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EKO•ENVIRONMENTAL

Storm Water Management Plan for the Alluvial Diamond Mining Operation on portion 1 and the Remainder the farm Rooidam 101, Winserton, Northern Cape

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FOR

Rooidam Plaas (Pty) Ltd

Date: February 2016

ECLARATION OF INDEPENDENCE

EKO Environmental is an independent company and has no financial, personal or other interest in the proposed project, apart from fair remuneration for work performed in the delivery of hydrogeological services. There are no circumstances that compromise the objectivity of the study.

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1 INTRODUCTION

The purpose of the assessment is to develop a (**SWMP**) Storm Water Management Plan to inform the (**WULA)** Water Use License Application that was submitted on behalf of Rooidam Plaas (Pty) Ltd to proceed with the mining of alluvial diamonds for which a mining authorization was also applied for in terms of the **MPRDA** (Mineral and Petroleum Resources Development Act).

1.1 Mining processes

The entire area under the mining authorisation is earmarked for potential mining by Rooipoort Plaas (Pty) Ltd.

The mining process at the facility will broadly entail the following:

- Stripping of topsoil and overburden and stockpiling it separately.
- Excavation of gravel in open voids/pits.
- Separation of gravel through a dense medium settlement process to isolate the diamond bearing gravel.
- The fine tailings is deposited on a fine tailings storage facility (slimes dam) and the course material is transported back to fill excavations.
- Water is obtained from the channel of the water scheme for use in the dense medium settlement process. No chemicals or additives are used in the process.

1.2 Scope of Work

The site is located on Portion 1 and the remainder of the farm Rooidam 101, 11 km north of Winserton in the Warrenton district in the Northern Cape. The purpose is to development a SWMP for the alluvial mining operations in support of the water use application in terms of the National Water Act, 1996. The main objectives of the SWMP are to ensure:

- Protection of life and property from flood hazards,
- Prevention of erosion,
- Protection of water resources from pollution,
- Ensure continuous operation through different hydrological cycles,

- Maintaining downstream water quality and quantity requirements,
- Protection of the natural environment with the emphasis on the water courses and their ecosystems.

1.3 Methodology

- Desktop assessment of all available hydrological and rainfall data, topographic information, contours, areal images and EMP (Environmental Management Plan).
- On site assessment of surface water features, and potential sources of contamination.
- Interpretation of surface water flow patterns calculated from available survey data.

1.4 Principles that were considered during the development of the SWMP

- Prevent the contamination of clean runoff.
- Dirty water must be contained and disposed or treated in an environmentally responsible manner.
- The SWMP must be sustainable for the life cycle of the mine and relevant for all different hydrological cycles.
- The statutory requirements of the various regulatory authorities and stakeholders must be considered and incorporated.

2 OVERVIEW OF THE HYDROLOGICAL CYCLE AND PROCESSES THAT AFFECTS THE GENERATION AND MANAGEMENT OF STORM WATER

2.1 Background

The farm (i.e. Rooidam 101) is located within the quaternary catchments of C91D and C33B, (Figure 1) which forms part of the Lower Vaal River Catchment in the Northern Cape. The site is located on the western banks of the Vaal River downstream of the town Warrenton. The surrounding area consists predominately of extensive commercial farming, including livestock, game and irrigation operations with water allocations from the Vaal River. There are also numerous other alluvial diamond mining operations located along the Vaal River.

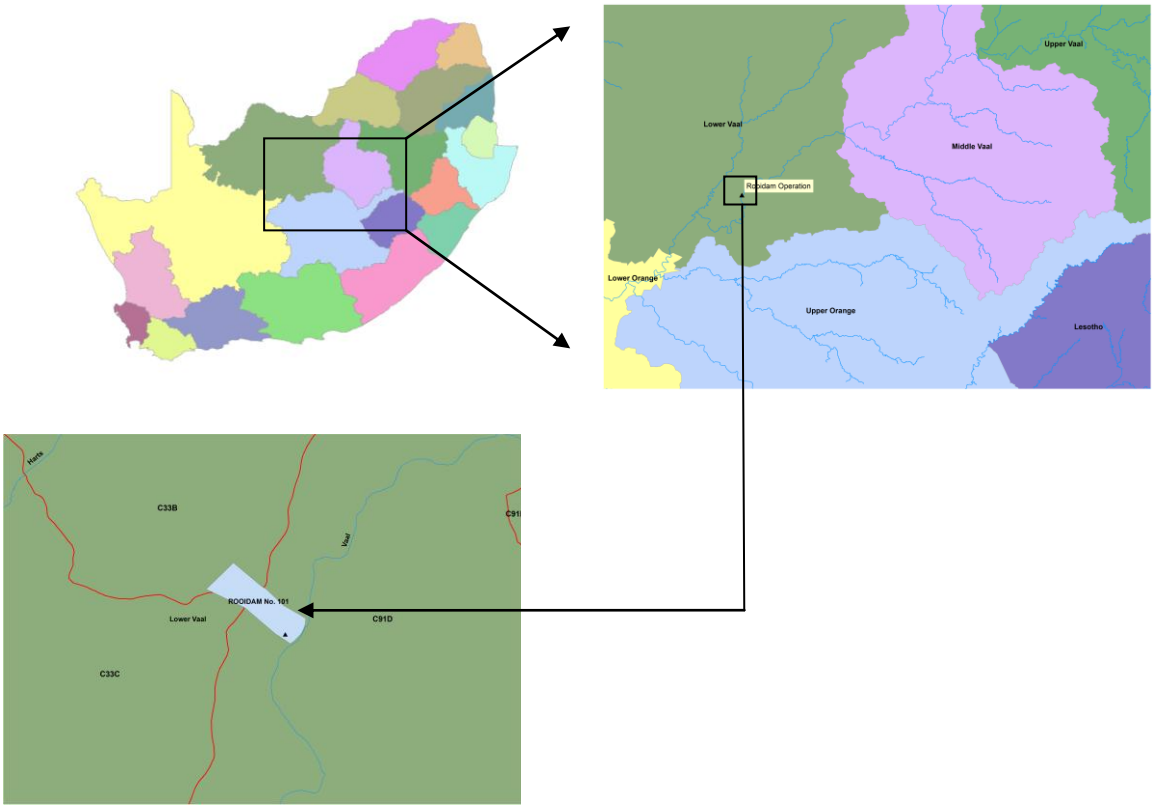

Figure 1: Map indicating the Water Management Areas and the quaternary catchments in which the mining area is located.

2.2 Precipitation

The site is located in a semi arid region with an average Mean Annual Precipitation of approximately 450 mm per annum which occurs during summer and autumn with very dry winters (Mucina & Rutherford, 2006). Mean annual evaporation of 2 896 mm/annum (South African Weather Bureau, Station 0290468 - Kimberley: 1957 - 1987). The surface water runoff in the area is therefore typically restricted to very high rainfall events.

The average storm water runoff volumes are thus relative low but it would be necessary to manage storm water during high rainfall events.

2.3 Infiltration

Under normal conditions or when land is undisturbed the rate of infiltration is average 80%. The type of development or land modification has an impact on the rate of infiltration and therefore the amount of storm water generated.

The infiltration of storm water will not be impacted on significantly by the operations. Open pits or excavations will contain insignificant volumes of the storm water which could not be diverted around active working areas.

The contribution of elevated runoff water volumes is also insignificant, unlike paved areas like in township areas that will increase the amount of storm water significantly.

2.4 Topography

Runoff is generated whenever the rain reaches the ground faster than it can infiltrate and the energy of the runoff water is a direct function of its potential to cause erosion.

The topography of the farm in the north western parts is very low (no steep slopes) and is classified as a flat plain that slopes towards the west. There is however a watershed in the centre of the farm which results in a slope from the watershed towards the southeast of the farm towards the Vaal River. This area has a slope of approximately 1:26 and is measured from the mining area to the Vaal River. The area is located between 1220 and 1135 m above sea level. The topography has been altered by historic mining activities/sites which forms part of the study area.

There are very few clearly defined waterways outside the flood plain. Closer to the river in the flood plain area, drainage features has developed where storm water is collected and discharges along defined waterways into the Vaal River. Due to the low rainfall, these waterways are mainly seasonal

The surface water flow patterns are a function of the local topography and indicated in Figure 2 below:

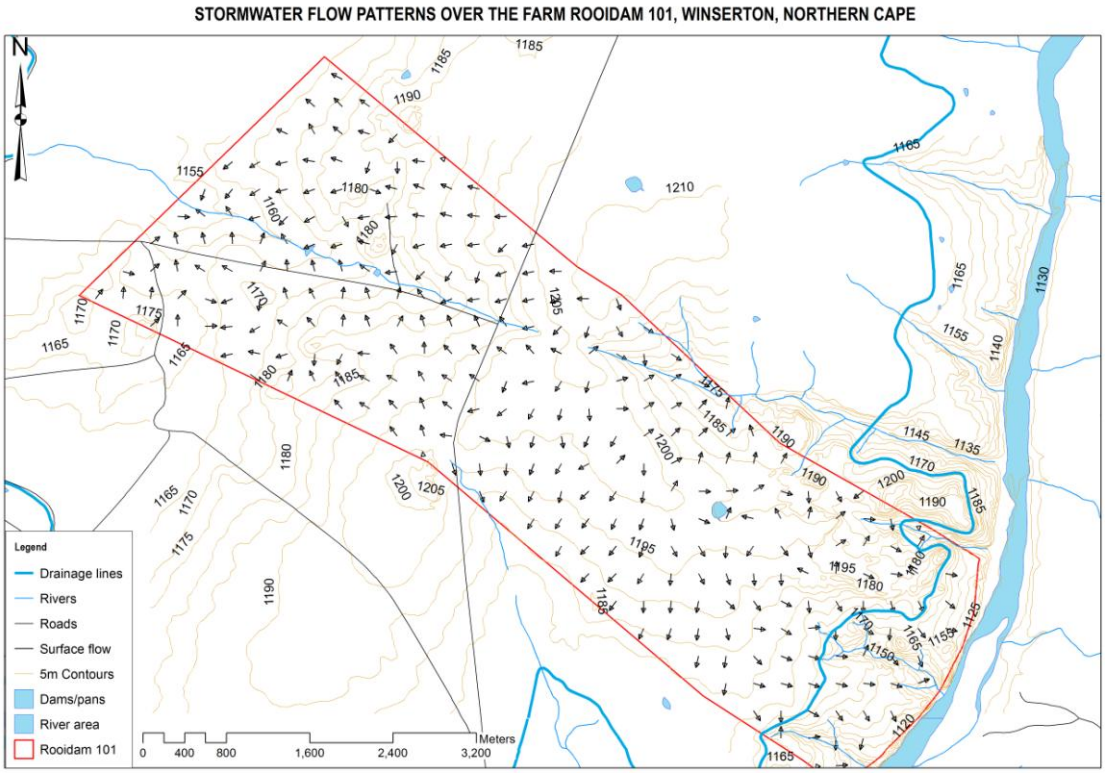

Figure 2: Storm water flow patterns on the mining area

2.5 Evapotranspiration

Evapotranspiration is the process whereby water is extracted from the soil by plants and respires as vapour through their leaves. The evapotranspiration is estimated to be 0.1 mm/day in the winter to 3 mm/day in summer. Although large areas will be disturbed during mining the impact of evapotranspiration will be negligible. This will also be ameliorated by the concurrent re-vegetation of rehabilitated open pits that are backfilled as mining progresses.

2.6 Recharge

Recharge is the vertical movement of surface water through the unsaturated zone to reach the ground water horizon. The rate of recharge is estimated to be 3 % of the **MAP** (Mean Annual Precipitation).

The rate of recharge and the MAP of the area is very low which reduces the potential of ground water pollution significantly. The risk of surface- or ground water contamination is further

reduced because of the nature of the operation and the inert characteristics of material that is mined.

2.7 Stream flow

There are a number of non-perennial drainage lines and non-perennial pans on the farm outside the flood plain that can flood their banks to cover large areas. Storm water occurs as sheet flow that converges in more definable water-ways closer to the Vaal River.

2.8 Ground water flow

The combination of a relative deep ground water table, geology and low relief make the area not conducive for the formation of any fountains or the recharge of surface water features from ground water.

3 ASSESSMENT OF CLEAN AND DIRTY AREAS

3.1 Plant areas

The entire study area consist over an area of 1 934 ha (i.e. farm Rooidam 101).

There are previously disturbed areas on the study area where mining activities occurred in the past.

The dirty areas of the operation will be confined to the plant areas where there are storage facilities for fuel, lubricants and waste, vehicle service areas and wash bays.

There is no mine waste or waste product generated as a result of the mining process that could contaminate storm water due to the inert nature of the minerals mined. The slimes dams consist of the fine material that is removed from the alluvial gravels by means of washing and screening. Only raw water from the Vaal River is used and no harmful chemicals are added in the processing of the alluvial gravels. The fines (slime) are inert and therefore no reason why any acid base determinations or leach tests is necessary. The risk for the generation of seepage from the facility that may have an impact on the groundwater is insignificant.

The main concern is that fine material be eroded from the facility during a rain event and mobilized as suspended solids into the storm water. A cut-off trench around the slimes dam will contain fine material eroded from the facility and divert clean storm water around it.

The pollution prevention measures around the fuel storage facility, wash bay and waste areas as described in the EMP are also sufficient to contain contaminated water at the source.

The risk of contaminating any storm water from the rest of the site is negligible.

3.2 Excavations

The only risk during heavy rainfall event is the mobilisation of suspended solids that may enter the Vaal River during extremely high rainfall events. It will therefore be necessary to divert storm water around opencast areas, overburden- and topsoil stockpiles.

4 STORM WATER MANAGEMENT PLAN **SWMP**

4.1 Slimes dam

The slimes dams on the mining areas will be very small and therefore the risk for the generation of poor quality seepage from the facility is insignificant but it will be necessary to install a storm water trench around the slimes dam to contain any fines that may be eroded from the side walls. The storm water trench will also divert clean storm water around the facility.

4.2 Storage facility, wash bay and waste area

All potentially hazardous substances and/or hazardous waste will be stored inside a bunded area, with an impermeable surface and walls, with the capacity to store 100% of the volume of the hazardous substances. This will ensure that storm water is not contaminated. Stormwater collected in the bunded areas will be pumped out and disposed of as hazardous waste as it is contaminated.

Waste products will be separated into different waste streams (i.e. general, hazardous, etc.) on site and disposed of appropriately.

4.3 Maintenance of machinery and mining vehicles

Mining vehicles/machinery should be parked inside dedicated parking areas with bund walls and drip trays to prevent spillages. In the event that spillage occurs from vehicles, machinery and/or storage areas, these spills should be cleaned up by removing the spilled material with any contaminated soil and storing it inside a bunded area and disposing of it in terms of best practices.

4.4 Excavations

Storm water should be diverted around open cast areas by means of a storm water trench upstream of active areas. Overburden and topsoil stockpiles should be placed inside the protection zone of the storm water trench of an active area.

As is currently implemented on the mining areas, previous excavations should be rehabilitated concurrently as mining progresses. The re-vegetation of disturbed areas is important to prevent erosion and improve the rate of infiltration. Erosion channels that may develop before vegetation has established should be rehabilitated by filling, levelling and re-vegetation where topsoil is washed away.

4.5 Operation in the flood plain area

The defined waterways in the floodplain area that is next to the Vaal River and protected with a 100 m buffer zone, should be preserved as storm water drainage canals. The ecological function of these channels is to collect storm water (sheet flow) during rain events from the upper reaches before it converge with the Vaal River.

Application for authorization should be submitted in terms of the NWA to extend the operation into the flood plain area. Clear management procedures should be developed to ensure that these waterways are protected or re-instated to prevent pooling and divert runoff unhindered into the Vaal River.

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