NAMIBIAN MARINE PHOSPHATE (PTY) LTD

Sandpiper Project

Proposed recovery of phosphate enriched sediments from the Marine Mining Licence Area No.170 off Walvis Bay Namibia.

Environmental Impact Assessment Report for the Marine Component

FINAL REPORT

Prepared by:

Mr. Jeremy Midgley (Pr.Sci.Nat)
J Midgley & Associates
In association with:
Enviro Dynamics
The CSIR

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March 2012

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Title	Environmental Impact Assessment for the proposed dredging of phosphate enriched sediments from Marine Licence Area No. 170	
Date	30 March 2012	
Prepared for	Namibian Marine Phosphate (Pty) Ltd Unit 5 Garthanri Park Thorp Street Southern Industria Windhoek: Tel + 264 61 400 460 Fax + 264 61 400 461	
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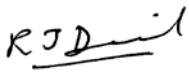
External review	CSIR. Mr Patrick Morant (MSc) (Pr.Sci.Nat)	
Public consultation	Mrs. Stephanie van Zyl (MSc) Enviro Dynamics (Pty) Ltd.	
Application	The EIA is prepared to meet the requirements of the Environmental Management Act (No. 7 of 2007) for Ministry of Environment and Tourism to issue of an environmental contract and to meet the requirements of the Ministry of Mines and Energy in respect of the conditions of the issued Mining Licence (ML 170). This EIA addresses activities within ML 170 and general vessel activities.	
Provision of key information	The Ministry of Fisheries and Marine Resources. The Confederation of Namibian Fishing Associations	
Report approval	**Namibian Marine Phosphates** Mr. Michael Woodborne (Pr.Sci.Nat) *Date: 30-03-12 Signature:*	
	Namibian Marine Phosphates Mr. Roger Daniel (Pr.Sci.Nat) *Date: 30-03-12 Signature:*	
Report approval	**Namibian Marine Phosphates** Mr. David Wellbeloved (SAIMM) *Date: 30-03-12 Signature:*	
Report preparation	**J Midgley & Associates** Mr. Jeremy Midgley (Pr.Sci.Nat) *Date:30-03-12 Signature:*	
Independent review	The report has been independently reviewed by Mr. Patrick Morant (Pr.Sci.Nat) of the CSIR *Date: 30-03-12 Signature:*	**CSIR** 
Environmental process compliance verification	This report has been prepared with due consideration to Namibian and international environmental legislation *Date: 30-03-12 Signature:*	**CSIR** 

contents

summary

NEED FOR THE PROJECT

Studies indicate that the global production of phosphorus may have peaked, leading to the possibility of shortages by 2040[1]. Globally 90 years' worth of phosphorus remains[2]. There is no artificial substitute for phosphorus, which is one of the three vital components in NPK fertilizers, and animal feeds. Pressure on farming and food supply is predicted to increase rapidly in response to pressure from global population growth predicted to reach 9 Billion by 2050. The demand for phosphate is very likely to grow as a result. Until now Namibia has not recorded any phosphate resources. However, with the development of the Sandpiper Project Namibia now has disclosed total phosphate mineral resources of 1,832 Mt (in situ, at 15 % P_2O_5 cut off), currently ranking as the seventh largest in terms of global phosphate resources[3]-[4]. The Namibian resource is identified as a large scale deposit with good average grade and importantly, one of consistent mineral quality.

About 93% of world rock phosphate production is used to produce mineral fertilizers, essentially DAP (diammonium phosphate), MAP (monoammonium phosphate), TSP (triple superphosphate), SSP (Single Superphosphate), phosphoric acid, and animal feed[5].

Phosphorus compounds are also important ingredients in high-grade detergents, cleaning agents, dental creams, toothpastes, flame retardants, stabilizer of plastics, corrosion inhibitors, dispersion agents in paints and primers and metal surface treatment products. Phosphorus compounds are also excipients in the pharmaceutical industry and are widely used in the food industry, in canned food and in freezing, thawing and cooking processes.

Through the proposed development of the Sandpiper Phosphate Project by Namibian Marine Phosphate (Pty) Ltd ("NMP"), Namibia has the opportunity to participate in the global phosphate industry, thereby positively contributing to the global phosphate resource and in this way contributing to securing farming output as well as to world food security. Food, food production, food security and nutrients, in particular phosphate, are extremely important in the global economy and the stability of food based economic strategies.

PROJECT CONCEPTUALISATION

The project concept is established against worldwide staple food shortages, limited agricultural land, growing market demand (for both agricultural and non-agricultural uses), existing resources becoming depleted, a viable product price, a large resource and the availability of proven marine dredging technology.

In the late 1960s a large deposit of phosphate-enriched sediments was discovered on the South African and Namibian continental shelf with zones of local enrichment, in particular off Walvis Bay. At that time the deposit was considered to be sub economic (1991: US$ 42.50 tonne). During August and September 2008, the price of phosphate (FOB price for Morocco 32% P2O5) peaked at US$ 430.00 per tonne and it now (February 2012) stands at US$ 192-50[6] tonne. Set against the current phosphate price trend and key market indicators and recent improvements in dredging technology the enriched phosphate sediments are now identified as economic.

Recent exploration by NMP over a 3000 km^2 area off Meob Bay and Conception Bay in water depths of 180 to 300 m verified a deposit currently

[1] Carpenter S.R. and Bennett E.M. (2011). "Reconsideration of the planetary boundary for phosphorus". *Environmental Research Letters* **6** (1): 1–12.

[2] Reilly, Michael (May 26, 2007). "How Long Will it Last?". *New Scientist* 194 (2605): 38–39.

[3] Data source, United States Geological Survey.

[4] Mineral resource is JORC compliant with: Measured resource as 4.093 Mt @ 20.45 % P_2O_5, Indicated Resource as 220.35 Mt @ 20.13 % P_2O_5, Inferred Resource of 1,607.8 Mt at 18.9 % P_2O_5

[5] Cisse. L, & Mrabet.T: World Phosphate Production: Overview and Prospects. Phosphorus Research Bulletin Vol. 15 (2004) p.21-25

[6] Commodity prices - World Bank data – www.indexmundi.com/commodities

estimated at 1,832 Mt Mt (1.832 Billion tonnes) at 15 % phosphate (P_2O_5) content[7]. Prefeasibility and scoping studies completed by NMP in November 2010 identified that dredging (using a Trailing Suction Hopper Dredger) 5.5 Mt of the phosphate enriched sediments annually would yield 3.0 Mt of export grade 'phosphate rock concentrate' Concluding comments from these studies established a robust economic project model which supported and justified the development of a Definitive Feasibility Study (DFS) subject to a mining licence being issued.

A full definitive feasibility study has been embarked upon with envisaged completion during the first quarter of 2012. The feasibility study is supported by integrated Environmental Impact Assessments that address the marine and terrestrial components respectively.

The main project elements are:

- Dredging annually 5.5 Mt of phosphate enriched marine sediments from 190 to 275 m water depths;
- Transporting this 'slurry' in the dredger to an offshore discharge buoy – pipeline (approximately 1.2 km offshore) and pumping the material to a coastal buffer pond, located to the south of the Walvis Bay salt works;
- Reclaiming the slurry from the buffer pond and screening out the shell fraction;
- Pumping the slurry along a 26 km pipeline to the processing plant located 5 km to the east of Walvis Bay;
- Processing (washing) the slurry to separate the Rock Phosphate from the fines, and
- Exporting the rock phosphate to International destinations through the Port of Walvis Bay.

LOCATION

The marine phosphate project ("Sandpiper") is located on the Namibian continental shelf approximately 120 km south southwest of Walvis Bay. The eastern boundary of the Mining Licence Area is approximately 40-60 km off the coast (directly west of Meob Bay and Conception Bay). The water depths in the licence area range from 180 to 300 m. The Mining Licence Area is 25.2 km wide (greatest width) and 115 km long (longest length) and covers an area of 2233 km^2. Three target recovery areas have been selected within the total mineral resource area, two of which are 22 x 8 km in size and one at 11 x 6 km (totalling 418 km^2) which are the particular focus of this evaluation. Of this resource, approximately 3 km^2 will be mined in the selected target recovery areas annually over the 20 year licence period to achieve the targeted 3 Mt pa dry product production target.

The Mining Licence Area is located within the Northern Benguela of the Benguela Current Large Marine Ecosystem, on the outer shelf to the south west of Walvis Bay. The Benguela displays a high degree of variability over a broad spectrum of time and spatial scales. It is an important centre of marine biodiversity and marine food production. Its distinctive bathymetry, hydrography, chemistry and trophodynamics combine to make it one of the most productive ocean areas in the world. This high level of primary productivity of the Benguela supports an important global (and local) reservoir of biodiversity and biomass of zooplankton, fish, sea birds and marine mammals, while near-shore and offshore sediments hold rich mineral deposits[8]. These living and non-living resources are of economic and strategic importance to Namibia.

EIA PROCESS

To ensure that the project complies with the requirements of the Environmental Management Act (No. 7 of 2007) it is necessary to conduct an Environmental Impact Assessment (EIA) and compile an Environmental Management Plan (EMP). This process and its outcomes then allows for the Ministry of Environment and Tourism (MET) in association with the relevant ministries to make an informed decision as to whether or not the project should receive an Environmental Certificate and be allowed to proceed.

[7] Established to the Joint Ore Reserve (JORC) standards of the Australian Stock Exchange (ASX)

[8] Shannon, L.V, and O'Toole, M.J.: Sustainability of the Benguela: ex Africa semper aliquid novi.

Given the marine and terrestrial operational environments encompassed by this project two separate yet integrated EIA processes are being conducted.

The key issues to be addressed in the EIA were determined through a scoping process that included inputs from governmental authorities, the public, business, NGOs, and the EIA team. The following categories of issues were identified:

- Governance;
- The EIA process;
- Biogeochemical impacts;
- Benthic impacts;
- Marine fauna – flora impacts;
- Cumulative impacts;
- Socio-economic impacts, and
- Project impacts.

CONSIDERATION OF THE "NO GO" OPTION

In common with the exploitation of all mineral deposits there is no alternative to the proposed project. It has been evaluated as a viable operation in respect of all corporate responsibilities, liabilities and requirements. The final decision as to whether the project will be permitted to proceed rests with the Authorities.

MINING SYSTEM ALTERNATIVES

Whilst the "No Go" option is not evaluated in mining project EIAs, alternatives have been considered in respect of identifying the optimal mining system to recover the phosphate-rich marine sands. Of the seven systems evaluated (trailing suction hopper dredger (TSHD), wireline dredge pipe, large diameter drill, mechanical grab, fall pipe and remotely operated vehicle (ROV), and flexible hose and ROV), the TSHD is identified as the system that optimally minimises the project technical risk and meets the project's commercial requirements. The dredger, with its sediment entrainment 'drag head,' its in built 'hopper' (sediment slurry entrainment 'cargo' space) carrying capacity and established (and tested) operational standards of practice (including environment and safety) establishes this type of recovery system as being the preferred method.

ASSESSMENT OF THE IMPACTS

Four specialist studies were undertaken to address the potential impacts of the proposed project, these are:

- Fisheries, mammals and seabirds, five impacts are evaluated;
- Changes to marine water quality, eleven impacts are evaluated;
- Benthos, nine impacts are evaluated; and
- Jellyfish, four impacts are evaluated.

The Specialists assessments are reported in full in Appendix 1, presented in Chapter 7 (environmental Impact Assessment), and summarised here below. These assessments are based on some in field measurements (benthic studies) as well as publicly available published information and/or data. This includes data provided by MFMR as well as the Confederation of Namibian Fishing Associations. As with all data sets, there are varying associated degrees of confidence. Notwithstanding, given the available data, this report provides the results and recommendations from the specialist evaluation of the body of reviewed scientific literature, extensive fisheries data as well as information / data collected from the licence area. The assessments of the impacts by the specialists are:

FISHERIES, MAMMALS AND SEABIRDS - Mr. D Japp

Impact: 1	**The impact on fishing operations of phosphate dredging on the main Namibian fishing sectors; a)** hake trawl and **b**) hake longline, **c)** monk trawl **d**) horse mackerel mid-water trawl, and **e)** small pelagic purse seine fisheries. The fishing sectors will not be able to operate in certain areas due to **1)** actual mining operations due to dredging operations and vessel activities, **2)** associated sediment plumes **3)** exclusion zones around the dredging site and **4)** increased levels of maritime traffic associated with the dredging operation.
Significance:	Medium - the project design might require modification to accommodate certain fishing operations.
Mitigation:	Consider options to minimise impact on fishing operations for example options with respect to spatial and temporal area closures.
Impact: 2	**The impact of phosphate mining on the ecologically important demersal and pelagic fish species.** The impact will result in the redistribution and/or displacement of hake, monk, horse mackerel, sole, orange roughy, bearded goby populations and small pelagics because of **1)** actual recovery activities due to dredging operations and vessel activities **2)** habitat disturbances and the removal of substrate and **3)** sediment plumes (turbidity)
Significance:	Medium - the duration of the impact is permanent but recovery of fish populations in the area may occur in the long term. The intensity is minor to moderate and the extent is confined to the MLA and Zone 1
Mitigation:	In terms of the ecosystem as a whole there are no particular mitigation measures that can be implemented.
Impact: 3	**The impact of phosphate dredging on the recruitment of key commercial fish stocks a)** hake **b)** horse mackerel **c)** monk and **d)** small pelagic species. The dispersal and survival of juveniles, eggs and larvae are effected by **1)** physical disturbance of the fishing grounds and **2)** sediment plumes (turbidity)
Significance:	Low
Mitigation:	No practical mitigation measures are possible.
Impact: 4	**The impact of phosphate dredging on species diversity.** Dredging operations will result in a reduction or loss in biodiversity because of the 1) actual dredging and vessel operations, 2) the habitat destruction and the removal of substrate and 3) sediment plumes
Significance:	Low – the impact on species diversity is not expected to influence project design provided the current area limitations are maintained. Expansion of dredging in the current or alternate lease areas without baseline monitoring of biodiversity and controls must be a prerequisite to the commencement of operations.
Mitigation:	No practical mitigation measures are possible.
Impact: 5	**The impact of phosphate dredging on seabirds and marine mammals.** Dredging operations will result in the displacement and/or redistribution of seabirds and mammals because of 1) disturbance of the ecosystem and availability of feed and 2) physical disturbance of the dredgers including noise pollution
Significance:	Medium - Most sea birds and mammal species found in the area will be affected but at a low level due to the limited extent of the dredging operations.
Mitigation:	Maintain a bridge watch for large mammal species. Although the dredger will have limited manoeuvrability a protocol to limit interaction should be followed – in this regard JNCC guidelines are recommended. Lighting control to minimise night strikes of birds.

MARINE WATER QUALITY - Dr. R Carter

Impact: 1 *Significance:* *Mitigation:*	Potential deterioration in water quality from discharges to sea of wastes such as oily water, sewage, food, grey water, from the dredger. None Ensure vessel discharge/retention systems and procedures are in good working order and do not malfunction.
Impact: 2 *Significance:* *Mitigation:*	Alien marine species may displace indigenous species and reduce indigenous biodiversity and/or affect aquaculture and/or aquaculture products. Follow IMO guidelines on ballast water management. None. (Alien introductions would become "improbable" but if introductions were to occur the consequences (significance) would still be high).
Impact: 3 *Significance:* *Mitigation:*	Dredging generates plumes of suspended sediments that adversely affect organisms in the water column Low Built in, with discharge below dredger's hull (10-15 m below sea surface)
Impact: 4 *Significance:* *Mitigation:*	Sulphidic sediment pore-water entrained in the dredged sediment is discharged with the over-spill water thereby affecting organisms in the water column Low None possible
Impact: 5 *Significance:* *Mitigation:*	Hypoxic/ anoxic bottom water is entrained in the discharged overflow water so reducing dissolved oxygen concentrations in the upper water column where it can affect organisms. None Not applicable
Impact: 6 *Significance:* *Mitigation:*	Increased availability of nutrients (ammonium and phosphorus) promote phytoplankton growth. Following senescence, the phytoplankton will add to the particulate organic matter flux to the seabed eventually further reducing dissolved oxygen concentrations through remineralisation None None possible
Impact: 7 *Significance:* *Mitigation:*	Trace metals (cadmium and nickel) bound in the dredged sediment are discharged with the over spill water thereby affecting organisms in the water column. Low None possible
Impact: 8 *Significance:* *Mitigation:*	Trace metals held within the target dredge area sediments are remobilized; they become bio-available through exposure to the overlying water during dredging with deleterious effects on filter and/or deposit feeding benthos. Low None possible
Impact: 9 *Significance:* *Mitigation:*	Sulphidic sediment pore-water is exposed by dredging, and the flux of dissolved H_2S into the lower water column is increased, so affecting benthos. Low None possible

Impact: 10	Exposure of anoxic sediments by dredging reduces the already low concentrations of oxygen that occur in the lower water column so affecting resident biota, primarily benthos.
Significance:	Low
Mitigation:	None possible
Impact: 11	Removal of thio-bacteria mats by dredging increases the flux of H_2S to the lower water column.
Significance:	None
Mitigation:	Not applicable

BENTHOS - Dr N Steffani

Impact:	The removal of the upper 1-<2.5 m (possibly up to 3 m) of sediment by dredging will result in the loss of the benthic biota associated with the sediment. The exposed sediments are likely to be different to the original superficial deposits, and sediment refill rates at this depth are likely to be very slow. Colonising assemblages are likely to differ to those present prior to the dredging activity.
Significance:	Medium
Mitigation:	Leave behind a residual sediment layer of at least 30 cm to cover the clay footwall. Leave behind undredged trenches to enable migration of mobile organisms from these areas.
Impact:	Further exploration and environmental work will be conducted in the larger ML170 that will remove benthic biota.
Significance:	None
Mitigation:	None
Impact:	The depth of the dredged area might change local near bottom hydrographical conditions and thus act as traps for very fine material. This could lead to high decomposition rates and consequently anoxic conditions and H_2S concentrations in the sediments.
Significance:	Low to medium
Mitigation:	Leave behind a residual sediment layer of at least 30 cm, which will reduce the depth of the dredged-out area.
Impact:	Dredging removes mats of large sulphur-oxidising bacteria from the sediment surface and from the upper layer.
Significance:	Low
Mitigation:	No mitigation necessary
Impact:	The anaerobic bacterium *Clostridium botulinum* type E might proliferate in the dredged area if the system turns anoxic, and may pose a health risk to humans and wildlife when entering the food chain.
Significance:	Low
Mitigation:	No mitigation necessary
Impact:	High suspended sediment concentrations near the sea bottom generated by the draghead and subsequent re-deposition of the material causes smothering effects.
Significance:	Low
Mitigation:	No mitigation necessary

Impact:	Re-deposition of particles in the overflow plume causes smothering of benthic organisms, particularly in the depo-center on the continental slope
Significance:	Low
Mitigation:	No mitigation necessary
Impact:	Dredging may mobilise dissolved nutrients from the sediments which could be released into the water column with the overflow. The increased nutrient level may result in extensive phytoplankton blooms, which upon death cause aggravated decomposition rates leading to anoxic conditions at the seafloor.
Significance:	Low
Mitigation:	No mitigation necessary
Impact:	Release of hydrogen sulphide from the sediments affects benthic communities
Significance:	Low
Mitigation:	No mitigation necessary

JELLYFISH - Prof. M Gibbons

Impact:	Blocking of vessel seawater intake system by dense surface aggregations of jellyfish. Dense surface volumes of jellyfish have been known to block the seawater intakes. This incoming seawater is used to cool the vessel's engines and any blockage of the intake system could cause the engines to overheat and fail, if remedial action is not taken.
Significance:	Low
Mitigation:	In the case of blockage, jellyfish will have to be physically removed or flushed from the system. Sailing the vessel to areas with less dense aggregations of jellyfish. Forward looking sonar could be installed on the vessel to identify dense masses of sub-surface jellyfish during operations. A "jellyfish observer" on deck should be able to identify jellyfish aggregations at the surface.
Impact:	Hydrogen sulphide released from dredge sediments causing mortalities to jellyfish.
Significance:	Low
Mitigation:	No mitigation is presented
Impact:	Lean water overflow from the vessel generates a tailings plume of fine sediments which settle out through and are dispersed in the water column. These fine sediments if present in sufficient quantities may cause mortalities to jellyfish, though this is considered unlikely
Significance:	Low
Mitigation:	No mitigation is presented
Impact:	Removal of seabed sediments will change the nature of the sediment surface. Jellyfish populations are known to increase in areas where there is an increase of hard substrate. Typically this occurs where rock, concrete or iron structures are erected. The removal of the upper relative soft layers of sediment, leaving a relative hard clay footwall surface may provide such a hard surface
Significance:	Low
Mitigation:	None: If between 10 - 15 % of the original thickness of the sediment is not recovered, there will sufficient soft-substrata to preclude polyp settlement.

CUMULATIVE IMPACTS

There is a growing amount of shipping activity in the Namibian Exclusive Economic Zone (EEZ) including, Fishing (Namibian and foreign) vessels, Oil tankers en route from Angola to China, general cargo vessels, vessels exploring/mining for diamonds and industrial minerals as well as activities relating to oil and gas including exploration deep seismic survey vessels and oil rigs

According to data provided by MFMR and CNFA, a proportion of the seabed within the vicinity of the Mining Licence Area (MLA) is already being repetitively disturbed by trawling, primarily for monk fish. It is estimated from trawl records (appendix 1a) that for 2007 – 2009, 26,022 hours of monk trawling was conducted in the general vicinity of the MLA.

The proposed dredging will remove sediments up to a depth of 3 m below the sea floor over an approximate area of up to 3 km^2 annually which represents a total of approximately 60 km^2 for a 20 year life of mine (which is the current term of the ML tenure).

In order for the cumulative and additive effects of all relevant marine activities on the Namibian continental shelf to be comprehensively addressed, an integrated assessment of all the user impacts needs to be undertaken. While this level of investigation lies within the responsibility of the governing entity, it is considered that the Benguela Current Commission could provide the platform for this important collaborative initiative.

ASSESSMENT OF THE MANAGEMENT PLAN

Following receipt of feedback from the review of the Draft EIA/EMPR, in order to ensure the effective implementation of mitigation and management actions the Final Environmental Management Plan (EMP) has now been prepared for the proposed project. This incorporates a detailed verification programme and long term monitoring protocol compiled by the Specialist scientists that have contributed to the EIA. The verification programme is to be completed prior to commencement of dredging .

The Final Environmental Management Plan report has been produced to provide the framework to ensure that :

- all corporate, legal and socio-economic requirements are complied with. This applies equally to subcontracting companies;
- the authorities and I&APs are appropriately consulted, advised and included in relevant on going project matters;
- all vessel operations are managed in accordance with Namibian, vessel flag state and International requirements as appropriate to the nature and location and scope of activities;
- a programme of field work is carried out prior to commencement of dredging operations to provide data for the verification of the Specialists current conclusions and considered impact assessments .;
- an on going monitoring programme is implemented to assess the recovery and or re-colonisation of the dredge areas after dredging operations have commenced.

If the verification survey data show no significant departure from the specialists' current conclusions and assessments then these assessments will be considered to remain fully valid. Alternatively, if on analysis of the site-specific validation data there are any significant departures for the initial specialist interpretations and assessments then those specific aspects of the EIA need to be revaluated and modified as may be deemed appropriate by the relevant specialist(s) and re-submitted for approval.

OVERALL ASSESSMENT

The significance of the potential impacts associated with the proposed Sandpiper project for dredging of marine phosphate enriched sediment has been investigated and assessed by relevant appointed specialists in the Environmental Impact Assessment and independently audited by CSIR.

The opinion of the specialist and the independent reviewer is that there are presently no identified issues of environmental significance to preclude the dredging of phosphate-enriched sediments from the Mining Licence Area No. 170. **In order to verify these conclusions,** ***a programme of work specified by the relevant specialists, has been included in the Environmental Management Programme that will be undertaken prior to the commencement of dredging to substantiate the findings provided in the impact assessment. Going forward, all environmental matters will need to be managed through the environmental management plan.*** These requirements are evaluated and detailed herein.

In making a decision whether or not to issue an Environmental Contract for the proposed project, the Namibian government agencies and authorities will need to evaluate the overall costs and benefits of the project. The primary purpose of this EIA process is to provide information that focuses on the key issues and to assist the authorities in understanding the project in terms of its effect on the natural environment, social impact and economic growth. Note, the latter two items are addressed in detail in the EIA for the related terrestrial operations.

In the final assessment it is important to note the significant benefits of this project. These are:

- **World phosphate resources:** The Sandpiper Project's current mineral resource estimate of 1,832 Mt at 15 % P_2O_5 (JORC and NI43-101 compliant) in ML170 alone, positions Namibia as seventh largest in terms of world phosphate resource. Phosphate (or Phosphorus) for which currently there is no known substitute, is a vital component of agricultural fertilizers and feeds. This resource thus has potential to contribute significantly not only to the sustained supply of Namibia but also world food production.
- **Macro-economic benefits:** The marine component of the project is relatively small and will create local employment opportunities for approximately 11 functions (there are a total of 37) onboard the vessel. From a local perspective, the employment and economic benefits from the marine component of the proposed project arise mostly from the wider downstream opportunities associated primarily with the port and vessel support services.
  By far the major economic benefit on local, regional and national levels, will be associated with the processing plant located in Walvis Bay. The project's socio-economic benefits are addressed in the EIA/EMPR for the terrestrial component. National macro-economic benefits also include contributions to government revenue through rates, taxes and royalties.

This environmental impact assessment is based on information about the Company's current strategy for the project development. If there is an alteration in the nature, intensity or extent of the proposed activities then the nature and significance of identified impacts may also change and will be duly re-assessed. In addition, any future or greater understanding of key environmental processes or changes in uses or activities in this region may also require reassessment of these environmental impacts.

In this report, the environmental impact assessment of the dredging of marine phosphates considers those impacts arising from dredging from within three target-recovery areas selected from within the boundaries of Mining Licence Area ML170. It must be recognised that the anticipated dredging in the target recovery areas for dredging in the Mining Licence Area ML 170 affects, only an extremely small portion of the total Benguela ecosystem on the Namibian continental shelf. The Mining Licence ML170 Area (2233 km^2) has been awarded for a 20-year period, from which annually approximately 5.5 Mt of phosphate enriched sediments are expected to be recovered from an area of approximately 3 km^2 (I.e. 0.1% of the MLA area).
Excluding other marine activities (such as fishing, oil and gas exploration, general shipping), the Mining Licence Area allocated to NMP is one of many Exclusive Prospecting Licences and Mining Licences already issued over the Namibian continental shelf. Consideration should therefore be given by the authorities to the cumulative effects of all exploration and mining by all mineral licence owners and operators. This cumulative

assessment needs also to include other users of the marine environment as noted above.

Namibian Marine Phosphate (Pty) Ltd will remain responsible for monitoring the impacts of their dredging activities in their Mining Licence Area. Such impacts should be considered relative to the proportion of the ecosystem contained within the Mining Licence Area, except where such impacts are shown to or are expected to extend beyond these boundaries.

Grateful acknowledgement is extended to the Namibian Confederation of Fishing Associations for their facilitation of obtaining and providing current fisheries data held by MFMR but not yet officially released or approved by MFMR. MFMR is respectfully acknowledged for providing permission to use the data provided via NCFA and for their provision of the other fisheries information presented in this EIA. Not all information requested from MFMR was provided. The I&APs who provided comment to both the scoping phase of this project and the review of the Draft EIA are acknowledged and thanked for their constructive input.

glossary of terms and abbreviations

µg/l	Parts per billion
Å	Angstronm
ASX	Australian Stock Exchange
BCLME	Benguela Large Marine Ecosystem
BENIFIT	Benguela Environment Fisheries Interaction and Training
Benthic	Sea bottom dwelling / environs
BOD	Biological Oxygen Demand
BID	Background information document: A document that provide summary of the project with an emphasis on environmental processes.
Bt	Billion tonnes
CFC	Chlorofluorocarbon
CH_4	Methane a gas found in marine sediments. Its eruption is reported to be a contributing factor to green house gases.
COD	Chemical Oxygen Demand
Demersal	Bottom or near bottom dwelling.
DFS	Definitive Feasibility Study
DP	Dynamic Positioning
EC	Environmental Contract
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMPR	Environmental Management Plan Report
Environment	The surroundings in which the company operates, including air, water, land, natural resources, flora, fauna, humans and their interrelation.
Environmental Contract	A legal agreement (based on the EMPR) issued and authorised by the Ministry of Environment and Tourism, signed by Namibian Marine Phosphate (Pty) Ltd and the Ministry of Mines and Energy.
EPL	Exclusive Prospecting License
GHG	Greenhouse gases
grt	gross registered tonnage
H_2S	Hydrogen Sulphide, as gas which is contained in the marine sediments of this region. (>4% in concentrations of the gas in air is fatal)
Hopper	A fully enclosed cargo hold space on dredging vessels where the dredge material is temporarily stored.
HP	Horse Power
I&APs	Interested and Affected Parties
IFA	International Fertilizer Industry Association
IMO	International Maritime Organization
ISM	International standard for the safe management and operation of ships and for pollution prevention
ISO	International Standards Organisation

Indicated resource	Is that part of a Mineral Resource for which tonnage, densities, shape, physical characteristics, grade and mineral content can be estimated with a reasonable level of confidence.
Inferred resource	Is that part of a mineral resource for which the tonnage, grad and mineral content can be estimated with a low level of confidence
JDN	Jan Du Nul NV – the Belgium dredging company
JORC	Joint ore reserves committee. The Australasian Code for reporting of Exploration Results, Mineral Resources and Ore Reserves. The Code is incorporated into the Listing Rules of the Australian Stock Exchange (ASX)
JV	Joint Venture
MET	Ministry of Environment and Tourism
MFMR	Ministry of Fisheries and Marine Resources
ML	Mining Licence
MLA	Mining Licence Area
MME	Ministry of Mines and Energy
Mt	Million tonnes
MWTC : DMA	Ministry of Works Transport and Communication: Department of Maritime Affairs
NatMIRC	National Marine Investigation and Research Centre
NGOs	Non Governmental Organizations
NMP	Namibian Marine Phosphate (PTY) Ltd
NORM	Naturally Occurring Radioactive Materials
(P_2O_5)	Phosphate
PA	Per annum
ppm	Parts per million
P&I	Protection and Indemnity
Pelagic	Surface or near surface dwelling
Rock Phosphate	A trade term, which in this instance refers to phosphate sands, of grain size (0.1 to 1.0mm). This is the term used to describe the final export product.
ROV	Remotely Operated Vehicle
SACW	South Atlantic Central Water
SEA	Strategic Environmental Assessment
SOPEP	Shipboard Oil Pollution Emergency Plan
STPM	Suction tube position monitoring
TAC	Total Allowable Catch
TCF	Trillion Cubic Feet
TENORM	Technologically-Enhanced Naturally Occurring Radioactive Materials
ToRs	Terms of Reference
TSHD	Trailing Suction Hopper Dredge. A standard marine dredging method, which converts to 'mining' in so far as then dredged material if subsequently processed (at another location) to extract a mineral
Wt %	Weight percent
XRD	X-Ray Diffraction
XRF	X-Ray Fluorescence