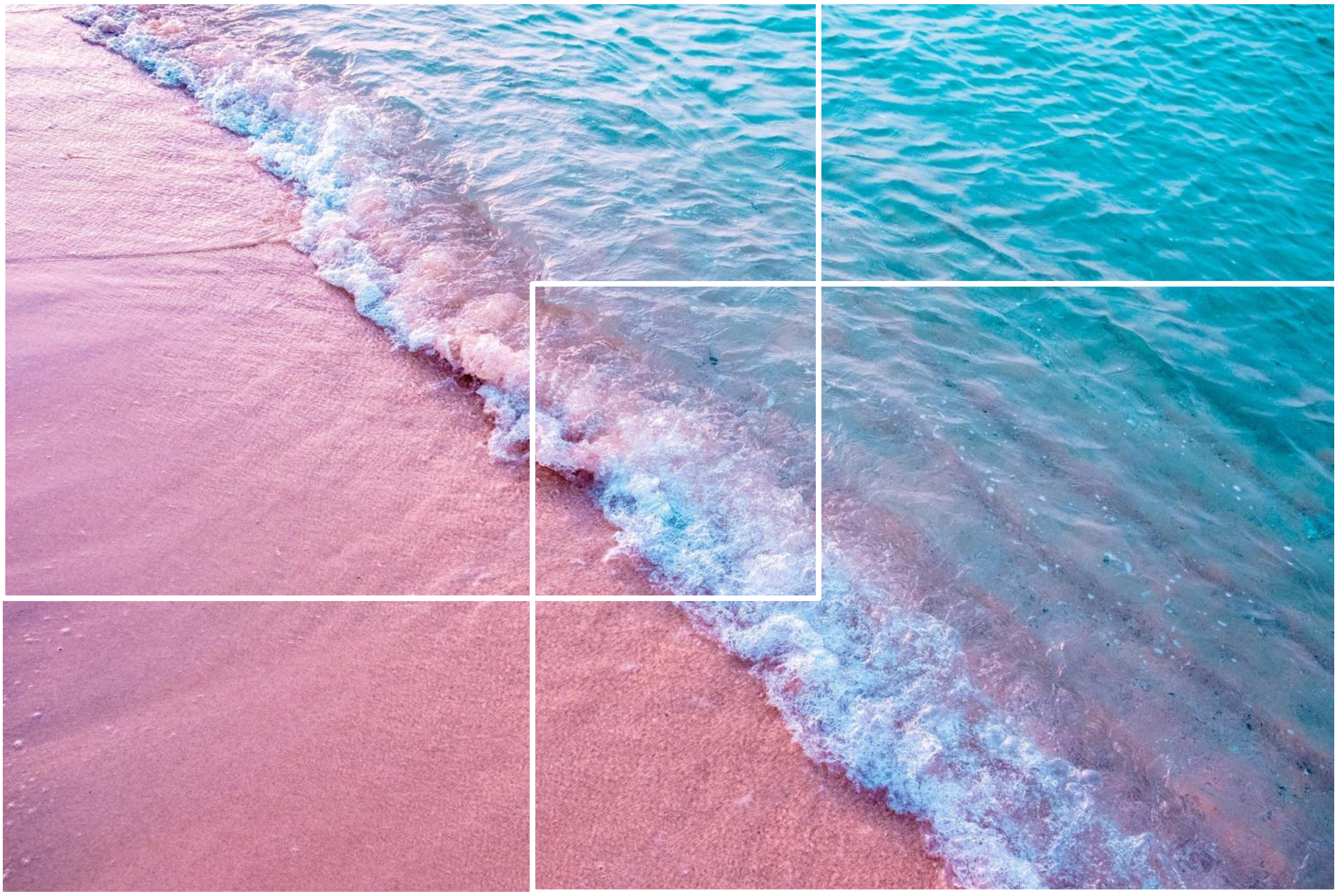

Submitted to: Namibian Marine Phosphate (Pty) Ltd
Attention: Mr Chris Jordinson
Private Bag 5018
7 Auob Street, Meersig
Walvis Bay
Namibia

REPORT:

FINAL SCOPING REPORT FOR THE PROPOSED SANDPIPER MARINE PHOSPHATE PROJECT WITHIN ML 170, OFFSHORE, NAMIBIA.

PROJECT NUMBER: ECC-133-377-REP-03-D

REPORT VERSION: REV 01

DATE: 7 JUNE 2022

Prepared by:
ECC ENVIRONMENTAL COMPLIANCE CONSULTANCY

TITLE AND APPROVAL PAGE

Project Name:	Final scoping report for the proposed Sandpiper Marine Phosphate Project within ML 170, offshore, Namibia.
Client Company Name:	Namibian Marine Phosphate (Pty) Ltd
Client Representatives:	Mr Chris Jordinson and Mr Michael Woodborne
Ministry Reference:	APP-003397
Authors:	Carlene Baufeldt, Jessica Bezuidenhout and Monique Jarrett
Status of Report:	Final For Government Submission/Rev 01
Project Number:	ECC-133-377-REP-03-D
Date of issue:	7 June 2022
Review Period	NA

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DISCLAIMER

Environmental Compliance Consultancy (ECC) (Reg. No. CC 2013/11401) has prepared this report on behalf of the Proponent. This report has been authored by employees of ECC, who have no material interest in the outcome of this report, nor do any of the ECC team have any interest that could be reasonably regarded as being capable of affecting their independence in the preparation of this report. ECC is independent from the Proponent and has no vested or financial interest in the Sandpiper Project, except for fair remuneration for professional fees rendered which are based upon agreed commercial rates. Payment of these fees is in no way contingent on the results of this report or the assessment, or a record of decision issued by Government. No member or employee of ECC is, or is intending to be, a director, officer, or any other direct employee of the Proponent. No member or employee of ECC has, or has had, any shareholding in the Sandpiper Project. Any personal views or opinions expressed by the writer may not necessarily reflect the views or opinions of Environmental Compliance Consultancy or its client.

Please note at ECC we care about lessening our footprint on the environment; therefore, we encourage that all documents are printed double sided.

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TERMS AND ABBREVIATIONS

ABBREVIATIONS	DESCRIPTION
μPa	pascal
3D	three dimensional
AIDS	acquired immunodeficiency syndrome
AVS	acid volatile sulphide
BCLME	Benguela Large Marine Ecosystem
BID	background information document
Bn	billion
BOQ's	bills of quantity
C	carbon
CAPEX	capital expenditure
CIA	cumulative impact assessment
cm/s	centimetres per second
CNFA	Confederation of Namibian Fishing Association
COM	Chamber of Mines
CSIR	Council for Scientific and Industrial Research
DAPR	direct application phosphate rock
dB	decibels
DEA	Directorate of Environmental Affairs
DFS	definitive feasibility study
E	east
EC	Environmental Commissioner
ECC	Environmental Compliance Consultancy
ECC	environmental clearance certificate
ECD	early childhood development
EEZ	exclusive economic zone
EIA	environmental impact assessment
EMA	Environmental Management Act, No.7 of 2007
EMP	environmental management plan
EPL	exclusive prospecting licence
ESIA	environmental and social impact assessment
FEED	front end engineering design
GDP	gross domestic produce
GVA	gross value added
H2S	hydrogen sulphide
Ha	hectares
HIV	human immunodeficiency viruses
Hz	hertz
IALA	the convention on the international organization for marine aids to navigation
I&APs	interested and affected parties

ABBREVIATIONS	DESCRIPTION
IFC	International Finance Corporation
JDN	Jan De Nul Group
Kg	kilograms
LFP	lithium ferro (iron) phosphate
m	meters
Ma	miocene age
MARPOL	International Convention for the Prevention of Pollution from Ships
MEFT	Ministry of Environment, Forestry and Tourism
MFMR	Ministry of Fisheries and Marine Resources
mg/l	milligrams per litre
MHSS	Ministry of Health and Social Services
ML	mining licence
mm	millimetres
mm/year	millimetres per year
MME	Ministry of Mines and Energy
mMOL/kg	millimole per kilogram
Mt	metric ton
mv	motor vessel
MWT	Ministry of Works and Transport
N	nitrogen
NamDeb	Debmarine Namibia
Namport	Namibia Ports Authority
NCE	Namibia Chamber of Environment
NDP 5	national development plan 5
NEWS	Namibia Environment and Wildlife Society
NGO	Non-Government Organisation
NMP	Namibian Marine Phosphate (Pty) Ltd
NNE	north-north-east
NPC	national population census
NTU	nephelometric turbidity unit
NUI	Namibia Uranium Institute
O	oxygen
ORP	oxidation reduction potential
P2O5	phosphorous pentoxide
POM	Particulate organic matter
RO	Reverse osmosis
S	south
SADC	Southern African Development Community
SADCO	Southern Africa Data Centre for Oceanography
SAEIA	Southern African Environmental Impact Assessment
SEMP	strategic environmental management plan
SEM	scanning electron microscopy

ABBREVIATIONS	DESCRIPTION
SME's	small and medium enterprises
$SO^{2-}{}_4$	sulphate
SP1	initial target area
SSP	single super rock
SSW	south south west
STPM	suction tube position monitoring
SW	southwest
TB	tuberculosis
TSHD	trailing suction hopper dredger
UNAM	University of Namibia
USA	United States of America
WINSN	workload indicators of staffing need
Wt.	weight
XRD	x-ray diffraction
ZOI	zone of influence

EXECUTIVE SUMMARY

Environmental Compliance Consultancy (ECC) has been appointed as the environmental assessment practitioner (EAP) by Namibian Marine Phosphate (Pty) Ltd (referred to as the Proponent or NMP herein) to conduct an environmental and social impact assessment (ESIA) for mining of phosphate, within mining licence 170 (ML 170). The area is located 120 km off the Namibian coast to the southwest of the of Walvis Bay (-24° 19' 59.99" S: 13° 53' 20" E). The eastern boundary of the mining licence is located approximately 40 km off the coast (directly west of Conception Bay). The proposed Sandpiper Marine Phosphate Project (SP1) is located within ML 170 (see Figure 4).

Mining activities will be undertaken within the initial target area (SP1) within ML 170 (Figure 4). The mining operation will entail dredging and recovery of marine phosphate sediments using a trailing suction hopper dredger (TSHD) from water depths between 190 to 250 m. The scale of the Sandpiper Project within the SP1 target area will involve mining a total area of 34 km^2 over a period of 20 years at an average of 1.7 km^2 annually. The annual mining area equates to 0.08% of ML 170. The total 20 year mining area equates to less than 2 % of ML 170 and less than 0. 0003% of the seabed within Namibia's exclusive economic zone.. Within this exclusive economic zone, the project would coexist with existing marine diamond mining, fishing, tourism, and the oil and gas industry, operations of a significantly larger scale. The other sites SP2 and SP3 also contain phosphate resources and may be considered at a later stage (refer Figure 4).

In terms of the Namibian Environmental Management Act, No. 7 of 2007 and its regulations, the Ministry of Mines and Energy (MME) is the competent authority for the proposed Project. Mining operations trigger listed activities in terms of the Act, and as such, requires an environmental clearance certificate.

SCREENING PHASE

Previously the Proponent had undergone an environmental impact assessment that was submitted to the competent authority, the Ministry of Environment, Forestry and Tourism (MEFT) and the Ministry of Fisheries and Marine Resources (MFMR) in 2012. Subsequent to that assessment, further verification studies were requested by the Ministry of Fisheries and Marine Resources (MFMR) in consultation with the Environmental Commissioner, which were completed in 2014. Further respective engagement and workshops with the respective line ministries took place in 2016 and 2018, whereby further scientific environmental baseline and socio-economic assessments were conducted and finalised in 2020. On conclusion of the legal action initiated in 2016, the High Court ruled in 2021 that NMP's Mining Licence ML 170 remains valid and that NMP is required to obtain a valid environmental clearance certificate in order to undertake the proposed mining activities within ML 170. Accordingly, NMP has taken the necessary steps to re-submit an environmental clearance certificate application for ML 170.

All previous data and scientific reports were utilised during the screening phase to determine the potential environmental and social impacts of the Project, which are listed below:

- Potential effects on the marine benthic fauna
- Potential impairment of food chain functionality
- Potential creation of new habitat colonized by as yet unknown fauna
- Potential modification to the water column, primarily turbidity
  - Reduction in light penetration caused by localized surface turbidity plume
  - Change in, i.e. oxygen levels related to sediment releases into water column
  - Possible release of hydrogen sulphide into the water column
- Potential removal of typical spawning substrate for fish
- Potential removal of foraging substrate for fish
- Potential interference with fish behaviour
- Associated implications for the commercial fishing industry
- Potential to increase the marine traffic in the vicinity of Walvis Bay
- Potential job creation and skills development due to the proposed project
- Potential social upliftment benefits for local and regional communities
- Potential influx of people moving to the Walvis Bay areas
- Potential social nuisances
- Potential value for development of a new mining sector and phosphate-based industry
- Potential regional and national economic benefits
- Potential role in regard to national policies and objectives for Blue Economy
- Development and Marine Spatial Planning

SCOPING PHASE

The objective of the scoping phase was to obtain a thorough understanding of the biophysical and socioeconomic environment in which the Project is located, using baseline and specialist studies. It also provided an opportunity for the public to have input into the scope of the assessment. The technical inputs combined with the inputs from the I&APs during the previous engagements led to the development of the Terms of Reference (ToR) for the assessment phase.

The following was considered during the preparation of the scoping report:

- Desktop and literature research
- Specialist studies available from between 2012 - 2020
- Peer review reports
- Available survey data
- Specialist baseline studies, including:
  - Marine ecology
  - Marine water quality
  - Benthos

- Jellyfish
- Geology and history of the deposit (verification study)
- Water column and sedimentary environment (verification study)
- Fisheries and biodiversity (verification study)
- Plume dispersion modelling (supplementary studies)
- Sediment toxicity (supplementary studies)
- Noise baseline (supplementary studies)
- Socio-economic baseline (supplementary studies)
- Independent external review reports
- Independent peer review reports

TERMS OF REFERENCE

The ToR within the scoping report proposed for the assessment phase and covered the following:

- Water column, water quality, sediments and benthos assessment
    - Seabed physiography
    - Sediment plume dispersion modelling
    - Current velocity and water mass characteristics
        - Dissolved oxygen
    - Sediments characteristics and chemistry
        - Particulate organic matter concentrations
        - Inorganic nutrient levels
        - Oxidative state
        - Heavy metal concentrations
        - Hydrogen sulphide
    - Sediment toxicity
    - Plankton
        - Phytoplankton
        - Zooplankton
    - Benthos
        - Thiobacteria
        - Meiofauna
        - Epifauna
        - Macrobenthos
    - Depositional history of phosphate deposits
- Fisheries, Mammals and Seabirds assessment
    - Biodiversity study
    - Ecosystem impact modelling
    - Biomass and stock estimates (hake/Monk)
    - Reproductive dynamics, recruitment and stock dynamics
    - Jellyfish

- Mammals and seabirds
- Noise

– Social and socio-economic impact assessment

Additionally, the scoping report defines the impact methodology that will be adopted for the impact assessment phase of the ESIA, this is included in chapter 6 of this report. The methodology was adopted from the previous assessments conducted in 2012 and 2014 respectively for the marine environment and to be applied to the updated specialist impact assessments to be completed in the Assessment phase of this application. A scoring system will be applied for the updated impact assessment chapter to appropriately evaluate the sensitive receptors, where feasible. A hierarchical decision-making process is followed, to prevent or eliminate, prevent, reduce or offset, mitigate or manage potential impacts. The draft scoping report and draft environmental management plan (EMP) was provided to the public for a 14 day period of review (22 April – 6 May 2022) prior to submission to the competent authority, including MEFT and MFMR on the 03 June 2022.

The next stage of this assessment is to conduct the impact assessment which will include updated specialist impact assessments as well as relevant amendment of draft EMP.

All I&AP comments on the Scoping Report, if any, were responded to, through providing an explanation or further information in the response table, which is attached as an addendum report to this final scoping report.

Once finalised, prior to formal submission, the final ESIA report and appendices, including relevant specialist reports, will be made available to all registered I&AP's and stakeholders for comment,.

The final ESIA report and appendices will then be formally submitted to the Environmental Commissioner as well as the competent authority, being the MME and , then to the MEFT as well as MFMR as part of the application for an environmental clearance certificate for the Sandpiper Marine Phosphate Project. The phases of the ESIA are provided in Figure 1.

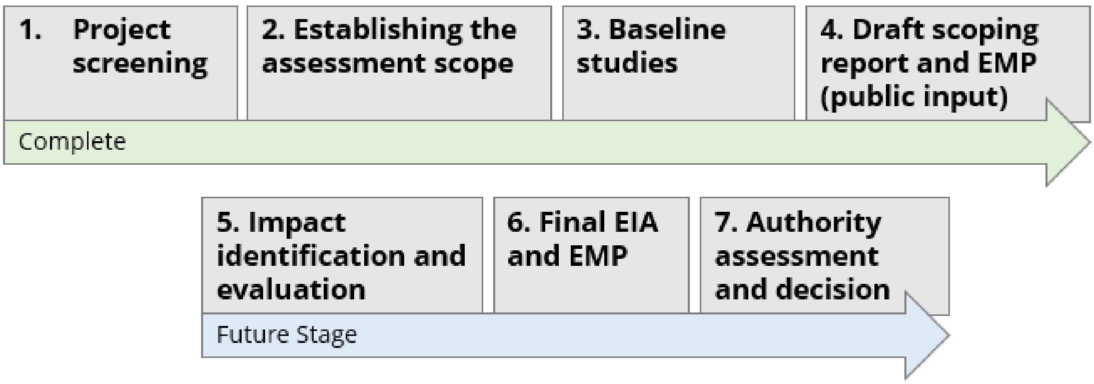


Figure 1 – Simplified Namibian ESIA process noting the Sandpiper Marine Phosphate Project progress

1 INTRODUCTION

1.1 COMPANY BACKGROUND

Environmental Compliance Consultancy (ECC) has been appointed as the environmental assessment practitioner (EAP) by Namibian Marine Phosphate (Pty) Ltd (referred to as the Proponent or NMP herein) to conduct an environmental and social impact assessment (ESIA) for mining of phosphate, within mining licence 170 (ML 170). The area is located 120 km off the Namibian coast to the southwest of the of Walvis Bay (-24° 19’ 59.99” S: 13° 53’ 20” E). The eastern boundary of the mining licence is located approximately 40 km off the coast (directly west of Conception Bay). The proposed Sandpiper Marine Phosphate Project (SP1) is located within mining licence ML 170 (see Figure 4).

Mining activities will be undertaken within the initial target area (SP1) within ML 170 (Figure 4). The mining operation will entail dredging and recovery of marine phosphate sediments using a trailing suction hopper dredger (TSHD) from water depths between 190 to 250 m. The scale of the Sandpiper Project within the SP1 target area will involve mining a total area of 34 km^2 over a period of 20 years at an average of 1.7 km^2 annually. The annual mining area equates to 0.08% of ML 170. The total 20 year mining area equates to less than 2% of ML 170 and less than 0.0003% of the seabed within Namibia’s exclusive economic zone. Within this exclusive economic zone, the project would coexist with existing marine diamond mining, fishing, tourism, and the oil and gas industry, operations of a significantly larger scale. The other sites SP2 and SP3 also contain phosphate resources and may be considered at a later stage (Refer Figure 4).

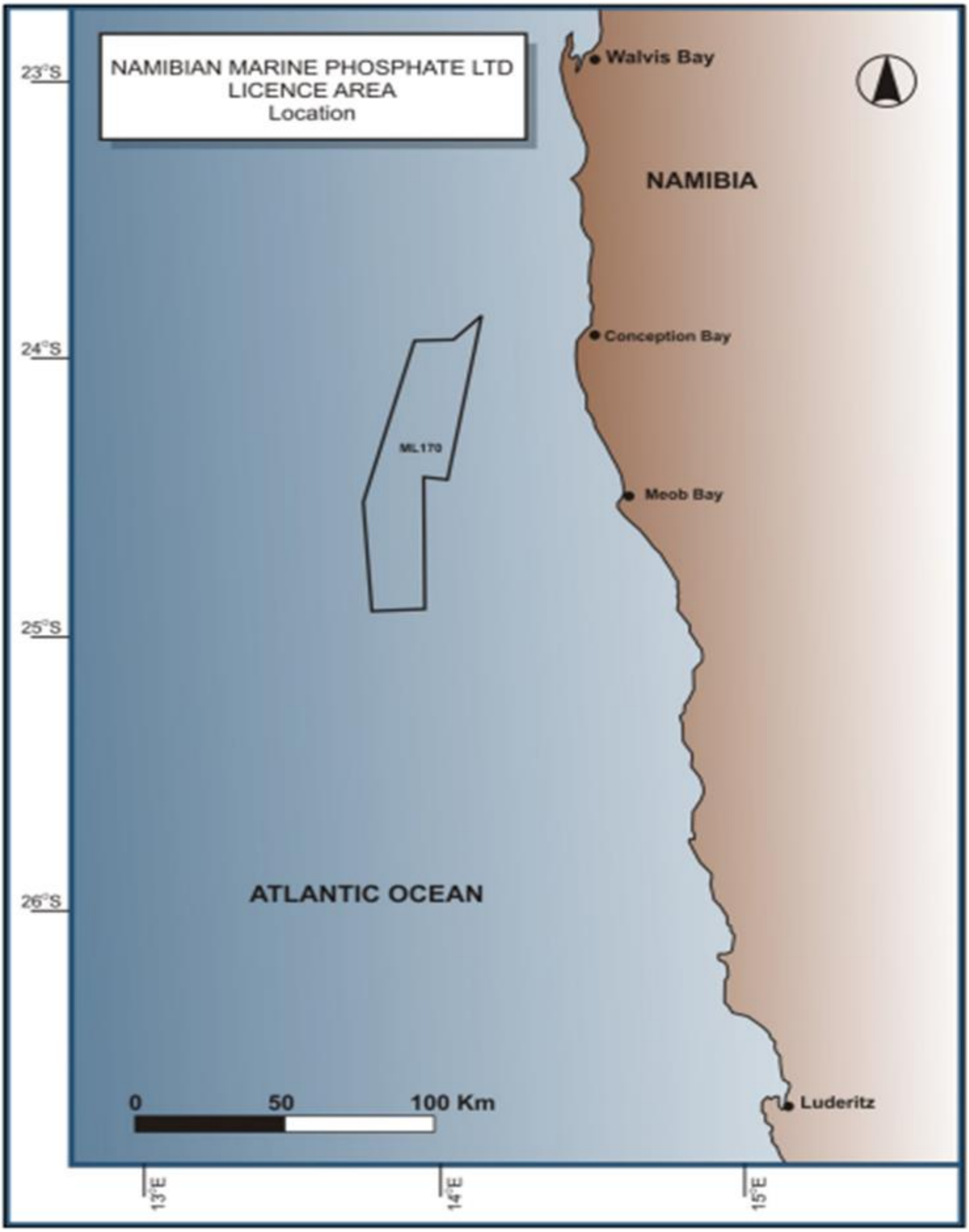


Figure 2 - Shows the locality map of the Sandpiper Marine Phosphate Project on ML 170

1.2 Purpose of the scoping report

An environmental and social impact assessment (ESIA) has commenced in compliance with the requirements of the Environmental Management Act, 2007 and its regulations. This report presents the findings of the scoping study that forms part of the larger ESIA process.

In addition to describing the prescribed ESIA process, the report describes the baseline biophysical and socioeconomic environments, provides a project description, outlines the terms of reference for the assessment phase, and presents a preliminary environmental management plan (EMP). The scope of the assessment was determined through undertaking a preliminary assessment of the proposed Project against the receiving environment, obtained through a desktop review, available site-specific literature, monitoring data, and site reports.

The scoping report and appendices was submitted to the public for review (add dates). This stage provided an opportunity for registered interested and affected parties (I&APs) to provide input, comments, and suggestions on the proposed Project and in so doing, guide the impact assessment phase (Appendix B – Public consultation document). The final scoping report, inclusive of the public comments, will be submitted to the Ministry of Mines and Energy (MME) as the competent authority for the Project. Thereafter, it will be submitted by MME to the Environmental Commissioner, Ministry of Environment, Forestry, and Tourism (MEFT) - Directorate of Environmental Affairs (DEA) for a record of decision.

1.3 The proponent of the proposed project

Namibian Marine Phosphate (Pty) Ltd (NMP) is the Proponent for the proposed Project. The Proponent holds the rights to ML 170 located 120 km off the coast to the southwest of Walvis Bay.

NMP was formed in 2008 as a joint venture company for the development of a marine phosphate resource contained within three primary EPLs, namely 3414, 3415 and 3323. NMP also holds another 3 EPL’s (4009, 4010, and 4059) with the potential to host resource in the same region.

NMP is a Namibian registered company with two primary shareholders namely Mawarid Mining LLC (Oman registered) holding 85% as the funding shareholder and Havana Investments (Pty) Ltd (Namibian registered) holding 15%.

Table 1 - Proponent's details

Company Representative:	Contact Details:
Namibian Marine Phosphate (Pty) Ltd Mr Chris Jordinson (Corporate contact person)	7 Auob Street, Meersig Walvis Bay Namibia Private Bag 5018 Tel: +264 85 580 0013 Email: info-namphos@namphos.com

1.4 ENVIRONMENTAL AND SOCIAL ASSESSMENT PRACTITIONER

Environmental Compliance Consultancy (ECC) (Reg. No. CC 2013/11401) has prepared this scoping report and the preliminary EMP on behalf of the Proponent.

This report was authored by employees of ECC, who have no material interest in the outcome of this report, nor do any of the ECC team have any interest that could be reasonably regarded as being capable of affecting their independence in the preparation of this report. ECC is independent of the Proponent and has no vested or financial interest in the Project, except for fair remuneration for professional fees rendered based upon agreed commercial rates. Payment of these fees is in no way contingent on the results of this report or the assessment, or a record of decision issued by the Government. No member or employee of ECC is, or is intending to be, a director, officer, or any other direct employee of Namibia Marine Phosphate. No member or employee of ECC has, or has had, any shareholding in Namibia Marine Phosphate.

All compliance and regulatory requirements regarding this report should be forwarded by email or posted to the following address:

Environmental Compliance Consultancy
PO Box 91193, Klein Windhoek, Namibia
Tel: +264 81 669 7608
Email: info@eccenvironmental.com

1.5 ENVIRONMENTAL REQUIREMENTS

The Environmental Management Act, 2007 and its regulations, stipulate that an environmental clearance certificate is required before undertaking any of the listed activities that are identified in the Act and its regulations. Potential listed activities triggered by the Project are provided in Table 2.

Table 2 – Activities potentially triggered by the NMP project

Source: Environmental Management Act, 2007, and its regulations

Listed activity	As defined by the act	Relevance to the project
Mining and quarrying activities	(3.1) The construction of facilities for any process or activities which require a licence, right, or other forms of authorization, and the renewal of a licence, right, or other forms of authorization, in terms of the Minerals (Prospecting and Mining Act), 1992. (3.2) Other forms of mining or extraction of any natural resources whether regulated by law or not. (3.3) Resource extraction, manipulation, conservation, and related activities.	− Mining is the primary listed activity that will be undertaken in mining licence ML 170 under the provisions of the Minerals (Prospecting and Mining) Act 33 of 1992. − The Minerals Act (1992) defines mining activities under the lawful ownership of a mining licence. − The primary activity to be undertaken is the mining or dredging of phosphatic sediments within ML 170. − The phosphatic sediment will be extracted in ML 170 using deep water dredging techniques and will then be transported to Walvis Bay for discharge and processing at an onshore facility. The onshore beneficiation operations, including transportation and discharge of the phosphate ore mined in ML 170 form a separate component of the project and will be the subject of a separate environmental and social impact assessment and in turn application for an environmental clearance certificate.
Hazardous substance treatment,	(9.1) The manufacturing, storage, handling, or processing of a hazardous substance defined in the Hazardous Substances Ordinance, 1974.	− The Proponent will ensure that the dredging company contracted to conduct the dredging operations are compliant with the provisions of International Convention for the

Listed activity	As defined by the act	Relevance to the project
handling and storage	(9.2) Any process or activity which requires a permit, licence, or another form of authorization, or the modification of or changes to existing facilities for any process or activity which requires amendment of an existing permit, licence or authorization or which requires a new permit, licence or authorization in terms of a governing the generation or release of emissions, pollution, effluent or waste. (9.4) The storage and handling of dangerous goods, including petrol, diesel, liquid petroleum gas, or paraffin, in containers with a combined capacity of more than 30 cubic meters at any one location.	Prevention of Pollution from Ships (MARPOL) and will verify that the vessel holds valid and applicable permits associated with the prevention of pollution of hazardous substances, if applicable. − The dredge vessel will hold a supply of fuel in the vessel's fuel tanks in accordance with standard international marine practice. Refueling will be conducted in the Port of Walvis Bay.

2 APPROACH TO THE ASSESSMENT

2.1 PURPOSE AND SCOPE OF THE ASSESSMENT

The aim of this assessment is to determine which impacts are likely to be significant; to scope the available data and identify any gaps that need to be filled; to determine the spatial and temporal scope; and to identify the assessment methodology.

2.2 THE ASSESSMENT PROCESS

The ESIA methodology applied to this assessment is compliant with Namibia's EMA 2007 which is applicable to all marine areas located within Namibia's Territorial Waters and Exclusive Economic Zone (EEZ) (Territorial Sea and Exclusive Economic Zone of Namibia Act 3 of 1990). The EISA methodology has been developed using the International Finance Corporation (IFC) standards and models performance Standard 1: 'Assessment and management of environmental and social risks and impacts' (International Finance Corporation, 2012 and 2017) as a guideline, as well as Namibian Draft Procedures and Guidance for EIA and EMP (Republic of Namibia 2008); international and national best practice guidelines and ECC combined relevant ESIA experience.

Furthermore, this assessment was undertaken for the Proponent in accordance with Namibian legal requirements.

This assessment is a formal process whereby the potential effects that the Sandpiper Project will have on the biophysical, social and economic environments are identified, assessed and reported, so that the significance of potential impacts can be taken into account when considering a record of decision for the proposed Sandpiper Project.

Final mitigation measures and recommendations are based on the cumulative experience of the consulting team and the client, taking into consideration the potential environmental and social impacts. The process followed, through the assessment, is illustrated in 3 and is detailed further in the following sections.

1. Project screening

Complete

The first stages in the ESIA process are to undertake a screening exercise to determine whether the Project triggers listed activities under the Environmental Management Act, 2007, and its regulations.

The screening phase of the Project is a preliminary analysis, in order to determine ways in which the Project might interact with the biophysical, social, and economic environments.

Stakeholder engagement:
- Registration of the project
- Preparation of the BID

2. Establishing the assessment scope

Complete

Where an ESIA is required, the second stage is to scope the assessment. The main aim of this stage is to determine which impacts are likely to be significant; to scope the available data and any gaps that need to be filled; to determine the spatial and temporal scope; and to identify the assessment methodology.

The scope of this assessment was determined through undertaking a preliminary assessment of the proposed Project against the receiving environment. Feedback from consultation with the public and the Proponent informs this process. The following environmental and social topics were scoped into the assessment, as there was the potential for significant impacts to occur. Impacts that are identified as potentially significant during the screening and scoping phase are taken forward for further assessment in the ESIA process. These are:

BIOPHYSICAL ENVIRONMENT
- Biogeochemistry;
  Effects of disturbances to the seabed for benthos
  Sediment plume and dispersion modelling
  Sediment toxicity
  Underwater noise
  CO_2 fluxes
- Biodiversity;
  Mammals
  Fisheries
  Seabirds

SOCIAL ENVIRONMENT
- Socio-economic

3. Baseline studies

Complete

A robust baseline is required, in order to provide a reference point against which any future changes associated with a Project can be assessed, and to allow suitable mitigation and monitoring to be identified.

The project area has been studied extensively from 2011 – 2020 utilising various specialist works, with an original impact assessment conducted in 2011/2012. Verification studies were conducted in 2013/2014 with supplementary studies conducted in 2020. This literature was available to be referenced. The Project site-specific area has been studied as part of the ESIA process for both the ML170 area and target mining area of SP-1 and the following has been conducted as part of this assessment:
- Desktop studies
- Consultation with stakeholders
- Specialist studies

The environmental and social baselines are provided in the scoping study.

4. Scoping report and EMP

Complete

The scoping report documents the findings of the current process and provides stakeholders with an opportunity to comment and continue the consultation that forms part of the environmental assessment. The EMP provides measures to manage the environmental and social impacts of the proposed Project, and outlines the specific roles and responsibilities required in order to fulfil the plan.

This scoping report focuses on describing the ESIA process, project description, baseline description and Terms of Reference for the assessment phase.

This report will be issued to stakeholders and I&APs for consultation, for a period of 7 days, meeting the mandatory requirement as set out in the Environmental Management Act, 2007. The aim of this stage is to ensure that all stakeholders and I&APs have an opportunity to provide comments on the assessment process, and to register their concerns, if any.

5. Impact identification and evaluation

Future Stage

The key stage of the ESIA process is the impact identification and evaluation stage. This stage is the process of bringing together project characteristics with the baseline environmental characteristics, and ensuring that all potentially significant environmental and social impacts are identified and assessed. It is an iterative process that commences at project inception, and ends with the final design and project implementation. The impact identification and evaluation stages will be updated in the assessment phase.

The final design of the proposed Project will be assessed, along with alternatives that were considered during the design process in accordance with the Environmental Management Act, 2007. Section 6 in this report sets out the assessment methodology to be used to assess the Project against the environmental and social baselines that would be affected.

6. Final EIA and EMP

Future Stage

All comments received during the I&AP public review period will be collated in an addendum report, which will accompany this scoping report when submitted to the MEFT: DEA. All comments will be responded to, either through providing an explanation or further information in the response table, or by signposting where information exists, or where new information has been included in the ESIA report or appendices. Comments will be considered, and where they are deemed to be material to the decision-making, or might enhance the ESIA, they will be incorporated.

The final ESIA report, appendices, and the addendum report, will be available to all stakeholders, and all I&APs will be informed of its availability for statutory review period of 21 days.

The ESIA report, appendices and addendum will be formally submitted to the competent authority (MME) and the MEFT: DEA as part of the application for an environmental clearance certificate.

7. Authority assessment and decision

Future Stage

The Environmental Commissioner, in consultation with other relevant authorities, will assess if the findings of the ESIA presented in the report are acceptable. If deemed acceptable, the Environmental Commissioner will revert to the Proponent with a record of decision and recommendations.

8. Monitoring and auditing

Future Phase

In addition to the EMP being implemented by the Proponent, a monitoring strategy and audit procedure will be determined by the Proponent and competent authority. This will ensure key environmental receptors are monitored over time to establish any significant changes from the baseline environmental conditions, caused by Project activities

Figure 3 - ESIA process and stages complete

2.3 STUDY AREA

This ESIA study area has been defined according to the geographic scope of the receiving environment and potential impacts that could arise because of the Sandpiper Project. The receiving environment is a summary term for the biophysical and socioeconomic environment that is described in the baseline chapter. The study area is presented in Figure 4.

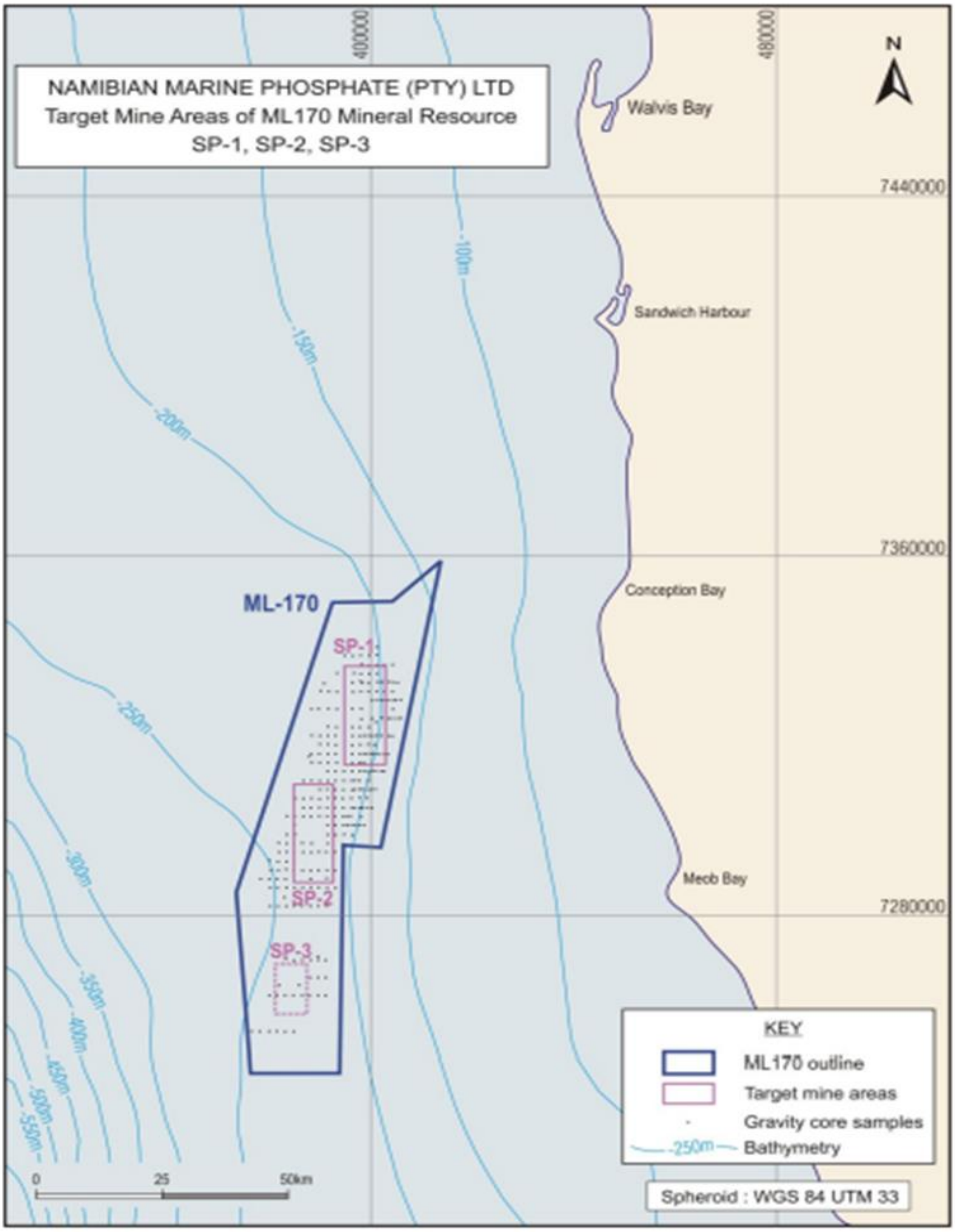


Figure 4 - ESIA study area

2.4 PUBLIC CONSULTATION

Public participation and consultation are a requirement stipulated in the Environmental Impact Assessment Regulations (Regulations 21 and 23) of the EMA, 2007 for a project undertaking a listed activity and requires an environmental clearance certificate.

Consultation is a compulsory and critical component of the ESIA process for achieving transparent decision-making and can provide many benefits. Consultation is ongoing during the ESIA process. The objectives of the public participation and consultation process are to:

- Provide information on the Sandpiper Project, introducing the overall project concept and planning in the form of a background information document (BID)
- Determine the relevant government, regional and local regulating authorities
- Listen to and understand community issues, record concerns and questions
- Explain the process of the ESIA and timeframes involved and establish a platform for ongoing consultation

Public consultation for the Sandpiper Project commenced on 27 January 2022 when pre-consultation letters were distributed to focus groups and identified key stakeholders and interested and affected parties.

Adverts for public meetings held in Windhoek and Walvis Bay were placed in local newspapers and the notification of the assessment in terms Regulation 21 of the Act was placed in the following newspapers on the 27 January and 3 February 2022 in the following newspapers:

- The Republikein;
- The Namibian Sun; and
- Allgemeine Zeitung.

2.4.1 IDENTIFICATION OF KEY STAKEHOLDER AND INTERESTED OR AFFECTED PARTIES

A stakeholder mapping exercise was undertaken to identify individuals or groups of stakeholders, and the method in which they will be engaged during the ESIA process.

Stakeholders were approached through direct communication (letters and phone calls), the national press, or directly by email. A summarized list of stakeholders for this project is given below:

- The general public with an interest in the Sandpiper Project;
- Ministry of Environment, Forestry and Tourism (MEFT);
- Ministry of Mines and Energy (MME);
- Ministry of Fisheries and Marine Resources;
- Ministry of Works and Transport (MWT);
- Erongo Regional Council;

- Walvis Bay Municipality;
- Swakopmund Municipality;
- Fishing unions such as the Confederation of Namibian Fishing Association (CNFA);
- Directorate of Maritime Affairs in the MWTC;
- Walvis Bay Salt Holdings;
- Namibia Ports Authority (Namport);
- Chamber of Mines (COM);
- Namibia Chamber of Environment (NCE);
- Namibia Uranium Institute (NUI);
- NGO's such as Namibia Environment & Wildlife Society (NEWS),
- The Dolphin Project;
- Swakopmund Scientific society;
- Mine Workers Union;
- LL Namibia Phosphate (Pty) Ltd; and
- Wet Landed Horse Mackerel Association.

The records of the public consultation process in the form of a summary report are provided in Appendix B – Public consultation document and provides a list of interested and affected parties (I&APs'), evidence of consultation, including notes of public meetings, advertisements in national newspapers, and a summary of the comments or questions raised by the public.

The draft scoping report was submitted to the competent authority, and all interested and affected parties for their review on the 22 April 2022. The public review period was open for a period of 14 days from the 22 April 2022 to 6 May 2022. All comments received were recorded, analysed, and incorporated into the summary report as an addendum to the scoping report as presented in Appendix C – Addendum report. The final scoping report will be submitted to the competent authorities and I&APs for their records.

2.4.2 SUMMARY OF ISSUES RAISED

Matters raised by registered I&APs in relevant stakeholder consultations and the public meetings in Windhoek and Walvis Bay are considered typical for the nature, location and scale of project, and these are summarised as follows:

- Potential effects on the marine benthic fauna;
- Potential impairment of food chain functionality;
- Potential creation of new habitat colonized by as yet unknown fauna;
- Potential modification to the water column, primarily turbidity;
- Reduction in light penetration caused by localized surface turbidity plume;
- Change in, e.g., oxygen levels related to sediment releases into water column;
- Possible release of hydrogen sulphide into the water column;
- Potential removal of typical spawning substrate for fish;

- Potential removal of foraging substrate for fish;
- Potential interference with fish behaviour;
- Associated implications for the commercial fishing industry;
- Potential to increase the marine traffic in the vicinity of Walvis Bay;
- Potential job creation and skills development due to the Sandpiper Project;
- Potential social upliftment benefits for local and regional communities;
- Potential influx of people moving to the Walvis Bay areas;
- Potential social nuisances;
- Potential value for development of a new mining sector and phosphate-based industry; and
- Potential regional and national economic benefits.

3 REVIEW OF THE LEGAL ENVIRONMENT

This chapter outlines the regulatory framework applicable to the proposed Project. As stated in Section 1, an environmental clearance certificate is required for any activity listed in the Government Notice No. 29 of 2012 of the EMA. The Sandpiper Project is located outside of any marine protected or heritage listed areas.

A thorough review of relevant legislation has been conducted for the Sandpiper Project. Table 3 identifies relevant legal requirements specific to the Sandpiper Project. Table 4 provides the national policies and plan. Table 5 specifies permits relevant for the Sandpiper Project. Table 6 identifies the international policies and plans relevant to the Sandpiper Project.

3.1 NATIONAL REGULATORY FRAMEWORK

Table 3 - Details of the regulatory framework as it applied to the Sandpiper Project

National Regulatory Regime	Summary	Applicability to the Sandpiper Project
Constitution of the Republic of Namibia (1990)	The constitution defines the country's position in relation to sustainable development and environmental management. The constitution refers that the State shall actively promote and maintain the welfare of the people by adopting policies aimed at the following: "Maintenance of ecosystems, essential ecological processes and biological diversity of Namibia, and the utilisation of living, natural resources on a sustainable basis for the benefit of all Namibians, both present, and future."	The Proponent is committed to the sustainable use of the environment, and has aligned its corporate mission, vision, and objectives within the ambit of the Constitution of the Republic of Namibia (1990).
Territorial Sea and Exclusive Economic Zone Act No.3 of 1990	To determine and define the territorial sea, internal waters, exclusive economic zone and continental shelf of Namibia and activities associated herewith. The continental shelf is defined as State land and the Exclusive Economic Zone (EEZ) extends to 200 nautical miles offshore (370.4 km). Namibian legislation regulates the activities of proposed exploration and mining projects that fall within these areas and not international guidelines or standards. As defined under this Act (Section 4) Within the exclusive economic zone - (a) any law of	The Sandpiper Project falls within the continental shelf of Namibia and in the EEZ zone.

National Regulatory Regime	Summary	Applicability to the Sandpiper Project
	Namibia which relates to the exploitation, exploration, conservation or management of the natural resources of the sea, whether living or non-living, shall apply; (b) Namibia shall have the right to exercise any powers which it may consider necessary to prevent the contravention of any law relating to the natural resources of the sea	
Minerals (Prospecting and Mining) Act No. 33 of 1992	The Act provides for the granting of various licences related to mining and exploration. Section 50 (i) requires: "An environmental impact assessment indicating the extent of any pollution of the environment before any prospecting operations or mining operations are being carried out, and an estimate of any pollution, if any, likely to be caused by such prospecting operations or mining operations." The Act sets out the requirements associated with licence terms and conditions, such that the holder of a mineral licence shall comply with. The Act also contains relevant provisions for pollution control related to mining activities and land access agreements and provides provisions that mineral licence holders are liable for any damage to land, water, plant, or animal life, caused by spilling or pollution, and must take all such steps	Mining Licence ML 170 was issued to the Proponent in July 2011 and is valid for a period of 20 years. The proposed mining activity in ML 170 requires an EIA to be carried out, as it triggers listed activities as defined in Government notice 29 in the Environmental Management Act 2007. Mining activities in ML 170 shall not commence until an Environmental Clearance Certificate has been issued in accordance with the provisions of the Environmental Management Act 2007. The Sandpiper Project shall be compliant with Section 76 of the Act with regard to records, maps, plans and financial statements, information, reports and returns submitted.

National Regulatory Regime	Summary	Applicability to the Sandpiper Project
	as may be necessary to remedy such spilling, pollution, loss, or damage, at its own costs.	
Environmental Management Act, 2007 (Act No. 7 of 2007) and its regulations (2012), including the Environmental Impact Assessment Regulation, 2007 (No. 30 of 2011)	The Act aims to promote sustainable management of the environment and the use of natural resources. The Act requires certain activities to obtain an environmental clearance certificate prior to project development. The Act states that an EIA should be undertaken and submitted as part of the environmental clearance certificate application process. The MEFT is responsible for the protection and management of Namibia's natural environment. The Department of Environmental Affairs, under the MEFT, is responsible for the administration of the EIA process.	This environmental scoping report documents the findings of the scoping phase of the environmental assessment undertaken for the proposed Sandpiper Project. The process will be undertaken in line with the requirements under the Act and its regulations. Mining activities in ML 170 shall not commence until an Environmental Clearance Certificate has been issued in accordance with the provisions of the Environmental Management Act 2007.
Marine Resources Act, 2000 (Act 27 of 2000)	The Act provides for the conservation of the marine ecosystem and the responsible utilization, conservation, protection and promotion of marine resources on a sustainable basis; for that purpose, to provide for the exercise of control over marine resources; and to provide for matters connected therewith.	The Proponent is committed to the conservation of the marine ecosystem and has taken steps to ensure that it uses a method of mining (dredging) that has been appropriately tried and/or tested in order to contribute the least amount of disruption to the marine environment.
The Namibian Ports Authority Act, 1994 (Act 2 of 1994)	The Act provides for the establishment of the Namibian Ports Authority to undertake the management and control of ports and lighthouses in Namibia, and the provisions of facilities and	During Sandpiper Project related construction, mobilisation and operations, any vessel(s) entering Namport waters will comply with all nautical safety

National Regulatory Regime	Summary	Applicability to the Sandpiper Project
	services related thereto. The Act gives provisions for licence to undertake activities in any port (including entry to a port).	requirements and will obtain relevant permission or licences where required.
Hazardous Substances Ordinance, No. 14 of 1974	This Ordinance provides for the control of toxic substances and can be applied in conjunction with the Atmospheric Pollution Prevention Ordinance, No. 11 of 1976. This applies to the manufacture, sale, use, disposal, and dumping of hazardous substances, as well as their import and export.	The planned Sandpiper Project will involve the handling and onboard storage of hazardous substances such as fuels, reagents, and industrial chemicals. The Proponent and appointed international dredging contractor shall ensure safe handling, transfer, storage, and disposal protocols are developed, implemented, and audited throughout its operations in accordance with all relevant National and International maritime practices and regulations The Proponent is obliged to ensure that all permits under this Ordinance are obtained prior to Sandpiper Project commencement.
Labour Act, No. 11 of 2007	The Labour Act, No. 11 of 2007 (Regulations relating to the Occupational Health & Safety provisions of Employees at Work, promulgated in terms of Section 101 of the Labour Act, No. 6 of 1992 - GN156, GG 1617 of 1 August 1997)	The Sandpiper Project shall adhere to all labour provisions and guidelines, as enshrined in the Labour Act. The Sandpiper Project shall also develop and implement a comprehensive occupational health and safety plan to ensure adequate protection for its personnel throughout the Sandpiper Project lifecycle.
The Merchant Shipping Act, No.73 of 1991	This Act regulates all shipping activities and includes the following matters: registration and licensing of	These matters are applicable to the proposed dredging activities on ML 170 and the navigation to and from the Port of Walvis Bay.

National Regulatory Regime	Summary	Applicability to the Sandpiper Project
	ship(s), safety of ships and life at sea, safety of navigation and collisions, accidents at sea and limitation of liability.	
Prevention and Combating of Pollution of Sea by Oil Amendment Act, No. 24 of 1991	The primary focus of this amendment Act deals with fines that may be imposed in respect of offences regarding pollution from ships at sea.	The dredger will release effluent during marine operational activities.
National Monuments Act, No. 28 of 1969	This Act regulates the disturbance of shipwrecks and archaeological deposits. If such finds are found, it details reporting requirements and further action to be taken by the Proponent.	NMP will adhere to the requirements of the Act if chance finds are discovered during marine operational activities.
Maritime Notice No. 4 of 1994	Provides rules and procedures for collecting non-mineralised waste from vessels in Namibian waters.	The dredger will have permanent staff to operate the vessel and provide support activities, therefore waste will be produced on board.
Petroleum Products and Energy Amendment Act, No.3 of 2000	Provides provision for the Minister to regulate the cleaning up of petroleum product spills, leaks and related incidents. The Proponent is required to carry all costs associated with such incidents.	The dredger has the potential to cause petroleum product spills or related incidents. The Proponent and appointed dredging contractor shall ensure that all necessary hazard management, mitigation, and recovery procedures as well as relevant marine and environmental insurance covers are in place and maintained throughout operations.

3.2 National policies and plans

Table 4 - National policies and plans applicable to the Sandpiper Project

Policy or plan	Description	Relevance to the Sandpiper Project
Vision 2030	Vision 2030 sets out the nation's development targets and strategies to achieve its national objectives. Vision 2030 states that the overall goal is to improve the quality of life of the Namibian people aligned with the developed world.	The proposed Sandpiper Project shall aim to meet the objectives of Vision 2030 and shall contribute to the overall development of the country through continued employment opportunities and ongoing contributions to the gross domestic product (GDP).
Fifth National Development Plan (NDP5)	The NDP5 is the fifth in a series of seven five-year national development plans that outline the objectives and aspirations of Namibia's long-term vision. The NDP5 pillars are economic progression, social transformation, environmental sustainability, and good governance.	The planned Sandpiper Project supports meeting the objectives of the NDP5 through creating opportunities for continued employment.
The Harambee Prosperity Plan ii (2021 – 2025)	Second Pillar: Economic advancement – ensuring increasing productivity of priority key sectors (including mining) and the development of additional engines of growth, such as new employment opportunities.	The Sandpiper Project will contribute to the continued advancement of the mining industry and create an additional employment generation engine within the regional and national landscape.
Namibia's Green Plan, 1992	Namibian has developed a 12-point plan for integrated sustainable environmental management to ensure a safe and healthy environment and to maintain a viable economy. Clause 2 (f) makes	Guidelines as best practise to be adhered too during operational activities.

Policy or plan	Description	Relevance to the Sandpiper Project
	specific mention to guidelines related to Mining and Sustainable Development.	
The Protocol on Fisheries for the Southern African Development Community (SADC), 2001	The goal of the strategy is to promote the sustainable use of living aquatic resources and ecosystems. Namibian has endorsed this protocol, which is based on 31 Articles. The specific policy objectives are to promote effective management of fish stocks, protect and preserve fish resources, promote aquaculture and mariculture development and promote trade in fish.	ML 170 overlaps partly with certain commercial fisheries where bottom trawling activities have historically taken place in the deeper parts of ML 170. However, the current 20 year target mining area represents less than 2% of the total ML 170 area and is located at the eastern margin of ML 170. The impact assessment process has taken the scale of the proposed operations and the specific potential impacts into account with various specialist studies from 2012 to 2022.
Pollution Control and Waste Management Bill (draft), 1999	This draft Act aims to promote sustainable development by regulating the discharge of pollutants into the air, land and sea. Additionally, to ensure Namibia has an integrated waste management approach and complies with international legislation.	NMP to take note of the draft bill that requirements are adhered to with regards to containment of pollutants of the dredger activities.
Minerals Policy	The Minerals Policy was adopted in 2002 and sets guiding principles and direction for the development of the Namibian mining sector, while communicating the values of the Namibian people. The policy strives to create an enabling environment for local and foreign investments in the mining sector and seeks to maximise the benefits for the Namibian people from the mining sector, while encouraging local participation.	The planned Sandpiper Project conforms to the Policy, which has been considered through the ESIA process and the production of this report. The Proponent intends to continue to support local spending and procurement. The Sandpiper Project will comply with the general guidelines of the Policy through the adoption of various legal mechanisms to manage all aspects of the environment effectively and sustainably from

Policy or plan	Description	Relevance to the Sandpiper Project
	The objectives of the Minerals Policy are in line with the objectives of the Fifth National Development Plan that include reduction of poverty, employment creation, and economic empowerment in Namibia.	the start. The ESIA is one such mechanism to ensure environmental integrity throughout the planned Sandpiper Project's lifecycle.
The Green Paper for the Coastal Policy of Namibia	The Green Paper provides an outline of the key findings of a long-term study on the conservation and management of the Namibian coast. It sets out the coastal policy and the vision for the coast, as well as principals, goals and objectives for coastal governance. It also presents the options for institutional and legal arrangements towards implementing the emerging Namibia Coastal Policy options for coastal governance in Namibia.	The principles of Integrated Coastal Zone Management will be used as guidance in the ESIA and have been considered and included where applicable in the EMP.
National Marine Pollution Contingency Plan	A coordinated and integrated system for preparing and responding to ship-sourced pollution incidents, setting out and defining Namibia's oil and hazardous and noxious substances (HNS or chemicals) pollution preparedness and response system	The measures set out in the Contingency Plan to prevent marine pollution incidents have been considered and included where applicable in the EMP.
Draft Sustainable Blue Economy Policy	Namibia's Sustainable Blue Economic Policy is based on the three interconnected pillars of sustainable ecosystem management: environmental protection, economic sustainability and social equity. The policy attempts to indicate and reflect the need to update approach towards marine and aquatic ecosystem management. This policy is currently in a draft phase and has not yet been gazetted.	The proponent is committed to supporting the principles and pillars of the Blue Economy Police which have been considered and will be included where applicable in the EMP once the Blue Economy Policy document has been finalised and gazetted.

Policy or plan	Description	Relevance to the Sandpiper Project
Marine Spatial Planning (and Draft Central Marine Spatial Plan)	Marine Spatial Planning (MSP) is being implemented under provisions of NDP5 and Blue Economy Policy. It is a participative decision-making process and management system that guides and prioritises where and when human activities occur in marine spaces, providing for comprehensive, integrated, and complimentary planning and management across all sectors and for all ocean uses in order to enable sustainable ocean development and to resolve potential conflicts in the marine space. This strategy guides the work of the Namibian Marine Spatial Planning (MSP) Working Group in establishing and implementing MSP in Namibia and developing the first marine spatial plan. This document is currently in a draft phase and has not been gazetted.	The Proponent is committed to promoting sustainable ocean development and applying the MSP objectives as set out in the implementation and Draft Central Marine Spatial Plan of this initiative which forms part of the Blue Economy Policy. Relevant aspects have been considered and will be included where applicable in the EMP once the Central Marine Spatial Plan has been finalised and gazetted.

Table 5 - Specific permits and licence requirements for the Sandpiper Project

Permit or licence	Act or Regulation	Related activities requiring a permit	Relevant Authority
Environmental clearance certificate	Environmental Management Act, No 7 of 2007	Required for all listed activities shown in Table 2. Requires issuance of Environmental Clearance Certificate by the Environmental Commissioner.	Ministry of Environment, Forestry and Tourism (MEFT)

Mining Licence	Section 90 (2) (A) of the Minerals Act, No.33 of 1992	Written permission from the mining commissioner in the form of a Mining Licence 170 has been issued to date.	Ministry of Mines and Energy (MME)

3.3 International conventions

Table 6 - International policies and plans applicable to the Sandpiper Project

Policy or plan	Description	Relevance to the Sandpiper Project
Convention for the Prevention of Pollution from Ships (MARPOL) – 73/78	MARPOL is one of the most important international conventions that is endorsed to prevent or minimize pollution at sea. Its main objective is to 'to preserve the marine environment through the complete elimination of pollution by oil and other harmful substances and the minimization of accidental discharge of such substances.' Discharges relate to sewage, non-mineralised waste, oil, hazardous substances and atmospheric emissions.	Namibia is not a signatory but the guidelines to the prevention of pollution from ships are relevant to the Proponent and will be applied by the appointed international dredging contractor. As at July 2019, Namibia was at an advanced stage of ratifying and becoming a party to MARPOL, Annex VI – air pollution. Cabinet in principle approved that Namibia accedes to the MARPOL convention to ensure its compliance as a member of the international community to protect the tenets of protecting the marine ecosystem as provided for under the constitution (2019 Statement by Information Minister Hon Stanley Simataa).
United Nations Law of the Sea Convention (UNCLOS), 1982	The UNCLOS provides an international legal framework to govern the seas and oceans of the world. Namibia as the designated State is required to administer	The Proponent adheres to the required Namibian legislation to comply with UNCLOS requirements.

Policy or plan	Description	Relevance to the Sandpiper Project
	exploitation, protection and preservation of the marine environment and natural resources on the Namibian Continental Shelf and Exclusive Economic Zone by enforcing the State's specific regulatory requirements for preventing pollution and damage to marine resources.	
Convention on the Control of Transboundary Movements of hazardous Wastes and their Disposal, 1994 (Basel Convention)	This convention controls the cross-border movement of hazardous wastes but does not address radioactive contaminated waste. Within Namibia, the Ministry of Environment, Forestry and Tourism is legally responsible to handle these applications and issue permits.	It is not envisaged that any hazardous waste will be produced by the dredging operations or will be required to be disposed of or moved across the Namibian border. However, this requirement will be addressed in the EMP.
Convention of Biological Diversity Rio de Janeiro, 1992	Namibia is a signatory on this convention and is obliged under international law to adopt the objectives and obligations of this convention through her national legislation with regards to biodiversity to maintain ecosystems, ecological processes and biodiversity for the benefit of present and future generations (Article 95(I)). Currently Namibia's second national biodiversity strategy and action plan (2013-2022) has been developed to address short comings with specific goals and targets, including reference to the mining sector.	The Proponent adheres to the required Namibian legislation to comply with CBD requirements.
United Nations Framework Convention on Climate Change (UNFCCC), 1992	This objective of the convention is to reduce and stabilize greenhouse gases at an atmosphere level to reduce impacts on climate systems, to allow ecosystems time to adapt to these changes, reduce food shortages	The Proponent adheres to the required Namibian legislation to comply with the requirements to reduce greenhouse gases during operational activities.

Policy or plan	Description	Relevance to the Sandpiper Project
	and that economies can develop in sustainable manners.	
The Stockholm Declaration on the Human Environment, Stockholm 1972	Namibia has adopted the declaration in 1996 with the following Principle 21 and 22 most relevant to the proposed Sandpiper Project. Namibia has the right to explore her own resources but to ensure that there is effective policies and controls in place to regulate these activities as to not cause detrimental harm to the environment. Whereby environmental damage has occurred in areas of her jurisdiction, compensation must be provided for victims of pollution or environmental degradation.	The Proponent adheres to the required Namibian legislation to comply with these requirements.

4 PROJECT DESCRIPTION

4.1 NEED FOR THE SANDPIPER PROJECT

Phosphate deposits contain phosphorus which is a vital element for growth in plants, animals and humans. There is no artificial substitute for phosphorous for this purpose. It is therefore an essential element used in the production of fertiliser and animal feed to promote and sustain health and growth. More recently, phosphorus has proven to have significant technical and environmental benefits if used as an alternative to metals such as cobalt to produce lithium iron phosphate batteries in the green energy and electric vehicle sectors.

With one of the world's largest undeveloped phosphate resources, establishing a phosphate based industry could position Namibia to meet the future global demand for phosphate to support production of agricultural products (fertilizers and animal feed), as well as the requirements for the development of green energy and electric vehicle battery markets as shown in Figure 5. The Proponent would be only one company within a new phosphate based industry in which an independent economic study has shown to have the potential to contribute up to 9% to Namibia's GDP and create over 50,000 direct and indirect induced jobs.

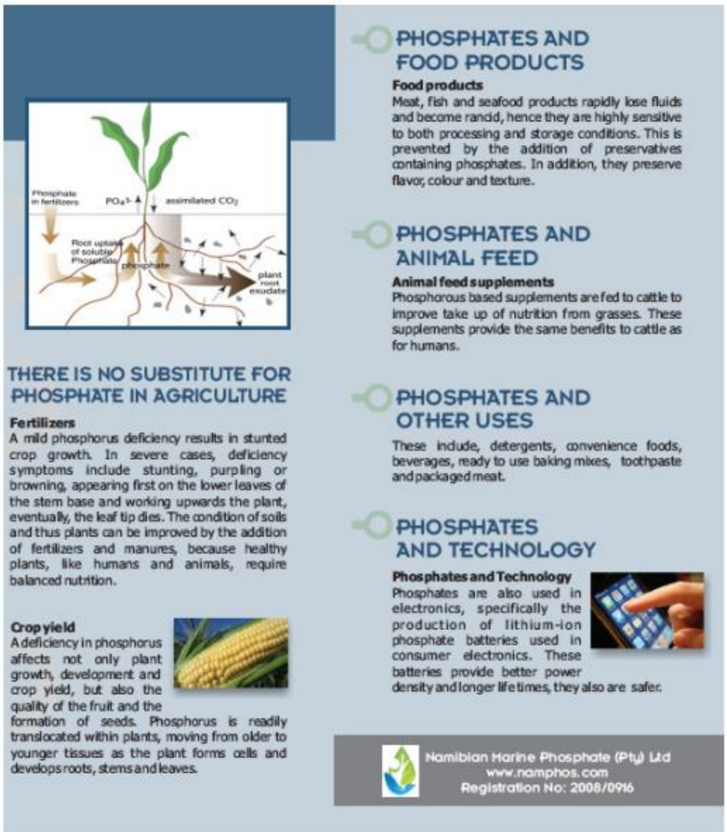


Figure 5 - Uses of phosphate in agriculture (NMP brochure) (Source: www.namphos.com)

Figure 6 – Phosphate industry development phases for the manufacturing of various phosphate products.

When farming for crops, fertilizer is applied to improve the crop yield per hectare, which is now a well-accepted practice with sound scientific support; and phosphate is also critical for plant and animal growth. Despite having one of the largest known phosphate resources in the world, Namibia still imports the majority of the fertilizer products needed to underpin its agricultural industry. Most of which comes from South African manufacturers. For example, a N$19.8 million contract to supply and import fertilizer was awarded to South African company Kynoch by the AgriBusDev Agency in Namibia (Article, Mar 30, 2020, Observer National). Additionally, due to the high import costs of fertilizer products, the per capita fertilizer consumption in Namibia is low as compared to other countries that have developed phosphate mineral resources such as South Africa, Egypt and Morocco as shown in Figure 7. Typically, the large proportion of subsistence farmers in Namibia cannot afford commercial fertilizers.

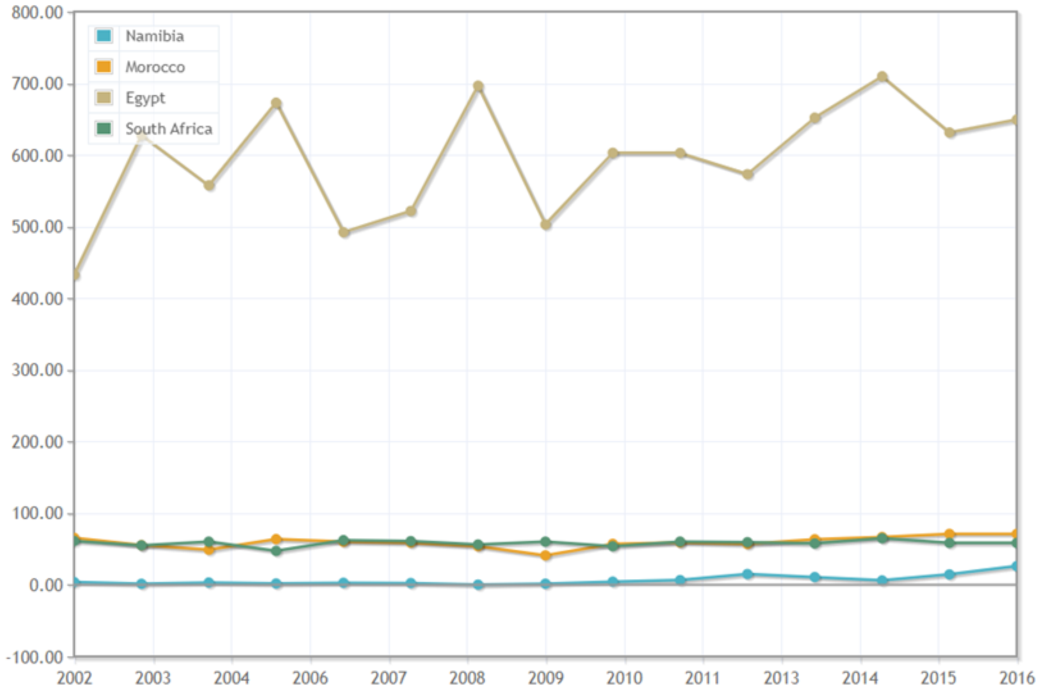


Figure 7 - Fertilizer consumption 2002 – 2016 (kg/ha of arable land) (Source: World Bank, World Development Indicators, January 2020)

The Proponent intends to pursue mining activities with the aim of producing a beneficiated phosphate concentrate product from these new mining prospects. This new mining project will enable production of phosphate concentrate in Namibia that can be used both as a direct application phosphate and as the primary product for producing fertilisers and animal feed. The definitive feasibility study (Bateman Advanced Technologies Ltd., 2013) for the Sandpiper Project completed by the Proponent, as well as an independent economic study on the potential development of a phosphate based industry in Namibia shows that development of this new mine could have a positive impact on the country's local and national economy in the areas of job creation, industrialisation and revenue generation. The 2013 definitive feasibility study concluded that the Sandpiper Project was technically, economically and environmentally feasible.

Establishing a fertilizer industry would enable an increase of in-country agricultural productivity and allow Namibia to become an exporter of phosphate and fertilizer, helping the world achieve food security. In fact, the Sandpiper Project's phosphate concentrate has been assessed by institutions internationally as being commercially viable and cost-effective for use as:

- A direct application fertilizer;
- Single super phosphate;
- A blend to more expensive forms of fertilizer; and
- A component of Lithium Ferro Phosphate batteries.

4.1.1 PHOSPHATE FOR THE ELECTRIC VEHICLE MARKET

The shift from coal and gas power to wind and solar power, in combination with the shift from combustion vehicles to electric vehicles, is driving the new demand for minerals, particularly copper, nickel and cobalt. Phosphate is a key component in lithium ferro phosphate (LFP) batteries, which are required for electric vehicles. The use of phosphates is also expected to lessen the use of cobalt and, therefore, reduce both the cost and environmental concerns of LFP batteries. According to estimates, electric vehicles are expected to make up over half of all passenger vehicle sales by 2040 with many governments committing to support the production of electric vehicles in a bid to decrease their dependency on oil and gas. The largest minerals importer, China, has, for example, set a goal by 2025 whereby electronic vehicles are to make up 20% of new car sales.

NMP is in the process of studying the LFP battery market to understand if, along with other applications NMP has already identified for the Namphos Concentrate (e.g., direct application, single super phosphate and blend for phosphoric acid production), there is a position for the Namphos Concentrate in the LFP battery market.

4.1.2 NAMIBIA ECONOMY AND NEED FOR NEW MINING INDUSTRY DEVELOPMENT

Namibia's economy is heavily dependent on the extraction and processing of minerals and products for export. Mining accounts for about 12.5% of the country's GDP but provides more than 50% of foreign exchange earnings.

Marine phosphate mining and processing will not only create new mining operations, such as NMP's Sandpiper Project but can also provide Namibia with the phosphate concentrate required to develop a fully integrated fertilizer industry that has the potential to contribute significant social and economic benefits for Namibia while addressing key issues such as job creation and poverty eradication. Additionally, the Project will contribute to an increase in shipment consignments from the Port of Walvis Bay.

Development of new primary and secondary industries in the mining sector is now, more than ever, a vital consideration in the drive to support sustained growth of the Namibian economy and its national socio-economic upliftment goals. Such as those outlined in the Harambee Prosperity Plan and the National Development Plan 5 (NDP 5).

An independent analysis of the economic benefits that could accrue to Namibia from opening the country to an incipient phosphate based industry was completed by Stratecon (2018) and circulated within Government, noted that:

- Countries that have abundant phosphate rock reserves (E.g. USA, Morocco, Egypt, Jordan) have benefited with employment in the tens of thousands and had significant contributions to GDP from phosphate mining and beneficiation.
- Namibia could benefit from its phosphate resource, just as it has benefited other countries with similar resources.
- Setup of the industry would occur over time in discrete steps comprising:
- Dredging and basic beneficiation to produce phosphate concentrate;
- Establishment of phosphate processing and product manufacturing factories to produce primary fertiliser products such as phosphoric acid, single super phosphate, dicalcium phosphate, triple super phosphate;
- Marketing and sale of fertiliser products; and
- Possibility for future production of advanced levels of beneficiation and products contingent on related developments in the Namibian economy.

4.2 BACKGROUND OF THE SANDPIPER PROJECT

4.2.1 PHOSPHATE IN NAMIBIA – PROJECT BACKGROUND AND ECONOMIC VIABILITY

Phosphates in the marine environment were first discovered and regionally mapped on the Namibian shelf in the late 1960s and 1970's, with subsequent exploratory work undertaken by the South African mining company Gencor Ltd and others in the 1990s and 2000's. The phosphate deposit off Walvis Bay was termed "Sandpiper Deposit" by Gencor, and that name has been retained. Phosphate deposits (of various type and grade) are known to be widely distributed on the Namibian continental shelf.

In the 1990s the Sandpiper Deposit was considered sub-economic based on price levels for rock phosphate concentrate (1991: US$ 42.50 tonne). From 2007 the value of phosphate rock concentrate (32%P_2O_5 70% BPL contract f.a.s. Casablanca) increased rapidly from US$ 80.00 per tonne, peaking at US$ 430.00 per tonne in August –September 2008, resulting in a re-rating of the economic viability of the Sandpiper deposit in Namibia and others worldwide. The 2008 pricing peak has since retracted to more consistent and sustainable price levels, despite cyclic fluctuations.

The current rock phosphate price at US$172/t (February 2022) is just below a 5-year high of US$177/t (Phosphate rock ((Morocco)), 70% BPL, contract, f.a.s. (Casablanca)), as a result of higher fertilizer prices as shown in Figure 8. The price has increased by 73% since March 2020, when the Covid-19 Pandemic became a world reality.

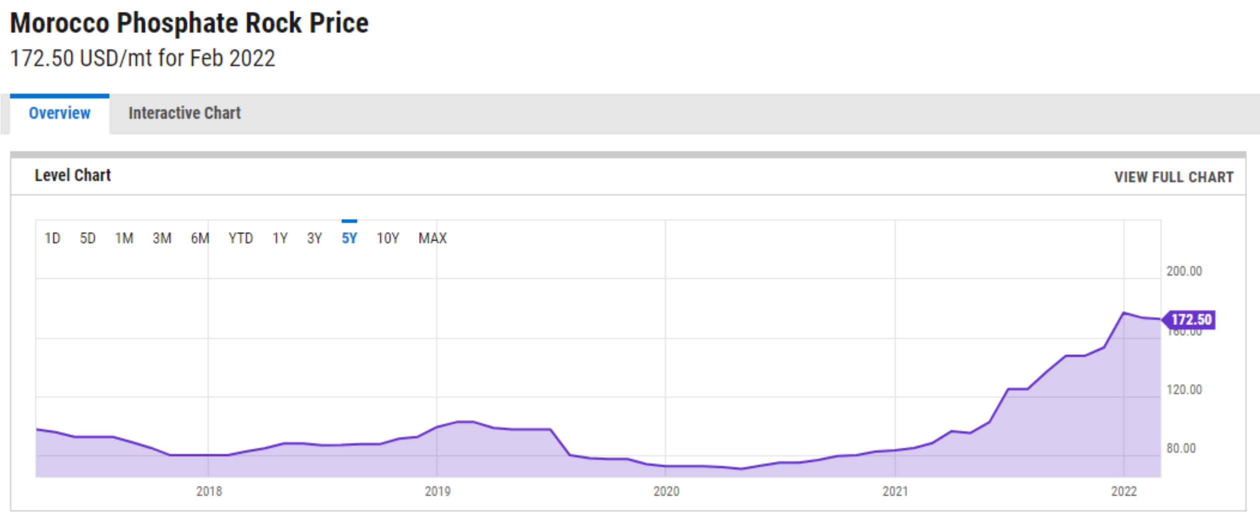


Figure 8 - Morocco Phosphate Rock Price as of February 2022 (*Rock Phosphate Monthly Price - US Dollar per Mectric Ton*, 2022)

4.2.2 SANDPIPER PROJECT AND EXPLORATION HISTORY

Commencing in 2006, comprehensive exploration and resource or reserve development programs were completed in selected target areas and comprising geological, geophysical and analytical surveys and studies which resulted in the delineation and classification of ore reserves and resources suitable to support long term mining operations. The exploration program confirmed the Sandpiper Project has:

- Ore reserves (proven and probable) of 132.76 Mt at 20.41% P_2O_5
- Indicated mineral resource inventory of 80Mt at 19.8% P2O5
- Inferred mineral resource of 1.61 billion tons at 18.9% P2O5
- Estimated at a 15% cut off grade

As such, the Sandpiper Project represents a potentially world class phosphate deposit with an initial mineral reserve and resource base of adequate size and average grade required to support the development of a long-term viable mining operation.

On 13th July 2011 a 20 year mining licence, ML 170, was granted over the whole of EPL 3414 and portions of EPL's 3415 and 3323. ML 170 covers an area of 2,233 km^2. The ML/EPL's lie approximately 120 km SW of Walvis Bay, in the vicinity of Meob and Conception Bay, Namibia and covers an area of approximately 6,000 km^2 in water depths ranging from 180m in the E of EPL 3323 to 300m in the SW of EPL 3415 as shown in Figure 9.

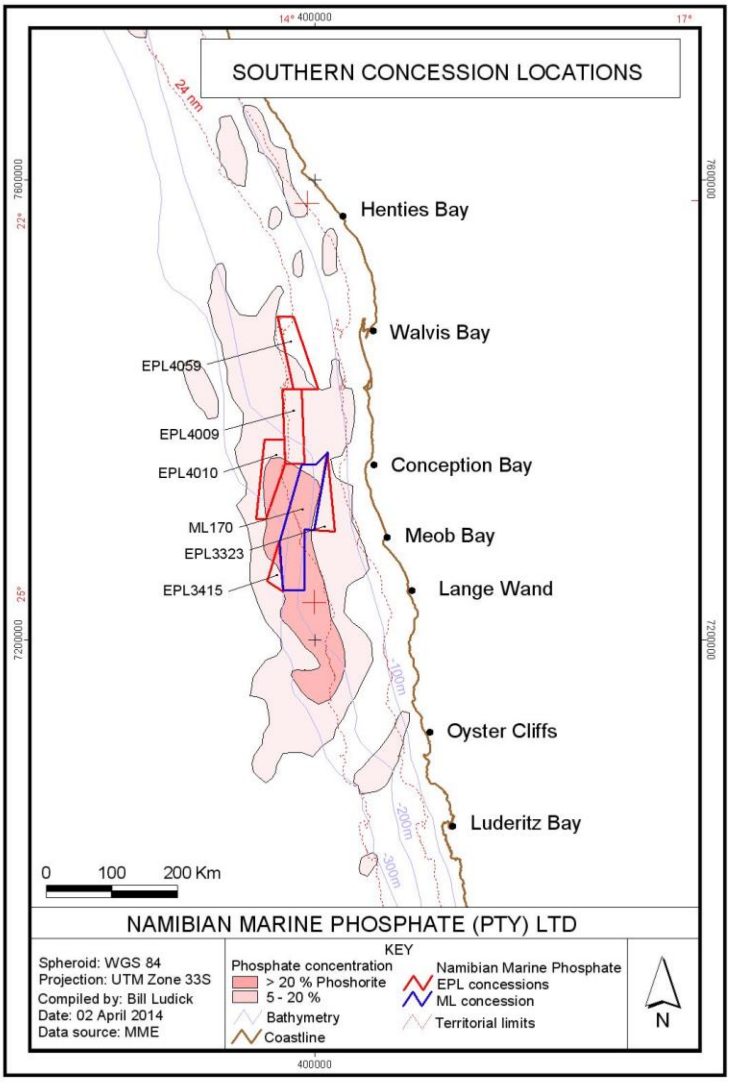


Figure 9 – Shows exploration and mining mineral tenements held by NMP on award of ML 170

A definitive feasibility study (DFS), completed by NMP for the Sandpiper Project in 2012 and updated in 2013 (Bateman Advanced Technologies Ltd., 2013), concluded that the Sandpiper Project is technically, economically and environmentally feasible. Based on a commercially viable cut-off grade of 15% P_2O_5, the DFS indicated there is sufficient phosphate resource within ML 170 to sustain mining operations and benefits for future Namibian generations for more than 100 years.

Environmental studies and stakeholder consultations have also been undertaken at various intervals commencing in 2010, including studies and stakeholder engagements completed in 2011, 2012, 2013, 2014, 2016, 2018 and 2020, respectively.

4.3 GEOLOGY AND MINERALISATION

The phosphate deposits are characterized by their spatial continuity (especially in an SSW - NNE direction) and general uniformity in grade. The variations in thickness are generally the product of thicker accumulation of sediment in very shallow palaeo-topographic depressions in the underlying clay surface.

The age and origin of the phosphorite deposits of ML 170 has been determined by analysis of sediment cores combined with strontium-36 isotope dating. These deposits formed over millions of years, initially by marine algae growing in the highly productive surface waters, dying and sinking to the seafloor where the organic phosphorus contained in the algal cells was incorporated into the mineral carbonate fluorapatite or francolite. Phosphorite grains were concentrated through repeated erosion of the sediment through wave and current activity during sea level lows. The repeated formation and reworking of these deposits have led to a highly enriched phosphorite deposit occurring in areas of the uppermost 2 m of the present-day seabed on the Namibian continental shelf and particularly in ML 170. The basal phosphorite muddy sand varies from 0.5 to 1.5 m in thickness.

The phosphorite grains formed predominantly during the early Pleistocene (2.6 to 1 Ma) and the deposit formed during the early to middle Pleistocene (2.6 to 0.126 Ma). This is overlain by increasingly shelly phosphorite sand of variably 0.5 to 1.5 m thickness, containing 65 to 86 wt.% sand and 4-5 wt.% mud.

The phosphorite is diluted by shell fragments, particular the upper layer. The upper sediment profile displays multiple erosional surfaces formed during sea-level low stands that occurred during the various glacial maxima since 1 Ma. These findings are new to science and provide a robust understanding of the origins and age of the Sandpiper phosphate deposit.

4.3.1 STRATIGRAPHY

The stratigraphy throughout the Sandpiper Project area has been ascertained from gravity cores (with a restricted maximum penetration potential of up to ~ 3 m) and older (Gencor) vibrocores (with a penetration of up to 6 m). The phosphatic horizon, which overlies a grey-green footwall clay of Miocene age, is subdivided into two distinct layers; an upper (layer 1) 0.1 to 1.0 m thick Miocene shelly phosphorite demonstrating a downward fining sequence and a lower (layer 2) 0.05 to > 2.0 m Miocene thick clayey phosphorite.

Phosphorite Horizon:

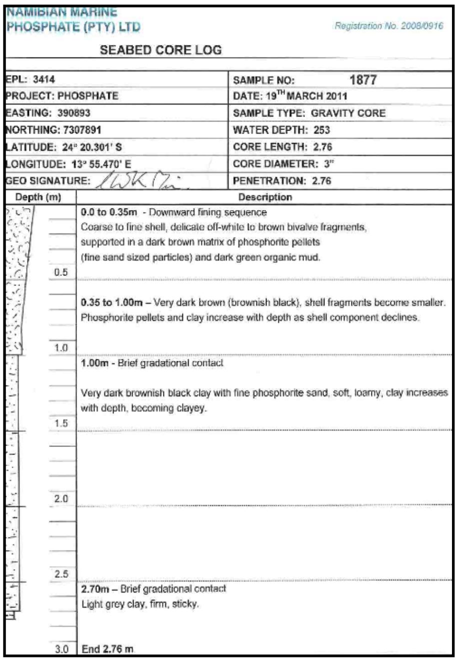
Layer 1: An upper 0.1 to 1.0 m thick shelly phosphorite identified as Miocene in age and demonstrating a downward fining sequence. This consists of a coarse broken shell bed that contains delicate off-white to brown bivalves and occasional turritella shells supported in a very dark brown (blackish) matrix of phosphorite pellets (fine sand sized particles) and dark green organic mud. Shell fragments become smaller and the phosphorite pellet component and clay increase with depth until the horizon becomes mostly a fine phosphorite sand with a small clay content. This horizon passes gradationally into layer 2.

Layer 2: A lower 0.05 to > 2.0 m thick clayey phosphorite identified as Miocene in age. This consists of a very dark brown (blackish), soft, sticky, clayey, fine phosphorite sand, which usually becomes more clayey with depth (there are exceptions where the clay content can decrease with depth). The phosphorite content is usually highest in this part of the sequence although in some areas clay predominates. Commonly brown porous bone fragments (often vertebrae) appear towards, or at the base of the horizon.

Clay Horizon (footwall)

The phosphorite horizon has a sharp bioturbated contact with an underlying Miocene marine footwall clay which gravity coring has penetrated to a maximum of 2m. This contact represents a sedimentary hiatus. This zone is a pale grey to dark olive green-grey, firm, sticky clay with coarse burrows in the top 15 cm filled with sediment from the layer above.

Typical sedimentary sequence of the deposit is shown in Figure 10, with core 1877 showing both layers 1 and 2 of the deposit and core 1939, showing only Layer 1.



NAMIBIAN MARINE PHOSPHATE (PTY) LTD — Registration No. 2008/0916

SEABED CORE LOG

EPL: 3414	SAMPLE NO: 1877
PROJECT: PHOSPHATE	DATE: 19TH MARCH 2011
EASTING: 390893	SAMPLE TYPE: GRAVITY CORE
NORTHING: 7307891	WATER DEPTH: 253
LATITUDE: 24° 20.301' S	CORE LENGTH: 2.76
LONGITUDE: 13° 55.470' E	CORE DIAMETER: 3"
GEO SIGNATURE:	PENETRATION: 2.76

Depth (m)	Description
0.5	**0.0 to 0.35m** - Downward fining sequence Coarse to fine shell, delicate off-white to brown bivalve fragments, supported in a dark brown matrix of phosphorite pellets (fine sand sized particles) and dark green organic mud.
1.0	**0.35 to 1.00m** – Very dark brown (brownish black), shell fragments become smaller. Phosphorite pellets and clay increase with depth as shell component declines.
1.5	**1.00m** - Brief gradational contact Very dark brownish black clay with fine phosphorite sand, soft, loamy, clay increases with depth, becoming clayey.
2.0	
2.5	
3.0	**2.70m** – Brief gradational contact Light grey clay, firm, sticky. **End 2.76 m**

Core log No. 1877	0 to 0.65 m	0.45 to 1.14 m

0.97 to 1.62 m	1.41 to 2.05 m	1.89 to 2.56 m	2.10 to 2.76 m

Figure 10 - Typical sedimentary sequence of the deposits with core 1877 showing both layers 1 and 2 of the deposit

The photograph and core log (sample 1877) collected from 235 m water depth in ML 170, shows layer 1, which is a shell rich phosphate rich mud 0.35 m thick, with approximately 60 % phosphate, 20 % shell and 20 % mud. Layer 1 continues to 1.0 m, it shows decreasing abundance of shell fragments with depth. Layer 2, is typically 80 % phosphate and 20 % mud (shell is absent in this layer throughout the deposit) is well represented in this core, (1.0 to 2.70 m). Layer 2 of the deposit sits on a footwall of bioturbated clay. These burrows are typically filled with phosphate rich mud.

4.3.2 NATURE OF THE PHOSPHATE MATERIAL

The phosphatic material within the sediment predominantly comprises unconsolidated fine sand sized phosphorite ooliths and pellets, falling in the 100 to 500 micron grain size range (mostly 150 to 250 microns). These pellets are formed of concentric phosphate layers and predominantly comprise calcium carbonate and phosphate (P_2O_5). They can also contain quartz grains, ilmenite and sulphides.

The phosphorite pellets form a matrix with organic rich mud and supports a downward fining and declining bed of coarse to fine shell fragments (bivalves and foraminifera) in the winnowed upper part of the deposit. The lower part of the deposit is shell free and clay rich in the matrix.

Using x-ray diffraction (XRD) and scanning electron microscopy (SEM) techniques it was confirmed that the phosphatic mineral is primarily francolite, a high carbonate apatite. Its formation was likely through chemical precipitation of dissolved phosphorous in a layered pattern to form mini nodules. Pyrite is evident in the layers, suggesting that it precipitated simultaneously with the nodule in an anaerobic environment. The francolite particles rarely occur without pyrite inclusions. Other inclusions of very fine ilmenite, quartz, mica and plagioclase are evident in the nodules.

Grades for individual samples rarely exceed 23% P_2O_5 and the majority lie between 17 and 21% P_2O_5. Average layer grades are typically 19 - 20% P_2O_5 for the lower layer (2) and 18 -19% for the upper layer (1).

The phosphate-enriched sediments and the defined mineral resources and reserves are located throughout the entire mining licence area. Within the ML 170 area, three initial target dredging areas have been identified namely SP1, SP2 and SP3.

The 20 year mine plan covering 34 km^2 is located in target area SP1 (176 km^2) which lies in water depths of 190 to 225m. The other target sites SP2 and SP3 also contain phosphate resources and may be considered at a later stage, at which time the requisite additional environmental evaluations will be made in accordance with the Environmental Management Act, No. 7 of 2007 shown in Figure 11.

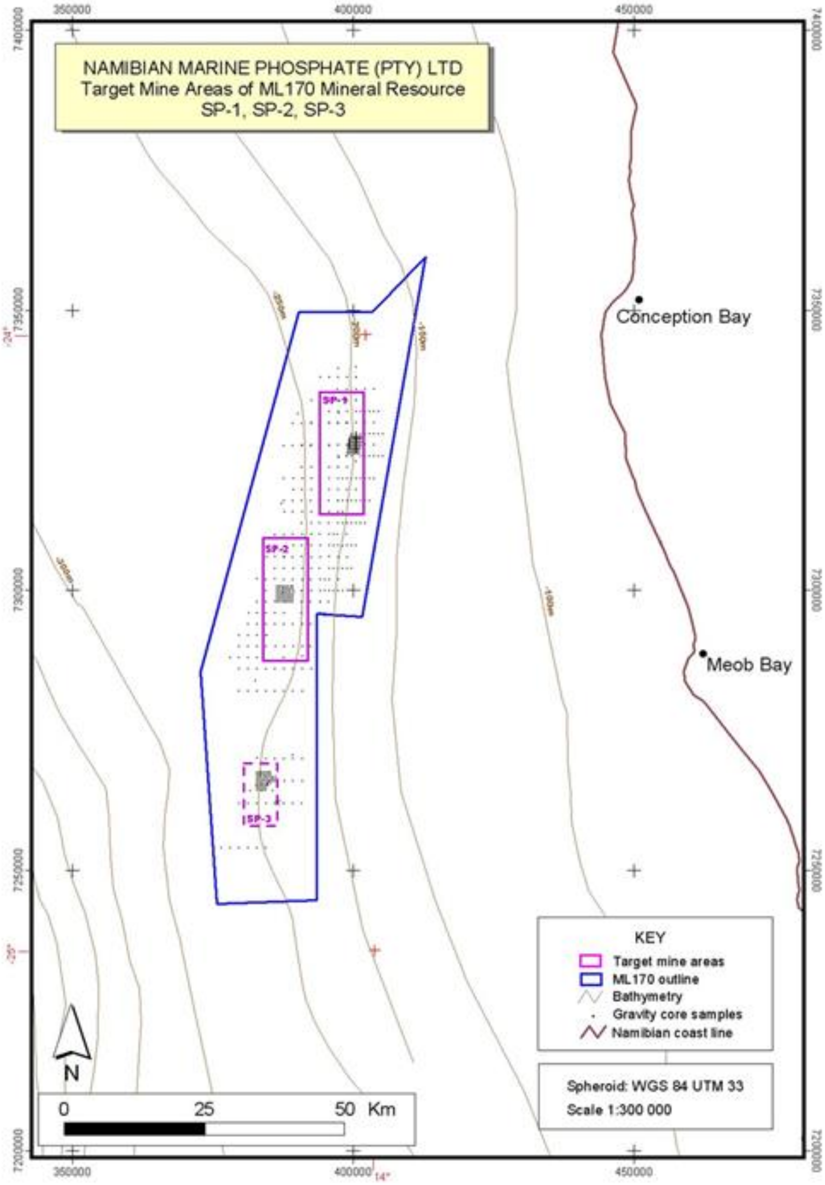


Figure 11 - Distribution of target dredging areas

4.4 SANDPIPER PROJECT LAYOUT

The Sandpiper Project comprises two separate but contingent primary activities which will be dealt with under two separate ESIA processes namely:

- Marine activities – includes all proposed activities to be undertaken in the ML 170 area (located offshore and some 120 km SW of Walvis Bay) per the conditions issued by the Ministry of Mines and Energy, and incorporating phosphate sediment recovery (dredging) and transport to the coast off Walvis Bay; and
- Land/Terrestrial activities (future activity covered in a separate environmental clearance application) – includes the proposed processing activities onshore in Walvis Bay comprising treatment/beneficiation of the material recovered, incorporating slurry

transfer pipeline to pump the material onshore from the dredger, ore discharge and screening material, the processing of the phosphate slurry to produce the export product 'rock phosphate concentrate' and the associated infrastructural requirements.

Note: Rock phosphate is an industry term used to refer to land-based phosphate deposits which typically occur in a hard rock form. The term is applied to the Sandpiper Project; however, the Namibian marine phosphate occurs in the seabed sediments as a fine black sand which forms the final concentrate product – referred to as "rock phosphate".

A trailing suction hopper dredger (TSHD) will be used to recover approximately 5.5 million tons of sediment to produce 3 million tons of phosphate concentrate at 27-28% P_2O_5 annually over the course of the remaining granted mine licence period.

The overall process for recovery and beneficiation of the marine phosphate will involve several steps shown in Figure 12.

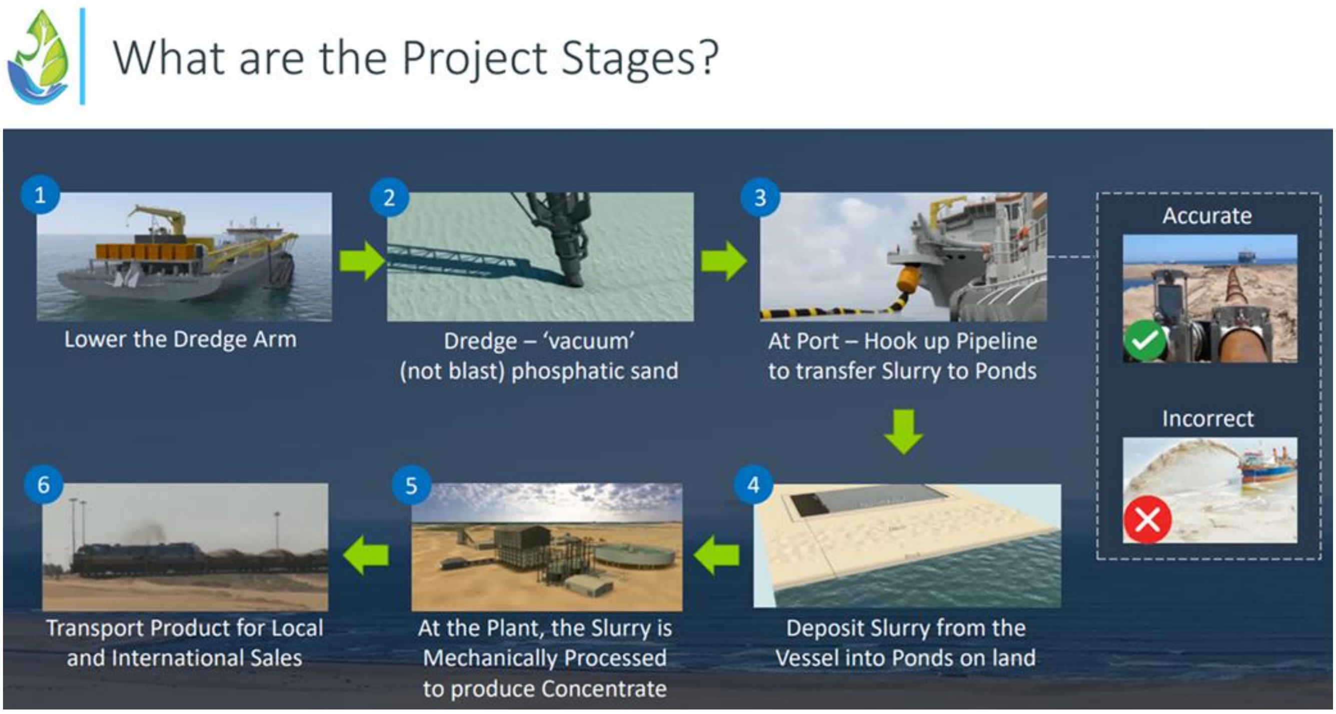


Figure 12 - Overall process for recovery and beneficiation of the marine phosphate

4.4.1 MARINE BASED SANDPIPER PROJECT COMPONENET (ML 170)

4.4.1.1 Dredging and transport

The ore is dredged from the ocean floor in ML 170 and stored in the hopper of the dredger, a special purpose ship designed for conducting dredging operations internationally. A specially designed dredging arm is to be used to reach the seabed at the required depth of 190 - 225 m.

Seabed dredging is a process that is used globally and has a common set of impacts on the seabed regardless of the purpose for which is it used. Primary examples of seabed dredging operations include:

- Aggregate mining;
- Shore and beach replenishment;
- Harbour and channel clearing; and
- Marine diamond mining.

The dredger then travels to Walvis Bay to berth at an appropriate facility to discharge the phosphate ore ashore as cargo.

4.4.2 LAND BASED SANDPIPER PROJECT COMPONENT (WALVIS BAY) OPERATIONAL CYCLE

The section below describes the shore-based beneficiation process which forms the Land component of the Sandpiper Project that will be carried out after phosphate has been dredged from the seabed floor and delivered to the proposed shore-based facility. This section is for information purposes only and will not form part of the current impact assessment report.

4.4.2.1 Ore handling

Ore is discharged from the dredger via a fixed slurry pipeline feeding into a storage facility (buffer pond) to be constructed within the North Port Bulk Terminal area (site allocation pending). The excess sea water pumped ashore will be conditioned to prescribed parameters and then returned from the buffer pond back to the sea.

4.4.2.2 Beneficiation

The beneficiation process utilizes sea water for processing and comprises effectively a sieving and sizing operation to separate coarse (shell) and fine (mud) fractions from the sand fraction which contains the phosphate. Ore is reclaimed as slurry from the buffer pond either by dredging or sluicing and the shell grit is screened out before it is pumped via a pipeline to the process plant site (site allocation pending) to be located close to the buffer pond. At the Walvis Bay Process Plant site, the ore slurry is de-slimed and attritioned (or polished) and the waste gangue material is rejected by gravity separation. Slimes and gravity tails are thickened using polymer flocculant and pumped into a tailings dam to be located near the processing plant (site allocation pending).

Fundamentally, the entire process is a mechanical process, with no chemicals used other than the bio-degradable flocculant used in the tailings dam.

If a market can be found for the shell grit it will be stockpiled and sold, alternately ground and incorporated in the tailings for storage. Excess sea water from the process is pumped back to the buffer pond site and re-used or discharged back into the sea. Clean water is required to wash the last vestige of salt water from the filtered concentrate. Options for the supply of the fresh water, including reverse osmosis are under investigation by Lithon mining engineers. The spent wash water is sent back to the buffer pond with the excess process water. The process explained above is shown in Figure 13.

Figure 13 - Beneficiation process

4.4.2.3 Phosphate concentrate product handling

After upgrading the resulting concentrate to 27 – 28 % P_2O_5 (phosphate), it is filtered, washed, dried and stockpiled for sale in a covered stockpile, as shown in Figure 14. The Phosphate concentrate product is then delivered to the Walvis North Port Bulk Terminal at Walvis Bay for shipping and distribution to the national, regional and international markets.

4.4.2.4 Product marketing and manufacturing

The citric acid and formic acid solubility of the phosphate concentrate is very high, compared with global results, indicating that the concentrate is suitable for direct application phosphate rock (DAPR). Bench-scale scoping tests to make single super phosphate (SSP) and phosphoric acid were promising. A detailed marketing survey was carried out on the global phosphates market with emphasis on phosphate rock and the specifications, markets and shipping for NMP phosphate concentrate.

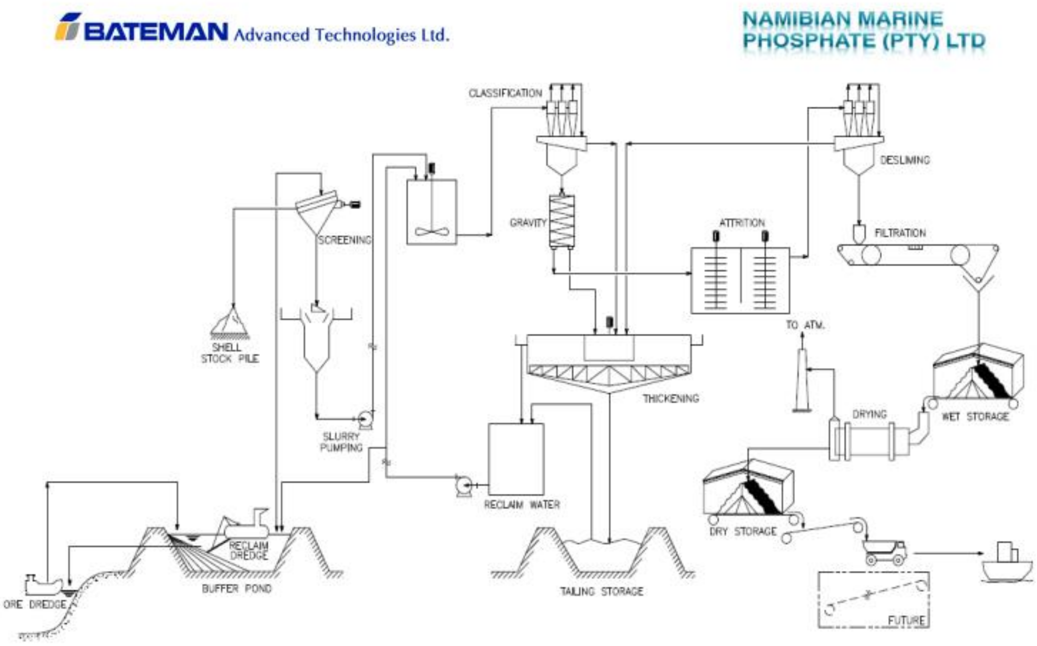


Figure 14 - Simplified concentrate production flow sheet (Source: Bateman Advanced Technologies Ltd.)

4.4.3 SANDPIPER PROJECT LAYOUT OPTIONS FOR SHORE BASED COMPONENT

In the ensuing delays in the period from 2012 to present date, there have been significant infrastructural and commercial developments at the Port of Walvis Bay that have enabled a significant adjustment to the options for project developmental plans and specifically the location of the proposed land-based operations, including the ore handling and discharge as well as onshore processing and product handling facilities. These developments as shown in Figure 15 include:

1. Expansion of the Walvis Bay Port facilities including the new North Port, SADC Gateway Development for bulk cargo handling and the Oil Terminal, including a new allocation and transfer of land to Namport.
2. Zoning and development of a new heavy industrial zone near the Walvis Bay airport by the Municipality of Walvis Bay.
3. Walvis Bay Industrial Development Initiative.

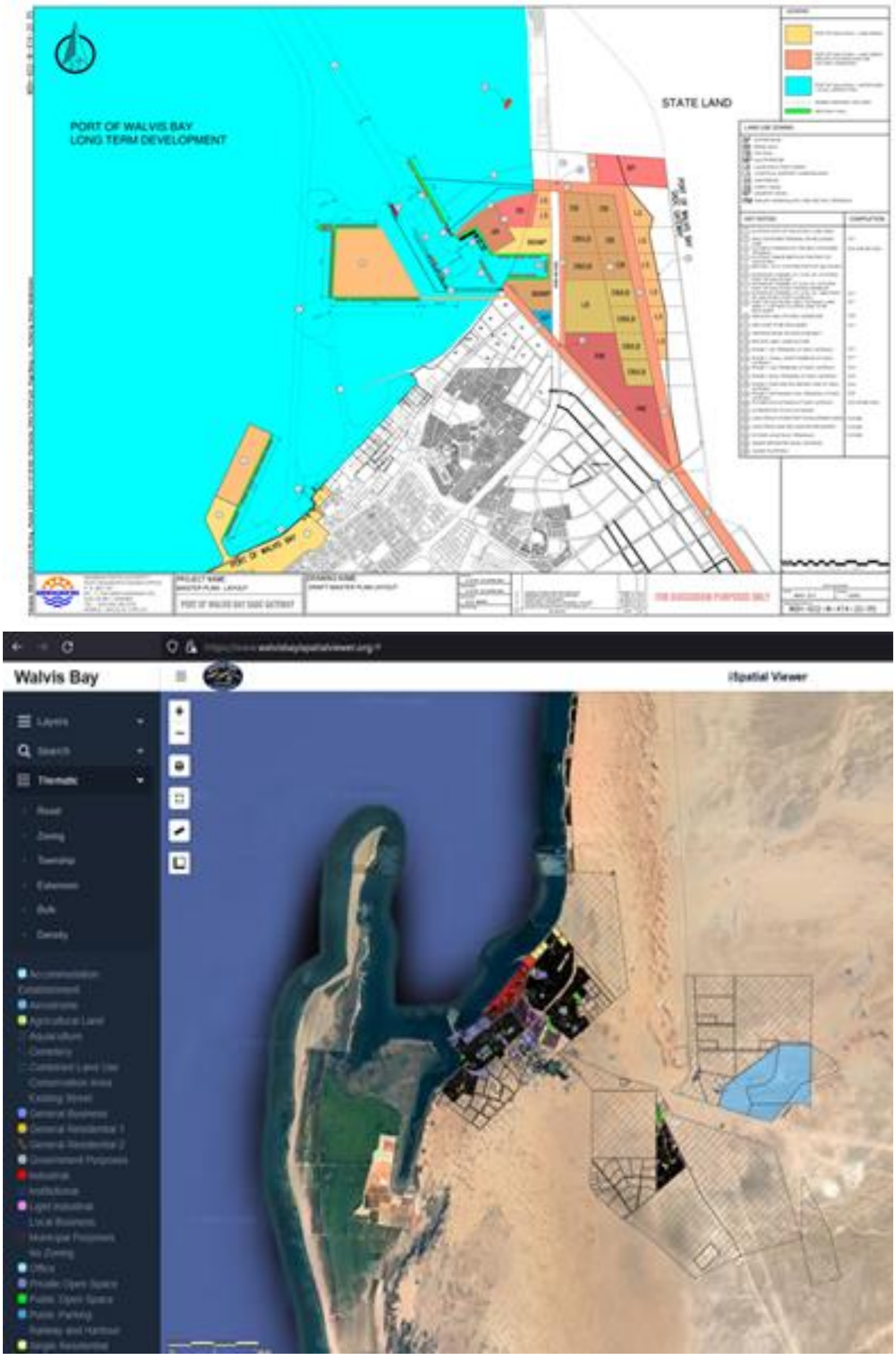


Figure 15 - Proposed site layout for the land-based operations

Port access for the dredger to enter the Port of Walvis Bay, SADC gateway bulk terminal to offload the dredged material, utilizing the newly dredged access channel is now a viable option.

Therefore, the Sandpiper Project development and layout plan for the land-based component of the Sandpiper Project can now be re-considered and substantially revised with opportunity for significant improvement over the original plan proposed in 2012.

Once the permitting for the marine component of the Sandpiper Project has been approved, site selection and land allocation application can be completed in consultation with the relevant authorities including Namport and Municipality of Walvis Bay and the Ministry of Works and Transport.

The ESIA and ECC application for the land component of the Sandpiper Project will be based on the revised Sandpiper Project development layout plan once land allocations have been approved as shown in Figure 16.

Figure 16 - ESIA and ECC application process needed for land component of a project to begin

Permitting for both the marine and land components of the Sandpiper Project is required in order to secure the funding required to commence with the 24-month plant and site construction phase of the Sandpiper Project development. Operations can then commence with employment and full-scale production.

4.5 INVESTMENT, REVENUES AND EMPLOYMENT

4.5.1 INVESTMENT AND REVENUE

Capital Expenditure (CAPEX) associated costs:

- The revised Sandpiper Project CAPEX (capital cost) is estimated at US$323.1M. A front end engineering design (FEED) was carried out as part of the 2012/13 definitive feasibility study. The purpose of the FEED was to provide sufficient engineering detail to permit a realistic estimate of the required investment to be prepared.
- This involved extension of the budget pricing for the equipment and for the construction work activities, preparation of packages for construction work execution and requesting offers for the construction works based on the prepared bills of quantity (BOQ's) in all the engineering disciplines.

At a project level, if it were to be implemented, NMP's Sandpiper Project will:

- Employ over 600 Namibians (directly and indirectly) for construction and operations in Walvis Bay;
- Create opportunities for SMEs and other economic sectors;
- Spend an estimated N$ 1 billion on civil and local infrastructure;
- Require a capital investment of N$ 5.2 billion for the development;
- Expect an annual revenue of N$ 4.2 billion;
- Contribute direct taxes of N$ 650 million/year; and
- Contribute royalties of N$ 78 million/year.

4.5.2 EMPLOYMENT

The development of the Sandpiper Project will bring much-needed investment and job opportunities to Namibia and more particularly the Erongo Region, supporting both Vision 2030 and Harambee policies as outlined in 0.

Sandpiper Project development and operations will employ over 600 Namibians (directly and indirectly) for construction and operations in Walvis Bay.

Additionally, the appointed dredging contractor, Jan De Nul, will establish an operations support base in Walvis Bay which will create further direct, indirect and induces employment opportunities in Walvis Bay area and regionally.

According to the Chamber of Mines Namibia's 2019 analysis, for every 1 new job created in the mining industry, 7 additional new jobs are created indirectly in the economy, forecasting that 600 direct and indirect jobs of the Sandpiper Project will create a further 4,200 jobs in the broader economy.

The production of phosphate concentrate product in Namibia at a project scale, creates the opportunity for further capital investments to enable further beneficiation and industrial development opportunities, at a much larger scale

An industry-based socio-economic study (Stratecon, 2018) around establishing a phosphate industry, circulated within Government, independently demonstrates that the potential economic benefits of establishing a phosphate-based industry alongside the existing marine diamond mining and fishing industries, if developed back in 2012, could by 2016 have:

- Created total jobs of 51,593 (direct, indirect and induced);
- Contributed N$14.7Bn to the Gross Domestic Product;
- Contributed N$11.3Bn to Gross National Income; and
- Contributed N$18.7Bn in Export Revenue.

4.6 ML 170 OPERATIONS (TARGET MINING AREA AND MINE PLAN)

4.6.1 OREBODY AND TARGET MINING AREA SP-1

The primary target dredge site for the 20 year licence period is SP1 (176 km^2) which lies in water depths of 200 to 225m.

The initial target mining area is defined based on the initial maximum water depth for the JDN dredging contract proposal, which is initially restricted to operations in water depth of up to 225m. JDN consider access to 250m water depth as easily achievable with some additional engineering. The grade in the initial target mining area is expected to range between 17% and 22% P2O5, refer to Figure 17.

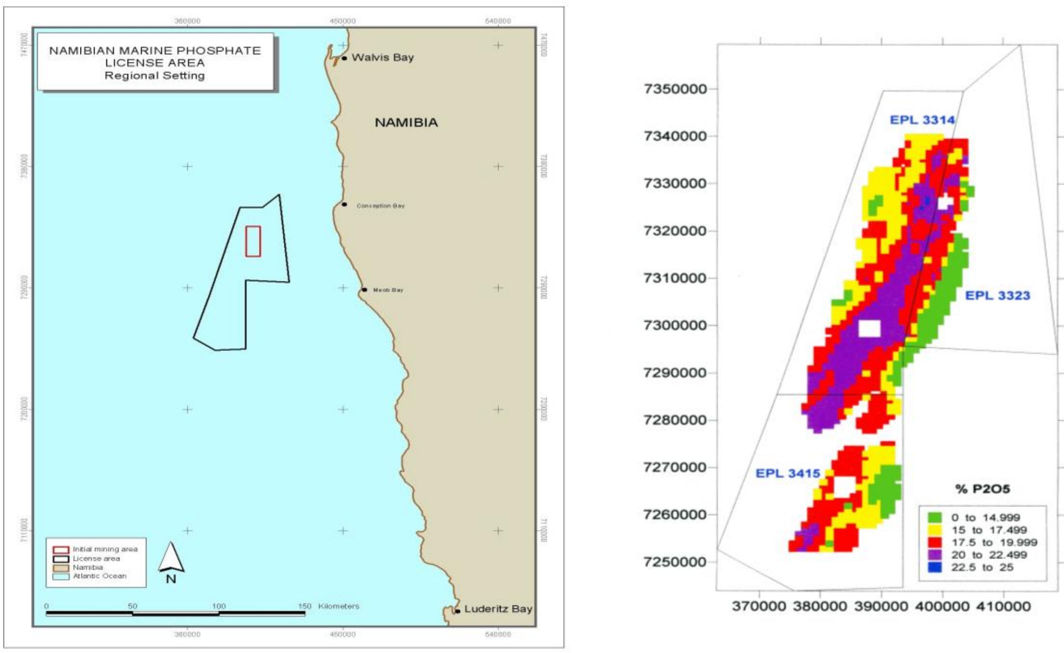


Figure 17 - Resource area and initial mining area

Details of the SP1 target mining area are provided in Table 7 below as follows:

Table 7 - Details of the SP1 target mining area

Detail	Sandpiper - SP1 Target Area
Boundary coordinates (Lat - Long) of the target mining areas	**A:** 24° 05' 24.500'' S 13° 57' 25.716'' E
	B: 24° 05' 26.359'' S 14° 02' 09.025'' E
	C: 24° 17' 21.597'' S 14° 02' 03.644'' E
	D: 24° 17' 19.720'' S 13° 57' 19.895'' E
Approx width - km	8
Approx length - km	22
Area (km^2)	176
Thickness Avg - m	1.69
Thickness Max - m[1]	2.5
Thickness Min (m)	0.50
Water depth range - m	190 - 235
Deposit > 3 m[2]	Non

4.6.2 20 YEAR MINE PLAN

The scale of the 20 year dredge mine plan area is primarily controlled by the annual export/sales requirement of 3 million tonnes of 'rock phosphate'.

The Sandpiper Project 20 year mine plan covers a total area of 34 km^2 and is located withing the SP1 target mining area. It is planned to ramp up the production of concentrate from 1 million tonnes per year in Year 1, and 2 million and 3 million tonnes per year in years 2 and 3 respectively.

In each year of the 20 year mine plan, the actual area that needs to be dredged to meet the commercial production target of 3 million tonnes of rock phosphate at 27-28% P_2O_5 concentrate depends on the thickness of the deposit, the grade and the mining/dredging rate.

[1] Not all cores terminated on footwall, these figures may change with further exploration.
[2] Depths in excess of 3 m are to be further evaluated with vibracoring sampling equipment.

For the initial 20 year mine plan the operating parameters for the annual dredging operations are as follows:

- Average sediment thickness to be dredged is 2.3m;
- Average area to be dredged is 1.7 km^2/year; and
- Average operating water depth is 215m (ranging from 201m – 224m over the 20 year period)

The detailed 20 year mine plan for the in SP1 target mining area in ML 170 is shown in Figure 18.

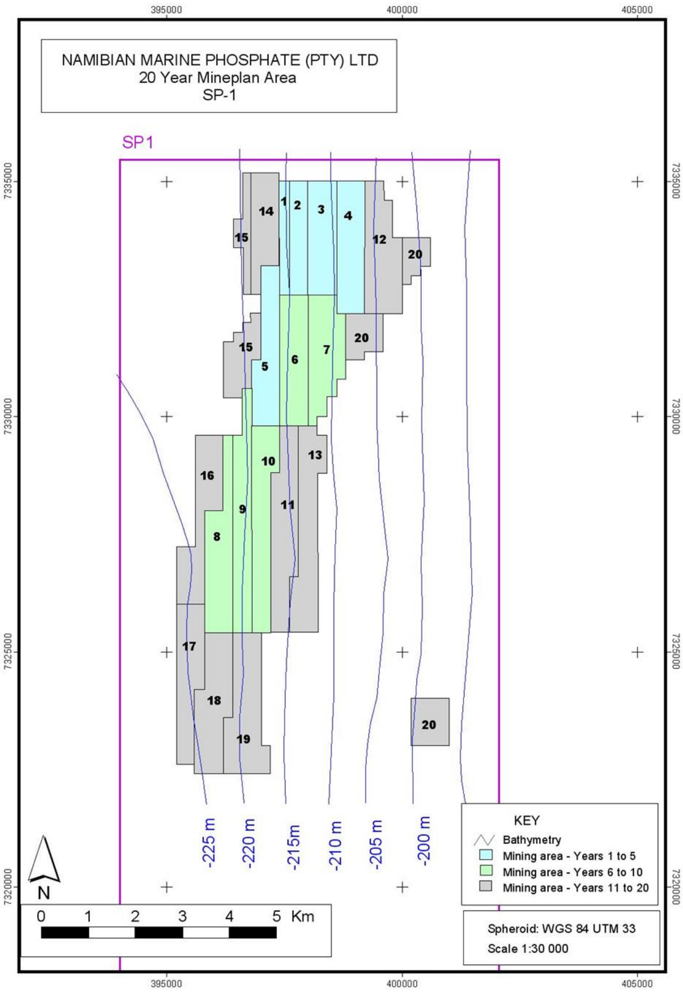


Figure 18 - 20 year mine plan for the in SP1 target mining area in ML 170

The deposit has a resource which can sustain continued production for over 100 years at the proposed rate, although the current plan is for a 20 year mine-life, related to the term of the mining licence.

4.6.3 SCALE OF OPERATIONS

The mining licence area is 25.2 km wide and 115 km long. ML 170 is 2233 km^2 in extent, representing approximately 2% of the Namibian continental shelf area (110 000 km^2)

Within ML 170 and within SP-1, the total area of the 20 year mine plan represents 1.5% of the total ML 170 licence area and less than 3/100ths of 1 percent (0.03%) of the Continental shelf Area off Namibia.

The average yearly dredged area of 1.7 km^2 represents 8/100ths of 1% (0.08%) of the total ML 170 area and less than 2/1000th of a percent (0.002%) of the total continental shelf area off Namibia. As such annual mining operations will occupy a very small area within the mining licences and will not present any sustantial or continous operational impacts to commercial fisheries or other marine activities being undertaken whtin the boundaries of ML 170.

Table 8 - The proportions of the Namibian continental shelf, ML 170 and SP1 affected by the proposed dredging for the project

	Continental Shelf	ML170	SP-1	**20 Year Mine Plan**	**Annual Dredged Mined Area**
Area (Km^2)	110,000	2,233	176	34	**1.7**
% SP1 Area			100%	19.32%	0.966%
% ML170 Area		100%	7.88%	**1.52%**	**0.076%**
% Continental Shelf Area	100%	2.03%	0.16%	**0.03%**	**0.002%**

4.7 MINING METHOD AND EQUIPMENT

In the last two decades the expansion of the global economy and increase in the world's population has compelled the dredging industry to adapt its fleet by building new vessels with increased transport capacity, installed power and dredging production. The dredging contractor Jan De Nul Group (JDN) has been the forerunner in satisfying these demands with its new trailing suction hopper dredgers (TSHD).

In June 2011 NMP and JDN entered into an agreement for design and operations for mining of phosphate-rich deposits off the coast of Walvis Bay, Namibia, based on the production of 3.0 Mtpa phosphate concentrate. The approach involved the utilization of an extended suction pipe, related equipment and modifications to the trailing suction head dredge (TSHD) cristobal colon. JDN has many years of experience in dredging work and the development of dredging technology, including amongst others considerable experience with sea conditions in Namibia and knowledge of the nature of the dredged material.

Current dredging technology allows recovery from depths of up to 165m. Dredging contractors, Jan de Nul, estimate that a purpose-built extended dredging arm, requiring limited modification of their largest dredge, the Cristobal Colon, will allow recovery from 225m depth with a 3m wide dredge head (Figure 19). Alternate technology under development by JDN will in due course enable recovery from even greater depths.

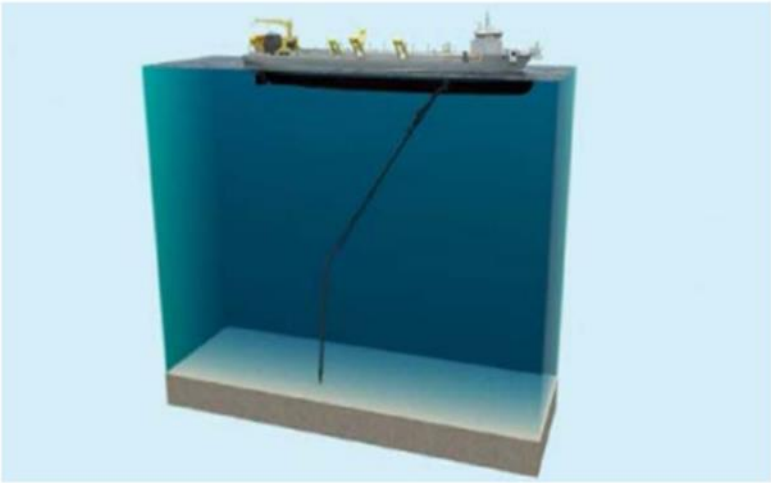


Figure 19 - Schematic of extended dredging arm (source: JDN)

The dredge vessel will recover sediments from individual continuous lanes within the target mine area initially from within the Sandpiper-1 (SP1). The length of each lane (cut) is 4 km and width of 600m. This lane length may vary in orientation as determined from geotechnical feedback information obtained during the dredging process and or as established from ongoing resource development exploration. Dredging will predominantly take place in a north – south (or south – north) direction e.g., aligned with the predominant swell and wind direction.

In the initial 4 km cut, the dredger will steam at 1 knot, which results in the seabed engaged dredge head excavating to a depth of 0.75 m below seabed with the 3m wide dredge head. In order to fill one hopper (vessel) load, 4 parallel adjacent or near adjacent cuts within the mine area are dredged and the vessel will cover approximately 4 km during this period. Subsequent cuts within the same lane will be made, so that the full vertical extent of the deposit can be extracted. By varying the speed of the vessel, the depth of cut can be increased (shallower cut) or decreased (deeper cut, to a maximum of 0.75 m).

The vessel will continue to dredge vertically within the particular lane to a point just above the footwall clays. Depending on the location within the deposits, these footwall clays may be located at depths from 1 m to 3 m or more below the original seabed level. The intention is not to cut (dredge) into the footwall clay, but to rather leave a residual thickness of marine sediments over the footwall. This thickness will vary but is envisaged to be between 10 and 15% of the original volume of target sediment layer(s). This will remain in situ on completion of recovery. The depth of recovery during dredging will be managed through positional software integrated with the hydraulic winch systems that control the position of the dredge arm and the location drag head. This residual sediment remaining above the footwall clay will be present as an uneven 'hummocked' surface.

4.7.1 DREDGING CONTROL

Dredging control for the vessel is typically maintained by means of the following systems and equipment:

- A positioning system;
- A dredging computer;
- A suction tube position monitoring system (STPM); and
- A dynamic tracking computer.

4.7.1.1 Positioning system

Dredging control is based upon a vessel positioning system. The Z or vertical co-ordinate of the ship is obtained from swell and tidal data from a prediction model based on historical data. The positioning computer determines the actual ship and draghead position as co-ordinates and presents the results, relative to the area to be dredged on navigational displays. These position results are derived by calculation from the X, Y and Z inputs from the suction tube position monitoring system (STPM) system as described below and the ship's bearing provided by the gyrocompass. The positioning computer also determines the actual vertical offset of the drag head as compared to the target dredge depth. Information outputs from the computer include:

- Plots of dredged tracks;
- Position of vessel and drag head visualized on screen on a background of bathymetric data;
- Obstacles and buoys;
- The display is in plain view with a differential colour chart showing the amount still to be dredged, together with a longitudinal and cross profile of the trench marking seabed level and target level; and
- Changes in X and Y co-ordinates as input to the dynamic tracking system.

4.7.1.2 Dredging control computer

The dredging control computer enables all the dredging processes such as the dredging level of the drag head, pump settings and 'lean water' to be controlled. The interface between the positioning computer and the dredging control computer enables control of the dredging process to pre-defined levels of input to the system from pre-dredge survey information and pipe profile design requirements.

4.7.1.3 Suction tube position monitoring system

The STPM is a system comprising a system of pressure and angle transducers, which allows the determination of the drag head position relative to the ship. This makes relative X, Y and Z co-ordinates of the drag head available to the positioning system and dredging computers.

4.7.1.4 Dynamic tracking

This system can automatically control the vessel's track and therefore the drag head's horizontal position by compensating for wind and current effects on the ship. It achieves such control by automatically adjusting rudder direction, propellers and bow thrusters.

4.7.1.5 Progress monitoring

During the process of line cut dredging, the progress is monitored on board by means of the dredging control systems and the multibeam or survey results. The dredging control system allows for the actual drag head depth and the target depth at the drag head position to be compared online and the difference displayed.

4.7.1.6 Survey

The survey procedures ensure that the survey methods used comply with the specifications and that surveys are carried out in an accurate and efficient manner. The procedures cover all survey works.

4.7.1.7 Equipment

The dredger is equipped with a multibeam echo sounder. This allows online surveys without the need of a separate survey vessel within the mining area. Alternatively, should the circumstances make surveying from the dredger less favourable, a separate survey vessel can be mobilized.

4.7.2 DREDGE CYCLE

Dredging operations in ML 170 are not conducted on a continuous 24/7 basis, as is the standard practice for marine diamond mining. The proposed dredging operations will be conducted on a cyclic basis, with an average of 2.85 dredge cycles per week.

The actual loading time (dredging onsite in ML 170) represents only 38% of the vessel operational time as shown in Table 9.

Table 9 - Details of the dredge cycle

Dredging cycle times	Minutes	Hours
Loading	798	13.30
Turning	199	3.32
Sailing time, loaded unrestricted	353	5.88
Sailing time, loaded restricted	0	0.00
Accelerate / slow down	20	0.33
Connect to pipeline	40	0.67
Discharge to shore	360	6.00
Disconnect from pipeline	20	0.33
Sailing time, unloaded unrestricted	316	5.26
Sailing time, loaded restricted	0	0.00
Total cycle time	2,106	35.10
Loading proportion of total dredging cycle		38%

Source: modified from JDN (2013)

4.8 MINE WASTE

4.8.1 DREDGE VOLUMES, PRODUCTION AND SEDIMENT DISCHARGE

It is planned to ramp up the production of concentrate from 1 million tpa in year 1, to 2 million tpa in year 2, to 3 million tpa in year 3. During the entire dredging cycle, there are no additives or precondition processes other than overflow of fines. The mass balance of the ramp up to full production capacity over 3 years is presented in Table 10.

Table 10 - Mass balance of the ramp-up to full production capacity

MASS BALANCE			
Dredge capacity (m3)	37,750	37,750	37,750
Dredge capacity planned (m3)	30,000	30,000	30,000
Dredge volume per week (m3)	90,000	90,000	90,000
Dredge volume per year (m3)	1,260,000	2,430,000	3,600,000
Dredge wet tonnes per year (t)	2,646,000	5,103,000	7,560,000
Dredge dry tonnes per year (t)	2,142,000	4,131,000	6,120,000
Processing yield per year with 40% reduction + 10% dredge loss (t)	**1,071,000**	**2,065,500**	**3,060,000**

4.8.2 DISCHARGE OF FINE SEDIMENTS

The overflow funnel(s) on the JDN dredger are vertically mounted tubes inside the hopper well that are used to drain off (through the keel) excess water inside the hopper well allowing the hopper load to be maximized. The anti-turbidity valve or so-called "green valve" is a hydraulically controlled valve mounted inside the overflow funnel(s). This valve drastically reduces the turbidity generated by the overflow water drained through the overflow funnels. It smothers the mixture flow through the overflow funnel. As a result, the water level inside the overflow funnel will be kept high and the mixture will "fall" from a lesser height. This will ensure that less air gets mixed into the overflow and hence the flow will not have a tendency to rise up next to or behind the vessel. Without the use of this green valve the finer particles in the overflow mixture are churned up by the vessel's propellers and hence create those infamous turbid clouds behind the trailer dredger.

4.9 SUPPORT SERVICES

For the operations in ML 170 being the marine component of the Sandpiper Project, the requirement for shore-based support services will be primarily for the dredging contractor, Jan De Nul to support and maintain operations of the dredging vessel. JDN intend to establish their own operations support office in Walvis Bay to oversee these requirements, support services they may require are likely to include:

- Supply boat and crew;
- Victuals for supply boat and dredge vessel;
- Bunkering for dredge vessel and support vessel;
- Accommodation; and
- Mechanical and electrical engineering support services.

4.10 UTILITIES

For onsite operations in ML 170, the dredging vessel is self-supporting, having access to utilities and support services to replenish requirements during the regular return trips to port of Walvis Bay.

4.10.1 POWER

All of the power required for operation of the dredging system and the vessel is generated onboard the dredge vessel, which is equipped with main engines, MAN B&W, 48-60, 4-stroke, 16 cyl's and generates total power of 41,650 kW.

4.10.2 WATER

Fresh water required for onsite operations is generated by RO systems (reverse osmosis) on board the vessel and or taken onboard when in port of Walvis Bay and stored in dedicated freshwater tanks.

4.10.3 SEWERAGE AND GENERAL WASTE

All waste produced will be contained within the vessel and will be managed in accordance with the International Convention for the Prevention of Pollution from Ships (MARPOL) requirements to which Namibia is at an advanced signatory stage.

4.10.4 OTHER

The Proponent will ensure that the dredging company contracted to conduct the dredging operations are compliant with the provisions of MARPOL and will verify that the vessel holds valid and applicable permits associated with the prevention of pollution of hazardous substances, if applicable.

The dredge vessel will hold supply of fuel in the vessel's fuel tanks in accordance with standard international marine practice. Refuelling will be conducted in the Port of Walvis Bay.

4.11 Rehabilitation

Rehabilitation of the dredged areas within the 20 year mine plan will be conducted in accordance with the substantial provisions of the environmental management plan.

To aid functional recovery of seabed benthos, operational procedures for dredging will include provisions:

- To leave a residual thickness of marine sediments over the footwall representing between 10 and 15% of the original volume of target sediment layer(s). This will remain in situ on completion of recovery. This residual sediment remaining above the footwall clay will be present as an uneven 'hummocked' surface.
- To leave lanes of undisturbed sediment to support infill and recolonisation of benthos.

Recovery of the seabed over time ranging from 2-16 years has been demonstrated and reported in monitoring studies conducted by Namdeb (DebMarine Namibia) over the past 20 years in their Namibian offshore mining licences.

5 ENVIRONMENT AND SOCIAL BASELINE

5.1 BASELINE DATA COLLECTION

Initial environmental baseline and specialist studies relevant to the Sandpiper Project commenced in 2010 and formed part of the 2012 environmental impact assessment (EIA) conducted for ML 170.

Following further consultation with key stakeholders the 2012 EIA baseline data and assessed impacts were further expanded, assessed, and verified to increased levels of confidence based on the results of a comprehensive 2 year program of in situ sampling, data analysis and specialist studies completed in 2013/2014 on the primary target dredge site SP1 in mining licence 170 (EIA Verification Study). The 2014 EIA verification study included participation of representatives from UNAM as independent observers of the program operations. The EIA verification program was finalised in close consultation with the Ministry of Fisheries and Marine Resources as well as Ministry of Mines and Energy and Ministry of Environment Forestry and Tourism. Representatives from MFMR participated in the fisheries component of the EIA verification study. The specialist studies and results included in the 2014 EIA verification work program were submitted for review by an external peer review panel of international experts with relevant experience.

In 2018, on instruction of the Minister of Environment, Forestry and Tourism (MEFT), the Environmental Commissioner (EC) completed a further round of public consultation to review the 2012 EIA and 2014 EIA verification study and then appointed independent external consultants to review submissions and to provide relevant recommendations on the outcome of the process. Based on the external reviewers' recommendations for further supplementary studies to be completed and submitted to the EC, the Proponent undertook additional specialist studies based on in-situ samples and data. These supplementary studies were completed in 2020.

As an outcome of these various assessments, the baseline knowledge and data for the receiving environment has been substantially expanded with the inputs from the wide range of comprehensive specialist studies which are further discussed as part of this environmental and social impact assessment process.

This section sets out the biophysical and socio-economic environments of the receiving environment in which the Sandpiper Project is situated. It is an important part of the scoping component of the assessment, as it determines if there are any knowledge gaps that require additional information prior to the assessment phase being completed.

5.1.1 SPECIALIST STUDIES

The specialist studies outlined in Table 11 were commissioned and completed (2012, 2014, 2020), to determine the current state of the baseline environments.

Table 11 - Specialist studies conducted for the ESIA

Study area	Purpose	Contributing Specialists/Organisation
Marine Ecology	– Assess impacts on fishing operations that could have a potential impact on the fishing sector – Identify and assess potential impacts on ecologically important demersal and pelagic fish species – Impacts on recruitment of key commercial fish stocks – Impacts on species diversity – Impacts on seabirds and marine mammals	– Mr D Japp, Capricorn Fisheries Monitoring cc, Dr Melanie Smith, Dr Tony Robinson, Dr Carola Kirchner, Dr Jeremy David
Marine Water Quality	– Changes to marine water quality impacting organisms and benthos – Water column and sediments alterations impacting organisms and benthos – Deterioration in water quality from discharges to sea of wastes – Alien marine species influence on indigenous species and aquaculture – Nutrient availability and phytoplankton growth – Trace metals impacts on organisms and filter/feeding benthos	– Dr R Carter, Lwandle Technologies Pty Ltd, Dr Sue Lane, Eric Koch, Carrie Pretorius
Benthos	– Loss of benthic biota due to upper sediment removal during dredging activities – Direct and indirect impacts on biota in larger ML – Alterations to local near bottom hydrographical conditions – Impacts on large sulphur-oxidising bacteria – Increasing anoxic conditions in sediment – Smothering effects during dredging operations on biota – Potential effects of Algal blooms	– Dr N Stefanni, Stefanni Marine Environmental Consultants cc, Dr Robin Carter, Lwandle Technologies
Jelly Fish	– Blockages on vessel water sea intake – Potential mortalities to jelly fish due to hydrogen sulphide releases	– Prof M Gibbons, University of Western Cape

Study area	Purpose	Contributing Specialists/Organisation
	– Potential mortalities to jelly fish due to tailings plume – Jelly fish population dynamics as a result of substrate alterations of the seabed floor	
Geology and History of Deposit (Verification studies 2014)	– Preliminary Model for the Origin and Age of the Sandpiper Deposit – A review of offshore phosphorite deposits on the Namibian margin	– Dr JS Compton, University of Cape Town
Water Column and Sedimentary Environment (Verification studies 2014)	– Gather data in the target mine area on currents, water column characteristics and sediment properties – Toxicology risk of heavy metals	– Dr Robin Carter, Lwandle Technologies (Pty) Ltd, Metocean Services
	– The utility of hydrodynamic and biogeochemical numerical modelling of dredge plumes to better inform the assessment of potential water column and benthic impacts	– Dr Roy Van Ballengooyen, CSIR, South Africa
	– Determination of bacterial genera involved in sulphur-oxidisation and sulphur-reduction (thiobacteria)	– Dr Bronwyn Kirby, University of Western Cape, – Next Generation Sequencing Facility
	– Meiofaunal Analysis of Namibian Offshore Sediments	– Dr S Forster, UK, Pgysilia
	– Conduct the identification and analysis of the benthic macrofauna communities – Review confidence levels for original assessment outcomes based on additional sampling and empirical data assessment	– Dr Nina Steffani Stefanni Marine Environmental Consultants
	– Epifauna survey – Biomass compositions – Comparisons to other trawling surveys – Environmental drivers such as jellyfish	– Dr Tim McKlurg, KZN Coastal Impact Consultants. Dr Melanie Smith, Capfish, Dr Mark Gibbons, University of Western Cape
	– Plankton which includes phytoplankton, zooplankton and ichthyoplankton	– Dr Robin Carter, Lwandle Technologies (Pty) Ltd

Study area	Purpose	Contributing Specialists/Organisation
	– Seabed Physiography and habitat, Geophysical survey and mapping SP1	– Gordon Rigg, Marine Data Consultants.
Fisheries and Biodiversity (Verification studies 2014)	– Survey of fish, mammals and seabirds – Assessment of fisheries biomass and stock assessment (Hake and Monk) – Assessment of ecosystem impacts – Assessment of recruitment – Biodiversity assessment	– Capricorn Fisheries Monitoring cc, Dr Dave Japp, Dr Melanie Smith
	– Biomass and stock estimates of hake and monk	– Dr James Gaylard Capricorn Fisheries Monitoring cc
	– Ecosystem Impacts related to dredging of phosphates offshore through ecosystem modelling	– Dr Kevern Cochran Capricorn Fisheries Monitoring cc
	– Fish reproduction dynamics and stock distribution of hake, monkfish, horse mackerel and sardine	– Dr Hilka Ndjauala, University of Namibia Capricorn Fisheries Monitoring cc
	– Assessment focus on pelagic fish species, demersal fish species and west coast rock lobster in the following study areas; – Spawning activity – Ichthyoplankton drift routes – Recruitment of Namibian marine fauna	– Capricorn Fisheries Monitoring cc and related sub-consultants listed above.
Plume Dispersion Modelling (Supplementary Studies 2020)	– Ocean current and plume dispersion modelling – Sensitive receptors included	– HR Wallingford, UK
Mine Area Sediment Toxicity (Supplementary Studies 2020)	– Sediment Toxicity test work of the ore body	– Dr Robin Carter, Lwandle Marine Environmental Services
Noise (Supplementary Studies 2020)	– TSHD sound measurements – Noise modelling below and above ground	– Jan De Nul N.V.
Socio-Economic Study	Economic Assessment of the Development of a Phosphate Based Industry in Namibia	– Stratecon Applied Economic Research

Study area	Purpose	Contributing Specialists/Organisation
Socio-Economic (Supplementary Studies 2020)	– Socio-economic assessment dredging works	- Jan De Nul N.V.

5.2 MARINE ENVIRONMENT

The mining licence area ML 170 is located within the Northern Benguela upwelling system of the Benguela Large Marine Ecosystem (BCLME). The Benguela current is very nutrient rich and supports a variety of sea life. The current licence area overlaps in some places towards the southwestern end of the ML 170, with fish trawling operations, which operate in water depths from 200m-600m. The main shipping lanes for Southern Africa lie seawards (west) of the Mining Licence however shipping activities could occur within ML 170 and between ML 170 and the coastline. Various mineral licences are located immediately adjacent to the Sandpiper Project (ML 170), with granted and or pending Exclusive Prospecting Licence (EPL) types including precious stones, semi-precious stones, industrial minerals and precious minerals Figure 20. Adjacent EPL's 4009, 4010, 3323 and 3415 are also held by NMP.

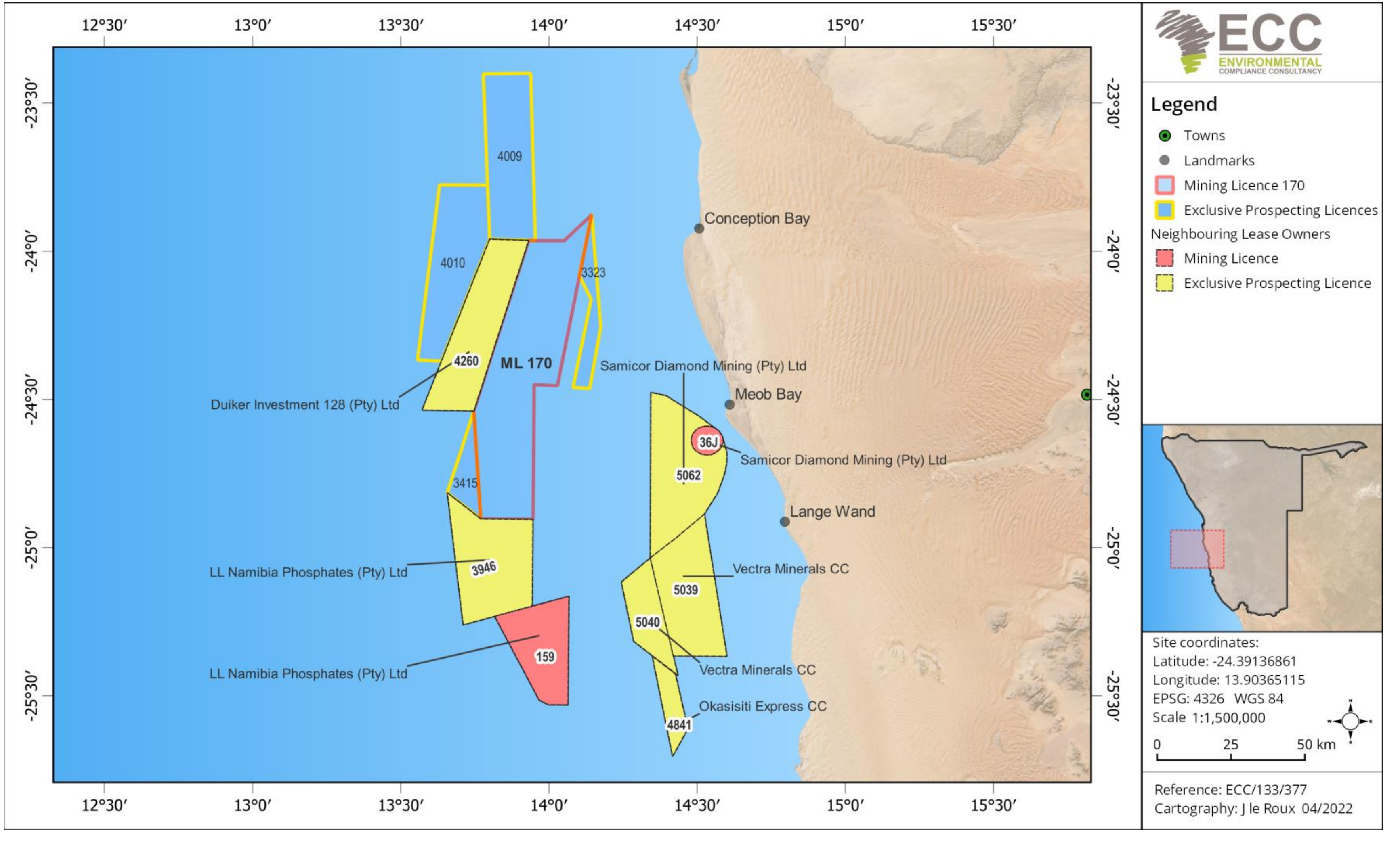


Figure 20 - Adjacent concession holders to ML 170

5.3 GEOLOGICAL SETTING

The local geology has been explained in detail in the original 2012 ESIA report (J Midgley and Associates, 2014) and genesis of the phosphate deposits is further summarised in Chapter 4 of this report from the specialist geological study conducted by Prof. John Compton, University of Cape Town, as included in the 2014 EIA verification study (J Midgley and Associates, 2014). The reader is referred to Section 4 for details of the geological information.

Three broad physical types of Phosphorite have been identified on the Namibian continental shelf and are geographically distinct, these phosphorites are found in the form of either sand, rock phosphorite or concretionary (nodular) phosphorite (Rodgers & Bremner, 1991). The phosphorite sand is divided further into either pelletal phosphorite and glauconitized pelletal phosphorite. Both varieties are located on the continental shelf in water and have been radiometrically dated as Miocene in age. The phosphorite sand of Miocene age (2.38 Ma) on the middle continental shelf is the target mineral deposit of the Sandpiper Project. Major sea levels changes also played an important role in the regional geology of the shelf dynamics (J Midgley and Associates, 2014).

The Sandpiper Project site ML 170 is located in water depths ranging from 150 m in the east to 350 m in the west. The initial target mining area SP1 is located in water depths of 190 – 250 m. The middle shelf at 200 m is mainly made up of pelletal phosphatic sediment and glauconitized pelletal sediment which occurs predominantly to the north of Walvis Bay. The pelletal deposit is mixed with gravel (molluscan shells) and mud (biogenic and terrigenous). The enriched part of the phosphorite deposit lies largely within ML 170 between Conception and Spencer Bay as shown in Figure 21 (J Midgley and Associates, 2014).

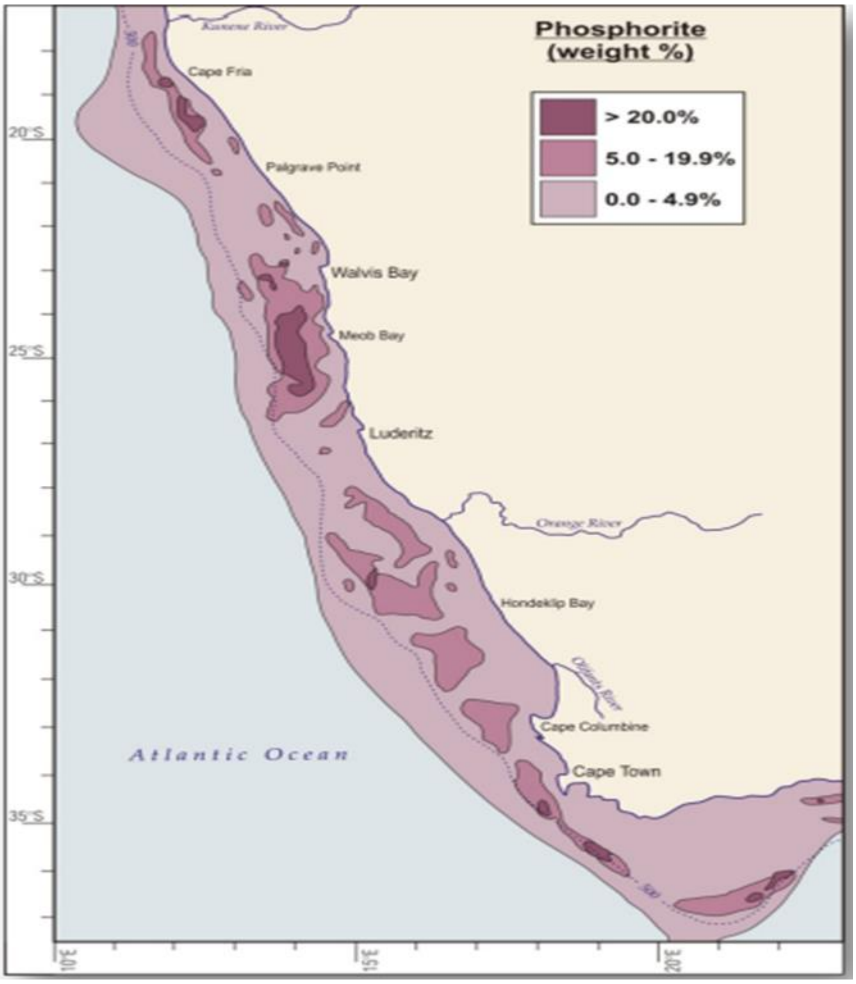


Figure 21 - The abundance of phosphate on the middle to outer shelf (in J Midgley and Associates, 2014)

The detailed geological study by Prof. J, Compton (Compton, 2014) (J Midgley and Associates, 2014) as presented in the 2014 EIA verification study included determination of the origin and age of the marine phosphorite deposits in the Sandpiper Project area ML 170. This was done by analysing the sediment cores combined with strontium-36 isotope dating. The findings from this study confirm that the deposits formed during the early to middle pleistocene period (2.6 to 0.126 million years ago (Ma)), therefore after the miocene age.

These deposits were initially formed by marine algae growing in highly productive surface waters, whereby the dying and sinking action to the seafloor allowed for the organic phosperous in the algal cells to be incorporated into the mineral carbonate fluorapatite or francolite. These phosphorite grains were concentrated through repeat erosion of the sediment by wave and current action during low sea levels. The phosphorite grains formed predominantly during the early pleistocene (2.6 to 1.26 million years ago (Ma)).

The stratigraphy of the deposits in ML 170 typically comprise a basal phosphorite muddy sand that varies from 0.5 to 1.5 m in thickness. This is overlain by increasingly shelly phosphorite sand of variably 0.5 to 1.5 m thickness, containing 65 to 86 wt.% sand and 4-5 wt.% mud. The phosphorite is diluted by shell fragments, particular the upper layer. The upper sediment profile displays multiple erosional surfaces formed during sea-level low stands that occurred during the various glacial maxima since 1 Ma (Compton, 2014) (J Midgley and Associates, 2014)

5.4 TOPOGRAPHY

The seabed on the middle continental shelf in the project area is typically flat, sediment covered and featureless, with a gradual slope to the west as evidenced by the generally evenly spaced bathymetric contours presented in regional and local studies and navigational charts.

The geophysical survey data gathered during the 2014 EIA verification study conclusively demonstrated a flat, smooth seafloor with a homogeneous surficial sediment cover across the northern part of SP1 and including the proposed 20 year mine plan area with the SP1 target mining zone as shown in Figure 22. Data mapping and interpretation confirmed no protruding obstacles (rocks and reefs) or biological features (cold water corals etc) were observed (J Midgley and Associates, 2014).

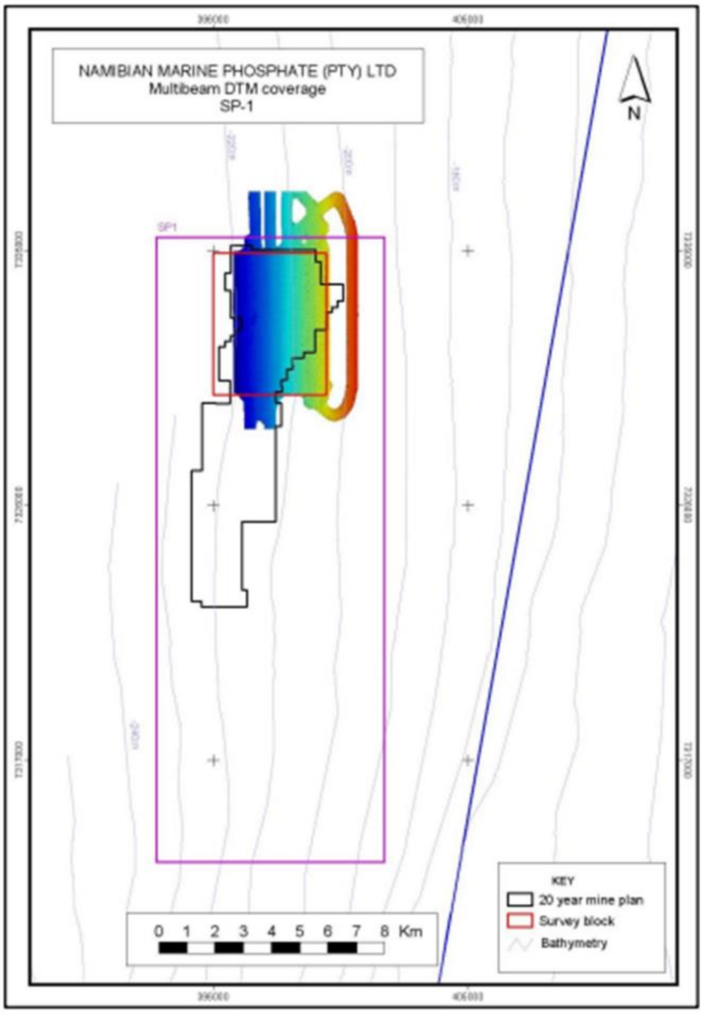


Figure 22 – Multibeam survey coverage of seafloor topography of SP1 and 20 year mine plan area (J Midgley and Associates, 2014)

5.5 SHIPPING INTERACTIONS, NAVIGATION, TRANSPORT AND DREDGER OPERATIONS

5.5.1 INTERACTIONS WITH COMMERCIAL VESSEL TRAFFIC

The main shipping lanes off the Namibian coast for Southern Africa lie seawards of the mining licence area. It is therefore a possibility that sea traffic could frequent the Sandpiper Project site. It is however envisaged that the dredger will only interact with sea traffic when travelling between ML 170 and Walvis Bay. When operational in the Sandpiper Project area (ML 170) the dredging contractor will provide advance notice to the Namibian Maritime Authority and Ports of Walvis Bay and Lüderitz per required operating procedures and protocols. The authorities in turn will issue relevant notices to mariners. The dredger will also display all relevant maritime signals while on station.

5.5.2 INTERACTIONS WITH FISHING VESSELS

Interactions with fishing vessels while the dredger is onsite in ML 170 are possible and the dredger has restricted movement when operational as shown in Figure 23. Therefore, before dredging activities take place in SP1, a notice to mariners of the exact location of dredging will be advertised and marked on hydrographic charts. The 20 year mining area within SP1 comprises a total of 34 km^2 and the average annual mining area of 1.7 km^2/year represents an insignificant footprint in comparison to the total annual Namibian bottom trawl area and commercial catch (primarily monkfish) operations, since data from Ministry of Fisheries and Marine Resources (MFMR) and related specialist studies show that historically minimal bottom trawling activity has been undertaken in the area (J Midgley and Associates, 2014). MFMR data shows that during 2005 to 2010 there was no monk or hake bottom trawling within SP1 (J Midgley and Associates, 2014). More recent data will be reviewed as part of the current assessment.

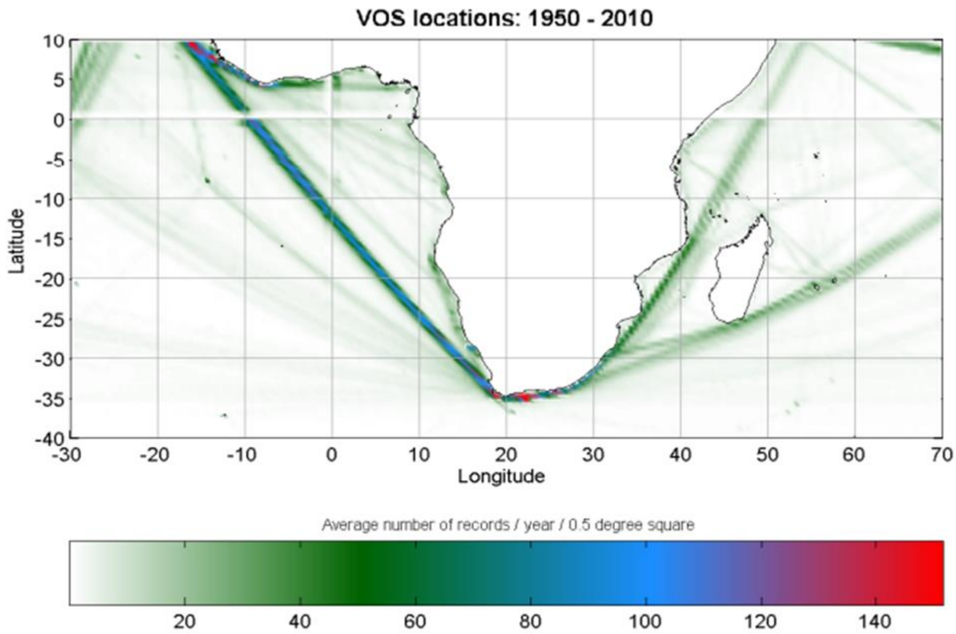


Figure 23 - Shipping routes off the west coast of Southern Africa

5.5.3 NAVIGATION

The coast of Namibia is dominated by a fog belt, which is a navigational hazard for sea and air operations. On average 50 fog days a year are experienced from Elizabeth Bay to Sandwich Harbour. The fog belt extends from the coast to 35 km offshore (Olivier, 1992 and 1995).

Buoyage in Namibian waters follows the Convention on the International Organization of Marine Aids to Navigation (IALA convention) for region A, which are guidelines to be followed by vessels. Apart from satellite navigation systems, Decca navigation is also provided for. Maritime radio services for emergency (channel 16) services, weather bulletins and navigation warnings are provided by Walvis Bay radio call sign ZSV (J Midgley and Associates, 2014).

Transportation access to the Sandpiper Project site is mainly via sea with the dredger. Fly in and fly out opportunities are possible with a helicopter from major harbour towns, such as Walvis Bay, Lüderitz and Cape Town. The dredger will mainly move between ML 170 and the port of Walvis Bay.

5.5.4 OPERATIONAL DISCHARGE FROM THE DREDGER

The dredger will be MARPOL compliant in terms of all operational emissions and non-dredging related discharges from the vessel. Emissions will be recorded and reported on annually. The individual and cumulative impact is to be assessed and expected to be minimal.

5.5.5 SEDIMENT PLUME MODELLING

Findings from an independent review and updated assessment in 2014 conducted by CSIR on the dredge plume characterisation indicate that there is a possibility that the plume dimensions (1500m long by 800m wide with suspended sediment concentrations ranging between 20 – 100 mg/l) may exceed the dimensions reported on in the 2012 ESIA by Lwandle (2013) (2 to 5 times larger). However, the implications for a cumulative impact to occur was assessed and confirmed to be low. It was recommended that an additional and comprehensive plume model be constructed for validation prior to commencement of the proposed commercial dredging operations (base case) and verified during dredging (operational case), as part of the monitoring commitments in order to predict and monitor sediment plume dispersion behaviour, including extent and duration of the sediment discharge.

Subsequently, following recommendations put forward to the Environmental Commissioner in 2018, in 2020 a comprehensive ocean current and sediment plume dispersion modelling study of the proposed 20 year dredging operations within SP1 was conducted by UK based hydrodynamic modelling specialist company HR Wallingford.

Further findings from this study are discussed in the section below. Sensitive receptors identified during public consultation in 2012 and 2018 were included in the plume modelling as defined in section 5.8.7.

The study made use of site specific measurements of water currents and available data to model water and sediment flows in the mining area using three-dimension (3D) technology. The dredger process was analysed in order to make reasonable estimates of the size and rates of sediment released from dredging operations. These inputs were used in the dispersion model to predict the extent of suspended sediments and subsequent deposition from dredging above background levels. These models will be refined with time when additional baseline data becomes available.

5.6.1.1 Zone of Influence (ZOI) from dredging

The zone of influence (ZOI) is the zone or area within which the dredging will lead to changes above background levels in suspended sediment concentrations or to deposition of sediments on the seabed, which are not negligible and the significance of which require an environmental assessment.

The ZOI of the dredging operation is defined as a combination of the suspended sediment footprint (the area in which either the peak concentration increases of more than 7.6 mg/l or mean concentration increases of more than 1 mg/l) and the deposition footprint (the area of fine sediment deposition of more than 5 mm) occur at any time over the course of the 20 year mining period (HR Wallingford, 2020).

HR Wallingford (2020) note that the ZOI does not imply that there will be an actual ecological impact within the ZOI area. The ZOI identifies that there are physical changes to suspended sediment concentration and to the seabed substrate above levels which could be immediately associated with negligible impact. Whether such changes could potentially cause significant adverse impact will depend on the precise nature of the changes and the nature and distribution of the ecological receptors present in the ZOI.

As such these changes cannot immediately be dismissed as insignificant without appropriate assessment, which will be conducted as part of the current process.

Outside the ZOI however, any changes can be considered as insignificant, and it can be concluded that there is no environmental impact.

For the dredging activity in the mine plan area (34 km^2) within ML 170, the overall ZOI for the total 20 year dredging operations extends over an area of 513 km^2 which lies predominantly within the boundaries of ML 170, and which extends only up to 11 km^2 outside of ML 170.

5.6.1.2 Comparison of ZOI and extent of the sediment plume at any given moment

It must be emphasised that the overall ZOI represent the area within which non-negligible changes in suspended sediment and or deposition above background levels are predicted to occur at any time within the proposed 20 year period of mining.

However, at any given moment within the 20 year period, the actual sediment plume represents a much smaller area than the total ZOI.

The sediment plume from the active dredging operation in a dredge cycle typically only covers an area of between 1 - 5 km^2 at any one time and occurs at different levels in the water column over time. As such the plume does not exist at all depths of the water column at the same time.

The ZOI is well separated from the coast and does not influence sensitive receptors in the region of Walvis Bay (HR Wallingford, 2020).

The conclusion drawn was that at any time during the 20 years of mining activity, the plume represents a much smaller area than the ZOI. The ZOI for a single dredging operation extends up to 5 km^2 outside of the 20 year mining plan area. On average the typical extent of the plume during active operations is less than 1% of the ZOI at any given time.

5.6.1.3 Fine Sediment deposition

With regards to the footprint sediment deposition over 20 years, the area is similar to (but slightly smaller than) the overall ZOI. An average sediment deposition of 0.07 m is predicted over the whole ZOI over 20 years. Whilst the predicted deposition rates appear unlikely to cause an ecological effect, the seabed area experiencing >0.1m deposition above background rates is likely to change to a predominantly silty substrate. However, as dredging occurs, the effects of bioturbation (reworking of surface sediments by animal activity such as burrowing, ingestion and defecation) will also be occurring during the dredging operation and likely to result in gradual mixing of the upper and lower sediment layers over time to varying degrees, depending on sediment deposition rates.

5.6.1.4 Suspended Sediment Concentration

The extents of predicted increases in suspended sediment concentration vary with the position of the dredging operation but as a whole the suspended sediment footprint associated with the 20 year mining area is predicted to extend up to 23 km north, 8 km east, 12 km south and 4 km west during the 20 year mining plan area in SP1. The predicted peak increases in plume concentration outside of the 20 year mine plan area is less than 50 mg/l above background.

Mean increases in suspended sediment concentrations above background are predicted to be below 5 mg/l except at the surface within 100 m horizontally of the dredging operation.

Time series analysis at locations sited 2 km from the boundary of the 20 year mine plan area shows that the predicted increase in surface concentrations of suspended sediments above background, outside of the 20 year mine plan area, do not exceed the acute concentration threshold of ecological effects of 7.6 mg/l. The mid depth concentrations and near bed concentrations increases above background exceed this threshold for 4% of the time or less.

5.6.1.5 Single dredge cycle

The ZOI parameters do not provide an indication of the general behaviours and vertical progress of the sediment plume through the water column. A summary of the plume behaviour over an individual dredging cycle is shown in Figure 24, as defined in the results of the plume modelling.

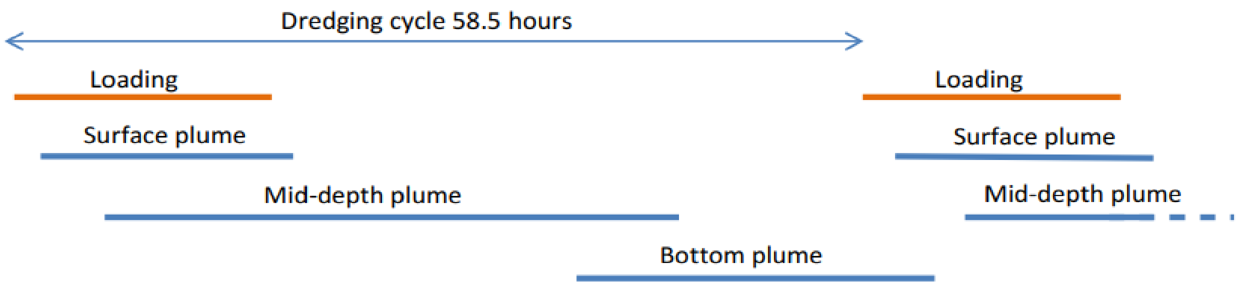


Figure 24 - Summary of plume behaviour over an individual dredge cycle

This is further described below:

- Loading takes 18 hours;
- The surface plume (defined by sediment concentration increases above background of greater than 7.6 mg/l) is present for up to 3hours following cessation of dredging;
- The mid-depth plume is present for 25-30 hours following cessation of dredging;
- The bottom plume is present for 17.5-30 hours but appears >20 hours after dredging ceases;
- The next period of loading starts and the surface plume becomes apparent before the bottom plume disappears;
- There is therefore no time when there is no plume present, either at the surface, mid-depth or bottom of the water column;
- Plumes are present (to some extent) in the bottom/mid-depth/surface for (on average) 41%/73%/34% of the time, respectively; and,
- Deposition over an individual cycle (58.5 hours) is predicted to be 0.3mm or less.

5.6 Biophysical Environmental Baseline

The Namibian coastline is dominated and influenced greatly by the Benguela upwelling system. Namibia and the west coast of South Africa forms part of the eastern boundary to the Benguela Current Large Marine Ecosystem (BCLME), which lies between 15-37°S and 0-26°E (Shillington et al., 2006). The surface currents of the Benguela are generally equatorward, with strong coastal upwelling cells and equatorward shelf edge jets. Subsurface currents on the continental shelf, especially below 100m depth are constantly poleward (Shillington et al., 2006). Upwelling intensity varies and is not uniform due to short term and seasonal differences in wind regime and coastal topography. The upwelling is associated with cool nutrient rich waters that are projected equatorward along the Namibian continental shelf generated by Ekman transport. This is one of the reasons the Namibian coastline is one of the richest fishing grounds internationally.

Hydrological data collected during the 2014 verification survey indicated a well-mixed layer of South Atlantic Central Water, with typical winter values for temperature and salinity and low oxygen levels near the seafloor.

5.6.1 WATER COLUMN AND SEDIMENTS

5.6.1.1 Currents

Measured currents in the target mining area (SP1) reflect consistent northwest (equatorward) flow in the near surface depths. At mid depth, currents switch between northwest and southward (poleward) flow. Near the seabed there is a period of continual poleward flow, followed by switching between poleward and equatorward flows (Shillington et al., 2006) At the time of the 2012 ESIA, mid-depth time series were not available and the results from the 2014 verification study depict new data for the region. (Shillington et al., 2006) reported that the seabed current velocities are <10 cm/s, however in 2014 velocities of 30 cm/s were recorded at the mooring, implying significant turbulence at the seafloor with implications for natural sediment dispersal and impacts on local benthos. The recorded data was also used to validate the oceanographic circulation and current models developed by HR Wallingford for conducting the sediment plume dispersion studies for the 20 year mine plan (total area 34 km^2) for the proposed dredging operations in SP1 (ML 170).

5.6.1.2 Current velocity

The 2014 verification study data concluded that most of the variability in velocity occurred in longer period (>3 day) fluctuations, with inertial and tidal periods also of importance. During the 2012 assessment, lunar tides were assumed to be the probable mechanism preventing accumulation of pelagically produced particulate matter (POM) in mid-shelf sediments immediately offshore of the mud belt. With this mechanism excluded, the ambient current velocities measured are sufficient to exert bottom shear stress forces well in excess of those required to suspend finer sedimenting particles, thereby preventing its accumulation in the survey area.

5.6.1.3 Water Mass Characteristics

The characteristics present in the study area represent oxygen depleted, saline South Atlantic Central Water flowing south, in the poleward undercurrent from the Angola gyre. Additionally, less saline, relatively oxic Eastern South Atlantic Central Water from the Cape Basin was also present. The influence of the latter on the ventilation of bottom water in the area is evident from the temperature, salinity and dissolved oxygen time series measurements that were made (J Midgley and Associates, 2014)

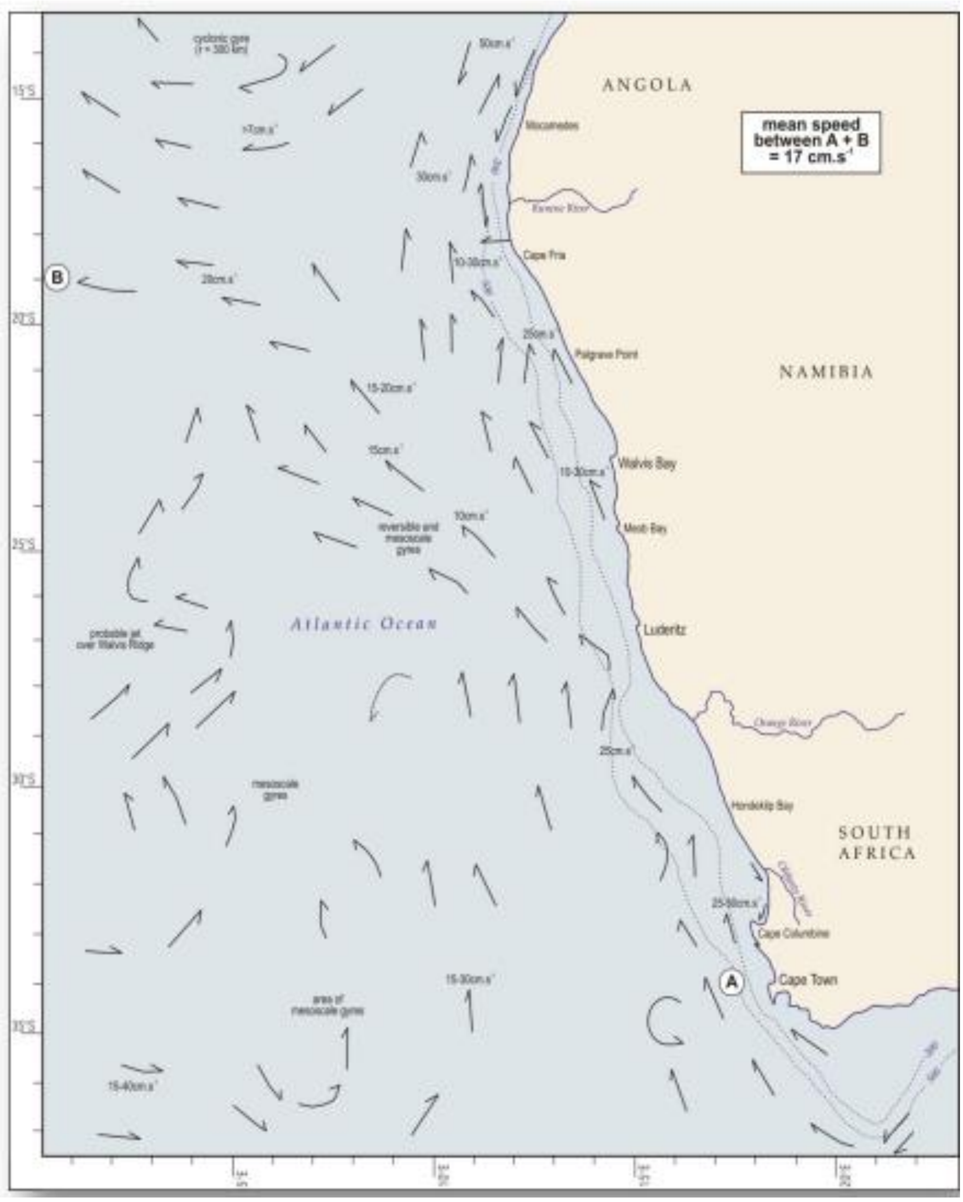


Figure 25 - Surface currents off the west coast of Southern Africa (Shannon, 1986)

5.6.1.4 Dissolved Oxygen Concentrations

Results during the 2014 survey showed that the upper mixed water layer was normoxic. This entails that the water is air-saturated and has a partial pressure of oxygen in the normal expected range. Dissolved oxygen concentrations are shown to decrease in depth and at the sub-thermocline these concentrations measured at 0.5 mg/l. The seabed displayed very low oxygen concentrations, demonstrating periods of hypoxia, which only increased during ventilation events (1/10 mg/l).

5.6.1.5 Turbidity

Turbidity throughout the water column and on the seabed floor during the survey period in the assumed benthic boundary layer was typically low (1 NTU). No clear association exists between recorded turbidity events, current speed, and direction. Thus, these measurements support the conclusions for the 2012 ESIA that observed turbidity events occur as a result of the near shore biogenic mud belt being advected past ML 170 towards the outer continental shelf and slope.

5.6.1.6 Sediment Composition

Surficial sediments are found to be silty, whilst underlying sediments are primarily silt. Evidence of clay was only found in low proportions (<8%) in the deeper sediments. Surficial and upper sediment layers were found to have low porosity, which entails that the sediment is firmly packed, with low pore water volumes and abundant shell material. These features make the sediment body resistant to re-suspension. These conclusions are aligned with the 2012 ESIA that local turbidity generation is a rate event.

5.6.1.7 Particulate Organic Matter (POM)

The average particulate organic matter (POM) concentrations in the sediments of SP1 were recorded to be 7.4 % during the field re-surveys in 2014. This is a higher percentage than the 6.9 % recorded in the 2012 ESIA. Carbon to Nitrogen ratios (C: N) in the POM were 11:4 in the surficial layers and 19:8 in the underlying sediments. These ratios are indicative of refractory organic matter (J Midgley and Associates, 2014).

5.6.1.8 Inorganic Nutrient Concentration

Concentrations in the sediment pore water shows evidence of enriched phosphorous when compared to the overlaying water column. There is also a noted deviation from the classical Redfield Ratio for nitrogen (Carbon: Nitrogen: Phosphorus 106:16:1). The higher phosphorus level concentration is attributed to enrichment from the pelleted phosphate ore body (J Midgley and Associates, 2014). The pore water volumes are low as a result of low sediment porosity. Therefore, significant alterations to upper water column Redfield ratios through translocation of pore water to the surface is not expected to occur (J Midgley and Associates, 2014).

5.6.1.9 Sediment Oxidative State

The findings from the 2012 ESIA and 2014 EIA verification draw to similar conclusions that sediments in ML 170 were hypoxic and thus yield low sulphide fluxes. In order to measure oxidative state of sediments, measurements are taken of oxidation reduction potential (ORP), nitrate-nitrogen and acid volatile sulphide (AVS). ORP was recorded as moderately high (>0 ± 100mv) throughout all sediment core samples, which implies that sediment samples are hypoxic. The presence of nitrate-nitrogen in the sediment pore water supports as when exposed to anoxic conditions, the chemical state changes to ammonia. AVS was below detection levels in the surficial sediments and averaged <2mMol/kg in the subsurface layers. The absence of AVS is consistent with hypoxia, as free sulphide is oxidized to sulphate (SO_4^{2-}) in the presence of oxygen.

5.6.1.10 Dissolved Heavy Metal and Heavy Metal Concentrations

Findings of the 2014 EIA verification found that dissolved heavy metal concentrations in the water column were insignificant and close to or below detection levels. Nutrient concentrations were found to be similar to regional measurements and the Redfield ratio (Molar N:O) averaged slightly higher at 17:71. This could be a result of minor nitrate-nitrogen enrichment. These findings support the conclusions in the 2012 ESIA that the water quality is close to or at its natural state in the Sandpiper Project area.

High concentrations of heavy metals (arsenic, cadmium, chromium, copper and nickel) are found in the surficial and subsurface sediments. This is a common feature of sediments that occur at various locations withing the BCLME. The 2012 ESIA predicted high concentrations of cadmium and nickel. Elutriation studies in the 2014 EIA verification for assessment of the bioavailability of these metals in the dissolved phase showed that they do not present a toxicity risk in situ or following physical disturbance in this phase.

The sediments on the Namibian continental shelf are characterised by elevated cadmium concentrations. It is suspected that resident demersal fish, such as hake and monkfish, would have elevated cadmium concentrations in their livers. Therefore, dredging operations would not have an effect on these species.

It is concluded that trophic transfers of heavy metals associated with dredging sediment plumes would include the ingestion by planktonic copepods. However due to rates of digestion being longer than gut passage time, the metals will be lost in faecal pellets. This sinking rate of the pellets is high and the metals will be returned rapidly to the sea floor (hours to days).

In order to gain more confidence in the results obtained from earlier studies, toxicity testing was further carried out on the proposed mine sediments in 2020 (Lwandle Marine Envrionmental Services, 2020) Sediment samples used for testing were the available core samples from the proposed mining area and the study focused on surficial layers of these cores. It is noted that the EMP will include a programme of core sampling and analyses to refresh the overall environmental baseline reference dataset before the commencement of mining which will include monitoring to assess toxicity levels at deeper sediment profiles across the planned mining area.

Nine core samples were subsampled at 5 - 15 cm core depths and sediments extracted for analysis. The toxicity testing measured acute and chronic effects on sea urchin fertilisation success and larval development. The toxicity test results are consistent with data collected during the 2014 EIA verification studies, an increase in heavy metal contamination is not likely through direct exposure or through ingestion.

Whilst surficial and subsurface sediments in the proposed dredging area support naturally higher concentrations of heavy metals such as arsenic, cadmium, chromium, copper and nickel, the bioavailability impact is considered not significant, as confirmed during elutriation test work completed in 2014. Therefore, even though the natural concentrations exceed the sediment quality guidelines for the region, the low release of metals in the dissolved phase does not pose a toxicity risk in this phase or in situ following physical disturbance.

With regards to demersal fish, the transfer of heavy metals is low, as these contaminates are reduced ay a primary consumer level. With regards to benthic species, the proposed mining operations will not increase additional exposure above what naturally occurs and therefore bioaccumulation potential is low.

The contamination of heavy metals of the sediment plume is thus not considered to have a significant impact on marine species in the water column when the increase in suspended sediment concentrations above background fall below the value of 7.6 mg/l.

5.6.2 NOISE IMPACTS

A literature-based assessment of the potential impacts of sound from dredging vessels on a variety of species showed that sound levels in all cases are well below those known to cause damage to marine life (J Midgley and Associates, 2014). In 2020 a supplementary study on trailing suction hopper dredger (TSHD) sound measurements were carried out by international dredging company Jan De Nul N.V.

Sound waves associated with the TSHD dredger are similar to that of a merchant vessel, with dominant sounds emitted from the main engine (500Hz) and propeller (300Hz), respectively. Higher frequencies are associated with draghead or soil interaction, hydraulic transport, hopper loading, and these frequencies are faster diminished.

Under water sound limits are internationally imposed to prevent potential damage to marine mammals and fish hearing organs. Such damages are noted to occur at sounds above 150 dB re 1μPa for defined range and continuous exposure periods, with avoidance responses triggered from 100dB re 1μPa. Currently, international and national noise limits set for dredging operations is limited. Using information from other studies including the Jan De Nul dredging vessel fleet and literature reviews, conclusions are drawn on the preferred acceptable range. The source level for a TSHD in operation is 180-190 dB re 1μPa at 1m (Jan De Nul Group, 2020). Figure 26 below summarizes the measurements of the Jan De Nul fleet and clarifies what can be found in literature, that the 150 dB contour range is less than 100m around the vessel (Jan De Nul Group, 2020). Shown in Figure 27 the propagation of underwater sound over a larger range is modelled for a TSHD dredger known as the Gerardus Mercator (Jan De Nul Group, 2020).

Due to the significant variability of ocean water properties and related aspects that influence the transmission of sounds from a specific source, no further meaningful studies for sound profiling of SP1 can be carried out until the intended dredger is on site.

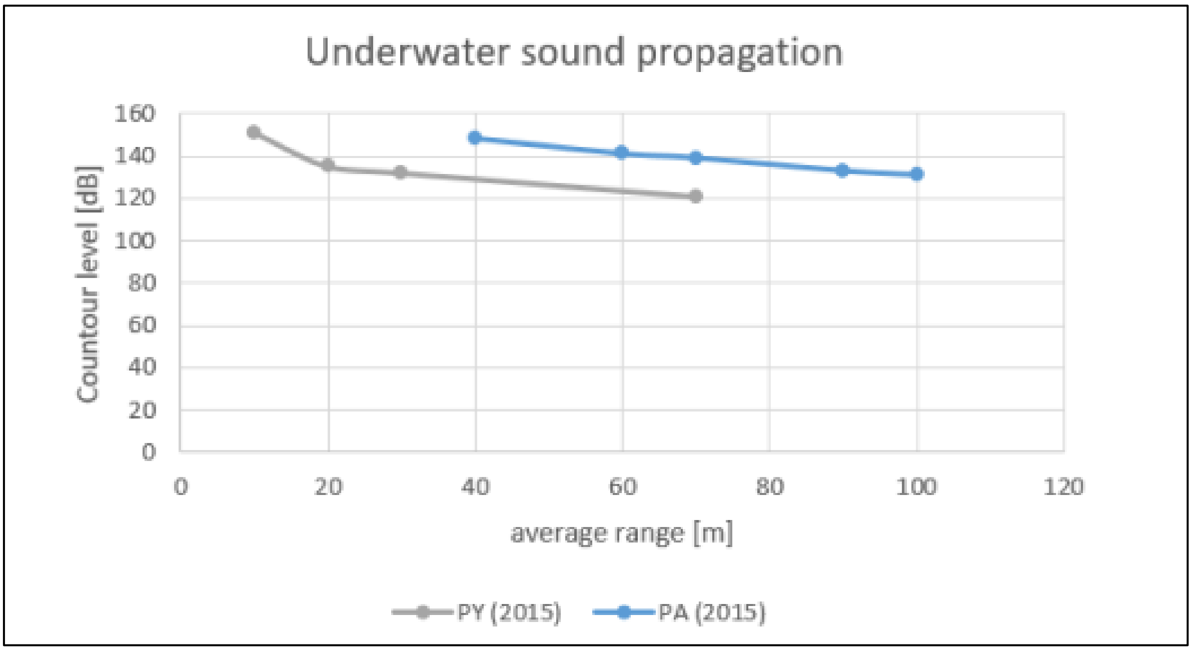


Figure 26 - Measured underwater sound from Jan De Nul fleet (Jan De Nul Group, 2020)

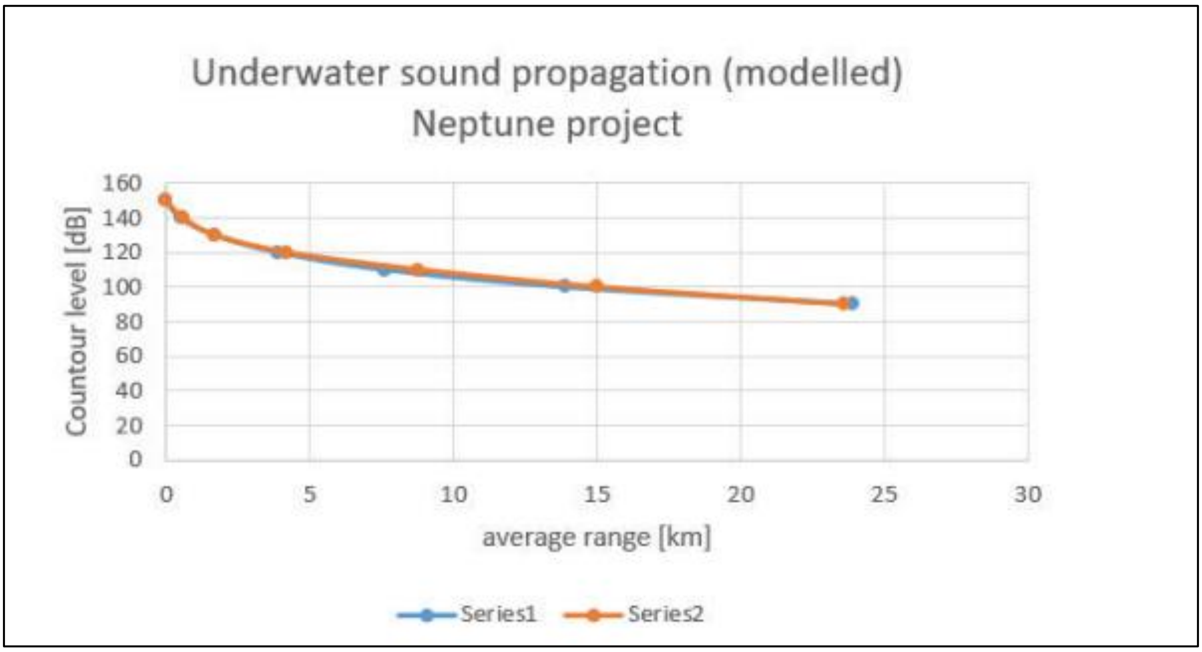


Figure 27 - Modelled underwater sound for TSHD Gerardus Mercator (GM) (Jan De Nul Group, 2020)

Above ground limits are imposed when working in close vicinity of tourist or residential areas. No measures are required for dredgers. The source level for a TSHD in operation is 80-90 dB re 1μPa at 1m (Jan De Nul, 2020). Figure 28 demonstrates measurements done around the JDN dredger fleet.

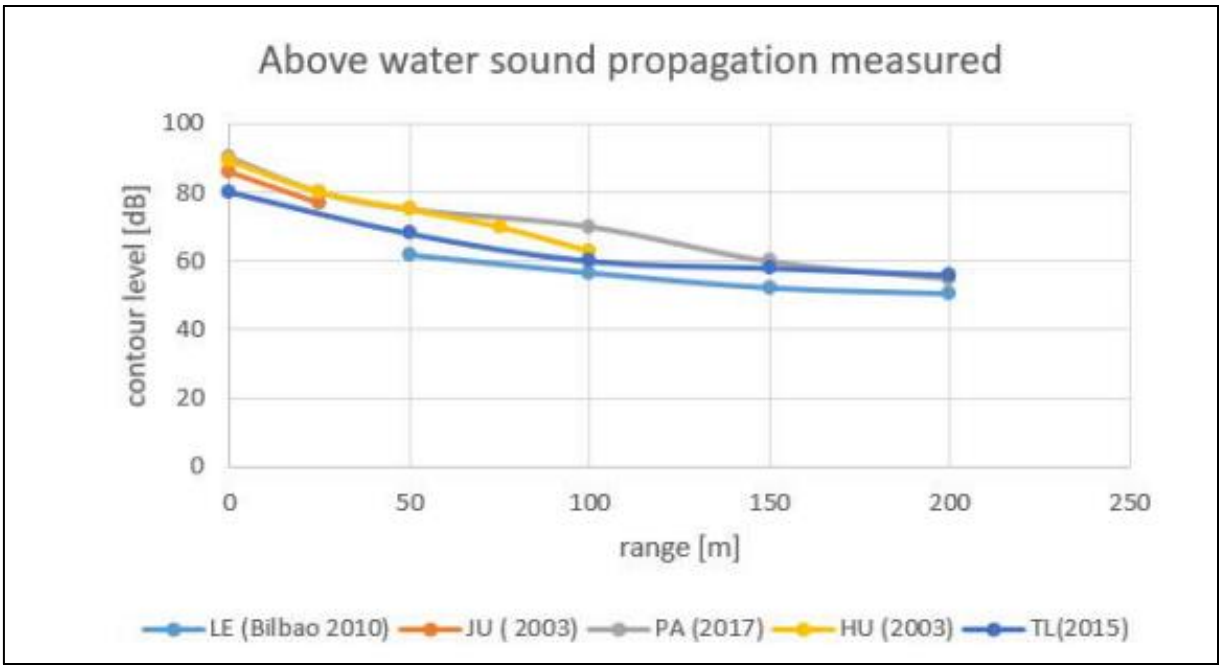


Figure 28 - Above water measurement of sound JDN dredger fleet (5 dredger total) (Jan De Nul Group, 2020)

5.7 METEOROLOGY AND CLIMATE

The meteorological conditions experienced along the Namibian coastline are controlled by the South African anticyclone, the Benguela current, associated upwelling and the divergence of the south-east trade winds as shown in Figure 30. The semi-permanent temperature inversion layer caused by the warm/dry air mass overlapping the cool air mass above the Atlantic Ocean allows for the regular formation of fog and low status clouds. Utilising seasonal and average wind rose data of the Licence Area from voluntary observing ships (Southern Africa Data Centre for Oceanography (SADCO)) over the last 51 year period (1960 – 2011) demonstrates the predominate winds from the south/southeast and are generally stronger in the spring and summer months for offshore winds. Nearshore wind data displays a predominantly strong southern component. There are however minor seasonal changes between southerly and south easterly winds. During the winter months, strong easterly winds from the Namib desert can carry aerosol plumes of sand and dust up to 150 km offshore.

Fog is one of the most distinctive features on the Namibian coastline and can reach up to 35 km offshore (20 nautical miles) which can have an effect on dredger discharge operations from a safety risk perspective. Fog is usually quite dense and reduces visibility intensely. The coast between Walvis Bay and Lüderitz experiences between 50 to 100 fog days a year, with the highest frequency found between Walvis Bay and Swakopmund (±30 km belt). Fog precipitation regularly exceeds rainfall and is considered more reliable moisture for the Namib desert. Fog precipitation averages 34 mm/year at the coast, whereby Swakopmund measured a high of 130mm in 1958 as shown in Figure 29.

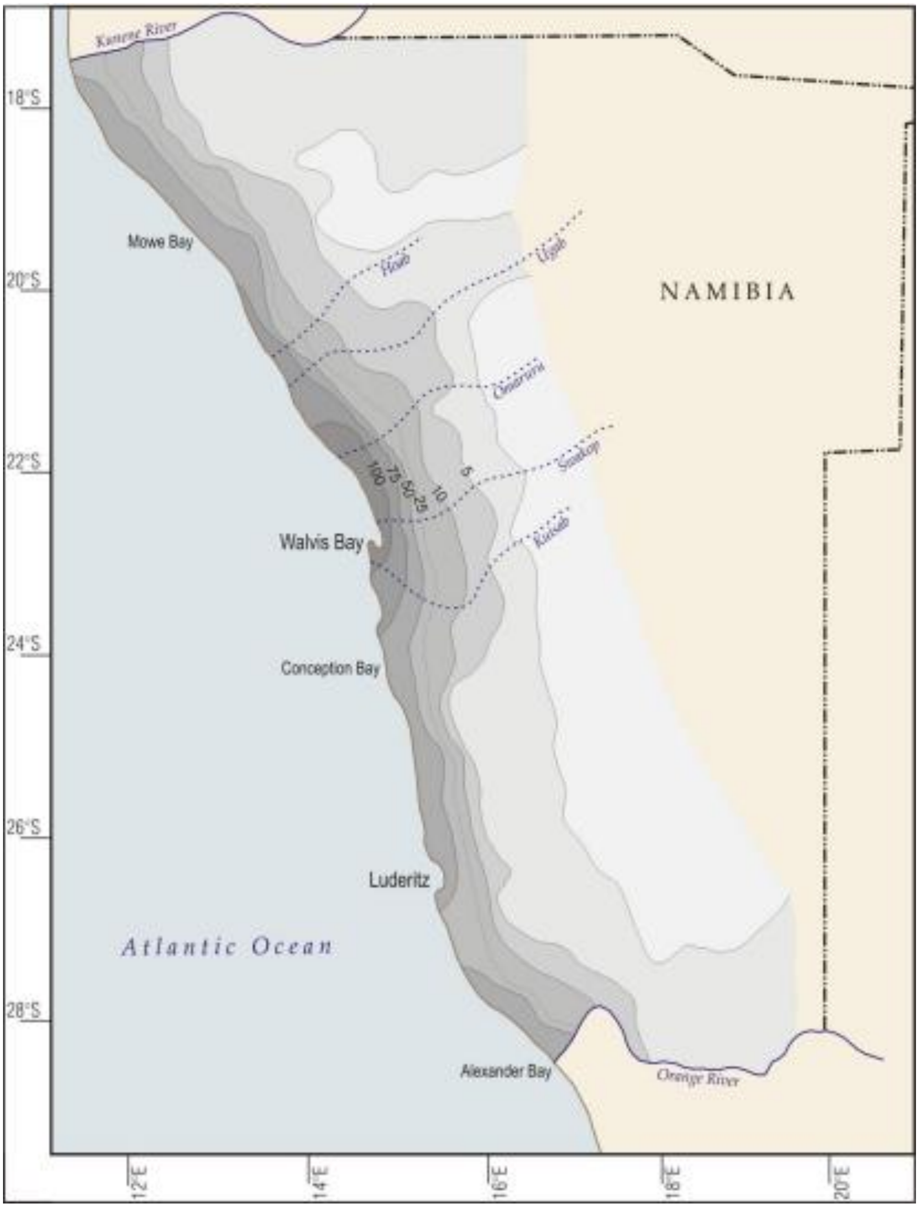


Figure 29 - 1984 Fog day frequency using Meteosat Images (Olivier, 1995)

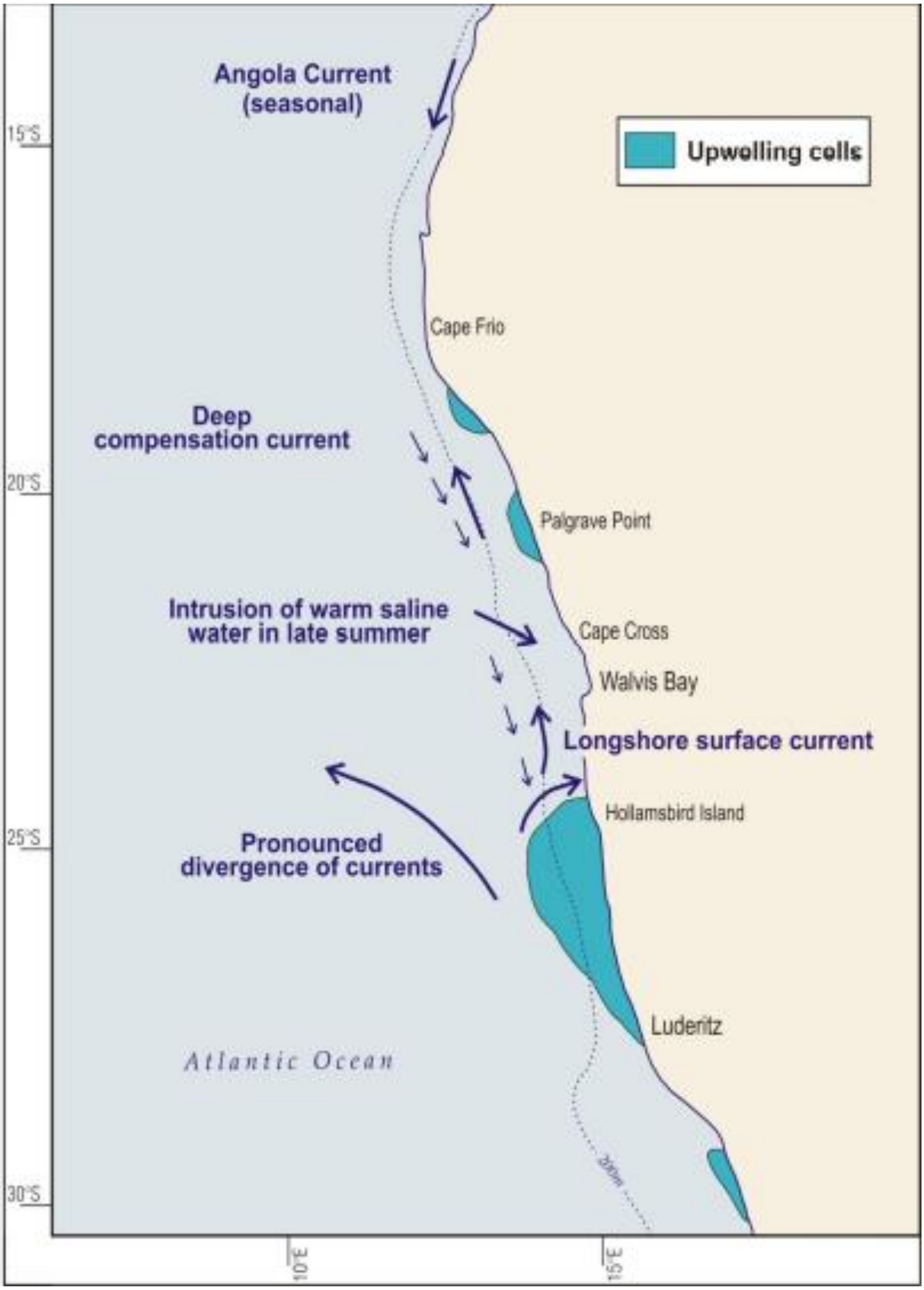


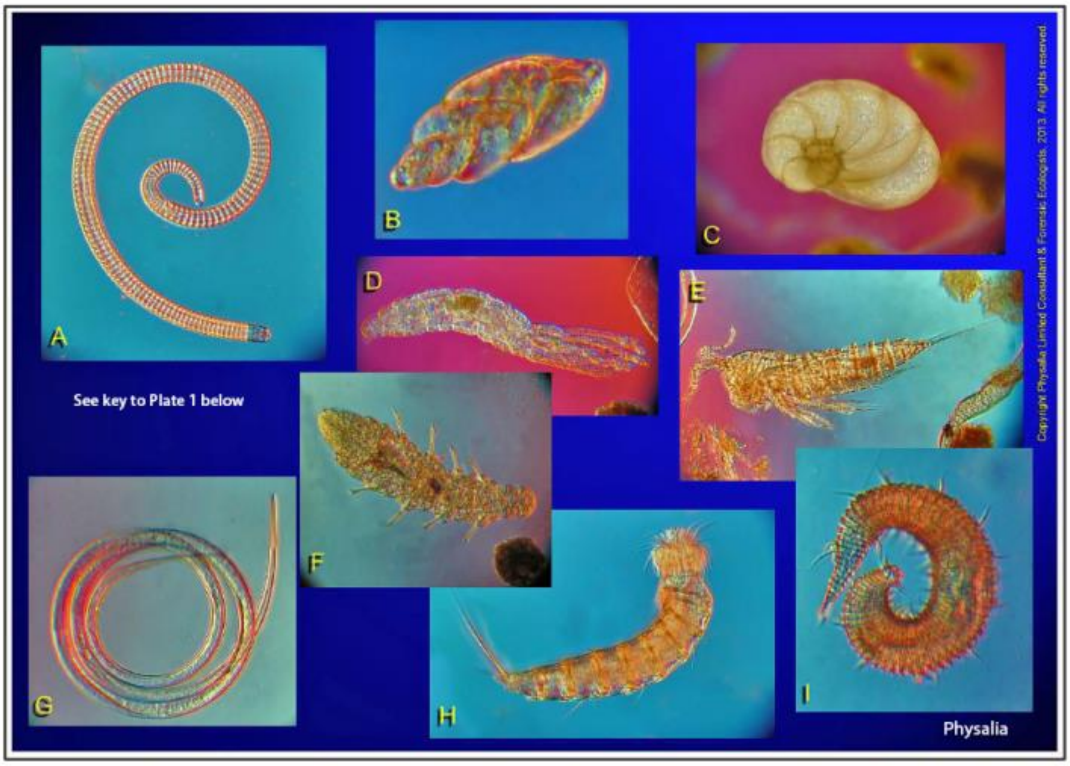
Figure 30 - Upwelling centres on the west coast of Namibia and Angola, with a schematic of currents (Shannon, 1986).

5.8 BIODIVERSITY BASELINE

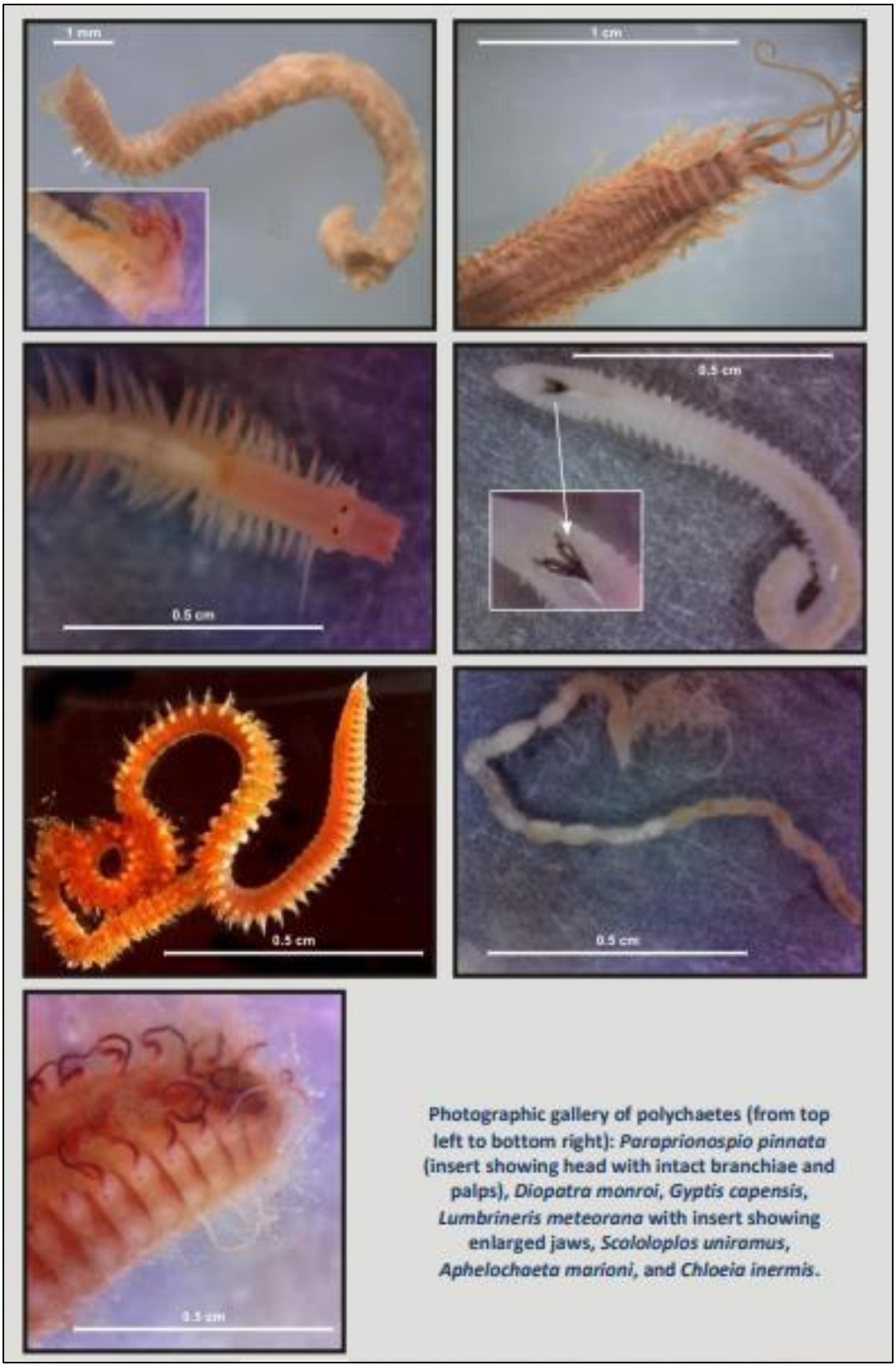
5.8.1 BENTHIC MEIOFAUNA AND MACROFAUNA

Benthic meiofauna and macrofauna are both found to be abundant in the surficial sediments in the Sandpiper Project area shown in Figure 31. Their presence is consistent with hypoxic sediment environments. The relative abundance of benthic macrofauna in the >1 000 µm size class indicates that this condition is persistent as (Para) Prionospio, which forms a large proportion of the fauna, has a life cycle of 1-2 years and Diopatra sp. may be as long-lived (Stefanni, 2014). The species abundance is consistent with a stable sedimentary environment The seasonal changes in the oxygen content in the overlaying water body will not greatly influence the benthic fauna. The macrofauna of ML 170 has a much larger geographical distribution and has been recorded on the continental shelf elsewhere along the Namibian and South African west coast.

The homogeneity of the meiofauna and macrofauna assemblages reflects the homogeneous nature of the seafloor in SP1.



A: The nematode worm ***Ceremonema*** sp.; ***B:*** The ***Bolivinitid type*** foraminiferan; ***C:***, The planospiral foraminiferan of the family Elphidiidae; ***D*** and ***F***: Juvenile/neochaete polychaete annelid worms; ***E***: Harpacticoid copepod; ***G***: The nematode ***Halalaimus*** sp; ***H***: A member of the phylum Kinorhyncha; ***I***: ***Quadricoma*** sp.



Photographic gallery of polychaetes (from top left to bottom right): *Paraprionospio pinnata* (insert showing head with intact branchiae and palps), *Diopatra monroi*, *Gyptis capensis*, *Lumbrineris meteorana* with insert showing enlarged jaws, *Scoloploplos uniramus*, *Aphelochaeta marioni*, and *Chloeia inermis*.

Photographic gallery of crustaceans, molluscs, and other taxa (from top left to bottom right): The amphipod *Gammaropsis* sp., shrimp *Pasiphaea* sp., isopod *Arcturella lineata*, amphipod *Grandidierella lutosa*, sea pen (Veretillidae), sea squirt (Ascidicea, *Molgula* ? sp.), and the bivalves *Tellina gilchristi* and Dosinia ? sp.

Figure 31 - Benthic meiofauna and macrofauna samples taken during 2014 field survey (J Midgley and Associates, 2014).

5.8.2 THIOBACTERIA

During field surveys in 2014 of the sampled bacterial assemblages of thiobacteria, it was observed that the large sulphide bacteria, namely from the genera Thiomargarita, Beggiatoa and Thioploca, were absent. These bacteria play significant roles in the oxidisation of H_2S. Smaller forms including *Thiobacillus spp* with relatively lower growth yields were present. Therefore, it can be concluded that sulphide fluxes are assumed to be low.

5.8.3 PLANKTON

The Atlantic oceanographic environment off the Namibian coastline is dynamic and influenced mainly by the Benguela current upwelling system. This system supports a rich ecosystem with a high abundance of phytoplankton, zooplankton and ichthyoplankton species. Within the Lüderitz upwelling cell, the species abundance is low however, abundance in species increases between the transitional zone of the southern and northern regions of the Benguela ecosystem, which is located north of ML 170. Additionally, species abundance decreases further offshore which is important since the proposed dredging site is located 60 km offshore. The plankton species present in the vicinity of the ML 170 area are commonly found in the region.

5.8.3.1 Phytoplankton

Phytoplankton communities in the Sandpiper Project area are dominated by diatoms and the majority of these species are found in the global oceans. Diatoms occur primarily inshore, with biomass decreasing offshore. These species found within ML 170 are therefore common and occur in decreased abundance when compared inshore.

5.8.3.2 Zooplankton

Zooplankton communities in the central Namibian waters are dominated by copepods. These species are common and not unique to the Sandpiper Project area. Zooplankton is found further offshore than phytoplankton, whereby species abundance peaks on the shelf-break at depths of approximately 200 m. The proposed dredging activity of the Sandpiper Project is located in water depths of 200 to 225 m, and therefore an increased abundance of zooplankton will be present (Japp, 2012).

5.8.3.3 Ichthyoplankton

Central Namibian waters support several commercial fisheries. Species of sardine, anchovy, hake and horse mackerel are of particular importance. The ichthyoplankton of these species plays an important role in recruitment, which is important for the fishing industry. Generally, fish off the Namibian coast spawn in inshore waters north of Walvis Bay. Based on assessment of the available information, the proposed 20 year mining area in SP-1 is not located within any important spawning or nursery grounds for the commercially fished monk and hake fisheries (Japp, 2012).

Although the central Namibian waters are productive and support large communities of plankton, the proposed dredging site does not occur within any identifiably important area for phytoplankton, zooplankton or ichthyoplankton growth and development (Japp, 2012).

5.8.4 FISH, SEABIRDS AND MAMMALS

The 2014 verification survey component for fish, fisheries and biodiversity consisted of a; i) review of ecosystem modelling and its application to ML 170 and ii) a monk trawl survey. These studies were conducted to further enhance the findings from the 2021 EIA and the subsequent results will be discussed in the sections below.

5.8.4.1 Ecosystem impact modelling

The review of the possible ecosystem impacts of dredging (up to 3 km^2 annually and 60 km^2 for the 20 year mining lease period) within the broader northern Benguela system concluded that the combination of the high uncertainty typically associated with projections by ecosystem models and the extremely small area that will be affected by the proposed dredging annually and cumulatively over 20 years means that it is unlikely that ecosystem modelling would be able to resolve and expose any unexpected or highly significant threats that have not already been considered and evaluated in the other specialist studies (Midgley 2014). Therefore, significant impacts on the ecosystem are unlikely.

5.8.4.2 Fisheries – biomass, recruitment and spawning

Conclusions drawn from the biodiversity survey are consistent with the 2012 ESIA assumptions and findings as well as the 2014 EIA Verification findings regarding the size distribution of the main commercial fish species (monk and hake) most likely to be impacted on. No evidence could be found of unique spawning and recruitment characteristics in the mining licence area. Juvenile and pre-recruiting Cape hake is found in abundance. No irregularities were found between proportions of juveniles and sex ratios (male and females), making the dredge area not unique.

With regards to monkfish, the verification survey provided evidence of a mix of juveniles, adults and pre-recruiting fish. Due to the survey team using monk-directed gear with a cod-end liner (20 mm mesh) to retain as much as possible, the proportion of juvenile fish caught was higher than would be expected for equivalent Biomass assessments completed by MFMR (J Midgley and Associates, 2014).

Both the field survey outputs and the biomass estimates for SP1 confirm that the dredging activity is likely to have only a very small impact relative to the overall abundance of the monk and hake stocks in Namibian waters (J Midgley and Associates, 2014). The impact in SP1 on monk reproduction and the recruitment will also be minimal.

Sole abundance was recorded as low during the survey. Additionally, predominantly large sole was caught. This further suggests that the SP1 area and adjacent grounds are unlikely to be a significant recruiting area for sole.

The verification surveys for the fish, mammals and seabirds confirmed the core assumptions of the 2012 ESIA, confidence levels of the impact assessments are now reported as high (J Midgley and Associates, 2014).

5.8.4.3 Biodiversity Trawl Survey

The biodiversity survey spanned a total of eight days in June 2014 in the Sandpiper Project area and was conducted under specifications set by MFMR and with participation of 2 members MFMR onboard the survey vessel. A commercial monkfish trawler was used, sampling 24 stations at depths greater than 200m. The aim of the survey was to provide biodiversity baseline data.

A total of 14 fish species, including two squid species (*Todarodes angolensis* and *Todaropsis sagittatus*) and one shark (*Hexanchus griseus*) was identified. Cape hake dominated the catch, amounting to 40% of the total fish weight. This was followed by monkfish at 35%, rat tail (*Coelorinchus simorynchus*) at 14%, West Coast sole at 3%, bearded goby at 2% and horse mackerel at 0.4%. Cape hake, monkfish and gobies were found in most of the trawls and little variation was noted throughout the survey area showed in Figure 35. In general fish diversity was lower than reported in the 2012 ESIA. The most probable reason is that the survey gear used in 2012 varied in type (hake, monk, midwater, purse seine). As a result of using dedicated monk trawl gear, no conclusions can be made regarding the availability and abundance of non-demersal species (horse mackerel, sardine, mesopelagics and gobies).

The fauna recorded in the 2014 verification survey were notably less abundant than reported in the 2012 ESIA. Fifteen species of seabird, 45% were White-chinned Petrel (*Procellaria aequinoactialis*), 20% Subantarctic Skua (*Catharacta antarctica*) and 12% Black-browed Albatross (*Thalassarche melanophrys*) as shown in Figure 36. Only two species of marine mammals were observed during the survey, the Cape fur seal (*Arctocephalus pusillus pusillus*) and the dusky dolphin (*Lagenorhynchus obscurus*) as shown in Figure 37. With respect to demersal fish species mammals and seabirds, no unique features were noted, and the results are consistent with the initial assessment in the 2012 ESIA that the abundance of certain species will vary.

No mesopelagic species were recorded in the trawl catches. Lantern fish are expected in the mid-water; however, the trawling gear would not have targeted these species.

Trawl catches between night and day varied as expected due to the normal diurnal behavioural patterns with regards to fish and crustaceans.

Fourteen taxa of epifauna were collected by the bottom trawl, which included; crabs, ascidians (sea squirts), brown sponges, sea pens, mantis shrimps, starfish and whelks shown in Figure 33 and 34. The colonial ascidian (Molgula sp.) was recorded as the most dominant bottom living organism, contributing up to 60% of the epifauna catch weight. This was followed by the pennate sea pens (family Veretellidae) at 37%. Both groups were found widely distributed over the survey area. Overall, the high abundance of ascidians was notable. Their abundance may in part be due to the historically very low density of trawling of the region and in particular in the Sandpiper Project area as shown in Figure 32.

Jellyfish, particularly *Chrysaora fulgidia* were also abundant in all trawl catches.

Figure 32 - Trawl contents showing a high abundance of spherical *Molgula sp* (family Ascidiacea) (J Midgley and Associates, 2014)

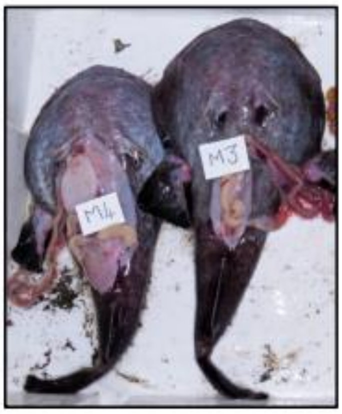
Figure 33 - Epibenthic fauna collected include: 1. *Odontaster australis*; 2 *Astropecten* (aboral view); 3 *Astropecten* (oral view); 4 *Molgula*; 5 *Proferia* (J Midgley and Associates, 2014)

Figure 34 - Epibenthic fauna collected include: 1 *Bathynectes piperitus*; 2 *Solenocera africana*; 3 *Pterygosquilla armata capensis*; 4 *Veretellidae*; 5 *Callianassa australis* (J Midgley and Associates, 2014)

Shallow water hake *Merluccius capensis* male

Shark (bluntnose sixgill) *Hexanchus griseus*

Shallow water hake *Merluccius capensis* female



Monk *Lophius vomerinus*

Figure 35 - Fish, shark and squid species collected during the survey (J Midgley and Associates, 2014)

Black browed albatross *Thalassarche melanophrys*;

Pintado petrel *Daption capense*;

Cape Gannet *Morus capensis*

Figure 36 - Avifauna species observed during the survey (J Midgley and Associates, 2014)

Figure 37 - Dusky dolphin (*Lagenorhynchus obscurus*) observed during the survey (J Midgley and Associates, 2014)

5.9 SOCIAL AND SOCIO-ECONOMIC BASELINE

The 2012 and 2014 ESIA reviewed the social and socio-economic environment for the proposed Sandpiper Project, in which associated impacts and key sensitivities were identified. Therefore, a summary of this review will be provided in this chapter. However more recent data for the Erongo and Walvis Bay coastal region will be sourced from Geological Survey of Namibia's Strategic Environmental Management Plan (SEMP) report(s) and the 2011 National Population Census (NPC). A recent pilot census was conducted in 2021, however this data is not yet available from the National Statistics Agency.

A supplementary socio-economic study was conducted in 2020 by Jan De Nul N.V. and the marine component of this study will be further elaborated on in this chapter. Additionally, an industry-based study was carried out in 2018 by Stratecon Applied Economic Research to conduct an economic assessment of the development of a phosphate-based industry in Namibia. Further details on the conclusion of this study will also be discussed.

The Namibian Government aims to encourage local and foreign investment, promote job creation, alleviate poverty and income inequality. The establishment of Namibia's first marine phosphate mining project will have positive short, medium and long term socio-economic impacts for Namibia. At full production of 3.0 Mtpa, it is expected that Namibia will be amongst the top ten world producers of phosphate.

One of the main positive contributors and tangible impacts of the dredging operations will be the employment opportunities created for the local communities. These are both direct and indirect such as material supplies, catering, training, education etc. The skill sets created in the community will remain after the Sandpiper Project has closed. Local purchasing in relation to the Sandpiper Project will also improve the local economy.

5.9.1 POPULATION AND GROWTH RATE

In 1991 the Erongo Region had a population of 55 470, in 2001 this increased to an estimated 107 663 and in 2011 this increased to 150 809 (Government of Namibia, 2011) as shown in Figure 38. The percentage increase from 2001 to 2011 is recorded as 40.1%. Therefore, an estimated 50 000 increase per decade is noted. The first main population increase in 1994 was noted due to the inclusion of Walvis Bay into Namibia from South Africa. The increase between 2001 and 2011 can be attributed to the increase in industrialisation in the coastal towns and the uranium rush. The Erongo Region is the seventh most populated region in the country (Government of Namibia, 2011). If the main urban towns and city populations are reviewed, Walvis Bay (62 096) and Swakopmund (44 725) are the third and fourth highest respectively. Persons per km^2 are calculated to be 2.4.

The growth rate in the Erongo increased from 1.3% in 2001 to 3.4% in 2011, with more males residing in the Erongo than females, with a difference of over 10 000. This status has remained relatively the same for both 2001 and 2011. This is mainly attributed to job availability in the industrialised market at the coast, whereby traditionally certain skill sets were not associated to be 'female jobs'. The Erongo Region is recorded to have had the highest growth rate than any other region between 2001 and 2011.

The Khomas and Erongo regions have also experienced the highest statistics with regards to inward migration at above 40% between 2001 and 2011.

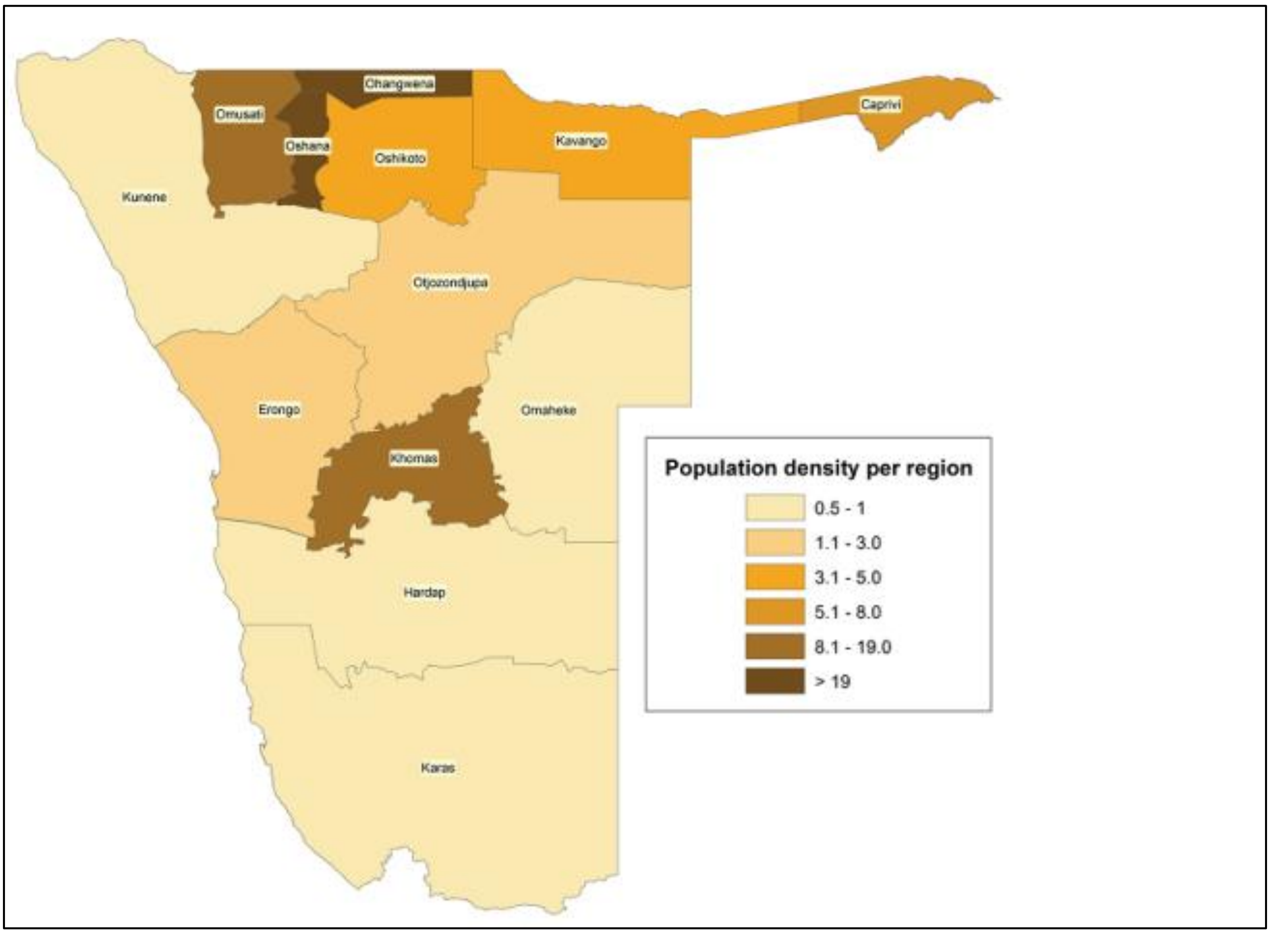


Figure 38 - Population density recorded per region (Government of Namibia, 2011)

5.9.2 POVERTY AND UNEMPLOYMENT

Urbanisation in the Erongo Region is noted to have increased between 2001 and 2011 from 80% to 87.4%. The unemployment rate in the Erongo Region decreased between 2001 (34%) and 2011 (30%). However, overall, the unemployment rate in the country increased from 28% in 2014 to 33% in 2018.

See Table 12 depicting urban population changes per main coastal town.

Table 12 - Urban population by census year for the Erongo Region main coastal towns

Town	2011	2001	Difference	Percentage Change
Walvis Bay	– 62 096	– 43 611	– 18 485	– 42.4
Swakopmund	– 44 725	– 23 808	– 20 917	– 87.9
Henties Bay	– 4 720	– 3 285	– 1 435	– 43.7
Arandis	– 5 214	– 3 974	– 1 240	– 31.2

The 2011 census determined that for the Namibian economically active population, 63% aged 15 years and above were employed, whilst 37% were unemployed. There were only slight differences between urban and rural areas. In the Erongo, 22.9% of the unemployed workforce was actively looking for jobs, with more females (29.7%) actively looking than males (17.5%). The latter is in fact the lowest country wide for the inactive male workforce.

As per information received from the Namibian Chamber of Mines and SEMP Report, the mining industry provided 9045 permanent and 498 temporary jobs in 2018. Additionally, 6681 individuals were subcontracted. Currently approximately 1.5% of Namibia's workforce is employed in the mining sector.

The COVID-19 pandemic has also had a negative effect on the economy and the livelihoods of individuals across the various sectors. Due to the stringent lockdown events that occurred in 2021 in Namibia, many people lost their jobs and had to seek alternative work or assistance. Namibia and her economy are still recovering from this as the pandemic is ongoing.

5.9.3 ECONOMIC ENVIRONMENT

Currently the main economic drivers of Walvis Bay and Swakopmund town are fishing, tourism, manufacturing, mining and the harbour. Of these industries, the fishing industry is perceived by certain groups to be affected by the proposed Sandpiper Project.

There are two main noted categories of fishing; pelagic and demersal. Pelagic fish are found near the upper layers of the open sea, whilst demersal fish are found on or near the seabed. Both types of fish are caught north and south of Walvis Bay and quotas per catch per day are allocated and monitored from the Ministry of Fisheries and Marine Resources.

Demersal fish are caught by bottom trawling on the seabed on the Namibian continental shelf at water depths ranging from 200-600 m in parts of the Sandpiper Project area (ML 170) and surrounding areas, bottom trawling operations are undertaken at water depths of 200-350 m. However as discussed earlier in this chapter from the scientific field surveys, at the scale of the proposed dredging operations, the operational and cumulative impacts and influences on the fishing industry are considered to be minimal.

The development of the proposed Sandpiper Project will contribute towards the NamPort expansion and bulk terminal development. NMP will move an estimated ~8.0 Mtpa (~5.0 Mtpa import and ~3.0 Mtpa export) of cargo through the port which will contribute to investment in Walvis Bay and the planned Walvis Bay development corridor.

5.9.4 HEALTH AND DISEASE

Currently the Namibian public health system experiences various short falls, which is a national issue. This was further exacerbated with the influence of the COVID-19 pandemic in 2021. There are three different types of health services available in Namibia; public, private and not-for-profit (NGO). Currently only 15% of the population can afford private healthcare and certain services are only available at these facilities.

The Ministry of Health and Social Services (MHSS) formulated a strategy including planned targets to be achieved by 2022. The implementation of this strategy depends on the availability of resources. The Ministry reconfirmed its commitment in 2018/2019 to capacity building and skills development of health workers to provide quality essential services.

What is evident from the 2019 MHSS statistics reviewed for the Erongo for the ambulance availability, number of registered healthcare facilities and the number of registered health care professionals is that these targets have not been met. The vessel will have onboard its own medical facility and officers who are trained in first aid. In the event of an emergency involving serious injury or illness NMP's emergency response procedures include provision for assessment and airlift to a hospital by medivac. Emergency response plans are integrated with details of onshore local medical facilities and medivac capabilities prior to commencement of operations.

In 2015 the MHSS conducted an exercise known as the Workload Indicators of Staffing Need (WISN). This exercise would determine the number of health care professional required per region according to national practice standards. The exercise focused on four categories of health workers that the MHSS determined as the most critical.

Table 13 summarised the WISN results for the Erongo, compared to the SEMP targets. Additionally, the table shows target ratios of health care professionals versus actual numbers in 2015, assuming a population of 175,750 residing in the Erongo. Currently the Erongo is not meeting the required figures or ratios.

Table 13 - Public health care professionals in the Erongo region (WISN and SEMP) (SEMP, 2018/2019)

	Doctor		Dentist		Pharmacist		Pharmacist assistant		Registered nurse		Enrolled nurse	
Health District	Actual	Required	Actual	Required	Actual	Required	Actual	Required	Actual	Required	Actual	Required
Omaruru district	3	4.6	0	0.8	0	2.8	1	2.5	0	33	0	30
Swakopmund district	5	14	2	1	0	4.3	4	6.7	49	64	27	43
Usakos district	2	4.7	0	2	0	2.8	1	4.2	24	36	16	30
Walvis Bay district	4	14	3	1	0	4.5	2	9.3	12	89	9	69
Total	**14**	**37**	**5**	**5**	**0**	**14**	**8**	**23**	**85**	**223**	**52**	**172**
Target ratio per 1000	1:1000		1:2000		1:2000		1:2000		2.5:1000		2.5:1000	
Actual ratio per 1000	1:12550		1:35150		None		1:22000		1:2070		1:3380	

Walvis Bay currently has the highest rate of tuberculosis (TB) infections in Namibia. This was also the first town during the COVID-19 pandemic where cluster infections were occurring. This can be seen as contributions from the international harbour, various trucking companies and overcrowding in townships, whereby airborne diseases travel faster. The 2016 Ministry of Health Centennial Surveillance Survey confirmed Walvis Bay had a HIV/AIDS prevalence rate estimated at 17.6% and Swakopmund of 18.6%. The national prevalence rate average stands at 17.2%. Both Swakopmund and Walvis Bay are above the national average; however, Walvis Bay has shown a noted decrease from previous surveys (29% in 2009) and Swakopmund has shown a significant increase from the 2015 survey (10.5%). National for urban areas, the age group 45-49 group had the highest prevalence rate, whereby in rural areas the age group 35-39 had the highest prevalence rate.

5.9.5 SOCIO-ECONOMIC ENVIRONMENT

Early childhood development (ECD) programmes are crucial for children to develop the necessary skills to further their future educational and career pathways. The 2011 census concluded that of the total children recorded between the ages of 0 to 4 years (283 501), only 13% attending ECD programmes country wide. Accesses to these ECD centres in urban areas were higher than in rural areas. At a regional level, a higher proportion of children attended ECD programmes in Erongo (24.2%). It can be concluded that the mining industry has played a role to better these facilities as part of its educational and community outreach programmes (2018-2019 SEMP report).

The 2011 NCP survey revealed that the literacy rate in Namibia for the population 5 years and above was 85.3%. The rate was marginally higher for men (85.4%) than for women (85.1%). Furthermore, literacy rates were higher in urban (93%) than in rural (79%) areas (Government of Namibia, 2011). The literacy rate in the Erongo was recorded at 94.3%, with females (94.5%) slightly more literate than males (94.2%). The Erongo has the second highest literacy rate behind the Khomas Region.

The 2011 national adult literacy rate (15 years and above) was 89%, with no major difference between males and females. The adult literacy rate in urban areas stood at 96% compared to 83% in rural areas (Government of Namibia, 2011). The adult literacy rate in the Erongo was 96.7%, with females (96.9%) slightly more literate than males (96.4%).

The 2011 literacy rate for youth (15 to 24 years) in Namibia was 94%, with higher proportions of women (95.3%) being literate than men (92.5%). The rate was again higher in urban (98%) than rural areas (92%) (Government of Namibia, 2011). The Erongo youth literacy rate was recorded to be 98.1%, with females (98.7%) more literate than males (97.6%).

The 2011 school enrolment rate for the school going population (5 to 24 years) was not high at 56%. However, the primary school enrolment rate for the Erongo was high (91.2%) with more primary school going females (92%) over males (90.5%).

The learner to teacher ratio for the Erongo in 2020 and 2019 was determined as 27 learners per teacher. This is slightly higher than the national average of 26 learners per teacher. No improvements have therefore been noted in the Erongo (SEMP, 2019).
With regards to persons living with a disability (physical or mental), the Erongo Region displayed the lowest percentage when compared to other regions (2.5%). The difference between female (2.4%) to male (2.6%) disability ratio was low. Of the disabled group, 36.3% are not able to engage in any learning or economic activity. This is one of the lowest percentages per region.

The labour participation rate for the economically active population in the Erongo (78.8%) was relatively high when compared to the average national percentage (64%) and other regional percentages (Government of Namibia, 2011). In the Erongo, a higher percentage of males (82.4%) are active than females (74.7%).

At a project level, the following socio-economic contributions are expected to occur when both the marine and terrestrial land components can commence:

- Over 600 Namibians will acquire jobs, directly or indirectly, with the construction and operational activities in Walvis Bay (land-based operations);
- Opportunities will be created for SMEs and other economic sectors;
- N$ 1 billion is estimated to be spent on civil and local infrastructure;
- Contribution of N$650 million/year in direct taxes;
- Contribution of royalties of N$78 million/year; and
- Expected annual revenue of N$4.2 billion.

The following information at a developed fertilizer industry level was predicted by Stratecon (2018) of the contribution of the phosphate industry to Namibia from zero contribution in 2010 to 2016:

- 4.3% Namibian GDP in 2012 and to 9% by 2016;
- 1.9% mining GVA in 2012 and to 4.2% by 2016;
- 18% manufacturing GVA in 2012 and 45.7% by 2016;
- 2.7% employment in 2012 and 7.6% by 2016; and
- Additionally, increased productivity in subsistence farming would have added 3.8% to agriculture GVA in 2012 and 5.2% by 2016.

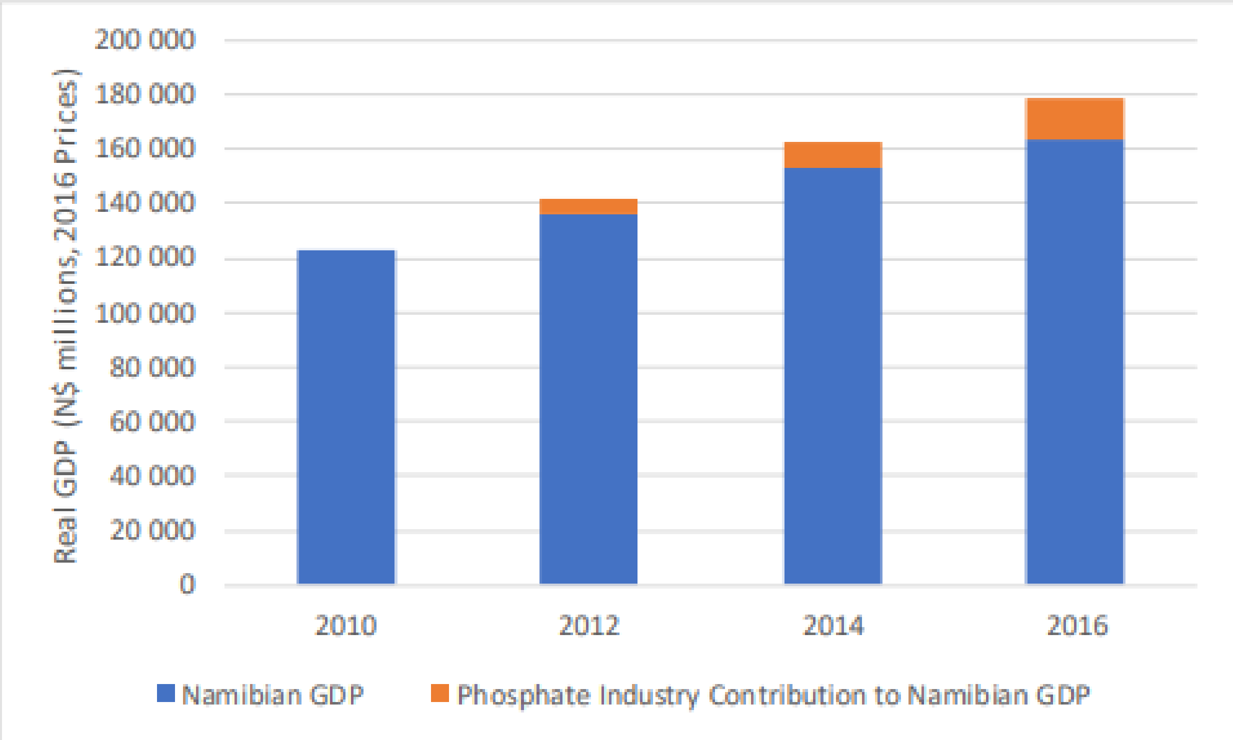


Figure 39 - Phosphate industry contribution to the GDP (Stratecon, 2018)

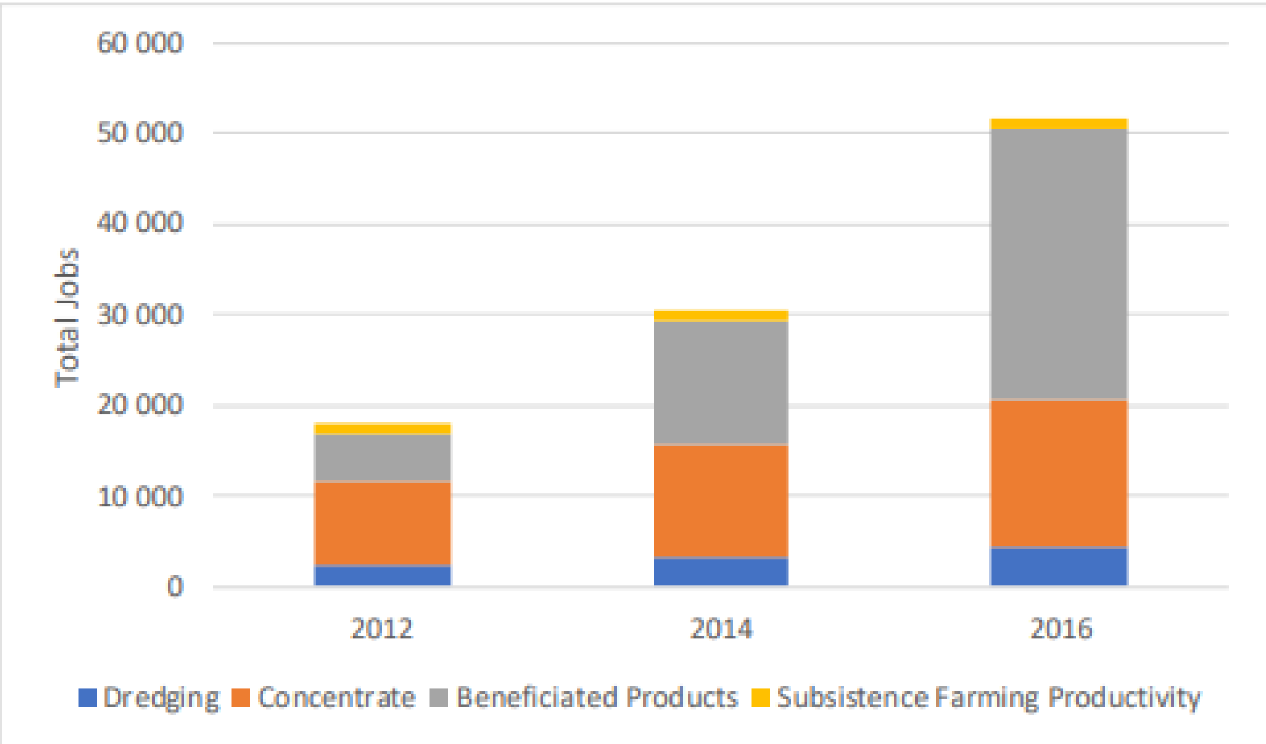


Figure 40 - Employment potential (Stratecon, 2018)

5.9.6 SOCIO-ECONOMIC INDICATORS

Table 14 below describes the socio-economic indicators as determined by the 2020 Jan De Vul study.

Table 14 - Socio-economic indicators assessed and defined

Indicator	Description
Local employees and sub-contractors	– Payment of salaries and benefits – Programmes relating to skills development and training/education – Workplace safety employed
Local Economy	– Local purchasing of goods and services within the project context. – Purchasing of goods and services outside the project context (tourism, living expenses etc.) – Social programmes and community upliftment. – Revenue for government through income tax, levies, other taxes, royalties profit taxes. – Profits retained and distributed to local shareholders.

The Sandpiper Project estimates that over 72 employees will be employed for land and sea-based operations, with 40 crew members working at sea. Employees will be skilled labour and receive an expected salary above the national average wage. Year 1 is expected to be a 3 month operation, year 2 a 6 month operation, year 3 and going forward is expected to be a 9 month operation. Man, hours will therefore differ per year. If skill sets are not readily available in Walvis Bay, specific training programmes will be established to build up this capacity.

The overall conclusion from the Stratecon (2018) study found that to commence with the Namibian phosphate industry would have a major positive impact on the country. It could potentially increase GDP by 9%, generate over 50 000 jobs from a fully integrated fertilizer industry and increase employment levels to 7.6% to 2016. The phosphate industry would help the country achieve both general and specific Vision 2030 and Harambee policy goals.

5.9.7 KEY SENSITIVE RECEPTORS

The key sensitivities were identified, and impacts assessed in the 2012 and 2014 ESIA and therefore will not be repeated for this report but rather summarised below.

Positive influences associated are job creation, skills transfer, improvements in the local and national economy (GDP).

Some potential negative influences associated are inward migration, spread of illness and disease and influences on fishing trawling activities.

Additional key sensitivities were identified during the public participation process and have been addressed in the 2020 supplementary studies covering the following areas:

- Fish spawning areas;
- Trawling protected juvenile zones;
- Hake and monk commercial fishing grounds; and
- Mariculture and Saltworks operations water intake.

A Map depicting commercial fishing zones (as sensitivity receptors) in relation to ML 170 is also shown in Figure 41.

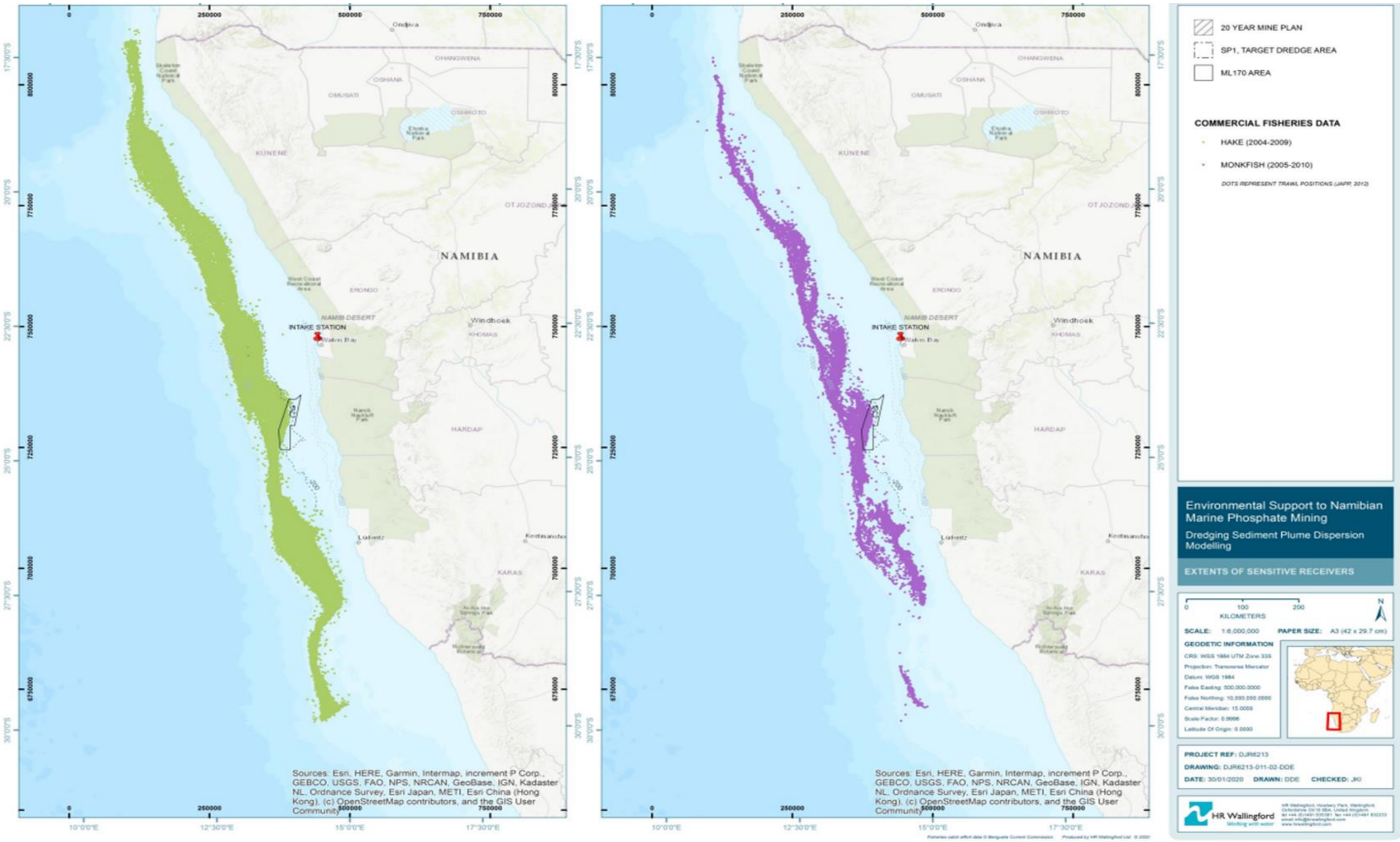


Figure 41 - Map depicting commercial fishing zones (as sensitivity receptors) in relation to ML 170 (HR Wallingford, 2020)

6 IMPACT IDENTIFICATION & EVALUATION METHODOLOGY

6.1 INTRODUCTION

Chapter 2 provides an overview of the approach used in this ESIA process and details each of the steps undertaken to date. Predication and evaluation of impacts is a key step in the ESIA process. This chapter outlines the methods followed, to identify and evaluate the impacts arising from the proposed Sandpiper Project.

This chapter provides comprehensive details of the following:

- The assessment guidance used to assess impacts.
- The limitations, uncertainties and assumptions with regards to the assessment methodology.
- How impacts are identified and evaluated and how the level of significance is derived.
- How mitigation is applied in the assessment and how additional mitigation will be identified.
- The cumulative impact assessment (CIA) method used.

The aims of this assessment process will be to determine which impacts are likely to be significant; to scope the available data and identify any gaps that need to be filled; to determine the spatial and temporal scope, to identify and describe the assessment methodology.

The scope of the assessment will be determined through undertaking a preliminary assessment of the proposed Sandpiper Project against the receiving environment. This will include a desktop review incorporating the available site-specific data, pertinent Project-specific literature and required specialist studies.

6.2 ASSESSMENT GUIDANCE

The following principal documents were used to inform the assessment method:

- Methodology utilised in initial 2012 environmental impact assessment and the 2014 verification assessment (J Midgley and Associates, 2014) for the biophysical environment.
- Namibian Draft Procedures and Guidance for EIA and EMP (Republic of Namibia, 2008) and best practice.
- International Finance Corporation (IFC) standards and models, in particular performance standard 1: 'Assessment and management of environmental and social risks and impacts' (International Finance Coorporation, 2021) for the social environment.
- International Finance Corporation Cumulative Impact Assessment (CIA) and Management Good Practice Handbook (International Finance Coorporation, 2013)for the social environment and overall cumulative impacts, where applicable.

Note that international guidelines related to deep sea mining are directed towards the seabed mining of deep-sea minerals comprising polymetallic sulphides, cobalt rich crusts, manganese nodules that occur in specific deep-water environments (1000m-6000m depth) and are not considered applicable to the proposed Sandpiper Project.

The proposed Sandpiper Project is located on the Namibian continental shelf in water depths of less than 300m and which is deemed national jurisdiction falling within the Namibian Exclusive Economic Zone (EEZ) which extends to 200 nautical miles (370.4 km) offshore. This is consistent with the definitions and provisions of the Territorial Sea and Exclusive Economic Zone of Namibia Act, Act 3 of 1990, whereby international laws are not applicable, and Proponents are required to comply with the required Namibian regulations. Reference to section 4 (3) (a) (b) of the Act therefore applies viz:

'(3) Within the exclusive economic zone –

(a) any law of Namibia which relates to the exploitation, exploration, conservation or management of the natural resources of the sea, whether living or non-living, shall apply and

(b) Namibia shall have the right to exercise any powers which it may consider necessary to prevent the contravention of any law relating to the natural resources of the sea.

6.3 Limitations, uncertainties and assumptions

The following limitations and uncertainties associated with the assessment methodology will be considered in the assessment phase:

- Topic specific assessment guidance has not been developed in Namibia. The definitions identified are in line with commonly applied impact criteria used in Southern Africa, recognised internationally and best practice.
- Guidance for cumulative impacts has not been developed in Namibia but a single accepted state of global practice has been applied.
- Determining the sensitivity of biological receptors to direct physical disturbance, e.g., seabed excavation, noise, and indirect effects from temporary modifications in the abiotic environment, e.g., increased water column turbidity, will be done per sub-discipline. Metrics employed can include proportions of known habitats for species and/or communities affected, their vulnerability to disturbance, and recovery potential from this. In cases where this is not feasible for either or both biodiversity attributes and ecosystem service(s) the receptor sensitivity will be excluded when scoring significance of the impact.

6.4 Assessment methodology

In order to ensure consistency in the approach in the evaluation of impacts from the 2012 and 2014 specialist's studies, the same methodology will be utilised and will form the basis for this ESIA process of the biophysical environment. The aforementioned methodology was verified and approved by the CSIR for both the 2012 EIA and the 2014 verification studies. Independent reviews were undertaken by UNAM as well as an independent peer review panel. Additionally, the appointed external reviewers (e.g., SAEIA) approved the methodology for both the 2012 and 2014 studies. To improve the robustness and confidence in the rating of significance of impacts, ECC will utilise best practice through application of a rating scale for probability to determine a score for significance of the impact to the receptor. IFC standards as modified by ECC will be utilised to rate the impacts for the social baseline.

The following describes the methods used to determine significance rating of impacts identified in the specialist's studies for the biophysical environment:

- Description of impact – reviews the type of effect that a proposed activity will have on the environment;
- What will be affected; and
- How it will be affected.
- Points 1 to 3 above are to be considered/evaluated in the context of the following impacts criteria:
- Extent;
- Duration;
- Probability; and
- Intensity or magnitude.

These impact criteria are to be applied as prescribed in the Table 15.

Table 15 - Impact criteria

Impact Criteria						
Extent	**Dredge Area** Per vessel cycle e.g., ~66 000 m^2 or 6.6 ha	**Annual Mining Area** Up to 3 km^2	**Specific Mine Site** (SP1 or SP2) each if 22x8 km or 176 km^2	**Local** 25-50 km or 2000 km^2 – 8 000 km^2	**Regional** 50-100 km or 8 000 km^2 – 30 000 km^2	**National** 100 km to EEZ (200 nautical miles) 100 to 370 km or >30 000 km^2
Duration	**Very Short Term** 3 days	**Short Term** 3 days – 1 year	**Medium Term** 1 – 5 years	**Long Term** 5 – 20 years	**Permanent** >20 years (life of mine)	
Intensity/ Magnitude	**No lasting effect** No environmental functions and	**Minor effects** The environment functions but	**Moderate effects** Environmental functions and processes are	**Serious effects** Environmental functions and processes are altered to such an extent that they permanently cease		

Impact Criteria				
	processes are affected	in a modified manner	altered to such an extent that they temporarily cease	
Probability	**Improbable** <5%	**Possible** 5% - 50%	**Probable** 50% - 90%	**Highly probable/Definite** 90% - 100%

The status of the impacts and degrees of confidence with respect to the assessment of the significance are stated below as follows:

- **Status of the impact**: a description as to whether the impact is positive (a benefit), negative (a cost) or neutral.
- **Degree of confidence in predictions**: based on the availability of information and specialist knowledge. This has been assessed as high, medium or low.

Based on the above considerations, a score is provided (1-100) that is linked to the significance of the impact. This score is tabled in a matrix (4x3) whereby the specialist provides an overall evaluation of the significance of the potential impact based on the sensitivity of the receptor, if applicable.

6.5 Mitigation

Mitigation comprises a hierarchy of measures ranging from preventing environmental impacts by avoidance, to measures that provide opportunities for environmental enhancement. The mitigation hierarchy is: avoidance; reduction at source; reduction at receptor level; repairing and correcting; compensation; remediation; and enhancement.

Mitigation measures can be split into three distinct categories, broadly defined as:

1. Actions undertaken by the ESIA process that influence the design process, through implementing design measures that would entirely avoid or eliminate an impact or modifying the design through the inclusion of environmental features to reduce the magnitude of change. These are considered as embedded mitigation.
2. Standard practices and other best practice measures for avoiding and minimising environmental impacts. These are considered as good practice measures.
3. Specified additional measures or follow-up action to be implemented, to further reduce adverse impacts that remain after the incorporation of embedded mitigation. These are considered as additional mitigation.

The ESIA is an iterative process whereby the outcomes of the environmental assessments inform the Sandpiper Project.

The provisional EMP attached in Appendix A provides an outline of the good practice measures and specified additional measures or follow-up actions to be undertaken. The project EMP will be finalised on completion of the impact assessment process and included in the final ESIA report.

Embedded mitigation and good practice mitigation will be taken into account in the assessment process. Additional mitigation measures will be identified for inclusion in the EMP when the significance of impact requires it and causes the impact to be further reduced. Where additional mitigation is identified, a final assessment of the significance of impacts (residual impacts) will be carried out, taking into consideration the additional mitigation measures.

7 TERMS OF REFERENCE AND SCOPE OF WORK

7.1 Terms of reference for the appointed environmental assessment practitioner (EAP)

The EAP has been appointed to manage and re-submit an application for an environmental clearance certificate as per the Environmental Management Act, Act 7 of 2007, to prepare and update the Environmental and Social Impact Assessment (ESIA) and Environmental and Social Management Plan (EMP) for the proposed Sandpiper Project to reflect the current state of the biophysical and social environmental baselines, in compliance with the provisions of the Environmental Management Act 2007 and associated regulations.

7.2 Terms of reference for the scoping report

These are:

1. To provide the public and authorities with the background information document (BID) on the Sandpiper Project.
2. To consult with I&AP's and the relevant stakeholders and authorities about the proposed Sandpiper Project.
3. To conduct public and stakeholder meetings with relevant authorities by invitation and through notices placed in national public newspapers.
4. To register their interest in the Sandpiper Project and to record their concerns and issues.
5. To ensure the transparency of this process.
6. Allow adequate opportunity for comments to be received from I&APs and the authorities in this participation process.
7. To ensure that appropriate specialist studies are included in the scope of the impact assessment report to address the key concerns and issues raised during the consultation phase.
8. To ensure that the application and scoping report are completed and submitted to the Competent Authority in the prescribed manner.

7.3 Terms of reference for the marine ESIA

The ESIA for ML 170 is to be conducted in accordance with the defined scope of work as outlined in this scoping report and or as subsequently approved by the Environmental Commissioner. The scope of the impact assessment report shall consider all related environmental and social matters raised during the public (including the authorities) consultation process, as well as impacts identified by the appointed specialist consultants to assist in the determination of the significance of those environmental impacts of the proposed Sandpiper Project.

The objectives of the ESIA are:

- To address the issues and concerns raised by authorities, the public (both interested and affected parties) and the specialist consultants through the public consultation and scoping process;
- To identify and evaluate actual and potential impacts resulting from the proposed dredging of marine phosphate-rich sediments from within Mining Licence Area 170, that potentially may influence the marine environment;
- To recommend management, mitigation and monitoring programmes to be implemented before and or during dredging; and,
- To define an appropriate Environmental and Social Management Plan (EMP) for the proposed dredging operations in ML 170.

7.4 ESIA Scope of work and specialist studies

The scope of work for the impact assessment report is defined with due consideration of the range of considered potential impacts resulting from the proposed dredging operations in ML 170 as outlined in the BID, as well as consideration of the concerns or comments raised through the public and stakeholder engagements.

The scope of the ESIA report will comprise an updated impact assessment in two primary components based on both existing and new data from related specialist studies as noted below.

7.4.1 WATER COLUMN, WATER QUALITY, SEDIMENTS AND BENTHOS

- Seabed physiography
- Sediment plume dispersion modelling
- Current velocity and water mass characteristics
  - Dissolved oxygen
- Sediments characteristics and chemistry
  - Particulate organic matter concentrations
  - Inorganic nutrient levels
  - Oxidative state
  - Heavy metal concentrations
  - Hydrogen sulphides
- Sediment toxicity
- Plankton
  - Phytoplankton
  - Zooplankton
- Benthos
  - Thiobacteria
  - Meiofauna
  - Epifauna

  - Macrobenthos
- Depositional history of phosphate deposits

7.4.2 FISHERIES, MAMMALS AND SEABIRDS

- Biodiversity study
- Ecosystem impact modelling
- Biomass and stock estimates (hake/Monk)
- Reproductive dynamics, recruitment and stock dynamics
- Jellyfish
- Mammals and seabirds
- Noise

7.4.3 SOCIO-ECONOMIC

- Potential job creation and skills development due to the proposed Sandpiper Project;
- Potential social upliftment benefits for local and regional communities;
- Potential influx of people moving to the Walvis Bay areas;
- Potential social nuisances;
- Potential value for development of a new mining sector and phosphate-based industry;
- Potential regional and national economic benefits; and
- Potential role in regard to national policies and objectives for the blue economy development and marine spatial planning.

8 CONCLUSION

This scoping report provides the baseline data, impact assessment methodology and scope of studies on key impacts for investigation in the assessment phase of the ESIA and an outline of the proposed provisions for the EMP.

The following specialist studies (2012 – 2020) below have provided sufficient baseline data:

- Marine ecology
- Marine water quality
- Benthos
- Jelly Fish
- Geology and history of the deposit (verification study)
- Water column and sedimentary environment (verification study)
- Fisheries and biodiversity (verification study)
- Plume dispersion modelling (supplementary studies)
- Sediment toxicity (supplementary studies)
- Noise baseline (supplementary studies)
- Socio-economic baseline (supplementary studies)
- Independent external review reports
- Independent peer review reports

The finalised baseline of specialist studies, site data and information have informed the scope and the terms of reference (ToR) for the assessment phase. Each study highlighted certain sensitivities that need to be assessed or have been assessed prior.

This scoping report with ToR for the assessment phase of the ESIA provides the basis needed for the ESIA to be undertaken. This scoping report will only be updated if required after the public review of the report. All written concerns and comments will be considered and where appropriate, the necessary changes to the ToR and additional aspects of the baseline will be incorporated accordingly.

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APPENDIX A – ENVIRONMENTAL MANAGEMENT PLAN

APPENDIX B – PUBLIC CONSULTATION DOCUMENT

APPENDIX C – ADDENDUM REPORT

APPENDIX D – EAPS CVS

APPENDIX E – 2014 VERIFICATION STUDY