APP-00651

LÜDERITZ MARICULTURE (PTY) LTD

OPERATIONS OF AN EXISTING OYSTER MARICULTURE FARM AND THE PROPOSED INTRODUCTION OF A NON-NATIVE SCALLOP FOR MARICULTURE PURPOSES AT LÜDERITZ

ENVIRONMENTAL ASSESSMENT SCOPING REPORT

Assessed by:

Assessed for:

Lüderitz Mariculture (Pty) Ltd

February 2020

Project:	**LÜDERITZ MARICULTURE (PTY) LTD: OPERATIONS OF AN EXISTING OYSTER MARICULTURE FARM AND THE PROPOSED INTRODUCTION OF A NON-NATIVE SCALLOP FOR MARICULTURE PURPOSES AT LÜDERITZ: ENVIRONMENTAL ASSESSMENT SCOPING REPORT**	
Report: **Version/Date:**	Final February 2020	
Prepared for: **(Proponent)**	Lüderitz Mariculture (Pty) Ltd P.O. Box 576 Luderitz Namibia	
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Report Approval	 **André Faul** Conservation Ecologist	

I, Jason Burgess, acting as the Proponent's representative (Lüderitz 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 Luderitz on the 25th day of February 2019/2020

Lüderitz Mariculture (Pty) Ltd

91/363
Company Registration / ID

EXECUTIVE SUMMARY

Lüderitz Mariculture (Pty) Ltd requested Geo Pollution Technologies (Pty) Ltd to undertake an environmental assessment for their existing oyster and proposed scallop mariculture operations situated along Radford Bay at Lüderitz. On land the facility currently hosts a processing and handling shed, a wet storage room, a tea room and ablution facilities. Offshore a wooden jetty, floating long lines and wooden rafts are present for installation of grow out baskets and lantern nets with oysters and scallops.

The environmental assessment is conducted to determine all environmental, safety, health and socio-economic impacts associated with the current and proposed operations of the 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 facility is located outside of Lüderitz, remote from any other developments. 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 play a role in providing a much needed contribution to employment and the 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. 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. The EMP 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

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

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

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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
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
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.

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

1 BACKGROUND AND INTRODUCTION

Geo Pollution Technologies (Pty) Ltd was appointed by Lüderitz Mariculture (Pty) Ltd (the Proponent) to undertake an environmental assessment for the operations of an existing Pacific Oyster (*Crassostrea gigas)* mariculture farm, and the proposed introduction of the non-native Peruvian Scallop (*Argopecten purpuratus)* for mariculture purposes, at Lüderitz. Mariculture takes place offshore in Lüderitz Harbour, while processing and packaging are land-based (Figure 1). In brief, current and proposed future operations of Lüderitz Mariculture involves:

- Offshore installation of floating long lines
- Land-based stocking of grow-out baskets with oyster spat and lantern nets with scallop spat
- Fixing grow-out baskets and lantern nets to the floating long lines as well as to existing wooden rafts
- Collecting grow-out baskets and lantern nets from floating long lines and rafts
- Sizing and sorting of oysters and scallops according to different size classes and returning undersized individuals to the offshore farming area
- Cleaning the oyster and scallop shells in preparation of packaging
- Transporting packed oysters (live) and scallops (frozen) to various markets
- 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 current and potential future 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. The mariculture industry will diversify and become more resilient by expanding operations to include scallops. This will also open up new markets for Namibian exports. Lüderitz Mariculture contributes to employment and development in Lüderitz and will contribute even more so should scallop mariculture realise. Benefits of the mariculture farm include:

- Economic development, diversification and resilience in Lüderitz,
- Contribution to the economy and export trade of Namibia,
- Employment, training and skills development.

2 SCOPE

The scope of the environmental assessment is to:

1. Determine the potential environmental impacts emanating from the operational, maintenance and decommissioning activities of the farm,
2. Identify a range of management actions which could mitigate the potential adverse impacts to acceptable levels,
3. Comply with Namibia's Environmental Management Act (2007),
4. Provide sufficient information to the Ministry of Environment and Tourism to make an informed decision regarding the operational, maintenance and decommissioning activities of the farm.

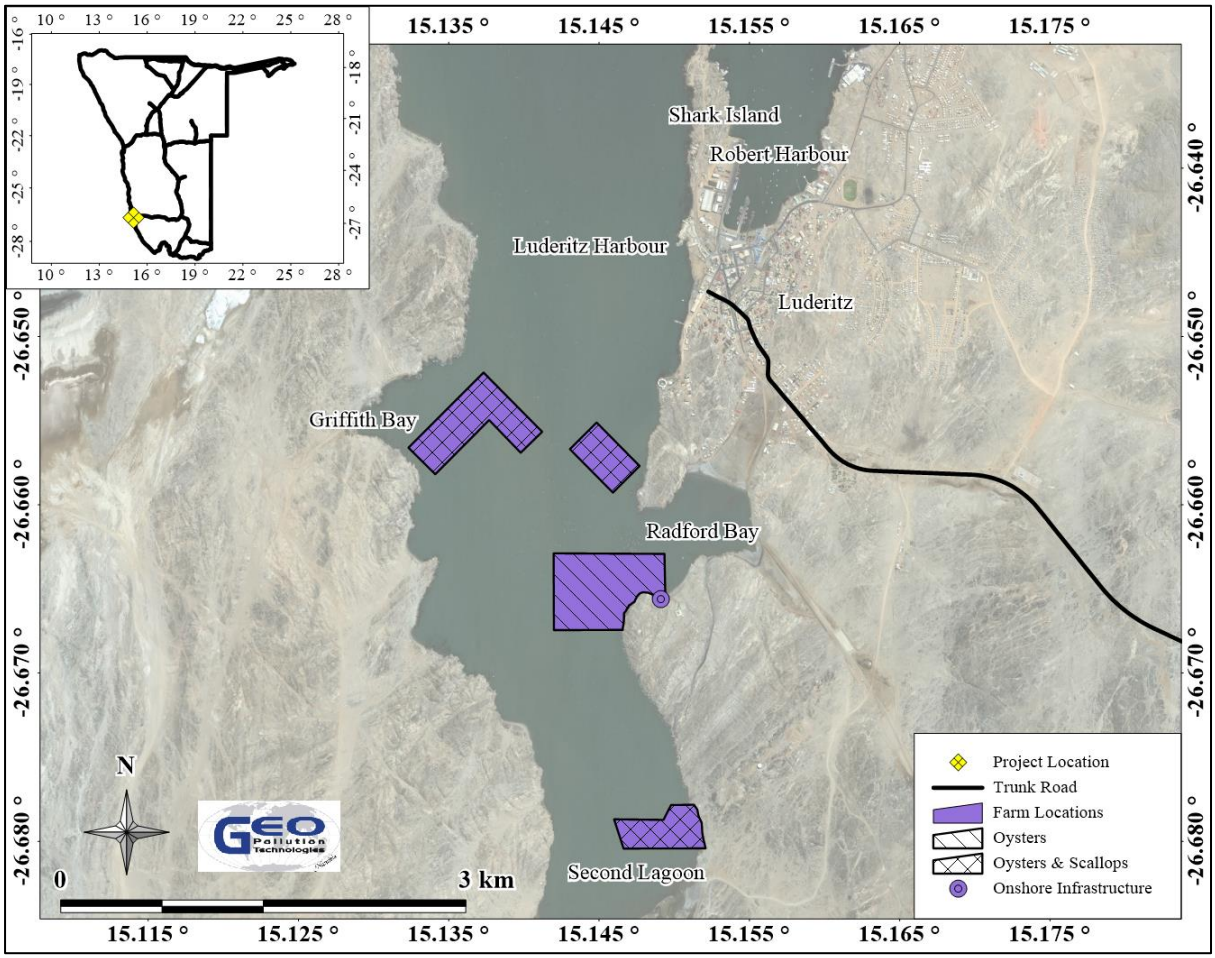


Figure 1. Project location

3 METHODOLOGY

The following methods were used to investigate the potential impacts on the social and natural environment due to the current and proposed operations of Lüderitz Mariculture:

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.
4. Possible enhancement measures are listed for positive impacts while mitigation / preventative measures will be provided for negative impacts.
5. As per the findings of this assessment, an environmental management plan (EMP) was incorporated into this report to be submitted to the Ministry of Environment and Tourism.

4 FACILITY OPERATIONS AND RELATED ACTIVITIES

Lüderitz Mariculture was registered as a company in Namibia in 1991 and has a licence to conduct mariculture of oysters (*C. gigas*) (Appendix A). Mariculture trials and operations have thus been ongoing for 27 years. Offshore they have four dedicated farms for mariculture purposes (Figure 1). A property neighbouring the western fringe of Radford Bay was previously acquired from the Municipality of Lüderitz for their land-based activities.

4.1 CURRENT OFFSHORE OPERATIONS

Currently, Lüderitz Mariculture only cultures Pacific Oysters. The life cycle of these oysters are indicated in Figure 2. Oyster larvae, known as spat once they attach to a substrate, are mainly obtained from Beira Aquaculture in Swakopmund, who currently has the only hatchery in Namibia. This supply is also augmented from international suppliers with the necessary approval and documentation like phytosanitary certificates. The spat is placed in small wooden baskets with polyethylene netting (Photo 1 and Photo 2) and is attached to shallow long lines in the shallowest part of their farm in Radford Bay (Photo 3). The long lines are ropes anchored at both ends with concrete blocks (Photo 4) and kept afloat by buoys or plastic drums of various sizes. As the oysters grow, they are moved to bigger baskets and to deeper water with deep long lines (Photo 5 and Photo 6) until they are ready for marketing. Currently Lüderitz Mariculture also has a number of floating rafts in the deeper section of the farm to which baskets are attached (Photo 7 and Photo 8). However, these are gradually being replaced by long lines.

Oysters are filter feeders that feed mainly on microscopic phytoplankton (generally referred to only as plankton). This diet consists mainly of algae and oysters filter approximately 50 litres of water per day to obtain enough food. Oysters feed only on naturally occurring plankton within the marine waters where they are cultured and no artificial feed is required.

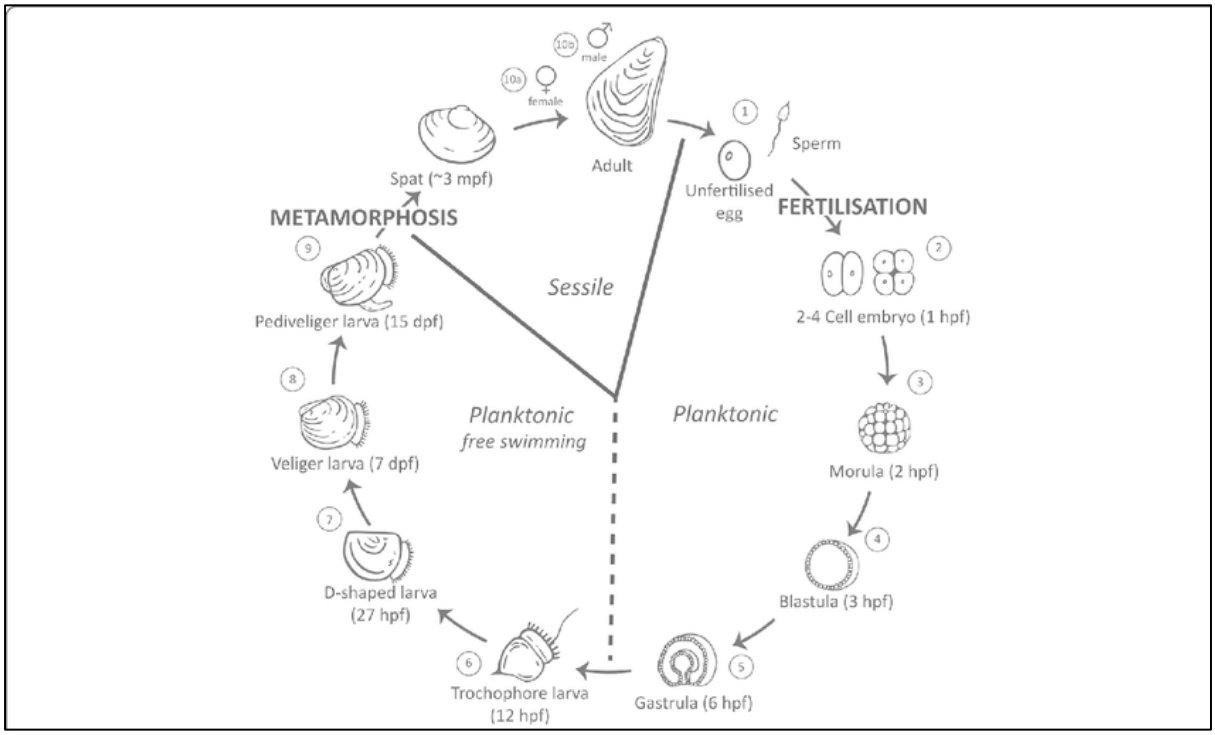


Figure 2. Life cycle of the Pacific Oyster (from Vogeler et al. 2016)

Photo 1. Open wooden basket with oyster spat

Photo 2. Oyster spat

Photo 3. Shallow long lines

Photo 4. Anchor blocks

Photo 5. Larger basket

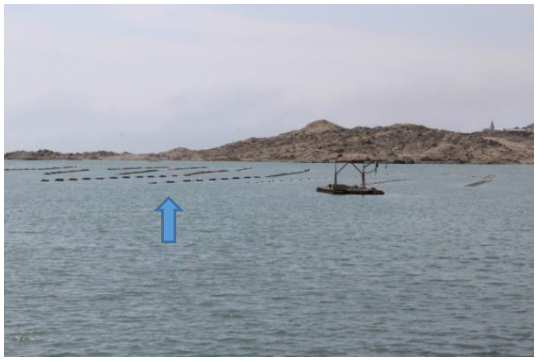


Photo 6. Deep long lines

Photo 7. Wooden rafts and jetty

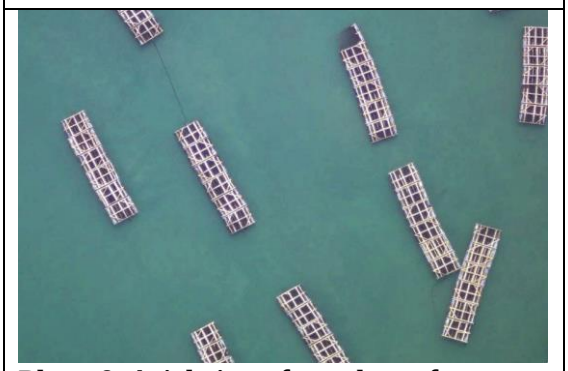


Photo 8. Arial view of wooden rafts

4.2 CURRENT ONSHORE INFRASTRUCTURE AND OPERATIONS

Current onshore operations can be divided into two main activities. These are the handling of re-growers, and their return to the ocean, and the handling of marketable oysters. In both instances the first step is to retrieve the baskets from the ocean and then to pressure wash them to get rid

of the majority of biofouling. Washing is done with seawater pumped from the nearby seawater intake.

4.2.1 Re-grower Handling

Once the spat reached a certain size, the baskets are removed from the water by motorised craft, usually small motor boats, and the spat is transferred to bigger baskets which are then moved to long lines in deeper water (Photo 9). At this stage oysters are referred to as re-growers. This process of transferring to bigger baskets is repeated as re-growers increase in size. This allow for suitably sized baskets for specific sized oysters in order to prevent overstocking. On land, re-grower baskets are pressure washed with seawater to get rid of most of the biofouling. Oysters do not all grow at the same speed, thus they are sorted according to different size classes using vibrating graders (Photo 10). Same sized oysters can then be moved to new bigger baskets (grow-out baskets) and placed in deeper water until they reach a marketable size. Oysters in baskets awaiting processing, or return to the ocean, are kept alive in concrete wet storage tanks (holding tanks) (Photo 11) that is filled with seawater by means of a flow through system. Water for this purpose is abstracted from the ocean (Photo 12) and by having a flow through system, the plankton in the tanks are continuously replenished to allow oysters to continue feeding. No artificial feed or chemicals are added to the water. Blowers are present to continuously aerate the tanks to ensure sufficient oxygen.

Photo 9. Workers transfering oysters to bigger baskets and basket repairs

Photo 10. Vibrating grader

Photo 11. Wet storage tanks

Photo 12. Seawater supply system with sand filter

4.2.2 Marketable Oyster Handling

After pressure washing of baskets containing marketable sized oysters, the oysters are cleaned by hand of any remaining biofouling. Oysters are then sorted and weighed using a special grading machine. Oysters grouped according to size are then moved to the wet storage tanks where they are kept alive until packaging can commence. During this period, the oysters do not receive any food, ensuring that their intestines are clean when shipped. This allows for provision of high quality oysters. To achieve this, before filling the tanks, abstracted seawater

first move through a sand filter (Photo 12) and then through a skimmer (Photo 14) to remove as much plankton and other particulate matter as possible. Water in these wet storage tanks is not continually replaced as is the case with the flow through system for re-growers, but rather recirculated.

Oysters can stay alive outside of water for up to a week or more as long as they are kept cold and moist. Oysters ready to be shipped are packed in plastic crates or bins and then transported in refrigerated trucks (one five ton and one eight ton) to Johannesburg, South Africa, for export via the Oliver Tambo International Airport.

Photo 13. Grader and weighing machine

Photo 14. Skimmer

4.2.3 Existing Infrastructure

The following is a list of infrastructure on site (Figure 3):

- Shed where the main handling and processing of oysters takes place (Photo 15)
- Wet storage room with skimmer, water reticulation and blowers (Photo 16)
- Office
- Ablution block with separate toilets and showers for male and female employees (Photo 17)
- Tea room with change room, toilets and showers (Photo 17)
- Concrete septic tank of 15,000 litres (Photo 18)
- Wooden jetty and wooden platforms for pressure washing and seawater intake (Photo 7)
- Plastic water tank for seawater supply system (Photo 12)
- Perimeter fence

4.2.4 Planned and Proposed Activities

The mariculture industry of Lüderitz proposes to initiate the culturing of scallops for export purposes. The scallop of choice is the non-native Peruvian Scallop *A. purpuratus* which is harvested extensively from their natural habitat in the coastal waters of Peru and Chili (Photo 19).

Culturing of scallops will more or less follow the same procedure as with oysters. Spat will be obtained from Beira Aquaculture in Swakopmund. The main difference is that the spat will be placed in lantern nets (Photo 20) and not in the baskets used for oysters. Scallops are also filter feeders and will rely on the naturally occurring plankton in the ocean for their diet.

Marketable scallops will be collected at sea by a motorised craft. Scallops will be sorted and cleaned at sea and only the scallops ready for export will be returned to shore. Scallops are exported frozen and packaging and freezing will take place in a scallop processing facility that is proposed to be constructed by Southern Breeze Aquaculture in Lüderitz.

The mariculture industry sent 165 individuals of the scallop brood stock of Swakopmund to a South African laboratory for vetting. These scallops undergo genetic analysis through the polymerase chain reaction (PCR) method in order to determine if they have any predispositions for pathogens or have fatal genetic flaws. Should no predispositions or flaws be detected, the brood stock will be cleared for hatchery and spat supply purposes. If not

cleared, brood stock will be obtained from international suppliers. These will then be placed in quarantine facilities and allowed to breed. Only second generation offspring will then be considered for brood stock for mariculture purposes. No additional onsite infrastructure is proposed for scallop culturing. However, additional long lines will be installed at sea.

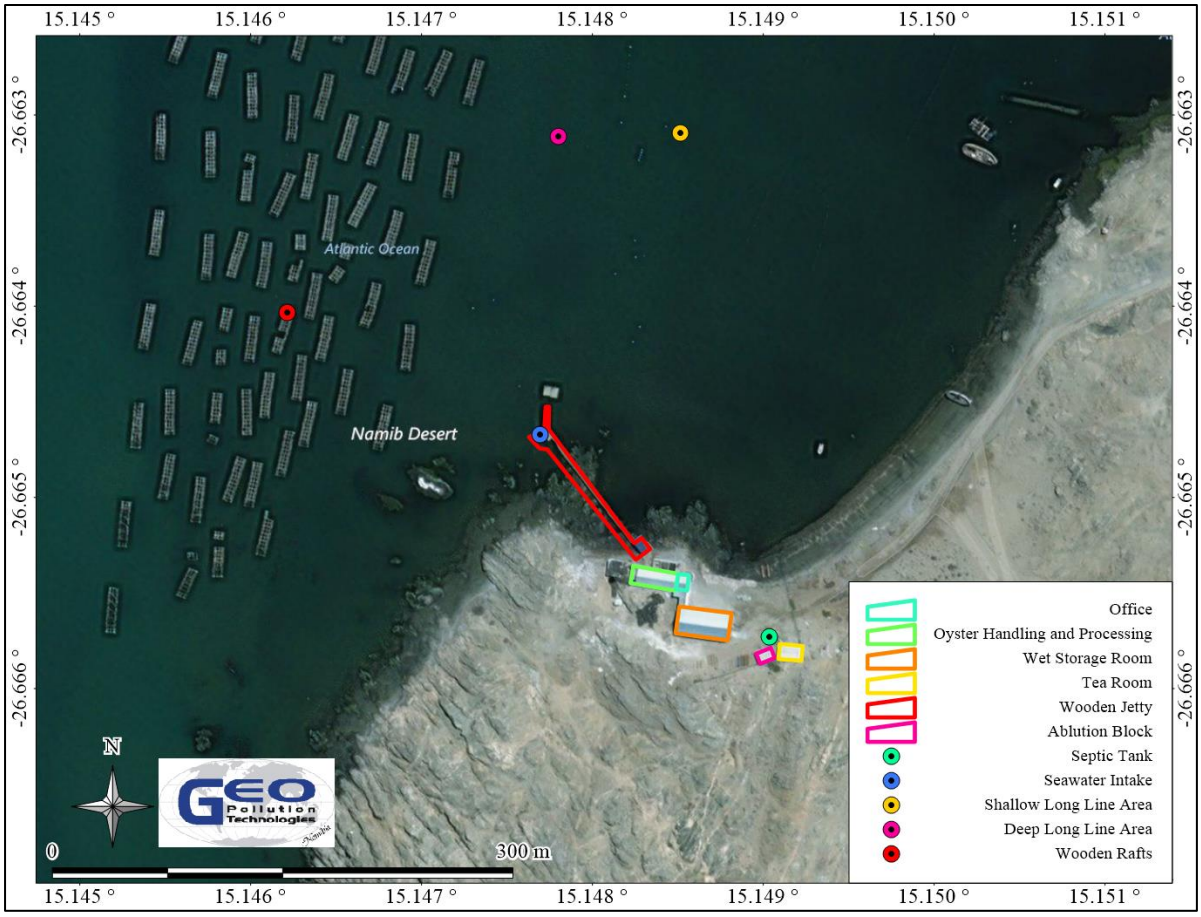


Figure 3. Site layout

Photo 15. Shed

Photo 16. Wet storage room

Photo 17. Ablution block (right) and tea room (left)

Photo 18. Septic tank

Photo 19. Peruvian Scallop

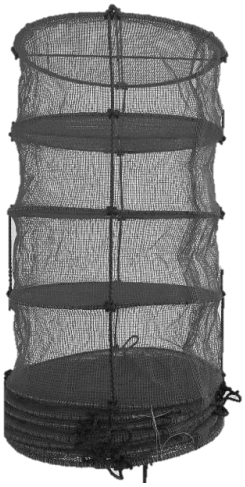


Photo 20. Lantern net

4.2.5 General Activities

Employment is offered to 26 Namibian citizens. Apart from the oyster handling activities a large part of the operations include repairs and maintenance on the various grow-out baskets, buoys, rafts, etc. Baskets are also periodically left in the sun to completely dry in order to easily get rid of biofouling. Lüderitz Mariculture is continuously investigating new technologies and methods, especially in terms of the type of baskets used. With previous mariculture activities of kelp in the Lüderitz area, a lot of plastic waste were produced as a result of pieces breaking of or coming loose (Photo 22). These washed up on the shores of the coastline and islands, and remnants of these can still be seen on beaches today. Lüderitz Mariculture implemented the use of baskets, and methods to tie them to long lines (Photo 23), with less risk of breaking off or polluting the environment. Doing this, they are recycling old redundant baskets to produce new better quality baskets.

Waste removal is performed by the municipality while Lüderitz Mariculture pumps the sewage from the septic tank into a tanker for disposal at the municipal sewage treatment plant. A limited amount of biological waste (offal), in the form of dead oysters and biofouling is produced. Currently these are returned to the ocean and it attracts a wide variety and large numbers of birds which feed in the shallow waters and coastline nearby (Photo 21). Among the birds are numerous African Black Oystercatchers (*Haematopus moquini*), an 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. Photo 21 shows a large number of Black Oyster Catchers feeding together, a sight not often seen elsewhere.

In addition to birds being attracted to the shoreline, a number of birds also perch on the wooden rafts where they feed on mussels attached to it. 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.

General administrative office activities and cleaning of the premises takes place on a daily basis. Regular beach clean-ups are also performed by the staff of Lüderitz Mariculture and this is not restricted only to the vicinity of their facility, but also as far away as agate beach on the opposite side of the town.

Photo 21. Birds attracted by biological offal

5 ALTERNATIVES

The facility is an existing operation with existing mariculture permits. The offshore locations for mariculture were assigned by the Ministry of Fisheries and Marine Resources and no alternative location is proposed. Lüderitz Mariculture is continuously investigating better equipment and methods (Table 1). From an environmental perspective the environmental assessment could not determine any fatal flaw which would prevent the expansion and operations at this facility, on condition that the facility will comply with all relevant Namibian standards or better, as prescribed by Namibian legislation.

Table 1. Alternative Comparison Table

Alternative Description	Advantages	Disadvantages	Preferred Alternative
Mussel culturing	♦ Fast growing ♦ Resilient to environmental stressors	♦ Lower value product thus requiring much larger scale of production to break even. ♦ Requires longer periods to rid themselves of PSP and DSP	♦ Combination of oysters and scallops will increase resilience in the mariculture industry
Oyster culturing	♦ High value product ♦ Purge themselves of PSP and DSP relatively quickly ♦ Lots of experience in culturing oysters in Namibian waters	♦ More susceptible to environmental stressors ♦ Large scale die off means huge financial losses ♦ Must transport and ship alive	
Scallop culturing	♦ High value product ♦ Fast production time due to rapid growth ♦ Transported frozen	♦ New venture with limited information available	
Old grow-out baskets	♦ Already have a lot of stock	♦ Lower quality baskets that continuously need repair	

Alternative Description	Advantages	Disadvantages	Preferred Alternative
	♦ No need for additional expense in buying new baskets	♦ More frequent losses of oysters from long lines	♦ New baskets ensure less losses which in turn counter the extra costs
New grow-out baskets	♦ Stronger, high quality baskets ♦ Partially made from old baskets, thus recycling what would have been waste ♦ Less oyster losses	♦ Additional expense	
Old methods of attaching baskets to long lines	♦ Less expensive	♦ More basket losses incurred also resulting in pollution of the environment	♦ New methods ensure less losses which in turn counter the extra costs with the added benefit of less potential pollution
New methods of attaching baskets to long lines using aluminium crimps and plastic hooks	♦ Less losses and pollution	♦ More expensive	

Photo 22. Waste from old methods

Photo 23. New and more reliable crimping method of attaching baskets to long lines

6 ADMINISTRATIVE, LEGAL AND POLICY REQUIREMENTS

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

Law	Key Aspects
The Namibian Constitution	♦ Promote the welfare of people ♦ Incorporates a high level of environmental protection ♦ Incorporates international agreements as part of Namibian law.
Environmental Management Act Act No. 7 of 2007, Government Notice No. 232 of 2007	♦ 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.
Environmental Management Act Regulations Government Notice No. 28-30 of 2012	♦ Commencement of the Environmental Management Act ♦ List activities that requires an environmental clearance certificate ♦ Provide Environmental Impact Assessment Regulations.
The Water Act Act No. 54 of 1956	♦ 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.
Water Resources Management Act Act No. 11 of 2013	♦ Provide for management, protection, development, use and conservation of water resources ♦ Prevention of water pollution and assignment of liability ♦ Not in force yet.
Marine Resources Act Act No. 27 of 2000	♦ 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.
Aquaculture Act Act No. 18 of 2002	♦ Regulates aquaculture activities to ensure sustainable development ♦ Provides for water quality monitoring to protect aquaculture activities.

Law	Key Aspects
Animal Health Act Act No. 1 of 2011	♦ Provide for the prevention, detection and control of animal disease ♦ Provide for the maintenance and improvement of animal health ♦ Regulates the importation and exportation of animals, animal products and restricted material into Namibia
Local Authorities Act Act No. 23 of 1992, Government Notice No. 116 of 1992	♦ Define the powers, duties and functions of local authority councils ♦ Regulates discharges into sewers.
The Namibian Ports Authority Act Act No. 2 of 1994	♦ Provide for the establishment of the Namibian Ports Authority and its functions ♦ Responsible to protect the environment within its areas of jurisdiction.
Public Health Act Act No. 36 of 1919	♦ Provides for the protection of health of all people.
Public and Environmental Health Act Act No. 1 of 2015, Government Notice No. 86 of 2015	♦ Provides a framework for a structured more uniform public and environmental health system, and for incidental matters ♦ Deals with Integrated Waste Management including waste collection disposal and recycling; waste generation and storage; and sanitation.
Labour Act Act No 11 of 2007, Government Notice No. 236 of 2007	♦ Provides for Labour Law and the protection and safety of employees ♦ Labour Act, 1992: Regulations relating to the health and safety of employees at work (Government Notice No. 156 of 1997).
Pollution Control and Waste Management Bill (draft document)	♦ Not in force yet ♦ Provides for prevention and control of pollution and waste ♦ Provides for procedures to be followed for licence applications.
Prevention and Combating of Pollution of the Sea by Oil Amendment Act (No. 24 of 1991)	♦ Amends the Prevention and Combating of Pollution of the Sea by Oil Act of 1981 to be more relevant to Namibia after independence.
Road Traffic and Transport Act **Act No. 52 of 1999 Government Notice No 282 of 1999**	♦ Provides for the control of traffic on public roads and the regulations pertaining to road transport.
Road Traffic and Transport Regulations **Government Notice No 53 of 2001**	♦ Prohibits the transport of goods which are not safely contained within the body of the vehicle; or securely fastened to that vehicle, and which are not properly protected from being dislodged or spilled from that vehicle.

Table 3. Relevant Multilateral Environmental Agreements for Namibia

Agreement	Key Aspects
Stockholm Declaration on the Human Environment, Stockholm 1972	♦ 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.
United Nations Framework Convention on Climate Change (UNFCCC)	♦ The Convention recognises that developing countries should be accorded appropriate assistance to enable them to fulfil the terms of the Convention.
Convention on Biological Diversity, Rio de Janeiro, 1992	♦ Under article 14 of The Convention, EIAs must be conducted for projects that may negatively affect biological diversity.
Benguela Current Convention of 2013	♦ 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.
Abidjan Convention of 1981	♦ The Convention for Cooperation in the Protection, Management and Development of the Marine and Coastal Environment of the Atlantic Coast of the West, Central and Southern Africa Region ♦ Provides an overarching legal framework for all marine-related programmes in West, Central and Southern Africa.
National Marine Pollution Contingency Plan of 2017	♦ Coordinated and integrated national system for dealing with oil spills in Namibian waters.

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, 8, 9 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.” (Lüderitz Mariculture’s 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)

Lüderitz Mariculture has an aquaculture licence issued in 2005 and valid until 2020 for their mariculture farms in Lüderitz (Appendix A).

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 onshore processing facility is situated on the southern shore of the entrance to Radford Bay (26.665582°S, 15.148890°E). It is zoned for special land use. The four farms are located in the Lüderitz Harbour (Farms 7 and 14), at the entrance to Radford Bay (Farm 8) and in the southern end of Lüderitz Harbour near Second Lagoon (Farm 20) (Figure 1). All land surrounding the onshore infrastructure is municipal land while Lüderitz Harbour is to the west. Beyond the townlands is the Tsau // Khaeb (Sperrgebiet) National Park. The rocky shore forms part of the Namibian Islands Marine Protected Area. The only built infrastructure nearby is the ruins of the old Angra Club, also property of the municipality. There are no heritage or cultural sites located within the project area. However, some built-up areas in Lüderitz town is considered to be of heritage value requiring protection (SPC 2015).

Implications and Impacts

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

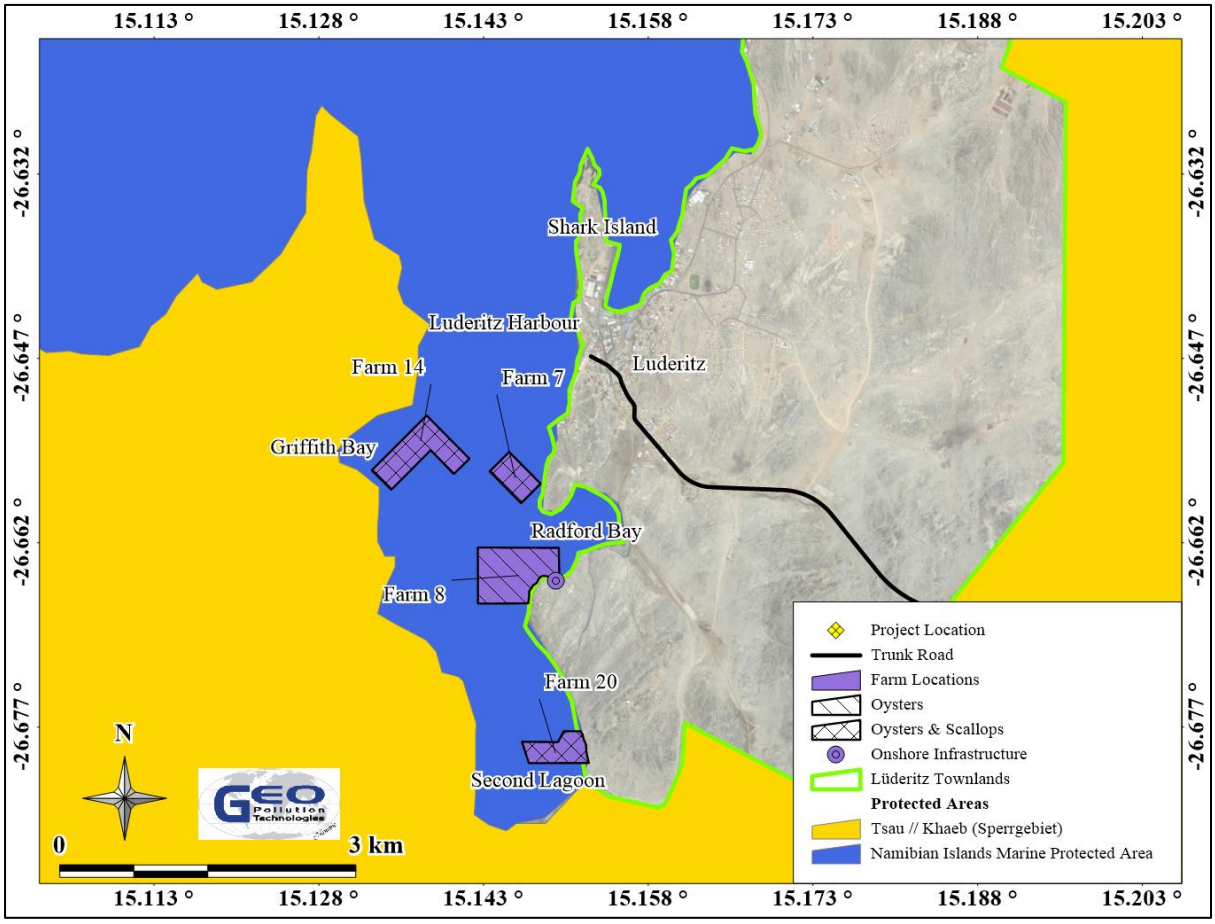


Figure 4. Surrounding Land Use

Photo 24. Undeveloped land surrounding the property

Photo 25. Ruins of the Angra Club

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.

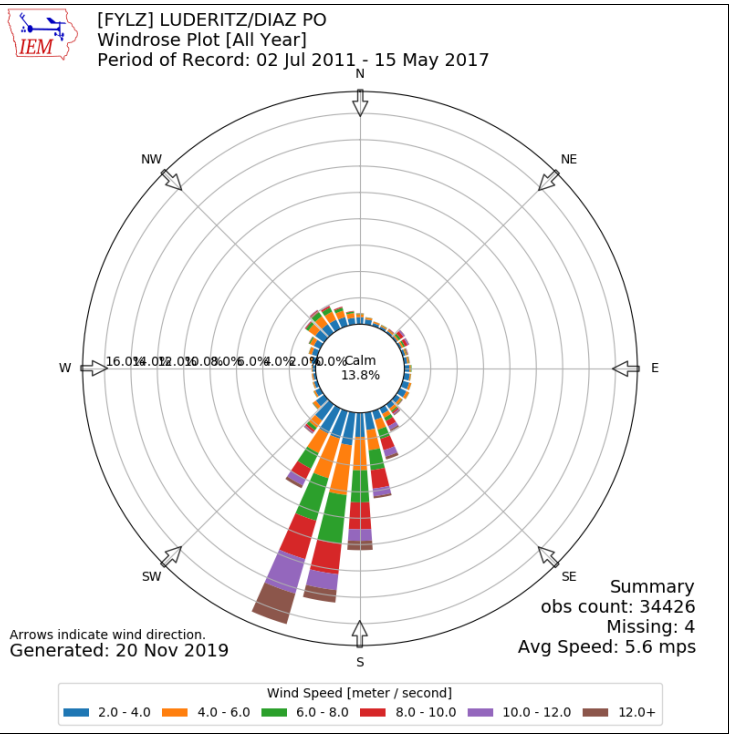
Namibia is situated within an anti-cyclone belt of the southern hemisphere. Winds generated from the high-pressure cell over the Atlantic Ocean blow from a southerly direction when they reach the Namibian coastline. As the Namibian interior is warm (particularly in summer), localised low-pressure systems 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 on average less than 50 mm per annum. However, occasional cloud bursts 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 farms should not be negatively affected by the typical weather experienced in Lüderitz, but infrastructure damage may occur if a cloudburst occurs. Although 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)

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

Wind rose for the period 2 Jul 2011 to 15 May 2017 for the Lüderitz Airport (http://mesonet.agron.iastate.edu/)	

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_2S) from the ocean is expected to contribute to corrosion (see Table 5 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)

	Pretoria CSIR	**Durban Bay**	**Cape Town Docks**	**Durban Bluff**	**Walvis Bay**	**Sasolburg**
Environment						
Location Type	Rural, Very Low Pollution	Marine, Moderate Pollution	Marine, Moderate Pollution	Severe Marine, Moderate or Low Pollution	Severe Marine, Low Pollution	Industrial High Pollution
SO_2 Range µg/m^3	6-20	10-55	19-39	10-47	NA	NA
Fog Days/year	NA	NA	NA	NA	113.2	NA
Avg. Rainfall (mm/year)	146	1,018	508	1,018	8	677
Relative Humidity Range %	26-76	54-84	52-90	54-84	69-96	49-74
Temp. Range °C	6-26	16-27	9-25	16-27	10-20	5-20
Unpainted Galvanized	5-15	3-5	3-7	3-5	0.6-2	5.-15

Steel Life, Years						
	Annual Corrosion Rate (mm/year)					
Stainless Steel						
Type 316	0.000025	0.000025	0.000025	0.000279	0.000102	NA
Type 304	0.000025	0.000076	0.000127	0.000406	0.000102	NA
Type 430	0.000025	0.000406	0.000381	0.001727	0.000559	0.000107
Aluminium Alloys						
AA 93103	0.00028	0.00546	0.00424	0.01946	0.00457	0.00281
AA 95251	0.00033	0.00353	0.00371	0.01676	0.00417	NA
AA 96063	0.0028	0.00315	0.00366	0.020	0.00495	NA
AA 96082	0.00033	0.00366	0.0034	0.02761	0.00587	NA
AA 85151	NA	NA	NA	0.0246	0.00375	0.00317
Copper	0.00559	0.0094	0.00711	0.0246	0.0384	0.014
Zinc	0.0033	0.0231	0.029	0.111	NA	0.0152
Weathering Steel	0.0229	0.212	0.0914	0.810	1.150	0.107
Mild Steel	0.0432	0.371	0.257	2.190	0.846	0.150

Implications and Impacts

Corrosion levels may be high and must be kept in mind when planning the maintenance of the facility and related 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 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). These islands may be regarded as barrier islands which offers some protection to the coastline at Lüderitz. The area between the islands and the mainland has a shallow basin. Deeper water is present at the entrance to Lüderitz Harbour which gradually becomes shallower towards the southern end where Radford Bay and the Second Lagoon is located.

The project area has mostly been levelled to allow for construction and operations. The immediate surroundings have an uneven terrain. Surface drainage is poorly developed in the area due to the minimal amount of precipitation that occurs. Any surface flow at the onshore facility is towards the north and west into Lüderitz Harbour.

Implications and Impacts

Any pollutants that are not contained and are transported via surface water flow will be transported out of the site and towards the ocean.

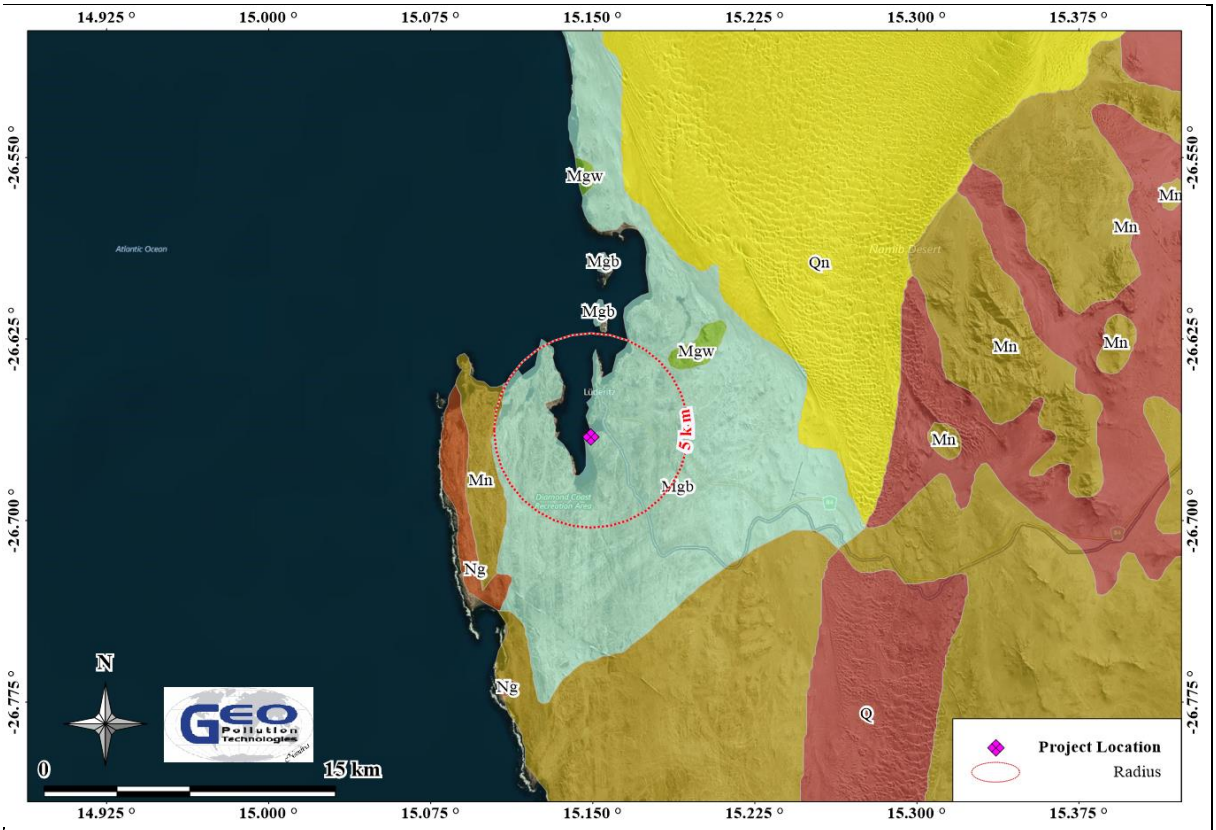
The mainland is sheltered from open ocean wave action and deposition and erosion processes associated with longshore drift. The rocky coastline restricts the dynamic shoreline processes which are more prevalent along sandy shores.

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 5). 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 was 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 the project area. No known boreholes are present within the immediate surroundings of Lüderitz.



LITHCODE	ROCKTYPES	REMARKS	AGE	FORMATION	COMPLEX	GROUP
Qn	Sand sea of the Namib Desert		Quaternary			Namib
Q	Alluvium, sand, gravel, calcrete		Quaternary			
Mgb	Pre- to syntectonic biotite-rich augen gneiss		Mokolian		Namaqua	
Mgw	Syn- to post-tectonic gneissic granite, granite, pegmatite		Mokolian		Namaqua	
Mn	Undifferentiated metamorphic/intrusive rocks of the Namaqua Complex		Mokolian	DOORNPOORT/ESKADRON	Namaqua	
Ng	Dolomite, shale, schist, greenschist, ortho-/para-amphibolite, quartzite, intraformational and basal mixtite, grit		Namibian		Gariep	

Figure 5. Geology Map

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 2017/2018 the actual volume of water sold by NamWater was 1,021,442 m^3. The potential supply of the scheme is 1,460,000 m^3. Based on the initial water use records of the period April to October 2018 there does not seem to be an increase in the demand for potable water. The average monthly water use for this period is 86,131 m^3

compared to 86,678 m^3 for the same period in 2017. Thus, based on NamWater estimates there is currently a surplus of 438,558 m^3 of potable water.

Implications and Impacts

The facility 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 Lüderitz 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 and invertebrate diversity (CEPF, 2005). Lüderitz Mariculture, and Lüderitz as a whole, are located in the Lüderitz Peninsula vegetation zone (Figure 6), but due to the towns 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 6) (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).

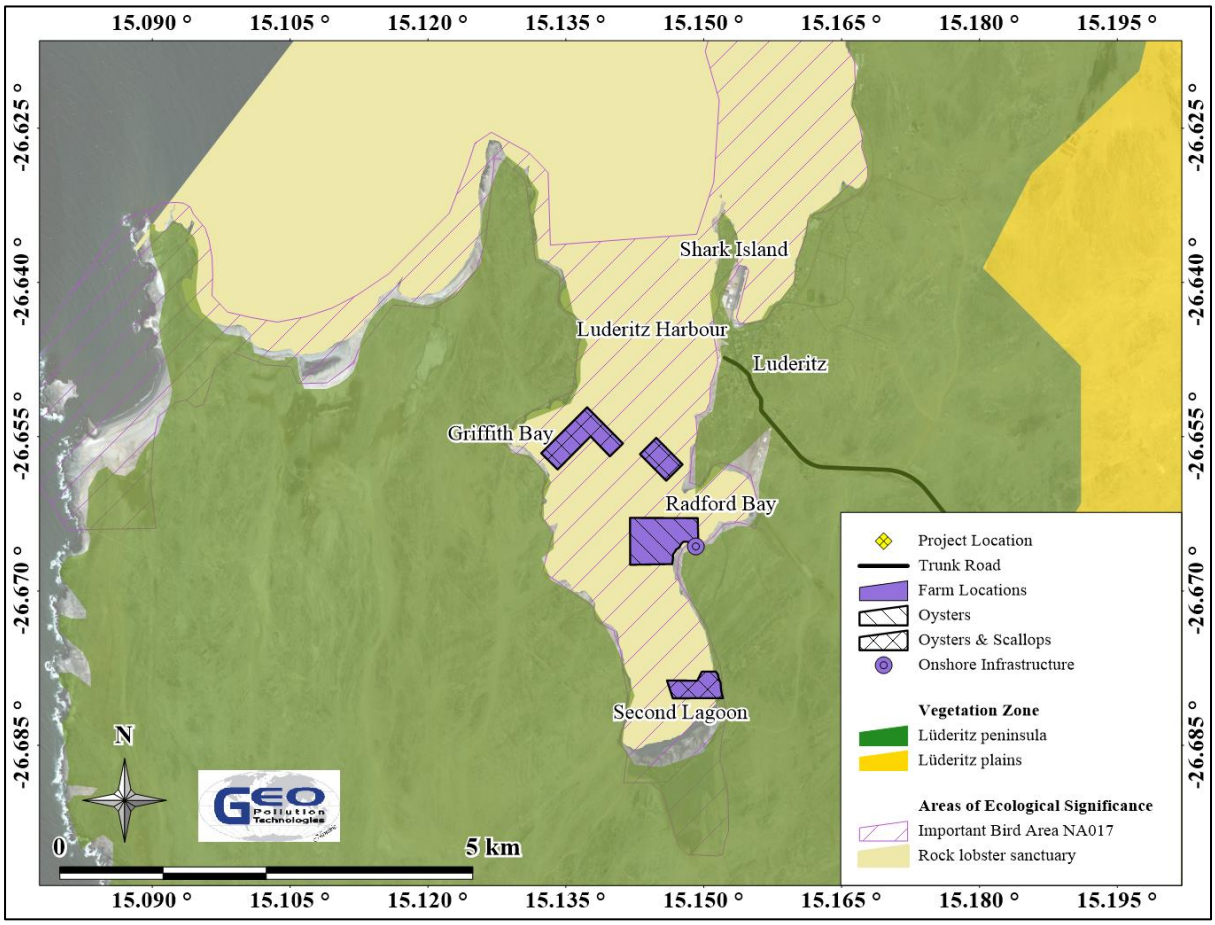


Figure 6. Vegetation zones and areas of ecological significance

Implications and Impacts

Lüderitz Mariculture is an existing business with existing land-based infrastructure. No additional impact is thus expected on terrestrial ecology. The presence of the mariculture farm creates foraging ground for birds. Bright lighting may negatively affects 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.

In the vicinity of the proposed development 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 algae (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 6) and falls within the Namibian Islands Marine Protected Area (Figure 4).

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 includes migratory, resident and semi-resident species.

Implications and Impacts

The presence of the mariculture farm creates extra habitat for marine species. The possibility of entanglement of larger marine species with the long lines exist. Entrapment of species at the seawater intake can occur. 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 and Lüderitz Mariculture is one of the major role players in this sector. 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. 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)

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

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

Implications and Impacts

The facility currently provides employment to 26 full time employees in the area, this will increase if scallop culturing realise. Some skills development and training benefit employees during the operational phase.

Sustained and increased employment opportunities (due to the proposed scallop mariculture) have a positive impact on Lüderitz. Additional introduction of scallops will result in an increase in revenue generation for Lüderitz as well as Namibia in general. The project therefore has a positive contribution to demographic and economic aspects of Lüderitz.

7.10 CULTURAL, HERITAGE AND ARCHAEOLOGICAL ASPECTS

There are no churches, mosques or related buildings and no known archaeological resources or other structures, sites or spheres of heritage of cultural significance near the mariculture farm. However 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 September 2019. A site notice was placed at the onshore processing plant. The Lüderitz Town Council, Ministry of Fisheries and Marine Resources and various stakeholders and potential interested and affected parties were also notified. A public meeting was conducted on 26 September 2019 at the Ministry of Fisheries in Lüderitz. See Appendix B for proof of the public participation processes. Concerns raised related to plastic (and other) pollution resulting from

mariculture activities as well as the potential negative impacts associated with the introduction of a non-native species. These are addressed in section 10 and in Appendix C.

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

Lüderitz Mariculture provide direct employment to an estimated 26 employees. An increase in employment will take place should mariculture of scallops realise. The farm thereby contribute to employment and economic sustainability and development in Lüderitz. Some training and skills development take place. True value addition and contribution to the Namibian economy are achieved by processing and packaging oysters and scallops in Lüderitz 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 are present on site and 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 is possible although not currently a threat.

9.3 WASTE PRODUCTION

Waste is 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.

9.4 TRAFFIC IMPACTS

During operations some traffic impacts can be experienced when trucks and delivery vehicles access the site. As this is not an area with heavy traffic, the impact is expected to be minimal.

9.5 SURFACE WATER CONTAMINATION

Surface water contamination can occur when pollutants including high organic loads enter the ocean (e.g. plastics and sewage). Sewage is contained in a plastic septic tank which is regularly emptied and discarded at the municipal sewage treatment plant.

9.6 TERRESTRIAL ECOSYSTEM AND BIODIVERSITY IMPACTS

The nature of 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 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 is 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 take place (refer to Appendix D).

9.7.3 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. Oysters do not 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 D).

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 operational and potential decommissioning activities of the facility. 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 7. Assessment Criteria

Criteria	Score
Importance of condition (A1) – assessed against the spatial boundaries of human interest it will affect	
Importance to national/international interest	4
Important to regional/national interest	3
Important to areas immediately outside the local condition	2
Important only to the local condition	1
No importance	0
Magnitude of change/effect (A2) – measure of scale in terms of benefit / disbenefit of an impact or condition	
Major positive benefit	3
Significant improvement in status quo	2
Improvement in status quo	1
No change in status quo	0

Negative change in status quo	-1
Significant negative disbenefit or change	-2
Major disbenefit or change	-3
Permanence (B1) – defines whether the condition is permanent or temporary	
No change/Not applicable	1
Temporary	2
Permanent	3
Reversibility (B2) – defines whether the condition can be changed and is a measure of the control over the condition	
No change/Not applicable	1
Reversible	2
Irreversible	3
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.	
Light or No Cumulative Character/Not applicable	1
Moderate Cumulative Character	2
Strong Cumulative Character	3

Table 8. Environmental Classification (Pastakia 1998)

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

10.1 Risk Assessment and Environmental Management Plan

The EMP provides management options to ensure impacts of the farm 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 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 operations and potential decommissioning of the 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 operations (including maintenance) and possible future 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 operations and decommissioning of the facility, 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 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, sub-contractors, 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 Lüderitz Mariculture employees and 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 operations and decommissioning as outlined in the EMP.
- Submit monitoring reports every six months to allow for environmental clearance certificate renewal applications when needed.
- 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

An increase of skilled and professional labour will take place due to the addition of scallops for mariculture purposes. Increased economic resilience of those residing in Lüderitz which may be employed by the proponent.

Resources are 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.

Project Activity / Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Daily Operations	Employment contribution to local economy	3	2	2	2	2	36	4	Definite
Indirect Impacts	Decrease in unemployment, contribution to local economy	3	2	2	2	2	36	4	Definite

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 operations, training is provided employees in order to maintain and operate various features of the mariculture farm. Skills are transferred to an unskilled workforce for general tasks. The technology required for the mariculture farm is often new to the local industry, aiding in operational efficiency. Development of people and technology are key to economic development.

Project Activity / Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Daily Operations	Technological development and transfer of skills	2	1	2	3	2	14	2	Definite
Indirect Impacts	Technological development and transfer of skills	2	1	2	3	2	14	2	Definite

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. However, such trends have not been observed since the facility became operational.

Project Activity / Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Daily Operations	Social ills related to unemployment	2	-1	1	2	2	-10	-2	Improbable
Indirect Impacts	The spread of disease	2	-1	1	2	2	-10	-2	Improbable

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 and Johannesburg for export purposes via the Oliver Tambo Airport. 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 at Helen van Rhyn Primary School is of specific concern where school children cross the road. Due to the scale and location of the operations, these impacts are expected to be minimal.

Project Activity / Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Daily Operations	Increase traffic, road wear and tear and accidents	2	-1	2	2	2	-12	-2	Probable

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 the Helen van Rhyn Primary School.

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 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.

Project Activity / Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Daily Operations	Physical injuries and criminal activities	1	-2	3	3	2	-16	-2	Probable

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).
- 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

Noise generated from the operational activities will be minimal and isolated to for example the pressure washing and blower fans.

Project Activity / Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Daily Operations	Noise generated from the operational activities – nuisance	1	-1	2	2	2	-6	-1	Improbable

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.
- Blower fans can be enclosed to reduce noise if needed.

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

Minimal waste is produced at the facility. Waste streams generated includes 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.

Project Activity / Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Daily Operations	Excessive waste production, littering, contaminated materials	2	-1	2	2	2	-12	-2	Improbable

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) of 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.
- The septic tank must be cleaned regularly to prevent overflow and contamination of the environment.

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

The nature of the operational activities is 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. Activities during the operational phase may disturb nesting / roosting birds on the rocky shore.

Project Activity / Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Daily Operations	Impact on terrestrial fauna and flora.	2	-1	3	2	2	-14	-2	Probable

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.

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 D. 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.

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

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 any new brood stock or 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 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 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).

Project Activity / Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Daily Operations	Reduction in seawater quality	2	-1	2	2	2	-12	-2	Probable

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.

Mitigation:

- 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.
- 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.

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 onshore facility is secluded with no neighbours and is not visible from the nearby tourist roads. The offshore infrastructure (buoys on long lines) has become part of the seascape character and is of interest to tourists.

Project Activity / Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Daily Operations	Aesthetic appearance and integrity of the site	2	-1	2	2	2	-12	-2	Probable

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

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 cumulative visual impact is related to the buoys at sea. Employment is a positive cumulative impact.

Project Activity / Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Daily Operations	The build-up of minor impacts to become more significant	2	-2	2	2	2	-24	-3	Probable

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 as construction activities include modification and decommissioning. 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

Lüderitz 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 Environmental Management Plan

11 CONCLUSION

The mariculture farm has a positive impact on Lüderitz and Namibia as a whole and the addition of scallops will create much needed employment opportunities and revenue generation, see Table 9. In addition to employment and revenue generation, the farm 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. Fire prevention should be adequate, and 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 Environmental Management Plan 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. Lüderitz Mariculture should use and in-house health, safety and environment plan and related policies and standards in conjunction with the Environmental Management Plan. It is imperative that all 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 Lüderitz 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

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

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

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Appendix A: Aquaculture Licence

Annexure B
(Regulation 3)

Aquaculture Licence issued under the Aquaculture Act, 2002

Name of Licensee: Luderitz Mariculture (Pty) Ltd

Licence Number: LUD 0022-04 Date of Issue: 27th January 2005

The person or entity described in this licence is licensed in accordance with the Aquaculture Act, 2002 (Act No. 18 of 2002) to engage in the type of aquaculture in such parts of Namibia or Namibian waters as described below, for the period described in this licence and in accordance with the terms and conditions set out in the Aquaculture Act, 2002 (No. 18 of 2002) and the conditions set out in this licence;

1. The name and business address of the licence holder;

   Luderitz Mariculture (Pty) Ltd, P O Box 576, Luderitz.

2. Location, size and description of the site at which the aquaculture is authorized;

   At the 2nd lagoon in Radford Bay;

3. The aquatic organism to be cultivated, and if more than one species, the species and type of aquaculture to which the authorization applies;

   Crassostrea gigas (Pacific oysters) suspended from rafts.

4. The maximum annual production authorized (number or weight);

   Oysters: Initially 1,0 million individuals per annum and aim to target for 5,0 million individuals.

5. The source of water supply at the aquaculture facility;

   Sea water (natural environment) in Radford Bay.

6. The composition and annual, quantity of any effluent to be discharged from the aquaculture facility.

   No effluent containing toxins or any other waste water or environmental pollutants to be discharged back into the sea.

CONDITIONS OF LICENCE

A. This licence is to be utilised within current Aquaculture Legislation in Namibia.

B. To abide by the regulations of the Luderitz Bay Municipality and NamPort Authorities with reference to operating at the 2nd lagoon.

7. Notifications required.

   Any changes to the site, cultivation method, planned production output, feeds and effluent discharges should be communicated to the office of the Permanent Secretary.

PERIOD OF VALIDITY

Subject to the Aquaculture Act, 2002 (Act No.18 of 2002) and the Regulations made there under, this licence is valid from 27th day of January 2005, to the 27th day of January 2020 (inclusive).

Dr Abraham Iyambo
MINISTER

27/1/2005
DATE

MINISTRY OF FISHERIES+MARINE RESOURCES
2005 -01- 27
PRIVATE BAG 13355
WINDHOEK

Appendix B: Notified and Registered Interested and Affected Parties

Notified IAPs

Name	Position/Department	Organisation
Ingrid Wiesel	Senior Scientist	Brown Hyena Research Project
Howard Head	Chief Executive Officer	Ghost Town Tours
	Member	Lüderitz Tourism Forum
	Member	Ocean Grown (Oysters)
Hon. Rev. Jan A. Scholtz	Chairman and Councillor / Karas Regional Council	Ministry of Urban and Rural Development - !Nami-#Nus Constituency
F Druker	Managing Director	Coastways Tours Lüderitz Pty Ltd.
Reginald Hercules		Community Member
Jessica Kemper	Biologist	Conservation Biologist and Lüderitz Resident
Suzan Ndjaleka	Manager	COSDEC
Rian Jones	Senior Fisheries Marine Technician	Ministry of Fisheries & Marine Resources
Rassie Erasmus	General Manager	Hangana Abalone
Michael Viljoen	Manager	Hangana Seafood
Nicolaas De Wee	Health, Water & Sewer Services	Lüderitz Town Council
Ulf Grünewald	General Manager	Lüderitz Nest Hotel
Christaline Kaangundue	Environmental Practitioners	Lüderitz Town Council
Wetupa Nakathingo	Environmental Health Practitioner	Lüderitz Town Council
I.N. Tjipura	Acting Chief Executive Officer / Technical Manager	Lüderitz Town Council
Crispin Clay	Chairman	Lüderitzbucht Foundation
Marion Schelkle	Owner and Tour operator	Lüderitz Safaris & Tours
David C Dennis	Chief Fire Officer	Lüderitz Town Council
C Kamupingene	Manager Economic	Lüderitz Town Council
Rodney Braby	Regional Technical Adviser	Marine Spatial Management and Governance Project - MARISMA
Wayne Handley	Acting Chief Warden: Kharas Parks	Ministry of Environment and Tourism
Foibe Nghoongoloka	Directorate of Aquaculture	Ministry of Fisheries & Marine Resources
Anja Kreiner	Fisheries Biologist	Ministry of Fisheries and Marine Resources
Erich Maletzky	Fisheries Biologist	Ministry of Fisheries and Marine Resources
Rudi Cloete	Director: Mariculture	Ministry of Fisheries and Marine Resources
Frikkie Botes	CFB Mariculture	Ministry of Fisheries and Marine Resources
Jean Paul Roux	Scientist	Ministry of Fisheries and Marine Resources

Kolette Grobler	Fisheries Biologist	Ministry of Fisheries and Marine Resources
Viktor Libuku	Fisheries Biologist	Ministry of Fisheries and Marine Resources
Pinehas N. Auene	Deputy Director: Marine Pollution Control and SAR	Ministry of Works and Transport
Heinz Manns		Namib Offroad Excursions
Cecil Kamupingene	Marketing Specialist	Namport
Elzevir Gelderbloem	Port Engineer	Namport
Johannes Isaaks		Namport
Max Cooper		Namport
Stefanus Gariseb	SHREQ Manager	Namport
Tim Eiman	Co-ordinator (EMS & QMS)	Namport
Manu Namukomba	Human Resources	NovaNam
Michael Mackenzie		NovaNam
Patricia Kaulinge	Environmental Section	NovaNam
Stefan Metzger		Novanam
Ferdie de Villiers	Manager	Novaship / Port Users Association
H. Ludwicht	Manager	Office of the President
Luqman Cloete	Journalist	The Namibian
Thandiwe Gxaba	Acting Executive Secretary	Benguela Current Commission
Simon Elwen		Namibia Dolphin Project
		Seaflower
		SEAFO (South East Atlantic Fisheries Organisation)

Registered IAPs

Name	Organisation	Date
Crispin Clay	Lüderitzbucht Foundation	04-09-2019
Ingrid Wiesel	Brown Hyena Research Project	05-09-2019
Ulf Grünewald	General Manager Lüderitz Nest Hotel	05-09-2019
Jessica Kemper	Biologist	11-09-2019
Wayne Handley	Acting Chief Warden Kharas Parks	16-09-2019
Frikkie Botes	Fisheries Biologist, Sub-division Mariculture, Ministry of Fisheries and Marine Resources	19-09-2019
Penthecilia Kalonda	Ministry of Fisheries and Marine Resources	19-09-2019
Ricardo Kasupi	Ministry of Fisheries and Marine Resources	19-09-2019
Anja Kreiner	Ministry of Fisheries and Marine Resources	19-09-2019
Nazima Khoa	Lüderitz Town Council	02-10-2019
Chief Executive Officer	Lüderitz Town Council	02-10-2019
I. Tjipura	Lüderitz Town Council	02-10-2019

Lüderitz Town Council Notification

TEL.: (+264-61) 257411 ♦ FAX.: (+264) 88626368
CELL.: (+264-81) 1220082
PO BOX 11073 ♦ WINDHOEK ♦ NAMIBIA
E-MAIL: gpt@thenamib.com

To: **Interested and Affected Parties** **20 August 2019**

Re: **Environmental Scoping Assessments and Environmental Management Plans for Mariculture Activities at Lüderitz**

Dear Sir/Madam

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

Project: Environmental Impact Scoping Assessments and Environmental Management Plans for Mariculture Activities in Lüderitz

Proponents: Lüderitz Mariculture (Pty) Ltd
Southern Breeze Mariculture CC
Lagoon Aquaculture CC
Five Roses Aquaculture CC

Environmental Assessment Practitioner: Geo Pollution Technologies (Pty) Ltd

Current operations entail farming of the Pacific oyster (*Crassostrea gigas*), while it is proposed to initiate farming of the non-native Peruvian scallop (*Argopecten purpuratus*). The locations of the respective farms are presented in Figure 1. All farms make use of *in situ* mariculture.

Operational activities are divided between offshore and onshore. Offshore, floating long lines are installed to which baskets containing oyster spat, and potentially scallops in future, are attached. Feeding is by filter feeding of naturally occurring plankton in the water. Culturing is staggered in terms of sizes so that marketable sized oysters can be harvested continuously. Baskets of oysters are collected using a small boat and returned to an onshore shed for cleaning, sizing and packaging. Undersized oysters (and scallops in future) are returned to the ocean in newly populated baskets. Packaged oysters are shipped live to Namibian and international markets. Oyster spat is also shipped to Walvis Bay to populate the mariculture farms located there.

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. A public meeting is planned in Lüderitz and details of the meeting will be communicated to all registered I&APs.

Please register as an I&AP and provide comments by **20 September 2019**.

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 Faul (Conservation Ecologist)

Civil
26 -09- 2019
Lüderitz Town Council
Posbus 19

Ministry of Fisheries and Marine Resources Notification

GEO Pollution Technologies

TEL.: (+264-61) 257411 ♦ FAX.: (+264) 88626368
CELL.: (+264-81) 1220082
PO BOX 11073 ♦ WINDHOEK ♦ NAMIBIA
E-MAIL: gpt@thenamib.com

To: **The Executive Director** **12 September 2019**
Ministry of Fisheries and Marine Resources
P/Bag 13355
Windhoek

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Thank you in advance.

MINISTRY OF FISHERIES & MARINE RESOURCES
OFFICE OF THE EXECUTIVE DIRECTOR
13 SEP 2019
RECEIVED
By: Thapelo

Sincerely,

André Faul
(Conservation Ecologist)

Newspaper Advertisements

6 sun MOSHIWAMBO WEDNESDAY SEPTEMBER 4 201

mOshiwambo

Shifeta a tulapo omulandu omupe

ya sile momake goohonda dhawo, moUsakos mEtitatu lyoshiwike sha ga gamenwa. Iimaliwa mbyoka oya li ya pumbwa okukwathela mokuypotha yomadhipago gaashi goshinwa momayalulo goombaanga dhuuminisiteli, opo yi vule okupewa yi ontuku. Kape na ngoka a tulwa miipandeko nopolisi oya patulula oshipotha shedhipago lyaashi lyoshiningilawina, okuhinga nuuhasha nendopo okuthikama pehala lyoshiponga. Okwa patululwa natango oshipotha shedhipago lyaashi lyoshiningilawina mOlyomakaya, konima shoMokahurua Tjikurame (24) a pumwa nokudhipagwa komuhingi keena omukanda gwokuhinga mOkakarara.

Mehuliloshiwike omukiintu okwa hulitha natango sho a lyatwa kohauto yOmashete yelelo lyOndoolopa yaMuthiya, omanga a li ta taaguluka ondjila pokati kOmuthiya nOndangwa. Opolisi otayi konaakona woo iipotha iyali yomadhipago moka omukiintu gwoomvula 31 a hulitha mOshakati mOlyomakaya konima sho a dhipagwa komumati gwe gwoomvula 31. Omulumentu ngoka okwa li a yi ontuku na okwa tulwa miipandeko mOsoondaha.

Opolisi natango otayi konaakona oshipotha shedhipago, sho Hanguwo Otiilie Mwatteuvi (36) a dhipagwa komulumentu gwe gwoomvula 54, sho e mu tete omuligu mOsondaha. Oshipotha shedhipago osha patululwa moKarasburg sha landula eso lyaJohn Matroos (28) ngoka a hulitha konima sho a tsuwa nombele. Omunamimvo 25 okwa tulwa miipandeko. Otaku hokololwa kutya aalumentu mboka yaali oya li taya ambulepo gasha taga monika.

Shifeta okwa popi ngaaka konima

IIPONGA: Ohauto ndjoka yalt tayi hingwa komuhingi keena ombaaptla yokuhinga oya gu nokugalangata popepi nOkakarara nokudhipaga omukiintu gwoomvula 24.

ETHANO: NAMPA

kondjo, sho nakusa a dhenge aniwa okanona komufekelwa.

Okwa patululwa oshipotha shek watonkonga mEtiyali lyoshiwik sha piti, sho okanona kokakadhon koomvula 12 kwa kwatwa onkong momukunda Mupini moKavang west. Omufekelwa omunamimv 49 okwa tulwa miipandeko na okw holoka komeho yompangu moRun du mOmaandaha. Aalumentu yaaal oya tulwa miipandeko mOmbay konima sho ya adhika nomayeg goondjamba gaali. Oonakutulwa mi ipandeko aanamimvo 47 oshowo 51

Omulumentu okwa tulwa mii pandeko konima sho omukiintu gwoomvula 28 pamwe nokanon ke komvula yimwe ya gu mohaut ndjoka a li ta hingi, na okwa ndop okuthikama nokugandja ekwatho Ayehe yaali oya falwa moshipangel shaMuthiya.

PUBLIC PARTICIPATION NOTICE

ENVIRONMENTAL ASSESSMENT FOR THE REZONING OF PORTION 68/H OF FARM BRAKWATER NO. 48, WINDHOEK

Geo Pollution Technologies (Pty) Ltd was appointed by **Oxford Investments CC** to undertake an Environmental Assessment for the rezoning Portion 68/H of Farm Brakwater No. 48, Windhoek. The detailed project location may be viewed at:

http://www.thenamib.com/projects/projects.html.

The environmental assessment will be conducted according to the Environmental Management Act of 2007 and its regulations as published in 2012.

Oxford Investment intends to rezone 0.53 ha of portion 68/H of Farm Brakwater No.48 from agricultural use to light industrial use. The rezoning is intended to facilitate operations performed by WD Contractors, leasing the property from Oxford Investments. Intended use of the property relate to administrative tasks, a consumer fuel installation, as managed by Total Namibia; and possible future industrial uses (as per the Windhoek Town Planning Scheme).

All Interested and Affected Parties are invited to register with the environmental consultant. By registering you are provided with the opportunity to share any comments, issues or concerns related to the facility, for consideration in the Environmental Assessment. Additional information can be requested from Geo Pollution Technologies.

All comments and concerns should be submitted to Geo Pollution Technologies by **17 September 2019**.

André Faul
Geo Pollution Technologies
Telephone: +264-61-257411
Fax: +264-88626368
E-Mail: oxford@thenamib.com

PUBLIC PARTICIPATION NOTICE

ENVIRONMENTAL ASSESSMENT: MARICULTURE ACTIVITIES AT LÜDERITZ

Geo Pollution Technologies (Pty) Ltd was appointed to undertake environmental assessments for existing and proposed mariculture activities at Lüderitz. The proponents are Lüderitz Mariculture (Pty) Ltd, Southern Breeze Mariculture CC, Lagoon Aquaculture CC and Five Roses Aquaculture CC. The detailed project location may be viewed at:

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Fax: +264-88626368
E-Mail: mariculture@thenamib.com

Woensdag 4 September 2019 Republikein NUUS 5

» **Veilige en** bemagtigde gemeenskap

Hartstigting ondersteun gesonde harte

Hartsiektes dra tot 30% van die totale sterftes in die land by.

Die Namibië Hartstigting (NHF) in Windhoek is Vrydag ampte-

Geslagsgeweld eis glo nóg twee

Twee vroue is die afgelope naweek vermoedelik deur hul kêrels vermoor.

Me. Hanguwo Mwateuvi (36) is Sondag omstreeks 18:30 na bewering deur haar 54-jarige kêrel op Kuisebmond vermoor.

Volgens die polisie se misdaadverslag het hy haar glo in hul sinkhuis keelaf gesny en het sy onmiddellik gesterf.

Die man is in hegtenis geneem.

Saterdag tussen 22:00 en 23:00 is me. Lucina Quimbra (30) glo deur haar kêrel (31) vermoor.

Die voorval het in die Okandjengedi-informele nedersetting op Oshakati plaasgevind. Quimbra en die man het glo van 'n kroeg tot by haar huis geloop en baklei.

Haar liggaam is later met oop wonde in die huis gevind.

Die twee het glo saam kinders. Die man het op die vlug geslaan, maar is Sondag in hegtenis geneem.

VERKRAGTING, MESDOOD

'n Meisie (12) is Donderdag in die Mupini-nedersetting in die Kavango-Wesstreek deur 'n 46-jarige man verkrag. Die man is in hegtenis geneem.

Saterdag om 18:20 is die 28-jarige mnr. Johan Matroos na wat verneem word op Karasburg doodgesteek.

Die oorledene het die 25-jarige verdagte se kind glo geslaan.

Die verdagte het toe na bewering 'n mes gegryp en die slagoffer in die nek gesteek. Die twee mans is glo swaers.

Die verdagte is in hegtenis geneem.

Die lyk van mnr. Andries Vries (65) is Sondag om 16:00 gevind deur 'n voetganger op die grondpad agter die Mariental-begraafplaas wat na die stortingsterrein lei.

Die oorledene is op 28 Augustus in die staatshospitaal op Mariental opgeneem.

Sy familie het hom Saterdag om 19:00 besoek en volgens hulle het hy toe nog in 'n bestendige toestand verkeer.

'n Nadoodse ondersoek sal volg.

DM02019003944837

PUBLIC PARTICIPATION NOTICE

ENVIRONMENTAL ASSESSMENT: MARICULTURE ACTIVITIES AT LÜDERITZ

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DM02019003944254

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André Faul
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Editor's corner

We need to act, now

The African Continental Free Trade

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Bone

CONTINUED FROM PAGE 1

"But I also know that the president has to make this decision based on consultation and I am sure there was some collective good enough to be voters and not for leadership positions.

He also questioned the return of politicians such as Katjavivi, Ekandjo and Mensah-Williams.

"The question is whether the president could have done better, especially looking at people who have never been to the electoral voting population. So the message then is, go and participate as voters but you are not good enough to be voted for," he said.

Youthful commentator Shaandre Finnies, who is a former speaker of the Children's Parliament, said Geingob must at least appoint the relatively young members to bring fresh ideas, represent and give agency to youth voices across the country.

"We want to see motions tabled, deliberations and consultations on bills - but this must be done with young people at the centre of it all.

"Finally, because there is such a would meet with the community on 2 September. "That is very far," she said, adding that the governor clearly "does not take it seriously".

According to Goaseb, they prepared for the 2 September meeting but that Ipinge "did not show up".

Ngairo added that they turned to the councillors too, who "said they would come, but never did".

On 12 July, Ngairo said they handed in a written submission at President Geingob's Otjozondjupa town hall meeting in Otjiwarongo. She said he undertook "to attend to it".

Nampa reported that Geingob, after having received several written proposals at Otjiwarongo, said "he would establish a team that would critically look into them".

yanna@namibiansun.com

Shooting

CONTINUED FROM PAGE 1

According to Kanguatjivi the suspects fled into the mountains and are still at large.

"They fled on foot into the nearby mountains and no arrests have been made to date," he said.

Presidential spokesperson Alfredo Hengari confirmed yesterday morning that Pakote was receiving treatment in a local hospital, following the attack. "The presidency wishes to request you to respect his privacy, and that of his family, during this period."

He also confirmed that the police are investigating the matter.

Before his appointment to the Office of the President, Pakote served as deputy executive director in the vice-president's private office.

jemima@namibiansun.com

» N$5,8 miljoen vir renosterjag

VSA jagter kry

PUBLIC PARTICIPATION NOTICE
ENVIRONMENTAL ASSESSMENT:
MARICULTURE ACTIVITIES AT LÜDERITZ

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Site Notice

Appendix C: Comments received and Minutes of Public Meeting

E-Mail Correspondence Received

Communication	Response
Jessica Kemper (Biologist) – 10 Sept 2019	
My biggest concern with this industry is plastic pollution (and there is a history of this locally, although we've been in contact with the companies about plastic pollution in the past and things have definitely improved over the years - there's still room for improvement though); I will try and elaborate on this in the next few days. I know next to nothing about the Peruvian scallop, but an obvious concern is the introduction of a non-native organism into the local ecosystem and therefore the potential of "escapees" directly (or indirectly, through any non-native parasites for example) impacting the natural fauna and flora.	Concerns noted and addressed in the EIA as well as during the public meeting.

Minutes of Meeting

Public Meeting: Environmental Assessment for the Lüderitz Mariculture Industry		
Date:	Thursday 26 September 2019	
Time:	10h00-11h30	
Venue:	Ministry of Fisheries and Marine Resources Boardroom, Lüderitz	
Parties Present /Project Team:	Crispin Clay (CC)	Lüderitzbucht Foundation
	Jessica Kemper (JK)	Private (Biologist)
	Rhosa Sinvula (RS)	Ministry of Environment and Tourism
	Penthecilia Kalonda (PK)	Ministry of Fisheries and Marine Resources
	Jason Burgess (JB)	Lüderitz Mariculture
	Gerd Kessler (GK)	Five Roses Aquaculture, Lagoon Aquaculture, Southern Breeze Aquaculture
	Andre Faul (AF)	Geo Pollution Technologies
	Quzette Bosman (QB)	Geo Pollution Technologies

List of Abbreviations

ECC	Environmental Clearance Certificate
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
GPT	Geo Pollution Technologies
IAP's	Interested and Affected Parties
IFC	International Finance Corporation

Meeting Proceeding

André Faul (AF) of Geo Pollution Technologies welcomed the audience to the meeting and proceeded with a presentation aimed at informing the general public regarding the environmental assessment being conducted for the Lüderitz Mariculture industry.

A discussion followed the presentation during which the following comments were discussed:

Jessica Kemper (JK) raised a concern regarding plastic pollution and the animal entrapment potential of the plastic materials used by the proponent. Direct and indirect entrapment continues to be a problem in the area which is exemplified by the cormorant population which utilises the material in their nest construction.

It was mentioned by Jason Burgess (JB) that some of the materials which are continually encountered, have not been employed for a number of years. These materials continue to wash up on the shores. It was further mentioned that clean-up initiatives are being conducted and for such attempts to be more successful, access is required to the various islands.

All parties were in agreement that improvements in terms of environmental performance have been made. JB encouraged the community to approach them at any time regarding any related concerns. A request was made by JK to formalise and include mitigation initiatives for plastic management in the EMP.

Crispin Clay (CC) asked if the oysters and scallops will be kept in separate farm areas. The project team confirmed that some of the operators will have separate farm areas (such as Southern Breeze) while others will conduct joint operations.

CC asked whether mussel farming could be considered as an alternative for the industry.

An explanation was provided by the project team why mussel farming is not a viable option for Lüderitz. When mussels are contaminated, they take much longer than oysters or scallops to purge themselves of toxins. Strict toxin testing requirements are therefore in place to ensure that all mussels sold are consumable. The tests required are very expensive with long delays before results are available. Therefore, much larger quantities of mussels are required to afford the tests. Lüderitz does not have the necessary deeper waters which are micro toxin free, to cultivate the required numbers. Two of the proponents do however have permits to cultivate mussels which are invasive and also foreign to Lüderitz.

CC wanted to know whether any studies were conducted related to the food chain dynamics of the lagoon. Specifically in terms of volume and diversity and how these parameters are being impacted on by the mariculture industry.

The project team confirmed that the infrastructure used during operations are creating a habitat for especially mussels, which in turn are a source of food for various other species. It was mentioned that there has been some evidence that juvenile crayfish also consider certain of the infrastructure components as suitable habitat. It was confirmed that no specific studies have been conducted regarding the food chain in the lagoon.

CC enquired how long it will take before the entire Lüderitz Harbour and Second Lagoon are used for mariculture and covered in long lines.

Gerd Kessler (GK) pointed out that there is a divide between the shallower areas in the southern parts of Lüderitz Harbour and the deeper waters northwards. The divide is in terms of the toxins [algae blooms causing PSP and DSP] being more prevalent in the deeper waters. He indicated this line on a map of the area (as per the presentation) and it was confirmed by the project team that the areas north are less desirable for mariculture. JB further reminded the attendees that the lagoon has a natural carrying capacity. Should the carrying capacity be exceeded, oyster and scallop growth will be slow and economically not feasible. Nutrients availability in the lagoon are largely driven by the wind. Windless days may result in plankton depletion in the lagoon and thus slower growth.

It was asked whether the project team would consider octopus farming, to which the project team replied that they would not. It was mentioned by JB that there are many moral issues related to octopus farming as well as feasibility and production challenges. The main difference between scallop, oyster and octopus farming being that octopuses need to be fed whereas oysters and scallops are filter feeders which do not require feeding when cultivated in the grow-out baskets in the lagoon.

A general discussion regarding tourism integration into the mariculture industry was held. One possible option identified is to consider mariculture tours for tourists.

CC wanted to know whether the project team have taken the effects of global warming into consideration for their future planning. The team suggested that global warming in itself will not present a concern as the oysters and scallops may withstand a temperature variation of about 10 ºC while stronger winds should neither be a major concern. Surges may present challenges for the infrastructure, however it has been the experience of the operators that much of the energy of the waves are lost by the time it reaches the inner lagoon area. It was confirmed that the operators are working with the Benguela Current Commission regarding these types of issues.

The project team were commended by JK for commissioning the EIA and it was confirmed by AF that the IAP database for the Pektranam project was used to ensure that all key IAP and stakeholders were notified about the project and public meeting.

The meeting was adjourned at 11:05.

Appendix D: Scallop Introduction Specialist Study

Introduction of the Peruvian Scallop, *Argopecten purpuratus* in Lüderitz Bay for Commercial Grow-out Purposes: Possible Physical and Biological Effects on the Marine Environment.

J.A. Esterhuizen

October 2019

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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. purpuratos* 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.

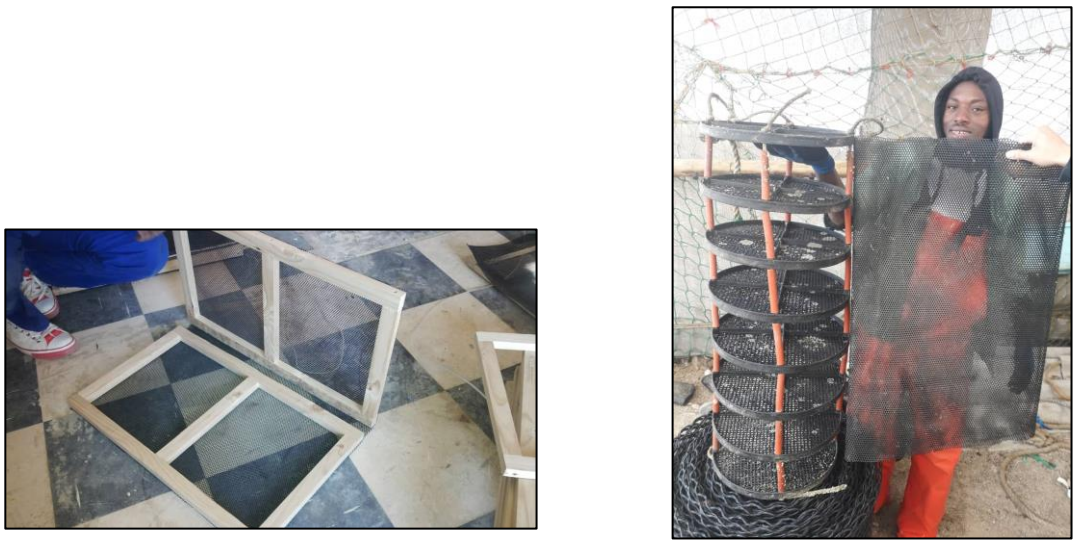
Target area

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).



(a) **(b)**

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.

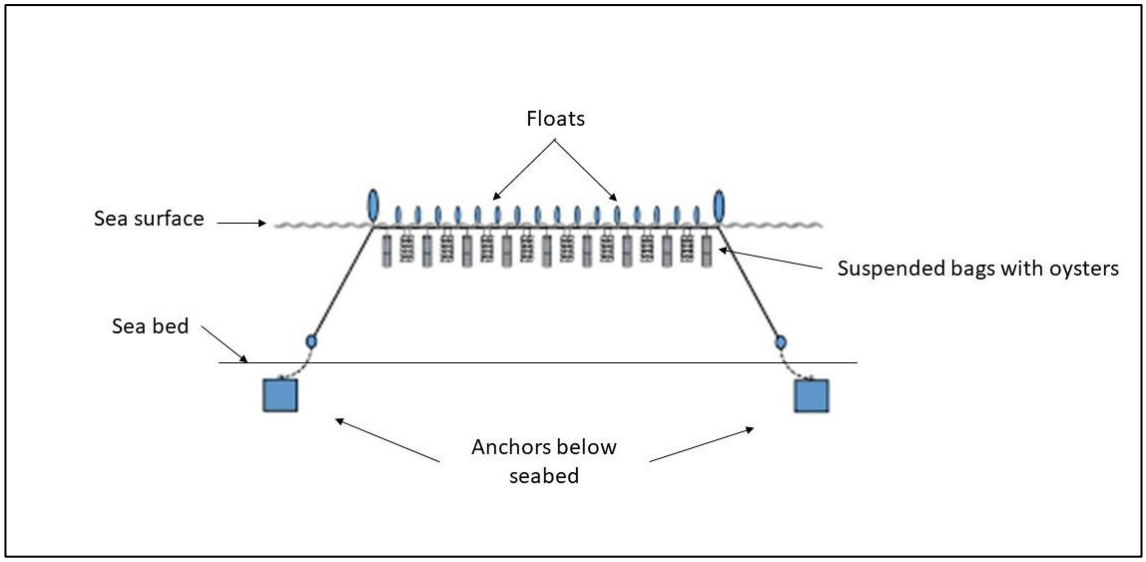


Figure 3: An illustration of a typical longline to which wooden baskets and lantern nets are attached to. Note that the anchors are placed below the seabed.

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

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

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

Table 2 Environmental Classification (Pastakia 1998)

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

Changes in ecological community structure

Project Activity / Resource	Nature (Status)	(A1) Importance	(A2) Magnitude	(B1) Permanence	(B2) Reversibility	(B3) Cumulative	Environmental Classification	Class Value	Probability
Introduction of non-native species	*A. purpuratus* settle and proliferate in the area	1	-1	3	3	1	-7	-1	Probable

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

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

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.

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

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

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

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

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

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

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

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

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

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.

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Appendix E: Consultants' Curriculum Vitae

Hydrogeologist **Pierre Botha**

Pierre Botha is the Managing Director of Geo Pollution Technologies, Namibia. Mr. Botha has excellent experience and knowledge in Environmental Impact Assessments, groundwater pollution assessment, groundwater exploration, resource evaluation, urban and rural water supply, groundwater management, monitoring and hydrochemistry. He gained most of his experience in Namibia and is involved in the Namibian groundwater industry since 1992.

Mr Botha's experience in the environmental / groundwater field has been gained from various projects ranging from groundwater exploration, groundwater management and modelling, environmental impact assessments, pollution mapping and rehabilitation to health risk evaluations.

CURRICULUM VITAE PIERRE BOTHA

Name of Firm	:	Geo Pollution Technologies (Pty) Ltd.
Name of Staff	:	PIERRE BOTHA
Profession	:	Hydrogeologist / Hydrologist Environmental Assessment Practitioner
Years' Experience	:	25
Nationality	:	Namibian
Position	:	Managing Director
Specialisation	:	Hydrogeology
Languages	:	Afrikaans – speaking, reading, writing – excellent English – speaking, reading, writing – excellent

EDUCATION AND PROFESSIONAL STATUS:

B.Sc. Geology & Geography	:	University of OFS, 1992
B.Sc. (Hons.)(*cum laude*) Geohydrology/Hydrology	:	University of OFS, 1994

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

PROFESSIONAL SOCIETY AFFILIATION:

Environmental Assessment Professionals of Namibia (EAPAN) – *President 2014 - Vice President 2012, 2013*
Hydrogeological Association of Namibia (HAN)
Geological Association of Namibia

AREAS OF EXPERTISE:

Knowledge and expertise in:

- risk based corrective action analyses
- bioremediation
- monitoring, mapping and evaluation of groundwater pollution
- hydrochemistry studies
- environmental impact assessments
- project management
- soil vapour surveys
- groundwater modelling
- groundwater monitoring
- hydrocensus
- hydrogeological data evaluation and interpretation
- groundwater exploration and resource evaluation
- geophysical interpretations (Ground Penetrating Radar, Electrical Resistivity, Electromagnetic & Magnetic)
- urban and rural water supply
- groundwater management
- borehole siting, drilling and test pumping supervision, aquifer testing

EMPLOYMENT:

1998-Date	:	Geo Pollution Technologies (Pty) Ltd
1995	:	Parkman Namibia (Groundwater Consulting Services) - Hydrogeologist
1994	:	Institute for Groundwater Studies, University of the Orange Free State - Hydrogeologist
1992-1993	:	Groundwater Consulting Services - Field Geologist
1988	:	Tsumeb Corporation Ltd - Student geologist

PUBLICATIONS:

Contract reports	: +400
Publications	: 1

ENVIRONMENTAL SCIENTIST **André Faul**

André entered the environmental assessment profession at the beginning of 2013 and since then has worked on more than 70 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 (Practitioner)

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

ENVIRONMENTAL ASSESSMENT PRACTITIONER **Quzette Bosman**

Quzette Bosman has 11 years' experience in the Impact Assessment Industry, working as an Environmental Assessment Practitioner and Social Assessment practitioner mainly as per the National Environmental Legislation sets for South Africa and Namibia. Larger projects have been completed in terms of World Bank and IFC requirements. She studied Environmental Management at the Rand Afrikaans University (RAU) and University of Johannesburg (UJ), including various Energy Technology Courses. This has fuelled a passion towards the Energy and Mining Industry with various projects being undertaken for these industries. Courses in Sociology has further enabled her to specialize in Social Impact Assessments and Public Participation. Social Assessments are conducted according to international best practise and guidelines. Work has been conducted in South Africa, Swaziland and Namibia.

CURRICULUM VITAE QUZETTE BOSMAN

Name of Firm	:	Geo Pollution Technologies (Pty) Ltd.
Name of Staff	:	QUZETTE BOSMAN
Profession	:	Social Impact Assessor / Environmental Assessment Practitioner
Years' Experience	:	8
Nationality	:	South African
Position	:	Senior Environmental Consultant
Specialisation	:	ESIA & ESMP; SIA
Languages	:	Afrikaans – speaking, reading, writing – excellent English – speaking, reading, writing – excellent

EDUCATION AND PROFESSIONAL STATUS:

BA	Geography & Sociology	:	Rand Afrikaans University, 2003
BA	(Hons.) Environmental Management	:	University of Johannesburg, 2004

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

PROFESSIONAL SOCIETY AFFILIATION:

Namibian Environment and Wildlife Society
International Association of Impact Assessors South Africa (IAIA SA)
Member 2007 - 2012
Mpumalanga branch Treasurer 2008/2009

OTHER AFFILIATIONS
Mkhondo Catchment Management Forum (DWAF): Chairperson 2008-2010
Mkhondo Water Management Task Team (DWAF): Member 2009

AREAS OF EXPERTISE:

Knowledge and expertise in:

- environmental impact assessments, social impact assessment and social management planning
- project management
- community liaison, social monitoring, public participation / consultation
- social risk management
- water use licensing
- environmental auditing and compliance, environmental monitoring
- strategic environmental planning

EMPLOYMENT:

2015 - Present	:	Geo pollution Technologies – Senior Environmental Practitioner
2014-2015	:	Enviro Dynamics – Senior Environmental Manager
2010 - 2012	:	GCS – Environmental Manager (Mpumalanga Office Manager)
2007 - 2009	:	KSE-uKhozi - Technical Manager: Environmental
2006 -2007	:	SEF – Environmental Manager
2004 - 2005	:	Ecosat – Environmental Manager

PUBLICATIONS:

Contract reports	: +150
Publications	: 1

ENVIRONMENTAL 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 English – 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 and Environmental Management Plans

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: +17