

**SENDELINGS DRIFT MINE
ORANGE RIVER MINES**

**MINING ACTIVITIES AND PROPOSED NEW
INPIT SLIMES DISPOSAL**

**Environmental Management Plan
(EMP)**

Compiled for:



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1. INTRODUCTION TO THE DEVELOPMENT

This Environmental Management Plan (EMP) provides guidance for managing the construction, operation and decommissioning of the proposed mining activities; and the development of the new input slimes disposal facility at Sendelings Drift Mine, in the Orange River Mining License Area.

The construction, operation and decommission of the tailings facility entails:

1. Excavation and earthworks of the overburden and upper lower grade gravel.
2. Transport relevant building material.
3. Construction of seepage control measures.
4. Installation of spray bars.
5. Deposition of tailings in the pit.
6. Seepage Interception where needed.
7. Decanting of water from tailings facility.

The construction, operation and decommission of the mine entails:

1. Excavation and earthworks of the overburden and upper lower grade gravel.
2. Mine pit construction as per the relevant design.
3. Ore excavation.
4. Transport of diamond bearing gravel via an access ramp out of the pit to the plant.
5. Bedrock cleaning with an impact hammer fitted to the excavator.
6. Periodic drilling and blasting of highly cemented gravels and oversized ore blocks.
7. Removal of any infrastructure in the mine pit after mine closure.
8. Rehabilitation (including possible re-vegetation)

This environmental management plan (EMP) aims to take a pro-active route by addressing potential groundwater and surface water problems before they occur. This should limit the corrective measures needed, although additional mitigating measures might be included if necessary. The EMP acts as a stand-alone document, which can be used in the area during the various phases (i.e. construction, operations and decommissioning).

All mine workers, operators of heavy-duty vehicles, contractors and sub-contractors taking part in any of the phases should be made aware of the contents of the EMP and of the existing draft Environmental Impact Assessment (EIA) for Sendelings Drift Mine in general, so as to plan their activities accordingly in an environmental sound manner.

2. ENVIRONMENTAL MANAGEMENT PLAN

In this EMP, the contractor refers to Namdeb Diamond Corporation (Pty) Ltd and its appointed contractors.

Before commencement of any construction work, the Contractor shall brief all staff on the content of the EMP and the EIA. The Contractor has the responsibility for implementing the EMP and ensuring their staff comply with the guidelines. Daily audits must be carried out; and corrective action implemented when needed. NAMDEB should promote the implementation of this EMP.

Protection of Natural Resources	
Management objectives	
◆ Minimise the impact on the natural environment ◆ Minimise the impact on groundwater and surface water ◆ Pollution prevention	
Management standards	
◆ Environmental Assessment Policy ◆ Nature Conservation Ordinance (4 of 1975) and amendments ◆ Environmental Management Act (Act 7 of 2007) ◆ Water Resources Management Act No.24 of 200	

2.1. Protection of Groundwater and Surface Water Resources

The Contractor is responsible for ensuring that the impacts on the environment around the proposed tailings facility and the mining activities are minimised. Groundwater in the area is not utilised for human consumption. Surface water in the form of the Orange River is however located 3km southwest of the tailings facility. The river is an important habitat for wild animals, vegetation and aquatic life; and forms part of a vital life support for many settlements and operations along the river.

For this reason, special emphasis is placed on the protection of the Orange River. No waste material may be disposed in the river. No hazardous chemicals, fuel or other lubricant storage facilities and/or storage drums should be erected in close proximity to the river. Storage and/or transportation of hazardous substances should be properly managed and controlled. Land disturbance should be minimised and restricted to the mining area.

Washing of vehicles, machinery, clothes or any hydrocarbon or chemical polluted items within 50m of the Orange River is strictly prohibited.

In order to protect the environment and achieve sustainable development of the environment, it is necessary to incorporate sound environmental management objectives and targets for the designated mining activities.

1. Staff management

The Contractor must ensure that their employees are properly trained for the job at hand (right man for the job) and proper emergency plans are in place. Namdeb's environmental staff should conduct an environmental briefing session with the relevant mining staff, highlighting identified potential ground and surface water impacts and mitigations thereof emanating from the tailings dam and mining activities.

The risk of groundwater pollution can be lowered through proper training of vehicular operators and mine workers.

2. Waste management

Any waste generated during construction activities of the tailings dam and the mine must be accumulated at the point of generation and disposed off at a suitable waste disposal site at the mine. The Contractor must provide sufficient bins or containers on-site to store any solid or liquid waste produced. The bins and containers should be weatherproof and scavenger-proof.

No hazardous chemicals, fuels and/or solvents should be disposed off into the river or stored in close proximity to the latter. The contractor must ensure that proper storage and handling of these products takes place. Any leakage or spillage from heavy-duty vehicles and machinery should be contained and remediated immediately. Sewage will be generated at the office block and workshops on the mine and at mine residence (if any).

3. Flood Management

The possibility of the tailings dam being flooded during a torrential rainstorm is highly unlikely as it will be designed in such a way that water ingress from outside will be

prevented. Flood occurrence in the Sperrgebiet area is highly unlikely due to its aridity and low rainfall.

4. Water Management

During the mining operations, it would be very important to manage and account for all water sources in the mine area. A concise water balance should be drawn up and maintained at Sendelingsdrift mine, in order to detect seepage and or access water. A water monitoring program should be put in place, so as to obtain relevant data for management to make informed decisions. The length of the tailings transport pipeline should form part hereof and regular inspection of the pipeline must be conducted to limit transport losses. Inspection of seepages must be made to prevent the creation of habitats. The water sources of such seepages must be eliminated.

Table 1. Tailings Storage Facility

Identified Impact	Description	Mitigation	Monitoring	Responsible Body
Impact on River Hydrology	Potential impact on the natural flow of the Orange River. The Orange River is 1km south of the facility. The flow of the Orange River is not expected to be altered in any way, as the facility is located well above the 1:100 year flood line.	Proper construction of the tailings storage facility. Continuous monitoring of the tailings dam structure throughout the mining operations.	Regular surface and groundwater monitoring.	NAMDEB (Pty) Ltd / Contractors
Soil and Groundwater Contamination	Potential health impact on groundwater users due to seepage and/or infiltration of contaminated water emanating from the tailings facility. Potential impact on natural environment from polluted groundwater, typically on vegetation and wildlife. Nearest vegetation are along the Orange River. No groundwater users, excluding vegetation, are expected to be impacted.	Proper construction of the tailings storage facility. Continuous monitoring of the tailings dam structure throughout the mining operations. Proper training of operators of the tailings facility.	Regular surface and groundwater water monitoring. Observation of potential threatening activities to soil and groundwater.	NAMDEB (Pty) Ltd / Contractors
Surface Water Contamination	Potential health impact on surface water users and on the natural environment associated with the river. Socio-economic impact on surface water users. The Orange River is 1km from the proposed fine tailings dam. Rate of seepage is expected to be low and the dilution effect of the river is expected to lower the risk on surface water users.	Proper construction of the tailings storage facility. Continuous monitoring of the tailings dam structure throughout the mining operations. Proper training of operators of the tailings facility.	Regular surface and groundwater water monitoring. Observation of potential threatening activities to surface water.	NAMDEB (Pty) Ltd / Contractors
Damage to Tailings Pipelines	Transfer pipelines can be damaged by the mine's heavy earthmoving machinery and surface runoff. Potential release of contaminated water into the environment can impact on groundwater quality. The tailings facility is relatively close (0.76km) to the proposed treatment plant. Pipelines and associated infrastructure should be properly constructed and monitored regularly.	The pipelines should be strategically located as to avoid being damaged by moving vehicles on the mine. Care should be taken when blasting occurs. Special care must be taken to avoid damage of the pipeline from surface runoff.	Regular inspection of the pipelines. Observation of any potential threatening activities to the pipelines.	NAMDEB (Pty) Ltd / Contractors
Dam Failure	The inlet facility relies on the containment formed by the sides of the excavation. Failure would most likely result in slumping into the pit. No or very little release of slimes is expected if this happens. The risk of slumping would decrease as the level of tailings in the pit increases.	Proper construction of the tailings storage facility. Continuous monitoring of the tailings dam structure throughout the mining operations. Proper spill control and emergency plan.	Regular surface and groundwater water monitoring. Observation of potential threatening activities to surface and groundwater.	NAMDEB (Pty) Ltd / Contractors
Dam Overflow	Dam overflow may occur due to heavy precipitation and or excessive water release into the dam, resulting in contamination of both groundwater and surface water pollution.	Continuous monitoring of the tailings dam level throughout the mining operations. Proper training of operators of the tailings facility. Proper spill control and emergency plan.	Observation of potential threatening activities to surface and groundwater.	NAMDEB (Pty) Ltd / Contractors

Table 2. Mining Activities

Identified Impact	Description	Mitigation	Monitoring	Responsible Body
Impact on River Hydrology	The mining areas at Sendelingsdrift mine are well above the level of the Orange River. Possible dewatering of the mine pits are not expected to impact the river hydrology in any way. In general, the abstraction of water for Namdeb mining activities in the area is not expected to reduce the flow of the Orange River noticeably and thus affect the downstream ecology. However, the cumulative effect of all current and future users may significantly reduce the water flow in the Lower Orange River. Placement of structures in the Orange River flood plain should be avoided where possible as it may influence the natural flow of the river. This would include the placement of rock discard dumps. Such structures may lead to higher flood levels in the section area, with resultant larger impact areas on the opposite side (South Africa) of the river.	Avoid placing structures in the 1:100year flood line. Clearance must be obtained from both the Namibian and the South African Departments of Water Affairs if such structures are placed in the flood plain.	Regular inspection of the effect of mining activities on the water level of the river and river flow. Regular surface and groundwater monitoring.	NAMDEB (Pty) Ltd / Contractors
Impact on groundwater	Impacts on the groundwater is mostly related to releases of chemicals and water from the mining operations.	Water budget, proper containment structures.	Inspection of chemical storage and handling facilities. Inspection of seepages.	NAMDEB (Pty) Ltd / Contractors
Excessive Dewatering	This may inevitably lower the water level in the area. This can cause springs to dry up; and lower water levels in any boreholes present in the area.	Care should be taken as to not dry up the spring in the area.	Regular inspection of the effect of mining activities on the spring and its habitats. Regular surface and groundwater monitoring.	NAMDEB (Pty) Ltd / Contractors
Surface Water Contamination	No waste material may be disposed off in the river. No hazardous chemicals, fuel or other lubricant storage facilities and/or storage drums should be erected in close proximity to the river. Leakage from heavy-duty vehicles and machinery might occur during the operations of the mine. Care must be taken in avoiding contamination of soil and groundwater, as surface - groundwater interaction might take place.	All spills should be cleaned up as soon as possible. Chemical, oil and/or fuel contaminated soil; clothing or equipments should not be washed in the Orange River.	Regular visual inspection by the Supervisor. Surface and groundwater water monitoring during mining operations.	NAMDEB (Pty) Ltd / Contractors
Failure of Dewatering Pipelines	Potential release of contaminated water into the environment impacting on groundwater quality.	Suitable dewatering pipelines should be properly installed. The path of the pipelines should be strategically located as to avoid being in the path of moving vehicles.	Regular pipeline inspection and tightness tests. Observation of any potential threatening activities to the pipelines.	NAMDEB (Pty) Ltd / Contractors
Generation of Waste	Waste in the form of contaminated soil due to spillages or leakages from petroleum products, solvents and chemicals might occur. This should be prevented through proper training of mine operators and the use of proper containment areas. Oil water / separator effluent originating from storm water runoff, tank bottoms and washing activities should be separated before disposal of the water. Proper servicing of the vehicles should also be conducted. Any waste generated during operations of the mine will be accumulated at the point of generation and	Prevent spillages of any chemical, oils or fuel. Proper training of operators of machinery and heavy-duty vehicles. Proper spill control plan and rehabilitation plan. Proper maintenance of machinery and vehicles.	Proper spill control plan. Proper maintenance of machinery and vehicles. Visual inspection of soil, groundwater and surface water contamination. Regular surface and groundwater	NAMDEB (Pty) Ltd / Contractors

Identified Impact	Description	Mitigation	Monitoring	Responsible Body
Generation of Waste Rock	disposed off at a suitable waste disposal site at the mine. Waste rock will be generated during the construction and operations of the mine. Leaching of metals contained in the excavated rock and gravel on the mine may occur through precipitation. Contaminated water may infiltrate into the bedrock, putting groundwater at risk. Flow on the bedrock may also take place, putting surface water at risk. The presence of large quantities of rock containing sulphide minerals in the mine can react with water and oxygen to create sulphuric acid. The acid leaches from the rock as long as its source rock is exposed to air and water, until all sulphides are leached out. Some of the contaminated water infiltrates into the bedrock, while some of the water is carried off the mine site by rainwater or surface drainage and deposited into nearby river. The risk to both ground and surface water is considered low in the area, as the area has a low average annual rainfall.	Mining should be limited to the proposed planned outline.	monitoring. Regular surface and groundwater monitoring.	NAMDEB (Pty) Ltd / Contractors
Erosion of Disturbed Waste Rock	Erosion of the disturbed and exposed rock may carry substantial amounts of sediment into the river. This may result in an increase in turbidity in the water, that limits light penetration and prohibits healthy plant growth on the riverbed. Excessive river sedimentation can also clog riverbeds affecting wildlife habitat and aquatic organisms. This should be prevented.	Surface runoff management. Proper routing of surface runoff around dumps and excavations.	Regular surface water monitoring. Monitoring of turbidity levels in the river.	NAMDEB (Pty) Ltd / Contractors
Destruction of Vegetation	Damage or destruction to vegetation can promote soil erosion. This might result in an increase of sediment loads into nearby water body. If limited to the proposed planned outline of the mine at Sendelingsdrift, the impacts during the mining activities are likely to be non significant.	If limited to the proposed planned outline of the mine at Sendelings Drift, the impacts during the mining activities are likely to be non significant.	Regular inspection of the effect of mining activities to any existing vegetation in the area.	NAMDEB (Pty) Ltd / Contractors
Spillage of Hazardous Chemical During Delivery	Spillage during the transport of hazardous chemicals is mainly related to damage to tankers during vehicle accidents. These hazardous substances can enter drainage systems and nearby water bodies. Namdeb's road signs and regulations should be adhered to. During delivery, spillages might occur during delivery to the tanks.	Namdeb's road signs and regulations should be adhered to. Risk of impact from this can be lowered through proper training of staff and the installation of suitable containment structures.	Monitoring degree of impact to the soil.	NAMDEB (Pty) Ltd / Contractors

3. CONCLUSIONS

The above Environmental Management Plan, if properly implemented will help minimise adverse impacts on the environment. Where impacts occur, immediate action must be taken to reduce the escalation of effects associated with these impacts. To ensure the relevance of this document to the specific mine development stage, it needs to be reviewed throughout all phases.

The Environmental Management Plan should be used as an on-site reference documents during all phases of the mining activities. Auditing should take place in order to determine compliance with the EMP, and Parties responsible for transgression of the EMP should be held responsible for any rehabilitation that may need to be undertaken.

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