APP-001182
TETELESTAI MARICULTURE
PROPOSED OYSTER AND SCALLOP MARICULTURE FARM AT LÜDERITZ
ENVIRONMENTAL ASSESSMENT SCOPING REPORT

Assessed by: Tetelestai Mariculture (Pty) Ltd
Assessed for:

May 2020
I, Jacobus A. Blanuw, acting as the Proponent’s representative (Tetelestai Mariculture (Pty) Ltd), hereby approve this report and confirm that the project description contained in herein 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 Walvis Bay on the 19 day of May 2020.

Tetelestai Mariculture (Pty) Ltd
SUMMARY
Tetelestai Mariculture (Pty) Ltd requested Geo Pollution Technologies (Pty) Ltd to undertake an environmental assessment for their proposed oyster and scallop mariculture operations at Lüderitz. The project will require an onshore processing facility and space within the dedicated mariculture farm areas. The onshore processing facility will likely be located within the Lüderitz Boatyard where similar facilities are already present. The offshore farm will be located in one of the declared mariculture areas within the Lüderitz Harbour – Second Lagoon area.

The environmental assessment is conducted to determine all environmental, safety, health and socio-economic impacts associated with the proposed mariculture farm. Relevant environmental data was compiled by making use of secondary data and from a reconnaissance site visit. Potential environmental impacts and associated social impacts were identified and are addressed in this report.

Due to the nature and location of the facility, limited impacts can be expected on the surrounding environment, see summary impacts table below. The Lüderitz Boatyard is a property of Namport and is used for industrial type activities. Limited impacts are thus expected from operation at the land-based facility. The offshore farm is an area earmarked for mariculture by the Ministry of Fisheries and Marine Resources. It is recommended that environmental performance be monitored regularly to ensure regulatory compliance and that corrective measures be taken if necessary. The operations of the facility will play a role in providing much needed contribution to the employment and economy of Lüderitz.

The major concerns related to the operations of the facility are that of potential surface water contamination, reduction in water quality and possible localised ecological impacts. These will however be limited by adherence to permit requirements and the implementation and maintenance of a biosecurity plan. Furthermore, noise pollution should meet the minimum requirements of the World Health Organisation standards and all local regulations of the Labour Act and other relevant health and safety standards must be adhered to. By appointing local contractors and employees and implementing educational programs, the positive socio-economic impacts can be maximised while mitigating any negative impacts.

The introduction of the non-native scallop for mariculture purposes is very similar to the Pacific oysters which have been cultivated in Lüderitz since 1986 and also are non-native. The scallops are not expected to have a negative impact on the local ecosystem and are not expected to become invasive. Careful monitoring of the marine environment is however recommended.

The environmental management plan (EMP) and an in-house health, safety and environment plan should be used as an on-site reference document during operational activities at the mariculture farm. This document and its supporting impact assessment should be reviewed on a regular basis, in order to ensure that it is still relevant to the activities executed on site. Parties responsible for transgression of the EMP should be held responsible for any rehabilitation that may need to be undertaken. Operators and responsible personnel must be taught the contents of these documents.

Impact summary class values

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</table>

BE = Biological/Ecological          EO = Economical/Operational        PC = Physical/Chemical        SC = Sociological/Cultural
# TABLE OF CONTENTS

1 BACKGROUND AND INTRODUCTION........................................................................................................1

2 SCOPE .....................................................................................................................................................2

3 METHODOLOGY.......................................................................................................................................2

4 PROJECT DEVELOPMENT AND OPERATIONS ....................................................................................3
   4.1 DEVELOPMENT PHASE.......................................................................................................................3
   4.2 OPERATIONS........................................................................................................................................4
   4.3 GENERAL ACTIVITIES.......................................................................................................................6

5 ALTERNATIVES..........................................................................................................................................6

6 ADMINISTRATIVE, LEGAL AND POLICY REQUIREMENTS .................................................................8
   6.1 THE ENVIRONMENTAL MANAGEMENT ACT..................................................................................10
   6.2 ADDITIONAL NATIONAL PLANNING LEGISLATION.....................................................................10

7 ENVIRONMENTAL CHARACTERISTICS...............................................................................................11
   7.1 LOCALITY AND SURROUNDING LAND USE ....................................................................................11
   7.2 CLIMATE..........................................................................................................................................11
   7.3 CORROSIVE ENVIRONMENT............................................................................................................13
   7.4 TOPOGRAPHY AND DRAINAGE ......................................................................................................14
   7.5 GEOLOGY AND HYDROGEOLOGY....................................................................................................14
   7.6 PUBLIC WATER SUPPLY ..................................................................................................................15
   7.7 TERRESTRIAL FAUNA AND FLORA ..................................................................................................15
   7.8 MARINE AND COASTAL ECOLOGY..................................................................................................16
   7.9 DEMOGRAPHIC AND ECONOMIC CHARACTERISTICS...................................................................17
   7.10 CULTURAL, HERITAGE AND ARCHAEOLOGICAL ASPECTS...........................................................18

8 PUBLIC CONSULTATION...........................................................................................................................18

9 MAJOR IDENTIFIED IMPACTS ..................................................................................................................18
   9.1 SOCIO-ECONOMIC IMPACTS ..........................................................................................................18
   9.2 HEALTH, SAFETY AND SECURITY IMPACTS................................................................................19
   9.3 WASTE PRODUCTION ....................................................................................................................19
   9.4 TRAFFIC IMPACTS ..........................................................................................................................19
   9.5 SURFACE WATER CONTAMINATION ..............................................................................................19
   9.6 TERRESTRIAL ECOSYSTEM AND BIODIVERSITY IMPACTS........................................................19
   9.7 IMPACTS ON MARINE AND COASTAL BIOTA ................................................................................19
      9.7.1 Physical Impacts .....................................................................................................................19
      9.7.2 Entanglement ..........................................................................................................................19
      9.7.3 Diseases ....................................................................................................................................19
      9.7.4 Ecosystem and Biodiversity Impacts .......................................................................................20

10 ASSESSMENT AND MANAGEMENT OF IMPACTS..............................................................................20
   10.1.RISK ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PLAN .............................................21
      10.1.1 Planning....................................................................................................................................22
      10.1.2 Revenue Generation and Employment ..................................................................................23
      10.1.3 Skills, Technology and Development ....................................................................................24
      10.1.4 Demographic Profile and Community Health ........................................................................25
      10.1.5 Traffic ......................................................................................................................................26
      10.1.6 Health, Safety and Security ....................................................................................................27
      10.1.7 Noise .......................................................................................................................................29
      10.1.8 Waste Production....................................................................................................................30
      10.1.9 Terrestrial Ecosystem and Biodiversity Impact .......................................................................31
      10.1.10 Impacts on Marine and Coastal Biota ..................................................................................31
      10.1.11 Surface Water and Soil Contamination .................................................................................33
      10.1.12 Visual Impact ........................................................................................................................34
      10.1.13 Cumulative Impact ................................................................................................................35
   10.2 DECOMMISSIONING AND REHABILITATION .............................................................................36
11 CONCLUSION .................................................................................................................. 36
12 REFERENCES .................................................................................................................. 38

LIST OF APPENDICES
APPENDIX A: NOTIFIED AND REGISTERED INTERESTED AND AFFECTED PARTIES .................. 39
APPENDIX B: COMMENTS RECEIVED .................................................................................. 48
APPENDIX C: SCALLOP INTRODUCTION SPECIALIST STUDY ................................................... 50
APPENDIX D: CONSULTANTS’ CURRICULUM VITAE ............................................................... 68

LIST OF FIGURES
FIGURE 1. PROJECT LOCATION ........................................................................................... 2
FIGURE 2. MARICULTURE AREAS WITH POSSIBLE ONSHORE PROCESSING FACILITY AT LÜDERITZ BOATYARD .......................................................................................... 4
FIGURE 3. SURROUNDING LAND USE .................................................................................... 11
FIGURE 4. GEOLOGY MAP .................................................................................................... 15
FIGURE 5. VEGETATION ZONES AND ECOLOGICALLY SIGNIFICANT AREAS ......................... 16

LIST OF PHOTOS
PHOTO 1. OFFSHORE LONG LINES ......................................................................................... 4
PHOTO 2. WOODEN BASKET FOR OYSTER SPAT ...................................................................... 5
PHOTO 3. OYSTER SPAT ........................................................................................................... 5
PHOTO 4. GROW OUT BASKETS ............................................................................................. 5
PHOTO 5. STACKED GROW OUT BASKETS ........................................................................... 5
PHOTO 6. PERUVIAN SCALLOP ................................................................................................ 6
PHOTO 7. LANTERN NET .......................................................................................................... 6

LIST OF TABLES
TABLE 1. ALTERNATIVE COMPARISON TABLE .................................................................... 7
TABLE 2. NAMIBIAN LAW APPLICABLE OF SPECIFIC INTEREST ........................................... 8
TABLE 3. RELEVANT MULTILATERAL ENVIRONMENTAL AGREEMENTS FOR NAMIBIA .......... 10
TABLE 4. SUMMARY OF CLIMATE DATA (DIGITAL ATLAS OF NAMIBIA) ....................... 12
TABLE 5. AVERAGE ANNUAL CORROSION RATE FOR VARIOUS METALS IN DIFFERENT LOCATIONS IN SOUTHERN AFRICA FROM NICKEL DEVELOPMENT INSTITUTE: STAINLESS STEELS IN ARCHITECTURE, BUILDING AND CONSTRUCTION. HTTP://WWW.NICKELINSTITUTE.ORG 13
TABLE 6. DEMOGRAPHIC CHARACTERISTICS OF LÜDERITZ BAY, THE KARAS REGION AND NATIONALLY (NAMIBIA STATISTICS AGENCY, 2011) ........................................................................ 18
TABLE 7. ASSESSMENT CRITERIA ............................................................................................ 20
TABLE 8. ENVIRONMENTAL CLASSIFICATION (PASTAKIA 1998) ........................................... 21
TABLE 9. IMPACT SUMMARY CLASS VALUES ......................................................................... 37
LIST OF ABBREVIATIONS

AIDS Acquired Immune Deficiency Syndrome
BE Biological/Ecological
BOD Biological Oxygen Demand
COD Chemical Oxygen Demand
DEA Directorate of Environmental Affairs
DSP Diarrhetic Shellfish Poisoning
DWA Department of Water Affairs
EA Environmental Assessment
EIA Environmental Impact Assessment
EMA Environmental Management Act No 7 of 2007
EMP Environmental Management Plan
EMS Environmental Management System
EO Economic/Operational
ES Environmental Classification
GPT Geo Pollution Technologies
HIV Human Immunodeficiency Virus
HPP Harambee Prosperity Plan
HSE Health, Safety and Environment
IAPs Interested and Affected Parties
ISO International Standards of Operation
IUCN International Union for Conservation of Nature
m/s Metre per second
mbs Metres below surface
MET Ministry of Environment and Tourism
mm/a Millimetres per annum
MSDS Material Safety Data Sheet
NDP National Development Plan
PC Physical/Chemical
PPE Personal Protective Equipment
ppm Parts per million
PSP Paralytic Shellfish Poisoning
SC Sociological/Cultural
UNFCCC United Nations Framework Convention on Climate Change
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.

Aquaculture - The farming and ranching of aquatic organisms.

Assessment - The process of collecting, organising, analysing, interpreting and communicating information relevant to decision making.

Biota - The animal and plant life of a specific region, habitat, or geological period.

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

Construction - means the building, erection or modification of a facility, structure or infrastructure that is necessary for the undertaking of an activity, including the modification, alteration, upgrading or decommissioning of such facility, structure or infrastructure.

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, PR productivity 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, the 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.

Interested and Affected Party (IAP) - any person, group of persons or organisation interested in, or affected by an activity; and any organ of state that may have jurisdiction over any aspect of the activity.

Mariculture - The farming and ranching of specifically marine organisms.

Mitigate - The implementation of practical measures to reduce adverse impacts.
**Non-native** – a plant or animal introduced to an environment that is not the location of its natural occurrence

**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 & 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.

**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.

**Stakeholder Engagement** - The process of engagement between stakeholders (the proponent, authorities and IAPs) during the planning, assessment, implementation and/or management of proposals or activities. The level of stakeholder engagement varies depending on the nature of the proposal or activity as well as the level of commitment by stakeholders to the process. Stakeholder engagement can therefore be described by a spectrum or continuum of increasing levels of engagement in the decision-making process. The term is considered to be more appropriate than the term “public participation”.

**Stakeholders** - A sub-group of the public whose interests may be positively or negatively affected by a proposal or activity and/or who are concerned with a proposal or activity and its consequences. The term therefore includes the proponent, authorities (both the lead authority and other authorities) and all interested and affected parties (IAPs). The principle that environmental consultants and stakeholder engagement practitioners should be independent and unbiased excludes these groups from being considered stakeholders.

1 BACKGROUND AND INTRODUCTION

Geo Pollution Technologies (Pty) Ltd was appointed by Tetelestai Mariculture (Pty) Ltd (the Proponent) to undertake an environmental assessment for the proposed establishment of Pacific oyster (*Crassostrea gigas*) and Peruvian scallop (*Argopecten purpuratus*) mariculture farms, at Lüderitz. Mariculture activities have been ongoing in the Lüderitz area for many years. Today, the key organisms cultured are oysters and abalone. For this purpose, areas within Lüderitz bay have been set aside by the Ministry of Fisheries and Marine Resources in cooperation with Namport. Tetelestai Mariculture, who currently conducts oyster mariculture in Walvis Bay, wishes to develop their own mariculture farms and associated infrastructure in Lüderitz. The proposed location for the offshore infrastructure is in the Lüderitz Harbour – Second Lagoon area where official mariculture farms are located (Figure 1). The Proponent intends to culture oysters to a specific size, before relocating them to their operations in Walvis Bay for final grow-out and fattening. Processing of scallops will occur in Lüderitz. Both oysters and scallops will mainly be for international markets such as Russia and various countries in Asia, although other markets may also be established. In brief, development and operations of Tetelestai Mariculture will involve:

- Acquiring an fitting an existing land based processing facility or construction of a new facility
- Offshore installation of floating long lines
- Land-based stocking of grow-out baskets and lantern nets with oyster and scallop spat respectively
- Fixing grow-out baskets and lantern nets to the floating long lines
- Collecting grow-out baskets and lantern nets from floating long lines
- Sizing and sorting of oysters and scallops according to different size classes and returning undersized individuals to the offshore farm
- Transporting live oysters to Walvis Bay for final stages of culturing
- Packaging, freezing and transporting scallops to various markets
- Regular maintenance and repairs to infrastructure and equipment such as basket repairs
- Waste removal

A risk assessment was undertaken to determine the potential impact of the development, 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”.

The environmental assessment was conducted to apply for an environmental clearance certificate in compliance with Namibia’s Environmental Management Act (Act No 7 of 2007).

**Project Justification** – Mariculture is one of the key aspects of the “Fishery Strategies and Desired Outcomes, 2017 – 2022” forming part of the National Development Plan 5 (NDP 5) of Namibia. The strategy promotes mariculture as a viable economic option and NDP 5 thus promotes investment in the mariculture sector. This is in line with Namibia’s Vision 2030, which recognises the potential of the mariculture industry and promotes its development. Currently operating in Walvis Bay, the Proponent suffers regular losses in oyster stock resulting from oxygen depletion caused by severe sulphur eruptions, a regular occurrence along the central Namibian coast. Thus the desire to relocate a portion of their operations to Lüderitz, where such losses are not regularly experienced. Furthermore, the additional development in Lüderitz will diversify the local industry and contribute to employment and development in Lüderitz. Benefits of the mariculture farm include:

- Economic development, diversification and resilience in Lüderitz, while simultaneously increasing the feasibility of the Proponents mariculture activities in Walvis Bay. Thus, also sustaining employment and economy in Walvis Bay.
- Contribution to the economy and export trade of Namibia.
- Employment, training and skills development to a local workforce and increasing spending power in Lüderitz.
The scope of the environmental assessment is to:

1. Determine the potential environmental impacts emanating from the development, operational and decommissioning activities of the farm.
2. Identify a range of management actions which could mitigate the potential adverse impacts to acceptable levels.
4. Provide sufficient information to the Ministry of Environment and Tourism to make an informed decision regarding the issuing of an environmental clearance certificate for the proposed project.

The following methods were used to determine and assess the potential impacts on the social and natural environment that may emanate from the proposed project:

1. Baseline information about the site and its surroundings was obtained from existing secondary information as well as primary information obtained during a reconnaissance site visit and through a specialist study on the potential impacts of introducing a non-native scallop into the environment.
2. As part of the scoping process to determine potential environmental impacts, interested and affected parties (IAPs) were consulted about their views, comments and opinions and these are put forward in this report.
3. Based on gathered information and public and stakeholder consultation, an assessment of potential impacts was conducted and a management plan prepared.
4 PROJECT DEVELOPMENT AND OPERATIONS

Tetelestai Mariculture was established as a private company in Namibia in 2008. Since then, they have been involved in the mariculture industry in Walvis Bay where significant experience were gained in the culturing of oysters. The Proponent therefore has established markets for the export of oysters as well as a small local market. The oyster cultured is the Pacific oyster (*Crassostrea gigas*) and the Proponent also intends to initiate the culturing of the Peruvian scallop (*Argopecten purpuratus*), the latter being a newly introduced species for culturing at Lüderitz. Both the oyster and scallop species are non-native to Namibian coastal waters. After more than 20 years of culturing oysters, no impact on the local environment has been observed due to its inability to naturally reproduce and proliferate in the local conditions. The same is expected of the scallops, that also require very specific conditions for reproduction.

4.1 DEVELOPMENT PHASE

The development phase consists of the various administrative tasks of obtaining various permissions as well as land and water area for the proposed activities. This assessment forms part of the development phase. Once all the permissions and approvals have been obtained, site establishment can commence. This will involve the acquisition of a suitable land based property from which the proponent can operate. One possibility for the onshore facility is within the Lüderitz Boat Yard owned by Namport. This location already hosts the mariculture facilities of Oceangrown Namibia which is currently not operational. Should the Lüderitz Boatyard not realise as an option, an alternative location will be established, which may require negotiations with the local town council.

Once the land based property is acquired, a processing plant will be established. Should the property already contain infrastructure it may require refurbishment and fitment with basic equipment such as screening and sorting machines, holding tanks, pressure sprayers, cold rooms and storage space. If an empty erf is acquired, a new building or shed will have to be constructed to host the aforementioned equipment. Additional facilities will include ablution facilities and an office. Construction may include some earthworks, concrete works and bricklaying, utilities installation, painting and finishing.

Offshore, the various individual demarcated mariculture areas (farms) are allocated to various mariculture companies. Tetelestai Mariculture will acquire space within the mariculture area for their offshore mariculture activities (Figure 2). It is possible that one or more of the farms may be used depending on the negotiations and allocations made within the mariculture industry. Regardless of which farm is used, the project activities will remain the same.

During the development phase long lines will be installed. These are typical of the local mariculture industry and involves the installation of long ropes, anchored at both ends, and kept afloat by buoys or plastic drums (Photo 4). The anchors used are typically steel beams that are jetted into the sediment on the seafloor. By being submerged and covered by sediment, oxygen supply that triggers corrosion is limited and thus the steel beams can last decades. The long lines are required for the attachment of grow out baskets or lantern nets for the culturing of oysters and scallops.
OPERATIONS

In their natural environment, oysters release sperm and eggs into the surrounding water where fertilisation takes place. After fertilisation, free-swimming larvae will after some time attach to suitable substrate at which stage they are generally referred to as spat. Here they will grow and reach maturity in about one year. In the Namibian mariculture industry, the larvae are produced in hatcheries (or obtained from international suppliers) and are commonly referred to as spat by the local industry, both prior to and after attachment to substrate.

Oyster and scallop larvae will mainly be sourced from Beira Aquaculture’s hatchery in Swakopmund, or from approved international suppliers such as Chile. Currently, Beira Aquaculture has the only hatchery in Namibia supplying oyster and scallop larvae to the industry. Where spat is sourced from international suppliers, all required phytosanitary and import permits...
will be obtained. The following is a description of the typical process followed once spat are received:

The oyster spat which are between four and six millimetres long, are placed in small wooden baskets with mesh netting (Photo 2 and Photo 3). The baskets are suspended in the water by attaching them to the previously installed long lines. The baskets are left in the water for more or less a month after which they are retrieved, and the slightly bigger oysters placed in larger baskets. They are then returned to the ocean and this process is repeated, and each time they are retrieved, they are sized and sorted, and placed in bigger baskets according to the different size classes. Once they reach the desired size for final fattening (cocktail, medium or large), they are transported to Walvis Bay for final conditioning.

Culturing of scallops (Photo 6) will follow a similar process as oysters. The main difference is that the spat will be placed in lantern nets (Photo 7) and not in the baskets used for oysters. Once scallops have grown sufficiently, they will be retrieved from long lines and then sorted and cleaned at sea. Undersized scallops are returned to the nets while marketable scallops are returned to shore. Scallops will be processed in the onshore facility where they are packaged, frozen and stored until shipment.

Oysters and scallops are filter feeders and will exclusively rely on naturally occurring microscopic phytoplankton, generally referred to as plankton, for their diet. This diet consists mainly of algae, oysters filter for example approximately 50 litres of water per day to obtain enough food. No artificial food, antibiotics or chemicals are used at any stage of the process.

Regular sampling and testing of oysters and mussels for heavy metals, paralytic shellfish poisoning (PSP) and diarrhetic shellfish poisoning (DSP) are conducted. This is in line with the requirements of the mariculture industry as performed by the Namibia Standards Institution.
4.3 GENERAL ACTIVITIES
Access to the mariculture farm will be by small motorised watercraft. Employment will be offered to approximately 30 Namibian citizens. Apart from the oyster handling activities a large part of the operations will include repairs and maintenance on the various grow-out baskets, buoys, etc. Waste removal will be performed by the municipality. Some biological waste (offal) in the form of dead oysters, mussels (naturally growing in and on baskets) and biofouling will be produced. These are typically returned to the ocean where it attracts large numbers of a wide variety of birds which feed in the shallow waters and coastline. Among the birds are numerous African Black Oystercatchers (*Haematopus moquini*), a Namibian and South African native, that previously was listed as Near Threatened by the International Union for Conservation of Nature (IUCN) (IUCN 2017). However, due to conservation efforts they now have a stable population with a relatively large range, and are now considered as Least Concern.

In addition to birds being attracted to the shoreline, the grow-out baskets also acts as a safe habitat for many marine species like juvenile lobsters and various other small crustaceans as well as small fish including kob, mullet and Cape silverside.

5 ALTERNATIVES
From an environmental perspective the environmental assessment could not determine any fatal flaw which would stop the proposed development, on condition that the proponent complies with all relevant Namibian standards or better, as prescribed by Namibian legislation. Table 1 provides a list of various alternatives that were considered.
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<td><strong>Location</strong></td>
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<tr>
<td>Walvis Bay</td>
<td>♦ Existing infrastructure currently operational</td>
<td>♦ Regular sulphur eruptions resulting in high mortality rates and financial losses</td>
<td>♦ Lüderitz</td>
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<tr>
<td></td>
<td>♦ No additional capital expenditure</td>
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<tr>
<td>Lüderitz</td>
<td>♦ Less sulphur eruptions and higher survival rates</td>
<td>♦ Additional capital expenditure</td>
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<td></td>
<td>♦ More profitable operations</td>
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<tr>
<td><strong>Choice of Organism</strong></td>
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<tr>
<td>Mussel culturing</td>
<td>♦ Fast growing</td>
<td>♦ Lower value product thus requiring much larger scale of production to break even</td>
<td>♦ Combination of oysters and scallops will increase resilience in the mariculture industry</td>
</tr>
<tr>
<td></td>
<td>♦ Resilient to environmental stressors</td>
<td>♦ Requires longer periods to rid themselves of paralytic shellfish poisoning (PSP) and diarrheic shellfish poisoning (DSP)</td>
<td></td>
</tr>
<tr>
<td>Oyster culturing</td>
<td>♦ High value product</td>
<td>♦ More susceptible to environmental stressors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>♦ Purge themselves of PSP and DSP relatively quickly</td>
<td>♦ Large scale die off means huge financial losses</td>
<td></td>
</tr>
<tr>
<td></td>
<td>♦ Lots of experience in culturing oysters in Namibian waters</td>
<td>♦ Must transport and ship alive</td>
<td></td>
</tr>
<tr>
<td>Scallop culturing</td>
<td>♦ High value product</td>
<td>♦ New venture with limited information available</td>
<td></td>
</tr>
<tr>
<td></td>
<td>♦ Fast production time due to rapid growth</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>♦ Transported frozen</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
To protect the environment and achieve sustainable development, all projects, plans, programmes and policies deemed to have adverse impacts on the environment require an environmental assessment, as per the Namibian legislation. The legislation and standards provided in Table 2 to Table 3 govern the environmental assessment process in Namibia and/or are relevant to the facility.

### Table 2. Namibian law applicable of specific interest

<table>
<thead>
<tr>
<th>Law</th>
<th>Key Aspects</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The Namibian Constitution</strong></td>
<td>♦ Promote the welfare of people ♦ Incorporates a high level of environmental protection ♦ Incorporates international agreements as part of Namibian law.</td>
</tr>
<tr>
<td><strong>Environmental Management Act</strong></td>
<td>♦ Defines the environment ♦ Promote sustainable management of the environment and the use of natural resources ♦ Provide a process of assessment and control of activities with possible significant effects on the environment.</td>
</tr>
<tr>
<td>Act No. 7 of 2007, Government Notice No. 232 of 2007</td>
<td></td>
</tr>
<tr>
<td><strong>Environmental Management Act Regulations</strong></td>
<td>♦ Commencement of the Environmental Management Act ♦ List activities that requires an environmental clearance certificate ♦ Provide Environmental Impact Assessment Regulations.</td>
</tr>
<tr>
<td>Government Notice No. 28-30 of 2012</td>
<td></td>
</tr>
<tr>
<td><strong>The Water Act</strong></td>
<td>♦ Remains in force until the new Water Resources Management Act comes into force ♦ Defines the interests of the state in protecting water resources ♦ Controls the disposal of effluent ♦ Numerous amendments.</td>
</tr>
<tr>
<td>Act No. 54 of 1956</td>
<td></td>
</tr>
<tr>
<td><strong>Water Resources Management Act</strong></td>
<td>♦ Provide for management, protection, development, use and conservation of water resources ♦ Prevention of water pollution and assignment of liability ♦ Not in force yet.</td>
</tr>
<tr>
<td>Act No. 11 of 2013</td>
<td></td>
</tr>
<tr>
<td><strong>Marine Resources Act</strong></td>
<td>♦ Prevents the discharge of anything that may be injurious to marine resources or may disturb ecological balance in any area of the sea or which may detrimentally affect the marketability of marine resources, or which may hinder their harvesting ♦ Regulates the conservation of marine resources and ecosystems ♦ Regulates the protection of the Namibian islands’ Marine Protected Area.</td>
</tr>
<tr>
<td>Act No. 27 of 2000</td>
<td></td>
</tr>
<tr>
<td><strong>Aquaculture Act</strong></td>
<td>♦ Regulates aquaculture activities to ensure sustainable development ♦ Provides for water quality monitoring to protect aquaculture activities.</td>
</tr>
<tr>
<td>Act No. 18 of 2002</td>
<td></td>
</tr>
<tr>
<td>Law</td>
<td>Key Aspects</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Animal Health Act</strong></td>
<td>◆ Provide for the prevention, detection and control of animal disease</td>
</tr>
<tr>
<td>Act No. 1 of 2011</td>
<td>◆ Provide for the maintenance and improvement of animal health</td>
</tr>
<tr>
<td></td>
<td>◆ Regulates the importation and exportation of animals, animal products and</td>
</tr>
<tr>
<td></td>
<td>restricted material into Namibia</td>
</tr>
<tr>
<td><strong>Local Authorities Act</strong></td>
<td>◆ Define the powers, duties and functions of local authority councils</td>
</tr>
<tr>
<td>116 of 1992</td>
<td><strong>The Namibian Ports Authority Act</strong></td>
</tr>
<tr>
<td>Act No. 2 of 1994</td>
<td>◆ Provide for the establishment of the Namibian Ports Authority and its</td>
</tr>
<tr>
<td></td>
<td>functions</td>
</tr>
<tr>
<td></td>
<td>◆ Responsible to protect the environment within its areas of jurisdiction.</td>
</tr>
<tr>
<td><strong>Public Health Act</strong></td>
<td>◆ Provides for the protection of health of all people.</td>
</tr>
<tr>
<td>Act No. 36 of 1919</td>
<td><strong>Public and Environmental Health Act</strong></td>
</tr>
<tr>
<td>Act No. 1 of 2015, Government Notice No. 86</td>
<td>◆ Provides a framework for a structured more uniform public and</td>
</tr>
<tr>
<td>of 2015</td>
<td>environmental health system, and for incidental matters</td>
</tr>
<tr>
<td></td>
<td>◆ Deals with Integrated Waste Management including waste collection</td>
</tr>
<tr>
<td></td>
<td>disposal and recycling; waste generation and storage; and sanitation.</td>
</tr>
<tr>
<td><strong>Labour Act</strong></td>
<td>◆ Provides for Labour Law and the protection and safety of employees</td>
</tr>
<tr>
<td>Act No 11 of 2007, Government Notice No. 236</td>
<td>◆ Labour Act, 1992: Regulations relating to the health and safety of</td>
</tr>
<tr>
<td>of 2007</td>
<td>employees at work (Government Notice No. 156 of 1997).</td>
</tr>
<tr>
<td><strong>Pollution Control and Waste Management</strong></td>
<td>◆ Not in force yet</td>
</tr>
<tr>
<td>Bill (draft document)</td>
<td>◆ Provides for prevention and control of pollution and waste</td>
</tr>
<tr>
<td></td>
<td>◆ Provides for procedures to be followed for licence applications.</td>
</tr>
<tr>
<td><strong>Prevention and Combating of Pollution of</strong></td>
<td>◆ Amends the Prevention and Combating of Pollution</td>
</tr>
<tr>
<td>the Sea by Oil Amendment Act (No. 24 of 1991)</td>
<td>of the Sea by Oil Act of 1981 to be more relevant to Namibia after</td>
</tr>
<tr>
<td></td>
<td>independence.</td>
</tr>
<tr>
<td><strong>Road Traffic and Transport Act</strong></td>
<td>◆ Provides for the control of traffic on public roads and the regulations</td>
</tr>
<tr>
<td>Act No. 52 of 1999 Government Notice No</td>
<td>pertaining to road transport.</td>
</tr>
<tr>
<td>282 of 1999</td>
<td><strong>Road Traffic and Transport Regulations</strong></td>
</tr>
<tr>
<td>Government Notice No 53 of 2001</td>
<td>◆ Prohibits the transport of goods which are not safely contained within</td>
</tr>
<tr>
<td></td>
<td>the body of the vehicle; or securely fastened to that vehicle, and which</td>
</tr>
<tr>
<td></td>
<td>are not properly protected from being dislodged or spilled from that</td>
</tr>
<tr>
<td></td>
<td>vehicle.</td>
</tr>
</tbody>
</table>
Table 3. Relevant multilateral environmental agreements for Namibia

<table>
<thead>
<tr>
<th>Agreement</th>
<th>Key Aspects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stockholm Declaration on the Human Environment, Stockholm 1972</td>
<td>♦ Recognizes the need for a common outlook and common principles to inspire and guide the people of the world in the preservation and enhancement of the human environment.</td>
</tr>
<tr>
<td>United Nations Framework Convention on Climate Change (UNFCCC)</td>
<td>♦ The Convention recognises that developing countries should be accorded appropriate assistance to enable them to fulfil the terms of the Convention.</td>
</tr>
<tr>
<td>Convention on Biological Diversity, Rio de Janeiro, 1992</td>
<td>♦ Under article 14 of The Convention, EIAs must be conducted for projects that may negatively affect biological diversity.</td>
</tr>
<tr>
<td>Benguela Current Convention of 2013</td>
<td>♦ The Convention is a formal treaty between the governments of Angola, Namibia and South Africa that sets out the countries’ intention “to promote a coordinated regional approach to the long-term conservation, protection, rehabilitation, enhancement and sustainable use of the Benguela Current Large Marine Ecosystem, to provide economic, environmental and social benefits.</td>
</tr>
<tr>
<td></td>
<td>♦ Provides an overarching legal framework for all marine-related programmes in West, Central and Southern Africa.</td>
</tr>
<tr>
<td>National Marine Pollution Contingency Plan of 2017</td>
<td>♦ Coordinated and integrated national system for dealing with oil spills in Namibian waters.</td>
</tr>
</tbody>
</table>

6.1 THE ENVIRONMENTAL MANAGEMENT ACT

The project is listed as an activity requiring an environmental clearance certificate as per the following points from Section 7 and 10 of Government Notice No. 29 of 2012 of the Environmental Management Act:

♦ 7.1 “Construction of facilities for aquaculture production, including mariculture and algae farms where the structures are not situated within an aquaculture development zone declared in terms of the Aquaculture Act, 2002.” (The core business is aquaculture.)
♦ 7.8 “The introduction of alien species into local ecosystems.” (The proposed introduction of the non-native Peruvian scallop.)
♦ 10.1 (e) “The construction of any structure below the high water mark of the sea.” (Installation of long lines and baskets.)

Strictly speaking, the onshore processing facility does not trigger any of the listed activities requiring assessment. The final chosen location for the onshore facility therefore should not influence the outcome of the environmental assessment. The facility and its location should however adhere to all local authority regulations.

6.2 ADDITIONAL NATIONAL PLANNING LEGISLATION

Additional planning legislation considered include:

♦ Harambee Prosperity Plan
♦ 5th National Development Plan (NDP5)

The Harambee Prosperity Plan (HPP) is a targeted action plan to accelerate development in clearly defined priority areas, which lay the basis for attaining prosperity in Namibia. The plan does not replace, but complements the long-term goal of the National Development Plans (NDPs)
and Vision 2030. The rationale behind the HPP is to introduce an element of flexibility in the Namibian planning system by fast tracking development in areas where progress is insufficient. It also incorporates new development opportunities and aims to address challenges that have emerged after the formulation of NDPs. It is the purpose of NDP5 to set out a roadmap for achieving envisioned rapid industrialization while adhering to the four integrated pillars of sustainable development as identified in the plan. Mariculture activities proposed by the proponent will contribute primarily to the “Economic Progression” pillar by increasing the volumes of locally produced goods.

7 ENVIRONMENTAL CHARACTERISTICS

This section lists pertinent environmental characteristics of the study area and provides a statement on the potential environmental impacts on each.

7.1 LOCALITY AND SURROUNDING LAND USE

The possible onshore processing facility is located within the Lüderitz Boatyard, a property of Namport (26.65493866 °S, 15.150703 °E). The offshore farm will one or more of the existing farms within the Lüderitz Harbour – Second Lagoon area (Figure 3). Beyond the townlands of Lüderitz is the Tsau // Khaeb (Sperrgebiet) National Park while the rocky shores form part of the Namibian Islands Marine Protected Area (NIMPA).

Implications and Impacts

No significant land use impact is expected. Any pollution that may enter Lüderitz Harbour will impact negatively on the mariculture industry.

![Figure 3. Surrounding land use](image-url)

7.2 CLIMATE

Lüderitz is located on the Namibian coastline in the arid Namib Desert. The arid conditions are as a result of dry descending air and upwelling of the cold Benguela Current. As a result, thick
fog or low stratus clouds are a regular occurrence in Lüderitz. This is due to the influence of the Benguela Current and forms a major source of water for the flora in the Namib Desert.

Namibia is situated within an anti-cyclone belt of the southern hemisphere. Winds generated from the high-pressure cell over the Atlantic Ocean blow from a southerly direction when they reach the Namibian coastline. As the Namibian interior is warm (particularly in summer), localised low-pressure systems are created which draws the cold southerly winds towards the inland desert areas. These winds manifest themselves in the form of strong prevailing south to south-westerly winds, which range from an average of 20 knots (37 km/h) during winter months to as high as 60 knots (111 km/h) during the summer (Table 4). Daily fluctuations in wind speed are characterised by calmer winds in the morning with strong wind from late morning to late afternoon. During winter, the east winds generated over the hot Namib Desert have a strong effect on temperature, resulting in temperatures in excess of 30°C. Such winds also tend to transport plenty of sand. Table 4 presents a summary of climate conditions in the Lüderitz area.

Rainfall is typically limited with an average of less than 50 mm per annum. However, occasional heavy rainfall do occur and this can result in rainfall of more than 100 mm in a short time.

**Implications and Impacts**

The operations of the mariculture farm should not be negatively affected by the typical weather experienced in Lüderitz, but infrastructure damage may occur if heavy rainfall occurs. Strong winds may lead to rough seas with safety risks for the crew of small watercraft and possible infrastructure damage when there are large swells.

**Table 4. Summary of climate data (Digital Atlas of Namibia)**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average annual rainfall (mm/a)</td>
<td>0-50 mm; half of the rainfall occurs from May to June</td>
</tr>
<tr>
<td>Variation in annual rainfall (%)</td>
<td>80 – 90%</td>
</tr>
<tr>
<td>Average annual evaporation (mm/a)</td>
<td>2,400-2,600</td>
</tr>
<tr>
<td>Water deficit (mm/a)</td>
<td>1,701-1,900</td>
</tr>
<tr>
<td>Temperature</td>
<td>Average maximum: Between 24 °C in March/April and 19.3 °C in September</td>
</tr>
<tr>
<td></td>
<td>Average minimum: Between 16.5 °C in February and 9.1 °C in August</td>
</tr>
<tr>
<td></td>
<td>Average annual &gt;16 °C</td>
</tr>
<tr>
<td>Fog</td>
<td>Approximately 126.7 days of fog per year</td>
</tr>
<tr>
<td>Wind</td>
<td>Prevailing wind strong south-westerly</td>
</tr>
</tbody>
</table>

Wind data for Diaz Point ([https://www.windfinder.com/windstatistics/diaz_point_luderitz](https://www.windfinder.com/windstatistics/diaz_point_luderitz))
7.3 **CORROSIVE ENVIRONMENT**

The corrosive environment of Lüderitz can be closely related to that of Walvis Bay. It is attributed to the frequent salt-laden fog, periodic winds and abundance of aggressive salts (dominantly NaCl and sulphates) in the soil. The periodic release of hydrogen sulphide (H\textsubscript{2}S) from the ocean is expected to contribute to corrosion (see Table 6 for corrosion comparison data of Walvis Bay with other centres). The combination of high moisture and salt content of the surface soil can lead to rapid deterioration of subsurface metal (e.g. pipelines) and concrete structures. Chemical weathering of concrete structures due to the abundant salts in the soil is a concern.

### Table 5. Average annual corrosion rate for various metals in different locations in southern Africa (from Nickel Development Institute: Stainless Steels in Architecture, Building and Construction, http://www.nickelinstitute.org)

<table>
<thead>
<tr>
<th>Environment</th>
<th>Pretoria CSIR</th>
<th>Durban Bay</th>
<th>Cape Town Docks</th>
<th>Durban Bluff</th>
<th>Walvis Bay</th>
<th>Sasolburg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location Type</td>
<td>Rural, Very Low Pollution</td>
<td>Marine, Moderate Pollution</td>
<td>Marine, Moderate Pollution</td>
<td>Severe Marine, Moderate or Low Pollution</td>
<td>Severe Marine, Low Pollution</td>
<td>Industrial High Pollution</td>
</tr>
<tr>
<td>SO\textsubscript{2} Range µg/m\textsuperscript{3}</td>
<td>6-20</td>
<td>10-55</td>
<td>19-39</td>
<td>10-47</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Fog Days/year</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>113.2</td>
<td>NA</td>
</tr>
<tr>
<td>Avg. Rainfall (mm/year)</td>
<td>146</td>
<td>1,018</td>
<td>508</td>
<td>1,018</td>
<td>8</td>
<td>677</td>
</tr>
<tr>
<td>Relative Humidity Range %</td>
<td>26-76</td>
<td>54-84</td>
<td>52-90</td>
<td>54-84</td>
<td>69-96</td>
<td>49-74</td>
</tr>
<tr>
<td>Temp. Range °C</td>
<td>6-26</td>
<td>16-27</td>
<td>9-25</td>
<td>16-27</td>
<td>10-20</td>
<td>5-20</td>
</tr>
<tr>
<td>Unpainted Galvanized Steel Life, Years</td>
<td>5-15</td>
<td>3-5</td>
<td>3-7</td>
<td>3-5</td>
<td>0.6-2</td>
<td>5-15</td>
</tr>
</tbody>
</table>

### Annual Corrosion Rate (mm/year)

<table>
<thead>
<tr>
<th>Stainless Steel</th>
<th>Type 316</th>
<th>Type 304</th>
<th>Type 430</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 316</td>
<td>0.000025</td>
<td>0.000025</td>
<td>0.000025</td>
</tr>
<tr>
<td>Type 304</td>
<td>0.000025</td>
<td>0.000076</td>
<td>0.000127</td>
</tr>
<tr>
<td>Type 430</td>
<td>0.000025</td>
<td>0.000406</td>
<td>0.000381</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Aluminium Alloys</th>
<th>AA 93103</th>
<th>AA 95251</th>
<th>AA 96063</th>
<th>AA 96082</th>
<th>AA 85151</th>
<th>Copper</th>
<th>Zinc</th>
<th>Weathering Steel</th>
<th>Mild Steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 316</td>
<td>0.00028</td>
<td>0.000546</td>
<td>0.00424</td>
<td>0.01946</td>
<td>0.00457</td>
<td>0.00281</td>
<td>0.0033</td>
<td>0.0229</td>
<td>0.0432</td>
</tr>
<tr>
<td>Type 304</td>
<td>0.00033</td>
<td>0.00353</td>
<td>0.00371</td>
<td>0.01676</td>
<td>0.00417</td>
<td>NA</td>
<td>0.00231</td>
<td>0.212</td>
<td>0.371</td>
</tr>
<tr>
<td>Type 430</td>
<td>0.00028</td>
<td>0.00315</td>
<td>0.00366</td>
<td>0.020</td>
<td>0.00495</td>
<td>NA</td>
<td>0.0246</td>
<td>0.0914</td>
<td>0.257</td>
</tr>
<tr>
<td>Type 316</td>
<td>0.00424</td>
<td>0.00371</td>
<td>0.00366</td>
<td>0.02761</td>
<td>0.00587</td>
<td>NA</td>
<td>0.029</td>
<td>0.810</td>
<td>2.190</td>
</tr>
<tr>
<td>Type 304</td>
<td>0.00028</td>
<td>0.00353</td>
<td>0.00371</td>
<td>0.01676</td>
<td>0.00417</td>
<td>NA</td>
<td>0.0246</td>
<td>0.0914</td>
<td>0.257</td>
</tr>
<tr>
<td>Type 430</td>
<td>0.00028</td>
<td>0.00315</td>
<td>0.00366</td>
<td>0.020</td>
<td>0.00495</td>
<td>NA</td>
<td>0.029</td>
<td>0.810</td>
<td>2.190</td>
</tr>
<tr>
<td>Type 316</td>
<td>0.00424</td>
<td>0.00371</td>
<td>0.00366</td>
<td>0.02761</td>
<td>0.00587</td>
<td>NA</td>
<td>0.029</td>
<td>0.0914</td>
<td>0.257</td>
</tr>
<tr>
<td>Type 304</td>
<td>0.00028</td>
<td>0.00353</td>
<td>0.00371</td>
<td>0.01676</td>
<td>0.00417</td>
<td>NA</td>
<td>0.029</td>
<td>0.810</td>
<td>2.190</td>
</tr>
<tr>
<td>Type 430</td>
<td>0.00028</td>
<td>0.00315</td>
<td>0.00366</td>
<td>0.020</td>
<td>0.00495</td>
<td>NA</td>
<td>0.029</td>
<td>0.0914</td>
<td>0.257</td>
</tr>
</tbody>
</table>
Implications and Impacts
Corrosion levels may be high and must be kept in mind when planning the construction and maintenance of infrastructure.

7.4 Topography and Drainage
The terrain around Lüderitz consist of a number of rocky outcrops with islands and peninsulas surrounded by the Atlantic Ocean. The result is protected bays and lagoons such as Lüderitz Harbour protected by Angra Point.

The coastline at Lüderitz are predominantly rocky with isolated sandy beaches in coves. The rocky coastline is also present on all of the islands forming part of the Lüderitz Bay island complex (comprising four islands: Halifax, Seal, Penguin and Flamingo). These islands may be regarded as barrier islands which offers some protection to the coastline at Lüderitz. The area between Seal, Penguin and Flamingo islands and the mainland has a shallow basin. Deeper water is present at the entrance to Lüderitz Harbour, west of the islands, which gradually becomes shallower towards the southern end where Radford Bay and the Second Lagoon are located.

Surface drainage is poorly developed in the area due to the minimal amount of precipitation that occurs. Surface flow is generally westwards towards the ocean.

Implications and Impacts
The topography of the area provides for sheltered areas that makes mariculture farms possible due to relatively calm waters. The mainland is sheltered from open ocean wave action and deposition and erosion processes associated with longshore drift. The rocky coastline restricts the dynamic shoreline processes which are more prevalent along sandy shores.

7.5 Geology and Hydrogeology
The area around Lüderitz is dominated by a desert with dunes and crystalline rock outcrops of the Mid-Proterozoic Era (Figure 4). This includes geology from the Namibian- and Mokolian Age. The Mokolian Age rocks is the oldest to be found in Namibia, dating back to 2,200 Ma. Quaternary deposits in the form of sand shifting dunes were formed by eroded sands that have been transported to the area by water and wind. The dunes occurs 7 km northeast of the project area.

The subsurface geology consist of rocks from the Mokolian Age. This subsurface geology consists primarily of gneiss and granites of the Namaqua Metamorphic Complex. The gneiss is mainly of pre- to syntectonic biotite-rich augen gneiss.

The local and regional geology were subjected to numerous events of deformation which led to the formation of geological folds, faults, fractures and thrusts. Groundwater flow would be mostly along fractures, faults (secondary porosity) and other geological structures present within the formations as well as through primary porosity in the unconsolidated top cover. No known permanent natural fresh surface water sources exist near Lüderitz. No known boreholes are present within the immediate surroundings of Lüderitz.
Implications and Impacts

It is not expected that the geology and hydrogeology will cause or enhance any environmental impacts of the facility. The stable geology of the area increases the feasibility of the project and reduces risks associated with structures which are less stable or more erosion prone.

7.6 Public Water Supply

The NamWater Koichab water supply scheme supplies Lüderitz with potable water. It consists of about nine production boreholes, supplying groundwater from the alluvial aquifer formed in a paleo-channel of the Khoichab River. During 2018/2019 the actual volume of water sold by NamWater was 1,027,508 m³. The potential supply of the scheme is 1,460,000 m³. Based on the water use records for 2019/2020 (excluding April 2020) there does not seem to be an increase in the demand for potable water. Thus, based on NamWater estimates there remains a surplus of about 430,000 m³ of potable water.

Implications and Impacts

The facility will only use potable water for domestic purposes and therefor is not expected to have an impact on the public water supply. Disruptions in potable water supply to Tetelestai Mariculture may slightly impact on their operational efficiency.

7.7 Terrestrial Fauna and Flora

The Lüderitz peninsula is part of the Succulent Karoo Biome with a succulent steppe vegetation type and dwarf shrubland structure (Atlas of Namibia). The Succulent Karoo is a biodiversity hotspot and has the world’s richest succulent diversity which is also characterised by high reptile diversity.
and invertebrate diversity (CEPF, 2005). Lüderitz and surroundings are located in the Lüderitz Peninsula vegetation zone (Figure 5), but due to the town's development this vegetation zone is highly degraded within the urban area. Brown hyena, jackal, springbok, porcupines and oryx are some of the mammals that utilize the areas surrounding Lüderitz. Nearby islands and the rocky shorelines also act as important sanctuaries for various bird species and forms part of an internationally recognized important bird area (NA017) (Figure 5) (Kolberg, 2015). The islands support more than 10,000 birds while the rocky shorelines of the mainland support more than 14,000 shorebirds (BirdLife International, 2017).

Figure 5. Vegetation zones and ecologically significant areas

**Implications and Impacts**

Onshore, the processing facility will likely be in an already disturbed area such as the Lüderitz Boatyard or similar. The presence of the mariculture farm will possibly create foraging grounds for birds. Bright lighting may negatively affect birds flying at night and may cause disorientation and collisions.

7.8 **MARINE AND COASTAL ECOLOGY**

The Namibian marine coastal environment is characterised by relatively low species diversity with high abundance. It is typically also a dynamic ecosystem with relatively high resilience against impacts, when compared with the more tropical waters of for example the east coast of southern Africa.

The seashore is mostly rocky with intertidal rocky shores and submerged reefs. Growth on the sea bottom is characterised by *Gracilaria* spp., a gelatinous red alga (Esterhuizen 2019). Biological communities found in these habitats are not particularly unique and their presence are mostly determined by the environmental characteristics such as depth, wave action and substrate (Pulfrich, 2010). According to Pulfrich (2010), Lüderitz Bay is not ecologically unique within the Benguela ecosystem, neither is it particularly pristine. However, it is important to note that
the entire Lüderitz Bay area is a proclaimed rock lobster (*Jasus lalandii*) sanctuary (Figure 5) and falls within the Namibian Islands Marine Protected Area (Figure 3).

Multiple cetaceans also occur along the Namibian coast. Cetaceans occurring in Lüderitz include species such as the Common Bottlenose Dolphins, the Namibian endemic Heaveside’s Dolphins, Dusky Dolphins, Humpback Whales and Southern Right Whales as well as the Cape Fur Seals. This include migratory, resident and semi-resident species.

### Implications and Impacts

The presence of the mariculture farm will create extra habitat for marine species. The possibility of entanglement of larger marine species with the long lines exist. The introduction of pathogens in the marine environment is possible if biosafety protocols are not followed.

### 7.9 Demographic and Economic Characteristics

From 2001 to 2011, the Karas Region showed a population increase of 1.1%. This is less than the Namibian intercensal growth rate of 1.4%. For the same period Lüderitz showed a decline in population size of 5.6% and had a population size of 12,537 in 2011 (Namibia Statistics Agency, 2011). The remoteness of Lüderitz and the lack of employment and economic diversification opportunities possibly contributes to this decline. This may lead to some inhabitants relocating to other urban centres offering better prospects. Lüderitz has an unemployment rate of 28.2% which is slightly lower than the rate of 32.2% of the Karas Region (Namibia Statistics Agency, 2011).

Lüderitz developed in the early 20th century mainly as a result of the diamond mining industry. Today however, the sustaining industries in Lüderitz are fishing and mariculture, mining and tourism. The majority of employment is provided by the fishing industry which mainly exports fisheries products to Europe. Rock lobsters are one of the key fisheries products. Mariculture of abalone and oysters are also actively pursued in Lüderitz. Diamond mining used to be a major part of the mining industry with zinc mining being the other major component.

The Port of Lüderitz, as operated by Namport, is central to the fishing and mining industries. During the period April 2016 to March 2017 156,458 tons of zinc product and 15,070 tons of lead concentrate were exported via the Port of Lüderitz. Zinc oxide is also imported in small quantities for refining purposes at the Rosh Pinah mines. The Rosh Pinah mines requires sulphur for their refining process and during the 2016/2017 period 92,078 tons of sulphur was imported via the port. During 2019 the export of manganese ore via Lüderitz, originating from South Africa, was initiated. The anticipated export volumes are in the range of 80,000 to 90,000 tons per month in three separate shipments.

Tourism plays an important part in the local economy, unfortunately a very small percentage of tourists visiting Namibia also visits Lüderitz. This is because Lüderitz is essentially situated at the end of a cul de sac. Main attractions are Kolmanskop, Diaz Point and the historic buildings of the town. Passenger liners call in the Port of Lüderitz from time to time with approximately 35 calling in port over the last four years (2015-2018).
Table 6. Demographic characteristics of Lüderitz Bay, the Karas Region and Nationally (Namibia Statistics Agency, 2011)

<table>
<thead>
<tr>
<th></th>
<th>Lüderitz</th>
<th>Karas Region</th>
<th>Namibia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population (Males)</td>
<td>6,300*</td>
<td>37,400</td>
<td>1,021,912</td>
</tr>
<tr>
<td>Population (Females)</td>
<td>6,200*</td>
<td>37,000</td>
<td>1,091,165</td>
</tr>
<tr>
<td>Population (Total)</td>
<td>12,500</td>
<td>74,400</td>
<td>2,113,077</td>
</tr>
<tr>
<td>Unemployment (15+ years)</td>
<td>N/A</td>
<td>32.9%</td>
<td>33.8%</td>
</tr>
<tr>
<td>Literacy (15+ years)</td>
<td>N/A</td>
<td>93.2%</td>
<td>87.7%</td>
</tr>
<tr>
<td>Education at secondary level (15+ years)</td>
<td>50%</td>
<td>55.2%</td>
<td>51.2%</td>
</tr>
<tr>
<td>Households considered poor</td>
<td>N/A</td>
<td>15.3%</td>
<td>19.5%</td>
</tr>
</tbody>
</table>

*Data available from preliminary results only (National Planning Commission, 2012)

**Implications and Impacts**

The facility will provide employment to approximately 30 full time employees in the area. Some skills development and training will benefit employees during the operational phase.

Increased employment opportunities will have a positive impact on Lüderitz. The additional mariculture farms in Lüderitz will result in an increase in revenue generation for the town as well as Namibia in general. The project will therefore have a positive contribution to demographic and economic aspects of Lüderitz.

7.10 **CULTURAL, HERITAGE AND ARCHAEOLOGICAL ASPECTS**

Many buildings in Lüderitz town are considered to be of heritage value requiring protection (SPC 2015). The town centre as well as nearby islands are considered to be of cultural and historic value.

**Implications and Impacts**

The facility will not impact on any of the cultural or historically significant areas or buildings.

8 **PUBLIC CONSULTATION**

Consultation with the public forms an integral component of an environmental assessment investigation and enables Interested and Affected Parties (IAPs) e.g. neighbouring landowners, local authorities, environmental groups, civic associations and communities, to comment on the potential environmental impacts associated with the facility and to identify additional issues which they feel should be addressed in the environmental assessment.

Public participation notices were advertised twice for two weeks in the national papers: Republikein and Namibian Sun on 04 and 11 March 2020. A site notice was placed at the reception of the Lüderitz Town Council. The Lüderitz Town Council, Ministry of Fisheries and Marine Resources, Namport and various stakeholders and potential interested and affected parties were also notified by hand delivered letters or e-mail. See Appendix A for proof of the public participation processes. The only concern raised related to potential entanglement of large marine mammals (whales and dolphins) in the long lines. This is addressed in section 10 and in the appendices.

9 **MAJOR IDENTIFIED IMPACTS**

During the scoping exercise a number of potential environmental impacts were identified. The following section provides a brief description of the most important of these impacts.

9.1 **SOCIO-ECONOMIC IMPACTS**

Direct employment to about 30 employees will realise. Some training and skills development will take place. The project will contribute to economic sustainability and development in Lüderitz. True value addition and contribution to the Namibian economy will be achieved by
processing and packaging scallops in Lüderitz and oysters in Walvis Bay and then transporting the products to international markets. Since oysters and scallops are high value products, their farming is an economically favourable venture.

9.2 HEALTH, SAFETY AND SECURITY IMPACTS
Some health and safety risks will be present during development and construction as well as during operations at the proposed processing plant and at sea. This include slipping on wet surfaces, falling objects, lifting heavy objects, accidents at sea and drowning, etc.

Molluscs being filter feeders often accumulate trace elements within their flesh and this may include heavy metals like cadmium and lead. They may also contain bacteria or can cause PSP and DSP. Health effects are thus also possible to the consumers of oysters and scallops. Poaching of oysters and scallops are possible although not currently a major threat to the existing mariculture industry.

9.3 WASTE PRODUCTION
Waste will be produced in the form of sewage, typical office related and domestic waste, plastic waste, old baskets, shells, etc. Litter and wind-blown waste may end up in the ocean. No hazardous waste is expected to be produced during normal operations of the facility. Waste generated during the construction phase may include building rubble and discarded equipment.

9.4 TRAFFIC IMPACTS
During construction and operations some traffic impacts can be experienced when trucks and delivery vehicles access the onshore site. This is not expected to significantly disrupt traffic flow in Lüderitz.

9.5 SURFACE WATER CONTAMINATION
Surface water contamination can occur when pollutants including high organic loads enter the ocean (e.g. plastics and sewage).

9.6 TERRESTRIAL ECOSYSTEM AND BIODIVERSITY IMPACTS
The nature of the proposed onshore operational activities is such that the probability of creating a habitat for flora and fauna to establish is low. Excessive lighting used at night and especially those that are directed upwards may blind birds like flamingos that fly at night. This may result in disorientation of birds and collisions with structures.

9.7 IMPACTS ON MARINE AND COASTAL BIOTA

9.7.1 Physical Impacts
Installation of long lines with anchors may cause temporary damage to the local habitat. However, being a dynamic ecosystem, recovery is expected to be rapid with no long lasting effects. Instead, the addition of anchors with ropes on the seabed may create additional habitat and a slight increase in the local biodiversity.

9.7.2 Entanglement
Marine mammals such as dolphins and whales can get entangled in the long lines. The likelihood for this to occur is low since the long line systems are not a mesh type system.

9.7.3 Diseases
Mariculture may lead to the introduction of non-target species into the environment. The occurrence of disease causing agents and parasites and pathogens in the spat, and the spread thereof to the natural environment, may have negative impacts on the operations as well as the environment. High stocking densities increases the stress on the animals, thereby impacting their immune systems. This may lead to higher risk of disease outbreaks, therefor it is imperative to maintain stocking densities that are favourable for oyster and scallop health.
The spread of diseases, parasites and pathogens are mostly related to the transfer thereof between the same species, although inter species transfer may also take place (refer to Appendix C).

9.7.4 Ecosystem and Biodiversity Impacts
Oysters have been cultured for many years in Lüderitz Harbour. No obvious impact on the local ecosystem and biodiversity is visible and oysters have not been observed to reproduce and settle in the area. Similarly, due to very specific conditions required for reproduction of scallops, they are not expected to settle in the environment or become invasive (refer to Appendix C).

Long lines and grow-out baskets create additional habitat and refuges for local species including juvenile lobsters and fish. This can be regarded as a positive impact.

10 ASSESSMENT AND MANAGEMENT OF IMPACTS
The purpose of this section is to assess and identify the most pertinent environmental impacts that are expected from the construction, operational and potential decommissioning activities of the project. An EMP based on these identified impacts are also incorporated into this section.

For each impact an environmental classification was determined based on an adapted version of the Rapid Impact Assessment Method (Pastakia, 1998). Impacts are assessed according to the following categories: Importance of condition (A1); Magnitude of Change (A2); Permanence (B1); Reversibility (B2); and Cumulative Nature (B3) (see Table 7).

Ranking formulas are then calculated as follow:

Environmental Classification = A1 x A2 x (B1 + B2 + B3)

The environmental classification of impacts is provided in Table 8.

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>
<thead>
<tr>
<th>Criteria</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Importance of condition (A1) – assessed against the spatial boundaries of human interest it will affect</td>
<td></td>
</tr>
<tr>
<td>Importance to national/international interest</td>
<td>4</td>
</tr>
<tr>
<td>Important to regional/national interest</td>
<td>3</td>
</tr>
<tr>
<td>Important to areas immediately outside the local condition</td>
<td>2</td>
</tr>
<tr>
<td>Important only to the local condition</td>
<td>1</td>
</tr>
<tr>
<td>No importance</td>
<td>0</td>
</tr>
<tr>
<td>Magnitude of change/effect (A2) – measure of scale in terms of benefit / disbenefit of an impact or condition</td>
<td></td>
</tr>
<tr>
<td>Major positive benefit</td>
<td>3</td>
</tr>
<tr>
<td>Significant improvement in status quo</td>
<td>2</td>
</tr>
<tr>
<td>Improvement in status quo</td>
<td>1</td>
</tr>
<tr>
<td>No change in status quo</td>
<td>0</td>
</tr>
<tr>
<td>Negative change in status quo</td>
<td>-1</td>
</tr>
<tr>
<td>Significant negative disbenefit or change</td>
<td>-2</td>
</tr>
<tr>
<td>Major disbenefit or change</td>
<td>-3</td>
</tr>
<tr>
<td>Permanence (B1) – defines whether the condition is permanent or temporary</td>
<td></td>
</tr>
<tr>
<td>No change/Not applicable</td>
<td>1</td>
</tr>
<tr>
<td>Temporary</td>
<td>2</td>
</tr>
</tbody>
</table>
Permanent

**Reversibility (B2)** – defines whether the condition can be changed and is a measure of the control over the condition

<table>
<thead>
<tr>
<th>Description</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>No change/Not applicable</td>
<td>1</td>
</tr>
<tr>
<td>Reversible</td>
<td>2</td>
</tr>
<tr>
<td>Irreversible</td>
<td>3</td>
</tr>
</tbody>
</table>

**Cumulative (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 – not to be confused with the permanence criterion.

<table>
<thead>
<tr>
<th>Description</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light or No Cumulative Character/Not applicable</td>
<td>1</td>
</tr>
<tr>
<td>Moderate Cumulative Character</td>
<td>2</td>
</tr>
<tr>
<td>Strong Cumulative Character</td>
<td>3</td>
</tr>
</tbody>
</table>

### Table 8. Environmental classification (Pastakia 1998)

<table>
<thead>
<tr>
<th>Environmental Classification</th>
<th>Class Value</th>
<th>Description of Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>72 to 108</td>
<td>5</td>
<td>Extremely positive impact</td>
</tr>
<tr>
<td>36 to 71</td>
<td>4</td>
<td>Significantly positive impact</td>
</tr>
<tr>
<td>19 to 35</td>
<td>3</td>
<td>Moderately positive impact</td>
</tr>
<tr>
<td>10 to 18</td>
<td>2</td>
<td>Less positive impact</td>
</tr>
<tr>
<td>1 to 9</td>
<td>1</td>
<td>Reduced positive impact</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>No alteration</td>
</tr>
<tr>
<td>-1 to -9</td>
<td>-1</td>
<td>Reduced negative impact</td>
</tr>
<tr>
<td>-10 to -18</td>
<td>-2</td>
<td>Less negative impact</td>
</tr>
<tr>
<td>-19 to -35</td>
<td>-3</td>
<td>Moderately negative impact</td>
</tr>
<tr>
<td>-36 to -71</td>
<td>-4</td>
<td>Significantly negative impact</td>
</tr>
<tr>
<td>-72 to -108</td>
<td>-5</td>
<td>Extremely Negative Impact</td>
</tr>
</tbody>
</table>

### 10.1 Risk Assessment and Environmental Management Plan

The EMP provides management options to ensure impacts of the proposed project are minimised. 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 might be included if necessary. The environmental management measures are provided in the tables and descriptions below. These management measures should be adhered to during the construction and 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 operations of the facility should be made aware of the contents in this section, so as to plan the operations accordingly and in an environmentally sound manner.

The objectives of the EMP are:

- to include all components of construction activities and operations of the proposed farm and its infrastructure;
- to prescribe the best practicable control methods to lessen the 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 operational personnel.

Various potential and definite impacts will emanate from the construction, operations and decommissioning phases. The majority of these impacts can be mitigated or prevented. The impacts, risk rating of impacts as well as prevention and mitigation measures are listed below.
As depicted in the tables below, impacts are expected to mostly be of medium to low significance and can mostly be mitigated to have a low significance. The extent of impacts are mostly site specific to local and are not of a permanent nature. Due to the nature of the surrounding areas, limited cumulative impacts are possible.

### 10.1.1 Planning

During the phases of planning for future construction, operations and decommissioning, 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 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 activities and operations of the project are in place and remains valid.
- Ensure all appointed contractors and employees enter into an agreement which includes the EMP. Ensure that the contents of the EMP are understood by the contractors, subcontractors, employees and all personnel present or who will be present on site.
- Make provisions to have a Health, Safety and Environmental Coordinator to implement the EMP and oversee occupational health and safety as well as general environmental related compliance at the site, by both the employees and the contractors and their employees.
- Have the following emergency plans, equipment and personnel on site where reasonable to deal with all potential emergencies:
  - Biosecurity protocol and disease management plan
  - Risk management / mitigation / EMP/ Emergency Response Plan and HSE 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.
- Establish and / or maintain a reporting system to report on aspects of construction activities, operations and decommissioning as outlined in the EMP.
- Submit monitoring reports every six months to allow for environmental clearance certificate renewal applications. This is a requirement of the Department of Environmental Affairs.
- Update the EIA and EMP if required and apply for renewal of the environmental clearance certificate prior to expiry.
10.1.2 Revenue Generation and Employment

Employment will be created and an increase of skilled and professional labour will take place if the project realises. This will result in increased economic resilience and spending power of employees which in turn will benefit the town.

Resources will be produced locally and then exported internationally, contributing to the economy and trade balance of Namibia. Employment will be sourced locally while skilled labour/contractors may be sourced from other regions.

<table>
<thead>
<tr>
<th>Project Activity / Resource</th>
<th>Nature (Status)</th>
<th>(A1) Importance</th>
<th>(A2) Magnitude</th>
<th>(B1) Permanence</th>
<th>(B2) Reversibility</th>
<th>(B3) Cumulative Environmental Classification</th>
<th>Class Value</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>Appointment of local contractors</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>20</td>
<td>3</td>
<td>Definite</td>
</tr>
<tr>
<td>Daily Operations</td>
<td>Employment contribution to local economy</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>36</td>
<td>4</td>
<td>Definite</td>
</tr>
<tr>
<td>Indirect Impacts</td>
<td>Decrease in unemployment, contribution to local economy</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>36</td>
<td>4</td>
<td>Definite</td>
</tr>
</tbody>
</table>

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

**Actions**

**Mitigation:**
- The proponent must employ local Namibians where possible. Deviations from this must be justified.
- If the skills exist locally, employees must first be sourced from the town, then the region and then nationally.

**Responsible Body:**
- Proponent
- Contractors

**Data Sources and Monitoring:**
- Bi-annual report based on employee records.
10.1.3 Skills, Technology and Development

During various phases of construction and operations, training will be provided to employees in order to maintain and operate various features of the mariculture farm. Skills will be transferred to an unskilled workforce for general tasks. Development of people and technology are key to economic development. Continuous improvements in the industry may lead to technological development.

<table>
<thead>
<tr>
<th>Project Activity / Resource</th>
<th>Nature (Status)</th>
<th>(A1) Importance</th>
<th>(A2) Magnitude</th>
<th>(B1) Permanence</th>
<th>(B2) Reversibility</th>
<th>(B3) Cumulative Environmental Classification</th>
<th>Class Value</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>Skills transfer</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td>Daily Operations</td>
<td>Technological development and transfer of skills</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>14</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Indirect Impacts</td>
<td>Technological development and transfer of skills</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>14</td>
<td>2</td>
</tr>
</tbody>
</table>

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

**Actions**

**Mitigation:**
- If the skills exist locally, contractors must first be sourced from the town, then the region and then nationally. Deviations from this practice must be justified.
- Training and skills development must be focussed on Namibians.
- Skills development and improvement programs to be made available as identified during performance assessments.
- Employees to be informed about parameters and requirements for references upon employment.

**Responsible Body:**
- Proponent
- Contractors

**Data Sources and Monitoring:**
- Record should be kept of training provided.
- Ensure that all training is certified or managerial reference provided (proof provided to the employees) inclusive of training attendance, completion and implementation.
- Bi-annual report based on records kept.
10.1.4 Demographic Profile and Community Health

The farm is reliant on labour during the operational phase. It is not foreseen that the project will create a change in the demographic profile of the local community, as employment will be sourced locally as far as possible. Community health may still to some extent be exposed to factors such as communicable disease like HIV/AIDS and alcoholism/drug abuse associated with unemployment and transport industries. Should an increase in foreign people (e.g. migrant workers) in the area take place, this may potentially increase the risk of criminal and socially/culturally deviant behaviour.

<table>
<thead>
<tr>
<th>Project Activity / Resource</th>
<th>Nature (Status)</th>
<th>(A1) Importance</th>
<th>(A2) Magnitude</th>
<th>(B1) Permanence</th>
<th>(B2) Reversibility</th>
<th>(B3) Cumulative Environmental Classification</th>
<th>Class Value</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>Social ills</td>
<td>2</td>
<td>-1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>8</td>
<td>-1</td>
</tr>
<tr>
<td>Daily Operations</td>
<td>Social ills related to</td>
<td>2</td>
<td>-1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>-10</td>
<td>-2</td>
</tr>
<tr>
<td></td>
<td>unemployment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indirect Impacts</td>
<td>The spread of disease</td>
<td>2</td>
<td>-1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>-10</td>
<td>-2</td>
</tr>
</tbody>
</table>

**Desired Outcome:** To prevent the spread of communicable diseases and prevent / discourage socially deviant behaviour.

**Actions:**

**Prevention:**
- Employ only local people from the area, deviations from this practice should be justified appropriately.
- Adhere to all municipal by-laws relating to environmental health, such as sanitation requirements.

**Mitigation:**
- Educational programmes for employees on HIV/AIDS and general upliftment of employees’ social status.
- Appointment of reputable contractors.

**Responsible Body:**
- Proponent

**Data Sources and Monitoring:**
- Municipal by-laws
- Bi-annual summary report based on employee demographics, educational programmes and training conducted.
10.1.5 Traffic
Transport requirements include the transport of equipment, of employees, and of oysters and scallops to various markets. This may cause a slight increase of traffic to and from the site and increase congestion and increase the risk of incidents and accidents in the town. Traffic on the road near schools are of specific concern where school children cross the road. Due to the scale and location of the proposed operations, these impacts are expected to be minimal.

<table>
<thead>
<tr>
<th>Project Activity / Resource</th>
<th>Nature (Status)</th>
<th>(A1) Importance</th>
<th>(A2) Magnitude</th>
<th>(B1) Permanence</th>
<th>(B2) Reversibility</th>
<th>(B3) Cumulative</th>
<th>Environmental Classification</th>
<th>Class Value</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>Increase traffic, road wear and tear and accidents</td>
<td>1</td>
<td>-1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>5</td>
<td>-1</td>
<td>Probable</td>
</tr>
<tr>
<td>Daily Operations</td>
<td>Increase traffic, road wear and tear and accidents</td>
<td>2</td>
<td>-1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>-10</td>
<td>-2</td>
<td>Probable</td>
</tr>
</tbody>
</table>

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

**Actions**

**Prevention:**
- Erect clear signage regarding access and exit points at the facility.
- Proper route determination to avoid problem areas.
- Training and information sharing with drivers of vehicles to ensure vigilance at hot spots like schools.

**Mitigation:**
- If any traffic impacts are expected, traffic management should be performed to prevent these.
- The placement of signs to warn and direct traffic where necessary will mitigate traffic impacts.

**Responsible Body:**
- Contractors
- Proponent

**Data Sources and Monitoring:**
- Any complaints received regarding traffic issues should be recorded together with action taken to prevent impacts from repeating itself.
- A bi-annual report should be compiled of all incidents reported, complaints received, and action taken.
10.1.6 Health, Safety and Security

Every activity associated with the construction and operational phase is reliant on human labour and therefore exposes them to health and safety risks. Injuries can occur due to incorrect lifting of heavy equipment and materials, drowning, stacked items tipping over, getting caught in moving parts of machines, accidents involving vehicles, etc. Security risks are related to unauthorized entry, theft (oyster or scallop poaching and theft) and sabotage.

The quality of oysters and scallops should be maintained in order to ensure no health risks to consumers.

<table>
<thead>
<tr>
<th>Project Activity / Resource</th>
<th>Nature (Status)</th>
<th>(A1) Importance</th>
<th>(A2) Magnitude</th>
<th>(B1) Permanence</th>
<th>(B2) Reversibility</th>
<th>(B3) Cumulative Environmental Classification</th>
<th>Class Value</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>Physical injuries and criminal activities</td>
<td>1</td>
<td>-2</td>
<td>2</td>
<td>2</td>
<td>-10</td>
<td>-2</td>
<td>Probable</td>
</tr>
<tr>
<td>Daily Operations</td>
<td>Physical injuries, illness and criminal activities</td>
<td>1</td>
<td>-2</td>
<td>3</td>
<td>3</td>
<td>-16</td>
<td>-2</td>
<td>Probable</td>
</tr>
</tbody>
</table>

**Desired Outcome:** To prevent injury, health impacts and theft.

**Actions**

**Prevention:**
At minimum the proponent must:
- Clearly label dangerous and restricted areas as well as dangerous equipment and products.
- Equipment that will be locked away on site must be placed in a way that does not encourage criminal activities (e.g. theft).
- Provide all employees with required and adequate personal protective equipment (PPE). This includes life jackets at sea.
- Ensure that all personnel receive adequate training on operation of equipment / handling of hazardous substances.
- All health and safety standards specified in the Labour Act should be complied with.
- Sampling as per the existing standard for mariculture industry in Namibia as performed by the Namibia Standards Institution.
- Develop a security protocol for transport of oysters and scallops which can include monitoring of vehicle movements (GPS tracking), emergency procedures, etc.
- Strict security that prevents unauthorised entry and theft.

**Mitigation:**
- Selected personnel should be trained in first aid and a first aid kit must be available on site. The contact details of all emergency services must be readily available.
- Security procedures and proper security measures must be in place to protect workers and clients.

**Responsible Body:**
- Proponent
- Contractors

**Data Sources and Monitoring:**
- Sampling as per the existing standard for mariculture industry in Namibia as performed by the Namibia Standards Institution.
- Monitoring and analysis reports on file.
- Any incidents must be recorded with action taken to prevent future occurrences.
A bi-annual report should be compiled of all incidents reported and all monitoring/analysis results. The report should contain dates when training were conducted and when safety equipment and structures were inspected and maintained.
10.1.7 Noise
Some noise will be generated during construction / maintenance activities. Noise generated from the operational activities will be minimal and isolated to for example the compressors of cold rooms, pressure washing of baskets and occasional trucks.

<table>
<thead>
<tr>
<th>Project Activity / Resource</th>
<th>Nature (Status)</th>
<th>(A1) Importance</th>
<th>(A2) Magnitude</th>
<th>(B1) Permanence</th>
<th>(B2) Reversibility</th>
<th>(B3) Cumulative Environmental Classification</th>
<th>Class Value</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>Noise generated from the construction activities – nuisance and hearing loss</td>
<td>2</td>
<td>-2</td>
<td>2</td>
<td>1</td>
<td>-20</td>
<td>-3</td>
<td>Probable</td>
</tr>
<tr>
<td>Daily Operations</td>
<td>Noise generated from the operational activities – nuisance</td>
<td>2</td>
<td>-1</td>
<td>2</td>
<td>2</td>
<td>-12</td>
<td>-2</td>
<td>Improbable</td>
</tr>
</tbody>
</table>

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

**Actions**

**Prevention:**
- Follow World Health Organization (WHO) guidelines on maximum noise levels (Guidelines for Community Noise, 1999) to prevent hearing impairment.
- All machinery must be regularly serviced to ensure minimal noise production.

**Mitigation:**
- Hearing protectors as standard PPE for workers in situations with elevated noise levels.

**Responsible Body:**
- Proponent
- Contractors

**Data Sources and Monitoring:**
- WHO Guidelines.
- Maintain a complaints register.
- Bi-annual report on complaints and actions taken to address complaints and prevent future occurrences.
10.1.8 Waste Production

During construction / maintenance waste in the form of building material, rubble and empty packaging material will be produced. Minimal waste will be produced during operations of the facility. Waste generated will include domestic waste, sewage, old baskets and equipment no longer required or recyclable/reusable, shells and dead oysters and scallops, biofouling when cleaning of baskets and shells. Biofouling is discharged into the ocean. Contaminated soil and water may be considered as hazardous waste. Unconfined wastes / litter such as empty bags may be blown away by strong winds and end up in the surrounding environment.

<table>
<thead>
<tr>
<th>Project Activity / Resource</th>
<th>Nature (Status)</th>
<th>(A1) Importance</th>
<th>(A2) Magnitude</th>
<th>(B1) Permanence</th>
<th>(B2) Reversibility</th>
<th>(B3) Cumulative Environmental Classification Class Value</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>Building rubble</td>
<td>1</td>
<td>-1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>-5</td>
</tr>
<tr>
<td>Daily Operations</td>
<td>Excessive waste production, littering, contaminated materials</td>
<td>2</td>
<td>-1</td>
<td>2</td>
<td>2</td>
<td>-12</td>
<td>-2</td>
</tr>
</tbody>
</table>

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

**Actions**

**Prevention:**
- Waste reduction measures should be implemented and all waste that can be re-used / recycled must be kept separate.
- Beneficial use of shells is promoted e.g. as source of calcium carbonate, additive to agricultural soil, etc.
- Ensure adequate disposal storage facilities are available.
- Ensure waste cannot be blown away by strong wind.
- Prevent scavenging (human and non-human) at waste storage.

**Mitigation:**
- 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), if any.
- A contingency plan must be developed to handle any hazardous biological waste, for example disease-bearing organisms. This should include proper disposal methods to prevent spread of contamination or scavenging by animals or humans.
- See the material safety data sheets available from suppliers for disposal of contaminated products and empty containers.
- Liaise with the municipality regarding waste and handling of hazardous waste.

**Responsible Body:**
- Proponent
- Contractors

**Data Sources and Monitoring:**
- A record should be kept of any disposal of hazardous waste.
- Any complaints received regarding waste should be recorded with notes on action taken.
- All information and reporting to be included in a bi-annual report.
10.1.9 Terrestrial Ecosystem and Biodiversity Impact

Construction activities, if any, will be within an already disturbed urban environment. As such no impact on the environment is expected. The nature of the operational activities will be such that the probability of creating a habitat for flora and fauna to establish is low. Lighting may occasionally be used at night and may blind birds like flamingos which fly at night, especially if directed upwards. This may result in disorientation of birds and collisions with structures.

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily Operations</td>
<td>Impact on terrestrial fauna and flora.</td>
<td>2</td>
<td>-1</td>
<td>3</td>
<td>2</td>
<td>-14</td>
<td>-2</td>
</tr>
</tbody>
</table>

Desired Outcome: To reduce disturbance and destruction of the ecological environment.

Actions.
Prevention:
- Lights used at the site should be directed downwards to the working surfaces to prevent disorientation of birds flying at night and it should not impact on neighbours. Proper installation should be considered from the start.

Mitigation:
- Report any extraordinary ecological sightings to the Ministry of Environment and Tourism.
- Keep record of any bird collisions / dead birds on site and investigate the causes and improve the conditions to prevent future occurrences.
- Mitigation measures related to waste handling should limit ecosystem and biodiversity impacts.
- Avoid scavenging of waste by fauna, mainly birds.
- The establishment of habitats and nesting sites at the facility should be prevented where possible.

Responsible Body:
- Proponent
- Contractors

Data Sources and Monitoring:
- All monitoring information and extraordinary animal sightings to be included in a bi-annual report.
10.1.10 Impacts on Marine and Coastal Biota

A number of potential negative impacts are possible as discussed in the specialist report in Appendix C. These include entanglement of large marine mammals in the long lines, scallops potentially becoming invasive, temporary seabed disruption for anchor placement, physical pollution, injury of non-target species and disease and pest introduction.

Grow-out baskets acts as refuges for many marine organisms which may have a positive influence on local diversity.

<table>
<thead>
<tr>
<th>Project Activity / Resource</th>
<th>Nature (Status)</th>
<th>(A1) Importance</th>
<th>(A2) Magnitude</th>
<th>(B1) Permanence</th>
<th>(B2) Reversibility</th>
<th>(B3) Cumulative Environmental Classification</th>
<th>Class Value</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily Operations</td>
<td>Impact on marine biota. Loss of biodiversity</td>
<td>2</td>
<td>-2</td>
<td>2</td>
<td>3</td>
<td>-28</td>
<td>-3</td>
<td>Improbable</td>
</tr>
</tbody>
</table>

**Desired Outcome:** To minimise destruction, degradation and disturbance of the ecological environment.

**Actions.**

**Prevention:**
- Implement and maintain a strict biosecurity protocol and disease management plan, which includes monitoring, mitigation and emergency response plans. This should include quarantine facilities and procedures if spat is imported as well as screening for diseases or parasites.
- Non-target species in grow-out baskets must be returned to the water as soon as possible.

**Mitigation:**
- Report any extraordinary sightings or occurrences to the Ministry of Environment and Tourism.
- Ensure regular sampling of oysters and scallops to ensure no diseases are present and the water quality remains adequate.
- Ensure stocking densities in baskets are optimised to ensure a healthy, stress-free environment for oysters and scallops.
- Lüderitz Harbour should be monitored to ensure no major changes in the local ecosystem and biodiversity takes place, including settlement and proliferation of oysters and / or scallops.

**Responsible Body:**
- Proponent
- Contractors

**Data Sources and Monitoring:**
- Sampling as per the existing standard for mariculture industry in Namibia as performed by the Namibia Standards Institution.
- Regular environmental monitoring (diving) to monitor benthic communities and rocky shore ecosystems for changes.
- Monitoring and analysis reports on file.
- All information and reporting to be included in a bi-annual summary report.
10.1.11 Surface Water and Soil Contamination
During onshore construction and maintenance activities, spillages or illegal dumping of waste may lead to surface water (ocean) and soil contamination. Localised reduction in seawater quality can occur when pollutants including high organic loads enter the ocean. High nutrient levels and organic loads may increases the chemical oxygen demand (COD) and biological oxygen demand (BOD).

<table>
<thead>
<tr>
<th>Project Activity / Resource</th>
<th>Nature (Status)</th>
<th>(A1) Importance</th>
<th>(A2) Magnitude</th>
<th>(B1) Permanence</th>
<th>(B2) Reversibility</th>
<th>(B3) Cumulative Environmental Classification</th>
<th>Class Value</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>Soil pollution and runoff</td>
<td>1</td>
<td>-1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>-5</td>
<td>-1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Probable</td>
</tr>
<tr>
<td>Daily Operations</td>
<td>Reduction in seawater quality</td>
<td>2</td>
<td>-1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-12</td>
<td>-2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Probable</td>
</tr>
</tbody>
</table>

**Desired Outcome:** To prevent the contamination of water and soil, and to prevent impacts on the seawater quality.

**Actions**

**Prevention:**
- Any contaminated water must be prevented from entering the ocean and environment and must be discarded as hazardous waste where required.
- All chemicals, if any, must be handled according to their respective material safety data sheet instructions.
- Develop a spill response plan with adequate spill response materials.
- Use of reputable and well trained contractors / employees are essential.
- Should any chemicals be used for cleaning that may enter the wastewater stream, the chemicals should either be in low enough quantities that no impacts on the environment occur, be environmentally friendly and biodegradable, or should be discarded at an approved site.

**Mitigation:**
- All spills must be cleaned immediately.

**Responsible Body:**
- Proponent
- Contractors

**Data Sources and Monitoring:**
- A report should be compiled bi-annually of all pollution incidents and corrective action taken.
### 10.1.12 Visual Impact

This is an impact that not only affects the aesthetic appearance, but also the integrity of the infrastructure and the visual landscape character. The offshore infrastructure (buoys on long lines) has become part of the seascape character and is of interest to tourists.

<table>
<thead>
<tr>
<th>Project Activity / Resource</th>
<th>Nature (Status)</th>
<th>(A1) Importance</th>
<th>(A2) Magnitude</th>
<th>(B1) Permanence</th>
<th>(B2) Reversibility</th>
<th>(B3) Cumulative Environmental Classification</th>
<th>Class Value</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>Building rubble not contained</td>
<td>2</td>
<td>-1</td>
<td>2</td>
<td>2</td>
<td>-10</td>
<td>-2</td>
<td>Probable</td>
</tr>
<tr>
<td>Daily Operations</td>
<td>Aesthetic appearance and integrity of the site</td>
<td>2</td>
<td>-1</td>
<td>2</td>
<td>2</td>
<td>-10</td>
<td>-2</td>
<td>Probable</td>
</tr>
</tbody>
</table>

**Desired Outcome:** To enhance aesthetically pleasing attributes of the existing landscape character and prevent degradation.

**Actions**

**Prevention:**
- 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.
- All structures and infrastructures, if painted, should be in line with the visual character of the landscape.

**Mitigation:**
- Any damage to structures or decommissioning of unused elements should be removed from site and the areas rehabilitated.
- All un-used elements should be removed from site or stored in an appropriate facility.

**Responsible Body:**
- Proponent
- Contractors

**Data Sources and Monitoring:**
- A bi-annual report should be compiled of all complaints received and actions taken.
10.1.13 Cumulative Impact

Cumulative impacts during construction will include increased traffic and possibly noise. Possible cumulative impacts associated with the operational phase include increased traffic in the area. This will have a cumulative impact on traffic through Lüderitz. The increasing number of farms that are operational in the Lüderitz Bay area may impact on water quality and the amount of pollutants entering the environment. The cumulative visual impact is related to the buoys at sea and the land based infrastructure. Employment and economic contributions are positive cumulative impacts.

<table>
<thead>
<tr>
<th>Project Activity / Resource</th>
<th>Nature (Status)</th>
<th>(A1) Importance</th>
<th>(A2) Magnitude</th>
<th>(B1) Permanence</th>
<th>(B2) Reversibility</th>
<th>(B3) Cumulative Environmental Classification</th>
<th>Class Value</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>Noise</td>
<td>2</td>
<td>-1</td>
<td>2</td>
<td>2</td>
<td>-10</td>
<td>-2</td>
<td>Probable</td>
</tr>
<tr>
<td>Daily Operations</td>
<td>The build-up of minor impacts to become more significant</td>
<td>2</td>
<td>-2</td>
<td>2</td>
<td>2</td>
<td>-24</td>
<td>-3</td>
<td>Probable</td>
</tr>
</tbody>
</table>

**Desired Outcome:** To minimise negative and enhance positive cumulative impacts associated with the facility.

**Actions**

**Mitigation:**
- Addressing each of the individual impacts as discussed and recommended in the EMP would reduce the cumulative impact.
- Reviewing biannual reports for any new or re-occurring impacts or problems would aid in identifying cumulative impacts and help in planning if the existing mitigations are insufficient.
- Should a reduction in seawater quality be expected, it is recommended that all industries in the area utilising seawater and discharging effluent into the ocean implement a joint monitoring program to ensure the localized water quality does not decrease.

**Responsible Body:**
- Proponent

**Data Sources and Monitoring:**
- Bi-annual reports provides a summary of the impacts of the operational phase and highlights cumulative impacts.
10.2 DECOMMISSIONING AND REHABILITATION
Decommissioning is not foreseen during the validity of the environmental clearance certificate. Decommissioning was however assessed. Should decommissioning occur at any stage, rehabilitation of the area may be required. Decommissioning will entail the complete removal of all infrastructure including buildings, underground infrastructure and offshore long lines. Any pollution present on the site must be remediated. The impacts associated with this phase include noise and waste production as structures are dismantled. Noise must be kept within WHO standards and waste should be contained and disposed of at an appropriately classified and approved waste facility and not dumped in the surrounding areas. Future land use after decommissioning should be assessed prior to decommissioning and rehabilitation initiated appropriately. The environmental management plan for the facility will have to be reviewed at the time of decommissioning to cater for changes made to the site and implement guidelines and mitigation measures.

10.3 ENVIRONMENTAL MANAGEMENT SYSTEM
Tetelestai Mariculture may subscribe to an environmental management system that 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.

11 CONCLUSION
The proposed mariculture farm has the potential to have a positive impact on Lüderitz and Namibia as a whole. It will create much needed employment opportunities and revenue generation, see Table 9. In addition to employment and revenue generation, the farm will contribute locally to the transfer of skills and training which in turn develops the local workforce during operations of the facility.

Negative impacts can successfully be mitigated. The implementation of a biosecurity protocol and disease management plan should mitigate the potential risk of pathogens and parasites. Oysters and scallops should be sampled and analysed regularly to ensure the quality is maintained. Noise pollution should at all times meet the prescribed WHO requirements to prevent hearing loss and not to cause a nuisance. Health and safety regulations should be adhered to in accordance with the regulations pertaining to relevant laws and internationally accepted standards of operation. Any waste produced must be removed from site and disposed of at an appropriate facility or re-used or recycled where possible. Hazardous waste, if any, must be disposed of at an approved hazardous waste disposal site. A detailed contingency plan is required to make provision for the safe disposal of oysters and scallops that requires discarding, especially during the events of a disease outbreak.

The introduction of the non-native scallop for mariculture purposes is very similar to the Pacific Oysters which also are non-native. The scallops are not expected to have a negative impact on the local ecosystem and are not expected to become invasive. Careful monitoring of the marine environment is however recommended.

The EMP should be used as an on-site reference document for all the operational activities. Parties responsible for transgression of the EMP should be held responsible for any rehabilitation that may
need to be undertaken. The Proponent should use and in-house health, safety and environment plan and related policies and standards in conjunction with the EMP. It is imperative that all construction and operational personnel are taught the contents of these documents to ensure better environmental practises all round.

Should the Directorate of Environmental Affairs (DEA) find that the impacts and related mitigation measures, which have been proposed in this report, are acceptable, an environmental clearance certificate may be granted to Tetelestai Mariculture. The environmental clearance certificate issued, based on this document, will render it a legally binding document which should be adhered to. Focus should be placed on Section 10, which includes an EMP for this project. It should be noted that the assessment process’s aim is not to stop the activity, or any of its components, but to rather determine its impact and guide sustainable and responsible development as per the spirit of the EMA.

Table 9. Impact summary class values

<table>
<thead>
<tr>
<th>Impact Category</th>
<th>Impact Type</th>
<th>Construction</th>
<th>Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Positive Rating Scale: Maximum Value</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Negative Rating Scale: Maximum Value</td>
<td>-5</td>
<td>-5</td>
</tr>
<tr>
<td>EO</td>
<td>Skills, Technology and Development</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>EO</td>
<td>Revenue Generation and Employment</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>SC</td>
<td>Demographic Profile and Community Health</td>
<td>-1</td>
<td>-2</td>
</tr>
<tr>
<td>SC</td>
<td>Traffic</td>
<td>-1</td>
<td>-2</td>
</tr>
<tr>
<td>SC</td>
<td>Health, Safety and Security</td>
<td>-2</td>
<td>-2</td>
</tr>
<tr>
<td>PC</td>
<td>Noise</td>
<td>-3</td>
<td>-2</td>
</tr>
<tr>
<td>PC</td>
<td>Waste Production</td>
<td>-1</td>
<td>-2</td>
</tr>
<tr>
<td>BE</td>
<td>Terrestrial Ecosystem and Biodiversity Impact</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BE</td>
<td>Impacts on Marine and Coastal Biota</td>
<td></td>
<td>-3</td>
</tr>
<tr>
<td>PC</td>
<td>Surface Water and Soil Contamination</td>
<td>-1</td>
<td>-2</td>
</tr>
<tr>
<td>SC</td>
<td>Visual Impact</td>
<td>-2</td>
<td>-2</td>
</tr>
<tr>
<td></td>
<td>Cumulative Impact</td>
<td>-2</td>
<td>-3</td>
</tr>
</tbody>
</table>

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


http://mesonet.agron.iastate.edu/ accessed 4 May 2017


Appendix A: Notified and Registered Interested and Affected Parties
<table>
<thead>
<tr>
<th>Name</th>
<th>Position/Department</th>
<th>Organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anja Kreiner</td>
<td>Fisheries Biologist</td>
<td>Ministry of Fisheries and Marine Resources</td>
</tr>
<tr>
<td>Cecil Kamupingene</td>
<td>Marketing Specialist</td>
<td>Namport</td>
</tr>
<tr>
<td>Cherilee Fortuin</td>
<td></td>
<td>Namdeb</td>
</tr>
<tr>
<td>Chief Executive Officer</td>
<td></td>
<td>Lüderitz Town Council</td>
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<tr>
<td>Christaline Kaangundue</td>
<td>Environmental Practitioner</td>
<td>Lüderitz Town Council</td>
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<tr>
<td>Crispin Clay</td>
<td>Chairman</td>
<td>Lüderitzbucht Foundation</td>
</tr>
<tr>
<td>David C Dennis</td>
<td>Chief Fire Officer</td>
<td>Lüderitz Town Council</td>
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<tr>
<td>Elzevir Gelderbloem</td>
<td>Port Engineer</td>
<td>NamPort</td>
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<tr>
<td>Erich Maletzky</td>
<td>Fisheries Biologist</td>
<td>Ministry of Fisheries and Marine Resources</td>
</tr>
<tr>
<td>F Druker</td>
<td>Managing Director</td>
<td>Coastways Tours Luderitz Pty Ltd.</td>
</tr>
<tr>
<td>Ferdie de Villiers</td>
<td>Manager</td>
<td>Novaship / Port Users Association</td>
</tr>
<tr>
<td>Foibe Nghoongoloka</td>
<td>Directorate of Aquaculture</td>
<td>Ministry of Fisheries &amp; Marine Resources</td>
</tr>
<tr>
<td>Frikkie Botes</td>
<td>CFB Mariculture</td>
<td>Ministry of Fisheries and Marine Resources</td>
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<tr>
<td>Gerd Kessler</td>
<td></td>
<td>Lagoon Aquaculture</td>
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<tr>
<td>H. Ludwicht</td>
<td>Manager</td>
<td>Office of the President</td>
</tr>
<tr>
<td>Heinz Manns</td>
<td></td>
<td>Namib Offroad Excursions</td>
</tr>
<tr>
<td>Hon. Rev. Jan A. Scholtz</td>
<td>Chairman and Councillor /</td>
<td>Chairman and Councillor/ Karas Regional Council</td>
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<td></td>
<td>Karas Regional Council</td>
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<tr>
<td>Howard Head</td>
<td></td>
<td>CEO Ghost Town Tours Member Lüderitz Tourism Forum</td>
</tr>
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<td></td>
<td></td>
<td>Member Ocean Grown ( Oysters)</td>
</tr>
<tr>
<td>I.N. Tjipura</td>
<td>Technical Manager</td>
<td>Lüderitz Town Council</td>
</tr>
<tr>
<td>Ingrid Wiesel</td>
<td>Senior Scientist</td>
<td>Brown Hyena Research Project</td>
</tr>
<tr>
<td>J. Wiese</td>
<td></td>
<td>Seaflower</td>
</tr>
<tr>
<td>Jean Paul Roux</td>
<td>Scientist</td>
<td>Ministry of Fisheries and Marine Resources</td>
</tr>
<tr>
<td>Jessica Kemper</td>
<td>Biologist</td>
<td>Conservation Biologist and Lüderitz Resident</td>
</tr>
<tr>
<td>Johannes Isaaks</td>
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<tr>
<td>Joyce Katjirua</td>
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<td>Namdeb</td>
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<tr>
<td>Jürgen Fleidl</td>
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<td>Five Roses Aquaculture</td>
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<tr>
<td>Kolette Grobler</td>
<td>Fisheries Biologist</td>
<td>Ministry of Fisheries and Marine Resources</td>
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<tr>
<td>La Toya Shivute</td>
<td></td>
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</tr>
<tr>
<td>Manu Namukomba</td>
<td>Human Resources</td>
<td>NovaNam</td>
</tr>
<tr>
<td>Marion Schelkle</td>
<td>Owner and Tour operator</td>
<td>Lüderitz Safaris &amp; Tours</td>
</tr>
<tr>
<td>Max Cooper</td>
<td>Port Manager: Lüderitz</td>
<td>Namport</td>
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<tr>
<td>Michael Mackenzie</td>
<td></td>
<td>NovaNam</td>
</tr>
<tr>
<td>Michael Viljoen</td>
<td>Manager</td>
<td>Hangana Seafood / Hangana Abalone</td>
</tr>
<tr>
<td>Ms Thandiwe Gxaba</td>
<td></td>
<td>Benguela Current Commission</td>
</tr>
<tr>
<td>Nicolaas De Wee</td>
<td>Health, Water &amp; Sewer</td>
<td>Health, Water &amp; Sewer Services</td>
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<td></td>
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<tr>
<td>Patricia Kaulinge</td>
<td>Environmental Section</td>
<td>NovaNam</td>
</tr>
<tr>
<td>Name</td>
<td>Position/Department</td>
<td>Organisation</td>
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</tr>
<tr>
<td>Pinehas N. Auene</td>
<td>Deputy Director: Marine Pollution Control and SAR</td>
<td>Ministry of Works and Transport</td>
</tr>
<tr>
<td>Rassie Erasmus</td>
<td>General Manager</td>
<td>Benguella Wealth Farming</td>
</tr>
<tr>
<td>Reginald Hercules</td>
<td>Community Member</td>
<td></td>
</tr>
<tr>
<td>Rian Jones</td>
<td>Senior Fisheries Marine Technician</td>
<td>Ministry of Fisheries and Marine Resources</td>
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<tr>
<td>Rodney Braby</td>
<td>Regional Technical Adviser</td>
<td>Marine Spatial Management and Governance Project - MARISMA</td>
</tr>
<tr>
<td>Rudi Cloete</td>
<td>Director: Mariculture</td>
<td>Ministry of Fisheries and Marine Resources</td>
</tr>
<tr>
<td>Simon Elwen</td>
<td></td>
<td>Namibia Dolphin Project</td>
</tr>
<tr>
<td>Stefanus Gariseb</td>
<td>SHREQ Manager</td>
<td>Namport</td>
</tr>
<tr>
<td>Suzan Ndjaleka</td>
<td>Manager</td>
<td>COSDEC</td>
</tr>
<tr>
<td>Tim Eiman</td>
<td>Co-ordinator (EMS &amp; QMS)</td>
<td>NamPort</td>
</tr>
<tr>
<td>Ulf Grünewald</td>
<td>General Manager</td>
<td>Lüderitz Nest Hotel</td>
</tr>
<tr>
<td>Victor Libuku</td>
<td>Fisheries Biologist</td>
<td>Ministry of Fisheries and Marine Resources</td>
</tr>
<tr>
<td>Wayne Handley</td>
<td>Acting Chief Warden: Kharas Parks</td>
<td>Ministry of Environment and Tourism</td>
</tr>
<tr>
<td>Wetupa Nakathingo</td>
<td>Environmental Practitioner</td>
<td>Lüderitz Town Council</td>
</tr>
<tr>
<td>Seafo (South East Atlantic Fisheries Organisation)</td>
<td></td>
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</tbody>
</table>

**Registered IAPs**

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Organisation</th>
<th>Date Registered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ulf Grünewald</td>
<td>General Manager</td>
<td>Lüderitz Nest Hotel</td>
<td>2020-03-04</td>
</tr>
<tr>
<td>Victor Libuku</td>
<td>Integrated Coastal Zone Management (ICZM) Section</td>
<td>Ministry of Fisheries and Marine Resources</td>
<td>2020-03-04</td>
</tr>
<tr>
<td>Simon Elwen</td>
<td>Director</td>
<td>Namibian Dolphin Project</td>
<td>2020-03-04</td>
</tr>
<tr>
<td>Jürgen Fleidl</td>
<td>Director</td>
<td>Five Roses Aquaculture</td>
<td>2020-03-05</td>
</tr>
<tr>
<td>La Toya Shivute</td>
<td>Senior Fisheries Biologist</td>
<td>Ministry of Fisheries and Marine Resources</td>
<td>2020-03-05</td>
</tr>
<tr>
<td>Julien Cloete</td>
<td>Environmental Management Coordinator: Assessments</td>
<td>Namdeb</td>
<td>2020-03-06</td>
</tr>
<tr>
<td>Ursula Witbooi</td>
<td>Environmental Manager</td>
<td>Namdeb</td>
<td>2020-03-06</td>
</tr>
</tbody>
</table>
To: Interested and Affected Parties

Re: Environmental Scoping Assessment and Environmental Management Plan for Tetelestai Mariculture’s Proposed Development at Lüderitz

28 February 2020

Dear Sir/Madam,

Geo Pollution Technologies (Pty) Ltd was appointed to undertake an environmental assessment for proposed mariculture activities at Lüderitz. The assessment will be conducted according to the Environmental Management Act of 2007 and its regulations as published in 2012.

Project: Environmental Scoping Assessment and Environmental Management Plan for Tetelestai Mariculture’s Proposed Development at Lüderitz

Proponent: Tetelestai Mariculture (Pty) Ltd

Environmental Assessment Practitioner: Geo Pollution Technologies (Pty) Ltd

The water at Lüderitz is ideal for mariculture activities and as such the local culturing of oysters, abalone and mussels have been ongoing for many years. The Proponent intends to establish a Pacific oyster (Crassostrea gigas) and Peruvian scallop (Argopecten purpuratus) farm, in a location to be determined within the dedicated mariculture area of Lüderitz.

Construction activities mainly involve the installation of long lines in the mariculture area. These are long ropes kept apart by buoys and anchored on the seabed at both ends. Long lines are used to attach grow out baskets in which oysters or scallops are placed. Onshore, some construction activities are possible, but the scale of construction will only be determined once a suitable land based location for oyster and scallop processing is determined. Operational activities are divided between offshore and onshore. Offshore, floating long lines are installed to which baskets containing oyster and scallop spat are attached. Onshore processing of oysters and scallops mainly comprise of cleaning, sizing and shipping.

All Interested and Affected Parties (I&APs) are invited to register with the environmental consultant to receive further documentation and communication regarding the project. By registering, I&APs will be provided with an opportunity to provide input that will be considered in the drafting of the environmental assessment report and management plan.

Please register as an I&AP and provide comments by 18 March 2020.

To register, please contact: Fax: 088-62-6368 E-Mail: mariculture@thenamib.com

Please contact Geo Pollution Technologies at telephone 061-257411 for more information.

Thank you in advance.

Sincerely,

André Paut (Conservation Ecologist)
To: The Executive Director  
Ministry of Fisheries and Marine Resources  
P/Bag 13355  
Windhoek  

Re: Environmental Scoping Assessment and Environmental Management Plan for Mariculture Activities of Tetelestai Mariculture at Lüderitz  

Dear Sir  

Geo Pollution Technologies (Pty) Ltd was appointed to undertake an environmental assessment for proposed mariculture activities at Lüderitz. The assessment will be conducted according to the Environmental Management Act of 2007 and its regulations as published in 2012.  

Project: Environmental Scoping Assessment and Environmental Management Plan for Tetelestai Mariculture’s Proposed Development at Lüderitz  

Proponents: Tetelestai Mariculture (Pty) Ltd  
Environmental Assessment Practitioner: Geo Pollution Technologies (Pty) Ltd  

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The Ministry of Fisheries and Marine Resources is invited to register with the environmental consultant to receive further documentation and communication regarding the project. By registering, the Ministry will be provided with an opportunity to provide input that will be considered in the drafting of the environmental assessment report and management plan. We further request your office to provide us with any documentation or legislation that may be deemed applicable to the project.  

Please register and provide comments by 18 March 2020. To register, please contact Fax: 086-62-6368, E-Mail: mariculture@thenamib.com or contact Geo Pollution Technologies at telephone 061-257411 for more information.  

Thank you in advance.  
Sincerely,  

André Faul  
(Conservation Ecologist)
Namport Notification

To: Interested and Affected Parties

28 February 2020

Re: Environmental Scoping Assessment and Environmental Management Plan for Tetelestai Mariculture’s Proposed Development at Lüderitz

Dear Sir/Madam

Geo Pollution Technologies (Pty) Ltd was appointed to undertake an environmental assessment for proposed mariculture activities at Lüderitz. The assessment will be conducted according to the Environmental Management Act of 2007 and its regulations as published in 2012.

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Proponents: Tetelestai Mariculture (Pty) Ltd

Environmental Assessment Practitioner: Geo Pollution Technologies (Pty) Ltd

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Please register as an I&AP and provide comments by 18 March 2020.

To register, please contact: Fax 084-62-6368

E-Mail: mariculture@thenamib.com

Please contact Geo Pollution Technologies at telephone 061-257411 for more information.

Thank you in advance.

Sincerely,

André Paul (Conservation Ecologist)
Newspaper Advertisements

Tetelekaik culture - EIA & EMP - May 2020

Geo Pollution Technologies (Pty) Ltd

Public Participation Notice
Environmental Assessment Process of the Midgard Country Estate

The environmental assessment will be conducted in accordance with the Environmental Management Act of 2008 and its regulations as published in 2012.

The process is for the public and interested stakeholders to be given an opportunity to make representations, comments or to express concerns. Additional information can be requested from Geo Pollution Technologies.

All comments and concerns should be submitted to Geo Pollution Technologies by 18 March 2020.
Glitches hit home affairs

There are suggestions, including the arrest of 63 suspects for wildlife-related crimes, have been recorded by anti-poaching units in the Elusho National Park since February last year.

This was revealed during a visit to Elusho by police inspector-general Sebuneh Ndubhie, environment minister Pothina Shoba and defense minister Pendar Ya Malaika last Friday.

The delegation flew in with a police helicopter to familiarize itself with the situation on the ground and interact with some of the units.

This is according to a statement issued by the police.

The anti-poaching units comprise of officials from the environment minister, the Ministry of Defence Forces (MODF) and the police.

The current commandant of phase 18 of the joint operation, Chief Inspector Donal Kukunle, was tasked to handle the implementation on behalf of the police.

The minister, who is also a pastor, said the pastoral care aspect had been incorporated into the local community action forums.

All interested and affected parties are invited to engage with the environment minister. By registering you are provided with the opportunity to share your comments, issues or concerns related to the project, and to participate in the environmental assessments. Additional information can be obtained from the Department of Environmental Affairs. All comments and concerns should be submitted to Geo Pollution Technologies by 18 March 2020.

Wednesday 11 March 2020

WEER

Vooruitsig

Binneland: Gewone heuwels en plaaslike regio’s sal besoek word.

Vlakland: Gewone heuwels en plaaslike regio’s sal besoek word.

Windsor: 10° C - 17° C

Durban: 10° C - 17° C

Bloemfontein: 6° C - 10° C

Marine tar: 22° C - 30° C

Nelspruit: 20° C - 30° C

Pretoria: 13° C - 24° C

Cape Town: 20° C - 30° C

KAAPSTAD: 10° C - 20° C

PUBLIC PARTICIPATION NOTICE

ENVIRONMENTAL ASSESSMENT PROPOSED MARINER DEVELOPMENT PROJECT - EIA

Geo Pollution Technologies (Pty) Ltd was appointed to undertake environmental assessment for proposed marine developments at Tsitsikamma (Pty) Ltd and Bushbuck Pass to be implemented in the KwaZulu-Natal province. The marine developments are likely to have significant impacts on the environment. Therefore, the environmental assessment will be undertaken to ensure that the developments are environmentally sustainable. In this regard, the public has an opportunity to provide comments on the environmental assessment reports. Public participation is a key component of the environmental assessment. Additional information can be obtained from the Department of Environmental Affairs. All comments and concerns should be submitted to Geo Pollution Technologies by 18 March 2020.

Tippi Chauri, Nelo, my Book of African Safari, but erindjere war saam met die bolboedjie, Cindy Creur, Geo Pollution Technologies, KwaZulu-Natal.

Tetiela Matriculture - EIA & EMP - May 2020

Geo Pollution Technologies (Pty) Ltd
Appendix B: Comments Received
E-Mail Correspondence Received

<table>
<thead>
<tr>
<th>Communication</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simon Elwen – Namibia Dolphin Project – E-mail of 4 March 2020</td>
<td>Comments noted. Should entanglements occur the industry should strongly consider the development of similar guidelines.</td>
</tr>
<tr>
<td>The proposed farms are mostly in fairly low-density areas for cetaceans in the lagoon - but there are a good few whales and dolphins which use the areas around the islands. Would recommend looking at in more detail if there is scope for that? Also - we've currently involved in drafting guidelines for the Saldanha Aquaculture Zone to minimise entanglement risk for the entire area. Definitely something worth doing there too.</td>
<td></td>
</tr>
<tr>
<td>Julien Cloete – Namdeb – E-mail of 6 March 2020</td>
<td>Noted. Will supply the files.</td>
</tr>
<tr>
<td>Can you also please send us the shape files of the project areas?</td>
<td></td>
</tr>
</tbody>
</table>
Appendix C: Scallop Introduction Specialist Study

J.A. Esterhuizen

October 2019

jaesterhuizen@gmail.com
Introduction

Members of the Lüderitz mariculture industry identified the need to diversify its aquaculture operations in Lüderitz Bay, Namibia. Currently, they are growing out the Pacific Oyster, *Crassotrea gigas* and plans to expand their operations by phasing in the Peruvian scallop (*Argopecten purpuratus*) employing the same culture method currently used for the Pacific Oyster, *C. gigas*.

Target species

The Peruvian Scallop (*Argopecten purpuratus*), also known as the Chilean Scallop, is a medium-sized bivalve with a wide distribution in Peru and Chile (Dall, 1909). In Chile, the cultured scallops reach a commercial size of around 9 cm in shell height within 14–16 months (Gonzalez et al., 1999). It is a relatively stenothermic (narrow temperature range) species as its natural habitat is largely under the influence of upwelling currents from Antarctica (Genetica et al., 2001). Research into the culture of *A. purpuratus* has gained significant interest in the last decade or so due to an intensification of market demand and overexploitation of natural stocks (Kluger et al., 2018). Among the scallop species, *A. purpuratus* enjoys significant interest as an aquaculture candidate due to its relative large size and fast growth rate (Wolff 1987; Wolff & Mendo 2000), as well as a higher associated market prices.

Biology

As is the case with other bivalve spp, scallops are suspension feeders that perform their functions in a range of habitats, in particular oceanic systems like estuaries and lagoons. They gain nourishment by filtering suspended particles such as phytoplankton and detritus from the water column and its by-products are dissolved ammonium. They sequester nitrogen in the form of protein in the meat and shell and stabilize phytoplankton growth dynamics through the moderation of ammonia cycling in the water column. Bivalve aquaculture has therefore the ability to affect the environment in both negative and positive ways, with a variety of effects on different parts of the ecosystem, including influencing primary and secondary productivity and community structure. Culture structures and operations can alter water flows, sediment composition and sedimentation rate, and disturb the benthic flora and other marine organisms (Mckindsey et al., 2011).

Reproductively, *A. purpuratus* is classified as hermaphrodites and fertilisation is achieved externally. Male and female gonads reach maturity simultaneously and it is well documented that the spermatozoa are released before the oocytes during spawning periods (Uriate et al., 2001).

Natural populations of *A. purpuratus* are found in sheltered areas with sufficient sedimentary substrate from 5 to 40 metres in depth with a low water exchange rate (Illanes, 1990). Geographical and spatial distributions of scallops are primarily characterised by temperature and nature of the aquatic habitat. “Scallop beds” are deemed areas where scallop abundance is significantly higher compared to adjacent areas, as the adjacent areas may lack adequate shelter and substrate for larval settlement. As a result, significantly large scallop beds may be widely separated geographically (hundreds of km’s). Although very little scientifically proven evidence exist that scallop larvae can be successfully transported by oceanic means to different geographic areas, the general notion is that the sustainability of scallop beds is self-induced and rely little on larval settlement from outside (Sinclair et al., 1985).

Common diseases found in scallops have been well documented by McGladdery et al. (2006) and is associated with bacterial, viral and parasitic infections. It is beyond the scope and purpose of this document to elaborate on the various types of diseases associated with bivalve culture, however, it is
important to highlight that disease outbreak under culture conditions remain a real possibility and almost no aquaculture venture has not experienced some type and form of disease outbreak (Gallardi, 2014). The spread of pathogens frequently occurs ahead of the diagnostics, but fortunately for the scallop industry in general, relatively few serious disease conditions have been described in scallop aquaculture (Mortensen, 2000). With regard to pests and diseases, the following criteria remain a real possibility when introducing a new bivalve species to a specific environment:

1) Transfer-effects of macro parasites and pests
   Bivalve shells are a target of shell boring polychaete, such as *Polydora ciliate* inhabiting the shells of mussels, oysters, scallops and clams. This polychaete weakens shell strength, increases energy requirements, impairs the overall health of the bivalve and harms the mantle tissues mainly responsible for reproduction. Thus it is classified as harmful to the host at least at high infestation rates.

2) Transfer-effects of micro parasites (Protozoa) and diseases
   Bivalves are both hosts and vectors of micro parasites i.e. *Marteilia, Bonamia, Microcytos* and *Perkinsus* species. As these parasites severely affect the health of host shellfish, it is important that prior to introduction of a non-native bivalve species to a new environment, the introductory animals be declared disease free. This requires the implementation of adequate quarantine procedures.

3) Transfer-effects of pathogenic agents, bacteria and viruses.
   Since bivalves are filter feeders, accumulation of pathogenic agents in bivalves pose a threat for human consumption. For example, seawater is the natural habitat of *Vibrio* bacteria and is feared as pathogens in fish and shellfish. *Vibrio* can cause severe ill-health in humans and high mortality rates in shellfish. Like bacteria, viruses can also be hosted in molluscs. Shellfish in general are efficient vehicles for inter- and intra-species transmission of viruses including humans.

4) Transfer-effects of bio toxins, cysts, larvae and eggs
   The main food source for bivalves is phytoplankton and thus the potential for accumulation of bio- and algal toxins remain high.

**Target area**

Lüderitz Bay, situated at 26°36’S 15°08’E forms part of the southern coast of Namibia and has subsidiary bays like Griffith Bay as well as two shallow lagoon areas namely first (Radford Bay) and second lagoon respectively. Growth on the sea bottom is characterised mainly by the gelatinous red algae, *Gracilaria spp*. The bay is heavily influenced by the strong upwelling of the Benguela current, featuring high level of natural production. In addition, the upwelling off the Lüderitz coast is more intense than any other area along the Namibian coast (Hardman-Mountford et al., 2003). Prevailing winds in the area are dominated by equator-ward-southerly winds and acts as the main driving force for associated upwelling together with the Coriolis force.

Lüderitz Bay has been zoned by the Ministry of Fisheries & Marine Resources for aquaculture development (figure 1) in accordance with the Aquaculture Act of 2002. These zones have already been allocated to entities already pursuing oyster grow-out for commercial purposes. Plots 7, 10-14 and 20 are intended for future grow-out of Peruvian scallops.
**Project Scope**

Production is estimated to reach 5-10 million scallops per annum after 2-3 years. Initially, scallop spat will be sourced from Beira Aquaculture, Swakopmund for on growing purposes in Lüderitz. The production will be sea-based and the grow-out of the scallops will take place in baskets suspended from floating longlines, an identical system used for oyster grow out. Initially, young, juvenile scallops (called spat) will be housed in wooden baskets covered with plastic PVC mesh (Figure 2 a) till they reach an approximate size of 6mm in length. Thereafter, they will be transferred to lantern nets (Figure 2 b) for the remainder of the grow out period (total grow out period approximately 18 months).

![Typical wooden baskets in which scallop spat will be housed initially till they reach 6mm in length (a) after which they will be transferred to lantern nets for remainder of grow-out period (b).](image)

**Figure 2:** Typical wooden baskets in which scallop spat will be housed initially till they reach 6mm in length (a) after which they will be transferred to lantern nets for remainder of grow-out period (b).

Once the scallops have reached market size, they will be harvested and transported to a land-based facility where they will be shucked for its meat. The meat will be packed according to market requirements and frozen till export.

Suspended longline culture involves hanging trays, baskets or nets housing young scallops/oysters from the surface of the water. This involves anchoring the longlines in the seabed and attaching floats on the line, usually large plastic, sealable drums. Baskets housing the scallops are then suspended from the longlines as shown in figure 3.
Figure 3: An illustration of a typical longline to which wooden baskets and lantern nets are attached to. Note that the anchors are placed below the seabed.

Each longline will be approximately 100m long from which 80 scallop bags will be suspended from. Initially, 3 of these longlines will be set up. As the spat grow larger, and stocking densities in each bag are reduced, more longlines will be phased into the project.

The afore-mentioned practise of culturing scallops in bags suspended from longlines are considered typically an extensive form of aquaculture (Nash and Kensler, 1989) with minimal direct, physical impacts on the environment. Although a large area of the sea surface are reserved for suspended longline culture, it remains an open water culture method with little to no interference of the sea bed below. In addition, human activity are limited to basic activities involving the use of a motorised raft for daily inspections of longline attachments, collection of suspended bags for grading scallops (either on-board of land based), cleaning bags (removal of biofouling normally using high pressure water jets) and restocking of scallop holding baskets. Considering that scallops are filter feeders and the aquaculture practice is based at sea, feed and chemical supplements to enhance production are rendered irrelevant and impractical.

Aquaculture Regulatory Setting

Regulatory guidelines were implemented by the government of the Republic of Namibia to act within the framework of the Environmental Assessment Policy. Regulations included in the National legislation that hold importance to aquaculture developments include:

- Pollution Control and Waste Management Bill of 1999

The Pollution and Waste Management Bill of 1999 has incorporated several Acts & Ordinances to provide protection for species diversity and other environmental resources. Various sections of relevance for the proposed aquaculture development include:

1. Air pollution
2. Water Pollution
3. Noise Pollution
4. Waste Management
5. Hazardous Substances

- Marine Resources Act of 2000

The Marine Resources Act provides for the protection of the marine ecosystem, responsible utilisation, conservation, protection and promotion of marine resources on a sustainable basis.

- Aquaculture Act of 2002

The Aquaculture Act no.18 of 2002 was indorsed to regulate aquaculture activities/developments and provide for the sustainable development of aquaculture in Namibia. Administered by the Ministry of Fisheries and Marine Resources, the Act prohibits any person or entity from engaging in aquaculture without a licence and without prior submission of an Environment Impact Assessment for a proposed aquaculture activity. Of particular importance and from a coastal zone management perspective, the provision of the Act concerns the establishment of aquaculture development zones. The Minister may impose restrictions and conditions regarding conduct of activities in these zones and no person may conduct any business other than aquaculture in such a zone without written permission.

**Potential Impacts on the Environment Posed by the Envisaged Project**

The potential impacts that the proposed project poses to the biological communities and marine ecology of Lüderitz Bay are listed below:

- Changes in ecological community structure found in Lüderitz bay as a result of the introduction of non-indigenous species, in this case *A. purperatus* that may prove invasive.

- Possible risk of altering water exchange dynamics within the Lüderitz Bay and ultimately resulting in changes of sediment characteristics of the lagoon. Culture in sub-tidal quiescent low energy areas can potentially produce a large accumulation of biodeposits and therefore have a greater localized impact on the benthos.

- Diseases and pest introduction – it is well documented in previous case studies that diseases have been transferred via movement of infected bivalve stocks and most well documented cases are related with the introduction of the Pacific Oyster, *Crassostrea gigas*.

- Driving of anchorage structures into the seabed may lead to disturbance of benthic fauna and flora.

- Noise pollution as result of daily operations at sea might redirect non-aquatic wildlife i.e. sea birds to other areas suitable for forage and breeding purposes.

- Physical pollution as a result of degradation of plastic materials used to construct scallop holding facilities.

- Introduction of artificial holding facilities to house scallops create refuge for indigenous faunal species to settle. This scenario is well manifested with the current oyster aquaculture bags currently used in Lüderitz Bay where rock lobster pueruli and a host of other aquatic organisms are observed on a daily basis during aquaculture operations. It is argued that the introduction
of artificial structures prove beneficial as these organisms would have perished anyway as a
direct result of a lack of natural structures and competition within and between species for this
resource.

Assessment and Management of Impacts

For each impact an Environmental Classification is determined based on an adapted version of the
Rapid Impact Assessment Method (Pastakia, 1998). Impacts are assessed according to the following
categories: Importance of condition (A1); Magnitude of Change (A2); Permanence (B1); Reversibility
(B2); and Cumulative Nature (B3) (see Table 1).

Ranking formulas are then calculated as follow:

Environmental Classification = A1 x A2 x (B1 + B2 + B3)

The environmental classification of impacts is provided in Table 2.

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 1  Assessment Criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Importance of condition (A1) – assessed against the spatial boundaries of human interest it will affect</td>
<td></td>
</tr>
<tr>
<td>Importance to national/international interest</td>
<td>4</td>
</tr>
<tr>
<td>Important to regional/national interest</td>
<td>3</td>
</tr>
<tr>
<td>Important to areas immediately outside the local condition</td>
<td>2</td>
</tr>
<tr>
<td>Important only to the local condition</td>
<td>1</td>
</tr>
<tr>
<td>No importance</td>
<td>0</td>
</tr>
<tr>
<td>Magnitude of change/effect (A2) – measure of scale in terms of benefit / disbenefit of an impact or condition</td>
<td></td>
</tr>
<tr>
<td>Major positive benefit</td>
<td>3</td>
</tr>
<tr>
<td>Significant improvement in status quo</td>
<td>2</td>
</tr>
<tr>
<td>Improvement in status quo</td>
<td>1</td>
</tr>
<tr>
<td>No change in status quo</td>
<td>0</td>
</tr>
<tr>
<td>Negative change in status quo</td>
<td>-1</td>
</tr>
<tr>
<td>Significant negative disbenefit or change</td>
<td>-2</td>
</tr>
<tr>
<td>Major disbenefit or change</td>
<td>-3</td>
</tr>
<tr>
<td>Permanence (B1) – defines whether the condition is permanent or temporary</td>
<td></td>
</tr>
<tr>
<td>No change/Not applicable</td>
<td>1</td>
</tr>
<tr>
<td>Temporary</td>
<td>2</td>
</tr>
<tr>
<td>Permanent</td>
<td>3</td>
</tr>
<tr>
<td>Reversibility (B2) – defines whether the condition can be changed and is a measure of the control over the condition</td>
<td></td>
</tr>
<tr>
<td>No change/Not applicable</td>
<td>1</td>
</tr>
<tr>
<td>Reversible</td>
<td>2</td>
</tr>
<tr>
<td>Irreversible</td>
<td>3</td>
</tr>
<tr>
<td>Cumulative (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 – not to be confused with the permanence criterion.</td>
<td></td>
</tr>
<tr>
<td>Light or No Cumulative Character/Not applicable</td>
<td>1</td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>---</td>
</tr>
<tr>
<td>Moderate Cumulative Character</td>
<td>2</td>
</tr>
<tr>
<td>Strong Cumulative Character</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Environmental Classification</th>
<th>Class Value</th>
<th>Description of Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>72 to 108</td>
<td>5</td>
<td>Extremely positive impact</td>
</tr>
<tr>
<td>36 to 71</td>
<td>4</td>
<td>Significantly positive impact</td>
</tr>
<tr>
<td>19 to 35</td>
<td>3</td>
<td>Moderately positive impact</td>
</tr>
<tr>
<td>10 to 18</td>
<td>2</td>
<td>Less positive impact</td>
</tr>
<tr>
<td>1 to 9</td>
<td>1</td>
<td>Reduced positive impact</td>
</tr>
<tr>
<td>0</td>
<td>-0</td>
<td>No alteration</td>
</tr>
<tr>
<td>-1 to -9</td>
<td>-1</td>
<td>Reduced negative impact</td>
</tr>
<tr>
<td>-10 to -18</td>
<td>-2</td>
<td>Less negative impact</td>
</tr>
<tr>
<td>-19 to -35</td>
<td>-3</td>
<td>Moderately negative impact</td>
</tr>
<tr>
<td>-36 to -71</td>
<td>-4</td>
<td>Significantly negative impact</td>
</tr>
<tr>
<td>-72 to -108</td>
<td>-5</td>
<td>Extremely Negative Impact</td>
</tr>
</tbody>
</table>
### Changes in ecological community structure

<table>
<thead>
<tr>
<th>Project Activity / Resource</th>
<th>Nature (Status)</th>
<th>(A1) Importance</th>
<th>(A2) Magnitude</th>
<th>(B1) Permanence</th>
<th>(B2) Reversibility</th>
<th>(B3) Cumulative Environmental Classification</th>
<th>Class Value</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction of non-native species</td>
<td><em>A. purpuratus</em> settle and proliferate in the area</td>
<td>1</td>
<td>-1</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>-7</td>
<td>-1</td>
</tr>
</tbody>
</table>

**Desired Outcome:** Minimum alteration to existing faunal community structure found in Lüderitz Bay.

**Actions**

**Prevention:**
Construction of sound holding facilities (and proper anchorage of longlines) to withstand environmental conditions.

**Mitigation:**
Routine daily/weekly inspections of longline structures and housing facilities with immediate repairs/mending when damaged structures are observed.

**Responsible Body:**
Proponent

**Data Sources and Monitoring:**
Record keeping of date of inspection with description to type/nature of damage observed on the structures and remedial action/maintenance done to mend damaged structures.
Search and retrieve as far as possible when scallop bags/holding facility are missing from longlines.
### Alteration of water exchange dynamics

<table>
<thead>
<tr>
<th>Project Activity / Resource</th>
<th>Nature (Status)</th>
<th>(A1) Importance</th>
<th>(A2) Magnitude</th>
<th>(B1) Permanence</th>
<th>(B2) Reversibility</th>
<th>(B3) Cumulative Environmental Classification</th>
<th>Class Value</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction and placement of longlines with scallop bags/holding facilities in lagoon</td>
<td>Reduced water flow at site with possible water flow diversion around longlines</td>
<td>1</td>
<td>-2</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>-14</td>
<td>-2</td>
</tr>
</tbody>
</table>

**Desired Outcome:**
Minimum alteration of water flow dynamics in area of aquaculture practice

**Actions**
Prevention:
Adhere to standard spatial placement of longlines and attachment of scallop bags to enhance water flow

Mitigation:
N/A

**Responsible Body:**
Proponent

**Data Sources and Monitoring:**
N/A
Disease and Pest Introduction.

<table>
<thead>
<tr>
<th>Project Activity / Resource</th>
<th>Nature (Status)</th>
<th>(A1) Importance</th>
<th>(A2) Magnitude</th>
<th>(B1) Permanence</th>
<th>(B2) Reversibility</th>
<th>(B3) Cumulative Environmental Classification</th>
<th>Class Value</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction of non-native species</td>
<td>Possibility of introducing pathogenic diseases</td>
<td>2</td>
<td>-2</td>
<td>3</td>
<td>3</td>
<td>-36</td>
<td>-4</td>
<td>Highly Probable</td>
</tr>
</tbody>
</table>

Desired Outcome:
Limit possibility of introducing new diseases/pests to which native species have no resistance/ability to withstand.

Actions
Prevention:
All imported scallop spat be quarantined and inspected for diseases in land-based system for a pre-specified duration.

Mitigation:
Adhere to standard practices to minimise physical handling of spat/scallops and maintain appropriate stocking densities to reduce stress.

Quarantine

Responsible Body:
Proponent to adhere to quarantine and animal handling procedures. Government institution to monitor adherence of regulation.

Data Sources and Monitoring:
Record keeping of date and place when possible disease outbreak is observed indicating actions to minimise further escalation of outbreak.
### Seabed Anchorage of Longlines

<table>
<thead>
<tr>
<th>Project Activity / Resource</th>
<th>Nature (Status)</th>
<th>(A1) Importance</th>
<th>(A2) Magnitude</th>
<th>(B1) Permanence</th>
<th>(B2) Reversibility</th>
<th>(B3) Cumulative Environmental Classification</th>
<th>Class Value</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driving longline anchors into seabed.</td>
<td>Temporary damage to habitat</td>
<td>1</td>
<td>-1</td>
<td>3</td>
<td>1</td>
<td>-7</td>
<td>-1</td>
<td>Definite</td>
</tr>
</tbody>
</table>

**Desired Outcome:**
Minimum damage to seabed.

**Actions**
Prevention:
N/A.

Mitigation:
Limit affected area of anchorage
Ensure correct position and placement of anchors to avoid redoing it.

**Responsible Body:**
Proponent

**Data Sources and Monitoring:**
N/A.
### Noise Pollution

<table>
<thead>
<tr>
<th>Project Activity / Resource</th>
<th>Nature (Status)</th>
<th>(A1) Importance</th>
<th>(A2) Magnitude</th>
<th>(B1) Permanence</th>
<th>(B2) Reversibility</th>
<th>(B3) Cumulative Environmental Classification</th>
<th>Environmental Class Value</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily maintenance and operational routines</td>
<td>Noise impacting on wildlife like birds</td>
<td>1</td>
<td>-1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>-4</td>
<td>-1</td>
</tr>
</tbody>
</table>

**Desired Outcome:**
Limit disturbance to wildlife

**Actions**
Prevention:
Routine maintenance on all machinery.

Mitigation:
N/A

**Responsible Body:**
Proponent

**Data Sources and Monitoring:**
N/A.
**Physical Pollution**

<table>
<thead>
<tr>
<th>Project Activity / Resource</th>
<th>Nature (Status)</th>
<th>(A1) Importance</th>
<th>(A2) Magnitude</th>
<th>(B1) Permanence</th>
<th>(B2) Reversibility</th>
<th>(B3) Cumulative Environmental Classification</th>
<th>Class Value</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of artificial construction materials to house scallops</td>
<td>Natural degradation of artificial construction materials over times lost to sea</td>
<td>2</td>
<td>-1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>-10</td>
<td>-2</td>
</tr>
</tbody>
</table>

**Desired Outcome:**
Limit amount of physical pollution in Lüderitz Bay.

**Actions**

**Prevention:**
Use of improved and stronger materials and technology limiting amount of biofouling and natural degradation of materials used

**Mitigation:**
Monitoring and regular clean up.

**Responsible Body:**
Proponent

**Data Sources and Monitoring:**
N/A.
### Introduction of Artificial Holding Facilities

<table>
<thead>
<tr>
<th>Project Activity / Resource</th>
<th>Nature (Status)</th>
<th>(A1) Importance</th>
<th>(A2) Magnitude</th>
<th>(B1) Permanence</th>
<th>(B2) Reversibility</th>
<th>(B3) Cumulative Environmental Classification</th>
<th>Class Value</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily maintenance and operational routines</td>
<td>Creates habitat/refuges for native species</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>63</td>
<td>4</td>
</tr>
</tbody>
</table>

**Desired Outcome:**
Enhance and maintain native faunal species composition and abundance in Lüderitz Bay.

**Actions**

**Prevention:**
Ensure diligent handling of scallop bags/holding facilities during operational activities and return aquatic organisms to sea when size grading scallops as soon as possible.

**Mitigation:**
N/A

**Responsible Body:**
Proponent

**Data Sources and Monitoring:**
N/A.
Conclusion

The culture of bivalves in general world-wide is regarded as the least invasive type of marine aquaculture. The extensive nature of culture methods used i.e. use of longlines, no artificial feeds required, open-water culture system, relative low degree of labour needed etc. mitigates the severity of the environmental impacts bivalve culture can have on the environment. Possible negative impacts listed above for the proposed scallop aquaculture venture can be successfully managed provided that adequate husbandry practices are ensured at all times. Furthermore, the promotion of the beneficial impact i.e. provision of artificial shelter that can potentially increase local biodiversity makes the proposition of scallop farming more attractive for Lüderitz Bay. The introduction of diseases remains the most important factor to consider and it strongly advised the project proponent ensures that correct quarantine measures are followed to contain possible disease outbreak. That said, proper husbandry practices, monitoring and data recording done hand-in-hand between the project proponent and the MFMR should be regarded as priority. It is understood that Beira Aquaculture is in the process of genetically testing its broodstock for pathogenic predispositions and genetic anomalies in its offspring. Should the broodstock be cleared of any such predispositions, it further reduces any possibility of “severe” disease outbreak.

References:


Appendix D: Consultants’ Curriculum Vitae
ENVIROMENTAL SCIENTIST

André Faul

André entered the environmental assessment profession at the beginning of 2013 and since then has worked on more than 120 Environmental Impact Assessments including assessments of the petroleum industry, harbour expansions, irrigation schemes, township establishment and power generation and transmission. André’s post graduate studies focussed on zoological and ecological sciences and he holds a M.Sc. in Conservation Ecology and a Ph.D. in Medical Bioscience. His expertise is in ecotoxicological related studies focussing specifically on endocrine disrupting chemicals. His Ph.D. thesis title was The Assessment of Namibian Water Resources for Endocrine Disruptors. Before joining the environmental assessment profession he worked for 12 years in the Environmental Section of the Department of Biological Sciences at the University of Namibia, first as laboratory technician and then as lecturer in biological and ecological sciences.

CURRICULUM VITAE ANDRÉ FAUL

Name of Firm : Geo Pollution Technologies (Pty) Ltd.
Name of Staff : ANDRÉ FAUL
Profession : Environmental Scientist
Years’ Experience : 17
Nationality : Namibian
Position : Environmental Scientist
Specialisation : Environmental Toxicology
Languages : Afrikaans – speaking, reading, writing – excellent
            English – speaking, reading, writing – excellent

EDUCATION AND PROFESSIONAL STATUS:

B.Sc. Zoology: University of Stellenbosch, 1999
B.Sc. (Hons.) Zoology: University of Stellenbosch, 2000
M.Sc. (Conservation Ecology): University of Stellenbosch, 2005
Ph.D. (Medical Bioscience): University of the Western Cape, 2018

First Aid Class A EMTSS, 2017
Basic Fire Fighting EMTSS, 2017

PROFESSIONAL SOCIETY AFFILIATION:

Environmental Assessment Professionals of Namibia (Environmental Assessment Practitioner and Executive Committee Member)

AREAS OF EXPERTISE:

Knowledge and expertise in:

♦ Water Sampling, Extractions and Analysis
♦ Biomonitoring and Bioassays
♦ Biodiversity Assessment
♦ Toxicology
♦ Restoration Ecology

EMPLOYMENT:

2013-Date : Geo Pollution Technologies – Environmental Scientist
2005-2012 : Lecturer, University of Namibia
2001-2004 : Laboratory Technician, University of Namibia

PUBLICATIONS:

Publications: 5 + 1 in preparation
Contract Reports: +120
Research Reports & Manuals: 5
Conference Presentations: 1
ENVIROMENTAL GEOLOGIST

Wikus Coetzer

Wikus has 4 years’ experience in environmental science related fields with 2 year experience in conducting environmental impact assessments and preparation of environmental management plans. He holds an honours degree in Environmental Sciences – Environmental Geology from the Northwest-University Potchefstroom (NWU) South Africa. He first completed a B.Sc. degree in Geology and Botany in the required time also from the Northwest University Potchefstroom, South Africa. His honours project focused on the rehabilitation and phytoremediation of various tailings types and soils.

He has working experience as an environmental monitor / assisting environmental officer at Petra Diamonds, Cullinan Diamond Mine (CDM) where he gained a proper understanding of environmental monitoring responsibilities as well as legislations, regulations and the implementation of EMS/ISO14001. He started working at Geo Pollution Technologies in 2017, and regularly conducts/assists and report on environmental impact assessments, environmental management plans and pollution surveys.

CURRICULUM VITAE WIKUS COETZER

Name of Firm: Geo Pollution Technologies (Pty) Ltd.
Name of Staff: WIKUS COETZER
Profession: Environmental Geologist
Nationality: South African
Position: Environmental Geologist
Specialisation: Environmental Geology/ Geochemistry
Languages: Afrikaans – speaking, reading, writing

EDUCATION AND PROFESSIONAL STATUS:

B.Sc. Environmental and Biological Sciences – Geology & Botany: NWU Potchefstroom 2013
B.Sc. (Hons.) Environmental Sciences – Environmental Geology: NWU Potchefstroom 2014

First Aid Class A EMTSS, 2017
Basic Fire Fighting EMTSS, 2017

AREAS OF EXPERTISE:

Knowledge and expertise in:
♦ Phytoremediation
♦ Environmental Geology / Geochemistry
♦ Environmental Monitoring
♦ Environmental Compliance
♦ Environmental Impact Assessments

EMPLOYMENT:

2017 - : Geo Pollution Technologies
2015 - 2016: Petra Diamonds CDM – Environmental monitor / Assisting environmental officer
2015: Petra Diamonds CDM – Graduate program: Environmental Officer
2014: NWU Potchefstroom department of Geo and Spatial Sciences – Research assistant

PUBLICATIONS:

Contract Reports: +20