ENVIRONMENTAL MANAGEMENT PLAN FOR THE NAMPOWER ANIXAS II POWER PROJECT, WALVIS BAY

Assessed by:

Assessed for:

December 2020

Project:	**ENVIRONMENTAL MANAGEMENT PLAN FOR THE NAMPOWER ANIXAS II POWER PROJECT, WALVIS BAY**		
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Report Version / Date	Final December 2020	**Report Approval**	**Pierre Botha** Managing Director

I _____ acting as the Proponent's representative (Namibia Power Corporation (Pty) Ltd), hereby confirm that the project description contained in this report (Bosman, Q., Botha, P., Faul, A., Coetzer, W. 2020. Environmental Management Plan for the NamPower Anixas II Power Project, Walvis Bay) is a true reflection of the information which the Proponent has provided to Geo Pollution Technologies. All material information in the possession of the proponent that reasonably has or may have the potential of influencing any decision or the objectivity of this assessment is fairly represented in this report.

Signed at _____ on the ___ day of _____2021.

_____ _____

Namibia Power Corporation (Pty) Ltd **Company Registration Number**

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ABREVIATIONS

AIDS	Acquired Immune Deficiency Syndrome
dB	Decibel (expression of the relative loudness of the un-weighted sound level in air)
dBA	Decibel (expression of the relative loudness of the A-weighted sound level in air)
EIA	Environmental Impact Assessment
EMA	Environmental Management Act (Act No. 7 of 2007)
EMP	Environmental Management Plan
EMS	Environmental Management System
GT	Gas Turbine
HFO	Heavy Fuel Oil
HIV	Human Immunodeficiency Virus
Hr	Hour
IAP	Interested and Affected Parties
IBA	Important Bird Areas
ICRE	Internal Combustion Reciprocating Engines
IFC	International Finance Corporation
ISO	International Organization for Standardization
IUCN	International Union for Conservation of Nature
LNG	Liquefied Natural Gas
m^3	Cubic Meter
MEFT	Ministry of Environment, Forestry and Tourism
mm	Millimetre
MW	Megawatt
MWh	Megawatt hour
OEM	Original Equipment Manufacturer
PPE	Personal Protective Equipment
rpm	Revolutions per minute
SANS	South African National Standards
SCR	Selective Catalytic Reduction
SI	Spark Ignited
WHO	World Health Organization

GLOSSARY OF TERMS

Alternatives - a possible course of action, in place of another, that would meet the same purpose and need, but which would avoid or minimize negative impacts or enhance project benefits. These can include alternative locations/sites, routes, layouts, processes, designs, schedules and/or inputs. The “no-go” alternative constitutes the ‘without project’ option and provides a benchmark against which to evaluate changes; development should result in net benefit to society and should avoid undesirable negative impacts.

Assessment - the process of identifying, predicting and evaluating potential substantial impacts, risks and consequences of proposed activities on the environment, as well as alternatives and mitigation measures that will minimize the impacts and maximize the benefits of these activities.

Competent Authority - means a body or person empowered under the local authorities act or Environmental Management Act to enforce the rule of law.

Cumulative Impacts - in relation to an activity, means the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.

Environment - as defined in the Environmental Assessment Policy and Environmental Management Act - “land, water and air; all organic and inorganic matter and living organisms as well as biological diversity; the interacting natural systems that include components referred to in sub-paragraphs, the human environment insofar as it represents archaeological, aesthetic, cultural, historic, economic, palaeontological or social values”.

Environmental Impact Assessment (EIA) - process of assessment of the effects of a development on the environment.

Environmental Management Plan (EMP) - a working document on environmental and socio-economic mitigation measures, which must be implemented by several responsible parties during all the phases of the proposed project.

Environmental Management System (EMS) - an Environment Management System, or EMS, is a comprehensive approach to managing environmental issues,

integrating environment-oriented thinking into every aspect of business management. An EMS ensures environmental considerations are a priority, along with other concerns such as costs, product quality, investments, and strategic planning. An EMS generally makes a positive impact on a company's bottom line. It increases efficiency and focuses on customer needs and marketplace conditions, improving both the company's financial and environmental performance. By using an EMS to convert environmental problems into commercial opportunities, companies usually become more competitive.

Evaluation – means the process of ascertaining the relative importance or significance of information, in light of people's values, preference and judgements in order to make a decision.

Hazard - anything that has the potential to cause damage to life, property and/or the environment. The hazard of a particular material or installation is constant; that is, it would present the same hazard wherever it was present.

Important Bird and Biodiversity Area (IBA) - is an area identified using an internationally agreed set of criteria as being globally important for the conservation of bird populations. IBA are developed and sites are identified by BirdLife International.

Megawatt hour (MWh) - is equal to 1,000 kilowatt hours (KWh). It refers to the period of time for which the amount of electrical power is used.

Mitigate - The implementation of practical measures to reduce adverse impacts.

Nitrogen oxides (NOx) - NOX is a term used to describe a mixture of nitric oxide (NO) and nitrogen dioxide (NO_2). They are inorganic gases formed by combination of oxygen with nitrogen from the air. NO is produced in much greater quantities than NO_2, but oxidises to NO_2 in the atmosphere. NO_2 causes detrimental effects to the bronchial system. NOx is emitted when fuel is being burned e.g. in transport, industrial processes and power generation.

Particulate matter ($PM_{10/2.5}$) - airborne particulate matter varies widely in its physical and chemical composition, source and particle size. PM_{10} particles (the fraction of particulates in air of very small size (<10 µm)) and $PM_{2.5}$ particles (<2.5 µm) are of major current concern, as they are small enough to penetrate deep into the lungs and so potentially pose significant health risks. Larger particles meanwhile, are not readily inhaled, and are removed relatively efficiently from the air by sedimentation.

Proponent (Applicant) - any person who has submitted or intends to submit an

application for an authorisation, as legislated by the Environmental Management Act no. 7 of 2007, to undertake an activity or activities identified as a listed activity or listed activities; or in any other notice published by the Minister or Ministry of Environment, Forestry and Tourism.

Public - citizens who have diverse cultural, educational, political and socio-economic characteristics. The public is not a homogeneous and unified group of people with a set of agreed common interests and aims. There is no single public. There are a number of publics, some of whom may emerge at any time during the process depending on their particular concerns and the issues involved.

Scoping Process - process of identifying: issues that will be relevant for consideration of the application; the potential environmental impacts of the proposed activity; and alternatives to the proposed activity that are feasible and reasonable.

Sulphur dioxide (SO_2) - fossil fuels contain traces of sulphur compounds, and SO_2 is produced when they are burnt. The majority of the SO_2 emitted to the air is from power generation, and the contribution from transport sources is small (shipping being an exception). Exposure to SO_2 can damage health by its action on the bronchial system. Sulphuric acid generated from atmospheric reactions of SO_2 is the main constituent of acid rain, and ammonium sulphate particles are the most abundant secondary particles found in air.

Significant Effect/Impact - means an impact that by its magnitude, duration, intensity or probability of occurrence may have a notable effect on one or more aspects of the environment.

Sustainable Development - “Development that meets the needs of the current generation without compromising the ability of future generations to meet their own needs and aspirations” – the definition of the World Commission on Environment and Development (1987). “Improving the quality of human life while living within the carrying capacity of supporting ecosystems” – the definition given in a publication called “Caring for the Earth: A Strategy for Sustainable Living” by the International Union for Conservation of Nature (IUCN), the United Nations Environment Programme and the World Wide Fund for Nature (1991).

Transmission Evacuation Capacity – The amount of power that can be transferred from the power station through the distribution network

Transmission Coefficient - A single number rating scale that measures a wall, ceiling, or floor assembly's ability to block sound transmission. The higher the number, the greater the drop in decibel levels bleeding through the surface.

1 INTRODUCTION

The Namibia Power Corporation (Pty) Ltd (the Proponent), requested Geo Pollution Technologies (Pty) Ltd to prepare an environmental management plan (EMP) for their Firm Power Project (FPP) to increase dispatchable firm power on the Namibian grid. The proposed FPP in Walvis Bay will include the existing 22.5 MW Anixas Power Station (Anixas I) and the extension (Anixas II) with a base case of 50 MW which will bring the total generation capacity to 72.5 MW. The FPP location in Walvis Bay is at the existing Anixas Power Station on Erf No. 5065, 15 John Ovenstone Street (Figure 1-1). NamPower proposes to employ similar engine technology as Anixas I, and to utilise the same transmission connection infrastructure to evacuate the electrical power to the Namibian grid. Although transmission evacuation capacity exists for further generation expansion of up to 142 MW, this option is not currently considered for implementation.

Figure 1-1. Project location

The technology selection for the proposed upgrade was conducted by the Technical Advisor, with input from environmental scientists who considered impacts associated with each technology. This included power station location, technology and fuel

options. An environmental assessment was conducted as per the Environmental Management Act, 2007 (EMA) of Namibia, following the technology selection process. The aim of the environmental assessment is to determine the potential impacts of the construction, operational and decommissioning phases of the project on the environment. The environment being defined in the Environmental Assessment Policy and Environmental Management Act as “land, water and air; all organic and inorganic matter and living organisms as well as biological diversity; the interacting natural systems that include components referred to in sub-paragraphs, the human environment insofar as it represents archaeological, aesthetic, cultural, historic, economic, paleontological or social values”. As part of the Environmental Assessment, an Environmental Management Plan (EMP) was drafted for the activities related to the construction and operations of the facility. Mitigation measures as proposed, are included in the EMP.

2 ASSUMPTIONS AND LIMITATIONS

The following assumptions and limitations were identified:

2.1 ASSUMPTIONS

- All existing infrastructure are licensed and permitted as per all required Namibian laws.

2.2 LIMITATIONS

- Information on Liquefied Natural Gas (LNG) transport, storage and use is limited, making assessment and mitigation problematic.
- Namibian law relating to water use and allocation, nature conservation and air quality is outdated and presents challenges to sustainable resource allocation, development and conservation. These ineffective laws may be inconsistent with the provisions of article 95(l) of the Namibian Constitution. Various vital legislation pieces do not have suitable regulations. Examples of this is the Hazardous Substances Ordinance 14 of 1974 and the Atmospheric Pollution Prevention Ordinance 11 of 1976.

3 OBJECTIVES OF THE EMP

The EMP provides management options to ensure impacts of the facility are managed, where negative impacts are minimised and positive ones are enhanced. An EMP is a tool used to take pro-active action by addressing potential problems before they occur. This should limit the corrective measures needed, although additional mitigation measures may be included where necessary. The environmental classification is provided in the tables and the management measures are provided in the bulleted descriptions below. These management measures should be adhered to during the various phases of the operation of the facility. This section of the report can act as a stand-alone document. All personnel taking part in the construction and operations of the facility should be made aware of the contents in this section, so as to plan the construction and operations accordingly and in an environmentally sound manner.

The objectives of the EMP are:

- to include all components of the construction activities (upgrades, maintenance, etc.) and operations of the power station;
- to prescribe the best practical control methods to lessen the negative environmental impacts associated with the project;
- to monitor and audit the performance of operational personnel in applying such controls; and
- to ensure that appropriate environmental training is provided to responsible construction (inclusive of decommissioning) and operational personnel.

4 IMPLEMENTATION OF THE EMP

Section 5 outline the management of the environmental elements that may be affected by the different activities. Impacts addressed and mitigation measures proposed are seen as minimum requirements which have to be elaborated on. Delegation of mitigation measures and reporting activities should be determined by the proponent and included in the EMP. The EMP is a living document that must be prepared in detail, and regularly updated, by the proponent as the project progress and evolve.

The EIA, EMP and Environmental Clearance Certificate (ECC) must be communicated to the site managers. A copy of the ECC and EMP should be kept on site. All monitoring results must be reported on as indicated. Reporting is important for any

future renewals of the ECC and must be submitted to the Ministry of Environment, Forestry and Tourism. Renewal of ECC will require six monthly reports based on the monitoring prescribed in this EMP.

5 MANAGEMENT OF IMPACTS

The following section provides management measures for both the operational phase as well as construction activities related to the project. In order to manage impacts, an assessment is required to determine the severity of impacts. Once determined, the appropriate and relevant management measures may be proposed. Assessment of impacts are conducted according to an assessment criteria.

For each impact, an environmental classification was determined based on the Rapid Impact Assessment Method as developed by Pastakia (Pastakia, 1998). Based on this method environmental impacts are assessed according to the following categories (see Table 4 1 to Table 4 5):

- importance of condition (A1) – assessed against the spatial boundaries of human interest it will affect;
- magnitude of change (A2) – measure of scale in terms of benefit/disbenefit of an impact or condition;
- permanence (B1) – defines whether the condition is permanent or temporary;
- reversibility (B2) – defines whether the condition can be changed and is a measure of the control over the condition; and
- cumulative nature (B3) – reflects whether the effect will be a single direct impact or will include cumulative impacts over time, or synergistic effect with other conditions. It is a means of judging the sustainability of the condition.

Environmental Classifications are then calculated = A1 x A2 x (B1 + B2 + B3)

The environmental classification of impacts is provided in Table 5-6.

The probability ranking refers to the probability that a specific impact will happen following a risk event. These can be improbable (low likelihood); probable (distinct possibility); highly probable (most likely); and definite (impact will occur regardless of prevention measures).

Table 5-1. Assessment Criteria - Importance of condition (A1)

Criteria	Score
Importance to national/international interest	4
Important to regional/national interest	3
Important to areas immediately outside the local condition	2
Important only to the local condition	1
No importance	0

Table 5-2. Assessment Criteria - Magnitude of change/effect (A2)

Criteria	Score
Major positive benefit	3
Significant improvement in status quo	2
Improvement in status quo	1
No change in status quo	0
Negative change in status quo	-1
Significant negative disbenefit or change	-2
Major disbenefit or change	-3

Table 5-3. Assessment Criteria - Permanence (B1)

Criteria	Score
No change/Not applicable	1
Temporary	2
Permanent	3

Table 5-4. Assessment Criteria - Reversibility (B2)

Criteria	Score
No change/Not applicable	1
Reversible	2
Irreversible	3

Table 5-5. Assessment Criteria - Cumulative (B3)

Criteria	Score
Light or No Cumulative Character/Not applicable	1
Moderate Cumulative Character	2
Strong Cumulative Character	3

Table 5-6. Environmental Classification (Pastakia 1998)

Environmental Classification	Class Value	Description of Class
72 to 108	5	Extremely positive impact
36 to 71	4	Significantly positive impact
19 to 35	3	Moderately positive impact
10 to 18	2	Less positive impact
1 to 9	1	Reduced positive impact
0	-0	No alteration
-1 to -9	-1	Reduced negative impact
-10 to -18	-2	Less negative impact
-19 to -35	-3	Moderately negative impact
-36 to -71	-4	Significantly negative impact
-72 to -108	-5	Extremely negative Impact

Section 5.1 and Section 5.2 provides a broad overview of the planning, construction and operational phases. Section 5.3 details the mitigation measures identified for identified impacts.

5.1 PLANNING PHASE

The impacts expected to be generated during the planning phase (which is inclusive of acquisition of the ECC) relate mostly to project design, legal and economic aspects.

During the phases of planning for future operations, construction and decommissioning of the power station, it is the responsibility of the Proponent to ensure they are and remain compliant with all legal requirements. The Proponent must also ensure that all required management measures are in place prior to

and during all phases, to ensure that potential impacts and risks are minimised. The following actions are recommended for the planning phase and should continue during various other phases of the project:

- Ensure that all necessary permits from the various ministries, local authorities and any other bodies that governs the construction, maintenance and operation activities of the project are obtained and remain valid. Such permits include, but are not limited to:
  - Fuel storage permit
  - Civil Aviation clearance
  - Municipal agreement with regards to hazardous waste disposal
  - Effluent disposal permit.
- Ensure all appointed contractors and employees enter into an agreement which includes the EMP. Ensure that the content of the EMP is understood by the contractors, sub-contractors, employees and all personnel present or who will be present on site. The Proponent shall ensure that the Contractor understands the EMP and will hold the Contractor responsible for ensuring that its sub-contractors and employees understand the contents of the EMP.
- Make provision to have a Safety, Health and Environmental Coordinator to implement the EMP and oversee occupational health and safety as well as general environmental compliance matters at the site.
- Have the following emergency plans, equipment and personnel on site, where reasonable, to deal with all potential emergencies:
  - Risk management/mitigation/EMP/Emergency Response Plan and Health, Safety and Environment Manuals
  - Adequate protection and indemnity insurance cover for incidents;
  - Comply with the provisions of all relevant safety standards;
  - Procedures, equipment and materials required for emergencies.
- If one has not already been established, establish and maintain a fund for future ecological restoration of the site. Should project activities cease and the site be decommissioned, environmental restoration or pollution remediation may be required.

- Establish and/or maintain a reporting system to report on aspects of construction, operations and decommissioning activities as outlined in the EMP.
- Submit bi-annual monitoring reports to the MEFT every six months to allow for future environmental clearance certificate renewal applications.
- Appoint an environmental consultant to update the environmental assessment and EMP and apply for renewal of the environmental clearance certificate prior to expiry. Bi-annual monitoring reports will be required by the MEFT for the renewal of the ECC.

5.2 CONSTRUCTION PHASE

Construction of the Anixas II Power Station and related infrastructure will be conducted without interfering with the operations of the existing Anixas I Power Station. Infrastructure development will include the establishment of the tank farm, fuel offloading and storage area, water tanks and cooling unit. Such site establishment activities constitute the construction phase. However, the definition of construction as per the EMA and its regulations, include care and maintenance activities. Most of the impacts initiated during construction will not be carried forward into the operational phase. Some of the impacts will however increase (such as potential impacts on the air quality, noise and traffic).

5.3 OPERATIONAL PHASE

The Anixas II Power Station will primarily serve to supplement electricity supply during times of shortages. These may include times when electricity imports are limited (regional power shortages), during transmission system outages, and when renewable power resources, such as photovoltaic and wind turbines, have reduced generation capacity under certain conditions. The latter instances typically being lack of sunlight (night time/cloudy), and calm wind conditions. The Anixas II Power Station will mainly operate as a stand-by power station for peaking hours. Peaking hours are from 6:00 am to 9:00 am in the morning and from 6:00 pm to 09:00 pm in the evening for five days a week. Continuous operations are not foreseen for the plant. However, such an eventuality may occur for short periods (days rather than weeks or months) during an emergency,

but the likelihood is very low. However, all specialist studies incorporated the eventually of a continuous operational scenario for assessment purposes.

5.4 ASSESSMENT AND MANAGEMENT OF IMPACTS

A description of anticipated impacts resulting from the proposed activities are presented below. Impact ratings are provided for relevant phases while prevention, mitigation and monitoring requirements are included for each impact description.

5.4.1 Developing Project Feasibility and Permitting

Continual development of the project feasibility could have various impacts on the social, political and economic spheres of the environment. The acquisition of various permits for the operations generate information and direct planning initiatives. Permit requirements and acquisition further necessitates certain activities to be performed and related capital expenditure to be conducted. Therefore planning activities contribute to the revenue flow generated through the project.

Project feasibility and related permit requirements may include preparation for restoration and rehabilitation funds, required to ensure a safe environment should activities come to an end. Such a fund should also serve to address rehabilitation concerns, should activities be abandoned for any reason, or any part of the facility fails unexpectedly. In terms of international best practice, such funds are usually kept separate from the operational costs and are grown through dedicated funds allocated monthly thereto. Numerous models for determining rehabilitation costs have been developed internationally. The impact of development of such a fund is mostly related to the economic sphere of the environment.

Infrastructure maintenance on a local and regional scale, such as roads and fuel supply/storage, may further have a potential impact on the feasibility of the project. Fuel transportation will be hampered if infrastructure is not maintained (inclusive of roads and the harbour). Continual communication with the related authorities should be sustained and included in regional planning aspects. Maintenance of the infrastructure will enable the project to continue contributing to the national development goals of Vision 2030.

Table 5-7. Developing project feasibility and permitting impact summary

Project Activity/Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Planning	The acquisition of various permits	2	1	2	3	3	16	2	Definite
	Preparation for restoration and rehabilitation fund	2	1	2	3	3	16	2	Probable
Decommissioning	Implementation of restoration and rehabilitation fund	2	1	2	1	1	8	1	Definite
Indirect Impacts	Contribution to national planning related to service delivery infrastructure requirements and national development goals	2	1	2	3	3	16	2	Probable

Desired Outcome: To contribute to sustainable development through interactive planning and partnership with authorities, neighbours and related industry.

Actions

Responsible party for action indicated in brackets.

Enhancement:

- All requirements related to the Labour Act to be met (Proponent).
- Obtain approval of building plans and project development from the regulatory authority (Proponent, Contractor).
- Obtain fuel storage permit from the Ministry of Mines and Energy (Proponent).
- Namibian companies to assist in permit acquisition (Proponent).
- Record all activities related to permit acquisition (Proponent).
- Facilitate information sharing with the public and authorities (Proponent & Contractor).
- Maintain communication and interaction with key parastatals and ministries (Proponent).
- Calculate rehabilitation costs (Proponent).

- Consider the establishment of a rehabilitation or insurance fund to provide for rehabilitation works (Proponent).

Data Sources and Monitoring:

- Record should be kept of all communication with neighbours or members of the community (Proponent & Contractor).
- Record should be kept of all communication with all authorities, parastatals and ministries (Proponent & Contractor).
- Record of expected rehabilitation costs kept (Proponent).

5.4.2 Plans and Aspirations for the Future of the Affected or Surrounding Community

Events, which may result in extended operational hours over a long period of time, should be communicated to employees, neighbours and affected parties. Similarly, any significant reduction in operations should be communicated to such parties. This will contribute to a sustainable relationship between the proponent and the local community. When clear communication is achieved between all parties, aspirations and plans for future development may be much more defined, realistic and achievable.

No significant public perception about the project, negative or positive, could be determined. This is mainly attributed to the existing operations of Anixas I and that there is no significant perceived impact contributing or degrading or enhancing of the surrounding community. Interest related to the project is focussed on business opportunities and employment. Some interest related to possible ecological and biophysical impacts were documented and included in the environmental assessment. These were however in the minority. Overall plans and aspiration of parties are noted to be of a positive nature and include perceptions of development planning.

Table 5-8. Plans and aspirations for the future of the affected or surrounding community impact summary

Project Activity/Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Construction	Communicating with governmental agencies neighbours and affected parties	1	1	2	2	2	6	1	Definite
Daily Operations	Communicating with governmental agencies neighbours and affected parties	2	1	2	2	2	12	2	Definite
Indirect Impacts	Plans and aspirations of neighbours and affected parties for the future	1	1	2	2	3	7	1	Probable

Desired Outcome: To contribute to positive and sustainable community cohesion and contribute to realistic and achievable development/operation. Improve stakeholder communications and relationship.

Actions

Responsible party for action indicated in brackets.

Enhancement:

- Communicate and obtain permits/permission related to the Walvis Bay Municipality (Proponent).
- Appoint a community liaison officer who will be responsible for communication with neighbours and affected parties when required (Proponent).
- Communicate timeously (well in advance) to all employees, any reduction in operations or any matters relating to, or affecting, employment security (Proponent).
- Facilitate information sharing with the neighbours and authorities regarding any major pollution or contamination event (Proponent).
- Maintain communication and interaction with key parastatals and ministries (Proponent).

Data Sources and Monitoring:

- Record should be kept of all communication with neighbours or members of the community it should include a complaints register (Proponent).
- Record should be kept of all communication with all authorities, parastatals and ministries (Proponent).
- Record all communication made with neighbours and affected parties regarding extended operational events or operational deviations (Proponent).

5.4.4 Skills, Technology and Development

During various phases of the project, training will be provided to a portion of the workforce. The technology employed for operations are in some instances new to the local industry (newer engines and possible use of LNG, selective catalytic reduction systems, etc.), which aides operational efficiency. Improvement of people's skills and knowledge, and technology are key to economic development as well as operational feasibility. Operational staff will be trained on the new technologies. All employees will receive emergency and evacuation plan training while the supervisors and identified employees will have fire-fighting and first-aid training.

Table 5-9. Skills, technology and development impact summary

Project Activity/Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Construction	Technological development and transfer of skills	1	2	3	3	3	18	2	Probable
Daily Operations	Technological development and transfer of skills	1	2	3	3	3	18	2	Definite
Indirect Impacts	Enhanced employability of workforce	2	1	3	3	3	18	2	Definite

Desired Outcome: To see an increase in skills of local Namibians, as well as development and technology advancements in the industry.

Actions

Responsible party for action indicated in brackets.

Enhancement:

- If the skills exist locally, construction contractors must first be sourced from the town, then the region and then nationally. Deviations from this practice must be justified (Proponent).
- Skills development and improvement programs to be made available as identified during performance assessments (Proponent & Contractors).

- Employees to be informed about performance parameters and requirements for employment references upon employment (Proponent & Contractors).
- The proponent must employ Namibians where possible. Deviations from this practise should be justified appropriately (Proponent, Contractor).

Data Sources and Monitoring:

- Record should be kept of training provided (Proponent & Contractors).
- Ensure that all training is certified or managerial reference provided (proof provided to the employees) inclusive of training attendance, completion and implementation (Proponent & Contractors).

5.4.5 Change in Land Use and Earning Potential

Change in land utilisation and related economic productivity will be initiated with the construction phase. Construction and operational activities will alter the land-use activities. The altered land use, will lead to changes in the way revenue is generated and contributed from the site to the local, regional and national economy. The earning potential of the project area will be increased. In addition, the flow of revenue will be altered as there will be a difference in purchasing of goods and use of services (especially during the construction phase). The anticipated impact is foreseen to have a positive impact on the economic sphere of the environment.

The related economic productivity of the land use will reach its full potential during the duration of the operational phase while the decommissioning phase will not share in such impact. However, no post-closure land use has been identified yet, and therefore the impact and related management and enhancement measures should be revisited closer to the decommissioning phase.

Table 5-10. Change in land use and earning potential impact summary

Project Activity/Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Construction	Change and increase of earning potential and flow of revenue	2	2	2	2	1	20	3	Definite
Daily Operations	Change and increase of earning potential and flow of revenue	3	1	2	2	1	15	2	Definite
Indirect Impacts	Increased economic resilience potential for state, private and industry parties	2	2	2	2	2	24	3	Probable

Desired Outcome: Contribution to local and national treasury as well as sustaining a stable earning potential for industry.

Actions

Responsible party for action indicated in brackets.

Enhancement:

- The proponent must employ local Namibians where possible (Proponent).
- Maintain value addition activities for the life of operations (Proponent).
- Investigate profitable post-closure land use possibilities (Proponent).

Data Sources and Monitoring:

- Ensure all taxes and governmental levies (where required) are paid (Proponent).
- Financial auditing (Proponent).

5.4.6 Revenue Generation and Employment

Infrastructure development for power generation, as well as power generation itself, will lead to changes in the way revenue is generated and paid to the local and national treasury. Revenue generated from the property will be increased during the construction and operational phases. Operations will provide stable and sustainable employment. Such employment contributes to the economic resilience of the employees. Employment will be sourced locally while skilled labour/contractors may be sourced internationally or from other regions should the skilled labour be unavailable locally. Should international contractors be appointed, there is a high probability that no additional employment opportunities will be provided during the construction phase. Any employment contributions will be of short duration for the construction phase as no additional employment opportunities are provided for in the operational phase. Operations will further contribute to the transport sector as well as the larger economy as a whole. The shipping of goods and fuel for construction and operations, is reliant on the transport sector. The impact is foreseen to have a positive impact on the economic and social sphere of the environment. Should the power station be decommissioned, there will be a change and probable loss in revenue generation, flow and employment. Post closure land use and possible revenue generating activities should be considered by the proponent closer to the decommissioning phase.

Table 5-11. Revenue generation and employment impact summary

Project Activity/Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Construction	Employment and contribution to local economy	2	1	2	2	2	12	2	Definite
Daily Operations	Existing employment and contribution to local and national economy	1	1	2	2	1	5	1	Definite
Indirect Impacts	Decrease in unemployment, contribution to associated industry	2	1	2	2	2	12	2	Definite

Desired Outcome: Contribution to local and national treasury and provision of employment to local Namibians.

Actions

Responsible party for action indicated in brackets.

Enhancement:

- The proponent must employ local Namibians where possible (Proponent).
- If the skills exist locally, employees must first be sourced from the town, then the region and then nationally. Deviations from this practice must be justified (Proponent).
- Post-closure land-use options to be considered by the proponent (Proponent).

Data Sources and Monitoring:

- Bi-annual summary report based on employee records (Proponent).
- All social security and related documentation kept on file (Proponent).
- Financial auditing (Proponent).

5.4.7 Demographic Profile and Community Health

Proposed operations are not expected to create a change in the demographic profile of the local community. Although operational and construction activities may result in risks to community health, it is not foreseen that such risks will realise. Community health may be considered from a social and biophysical aspect. However, should the Proponent employ a foreign company during the construction phase, there is a high probability that a large portion of the construction crew, including some skilled staff, will be brought into the Walvis Bay for the project. In light of other capital projects which have been conducted in the past in Namibia, including ongoing projects, the probability of such an occurrence is high. Thus, seasonal in-migration is expected during the construction phase and partly during the operational phase (which may be required a skilled workforce for maintenance and operational challenges).

Social aspects have proven to be most affected during the construction phase of capital projects. An increase in foreign people in the area (foreign labourers and local, potential job seekers) may potentially increase the risk of criminal and socially/culturally deviant behaviour. However, the proponent is not the only employer in the area and therefore potential impacts on the demographic profile are largely cumulative. The project will probably ensure labour migration and accommodation within Walvis Bay will be required for the construction crew. Seasonal migration is especially known to have significant effects on local communities which include an increase in risky social behaviour such as substance abuse and commercial sex (LeBeau, 2008). It is therefore expected that there will be a rise in socially risky and deviant behaviour within the local community. Seasonal migration as well as a highly mobile workforce are very likely to increases the key HIV/AIDS drivers in Walvis Bay. Thus, there will be an escalation in exposure to communicable infection and similar health related diseases.

The biophysical risks associated with the project relate to noise and pollutant emissions from the site, mainly during the operational phase of the project. As such, mitigation measures as suggested by various specialists, as part of the project team, were adopted by the proponent. The most significant of these relate to the location of the plant, now proposed at site Option 3 (located the

furthest from receptors, yet requiring demolition and additional construction activities) as opposed to site Option 1 (which is located closer to receptors and has less construction requirements). Additional mitigation measures have been proposed and will be included in the terms of reference for construction contractors which will ensure that noise and pollutant emissions will be within the regulations at receptor level.

Employee health is a core consideration for all operations. Regulations related to employee health are stipulated in the Labour Act. Construction and operational activities present health risks to humans. NamPower has existing health and safety policies which will be enforced for the project. Additional consideration regarding the removal of asbestos may fall outside the existing health and safety policies of the proponent. Asbestos may be encountered during demolition activities required for the construction of Anixas II.

Table 5-12. Demographic profile and community health impact summary

Project Activity/Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Without Mitigation and Preventive Measures									
Construction	Exposure to social ills and communicable disease related to socially deviant behaviour.	2	-2	3	3	2	-32	-3	Probable
Daily Operations	Exposure to noise and emissions	2	-2	1	2	2	-20	-3	Probable
Indirect Impacts	The spread of disease, increase of criminal and deviant social and destructive behaviour.	2	-2	2	2	2	-24	-3	Probable
With Mitigation and Preventive Measures									
Construction	Exposure to social ills and communicable disease related to socially deviant behaviour.	2	-1	2	2	2	-12	-2	Probable
Daily Operations	Exposure to noise and emissions	2	-1	1	2	2	-10	-2	Probable

Indirect Impacts	The spread of disease, increase of criminal and deviant social and destructive behaviour.	2	-1	2	2	2	-12	-2	Probable

Desired Outcome: To prevent the spread of communicable diseases and prevent/discourage socially deviant or criminal behaviour. To prevent community health impacts.

Actions:

Responsible party for action indicated in brackets

Prevention:

- Employ primarily local people from the area, deviations from this practice should be justified appropriately (Proponent).
- Adhere to all municipal by-laws relating to environmental health (Proponent & Contractor).
- Prohibit substance abuse on the site (Proponent & Contractor).
- Adopt an open-door policy to reporting of socially deviant or destructive behaviour related to employment duties (Proponent & Contractor).
- Provide a safe protocol for the reporting or whistle-blowing of criminal activities (Proponent & Contractor).
- Implement a reward system for excellence in conduct and performance (Proponent & Contractor).
- Formulate a HIV and gender policy and programme (Proponent & Contractor).
- Specify any empowerment initiatives, maternity benefits and services that may apply (Proponent & Contractor).
- No hiring of casual or unskilled labourers at the gate – erecting signage to indicate as such (Proponent & Contractor).
- Promote use of health and HIV services (such as Kuisebmond Clinic). De-stigmatize going to the clinic through policies and communication (Proponent & Contractor).
- Build and uphold social norms and structures that promote gender equality (Proponent & Contractor).

- Adhere to all the air quality mitigation measures in terms of emissions reduction and monitoring as set out in this report and related specialist report (Proponent & Contractor).
- Adhere to all noise reduction measures as set out in the noise specialist assessment included in the report appendices. Adopt best practise policies as per the World Health Organisation's guidance for community noise levels (Proponent & Contractor).
- Ensure the health and safety policy is updated with regards to prevention measures to reduce health risks associated with asbestos handling (Proponent, Contractor).

Mitigation:

- Educational programmes for employees on HIV/AIDs and general upliftment of employees' social status (Proponent & Contractor).
- Penalties for construction companies not adhering to EMP requirements (Proponent).
- Health screening of employees exposed to known high risk factors such as asbestos (Proponent & Contractor).

Data Sources and Monitoring:

- Bi-annual summary report based on educational programmes and training conducted (Proponent).
- Bi-annual report and review of employee demographics (Proponent).
- Records kept of all socially deviant, destructive or criminal reports received (Proponent).
- All air quality monitoring results to be kept on file (Proponent & Contractor).
- Implemented noise reduction measures to be documented and kept on file (Proponent & Contractor).

5.4.8 Firm Power Supply

The project will support firm power supply to Namibia, thereby reducing the risk of power outages and load shedding. Firm supply of electricity is of paramount importance for economic growth and is internationally measured by the World Bank. The "Getting Electricity" indicators used by the World Bank, measures the reliability of supply, transparency of tariffs and the price of electricity (World Bank, 2019). Additionally, the indicators also measure the procedures, time and cost required for a business to obtain a permanent electricity connection for a newly constructed warehouse. During 2019, Namibia was ranked 76th in the International ratings while South Africa was ranked 114th. The project will therefore contribute to the reliability of electrical supply in the region and nationally.

Table 5-13. Firm power supply impact summary

Project Activity/Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Daily Operations	Firm electrical supply to the region and nation	2	2	2	2	2	24	3	Probable
Indirect Impacts	Contribution to economic stability	2	1	2	2	2	12	2	Probable

Desired Outcome: Secure supply of electricity for Namibia and Erongo Region.

Actions

Responsible party for action indicated in brackets

Enhancement:

- Maintenance of all mechanical and electrical components (Proponent).
- Inspection and maintenance of installations (Proponent).
- Ensure secure and readily available fuel supply (Proponent).
- Adopt a transparency policy related to operations, fuel supply and transportation (Proponent).
- Appoint reputable contractors (Proponent).

Data Sources and Monitoring:

- Annual maintenance and inspection reports kept on file (Proponent).
- Annual report indicating financial expenditure (Proponent).
- Financial auditing (Proponent).

5.4.9 Traffic

Delivery of materials during the construction phase, and fuel for operations during the operational phase, will increase traffic flow to the site. The Proponent has considered the implementation of a pipeline from neighbouring petroleum companies who may be contracted to supply fuel for operations. The option has not been finalised. Should a pipeline be implemented, the traffic incident risk will be reduced. However, additional safety measure related to the fuel industry will have to be incorporated. Access points to the site will be suitably strengthened, if so required to accommodate heavy motor vehicles transporting material and fuel. Additional traffic presents additional collision and incident risks associated with the transport of commodities to and from the site. The close proximity of the site to the harbour will allow for minimal traffic impact, especially during the construction phase of the project which will see large equipment transported to the site.

Table 5-14. Traffic impact summary

Project Activity/Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Without Mitigation and Preventive Measures									
Construction	Disruption of traffic, and accident/incident risks	2	-2	2	2	2	-24	-3	Probable
Daily Operations	Increased traffic, and accident/incident risks	2	-2	2	2	2	-24	-3	Probable
Indirect Impact	Traffic increase, road surface deterioration.	2	-2	2	2	2	-24	-3	Probable
With Mitigation and Preventive Measures									
Construction	Disruption of traffic, and accident/incident risks	1	-2	2	2	2	-12	-2	Probable
Daily Operations	Increased traffic, and accident/incident risks	1	-2	2	2	2	-12	-2	Probable
Indirect Impact	Traffic increase, road surface deterioration.	1	-2	2	2	2	-12	-2	Probable

Desired Outcome: Minimum impact on traffic and no transport or traffic related incidents.

Actions

Responsible party for action indicated in brackets.

Prevention:

- Erect clear signage for access points to the site (Proponent & Contractor).
- Maintain the access point according to the requirements of the Municipality of Walvis Bay (Proponent & Contractor).
- All contractors or employees driving heavy motor vehicles should have appropriate training and qualifications to operate such vehicles (Proponent & Contractor).
- All vehicles to be roadworthy and appropriately licensed (Proponent & Contractor).
- All loads of material to be covered (Proponent & Contractor).
- Liaison with Namport and the local municipality regarding the movement of equipment to the site (Proponent, Contractor).

Mitigation:

- If any traffic impacts are expected, traffic management should be performed (Proponent & Contractor).
- Movement of any large and abnormal loads to be conducted along suitable nodes and with the required municipal and traffic management measures (Proponent & Contractor).

Data Sources and Monitoring:

- Any complaints received regarding traffic issues should be recorded together with action taken to prevent repeats (Proponent & Contractor).
- A report should be compiled every six months of all incidents reported, complaints received, and action taken (Proponent & Contractor).

5.4.10 Fire

Construction activities and operation of mechanical and electrical machinery, as well as the storage of fuel, increases the risk of fires on site. Combustion of fuel during the operational phase may further increase the risk of fires. Similarly bulk fuel storage and handling will contribute to the fire and explosion risk.

Table 5-15. Fire impact summary

Project Activity/Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Without Mitigation and Preventive Measures									
Construction	Fire risk	2	-2	2	2	1	-20	-3	Probable
Daily Operations	Fire and explosion risk	2	-2	2	2	1	-20	-3	Probable
Indirect Impact	Down-time and no firm power back-up supply to the National grid, local power outages.	2	-3	2	2	2	-36	-4	Improbable
With Mitigation and Preventive Measures									
Construction	Fire risk	1	-1	2	2	1	-5	-1	Probable
Daily Operations	Fire and explosion risk	1	-1	2	2	1	-5	-1	Probable
Indirect Impact	Down-time and no firm power back-up supply to the National grid, local power outages.	1	-3	2	2	2	-18	-2	Improbable

Desired Outcome: To prevent property damage, possible injury and impacts caused by explosions or uncontrolled fires.

Actions:

Responsible party for action indicated in brackets.

Prevention:

- Ensure all chemicals, lubricants and flammable agents are stored according to MSDS instructions (Proponent & Contractor).

- Maintain regular site, mechanical and electrical inspections and maintenance (Proponent & Contractor).
- Firefighting training to be provided to staff (Proponent & Contractor).
- Use appropriate electrical equipment and wiring methods (Proponent & Contractor).
- Control smoking (designated smoking areas), open flames and sparks (Proponent & Contractor).
- Prevent mechanical sparks and friction and ensure mechanical parts are maintained and efficiently lubricated (Proponent & Contractor).

Mitigation:

- A holistic fire protection and prevention plan is needed. This plan must include an emergency response plan and firefighting plan (Proponent & Contractor).
- Maintain firefighting equipment, good housekeeping and personnel training (firefighting, fire prevention and responsible housekeeping practices) (Proponent & Contractor).

Data Sources and Monitoring:

- A register of all incidents must be maintained. This should include measures taken to ensure that such incidents do not repeat themselves (Proponent & Contractor).
- A record of maintenance carried out on fire protection and firefighting equipment (Proponent, Contractor)
- A report should be compiled every six months of all incidents reported. The report should contain dates when fire drills were conducted and when fire equipment was tested and training given (Proponent & Contractor).

5.4.11 Air Quality

Assessment of possible impact on the air quality was augmented by specialist investigations related to possible emissions of the power stations on the environment. Although the existing Anixas I Power Station only operates a few hours a year (historically less than 500 hours per annum), air quality modelling factored in operations of the existing power station into the modelling. The specialist findings are based on modelling of predicted operations. Initial modelling conducted considered a combination of various technologies and fuel options for Anixas II. These included gas turbines and ICREs fuelled by either HFO, diesel or natural gas. The results were presented to the project team to assist with determining the preferred technology. Additional modelling was then conducted on the selected technology. The second modelling only considered ICRE technology in terms of eight different operating scenarios for both Anixas I and Anixas II power stations. The operating scenarios included different operational times and fuel. Pollution dispersion is influenced by stack height. Therefore all scenarios were modelled on a stack height of 60 m (same as the height for the existing Anixas I Power Station), apart from Scenario 2D which incorporated a stack height of 80 m for comparative purposes. The different operating scenarios for the preferred technology are presented in Table 5-16.

The most realistic operation regime (in terms of reflecting current and proposed operations) is highlighted in green (scenario 2A), Anixas I and Anixas II operating in peak mode (three hours in the morning and three hours in the evening). However, the Anixas II plant is designed to also accommodate continuous operations during an electricity shortage (for stand-by power which may last days). Therefore a likely scenario of emissions was conducted for Anixas I in peak mode and Anixas II in continuous mode as presented in scenario 2C, indicated in blue (Table 5-16).

While the worst case scenario is indicated in yellow (2B), considering both power stations in continuous operating mode (24 hours, seven days a week) using HFO.

Table 5-16. Technology and fuel scenarios considered in the final air quality modelling

Scenario Name	Power Station	Operation Time	Fuel	Sulphur Content
Scenario 1A	Anixas I	Peak	HFO	2.6%
	Anixas II	Not Operational		
Scenario 1B	Anixas I	Continuous	HFO	2.6%
	Anixas II	Not Operational		
Scenario 2A	Anixas I	Peak	HFO	2.6%
	Anixas II	Peak	HFO	2.6%
Scenario 2B	Anixas I	Continuous	HFO	2.6%
	Anixas II	Continuous	HFO	2.6%
Scenario 2C	Anixas I	Peak	HFO	2.6%
	Anixas II	Continuous	HFO	2.6%
Scenario 2D	Anixas I	Peak	HFO	2.6%
	Anixas II*	Continuous	HFO	2.6%
Scenario 3	Anixas I	Peak	Diesel	0.005%
	Anixas II	Continuous	Diesel	0.005%
Scenario 4	Anixas I	Peak	LSHFO	2% **
	Anixas II	Continuous	LSHFO	2% **

** Note increased stack height for Scenario 2D*
***Sulphur content to ensure ambient compliance was determined by dispersion modelling*

The last scenario considered (Scenario 4), was designed to determine the maximum amount of sulphur content of the fuel, and the maximum NOx emission rate at the stack, could be tolerated to achieve compliance for the second most likely scenario (Scenario 2C). Thus, Scenario 2C was remodelled and presented as Scenario 4, with the change in having a lower sulphur content (of 2%) in the HFO, as well as predicting the required reduction in NOx emissions at the stack, to meet the SA NAAQS receptor limits. The lower sulphur and NOx content was determined by conducting a reverse modelling exercise based on the allowable pollutant limit, as suggested by the SA NAAQS.

For the purpose of the impact assessment, the project team adopted the worst-case scenario possible, Scenario 2B. Therefore impacts are assessed based on continuous operations of Anixas I together with continuous operation

of Anixas II, both using the most common HFO currently available in Namibia. The rational is to provide a robust EMP which would cater for all eventualities in future and not only the most likely scenario. This approach will factor in the use of expensive mitigation measures such as selective catalytic reduction for Anixas II, stack height increase and using 2% (or less) sulphur HFO.

The most pertinent pollutants considered as per the SA NAAQS and WHO guidelines include PM, NO_2 and SO_2. These guidelines include ambient, 1-hour and 24-hour levels. The specialist modelling therefore considered the emission and dispersion of such pollutants for each scenario. Modelling was conducted by calculating pollutant concentrations for every hour over a three year timeframe. This provides the average annual concentration. To improve the representativeness of the model predictions, the 99^{th} percentile of the predicted 24-hour and 1-hour concentrations are presented. In other words, the highest 1% of predicted concentrations are regarded as outliers and are removed from the data generated. Therefore 88 data values are removed from the 8,760 hourly predicted values in a year, and four data values are removed from 365 daily values in a year. The average datasets then become known as the "Predicted 99^{th} percentile" of the 1-hour and 24-hour predictions.

Results of the three scenarios, as mentioned above, are indicated in this report. These are for the most likely, second most likely, as well as for the worst case scenario.

Air quality indexes evaluate air pollution concentrations on time scales of either 1 hour, 8 hours, or 24 hours (aggregating measurements and rating the respective averages). While it may be acceptable for individuals to be exposed to a higher concentration of certain pollutants for a short time, this may not be the case in the long run. Thus, pollution thresholds may vary between different time scales. The overall air quality index for a full day may be worse than each individual hourly air quality index. Average measurement benchmarks for 1-hour, 8-hour, and 24-hour intervals provide more accurate air quality data, which in turn allows individuals and governments to make better health and safety decisions.

Modelled results are presented in a map form and pollution values presented by isopleths. An isopleth is a line on a map connecting points at which a given variable has a specified constant value. In the assessment of air quality, isopleths present lines of constant concentration or frequency of exceedance of a given limit value as a function of distance.

Figure 5-1 to Figure 5-3 presents the modelled results for the most likely scenario (scenario 2A). All pollutants considered (NO_2, SO_2 and particulate matter) indicate modelled results within the SA NAAQS and World Health Organisation standards.

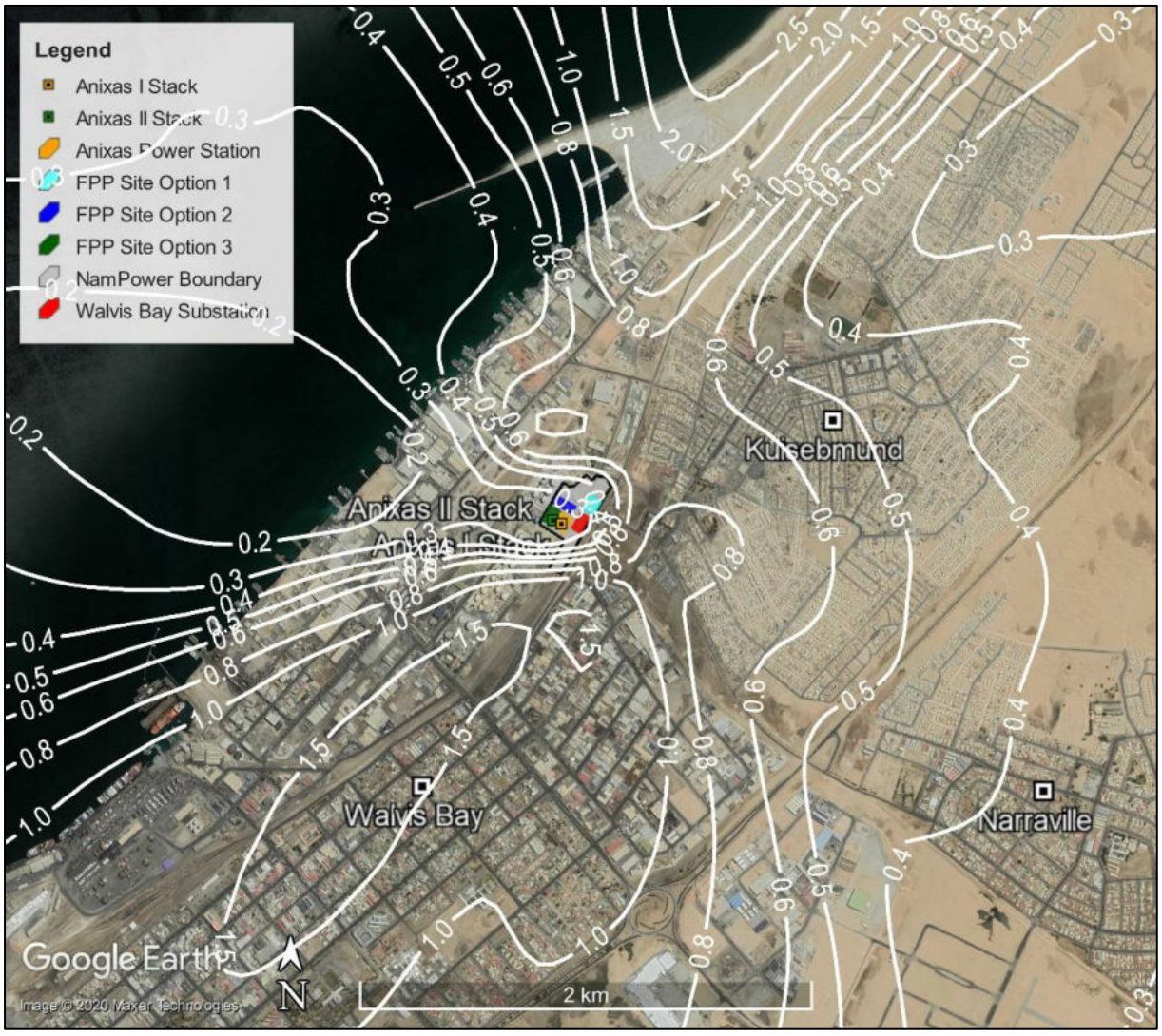

Figure 5-1. Predicted annual average SO_2 concentrations in µg/m^3 for Scenario 2A (uMoya-NILU, 2020)

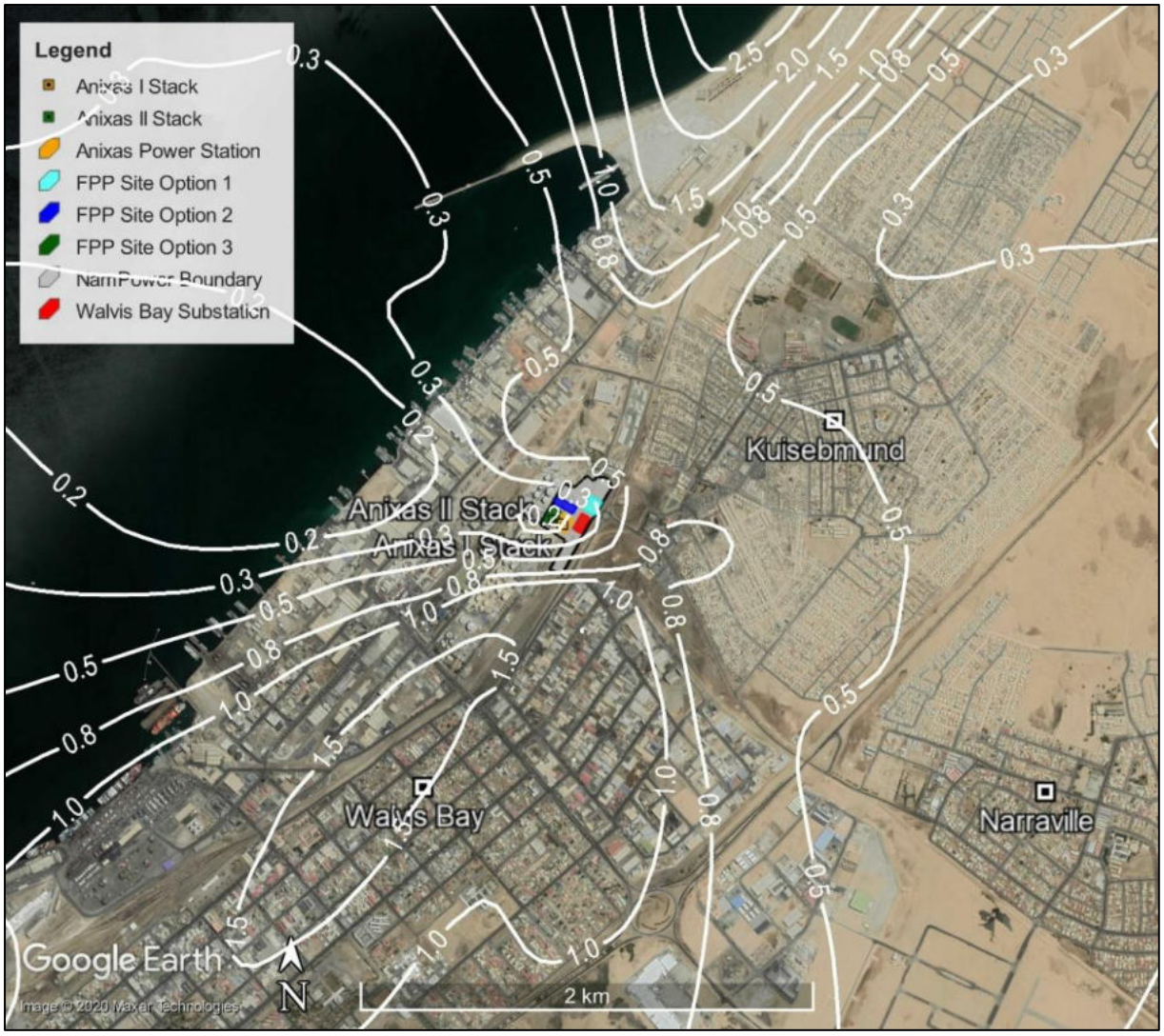

Figure 5-2. Predicted annual average NO_2 concentrations in µg/m^3 for Scenario 2A (uMoya-NILU, 2020)

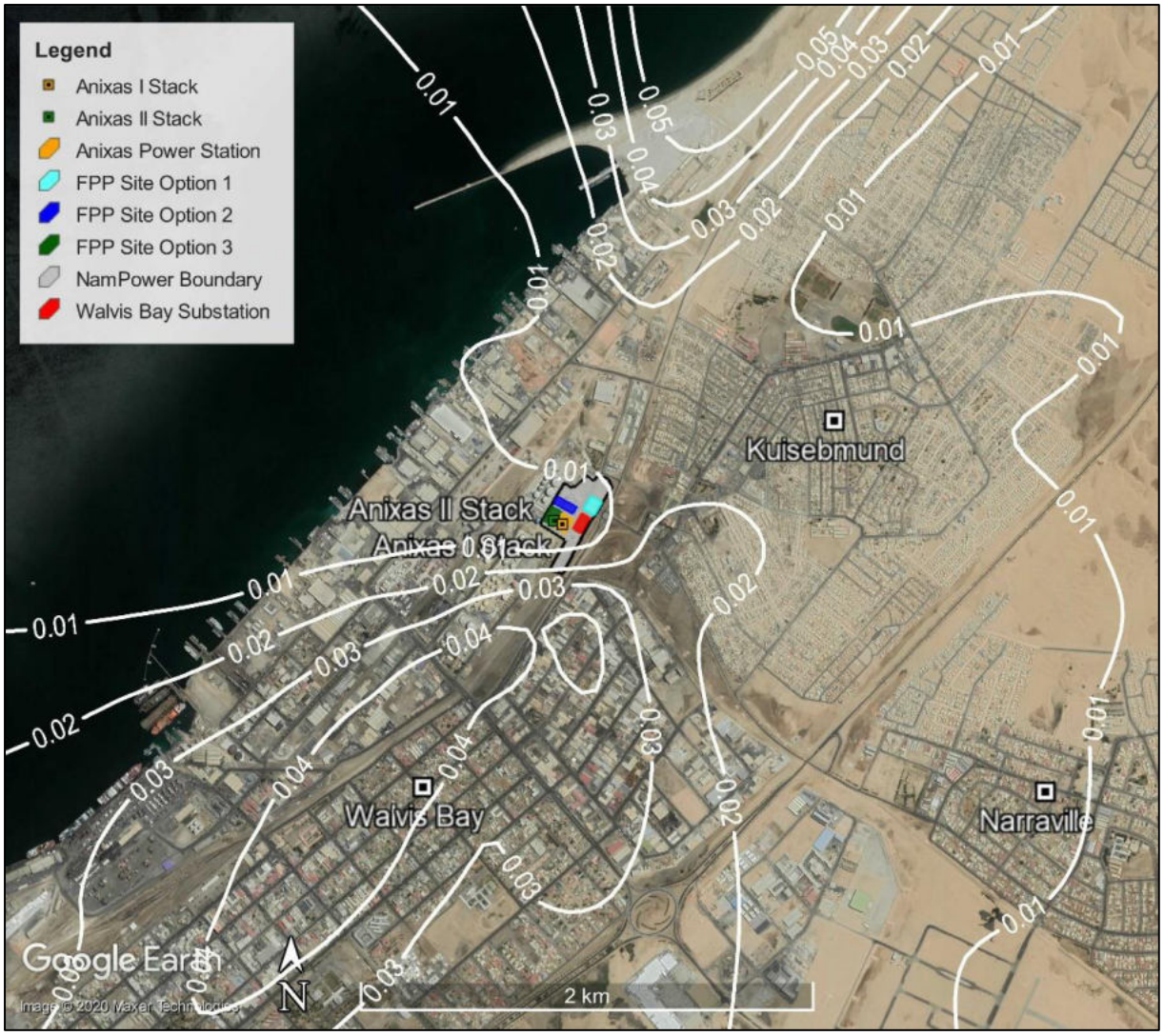

Figure 5-3. Predicted annual average PM_{10} concentrations in µg/m³ for Scenario 2A (uMoya-NILU, 2020)

Figure 5-4 to Figure 5-6 present the modelled results for the second most likely scenario (Scenario 2C).

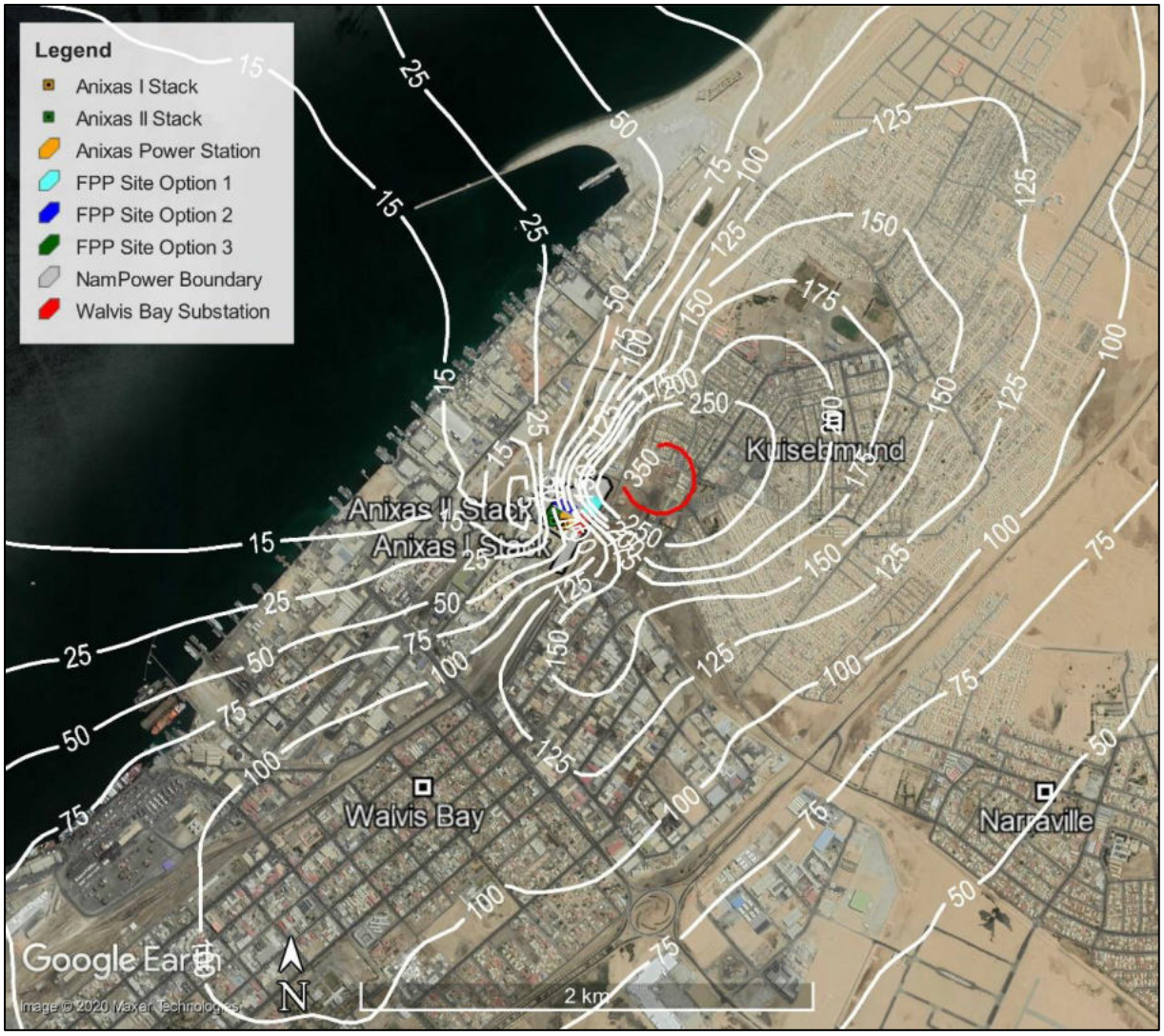

Figure 5-4. Predicted 99th percentile of the 1-hour SO_2 concentrations in µg/m³ for Scenario 2C (uMoya-NILU, 2020)

Although the annual average of SO_2 concentrations for Scenario 2C are not exceeded, parameters are exceeded for the 1-hour limit for SO_2 for the SA NAAQS and World Health Organisation. The red line in Figure 5-4 indicates the limit value of 350 µg/m³ for SO_2 (1-hour limit).

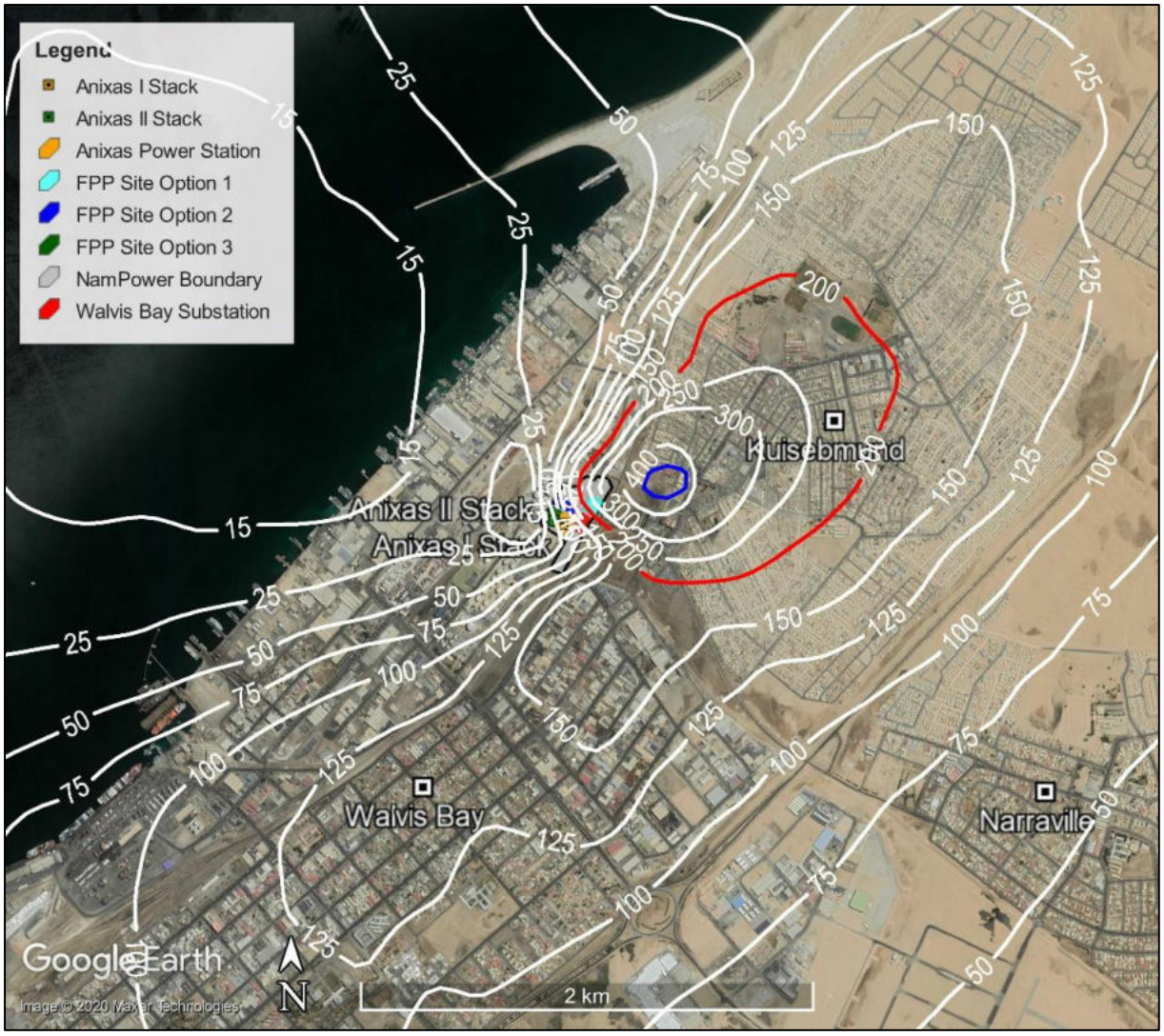

Figure 5-5. Predicted 99th percentile of the 1-hour NO_2 concentrations in µg/m³ for Scenario 2C (uMoya-NILU, 2020)

The annual average of NO_2 concentrations for Scenario 2C are not exceeded. Parameters are however exceeded for the 1-hour limit for NO_2 for the SA NAAQS and World Health Organisation (284 instances of exceedance which is more than the allowable exceedances of 264 per 3 year period). The red line indicates the limit values of 200 µg/m³ for NO_2 (1-hour limit). The blue line indicates the tolerance of 264 exceedances in the 3-year modelling period.

Particulate matter modelled results indicate compliance to all standards.

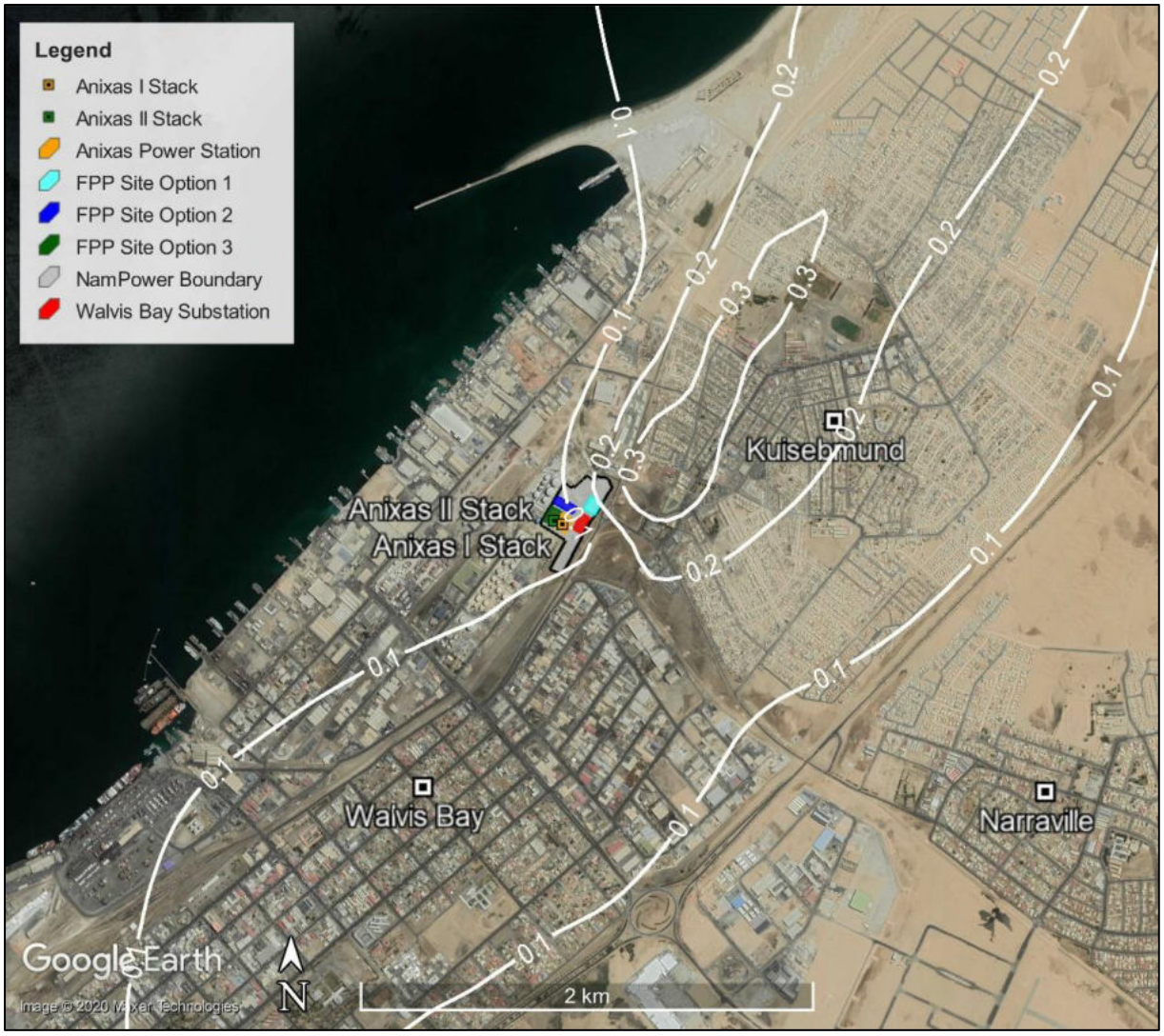

Figure 5-6. Predicted annual average PM_{10} concentrations in µg/m³ for Scenario 2C (uMoya-NILU, 2020)

Figure 5-7 to Figure 5-9 presents the modelled results for the worst-case scenario (Scenario 2B).

Figure 5-7. Predicted 99th percentile of the 1-hour SO_2 concentrations in µg/m³ for Scenario 2B (uMoya-NILU, 2020)

Although the annual average of SO_2 concentrations for Scenario 2B are not exceeded, parameters are exceeded for the 1-hour limit for SO_2 for the SA NAAQS and World Health Organisation. The exceedance is over a larger area as that of Scenario 2C. The red line in Figure 12 4 indicates the limit value of 350 µg/m³ for SO_2 (1-hour limit).

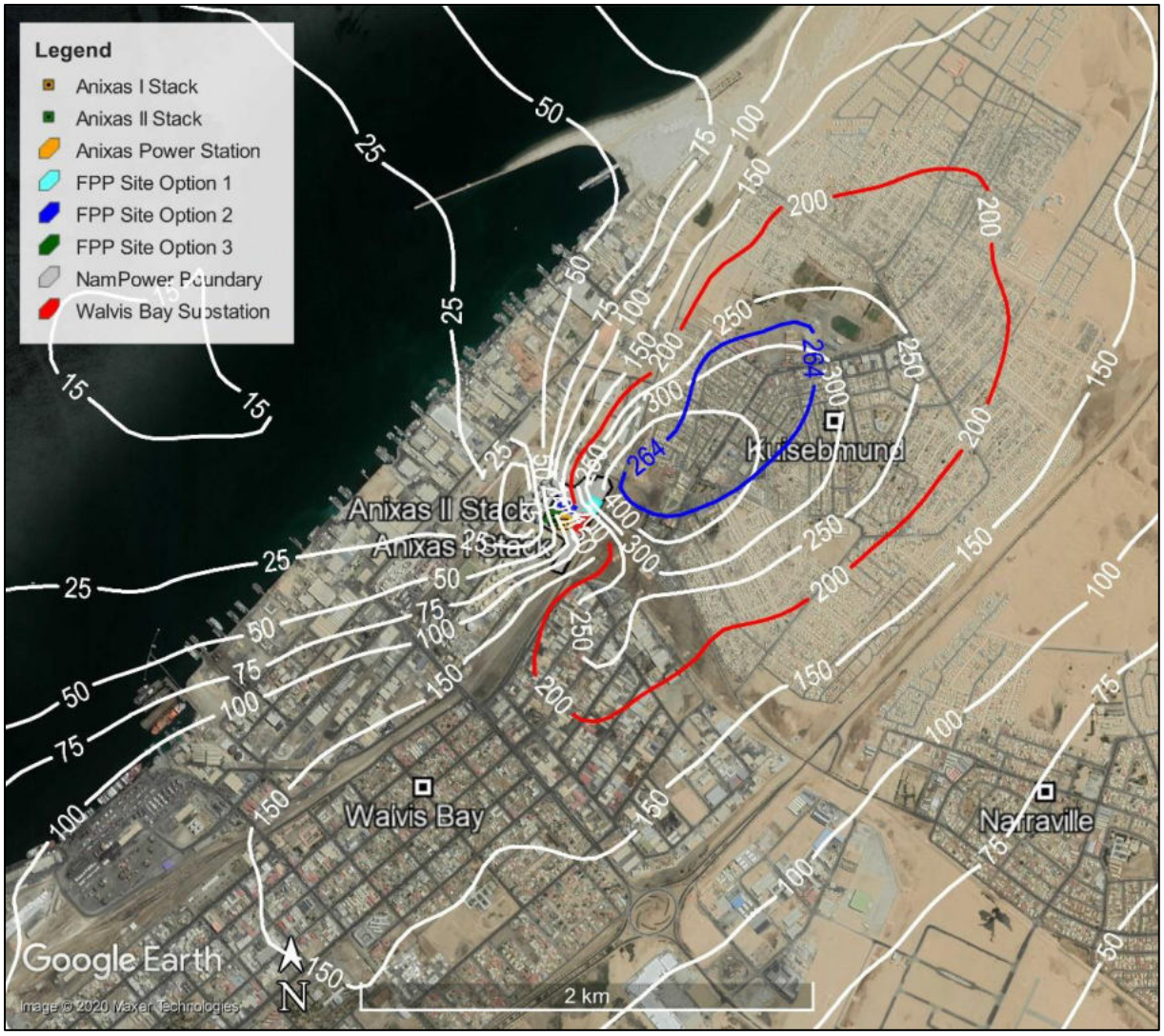

Figure 5-8. Predicted 99th percentile of the 1-hour NO_2 concentrations in µg/m³ for Scenario 2B (uMoya-NILU, 2020)

The annual average of NO_2 concentrations for Scenario 2B are not exceeded, parameters are however exceeded for the 1-hour limit for NO_2 for the SA NAAQS and World Health Organisation (352 instances of exceedance which is more than the allowable exceedances of 264 per 3 year period). The red line indicates the limit values of 200 µg/m³ for NO_2 (1-hour limit). The exceedance area is larger than that of Scenario 2C. The blue line indicates the tolerance of 264 exceedances in the 3-year modelling period.

Particulate matter modelled results indicate compliance to all standards.

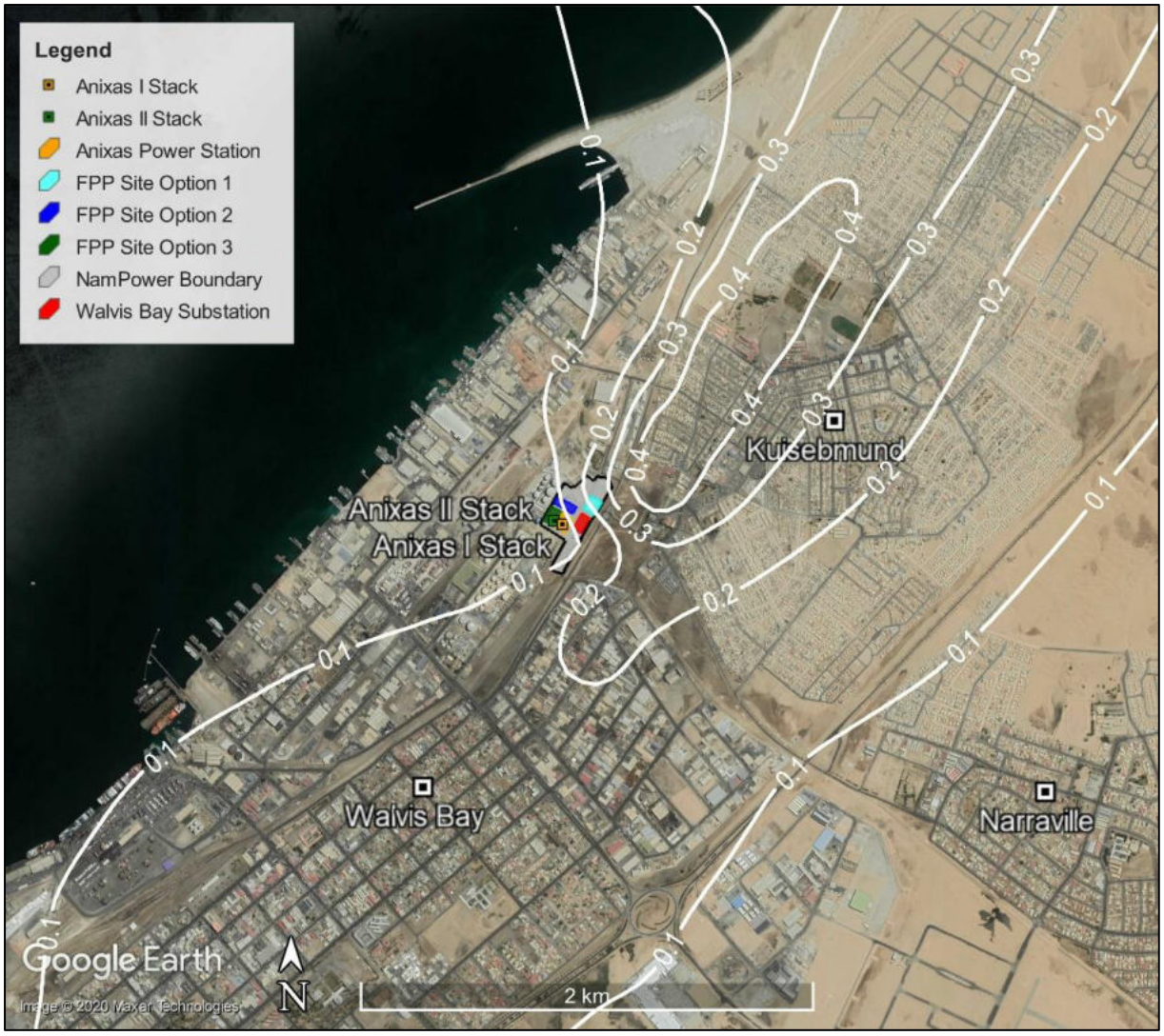

Figure 5-9. Predicted annual average PM10 concentrations in µg/m3 for Scenario 2B (uMoya-NILU, 2020)

Figure 5-10 presents the NO_2 pollution model for peak hour operation of Anixas I while Anixas II is in continuous mode using low sulphur HFO (Scenario 4). While Figure 5-11 presents the findings of the 99th percentile of the 1-hour SO_2 concentrations in µg/m^3 for Scenario 4.

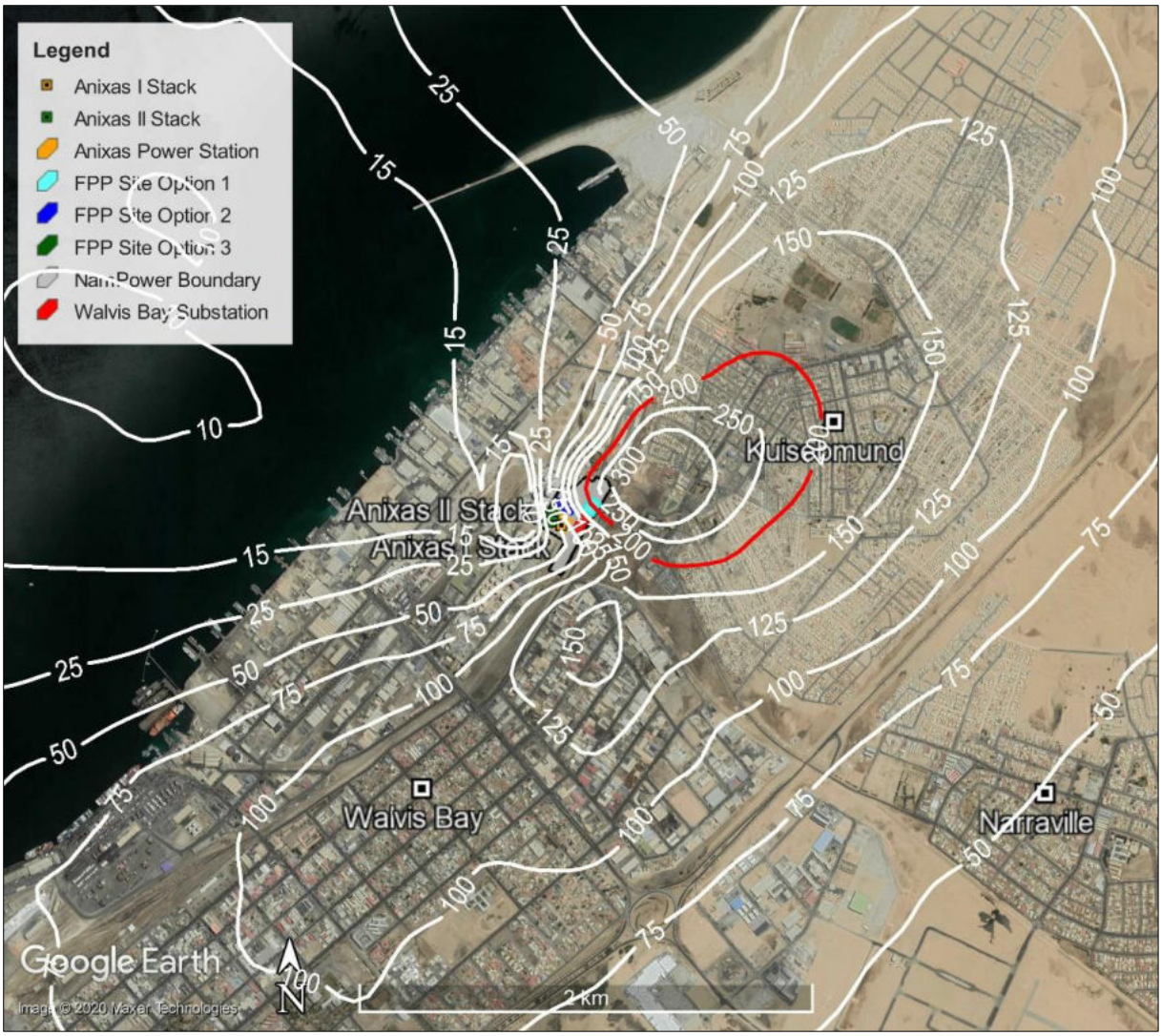

Figure 5-10. Predicted 99th percentile of the 1-hour NO_2 concentrations in µg/m³ for Scenario 4 (uMoya-NILU, 2020)

The annual average of NO_2 concentrations for Scenario 4 are not exceeded, parameters are however exceeded for the 1-hour limit for NO_2 for the SA NAAQS and World Health Organisation. The red line indicates the limit values of 200 µg/m³ for NO_2 (1-hour limit). The exceedance area is larger than that of Scenario 2C.

Particulate matter modelled results indicate compliance to all standards.

Figure 5-11. Predicted 99th percentile of the 1-hour SO_2 concentrations in µg/m³ for Scenario 4 (uMoya-NILU, 2020)

Predicted ambient SO_2 and NO_2 concentration, as well as the predicted 99th percentile of the 24-hour and 1-hour concentrations, are below SA NAAQS standards; apart from the 1-hour NO_2 concentrations (for scenario 4). The predicted 99th percentile of the 1-hour concentrations exceed the Limit Value of the SA NAAQS and World Health Organisation over a relatively large area to the north-northeast, east and south of the site (Figure 5-10). There were 263 modelled exceedances at the point of maximum predicted concentration, fewer than the permitted tolerances of 264. Therefore although exceedances occur, the number of exceedances are below the allowable limit.

The red line (isopleth) in Figure 5-10 indicates the Limit Value of 200 µg/m³. The area where the Limit Value is exceeded is therefore inside the red 200 µg/m³

line. The tolerance of 264 was not exceeded implying that there is compliance with the NAAQS for NO_2 for Scenario 4. In all instances the particulate matter as measured PM_{10} is well within all regulatory requirements. Table 5-17 presents a summary of compared results for the various scenarios.

Table 5-17. Maximum predicted ambient annual SO_2, and NO_2 concentrations in $\mu g/m^3$ and the predicted 99th percentile concentrations for 1-hour with three years exceedances values, with the South African NAAQS

Scenario	Power Station	Operation Time	Fuel	Sulphur dioxide (SO_2) in ($\mu g/m^3$)		Nitrogen dioxide (NO_2) in ($\mu g/m^3$)	
				Annual	1-hour	Annual	1-hour
2B	Anixas I	Continuous	HFO	18.0	601 237/3Y	17.0	611 µg/m³ 352/3Y
	Anixas II	Continuous	HFO				
2C	Anixas I	Peak	HFO	10.2	415 95/3Y	11.8	479 µg/m3 284/3Y
	Anixas II	Continuous	HFO				
2D (80 m Stack)	Anixas I	Peak	HFO	7.1	286 0/3Y	8.0	332 µg/m³ 139/3Y**
	Anixas II	Continuous	HFO				
4	Anixas I	Peak	LSHFO	7.9	319 0/3Y	9.8	397* µg/m³ 263/3Y**
	Anixas II	Continuous	LSHFO				
NAAQS limit value				**50**	**350 µg/m³ 264/3Y**	**40**	**200 µg/m³ 264/3Y**

** This is achieved with NOx reduction technology, not the LSHFO fuel*
*** The Number of 1-hour exceedances are within the limit of allowable annual exceedances*
3Y = Three year model period

Impact Assessment

During construction phase, dust may be generated through a variety of activities. Movement of material, demolition of old structures, and movement of vehicles and machines are some of the main dust generating activities. Dust may impair visibility along roads, pose health risks due to inhalation of suspended particulate matter, or inhibit plant health through settling on vegetation. Low levels of radon, which occurs naturally in the area (Njinga, R., et al. (2016), is not foreseen to detrimentally impact the project or construction workers during the construction phase.

Operational phase activities will see the release of emissions from the fuel combustion process used to generate electricity. Generally, the air quality impacts associated with the project are relatively low when operated as a peak station. The impacts increase when the plant is operated continuously. The probability of the plant operating in continuous mode will only realise as an emergency incident. In such an instance, the modelled results indicate that

limit values as prescribed by SA NAAQS, IFC and World Health Organisation will be exceeded. The proponent has therefore incorporated mitigation measures specifically for such instances. The use of engine combustion optimisation and selective catalytic reduction system (SCR, with up to 70 %) will reduce the NO_x released. The SCR system comprises an addition of ammonia and/ or urea to the exhaust gasses (flue gas) prior to its release. The NOx emissions are then decomposed into N_2 and H_2O. Therefore, during the design of the project, allowance has been made for the possible future incorporation of such a system as well as for the storage of the required material. SO_2 reduction will be achieved by using a lower sulphur (of 2% or lower) HFO. However, an alternative mitigation measure would be to raise the stack height, for Anixas II, above 60 m, as may be optimised by the contractor. Therefore by employing a combination of the former two mitigation measures, or the latter, emission reduction will be achieved. All emissions can therefore be mitigated to ensure the regulatory standards are met at receptor level.

Table 5-18. Air quality impact summary

Project Activity/Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Without Mitigation and Preventive Measures									
Construction	Excessive dust generated from construction activities	2	-1	2	2	2	-12	-2	Probable
Daily Operations	Emissions release from Continuous combustion activities	3	-2	2	2	2	-36	-4	Definite
Indirect Impact	Degradation of ambient air quality	2	-2	2	2	2	-24	-3	Probable
With Mitigation and Preventive Measures									
Construction	Excessive dust generated from construction activities	1	-1	2	2	2	-6	-1	Probable
Daily Operations	Emissions release from combustion activities	2	-1	2	2	1	-10	-2	Definite
Indirect Impact	Degradation of ambient air quality	1	-1	2	2	1	-5	-1	Probable

Desired Outcome: To prevent health impacts and minimise dust generation.

Actions

Responsible party for action indicated in brackets

Mitigation:

- Personnel issued with appropriate masks where excessive dust is present (Proponent & Contractor).
- A complaints register should be kept for any dust related issues and mitigation steps taken to address complaints where necessary e.g. dust suppression (Proponent & Contractor).
- Employ dust monitoring systems (Proponent & Contractor).
- During construction dust suppression to be employed to reduce suspended dust in the air. (Contractor)
- Purchase and use the cleanest fuel available within the financial constraints of project feasibility (natural gas is preferable to oil and low sulphur HFO as opposed to regular HFO). Diesel will unfortunately make the project not feasible. (Proponent).
- Implementation of additional NO_X controls such as combustion optimisation, increasing the stack height (design phase) or as a last resort install a selective catalytic reduction (SCR) system during continuous operational events, or when ambient air quality standards (as per SA NAAQS) are exceeded (Proponent, Contractor).
- Installation of additional SO_X controls such as use of low sulphur fuel, increase the stack height (Design phase) or as a last resort install a desulphurisation scrubber (if possible) during continuous operational events, or when ambient air quality standards (as per SA NAAQS) are exceeded (Proponent, Contractor).
- Ensure that maintenance of the Plant is carried out as per OEM requirements, so that design levels are maintained. (Proponent, Contractor)

Data Sources and Monitoring:

- Any complaints received regarding dust or emissions during the construction and operational phases should be recorded with notes on action taken (Proponent & Contractor).

- Continuous emission monitoring and six monthly reports to be kept.
- All information and reporting to be included in a bi-annual report (Proponent & Contractor).

5.4.12 Noise

Human response to noise is not an empirical absolute, as it is seen as a multi-faceted psychological concept, including behavioural and evaluative aspects. Therefore, noise need not be loud to be considered “disturbing”. Various factors may impact the severity of the perceived annoyance. The factors include background noise levels, physiological state of the receptor and the manner in which the receptor can control the noise. Sound described as noise implies a negative response from the receiver. Although most of the characteristics of sound are subjective, criteria exists for the assessment of noise. Criteria of concern related to noise assessment includes:

- increase in ambient noise levels;
- zone sound levels; and
- absolute or total noise levels.

The standards adopted for the project consider the World Health Organisation and South African standards. Modelling was focussed on the operational phase of the project due to the long term envisaged operations of the power station as opposed to the relatively short construction phase.

Noise modelling commenced once expected noise emission levels, typical to the technology proposed, were established. Modelling considered existing noise sources and environmental factors from various location options within the site. Expected noise generating activities which do not have specific values, for example, general construction noise was also incorporated. Modelling was conducted for the existing Anixas I Power Station as well as the proposed Anixas II Power Station operating with either GT or ICREs. Modelled results differentiated between day and night-time noise levels.

The conceptual scenarios which were developed for the operational phase considered proposed operations with either GT or ICREs on three site options. Therefore six scenarios were developed and modelled. The output of the modelling exercise indicated the following results:

- A noise impact of low significance is observed for all daytime operational activities, irrespective of the site or technology alternatives.

- If the power stations are operated at night, the following noise impacts are observed:
  - A high significance for the ICRE technology power station, developed at Site Option 1;
  - A medium significance for the ICRE technology power station, developed at Site Option 2;
  - A medium significance for the ICRE technology power station, developed at Site Option 3;
  - A high significance for the GT technology power station, developed at Site Option 1;
  - A high significance for the GT technology power station, developed at Site Option 2;
  - A medium significance for the GT technology power station, developed at Site Option 3;

Based on the results of the modelling for the proposed Anixas II Power Station, the specialist recommended that ICRE technologies be employed on site Option 3. Mitigation is recommended to ensure that potential noise annoyance with the project is managed and to reduce the potential significance of the noise impact (if the power stations are to be operated at night). Figure 5-12 and Figure 5-13 depict the day and night sound levels for ICRE (the technology to be employed for the project). These sound levels include the modelled noise (from the ICRE) onto the existing baseline noise level of the area.

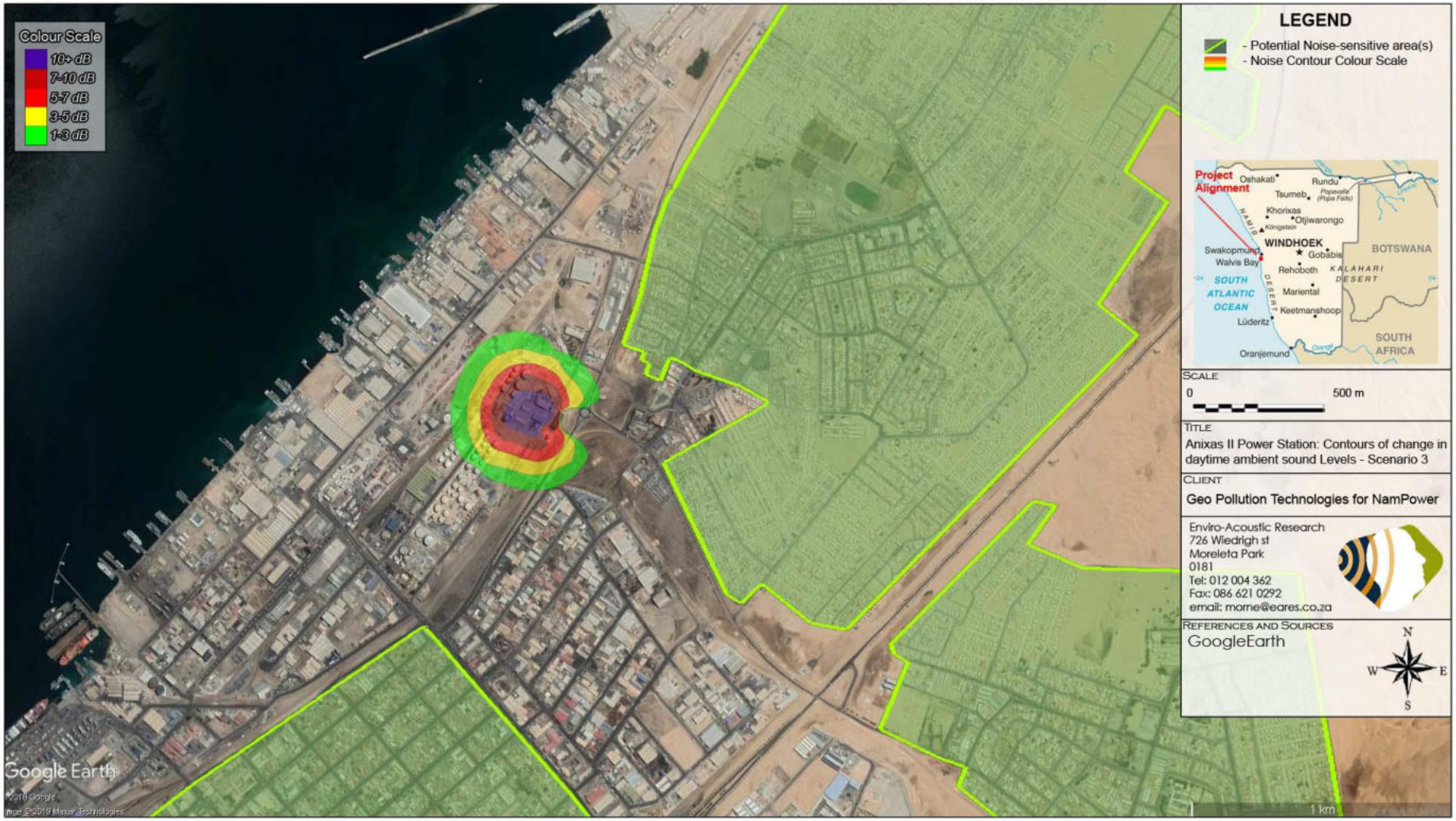

Figure 5-12. Modelled change in daytime ambient sound levels for ICRE from Site Option 3 (De Jager, 2020)

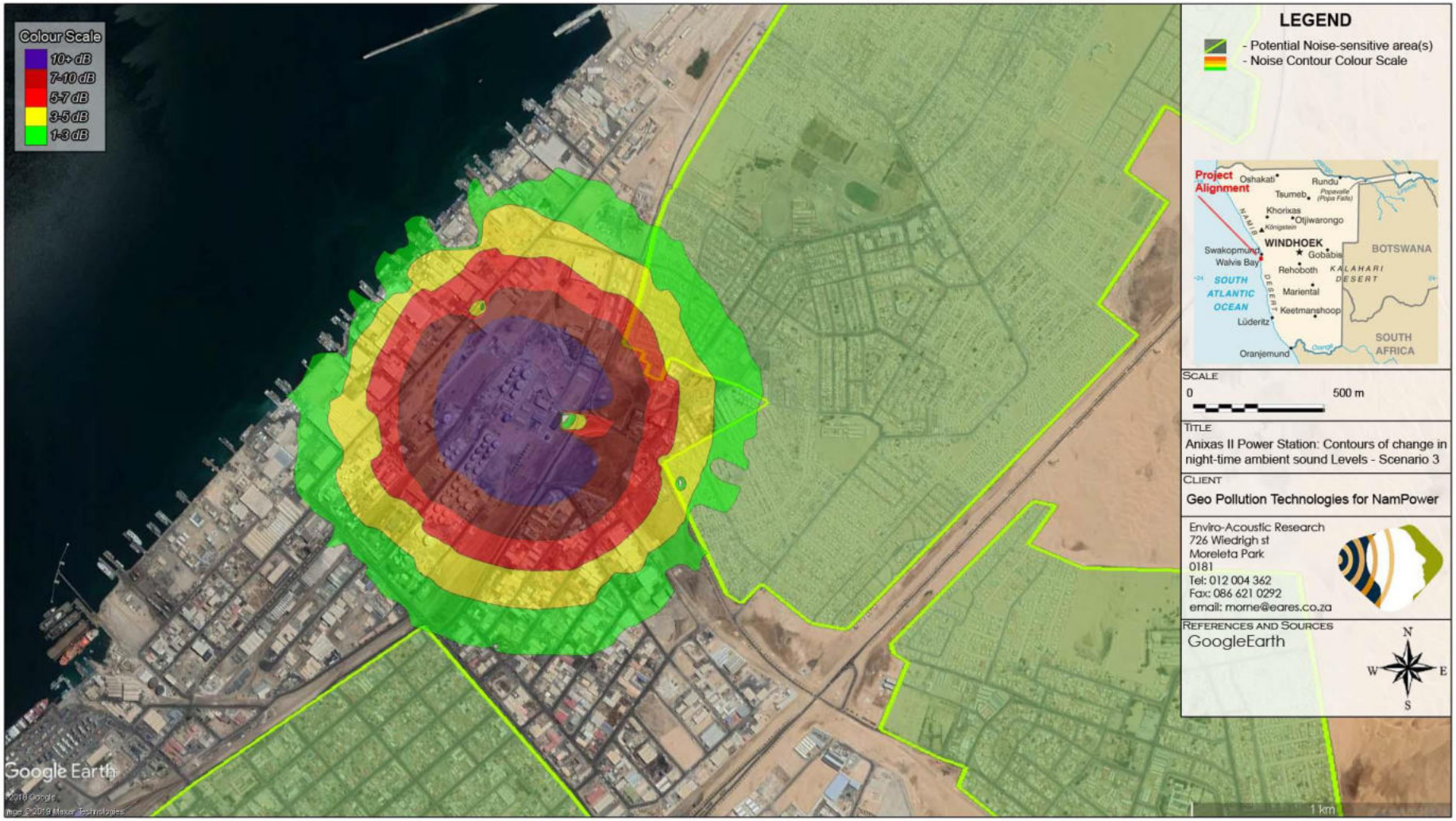

Figure 5-13. Modelled change in daytime ambient sound levels for ICRE from Site Option 3 (De Jager, 2020)

In summary it was highlighted that:

- Acoustical measurements identified an area where the ambient sound levels are elevated and typical of an urban area. As such noise limits of 55 and 45 dBA day/night-time limit was recommended as advised by the World Health Organization (for residential land use). Since the existing ambient sound levels already exceed these values, it is recommended that the proposed project limit the increase in sound levels to less than 3 dB within the residential areas.

As the site is located within an industrially zoned area, it is recommended that the Proponent limit the noise emission levels to be less than 70 and 60 dBA during the day and night-time periods. Noise levels should be limited to be less than 61 dBA when measured over a period of 24 hours at the boundary, as recommended in the Noise Specialist report, see Appendix C.

During the operational phase several noise generating activities are involved. All operating machines emit continual noise, contributing to the overall ambient noise of the site. The distance from the site to the closest neighbouring receptor abates the majority of noise generated on site. The noise assessment considered possible noise impacts emanating from a worst case scenario for four ICRE engines operating at 500 RPM. Changing the size of the ICRE engines from 12.5 to 18 MW has a relatively small change in the total noise generation level which should be less than 3 dB.

Therefore, operational activities during the day have a low significance rating when activities are conducted on Site Option 3, as the most significant mitigation measure. Impacts during night-time have a medium to high significance and requires additional mitigation measures to ensure a lower significance rating. During the construction phase, the main noise generating activities are related to earthworks and material handling and are not considered to have a significant impact when compared to the operational phase.

Table 5-19. Noise impact summary

Project Activity/Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Without Mitigation and Preventive Measures									
Construction	Excessive noise generated from construction/maintenance activities	2	-2	2	2	1	-20	-3	Definite
Daily Operations	Noise generated from the operational activities during the day	2	-2	2	2	2	-24	-3	Improbable
Daily Operations	Noise generated from the operational activities during the night	2	-3	2	2	2	-36	-4	Likely
Indirect Impact	Impact on community health	2	-2	2	2	1	-20	-3	Improbable
With Mitigation and Preventive Measures									
Construction	Excessive noise generated from construction/maintenance activities	1	-2	2	2	1	-10	-2	Definite
Daily Operations	Noise generated from the operational activities during the day	2	-1	2	2	2	-12	-2	Improbable
Daily Operations	Noise generated from the operational activities during the night	2	-3	2	2	2	-18	-2	Likely
Indirect Impact	Impact on community health	2	-1	2	2	1	-10	-2	Improbable

Desired Outcome: To prevent any nuisance and hearing loss due to the noise generated.

Actions

Responsible party for action indicated in brackets.

Prevention:

- Follow World Health Organisation guidelines on maximum noise levels (Guidelines for Community Noise, 1999) (Proponent & Contractor).

- All machinery must be regularly serviced to ensure minimal noise production (Proponent & Contractor).
- In the engine hall the amount of openings such as doors should be minimized and always be closed during operation (Proponent & Contractor).
- The walls of the engine hall can be thicker to increase the transmission coefficients. Additional walls or partitions can also be constructed inside the engine hall to absorb, diffract and reflect noise levels (Proponent & Contractor).
- The engine hall roof can use a material with a higher transmission coefficient (Proponent & Contractor).
- Noise dampers to be fitted to engines where suitable. Correct use and design of silencers/attenuators with the potential use of acoustical resonators (to remove certain frequencies) (Proponent & Contractor).
- Ventilation fans should be fitted with attenuators or silencers to minimise the leaking of acoustic energy via this path (Proponent & Contractor).
- The appropriate use of anti-vibration mounts for ducting/piping, fans and compressors as well as the ICRE (Proponent & Contractor).
- Correct design of the intake and exhaust ducting (correct diameter, damping and material) to reduce acoustical lagging (Proponent & Contractor).
- Noise level measurements should be performed to determine the most pertinent noise generators. Appropriate PPE should be provided to all employees in close proximity to such noise generators (Proponent & Contractor).
- Annual noise monitoring conducted while plant is operational (Proponent)

Mitigation:

- Hearing protectors as standard PPE for workers in situations with elevated noise levels (Proponent & Contractor).

Data Sources and Monitoring:

- Maintain a complaints register (Proponent & Contractor).
- Bi-annual report on complaints and actions taken to address complaints and prevent future occurrences (Proponent & Contractor).

- Noise monitoring results documented when conducted (Proponent & Contractor).

5.4.13 Waste Production

Various waste streams will be produced during the construction and operational phase. Waste presents a contamination risk and when not removed regularly may become a fire and/or health hazard. Expected waste from the site will include domestic, general, hazardous and effluent waste.

The construction phase will see the generation of building rubble, general construction waste as well as hazardous waste in terms of chemicals and hydrocarbons (amongst others) used in the construction phase.

Although asbestos is considered an environmental hazard, it was used as a building material in the past. The workshops to be demolished on site contain asbestos and would therefore be considered as a hazardous substance when dismantled.

The operational phase will generate significantly less waste than the construction phase. The burning of HFO for electricity generation does not result in significant waste streams. In addition, there will be no wet cooling on site and therefore no discharge of process, industrial water. Any process / industrial water disposed into the municipal sewer, must comply with Municipal regulation. Sewage and grey water from the ablution facility will tie into the existing municipal sewer. It is foreseen that there will not be a significant increase from the project.

All fuel products do have a limited storage life. Care must be taken that fuel storage is properly managed so as not to turn the fuel into waste due to its shelf life expiring.

Table 5-20. Waste production impact summary

Project Activity/Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Without Mitigation and Preventative Measures									
Construction	Waste production, littering, illegal dumping, contaminated materials	2	-2	2	2	2	-24	-3	Definite

Daily Operations	Waste production, littering, contaminated materials	2	-2	2	2	2	-24	-3	Definite
Indirect Impact	Increased pressure on municipal waste management system	2	-1	2	2	1	-10	-2	Definite
With Mitigation and Preventative Measures									
Construction	Waste production, littering, illegal dumping, contaminated materials	1	-2	2	2	2	-12	-2	Definite
Daily Operations	Waste production, littering, contaminated materials	1	-2	2	2	2	-12	-2	Definite
Indirect Impact	Increased pressure on municipal waste management system	1	-1	2	2	1	-5	-1	Definite

Desired Outcome: To reduce the amount of waste produced and prevent contamination, pollution and littering.

Actions

Responsible party for action indicated in brackets.

Prevention:

- All hazardous waste such as oily rags and waste oil should be removed from the site on a weekly bases (Proponent & Contractor).
- Waste reduction measures should be implemented and all waste that can be re-used/recycled must be kept separate (Proponent & Contractor).
- Ensure adequate disposal and storage facilities are available (Proponent & Contractor).
- Waste collection points to be clearly demarcated and maintained (Proponent & Contractor).
- Hazardous waste storage and collection points (such as for old oil, rags, etc.) should be on a contained impermeable layer (Proponent & Contractor).
- Ensure waste cannot be blown away by wind (Proponent & Contractor).
- Prevent scavenging (human and non-human) of waste (Proponent & Contractor).
- Should any construction or operational activity require discharge of effluent into municipal sewers, a permit is to be obtained from the Municipality of Walvis Bay (Proponent).

Mitigation:

- Solid waste should be disposed of regularly and at appropriately classified disposal facilities, this includes hazardous materials (empty chemical containers, contaminated rugs, paper, water and soil) (Proponent & Contractor).
- See the MSDS available from suppliers for disposal of contaminated products and empty containers (Proponent & Contractor).
- Liaise with the municipality regarding waste and handling of hazardous waste where required (Proponent).

Data Sources and Monitoring:

- A register of hazardous waste disposal should be kept. This should include type of waste, volume as well as disposal method/facility (Proponent & Contractor).
- Any complaints received regarding waste should be recorded with notes on action taken (Proponent & Contractor).
- All information and reporting to be included in a bi-annual report (Proponent).

5.4.14 Ecosystem and Biodiversity Impact

The majority of habitats associated with the site have been impacted and altered during the existing site establishment. The nature of the current operational activities (Anixas I) on portions of the site, is such that the probability of creating a habitat for flora and fauna to establish is low. No species of importance have been identified on site during the reconnaissance site visit. Impacts which have resulted due to the existing site establishment include the following:

- Flora destruction due to the physical removal of vegetation cover.
- Habitat destruction and disturbance of fauna and flora. Disturbances may range from dust, noise, movement, vibration and lighting.

The site is part of an established industrial area in Walvis Bay which has seen ecological disturbance since its development. There however remains various important bird areas in the proximity of Walvis Bay. Bird flight paths between these important areas may be impacted by additional and large infrastructure such as emission stacks and bright lighting.

Table 5-21. Ecosystem and biodiversity impact summary

Project Activity/Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Without Mitigation and Preventive Measures									
Construction	Impact on fauna. Disruption and impact on flight paths.	2	-2	1	1	2	-16	-2	Improbable
Daily Operations	Impact on fauna. Disruption and impact on flight paths. Bird strikes and ambient air quality.	2	-2	1	1	2	-16	-2	Probable
Indirect Impact	Reduction in adaptation capability and increase in bird mortality	2	-2	1	1	1	-12	-2	Improbable
With Mitigation and Preventive Measures									
Construction	Impact on fauna. Disruption and impact on flight paths.	2	-1	1	1	2	-8	-1	Improbable

Daily Operations	Impact on fauna. Disruption and impact on flight paths. Bird strikes and ambient air quality.	1	-1	1	1	2	-4	-1	Probable
Indirect Impact	Reduction in adaptation capability and increase in bird mortality	2	-1	1	1	1	-6	-1	Improbable

Desired Outcome: To avoid pollution of, and additional impacts on, the ecological environment.

Actions.

Responsible party for action indicated in brackets.

Prevention:

- Prevent scavenging of waste by fauna (Proponent & Contractor).
- The establishment of primary and invader species on site should be prevented. Regular clearing of invader species should be conducted to prevent spread of such species across the site and onto neighbouring properties (Proponent).
- Any sighting of protected species should be documented (Proponent & Contractor).
- All lighting on the structures should be down-shielded, to reduce the cumulative impacts of lighting in the area on birdlife, especially night-flying species (Proponent & Contractor).

Data Sources and Monitoring:

- Bird strikes (collisions) with any infrastructure on site to be documented and corrective action implemented (Proponent & Contractor).
- All information and reporting to be included in a bi-annual report (Proponent).

5.4.15 Groundwater, Surface Water and Soil Contamination

Construction will include activities such as the mixing of concrete and the use of fuel, oils and lubricants. Operations will also require the use, storage and handling of HFO and diesel. Such activities, along with oils and lubricants of mechanical parts, present a contamination risk during the operational phase. Contamination may either result from failing storage facilities, pumps and pipelines, spills and leaks associated with overfilling, human error, or incorrect disposal of waste. Such spills may contaminate the soil and groundwater.

Table 5-22. Groundwater, surface water and soil contamination impact summary

Project Activity/Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Without Mitigation and Preventive measures									
Construction	Contamination from hazardous material spillages and hydrocarbon leakages	2	-2	2	2	1	-20	-3	Improbable
Daily Operations	Contamination from hazardous material spillages and hydrocarbon leakages	2	-2	2	2	2	-24	-3	Improbable
Indirect Impact	Reduction in groundwater quality	2	-2	2	2	2	-24	-3	Improbable
With Mitigation and Preventive measures									
Construction	Contamination from hazardous material spillages and hydrocarbon leakages	1	-1	2	2	1	-5	-1	Improbable
Daily Operations	Contamination from hazardous material spillages and hydrocarbon leakages	1	-1	2	2	2	-6	-1	Improbable
Indirect Impact	Reduction in groundwater quality	1	-1	2	2	2	-6	-1	Improbable

Desired Outcome: To prevent the contamination of water and soil.

Actions

Responsible party for action indicated in brackets.

Prevention:

- Obtain a permit from the Ministry of Mines and Energy for the storage of fuel for additional fuel storage to be implemented (Proponent).
- No servicing or maintenance of machines to be conducted on bare ground. The use of drip trays and impermeable surfaced areas should be employed (Proponent & Contractor).
- The procedures followed to prevent environmental damage during service and maintenance, and compliance with these procedures, must be audited and corrections made where necessary (Proponent & Contractor).
- Spill control structures and procedures must be in place according to fuel storage permit conditions, SANS standards or better (Proponent & Contractor).
- All storage of hydrocarbons must occur in suitably bunded areas with a capacity of 110% of the largest tank contained, and with concrete floors (Proponent & Contractor).
- Polluted soil and building rubble must be transported away from the site to an approved and appropriately classified waste disposal site (Proponent & Contractor).
- All handling of hydrocarbons should be on spill proof surfaces connected to an oil water separator (Proponent & Contractor).
- Proper training of operators must be conducted on a regular basis (fuel handling, spill detection, spill control) (Proponent & Contractor).
- Contaminated water must be prevented from entering the municipal sewers or environment, and treated as hazardous waste (Proponent & Contractor).

Mitigation:

- Any hydrocarbon fuel spillage of more than 200 litre must be reported to the Ministry of Mines and Energy (Proponent & Contractor).
- Spill clean-up means must be readily available on site and spills must be cleaned up immediately (Proponent & Contractor).
- Surfactants (soap) may not be allowed to enter the spill catchments or any oil water separation process e.g. soap usage on spill control surfaces (Proponent & Contractor).

- Consult relevant MSDS information and a suitably qualified specialist where needed for spill remediation and storage etc. (Proponent & Contractor).

Data Sources and Monitoring:

- Maintain MSDS for hazardous chemicals (Proponent & Contractor).
- Report all spills or leaks to management and initiate clean-up immediately (Proponent & Contractor).
- Maintain a register of all incidents on a daily basis. This should include measures taken to ensure that such incidents do not repeat themselves (Proponent & Contractor).
- A report should be compiled bi-annually of all monitoring and spills or leakages reported. The report should contain the following information: date and duration of spill, product spilled, volume of spill, groundwater monitoring results, remedial action taken, etc., and a copy of documentation in which a spill was reported to the Ministry of Mines and Energy (Proponent & Contractor).

5.4.16 Visual Impact

The nature of the project is in accordance with the existing landscape character. Surrounding land use comprises mainly of industrial activities. Business developments around the Port of Walvis Bay have altered the landscape to its industrial character. The project will cause slight changes to the overall visual character of the area while having greater changes on site. Such changes may affect visual receptors, existing land users and neighbouring operations. However, none of the visual receptors (neighbours) were identified to be reliant on this specific landscape character or are sensitive to site changes. The most significant visual changes will relate to the stacks and related higher structures as proposed.

Table 5-23. Visual impact summary

Project Activity/Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Without Mitigation and Preventive Measures									
Construction	Aesthetic appearance and integrity of the site.	1	-1	2	2	2	-6	-1	Improbable
Daily Operations	Increase of industrial landscape character.	2	-2	3	3	1	-28	-3	Definite
Indirect Impact	Strengthening of industrial landscape character	1	-1	2	2	1	-5	-1	Definite
With Mitigation and Preventive Measures									
Construction	Aesthetic appearance and integrity of the site.	1	-1	2	2	2	-6	-1	Improbable
Daily Operations	Increase of industrial landscape character.	1	-1	3	3	1	-7	-1	Definite
Indirect Impact	Strengthening of industrial landscape character	1	-1	2	2	1	-5	-1	Definite

Desired Outcome: To minimise aesthetic impacts associated with the project.

Actions

Responsible party for action indicated in brackets.

Mitigation:

- Regular waste disposal, good housekeeping and routine maintenance on infrastructure will ensure that the longevity of structures are maximised and a low visual impact is maintained (Proponent & Contractor).

Data Sources and Monitoring:

- A report should be compiled every six months of all complaints received and corrective action taken related to aesthetic appearance of the site (Proponent & Contractor).

5.4.17 Navigational Impacts

Navigational impacts will relate to the stacks and related higher structures as proposed. These structures may present navigational challenges due to its location and structural illumination for maritime and air traffic. The additional proposed stack may present a collision risk as it is located north of the aircraft approach for the Walvis Bay International Airport, although the additional proposed stack is considered to be shielded by the existing stack (which has a civil aviation clearance of 150 m). The proposed stack will approximately be in line with the Fisheries Channel of the Walvis Bay Harbour. Aircraft navigation lights on the stack may potentially be confused as a leading light for the marine traffic in the Fishing Channel.

Therefore, prior to the construction of an additional stack, the proponent will discuss the visual safety aspects with the Civil Aviation Authority as to agree on a safe height and location for the stack. Similarly discussions should be held with Namport regarding stack illumination.

Table 5-24. Navigational impact summary

Project Activity/Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Without Mitigation and Preventive Measures									
Construction	Possible flight obstruction	2	-1	2	2	2	-12	-2	Improbable
Daily Operations	Maritime and flight navigational challenge	2	-2	3	3	1	-28	-3	Improbable
Indirect Impact	Maritime traffic incident	2	-1	2	2	1	-10	-2	Improbable
With Mitigation and Preventive Measures									
Construction	Possible flight obstruction	1	-1	2	2	2	-6	-1	Improbable
Daily Operations	Maritime and flight navigational challenge	1	-1	3	3	1	-7	-1	Improbable
Indirect Impact	Maritime traffic incident	1	-1	2	2	1	-5	-1	Improbable

Desired Outcome: To avoid air traffic and marine traffic impacts.

Actions

Responsible party for action indicated in brackets.

Prevention

- Implementation of Civil Aviation recommendations related to stack structures (Proponent, Contractor).
- Design and placement of lights should be cleared with Namport to ensure that they will not be mistaken for port navigation lights (Proponent, Contractor).

Mitigation:

- Respond appropriately to complaints received (Proponent & Contractor).

Data Sources and Monitoring:

- A report should be compiled every six months of all complaints received and corrective action taken related to potential navigation impacts (Proponent & Contractor).

5.4.18 Cumulative Impacts

Cumulative impacts are those potential impacts which in itself may not be considered significant, however when considered as a collective may be significant. Some of the identified impacts may be at a regional scale.

- Sustainable and long term employment (positive),
- Contribution to local and regional economy (positive),
- Air quality degradation (negative),
- Increased ambient noise (negative), and
- Waste production (negative).

Desired Outcome: To minimise all cumulative impacts associated with the power station.

Actions

Responsible party for action indicated in brackets

Mitigation:

- Addressing each of the individual impacts as discussed and recommended in the EMP would reduce the cumulative impact (Proponent & Contractor).
- Reviewing bi-annual reports for any new or re-occurring impacts or problems would aid in identifying cumulative impacts. Planning and improvement of the existing mitigation measures can then be implemented (Proponent).

Data Sources and Monitoring:

- Create a six monthly summary report based on all other impacts to give an overall assessment of the impacts of the operational phase (Proponent).

5.5 ENVIRONMENTAL MANAGEMENT SYSTEM

The proponent could implement an Environmental Management System (EMS) for their operations. An EMS is an internationally recognized and certified management system that will ensure ongoing incorporation of environmental constraints. At the heart of an EMS is the concept of continual improvement of environmental performance with resulting increases in operational efficiency, financial savings and reduction in environmental, health and safety risks. An effective EMS would need to include the following elements:

- A stated environmental policy which sets the desired level of environmental performance;
- An environmental legal register;
- An institutional structure which sets out the responsibility, authority, lines of communication and resources needed to implement the EMS;
- Identification of environmental, safety and health training needs;
- An environmental program(s) stipulating environmental objectives and targets to be met, and work instructions and controls to be applied in order to achieve compliance with the environmental policy; and
- Periodic (internal and external) audits and reviews of environmental performance and the effectiveness of the EMS.
- The EMP.
- Closure plan.

5.6 DECOMMISSIONING AND REHABILITATION

Decommissioning of the power station is not foreseen within the next 25 years. However, the Proponent should formulate a closure strategy which may be planned and provided for during the operational phase. During the decommissioning phase, operations will be scaled down as works are prepared to be closed (for example no additional fuel storage). Once all operations have ceased and the related social and labour closure considerations implemented, the Proponent may finalise rehabilitation efforts within the site. As no closure plan has been drafted yet, no specific potential impacts could be identified. However, general anticipated and residual impacts have been listed. Additional closure activities include the continuous monitoring of various environmental parameters. Such monitoring initiatives should be included in the closure strategy while the

EMP for this phase will have to be reviewed prior to the time of decommissioning, to incorporate any new legislation, requirements and environmental constraints.

6 CONCLUSION

Positive impacts are mostly economical, however a strong motivator is firm power supply which enables business development and boosts investors' confidence in Namibia. Infrastructure and power supply maintenance are key to sustainable development and related development goals. As per Table 6-1 the majority of impacts are negative. However, they can be mitigated to have a lesser severity as proposed. Operational related impacts must be mitigated by implementing strict monitoring and control methods. All permits and approvals must be obtained from relevant ministries or authorities for the operations of the power station. Pollution prevention measures should be adequate to prevent incidents that may potentially pollute groundwater and surface water. Health, safety and security regulations should be adhered to in accordance with the regulations pertaining to relevant laws and standards. The possible use of LNG in the future will particularly require specific safety considerations in terms of LNG transport, storage and handling.

The environmental management plan should be used as an on-site reference document during all phases of construction and operations. Parties responsible for transgression of the EMP should be held responsible for any rehabilitation that may need to be undertaken. Monitoring reports must be submitted to the Ministry of Environment, Forestry and Tourism every six months to allow for the future renewal of the Environmental Clearance Certificate.

The environmental clearance certificate issued, based on this Environmental Management Plan, will render it a legally binding document which should be adhered to.

Table 6-1. Impact summary class values

Impact Category	Impact Type	Construction	Operations
Positive Rating Scale: Maximum Value ***With Mitigation and Prevention Measures***		5	5
Negative Rating Scale: Maximum Value ***With Mitigation and Prevention Measures***		-5	-5
EO	Developing Project Feasibility & Permitting		
SC	Plans and Aspirations for the Future		
EO	Skills, Technology and Development		
EO	Change in Land Use and Earning Potential		
SC	Revenue Generation and Employment		
SC	Demographic Profile and Community Health		
EO	Firm Power Supply		
SC	Traffic		
BE/EO	Fire		
PC	Air Quality		
PC	Fire		
SC	Noise		
PC	Waste Production		
BE	Ecosystem and Biodiversity Impact		
PC	Groundwater, Surface Water and Soil Contamination		
SC	Visual Impact		
BE	Navigational Impacts		

BE = Biological/Ecological EO = Economical/Operational PC = Physical/Chemical SC = Sociological/Cultural

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