SANDPIPER PROJECT

Verification Programme Report: Mining Licence Area No. 170

SECTION B:

IMPACT ASSESSMENT VERIFICATION

SECTION B

IMPACT ASSESSMENT VERIFICATION

B1.1 Water Column and Sediments
B1.2 Fisheries Mammals and Seabirds
B1.3 Macrofauna
B1.4 Jellyfish
B2.0 Cumulative Effects

Prepared for:
Namibian Marine Phosphate (Pty) Ltd.

Prepared by:
Jeremy Midgley
Jeremy Midgley and Associates

Reviewed by:
Patrick Morant
CSIR

November 2014

Primary Contributing authors:

Dr R Carter	*Water Column and Sediments*	Lwandle Technologies (Pty) Ltd
Dr N Steffani	*Benthic Macrofauna*	Steffani Marine Environmental Consulting
Mr D Japp	*Fish, Mammals and Seabirds*	Capricorn Fisheries Monitoring (Pty) Ltd
Prof. M Gibbons	*Jellyfish*	University of the Western Cape

Email: info@namphos.com
127 Theo-Ben Gurirab Street
Walvis Bay
Namibia

contents

figures

tables

SUMMARY

The verification programme addresses the impacts associated with dredging within the target dredge area SP-1.

The Environmental Impact Assessment (of 2012) concluded, "***The opinion of the specialists 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."***

An expanded verification programme was undertaken following discussions with and information provided by external reviewers, (as commissioned by the Environmental Commissioner, MET) MFMR and I&APs) during 201 and 2014. NMP's specialist consultants and the independent reviewing parties confirm, based on the results of the verification programme that the assessments as presented in the EIA (2012) are reliable and that these assessments now can be reported with a high degree of confidence.

The impacts assessed in the 2012 EIA are reassessed here. Details of various specialist assessments that allowed for the confirmation of the impact risk and its significance are to be found in the individual specialist reports (Section C). The content and approach to the verification programme and its findings have been subjected to:

1. Independent peer review of the specialist study reports, supporting studies and documentation;
2. Independent review by the University of Namibia of the processes followed during the undertaking of the Verification Programme; and,
3. Independent review of the Verification Programme Report by the CSIR.

The full scope of the verification programme is detailed in Section D, Appendix 4, with the specialists' assessments reported in Section C. The programme considered three main categories of assessment, including:

- Water column and sediments;
- Fish, mammals and seabirds; and,
- Benthic fauna.

These three main categorises of assessment, included a several integrated programmes. A verification programme related to jellyfish (which were assessed in the EIA of 2012) was not undertaken, primarily because of the significance of the four impacts assessed being reported as low (2) and very low (2). However, the impact tables for jellyfish are presented here, since the general outcome of the verification programme has information relevant to the impact assessment of jellyfish.

The verified impact statements of the respective specialists are presented in this section. All confirmed their original assessments with a greater degree of confidence as determined from site-specific data.

Overall the level of confidence in the original assessment has been raised from medium to high. Some of the original assessments are unchanged because they were deemed to be of low or no significance with the confidence level being high. A key change with respect to the assessment of fisheries impacts is the reduction of the extent (area of influence) from that of the MLA (2233 km^2) to the specific site SP-1 dredge site (176 km^2).

The significance ratings of the impacts re-evaluated following the completion of the verification programme are presented in the table on pages viii to xi.

Water Column and Sediments: Summary of impact assessment determinations: Re-evaluated following the verification assessment.

Reference table number refers to the individual impact table number found in the specialists section.

Ref. Tbl No.	**1.1.1**	**1.1.2**	**1.1.3**	**1.1.4**	**1.1.5**	**1.1.6**	**1.1.7**	**1.1.8**	**1.1.9**	**1.1.10**	**1.1.11**
Risk Area	**Vessel Operation**		**Overspill discharge**					**Seabed dredging**			
Impact	**Pollution from wastes**	**Alien spp. in ballast water**	**Turbid plume**	**H_2S toxicity at surface**	**Oxygen deficient water at surface**	**Nutrients added at surface**	**Trace/heavy-metal toxicity at surface**	**Trace-metal toxicity on seabed**	**H_2S toxicity on seabed**	**Lowered oxygen levels on seabed**	**Increase of H_2S flux.**
Extent	Dredge area	National	Dredge area	Dredge area	Dredge area	Dredge area	Dredge area	Annual Mining Area	Dredge area	Annual Mining Area	Dredge area
Duration	Very short term	Short term to permanent	Very short term	Short term	Very short term	Short term	Short term	Short term	Medium term	Medium term	Medium term.
Intensity	No lasting effect	None to serious	No lasting effect	Minor effects	No lasting effect	No lasting effect	Minor effects	Minor effects	Minor effects	Minor effects	Minor effects
Probability	Possible	Possible	Possible	Possible	Improbable	Possible	Possible	Possible	Possible	Possible	Improbable
Status	Negative	Negative	Negative	Negative	Negative	Neutral	Negative	Negative	Negative	Negative	Negative
Significance (no mitigation)	None	Can be high	Low	Low	Low	None	Low	Low	Low	Low	Low
Mitigation	System maintenance	IMP guidelines	Built in	None possible	Non	None possible	None possible	None possible	None possible	Not possible	n/a
Significance (with mitigation)	None	None	Low	Low	Low	None	Low	Low	Low	Low	Low
Confidence level 2012	High	High	High	Medium	High	Medium	Medium	Medium	Medium	High	Medium
Re-evaluated 2014 confidence level	**High**	**High**	**High**	**High**	**High**	**High**	**High**	**High**	**High**	**High**	**High**
Reason	MARPOL 73/78 discharge standards apply	IMO guidelines for ballast water apply	Dredge area >20mg/ℓ suspended sediment concentration. Plume disperses 1 to 2 days	Mine site sediment property data indicate low H_2S presence, pyrite sulphide will have low solubility	Mixing factors are therefore <1%; and dissolved oxygen concentration reductions will be negligible (<0.1ml/ℓ).	Mine site sediment pore water volumes are low	Mine area Heavy metals have low solubility and bioavailability, trophic transfers are attenuated at primary consumer level	Mine area Heavy metals have low solubility and bioavailability, dredging should not increase exposures	Mine site sediment property data indicate low H_2S presence	POM in sediments is relatively refractory	Mine site sediment property data indicate low H_2S presence and release from iron pyrites should be low.

Fish Mammals and Seabirds: Summary of impact assessment determinations: Re-evaluated following the verification assessment.

Reference table number refers to the individual impact table number found in the specialists section.

Ref. Tbl No.	**1.2.1**	**1.2.2**	**1.2.3**	**1.2.4**	**1.2.5**
Risk Area	**Seabed dredging: Fish Mammals and Seabirds**				
Nature of the impact	Fishing operations	Ecologically important species	Recruitment of key commercial species	Biodiversity	Seabirds and Mammals
Extent 2012	MLA	MLA	MLA	MLA	MLA
Extent re assessed 2014	**Specific mine site**	**Specific mine site**	**MLA**	**Specific mine site**	**Specific mine site**
Duration	Long term	Permanent	Permanent	Permanent	Long term
Intensity	Serious effect	Moderate effect	Minor effect	Minor effect	Minor effect
Probability	Definite	Highly probable	Improbable	Improbable	Probable
Status (- ve of + ve)	Negative	Negative	Negative	Negative	Negative
Significance (no mitigation)	Medium	Medium	Low	Low	Medium
Significance (with mitigation)	Medium to low	Medium	Low	Low	Low
Confidence level 2012	High	Low to medium	Low to medium	Low to medium	Medium
Re-evaluated 2014 confidence level	**High**	**High**	**High**	**High**	**High**

Macrofauna: Summary of impact assessment determinations: Re-evaluated following the verification assessment.

Reference table number refers to the individual impact table number found in the specalists section.

Ref. Tbl. No.	**1.3.1**	**1.3.2**	**1.3.3**	**1.3.4**	**1.3.5**	**1.3.6**	**1.3.7**	**1.3.8**	**1.3.9**
Risk Area	**Seabed dredging: Benthic Macrofauna**								
Nature of the impact	**Sediment removal: benthos re establishment**	**Exploration activities and removal of benthos**	**Change of hydrographical conditions**	**Removal of sulphur oxidizing mats**	***Clostridium botulinum exposure***	**Sediment smothering benthos: Drag head**	**Benthos smothering: Dredge overspill plume**	**Nutrients added at surface: overspill plume**	**Increase of H_2S flux.**
Extent	Dredge area	Dredge area	Specific mine site	Specific mine site	Specific mine site	Dredge area	Local to regional	Local	Local
Duration	Long term >20 years	Short term	Long term >20 years	Medium to long term	Sort term	Very short	Very short	Very short	Short term
Intensity	Moderate to serious	No lasting effects	Moderate to serious	Moderate to minor	Serious	Minor	Minor	Minor	Moderate
Probability	Definite	Probable	Probable	Improbable	Improbable	Highly probable	Probable	Possible	Probable
Status	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative
Significance (no mitigation)	Medium	Non	Medium	Low	Low	Low	Low	Low	Low
Mitigation	Leave residual sediment layer / un mined areas	None required	Leave residual sediment layer / un mined areas	Non	Non	Non	Non	Non	Non
Significance (with mitigation)	Medium	None required	Low to Medium	Low	Low	None necessary	Low	Low	Low
Confidence level 2012	Medium	High	Medium	Medium	Medium	High	Medium	Medium	Medium
Re-evaluated 2014 confidence level	**High**	**No change**	**High**	**High**	**No change**	**No change**	**No change**	**High**	**High**

Jellyfish. Summary of impact assessment determinations: A verification assessment specifically related to jellyfish was not undertaken.

Reference table number refers to the individual impact table number found in the specialists section.

Ref. Tbl No.	**1.4.1**	**1.4.2**	**1.4.3**	**1.4.4**
Risk Area	**Dredging: Jellyfish**			
Nature of the impact	Blocking sea water intakes of vessel	H_2S mortalities to Jellyfish	Turbidity cause mortalities	Hard substrate exposed
Extent	Dredge event	Dredge event	Dredge event	Annual mining area
Duration	Extremely short term	Extremely short term	Extremely short term	Very short term
Intensity	No lasting effects	No lasting effects	Minor effects	Minor effects
Probability	Highly probable	Possible	Rare	Rare
Status (- ve of + ve)	Negative (to Jellyfish)	Negative (to Jellyfish)	Negative (to Jellyfish)	Positive (to jellyfish)
Significance (no mitigation)	Low	Low	Very low	Low
Significance (with mitigation)	Very low	Low	Very low	Very low
Confidence level 2012	High	Low	Low	High
Re-rated 2014 confidence level	**High**	**Low**	**Low**	**High**

B2 CUMULATIVE EFFECTS ASSESSMENT

B2.1 INTRODUCTION

The assessment of cumulative effects is widely accepted as an integral part of an EIA and more so of an SEA. However, it is acknowledged that actually achieving this objective, particularly at the individual project level, can be difficult. Cumulative effects are commonly understood as the impacts, which combine from different projects, and activities, which jointly result in significant change, which is larger than the sum of all the impacts (DEAT 2004).

Ideally cumulative effects assessments should be undertaken by, or for, the national managing authority in the country in which the individual projects take place. In other words, cumulative effects assessment should be undertaken as part of a strategic environmental assessment (SEA). In order to assess cumulative effects the following need to be understood:

- Interactions between stressors that may have cumulative effects on components of the ecosystem;
- interactions between these components; and
- The response of the ecosystem to these multiple stressors (Clarke *et al*., 2014).

At best understanding of these inputs to the assessment of cumulative effects will be incomplete. A solution is to assess potential cumulative effects with the best available information, identify and monitor indicators of change in the ecosystem, and adapt management in response to changes as, and when, necessary. Adaptive management is a foundation element and integral component of the project based environmental management plan. The difficulty in the marine environment is that it is dynamic. Yet within those limits of change (thresholds beyond which the point of change under irreversible), there is a dynamic stability. Thus, within this envelope of dynamic stability there are determinable standards of compliance that are acceptable. These standards form the conditions in which the project may be pursued. These standards are described in the project EMP, and may include additional performance standards prescribed by the authorities in the record of decision.

In the context of the Namibian Exclusive Economic Zone (EEZ) there are numerous anthropogenic activities, e.g. port infrastructure development, port access channel dredging and spoil disposal, fishing, merchant shipping, coastal and deep water diamond mining, fish processing, mariculture, waste water disposal, desalination plant effluent and saltworks biterns discharges, all of which have both direct and indirect effects on the marine ecosystem. For example, bottom trawling not only results in the direct mortality of the target species but also causes bycatch mortality, habitat destruction (smoothing of the sea floor) and suspension of sediments. In the case of Namibian demersal fishing these activities occur within an area of approximately 70 000 km^2, with approximately 40% of the area being bottom trawled annually. In addition, the trawler itself will interact with vessels at sea, emit exhaust fumes and discharge sewage, galley and other wastes. Similarly other vessels operating in Namibian waters interact with each other and discharge effluent to sea and the atmosphere. The larger the vessel, the larger the impact, with a commercial passenger liner discharging significant amounts of effluent.

It is clear that at the individual licence area and/or project level it is unrealistic that this multiplicity of actions and interactions (pathways of cumulative effects) resulting from a multiplicity of anthropogenic activities and natural processes (over which the individual project proponent has no control), can be assessed effectively in a cumulative manner in an EIA, which is by design, an assessment at a project level. At this level the opportunity for assessing cumulative effects is generally limited to "more of the same" actions, e.g. more area dredged, greater volumes of fine materials discharged, etc. The provision of more of the same assessment reporting is a primary output of the annual environmental assessment report submitted to the authorities, this report being the annual compliance statement in respect of the project EMP. This, in turn requires the authorities to accept the responsibility for integrating information from a multiplicity of sources, e.g. from individual project monitoring, scientific surveys, and fisheries resource monitoring, to determine thresholds for individual project / industry sector use of the common resource. Ideally this should take place within the overall marine spatial planning context.

At the project level, in the case of the proposed NMP dredging operations a single vessel will operate on an intermittent but regular basis i.e. dredging a full load from the target area in SP-1 and then steaming to Walvis Bay to discharge the phosphate ore. This amounts to 16 hours of dredging in every 37 hour dredge cycle.

The significance of the cumulative effects of the proposed project at both the project level and also in regard to regional considerations are presented and discussed in the following sections.

B2.2 SHIPPING INTERACTIONS

2.2.1.1 Interactions with commercial vessel traffic

The mining licence area (MLA) lies well seawards of the main coastal shipping lane and to the east of the main Cape to Europe shipping routes. Thus the dredger will only interact with this traffic when travelling between the MLA and Walvis Bay. The vessel will be an insignificant addition to the overall shipping traffic which has grown considerably in recent years notably as the result of 38% of all Angolan oil production being shipped to China along this route (*China Daily,* quoted by allAfrica.com).

2.2.1.2 Interactions with fishing vessels

The location of the SP-1 target dredging area will be advertised by means of a Notice to Mariners and will be marked on hydrographic charts so as to inform fishing and other vessels that a vessel (the dredger) with restricted ability to manoeuvre (in particular whilst the dredge head is engaged with the seabed) will be operating in the area. The area of the MLA (2233 km^2), and in particular SP-1 (176 km^2), make an insignificant contribution to the total annual Namibian bottom trawl catch, primarily of monkfish, since almost no bottom trawling is, or has been, undertaken in the area. During 2005 to 2010 there was no monk bottom trawling within SP-1 (Japp in Midgley 2012) The dredging activity in SP-1, therefore, will have an insignificant *operational* impact on bottom trawling activities.

2.2.1.3 Operational discharges from the dredger

The dredger will be MARPOL compliant in terms of all operational emissions and discharges from the vessel and thus will have a minimal individual impact and similarly will make a negligible contribution to the cumulative emissions and discharges from vessels currently operating in the Namibian EEZ. However, the EMP will require the recording of emissions, which will be reported annually. This information is then available to the authorities for cumulative assessments along with similar reporting from other marine users.

B2.3 DREDGING

2.3.1.1 Disturbance of the benthic environment

The EIA has determined that dredging in SP-1 (up to 3 km^2 annually and up to 60 km^2 for the period of licence issue) which is an area of 176 km^2 will have a severe local impact on the benthic communities in the areas actually dredged, but in terms of the benthic habitat in ML 170 (2233 km^2) and the broader mid-continental shelf (93695 km^2)[2] of Namibia the effect of dredging (3 km^2 annually) in SP-1 will be insignificant for the proposed 20-year dredging programme. However, since no data on the actual impact on, and recovery times of, the benthic habitat affected by bottom trawling are available, the contribution of dredging in SP-1 to the overall impact on the benthic environment and wider marine ecosystem can only be estimated, on the basis of relative scales, to be insignificant. In Section C, Chapter 3.3, Cochrane comments "The impacts of extraction in the specific area planned to be dredged can be expected to have considerably greater, and longer-lasting, direct impacts on the biota in that area than does bottom trawling. However, the limited area currently designated to be dredged means that, overall, these impacts will almost certainly be considerably less across the northern Benguela shelf and southern slope environments as a whole than have been the impacts of trawling on these environments, noting that the impacts of trawling are well-managed and considered to be sustainable."

2.3.1.2 Discharge of fines to the water column

It is estimated that the dredger will discharge 500 000 tonnes of fines (particles < 100 microns) annually as lean water overflow (discharged at -10 m below the sea surface) when running at full production, 5.5 M tonnes per annum. The discharge will only occur during the dredging of each lane as the vessel's hopper is filled with phosphate ore. Four 4 km-long lanes will be dredged over a period of approximately 16 hours, this being the time required to fill the vessel's hopper, after which it will leave the site for a period of approximately 20 hours to discharge the dredged sediments, and then return to start dredging again. The plume of fine material is thus generated in a spatially dispersed manner for approximately 40% of the time (the plume is only generated whilst the dredge head is engaged with the seabed). The effect of this plume on water column physics, chemistry and ecology has been assessed to be insignificant (Section C, Chapter 2.1). Attempting to place the impact of the episodic fine material discharge from the dredger into an EEZ-wide cumulative context is probably unrealistic. Apart from natural turbidity events, suspended sediment plumes are generated either at the seafloor by trawling (net and trawl gear engaging with the sediments, more so with monk dedicated gear than other demersal fishing) and to a much lesser extent by dredgers or at the surface by dredger overspill discharge or 'over and undersize' sediment discharge as is the case with marine diamond mining. In the Namibian EEZ sediment plumes are generated in geographically widely separated areas on a range of spatial and temporal scales. Plume or suspended sediment-generating activities include; maintenance and capital dredging at the ports of Walvis Bay and Lüderitz, coastal and deep water diamond mining (mostly south of the latitude of Lüderitz), the proposed phosphate ore dredging in SP-1 and from the LL Phosphate project (ML 159) and, most extensively, from bottom trawling. In terms of relative scale, or size of "footprint," bottom trawling plume generation far

[2] www.seaaroundus.org/eez/516.aspx

exceeds any other anthropogenic sources of suspended fine material on the Namibian continental shelf. However, the effects of both the trawl plume and the physical disturbance of the benthic communities by trawling on the Namibian shelf has not been evaluated.

B2.4 EXPANSION OF PHOSPHATE MINING ACTIVITIES

One of the primary concerns raised by I&APs is the potential risks to the environment and fishing industry arising from a sudden massive expansion of phosphate mining activities across the continental shelf area. It is feared that, as a consequence, there could then be a multiplicity of phosphate mining activities occurring over a wide area of the continental shelf resulting in cumulative impacts on the marine.

Currently there are only two issued mining licences for phosphate. However, the primary basis for the concern is the existence of a large number of exclusive exploration licences (EPLs) that have been issued by the Ministry of Mines and Energy (MME). These current EPLs cover a large part of the continental shelf which is considered prospective for phosphate.

There are a number of existing controls that limits the perceived threat of this phosphate-mining cumulative impact, thus making it an implausible outcome.

i) *Conversion of an EPL to a Mining Licence*

Taking out an EPL does not automatically result in the opportunity to convert to a mining licence (ML). There is significant historical marine mining industry experience to show that a very low percentage of exploration projects/targets ever make it through to development of a successful mine. In order to make application for a Mining Licence, the economic viability of a project needs to be demonstrated. Fundamentally, the in situ value (i.e. grade or concentration) of the target mineral needs to be higher than the total cost of production in order for a project to be economically viable.

Current feasibility studies indicate that in situ phosphate grades below 15% P_2O_5 are unlikely to be viable. While phosphate occurs in a variety of forms (pelletal, concretionary, crusts) over the Namibian continental shelf, the areas with concentrations above 15% are restricted to two main areas, the largest of which lies to the southwest of Walvis Bay off Meob Bay.

Using the marine diamond industry by way of example, in the early to mid 1990s almost the entire continental shelf off Namibia was covered by EPLs issued for precious stones (diamonds), which resulted in issuing of approximately 5 mining licences in total.

ii) *Mineral Market Constraints*

The rate of supply of any commodity, inducing phosphate, is controlled by the market demand for that commodity. The capacity of the market therefore dictates the supply of new material to that market. An oversupply of commodity will force a reduction in the market price which in turn will affect the economic viability of any mines supplying product. Therefore there is a limit to the quantity of new material that can be supplied to the market from existing or new mine production.

In 2011, the world trade in phosphate rock from current producing mines was 30 million tonnes. Of this 80% (24 Mt) was utilised for phosphoric acid production, 10% (3 Mt) for Single

Super Phosphate and 10% (3 Mt) for Direct Application. Growth in the market requiring new production is around 10% per annum (3 Mt)[3]. In the phosphate industry, existing mines are most favourably placed to meet demand for new product thereby providing increased pressure on prospective new entrants.

Therefore, even if Namibia has the capacity to allow for several new mines to be developed, along with competition from other potential new phosphate mines around the world, the size of the global market for new phosphate rock supply provides a natural economic barrier that further limits the probability of a sudden rapid increase in the number of viable and sustainable marine phosphate mines in Namibia

iii) Existing Legal Controls

Through current legislation the government of Namibia has a range of powers available to manage and regulate the scale and rate of development of various sectors within the mining industry. The authority for issue of mining licences rests with the Ministry of Mines and Energy. The Minerals Act of Namibia 1992, also makes provision for the Minister to declare a moratorium on the issue of new mining licences under certain conditions. This power was invoked by the Ministry in regard to the rapid development of the uranium industry in Namibia.

B2.5 REFERENCES

Clarke Murray, Cathryn, Mach, Megan E, and Martone, Rebecca, G (2014). Cumulative effects in marine ecosystems: scientific perspectives on its challenges and solutions. WWF-Canada and Venter for Ocean Solutions. 60pp.

DEAT (2004) Cumulative Effects Assessment, Integrated Environmental Management, Information Series 7, Department of Environmental Affairs and Tourism (DEAT), Pretoria.

Japp 2012. Appendix 1a. Namibian Marine Phosphate – Environmental Impact Assessment of Fish, mammals and seabirds: Proposed monitoring and verification of Impacts in the proposed Mining Area). In: Midgley 2012. Sandpiper Project Environmental Impact Assessment Report http://www.namphos.com/project/sandpiper/environment/item/57-environmental-marine-impact-assessment-report.html.

[3] CRU 2013, Independent Market Consultant's Report for the Sandpiper Project. Prepared for Namibian Marine Phosphate Internal Report.