticipated impacts be found, the level of assessment may be elevated accordingly.
- ***Assessment Subjectivity*:** The assessment requires a subjective judgement as to whether an impact is negative or positive is based on the assumption that the majority of people are likely to prefer to view a natural or a rural landscape / seascape rather than an industrial landscape / seascape.
- ***Site Visit*:** A site visit was undertaken on a single day (1st February 2021) to verify the likely visibility of the proposed project. Information collected during this site visit has been used in the preparation of this report.
- ***Visibility Assessment:*** Visibility of the proposed elements has been assessed using the viewshed tool in the Global Mapper GIS program. The visibility assessment is based on terrain data that has been derived from satellite imagery. This data was originally prepared by NASA and is freely available on the CIAT-CCAFS website (http://www.cgiar-csi.org). This data has been ground truthed using a GPS as well as online mapping; and calculation of visibility is based purely on the Digital Elevation Model and does not take into account the screening potential of vegetation.
- ***Extent of Development Visible****:* The approximate extent of the development visible from each viewpoint as indicated in Section 4 has been approximated by measuring on plan the angle of the view that the development occupies given that each view was taken with a 28mm lens which has an approximate angle of vision of just over 74°. This has been cross referenced with known land marks.

Socio-economic Specialist

- ***Construction phase assumptions****:* The following assumptions regarding the construction phase of the proposed Powerships and its related infrastructure are made:
    - The construction of Powerships related infrastructure is planned to commence in 2021 contingent on project approval.
    - The duration of the construction phase is anticipated to be 12 months.
    - The total investment is valued at R252.7 million in 2020 prices, of which R160.5 million will be spent within the South African economy with the rest on imported goods and services.
    - Only local expenditure is considered in this analysis.

    - The construction of the related infrastructure will create an estimated 90 Full Time Equivalent (FTE) project specific employment opportunities over the period of construction, 80 of which will be created for South African citizens.
    - Approximately 51% of the total employment positions for South African citizens will be from local communities.
- ***Operational phase assumptions:*** The following assumptions regarding the operational phase of the proposed Powerships and its related infrastructure are made:
    - The Powerships are anticipated to begin operating once construction is completed.
    - The average annualised operations and maintenance cost of the Powerships will be R300.8 million per annum over the 20-year operational life of the project.
    - The greatest share (46.6%) of operational local spending will be directed at covering labour costs associated with the employment of 166 workers, 96 skilled workers and 69 unskilled workers.
    - During its operation, the Powerships and related infrastructure will employ 166 project specific personnel of which 120 employment positions will be created for South African citizens.
    - Approximately 43% of the total employment positions for South African citizens will be from local communities.
- *Decommissioning phase assumptions:* The costs of decommissioning the plant are not yet known. Given the nature of the Powerships and the largely unlimited input supply, it is highly likely that instead of decommissioning them, they will be refurbished in order to extend its lifespan beyond the 20-year period.

Major Hazard Risk Specialist

- *Events Following a Loss of Containment*:
    - Where no Boiling Liquid Expanding Vapour Explosion (BLEVE) and fireball occur following an instantaneous release with direct ignition, a liquid pool is formed, and a vapour cloud will expand to atmospheric pressure. The direct ignition of the vapour cloud is modelled as a flash fire (probability 0.6) and explosion (probability 0.4).
    - For an above-ground storage vessel (or road tanker), a BLEVE or fireball may occur. A BLEVE can occur when a flame impinges on a vessel containing a material that is a gas at atmospheric pressure and temperature but is a liquid at storage temperature and pressure. It is assumed that a BLEVE occurs when the vessel or road/ rail tanker is full. While BLEVEs are possible because of catastrophic vessel failure and localised vessel failure, they typically occur outside of these two events. Should this not occur, a vapour cloud may form. The ignition of the vapour cloud is modelled as a flash fire and explosion.
    - The flash fire is modelled through simulating the expansion of the initial cloud to the lower flammability limit (LFL) with air entrainment. The damage area then corresponds to the LFL cloud footprint. The explosion is modelled using the total mass subject to the lower flammability limit (LFL).
    - Accidental high velocity releases of ignited flashing liquids of pressurised flammable material at ambient temperature are classed as liquid jet fires. Jet fires occur when the jet of hydrocarbon can entrain air and burn at its edge. The jet remains ignited because the burning of the flame is greater than the velocity of the hydrocarbon jet, i.e. the flame can burn back towards the source of the jet. As a worst-case scenario, it is assumed that all failures occur in a horizontal position, i.e. the flame is orientated horizontally.

- *Scenarios Modelled*: This report was done in terms of SANS 1461 and this standard refers to 'BEVI' as the preferred reference to be used. All modelling was conducted according to Bevi and stipulates the following:
    - There are no scenarios for intrinsic failure for ships. It is assumed that loading takes place for most of the time that a ship is present, and the loading scenarios are dominant compared to intrinsic failure.
    - The only scenarios that are relevant in addition to loading, are external damage as a result of ship collisions. These are very much determined by the local situation. In the case that a ship is in a port outside the transport routes, the probability of a collision that leads to an outflow is so small that it does not need to be taken into consideration.
- *Jet Fires*:
    - Jet fires occur when flammable material of a high exit velocity ignites. Ejection of flammable material from a vessel, pipe or pipe flange may give rise to a jet fire and in some instances the jet flame could have substantial 'reach'. Depending on wind speed, the flame may tilt and impinge on pipelines, equipment or structures. The thermal radiation from these fires may cause injury to people or damage equipment some distance from the source of the flame.
    - For this Assessment, jet fires from a 1-inch leak in a transfer hose was assumed. The worst-case scenario of the jet fire being horizontal and in the same direction of the wind was assumed.
    - The flame length for a 1-inch hole in the transfer hose was calculated at 68.689m with a wind speed of 1.5m/s. The effects from the jet fire could not extend beyond the ships. The jet fire could not reach and impact on other activities at any of the berths.
- *Flash Fires*:
    - A loss of containment of flammable materials if not immediately ignited, would mix with air and form a flammable cloud. This cloud could drift and if ignited could result in a flash fire or vapour cloud explosion.
    - The cloud of flammable material would be defined by the lower flammable limit (LFL) and the upper flammable limit (UFL). An ignition within a flammable cloud can result in an explosion if the front is propagated by pressure. If the front is propagated by heat, the fire moves across the flammable cloud at the flame velocity and is called a flash fire. In some instances, pockets of flammable clouds may extend beyond the LFL due to localised conditions. The ½ LFL endpoint assumes there are no isolated pockets and that ignition would not occur beyond this point.
    - A flash fire from a catastrophic leak (Hose shear and overfill) from the ship is shown below. Flash fires could have impacts beyond the berths.
    - The flammable cloud will extend past the berth for a distance for about 350m. This release can also extend onto the next berth depending on angle of release and wind direction.
- *Confined Gas Explosions*:
    - Vapour cloud explosions are one of the most devastating events which can occur in the process industries. It was recognised that a facility design should include limiting explosion damage. The determination of peak overpressures from gas explosions and development of design criteria for structural support become more complex due to high pressure inventories in congested areas.
    - There are four key factors in an explosion. These are related to the overpressure which is the pressure rise above normal atmospheric pressure, the positive phase duration which is the time during which the pressure is above atmospheric pressure, the degree of confinement of the flammable mixture which causes turbulence and acceleration of the flame front and influences the overpressure, and the impulse (area under the pressure-time profile).

    - It is well established that it is not the size of the vapour cloud that matters when it comes to blast strength, but the degree of confinement of the vapour cloud and congestion in the path of the flame front. The energy of ignition source (e.g. naked flame) plays a dominant role in determining the blast strength, although a well-designed facility with strict implementation of hazardous area classification requirements in terms of hardware and safety management system can reduce the strength of a potential ignition source significantly.
    - The Multi-Energy Model (MEM) for rapid assessment of explosion overpressure has been developed by TNO (1997). It is based on the concept that significant overpressures can be generated by the ignition of a vapour cloud only in the presence of partial confinement or obstacles in the path of the flame front. This model, however, requires assumptions on the initial blast strength, which significantly influences the predictions. CFD models used in offshore modules have shown that rapid assessment models can underestimate the blast overpressures.
    - There are confined areas at the Port such as the service chambers and buildings.
- *Delayed Ignition*: The probability of delayed ignition depends on the end of the calculation. In the calculation of the location-specific risk only ignition sources on the site of the establishment are considered. Ignition sources outside the establishment are ignored: it is assumed that if the cloud does not ignite on site and a flammable cloud forms outside the establishment, ignition always occurs at the biggest cloud size. In the calculation of societal risk, all ignition sources are considered, including population. If ignition sources are absent, it is possible in the societal risk calculation that the flammable cloud does not ignite.

Coastal and Estuarine Specialist

- Identified knowledge gaps include the following:
    - The choice of transmission infrastructure is undecided (steel lattice, monopole vs underground cabling) (Siris, 2020)
    - Recent data on the water quality and biological communities of the Coega Estuary is unavailable and/or lacking.
- Project assumptions and limitations include:
    - Having been provided with all the relevant information required;
    - Only readily available data and information was used;
    - No physical, chemical or biological sampling was undertaken during the field investigation; and
    - Extremely short timeframe constrained the level of investigation and assessment.

Greenhouse Gas Emissions Specialist

- The following assumptions were allowed for:
    - Total emissions calculated are based on site reference conditions 1013.25 mbar and 25°C.
    - Total emissions calculated are based on Plant operation at 100% contracted capacity.
    - Total emissions calculated are based on 3723 hours per annum operation.
    - Engine degradation allowed for 1.5% over 18,000 hrs (Wartsila 18V50SG degradation curve)

Noise Specialist

- The initial location of the project was supplied by the client.
- The Powerships and related infrastructure will be operational for 24 hours per day.

- The sound power levels for the operational equipment was supplied by the client. Where no information regarding the sound power levels was available, the author used values based on similar studies conducted elsewhere.
- The Powerships will be modelled based on a combined electrical power output of 540MW. The components have been plotted according to information supplied by the client.
- A Liquid Natural Gas Carrier (LNGC) will take 1-2 days to offload LNG cargo to the FSRU every 20 days.
- It is assumed that the eastern breakwater will not provide any attenuation as the noise sources will be above the top of the breakwater wall.
- A detailed and validated study of the noise emissions and impacts around an *existing* Powership was not available for reference. This would have enabled the author to obtain a "feel" for the noise impacts.

Cumulative Impacts

- The potential cumulative impacts of the proposed development on the environment is required to be considered. Cumulative impacts, as the name suggests, take into account the incremental, collective or aggregated impacts on a particular aspect of the environment. These types of impacts are difficult to quantify given their high spatial and temporal variability. In addition, the cumulative impact assessment must assess the cumulative impacts from the various existing and proposed developments with the area. Triplo4 have made every effort to obtain the details of the surrounding existing and proposed developments.

9 CONCLUDING STATEMENT AND RECOMMENDATIONS

The following are the final proposed alternatives, as described in detail in Section 3 and 8.4.

9.1 FINAL PROPOSED ALTERNATIVES

9.1.1 Powership and FSRU Positioning

The Powerships and FSRU are to be moored in the protected waters within the Port of Ngqura. The operational requirements at the Port cannot accommodate the use of existing berthing infrastructure and therefore the vessels will be positioned in unused areas of the port and will utilise their own mooring system. No marine structures are planned and the mooring system for the vessels will generally be heavy chain lying on the seabed attached to anchors which will become buried in a very short time.

No dredging is required as the mooring locations are positioned in sufficient water depth to safely accommodate the moored vessels. In the process of identification of the potential sites, the existing cargo facilities and the Port's future short-term developments were avoided. The Sand-spit area has been identified as sensitive and a 200m offset from the water line to the moored vessels maintained.

Key considerations for a feasible position are the size of the turning circle for the LNG carrier as well as that the approach channel and turning circle will be shared with the coal terminal and bulk berths, i.e. traffic in basin from coal vessels, cargo vessels and tugs are not impeded by the Powership project.

The preferred position alternative (figure 9.1 below) is supported from the engineering design perspective, as the Powerships and FSRU are not located close to each other and are positioned adjacent to the break bulk quay /multi-purpose terminal. This option is to position the two Powerships adjacent to the admin craft basin and the FSRU along the eastern breakwater. Alternative 1- is the preferred as it is in line with the FSRU in the port's long term FSRU berth position plans.

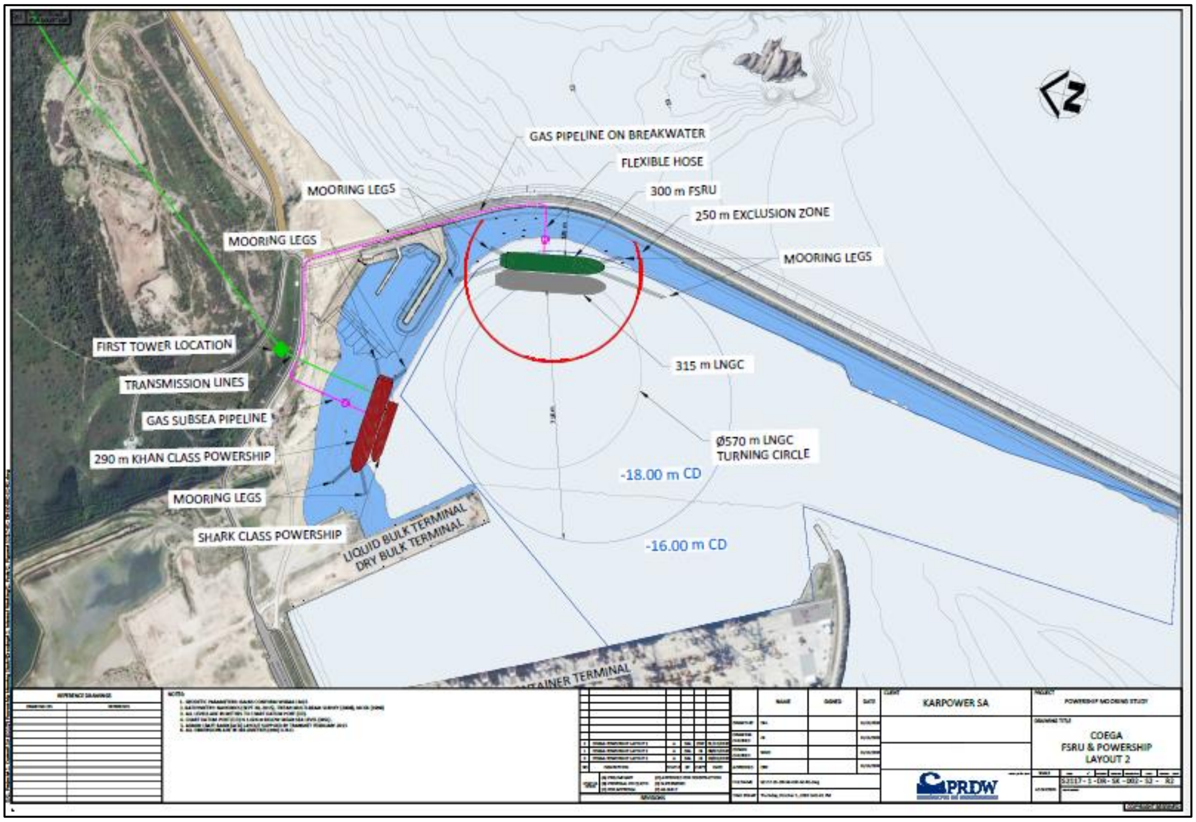


Figure 9-1: Alternative 1- Preferred: position within the port in relation to the gas pipeline.

The following table provides insight into the mooring of the FSRU and the powerships.

Table 9-1: Coordinates for the Powerships and FSRU

Powerships and FSRU	GPS-COORDINATE	
	Longitude	Latitude
FSRU	33°48'3.84"S	25° 41'49.63"E
Powership Khan and Shark Classes Alternative 1	33°47'47.06"S	25° 41'25.07"E
Powership Khan and Shark Classes Alternative 2	33°47'55.05"S	25° 41'40.04"E

The physical size of the Powerships and FSRU:
Powerships – 19 000m²
FSRU – 29 300m²

9.1.2 Gas Pipelines Alternatives

A gas line is required between the FSRU and Powerships to ensure gas supply for power generation.

The subsea pipeline from the FSRU will be installed on the seabed and through the existing revetment. The first leg of the overland pipeline will be installed on plinths above ground between the paved area of the admin craft basin and the crest of the breakwater.

The remainder of the overland pipeline will be trenched alongside the existing access road and crossing the existing entrance to the Admin Craft Basin. The subsea pipeline will be buried through the shore crossing and laid on the seabed connecting the overland pipeline to the Powerships. The horizontal and vertical alignment of the overland pipeline will take existing structures and services as well as safety aspects into consideration.

The gas pipeline connecting the FSRU to the Powerships will be routed along the edge of the existing eastern breakwater and will connect to the vessels via a flexible marine hose. The gas pipeline will likely be mounted on small footings requiring minor civil works to be constructed and installed. There are two proposed alternative routes for the gas pipeline, and these are directly influenced by the selected positions of the Powerships in relation to the position of the FSRU. Refer to Figure 9.1 (pink line).

An approx. 10 meters servitude will be required for the placement of the subsea gas pipeline, therefore the total footprint is of this gas pipeline route is approx. 16 000m² .

Estimated size for the temporary assembly/ laydown area for the installation of the gas pipeline is approximately 5463m^2, as indicated in Figure 9-2 below. The selected site is adjacent to the existing harbour arterial and within a historically transformed area due to previous disturbance. This area will be rehabilitated after the completion of the installation of the pipeline.

Figure 9-2: Proposed location for the temporary laydown area for the installation of the gas pipeline.

Table 9-2 below indicates the coordinates of the preferred gas pipeline route alternative and the laydown area.

Table 9-2: Coordinates for the gas pipelines' alternatives with laydown areas

Subsea Gas pipeline	GPS-COORDINATE	
	Longitude	Latitude
Gas pipeline Route Alternative 1 - Start point	33°48'1.86"S	25°41'49.66"E
Gas pipeline Route Alternative 1 - End point	33°47'48.67"S	25°41'27.97"E
Gas pipeline Route Alternative 1 – mid way point	33°47'50.68"S	25°41'49.67"E
Gas pipeline Route Alternative 1 – Bend 1	33°48'1.03"S	25°41'54.95"E
Gas pipeline Route Alternative 1 – Bend 2	33°47'40.33"S	25°41'42.85"E
Gas pipeline Route Alternative 1 – Bend 3	33°47'41.03"S	25°41'29.73"E
Temporary laydown area 1 (Central)	33°47'40.70"S	25°41'24.41"E
Temporary laydown area 2 (Central)	33°47'42.87"S	25°41'38.93"E

9.1.3 Transmission Line Alternatives

The power generated by the Powerships is converted by a high voltage substation on board the Powerships and transmitted along a 132kV double circuit twin Tern overhead transmission line, approximately 7.5 km in length from Port to the Dedisa Substation, situated within both the Coega SEZ and Transnet properties.

Two transmission line alternatives were initially proposed during the Accepted Final Scoping which took into consideration engineering and Port requirements.

<u>Alternative 1 (Preferred)</u>

This preferred route as presented in the Accepted Scoping Report has been adjusted slightly in order to avoid a section of Bontveld set aside as conservation open space in which development is prohibited. One monopole structure is present in a small area of disturbance within this habitat type.

This option utilises overhead lines to connect the Powerships' plant to Dedisa substation at 132 kV voltage level using Twin Tern conductors at higher templating temperature rated @ 350 MVA each.

This alternative comprises:

- Extending the Dedisa132 kV busbar to accommodate an additional 132 kV feeder bay;
- Installing 2 x 132 kV feeder bays at Dedisa;
- Constructing the Saltpan 132 kV switching station onshore to connect to the HV yard in the Khan Powership via overhead lines;
- Installing 4 x 132 kV feeder bays at Saltpan switching station (approx. 105m x 105m);
- Connecting 2 x 132 kV overhead lines (about 1 km) from the Powership 132 kV yard to the Saltpan switching station; and
- Constructing 2 x 7.5 km of 132 kV double circuit Twin Tern conductor lines from Saltpan switching station to Dedisa substation.

This alternative route begins in an FEPA wetland (as per the NFEPA dataset; Nel *et al*, 2011), thereafter this route heads in a north-easterly direction and finally a north-westerly direction before reaching its end point at the Dedisa substation. With respect to the FEPA wetland, while the dataset indicates that this is a FEPA wetland, a site verification by the wetland specialists has determined that this wetland no longer exists.

The route is the preferred overhead transmission line from the Powership to the proposed switching station, as it offers a shorter route to the end point (approximately 7.5km in length with 28 monopoles). The majority of the preferred route is located in areas of low to moderate sensitivity with the location of a single monopole structure within a degraded area inside of the bontveld set-aside within the SEZ.

Overall, this route is located in low to moderate sensitivity areas, mainly due to its location in transformed areas or in highly degraded areas adjacent to transformed areas, and a large portion of this alternative follows the route of the existing powerline servitude (yellow line in Figure 9-3). Furthermore, the Wetland specialist supports the construction and operational activities that will occur along this route. The specialist further indicates that the transmission line will not impact on the estuarine environment or the FEPA wetland. The assessment of the impacts of this alternative are presented in Section 8.transmission line route.

Figure 9-3: Alternative 1: Power Evacuation Route (Preferred).

Figure 9-3 as per the yellow line is the preferred amended option (Alternative 1) from an engineering perspective, therefore making this alternative feasible from a technical perspective.

Indications are that there are no space constraints around the Dedisa substation and there is sufficient space available to accommodate the required two or three 132 kV feeder bays to connect to the Powerships. However, this information will need to be confirmed by Eskom through a formal Grid Connection Application process. The connection solution to Dedisa at 132 kV voltage level with its lower connection cost and shorter implementation timeframes offers the most practical alternative.

Figure 9-4: Proposed connection placement of the switching station.

The Monopole towers, each with a footprint of 15m x 15m (for stay wires) or 0.6m x 0.6m to a maximum of 2.5m x 2.5m (for monopole bases), are to be positioned within the servitude of 30m for the length of the route. The total footprint of the preferred transmission line route is 225 000m². The footprint of the proposed new switching station is approx. 11 025 m². The proposed monopoles towers will include bird friendly measures as part of their designs

The preferred evacuation line is in accordance with the proposed 2015 Transnet Evacuation Route.

Table 9-3 below show the GPS co-ordinates for the of the start and end points of the preferred transmission line route – from the powerships to the start point, and from the start point to the end point.

Table 9-3: Coordinates for the Preferred Alternative for the Transmission line route

Transmission line	GPS-COORDINATE	
	Longitude	**Latitude**
From powership (Khan Class) to First Tower Alternative 1 – Start point	33°47'48.21"S	25°41'24.57"E

From powership (Khan Class) to First Tower Alternative 1 – End point	33°47'42.26"S	25°41'25.87"E
From powership (Shark Class) to First Tower Alternative 1 – Start point	33°47'51.06"S	25°41'24.89"E
From powership (Shark Class) to First Tower Alternative 1 – End point	33°47'42.26"S	25°41'25.87"E
From powership (Khan Class) to First Tower Alternative 2 – Start point	33°47'48.21"S	25°41'24.57"E
From powership (Khan Class) to First Tower Alternative 2 – End point	33°47'40.03"S	25°41'33.05"E
From powership (Shark Class) to First Tower Alternative 2 – Start point	33°47'51.06"S	25°41'24.89"E
From powership (Shark Class) to First Tower Alternative 2 – End point	33°47'40.03"S	25°41'33.05"E
From powership (Khan Class) to First Tower Alternative 3 – Start point	33°47'48.21"S	25°41'24.57"E
From powership (Khan Class) to First Tower Alternative 3 – End point	33°47'42.23"S	25°41'38.22"E
From powership (Shark Class) to First Tower Alternative 3 – Start point	33°47'51.06"S	25°41'24.89"E
From powership (Shark Class) to First Tower Alternative 3 – End point	33°47'42.23"S	25°41'38.22"E
Transmission Line Route – Alternatives 1– Start point	33°47'48.21"S	25°41'24.57"E
Transmission Line Route – Alternatives 1– End point	33°44'37.16"S	25°40'38.53"E
Transmission Line Route – Alternatives 2– Start point	33°47'40.03"S	25°41'33.05"E
Transmission Line Route – Alternatives 2– End point	33°44'37.16"S	25°40'38.53"E
Transmission Line Route – Alternatives 3– Start point	33°47'42.23"S	25°41'38.22"E
Transmission Line Route – Alternatives 3– End point	33°44'37.16"S	25°40'38.53"E
Transmission Line Route Alternative 1 – mid-way point	33°46'5.74"S	25°41'45.86"E
Transmission Line Route Alternative 1 (bend 1)	33°47'27.01"S	25°41'30.71"E
Transmission Line Route Alternative 1 (bend 2)	33°47'11.85"S	25°41'51.67"E
Transmission Line Route Alternative 1 (bend 3)	33°46'34.50"S	25°42'11.19"E
Transmission Line Route	33°44'46.24"S	25°40'35.55"E

Alternative 1 (bend 4)		

9.1.4 No-go option

While the no-go alternative will not result in any negative environmental impacts, it will also not result in any positive socio-economic benefits. It will also not assist government in addressing its set target for a sustainable energy supply mix, nor will it assist in supplying the increasing electricity demand within the country and will not contribute further to the local economy by provide employments opportunities. From the environmental perspective, the specialists hadn't identified any fatal flaws in authorising the proposed project, and mitigation measures were provided to manage identified impacts.

For a socio-economic perspective, when compared with the no-go option – which entails the Powerships and their associated infrastructure not being deployed, and none of the positive or negative impacts identified arising– the proposed project is associated with greater socio-economic benefits and should be authorised, hence the "no-go" alternative is not the preferred alternative.

9.2 EAP'S OPINION AND RECOMMENDED CONDITIONS OF AUTHORISATION

Based on the findings of the independent specialist studies, the proposed project will not result in highly sensitive environmental or social impacts, given that all standards be adhered to and mitigation measures as well as specialist recommendations be implemented. It is the reasoned opinion of the EAP that the proposed 540MW Gas to Power Powership Project, should be authorised. This is however, subject to the implementation of the mitigation measures and monitoring for potential environmental and socio-economic impacts as outlined in the EIA Report and EMPr being implemented by Karpowership South Africa (Pty) Ltd.

The authorisation would include the following key infrastructure and components:

- Two Powerships;
- FSRU;
- LNGC for refuelling;
- Gas pipeline;
- 132 kV Transmission Lines;
- Switching Station; and
- Temporary laydown area

It is the recommendation of the EAP that the following key management and mitigation conditions must be incorporated into the authorisation for the project:

- All mitigation measures specified within this EIA Report, EMPr (Appendix G), as well as the specialist reports contained in Appendix I, are to be implemented.
- The EMPr (Appendix G and its appendices) for this EIA Report must be a binding document between Karpowership South Africa (Pty) Ltd and the appointed contactor for construction and maintenance, in order to ensure compliance with environmental specifications and management measures.

- It is recommended that external EMPr monitoring takes place by an independent Environmental Control Officer (ECO) to ensure that the requirements of the EMPr are being correctly implemented, thus ensuring the protection of the surrounding environment.
- Permits from relevant provincial authorities, i.e. Biodiversity Permits, must be obtained prior to the removal or relocation of the identified Species of Conversation Concern.
- Obtain all other mandatory and environmental permits for the project, as required.

10 REFERENCES

ADAMS, C. A. *et al.* (2019) 'Effect of anthropogenic light on bird movement, habitat selection, and distribution: a systematic map protocol', *Environmental Evidence*, 8(1), p. 13. doi: 10.1186/s13750-019-0155-5.

ADAMS, J. B., FERNANDES, M. AND RIDDIN, T. (2019) 'Chapter 5: Estuarine Habitat extent and trend', in *South African National Biodiversity Assessment 2018: Technical Report. Volume 3: Estuarine Realm. Report Number: SANBI/NAT/NBA2018/2019/Vol3/A*. Pretoria: South African National Biodiversity Institute.

ANCHOR. 2015. Assessment framework for the management of effluent from land based sources discharged to the marine environment. Report 16618/1. 94 pp.

ARC. (2006). Land Types of South Africa. Pretoria: Agricultural Research Council.

BERLINER, D. AND DESMET, P. 2007. Eastern Cape Biodiversity Conservation Plan Technical Report. Mainstream Biodiversity in Land Use Decision-Making in the Eastern Cape Province. DWAF Project No. 2005-012.

BINNEMAN, J. 1994. Report on Phase 1 survey of visible archaeological features at Schelmhoek and Hougham Park. Report prepared for PPC.

BINNEMAN, J. 1999. Coega Industrial Development Zone: cultural sensitivity Phase 2 Report. Report prepared for Coega IDZ.

BINNEMAN, J. 2008. A phase 1 archaeological heritage impact assessment of the proposed aquaculture operation for the grow-out of prawn larvae for commercial purposes in Zone 10 of the Coega Industrial Development Zone, Port Elizabeth. Prepared for CEN Integrated Environmental Management Unit, Port Elizabeth.

BINNEMAN, J. 2010. A Phase 1 Archaeological Impact Assessment of the greater Coega Industrial Development Zone (IDZ), near Port Elizabeth, Nelson Mandela Bay Municipality, Eastern Cape. Province. Report prepared for Coega Industrial Development Corporation (Pty) Ltd. Eastern Cape Heritage Consultants, Jeffery's Bay.

BINNEMAN, J. AND WEBLEY, L. 1996. Proposed Eastern Cape Zinc and Phosphoric Acid Project: Baseline report: sensitivity of cultural sites. Report prepared for African Environmental Solutions.

BINNEMAN, J. AND WEBLEY, L. 1997a. Coega Industrial Development Zone: Cultural Sensitivity. Report prepared for African Environmental Solutions.

BINNEMAN, J. AND WEBLEY, L. 1997b. Proposed Port Elizabeth harbour expansion and corridor link to Coega: cultural sensitivity report. Report prepared for African Environmental Solutions.

BIRDLIFE (2016) 'Important Bird and Biodiversity Areas of KwaZulu-Natal'. Birdlife South Africa. Available at: http://www.birdlife.org.za/wp-content/uploads/2018/06/IBA_KZN_2016_web.pdf

BORNMAN T, STEYN P-P. 2014. Large-scale toxic red tides plague eastern and southern coasts of South Africa. eNewsletter February 2014, SAEON.

CAMPBELL, E. E., BATE, G. C. 1988. The estimation of annual primary production in a high energy surfzone. *Botanica Mar.* 31: 337-343.

CDC (no date), *CDC Guidance Note: Heavy Fuel Oil Fired Power Plants*, CDC Group plc. https://assets.cdcgroup.com/wp-content/uploads/2018/12/10150725/CDC_HFO-fired_Power_Guidance_2018.pdf [Accessed 05 October 2020]

CEN. 1997. Feasibility study. Environmental impact report on a proposed harbour in the vicinity of Coega, Port Elizabeth. CEN Integrated Environmental Management Unit, Port Elizabeth.

CEN (2015) 'A Coastal Management Program for the Nelson Mandela Bay Municipality'. Nelson Mandela Bay Municipality.

CES (2000) 'Coega Environmental Impact Assessment for the Rezoning of the Core Development Area from Agriculture to Special Purposes. Environmental Impact Report.' Report prepared by Coastal and Environmental Services for Coega Development Corporation.

CES. 2001. The Subsequent Environmental Impact Report for the Proposed Port of Ngqura. 511 pp.

CSIR. 2012. Environmental Impact Assessment for the Proposed Bulk Liquid Storage and Handling Facility in Zone 8 of the Coega IDZ.

CSIR (2013) 'Scoping and Environmental Impact Assessment for the proposed Manganese Export Facility and Associated Infrastructure in the Coega Industrial Development Zone, Port of Ngqura and Tankatara area: Final EIA Report. Volume 1. CSIR Report Number: CSIR/CAS/EMS/'. Stellenbosch: Report prepared by the Council for Scientific and Industrial Research for Transnet SOC Ltd.

CSIR (2015a) 'Desktop Provisional EcoClassifcation of Temperate Estuaries of South Africa'. Report prepared by the Council for Scientific and Industrial Research for the Water Research Commission.

CSIR (2015b) 'Proposed Demolition of the unused Coega Saltworks Facility and associated structures in the Port of Ngqura within the Coega IDZ, Port Elizabeth, Nelson Mandela Bay Municipality. Final Basic Assessment Report. CSIR Report No: CSIR/CAS/EMS/ER/2015/0003/B'. Durban: Council for Scientific and Industrial Research.

CSIR. 2017. Long-term ecological monitoring programme for the Port of Ngqura: surveys made in 2016/2017. Report CSIR/NRE/ECOS/IR/2017/0086/C. 97 pp.

CSIR. 2018. Long-term ecological monitoring programme for the Port of Ngqura: surveys made in 2017/2018. Report CSIR/NRE/ECOS/IR/2018/0060/C. 113 pp.

DALI, L. O. 2010. Initial investigations into dynamics of mesozooplankton community structure in Algoa Bay, South Africa. MSc Thesis, Rhodes University, 202 pp.

DEA (2014a): Environmental Assessment Regulations, 2014 identified in terms of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004), Government Gazette 38282, Notice No. R 982 of 4 December 2014.

DEA and Royal HaskoningDHV (2017) 'Updated User-Friendly Guide to South Africa's Integrated Coastal Management Act (Revised Edition, 2017)'. Cape Town: Department of Environmental Affairs (DEA). Available at: https://www.environment.gov.za/sites/default/files/reports/updateduserfriendlyguide_SAICMAct.pdf.

DEGNARAIN, N (2020). What Is Heavy Fuel Oil, And Why Is It So Controversial? Five Killer Facts. Forbes Online Article, Aug 14, 2020,06:10pm EDT. https://www.forbes.com/sites/nishandegnarain/2020/08/14/what-is-heavy-fuel-oil-and-why-is-it-so-controversial-five-killer-facts/#2885b0be74c0 [Accessed 05 October 2020]

DEPARTMENT OF ENVIRONMENTAL AFFAIRS. (2019). South African National Land-Cover (SANLC) 2018. South Africa: DEA on 1st October 2019.

DEPARTMENT OF ENVIRONMENT AFFAIRS AND TOURISM SOUTH AFRICA. 2007. Long Term Mitigation Scenarios, Strategic Options for South Africa. Scenario Building Team, October 2007.

DER WAALS, J. G. (2019). Developing Wetland Distribution And Transfer Functions From Land Type Data As A Basis For The Critical Evaluation Of Wetland Delineation Guidelines By Inclusion Of Soil Water Flow Dynamics In Catchment Areas Volume 3. Wrc Report No. 2461/3/18.

DICKEN, M. L. 2010. The ichthyofauna in the Port of Ngqura, South Africa. *African Journal of Marine Science* **32(3)**: 491-499.

DICKEN, M. L. 2011. Population size of neonate and juvenile dusky sharks *Carcharhinus obscurus* in the Port of Ngqura, South Africa. *African Journal of Marine Science* **33(2)**: 255-261.

DICKENS, C.W.S. AND GRAHAM, P.M. (2002). The South African Scoring System (SASS) version 5 Rapid Bio assessment Method for Rivers. African Journal of Aquatic Sciences, 27: 1-10

DMEA. (1991). *3324 Port Elizabeth - 1:250 000 Geological Series.*

DONNELLY, LYNLEY. 2018. Behind the Eskom purge. The M&G Online. [Online] https://mg.co.za/article/2011-06-10-gigaba-wields-the-axe/ (Accessed 06 May 2020)

DRIVER, A., NEL, J.L., SNADDON, K., MURRAY, K., ROUX, D.J., HILL, L., SWARTZ, E.R., MANUEL, J. AND FUNKE, N. 2011. Implementation Manual for Freshwater Ecosystem Priority Areas. Report to the Water Research Commission. WRC Report No. June 2011.

DU PREEZ, D. R. 1996. The structure and ecophysiology of the surf diatom, *Anaulus australis*. PhD Thesis. University of Port Elizabeth, South Africa, 324 pp.

DWAF (1995) 'South African Water Quality Guidelines for Coastal Marine Waters'. Volume 1: Natural Environment, Department of Water Affairs and Forestry.

DWAF. (2006). Groundwater Resource Assessment II.

DWS. (2016). *New Water Management Areas.* South Africa: Government Gazette No. 40279.

EASTERN CAPE PLANNING COMMISSION (2014) Eastern Cape Vision 2030 Provincial Development Plan (2014), Eastern Cape Planning Commission, Province of Eastern Cape.

EASTERN CAPE SOCIO ECONOMIC CONSULTATIVE COUNCIL (2020): Strategic Plan 2020 – 2025 (2020)

EOH. 2015. Independent Power Producers Programme: EIA For A Floating Power Plant, Port Of Ngqura, Eastern Cape Province, South Africa

ESCOTT, B, LIVINGSTONE, TC, NXELE, B, HARRIS, J, & JEWITT, D. 2012. Draft Document Describing The Conservation Planning Terms For The EKZNW Spatial Planning Products For Ezemvelo KZN Wildlife.

EZEMVELO KZN WILDLIFE, 2016. KZN Biodiversity Spatial Planning Terms and Processes, Version 3.3 Unpublished Report, Biodiversity Spatial Planning and Information Division, Ezemvelo KZN Wildlife.

GEOSCIENCES, 2011. Annual Technical Report of the Council for Geosciences.

GCS (October 2020): Desktop Hydropedology Assessment for the Proposed Karpowership Transmission Line – Coega Bay Port.

GCS (October 2020): Preliminary Aquatic Assessment for the Proposed Karpowership Transmission Line – Coega Bay Port.

GCS (October 2020): Desktop Hydrological Assessment for the Proposed Karpowership Transmission Line – Coega Bay Port.

GCS (October 2020): Geohydrological Assessment for the Proposed Karpowership Transmission Line – Coega Bay Port.

GOLDBERG, A. 2015. The economic impact of load shedding: The case of South African retailers. Pretoria: University of Pretoria.

GOSLING, Melanie. 2019. Eskom and the multi-billion rand mega projects that could have saved SA. Fin24. [Online] https://www.news24.com/fin24/Economy/eskom-and-the-multi-billion-rand-mega-projects-that-could-have-saved-sa-20190213. (Accessed 06 May 2020)

IRP. 2011. Integrated Resource Plan for Electricity 2010 – 2011. Department of Energy.

LTPF, 2015. Transnet Long Term Planning Framework, s.l.: Transnet Group Planning.

IUCN. 2020. The IUCN Red List of Threatened Species. Version 2020-3. Downloaded from http://www.iucnredlist.org on 25/01/2021.

JAMES, N. C. AND HARRISON, T. D. (2010) 'A preliminary survey of the estuaries on the southeast coast of South Africa, Cape St Francis – Cape Padrone, with particular reference to the fish fauna', *Transactions of the Royal Society of South Africa*, 65(1), pp. 69–84.

JENKINS AR, SMALLIE JJ & DIAMOND M. 2010. Avian collisions with power lines. A global review of causes and mitigation with a South African perspective. Bird Conservation International doi:10.1017/S0959270910000122.

JOB, N., LE ROUX, P., TURNER, D., VAN DER WAALS, J., GRUNDLING, A., VAN DER WALT, M., PATERSON, D. (2019). Developing Wetland Distribution And Transfer Functions From Land Type Data As A Basis For The Critical Evaluation Of Wetland Delineation Guidelines By Inclusion Of Soil Water Flow Dynamics In Catchment Areas. Volume 1. Pretoria: WRC Report No. 2461/1/18.

KAPLAN, J. 1993. The State of Archaeological Information in the Coastal Zone from the mouth of the Orange River to Ponto do Ouro. Report prepared for the Department of Environment Affairs & Tourism. ACRM, Riebeek West.

KAPLAN, J. 2007. Phase 1 archaeological impact assessment the proposed Coega integrated liquified natural gas (ing) to power project (cip) Coega industrial development zone, Port Elizabeth, Eastern Cape Province. Prepared for CSIR. ACRM, Riebeek West

KAPLAN, J. 2008a. Phase 1 Archaeological Impact Assessment for the proposed Exxaro Manganese Smelter, Coega Industrial Development Zone. Report prepared for Coastal Environmental Services. ACRM, Riebeek West.

KAPLAN, J. 2008b. Phase 1 Archaeological Impact Assessment for the proposed Kalagadi Manganese smelter in the Coega Industrial Development Zone Port Elizabeth Eastern Cape Province. Report prepared for Coastal Environmental Services. ACRM, Riebeek West

KING, G., MARITZ, E., & AND JONCK, F. (1998). 3324 PE - 1:500 000 Hydrological Map Series of the Republic of South Africa.

KLAGES, N. T. W., CAMPBELL E. E., STEYN P-P. 2006. Port of Ngqura marine biomonitoring programme. Summer 2005/2006. Integrated Environmental & Coastal Management Report C138: 41pp.

KLEYNHANS, C. J., AND LOUW, M. D. 2007. Module A: EcoClassification and EcoStatus determination in River EcoClassification: Manual for EcoStatus Determination (version 2). Joint Water Research Commission and Department of Water Affairs and Forestry report. WRC Report No.TT 329/08.

KOTTEK, M., GRIESER, J., BECK, C., RUDOLF, B., & RUBEL, F. (2006). World Map of the Köppen- Geiger climate classification updated. Meteorol. Z.15, 259-263. doi:10.1127/0941- 2948/2006/0130.

LOURENS, P. (2013). The relationship between South African geology and geohydrology. IGS, University of the Free State, Bloemfontein. Masters Dissertation.

LEIGH DE WET (October 2020): Preliminary Terrestrial Ecological Assessment for the Proposed Gas to Power Project, Coega, Eastern Cape.

LTPF, 2015. Transnet Long Term Planning Framework, s.l.: Transnet Group Planning.

LUMEC, 2020. Socioeconomic Assessment - input on Demographics for the Port of Ngqura.

LWANDLE (2021) 'Marine Ecology Specialist Study G2P Development, Port of Ngqura: Baseline and Impact Assessment Report. Report Ref.: LT 889 BR NGQURA V 1.0'. Cape Town: Report prepared for Triplo4 Sustainable Solutions by Lwandle Technologies (Pty) Ltd.

MELLY, B. L., MCGREGOR, G., HOFMEYR, G. J. G., PLON, S. 2017. Spatio-temporal distribution and habitat preferences of cetaceans in Algoa Bay, South Africa. *Journal of the Marine Biological Association of the United Kingdom:* 1-15.

MBAMBO, S. W. 2014. Scales of variability of phytoplankton composition and biomass in Algoa Bay, South Africa. MSc Thesis. University of Cape Town, 70 pp.

MCLACHLAN, A., 1983. The ecology of sandy beaches in the Eastern Cape, South Africa. In *Sandy beaches as ecosystems* (pp. 539-546). Springer, Dordrecht.

MHI 2020. Risk Assessment in terms of the Major Hazard Installation Regulations for the EIA application for Karpowership Gas to Power Operations at the Port of Ngqura. Major Hazard Risk Consultants, October 2020.

MOORE, L. AND BREETZKE, T. (2020) 'Coastal and Climate Change Scoping Assessment for Richards Bay, Coega and Saldanha BayTitle'. Cape Town.

MUCINA, L. AND RUTHERFORD, M. C. (EDS). 2006. The Vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

MUCINA, L. AND RUTHERFORD, M. C. 2012. Updated Vegetation of South Africa, Lesotho and Swaziland. South African National Biodiversity Institute, Pretoria.

NATIONAL DEVELOPMENT PLAN. 2030. Our Future-make it work, National Planning Commission, Department: The Presidency-Republic of South Africa

NEL, J.L., MURRAY, K.M., MAHERRY, A.M., PETERSEN, C.P., ROUX, D.J., DRIVER, A., HILL, L., VAN DEVENTER, H., FUNKE, N., SWARTZ, E.R., SMITH-ADAO, L.B., MBONA, N., DOWNSBOROUGH, L. AND NIENABER, S. (2011). Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report No. K5/1801

NELSON MANDELA BAY MUNICIPALITY Draft Integrated Development Plan (IDP) – 2017/18 – 2021/22 (Fourth Edition)

PATTRICK, P., STRYDOM, N. A. 2014. Larval fish variability in response to oceanographic features in a nearshore nursery area. *Journal of Fish Biology* **85:** 857-881.

PARSONS, R. (1995). A South African Aquifer System Management Classification. Water Research Commission Report No. KV 7795.

PETTERSON, D. (2019). Unique port sand bypass system successfully mimics nature. Infrastructure News. [Online]. Available from: https://infrastructurenews.co.za/2019/04/18/unique-port-sand-bypass-system-successfully-mimics-nature

PICHEGRU L, NYENGERA R, MCINNES AM & PISTORIUS PA. (2017). Avoidance of seismic survey activities by penguins. www.nature.com/scientificreports 10) Shannon G, McKenna MF, Angeloni LM, Crook.

PRDW (2020b) ‘SA Powership Mooring Study: Richards Bay Cooling Water Disperion Modelling. S2117-1-TN-CE-003-R0’. Cape Town: Report prepared by PRDW for Karpowership.

ROBINSON, T.B. 2013. The release of warmed cooling water and associated continuous chlorination: impacts on the marine environment. Report for KNPS, Eskom. 15pp.

ROMER, G. 1986. Faunal assemblages and food chains associated with surf phytoplankton blooms. MSc thesis. University of Port Elizabeth, 194 pp.

SANBI, 2011. National Biodiversity Assessment. An Assessment of South Africa’s biodiversity and ecosystems.

SANBI (2018) *The Vegetation Map of South Africa, Lesotho and Swaziland. Version 2018*. Edited by L. Mucina, M. C. Rutherford, and L. W. Powrie. South african National Biodiversity Institute. Available at: http://bgis.sanbi.org/Projects/Detail/186.

SANDERFOOT O & HOLLOWAY T. 2017. Air pollution impacts on avian species via inhalation exposure and associated outcomes. Environmental Research Letters. 12. 083002. 10.1088/1748-9326/aa8051.

SCHULTZE, R.E. 2010. Mapping hydrological soil groups over South Africa for use with the SCS-SA design hydrograph technique: methodology and results. School of Agriculture, Earth and Environmental Sciences, University of KwaZulu-Natal, Pietermaritzburg.

SCHULTZE, R.E., SCHMIDT, E.J. and SMITHERS, J.C., 1992. PC-based SCS flood estimates for small catchments in Southern Africa. Department of Agriculture Engineering, University of Natal, Pietermaritzburg.

SHANNON G, MCKENNA MF, ANGELONI LM, CROOKS KR, FRISTRUP KM, BROWN E, WARNER KA, NELSON MD, WHITE C, BRIGGS J, MCFARLAND S, AND WITTEMYER G. (2015) A synthesis of two decades of research documenting the effects of noise on wildlife. Biological Reviews. pp. 000–000. Cambridge Philosophical Society doi: 10.1111/brv.12207.

SHAW M, REID TA, GIBBONS BK, PRETORIUS M, JENKINS AR, VISAGIE, R, MICHAEL MD, Ryan PG. 2021. A large-scale experiment demonstrates that line marking reduces power line collision mortality for large terrestrial birds, but not bustards, in the Karoo, South Africa. Ornithological Applications DO 10.1093/ornithapp/duaa067.

SHELL (2020). Natural Gas. https://www.shell.co.za/energy-and-innovation/natural-gas.html [Accessed 05 October 2020]

SOUTH AFRICAN WEATHER BUREAU (SAWB) (1998): Climate of South Africa, Climate Statistics up to 1990, WB40.

SOUTH AFRICAN WEATHER BUREAU (SAWB) (1992): Climate tables of South Africa, Climate Statistics, WB42.

SMITH, A. (2020): Archaeological Impact Assessment (Desktop Study) Proposed Karpowership At The Port Of Ngqura Within The Coega Industrial Development Zone Eastern Cape Province

SRK (2014) 'Nelson Mandela Bay Municipality Final Bioregional Plan'. Port Elizabeth: Report prepared by SRK Consulting (Pty) Ltd for Nelson Mandela Bay Municipality.

STAFF WRITER .2020 (b). New regulations will allow South African municipalities to buy and generate their own electricity [Online] https://businesstech.co.za/news/energy/395495/new-regulations-will-allow-south-african-municipalities-to-buy-and-generate-their-own-electricity/ (Accessed 06 May 2020)

STATSSA. 2016. Community Survey 2016: Provinces at a glance. Pretoria: StatsSA.

THERMIS ENVIRONMENTAL (2020): Coastal and Climate Change scoping report for the proposed Powerships at Saldanha Bay, Port of Ngqura and Richards Bay

TRANSNET (2015): Transnet Preparations for Gas Infrastructure in South Africa. South Africa Gas Options Conference- 29 September 2015, Cape Town.

TRIPLO4 SUSTAINABLE SOLUTIONS- MALEK-HOOSEN, S., (October 2020): *Wetland Delineation and Functional Assessment for the Proposed Transmission Lines in the Port of Ngqura, Nelson Mandela Bay Metropolitan Municipality, Eastern Cape*.

TURPIE, J. AND CLARK, B. (2007) 'Development of a conservation plan for temperate South African estuaries on the basis of biodiversity importance, ecosystem health and economic costs and benefits'. Final Report. Anchor Environmental Consultants.

UMOYA-NILU (June 2020): Atmospheric Impact Report – Port of Ngqura.

VAN NIEKERK, L., ADAMS, J.B., LAMBERTH, S. J., TALJAARD, S. AND WEERTS, S. P. (2019) 'Restoration measures needed to improve the condition and productivity of South African estuaries.', in South African National Biodiversity Assessment 2018: Technical Report. Volume 3: Estuarine Realm. Report Number: SANBI/NAT/NBA2018/2019/Vol3/A. Pretoria: South African National Biodiversity Institute.

VAN NIEKERK, L., ADAMS, J. B., et al. (2019) 'South African National Biodiversity Assessment 2018: Technical Report. Volume 3: Estuarine Realm. Report Number: SANBI/NAT/NBA2018/2019/Vol3/A.' Pretoria: South African National Biodiversity Institute.

VAN NIEKERK, L., TALJAARD, S., et al. (2019) 'Chapter 7: Condition of South Africa's estuarine ecosystems', in South African National Biodiversity Assessment 2018: Technical Report. Volume 3: Estuarine Realm. Report Number: SANBI/NAT/NBA2018/2019/Vol3/A. Pretoria: South African National Biodiversity Institute.

VAN NIEKERK, L., TURPIE, J. K. AND LAMBERTH, S. J. (2019) 'Estuary Biodiversity Importance.', in South African National Biodiversity Assessment 2018: Technical Report. Volume 3: Estuarine Realm. Report Number: SANBI/NAT/NBA2018/2019/Vol3/A. Pretoria: South African National Biodiversity Institute.

VAN NIEKERK, L. *et al.* (2020) 'An Estuary Ecosystem Classification that encompasses biogeography and a high diversity of types in support of protection and management', *African Journal of Aquatic Science*, 45(1).

VAN SCHALKWYK, L. and WAHL, B. 2006. Heritage resource scoping assessment of integration of electrical infrastructure, Coega Industrial Development Zone, Port Elizabeth, Eastern Cape.

WEBLEY, L. 2007a. Phase 1 Heritage Impact Assessment for Straits Chemicals proposed chlor-alkali and salt plant Coega Eastern Cape Province. Report prepared for SRK Consulting.

WEBLEY, L. 2007b. Phase 1 heritage impact assessment of the proposed Afro-Asia steel recycling facility at the Coega Industrial Development Area, Port Elizabeth. Prepared for SRK Consulting, Port Elizabeth.

WESTON L. 2020. Marine ecology issues list G2P development, Ports of Saldanha, Ngqura and Richards Bay. Lwandle Marine Environmental Services.

WHITFIELD, A. K. (1992) 'A characterization of southern African estuarine systems', *South African Journal of Aquatic Science*, 18(1), pp. 89–103.

WILLIAMS, B. (2021) 'Noise Specialist Study for the Proposed Gas to Power Powership at the Port of Ngqura within the Coega SEZ, Nelson Mandela Bay Municipality'. Report prepared by SafeTech for Triplo4 Sustainble Solutions.

WOOLDRIDGE T. H., KLAGES, N. T., SMALE, M. J. 1997. Proposed harbour development at Coega (Prefeasibility Phase). *Specialist report on the nearshore environment.* Produced for Portnet. 38 pp.

WRIGHT, J.G. AND CALITZ, J.R., 2020. Setting up for the 2020s: Addressing South Africa's electricity crises and getting ready for the next decade. Version 1.1.

WRC. (2015). http://www.waterresourceswr2012.co.za/resource-centre/. Retrieved from Water Resources of South Africa, 2012 Study (WR2012). ARC, 2006

WRC (2018) The Critical Evaluation of Wetland Delineation Guidelines by Inclusion of Soil Water Flow Dynamics in Catchment Areas. Volume 1. Pretoria: Wrc Report No. 2461/1/18.

https://oceansnotoil.org/2020/10/09/gas-to-power-powership-project-register-as-interested-affected-party/

https://www.egsa.org.za/fossil-fuels/notice-of-ea-and-ael-application-the-proposed-gas-to-power-powership-project-port-of-ngqura-eastern-cape/

https://web.facebook.com/WESSAEastCape/posts/wessa-algoa-bay-branchplease-read-through-the-letter-below-from-triplo4-sustaina/2816169225282489/?_rdc=1&_rdr

https://www.reddit.com/r/southafrica/comments/jk6kjq/turkish_floating_gas_power_ships_applied_for/

https://www.egsa.org.za/?s=triplo4

https://www.dailymaverick.co.za/article/2020-10-18-turkish-floating-gas-power-ships-sail-into-public-consultation-process-after-back-door-passage-to-sa-freezes-up/