ZANDBERG SANDPUT (PTY) LTD

PORTION 4 OF THE FARM ZANDBERG FONTEIN 97

ROBERTSON MUNICIPAL DISTRICT

WESTERN CAPE PROVINCE

STORM WATER MANAGEMENT PLAN

DEPARTMENTAL REFERENCE NUMBER:

WC 30/5/1/2/2/87 MR & WC 30/5/1/2/2/10080 MR

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1. INTRODUCTION

Sand mining commenced in the 1980's on Portion 4 of the farm Zandberg fontein No 97, Robertson. The Zandberg Sand Mine operated under an old order mining permit (Reference No: MP 39/98) that was converted to a new order mining right (Protocol No: 1435) in terms of Item 7 of Schedule 2 of the MPRDA, 2002 in March 2011. This mining right (7.4826 ha) was valid until February 2016, upon which the DMRE renewed it until May 2047. In 2014, the MR Holder applied for a 10.2026 ha extension of the approved 7.4826 ha mining area that was granted in December 2018. In November 2018, the mining right was ceded from WJ Viljoen to Zandberg Sandput (Pty) Ltd that is the current MR holder.

Zandberg Sandput (Pty) Ltd submitted a Section 102 ("S102") amendment application to add 4 ha to the current 17.6826 ha mining footprint. The S102 application necessitates an application for a Part 2 amendment of the mine's EMPR in terms of GNR 326 Section 31. The S102 application further constitute listed/specified activities in terms of the NEMA: EIA Regulations, 2014 (as amended) and therefore requires an environmental impact assessment (EIA). Greenmined Environmental (Pty) Ltd ("Greenmined") is the consultants responsible for the S102 amendment application ("S102") and associated amendment of the EMPR. In light of this, the Storm Water Management Plan was accordingly drafted to propose methods for removing, reducing, or retarding run-off flows, and prevent targeted storm water run-off constituents, pollutants and contaminants from reaching receiving waters.

2. OBJECTIVE OF STORM-WATER MANAGEMENT

The objective to proper storm water management is to:

» Prevent the contamination of clean runoff,
» Contain dirty water, dispose or treat it in an environmental responsible manner,
» Prevent soil erosion as a result of increased runoff from the mining area, and
» Prevent the loss of stockpiled topsoil to be used during the rehabilitation phase.

This Storm Water Management Plan must be seen as a dynamic document that must biennially be reviewed and adjusted to the site specific conditions experienced at the Zandberg Sand Mine.

3. PROJECT DESCRIPTION

Mining commenced in the south-eastern corner of the approved mining area. Presently, the mining direction is towards the northern- and western boundaries of the approved footprint. The EMPR of the MR Holder mentions that at no time may there be more than 1 ha of land opened and/or in use. As shown in the figure below, the initial mining footprint (G – K / dark blue polygon) has been mined-out, and mining now extends into the approved extension area (I – N / light blue polygon). Approximately 7.6 ha (as estimated October 2021) of the approved 17.6826 ha area remains available for mining.

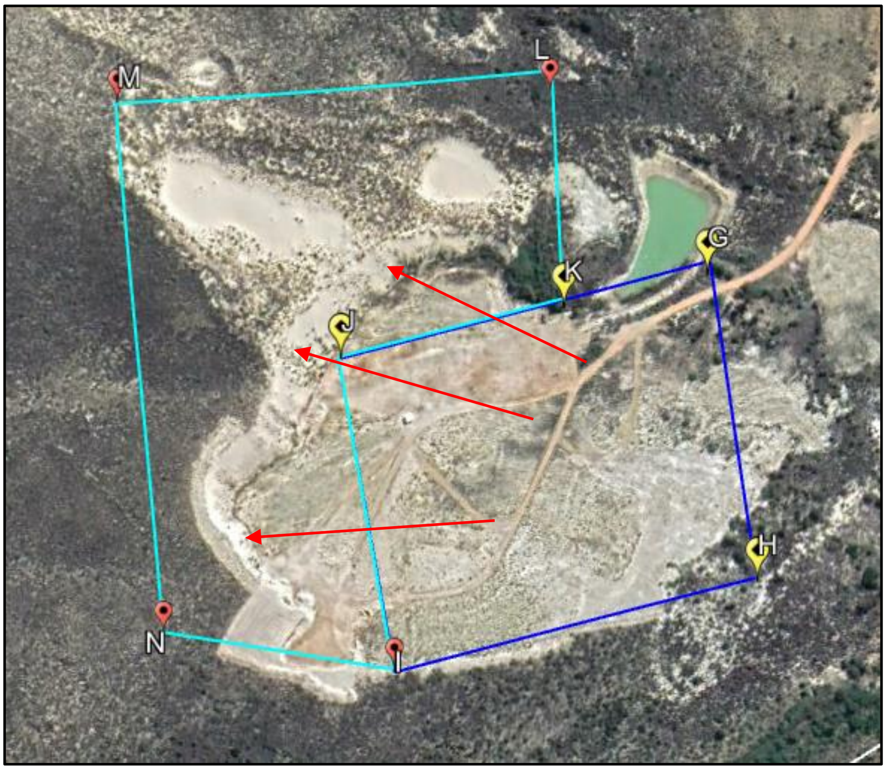

Figure 1: Satellite view showing the mined-out G – K area (dark blue polygon), as well as the area I – N (light blue polygon) that is presently being mined. The arrows indicate the mining direction. (Image obtained from Google Earth 2020).

The operational phase of the current mine involves the removal of the topsoil of a strip of ±0.25 ha within which the sand is mined in a block of approximately 50 x 50 m. The topsoil is stockpiled at the edge of the strip to be replaced during the rehabilitation of the area. The sand is then removed from the stripped area with a FEL that loads it directly onto the trucks of clients. To date every mined-out strip (±0.25 ha) was rehabilitation before work continued at the consecutive phase/strip. However lately the height of the dune increased considerably and safety requirements now dictate that the MR Holder reduce the height of the mining face. This is achieved by pushing the sand (after removal of the topsoil) down the mining face onto a section of the adjacent/most recently mined-out strip. The excavator then loads the sand from the floor of the mine onto the trucks of the clients. In light of this, the mining method now requires a maximum of two strips (±0.5 ha) to be open at any given time. As the face of the dune recedes, the mined out areas (no longer needed for the loading of sand) is rehabilitated.

During the EIA phase of the S102 application, three site alternatives (referred to as Site Alternative 1 (S1), Site Alternative 2 (S2), and Site Alternative 3 (S3) in this document) were identified by the project team that could all allow the mining of the sand resource on the property, although only one can be approved due to the size restrictions (4 ha) derived from the CBA offset ratio (1:30).

Subsequently, MLB Consulting (MLB) was appointed to compile a Geology, Geotechnical and Mining Assessment to comment on the mining prospect of each identified site alternative. MLB concluded that the potential for circular failure is regarded as Low if a factor of safety (FOS) of ~1.66, with a very low shear strain rate of 4×10^{-6}, is maintained at S2. The overall slope is predicted to remain stable for the input parameters used in the above model (Le Bron, 2021). For S1, MLB concluded that the potential for circular failure is regarded as Low if a FOS of ~1.21, with a very low shear strain rate of 5×10^{-6}, is maintained. The overall slope is predicted to remain stable for the input parameters used in the above model (Le Bron, 2021). The same is applicable to S3.

MLB concluded that the final pit geometry (S1/S2/S3) must comply with the following:

» bench heights of 10 m;
» bench widths of 20 m;
» bench face angles of ~27°; and
» overall slope angle of ~16°.

MLB recommended the following mining sequences as presented in the following schematics, with the mining direction extending from the extreme rear extent towards the face of the excavation model with increasing depth.

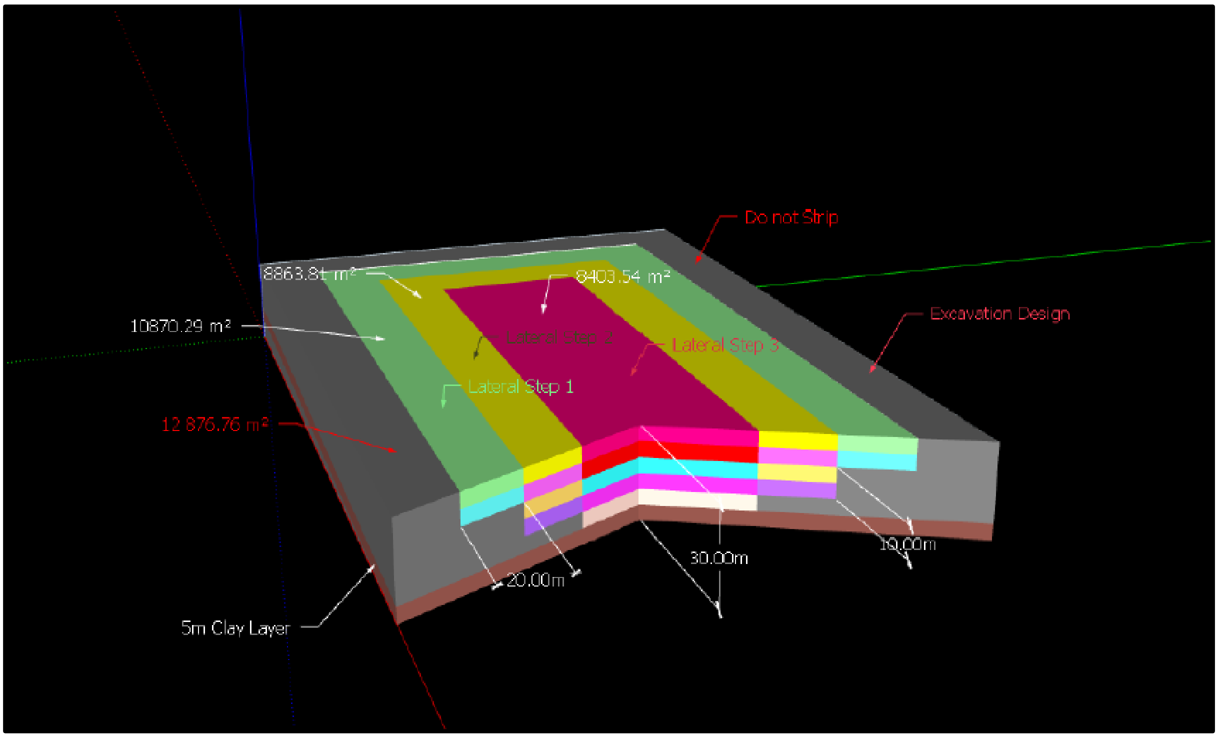

Figure 2: Schematic plan showing the recommended mining sequence for Site Alternative 1 (image obtained from MLB).

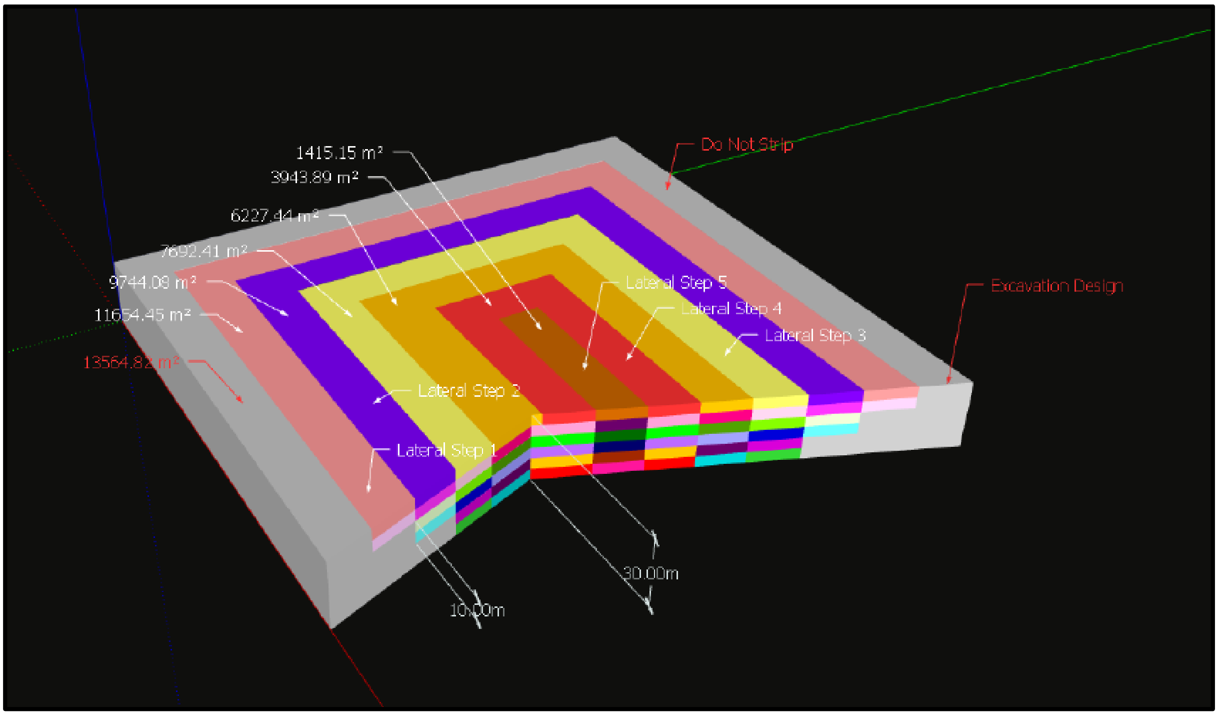

Figure 3: Schematic plan showing the recommended mining sequence for Site Alternative 2 (image obtained from MLB).

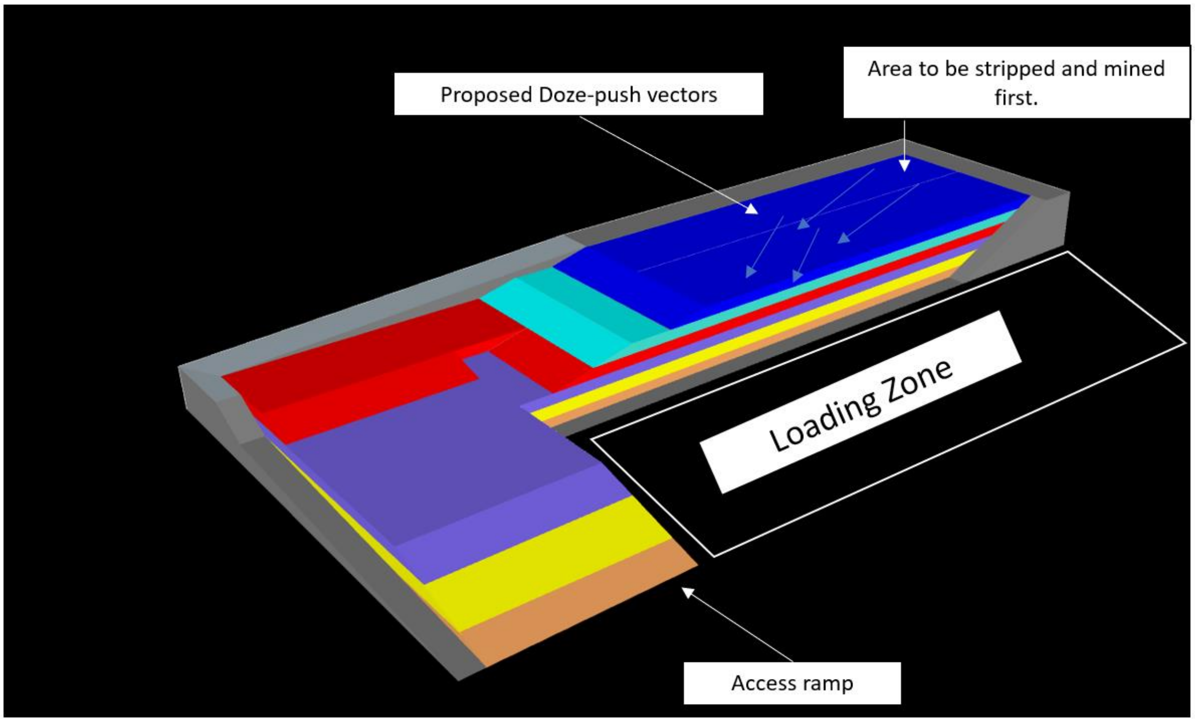

Figure 4: Annotated extraction model showing proposed extraction strategy for S3 MLB, 2022).

4. SITE CHARACTERISTICS

Climate:

The Robertson area receives an average of 255 mm of precipitation per year. The monthly distribution of average daily maximum temperatures shows that the average midday temperatures range from 16.7˚C in July to 29˚C in February. The region is the coldest during July (4.2°C on average). During the summer/spring months the south to south-eastern wind dominates in the Robertson area (blowing in a northern direction), whilst during the winter/autumn months the west-north-western wind is dominant as presented in the figure below. According to the data of windfinder.com the average wind speeds range from 4 – 6 kts during the year.

Topography:

The topography of S1 is less dramatic than that of S2 with the altitude ranging from 217 masl at the lowest point sloping up to 257 masl toward the western corner. The earmarked footprint has an elevation gain of 2.4 m, with a maximum slope of 27%, and an average slope of 12.8% between the lower eastern corner and the higher western corner (distance of 315 m) as shown in the following figure.

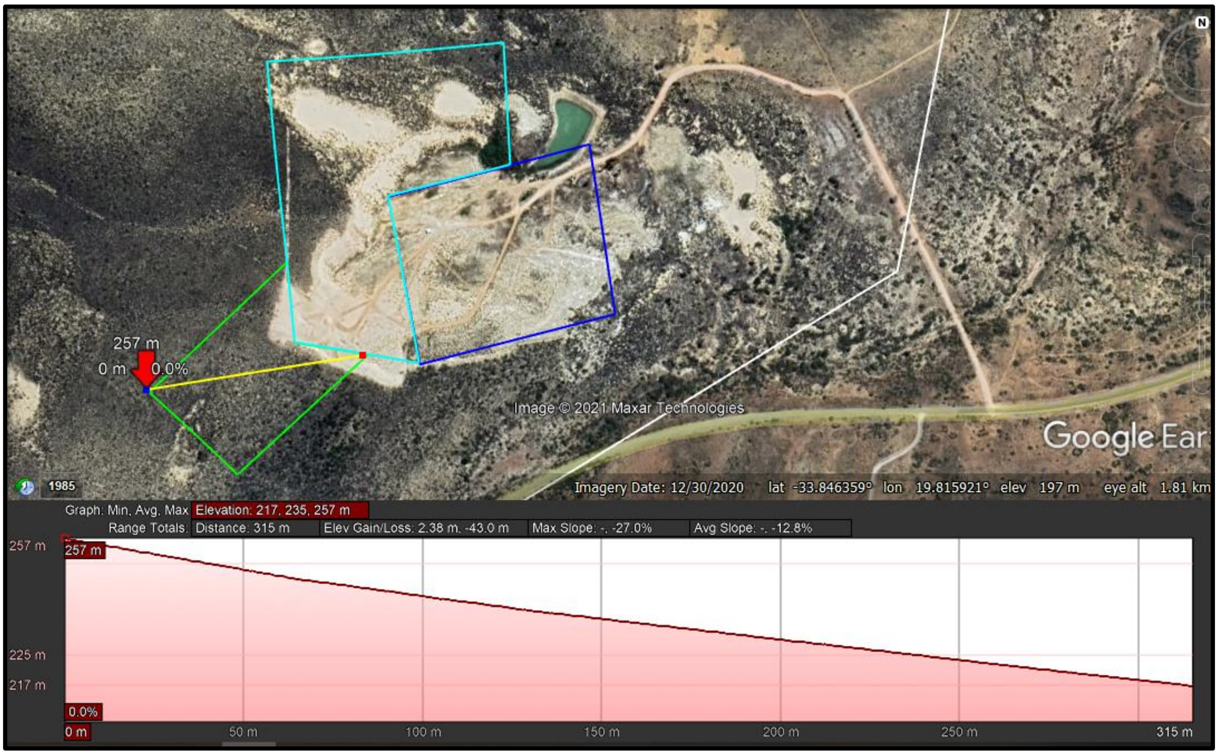

Figure 5: Elevation profile of the Site Alternative 1 (image obtained from Google Earth).

The topography of Site alternative 2 steeply slopes up the dune from the existing mining footprint, from 238 masl (eastern corner) rising to a maximum of 316 masl at the western corner over a distance of 335 m. The earmarked footprint has an elevation gain of 80.0 m, with a maximum slope of 40.4%, and an average slope of 22.8% between the lower eastern corner and the higher western corner as shown in the following figure.

Figure 6: Elevation profile of the Site Alternative 2 (image obtained from Google Earth).

Site alternative 3 gradually rises- up the dune from the lower southern part, from 231 masl (south-eastern corner) rising to a maximum of 289 masl at the north-western corner over a distance of 414 m. The earmarked footprint has an elevation gain of 80.0 m, with a maximum slope of 37.9%, and an average slope of 14.1% between the lower south-eastern corner and the higher north-western corner as shown in the following figure.

Figure 7: Elevation profile of the Site Alternative 3 (image obtained from Google Earth).

Hydrology:

The study area is located within the Upper Breede Sub-Water Management Area which is managed as part of the Breede Water Management Area by the Department of Water and Sanitation (DWS). Portion 4 of Zandberg fontein 97 falls within the H40J quaternary catchment. There are no dams, rivers or wetlands in the proposed extension footprint (S1/S), however it extends over an area classified as a Phase 2 FEPA (Freshwater Priority Area) according to the National Wetlands and NFEPA map of SANBI.

The EMPR of the mine notes that water is in evidence as a leachate at the tow of the dune. This is due to a perched water table caught in the sand overlaying the sandstone formation of the area. The seepage naturally occurs all along the foot of the dune with a clearly defined water course (drainage line) in evidence (opposite the road). According to the EMPR, the sand dune is classified as an unconfined phreatic aquifer located above the regionally extensive aquifer. A feature of phreatic aquifers is that they release large quantities of water by drainage through the pores of the aquifer. In this case the border of the sand dune. Because there is no aquitard confining the water, this drainage typical continues up to the drainable porosity of the aquifer material. The visible effect of drainage is more pronounced in the winter rainy season. No evidence was found that there is a cone of depression in the groundwater formed by the mining activities, normally visible through vegetation distress (or failing of boreholes).

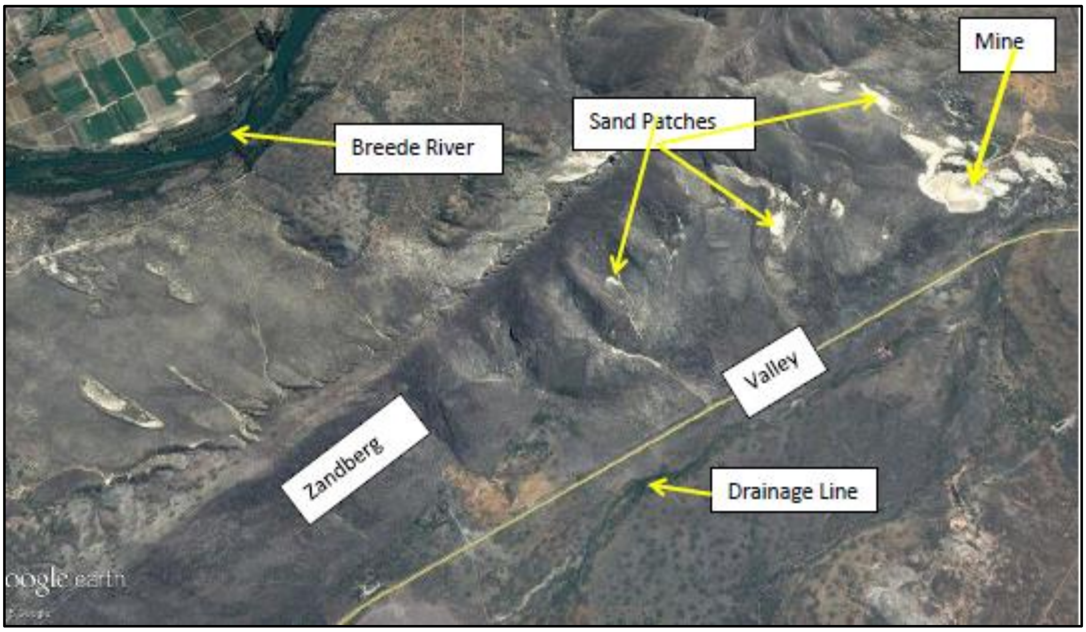

Figure 8: Image obtained from the Wetland Delineation Report that shows the drainage line on the opposite side of the La Chasseur/Agter-Kliphoogte road (WATSAN Africa, 2016).

In 2021, Afzelia was appointed to undertake a watercourse delineation and habitat assessment (WDHA) (inclusive of a DWS Risk Assessment) of the proposed extension areas (S1 – S3), with the main focus of the study placed on S3. The infield- and desktop watercourse delineation confirmed the presence of two wetland habitats within the 500 m DWS regulated area (see following figure). The wetlands were classified as an artificial wetland habitat (Unit AW1) and a unchannelled valley bottom wetland (UCVB1). The AW1 was evaluated as being at a high risk of being impacted by the proposed development, whilst the UCVB1 was at a low risk. The specialist also recorded an artificial off-stream dam (AD1) that was being used as a source of water.

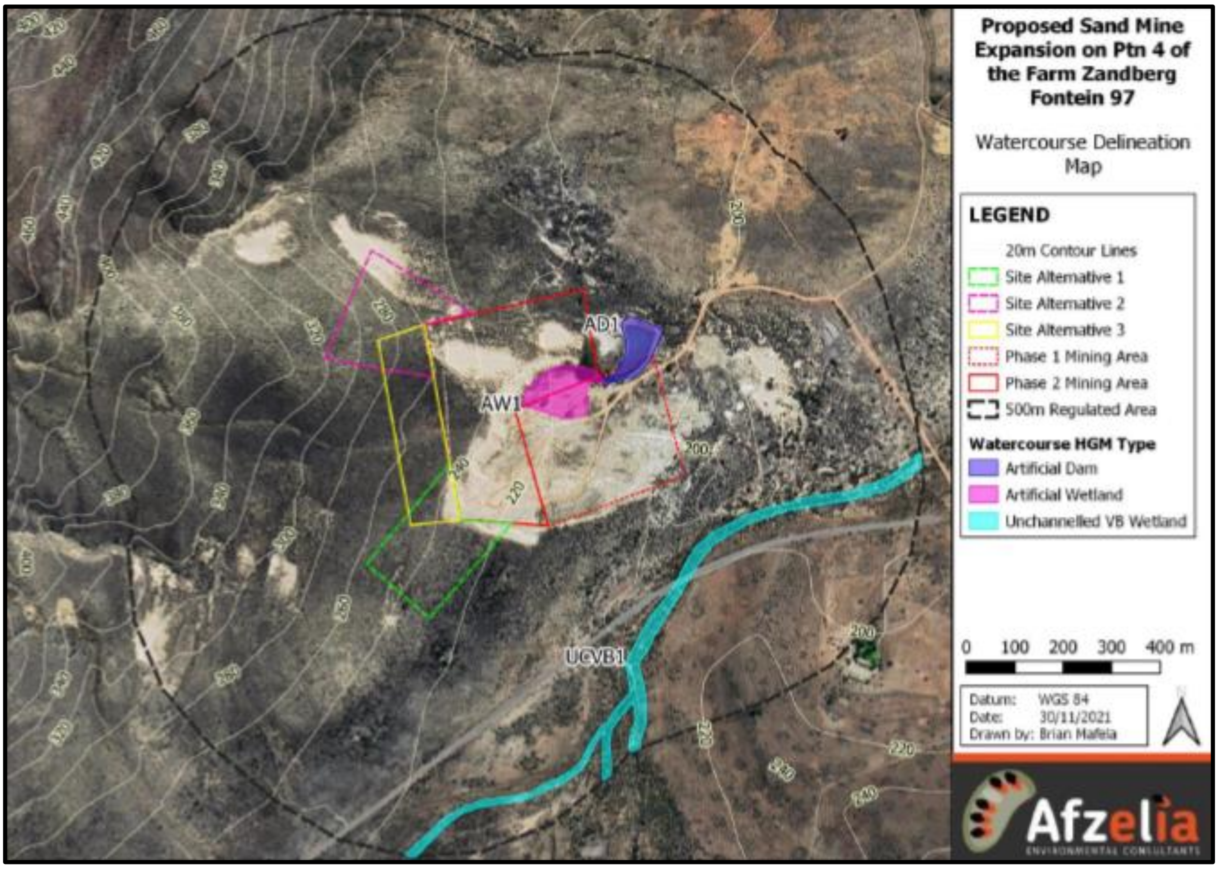

Figure 9: Watercourse delineation and classification map (Afzelia, 2021).

The above figure shows that both AW1 and UCVB1 fall outside the proposed extension areas (S1 – S3) and will therefore not be affected by the expansion of the mining footprint (refer to the WDHA attached as Appendix G3 for an assessment of the identified units). Although mining in the extension areas will not affect the identified wetland units, the specialist did propose a buffer area of 15 m that must be maintained around the footprint of AW1 to prevent trucks and/or equipment driving through/parking in the area. This recommendation was added to the mitigation measures proposed in this report.

The WDHA (2021) concludes that no watercourse was identified within the footprint of S3, and therefore expanding the mine towards the west into S3 will not result in the transformation of any watercourse. Afzelia notes that implementation of recommended standard best practice mitigation measures (as included in the EIAR & EMPR) will reduce the potential impacts to either negligible or low significance. It is the opinion of Afzelia that the proposed expansion of the Zandberg mine meets environmental requirements as far as watercourses are concerned and therefore should be approved provided all other environmental requirements are met.

If the earlier discussion regarding groundwater is applied to the proposed extension of the mining area (S1-S3), it is noted that the water table, in the valley below the mining area (±197 masl), is ±3 m below ground level. The MR Holder proposes to mine the sand resource up to the underlying sandstone layer that gradually inclines up the hill. The sandstone layer will be the limiting depth of the proposed mining activity, and no mining will be allowed into/below it. In order to avoid impacting on infiltration, groundwater recharge and flow, the Department of Water and Sanitation (DWS) generally stipulates that sand mining not be allowed within 1.5 m of the groundwater level. As the groundwater level is ±3 m deep in the valley below the mining area, it is not expected that mining the sand from the proposed extension area (S2 or S3) will intercept (or come within 1.5 m) the groundwater layer if the mining depth is limited to the underlying sandstone layer.

5. EROSION RISK

The removal of vegetation and disturbance of soil, makes an area vulnerable to erosion. Erosion occurs as flowing or falling water picks up particles of soil, gravel, stone or rock. A lack of roots within soil makes it easier for it to be lifted by water. Vegetation also serves to slow the speed of water, and a lack of vegetation means that falling rain and flowing run-off has more energy to pick up greater volumes and sizes of particles. Bare soil therefore is prone to be washed away and bare areas facilitate erosion downstream.

At the proposed mining area downslope erosion, during the operational phase, can be caused by run-off accumulation from the mining excavation. Water running from denuded areas contains higher sediment loads, and therefore, channelled run-off from active or un-rehabilitated mine areas must be slowed and controlled. By planning the layout and position of the excavation with a sufficient erosion and rehabilitation plan in place the potential for erosion to occur can be maintained to an absolute minimum and localised, avoiding such impact to the surrounding areas.

As mentioned earlier, MLB reported that if the extension area (S1/S2/S3) is developed in accordance with the recommendations of the specialist, the overall slope of the mining footprint is predicted to remain stable and the potential for circular failure is regarded as low.

6. STORM WATER MANAGEMENT

In order to adequately manage the storm water at the mining area, the following mitigation measures must be implemented for the duration of the site establishment-, operational- and decommissioning phases:

- Mining must be conducted only in accordance with the Best Practice Guideline for small scale mining that relates to storm water management, erosion and sediment control and waste management, developed by the Department of Water and Sanitation (DWS), and any other conditions which that Department may impose:
  - Clean water (e.g. rainwater) must be kept clean and be routed to a natural watercourse by a system separate from the dirty water system. Prevent clean water from running or spilling into dirty water systems.
  - Dirty water must be collected and contained in a system separate from the clean water system.
  - Dirty water must be prevented from spilling or seeping into clean water systems.
  - The storm water management plan must apply for the entire life cycle of the mine and over different hydrological cycles (rainfall patterns).

- Site management must ensure that the 15 m buffer area around the artificial wetland (AW1) is maintained in a suitable condition with a well-developed vegetation covering (roughage). Monthly monitoring of the buffer areas must be done.

- Phased mining and vegetation clearance must be done. No vegetation outside of the active layer may be disturbed until it is time for that specific area to be mined. Furthermore, upon finishing a layer, immediate rehabilitation must occur wherein a stable vegetation cover is established in accordance with the Closure Plan.

- Storm water must be diverted around the topsoil heaps and mining areas to prevent erosion.

- Soil that are to be removed must be done so at right angles to the slope, as this will slow down surface runoff and help to prevent erosion.

» When mining within steep slopes, it must be ensured that adequate slope protection is provided.

» During mining, the outflow of run-off water from the mining excavation must be controlled to prevent down-slope erosion. This must be done by way of the construction of temporary banks and ditches that will direct run-off water (if needed). These must be in place at any points where overflow out of the excavation might occur.

» Where possible, storm water (and road-surface run-off) must be redirected towards the surrounding vegetated areas to increase groundwater infiltration, thereby providing sufficient soil moisture to support the vegetation cover (ensure that this water is slowed down, not channelized and spread out across the surface in order to prevent this water flow from causing erosion – where erosion signs are present prompt actions and measures should be taken to rehabilitate these areas and prevent erosion from occurring in these areas in the future).

» No mining may extend into/below the underlying sandstone layer.

» Roads and other disturbed areas within the project area must be regularly monitored for erosion and problem areas must receive follow-up monitoring to assess the success of the remediation.

» Any erosion problems within the mining area as a result of the mining activities observed must be rectified immediately (within 48 hours) and monitored thereafter to ensure that it does not re-occur.

» Silt/sediment traps/barriers must be used where there is a danger of topsoil or material stockpiles eroding and entering downstream drainage lines and other sensitive areas. These sediment/silt barriers must regularly be maintained and cleared so as to ensure effective drainage of the areas.

» If there is any channelled run-off from active or un-rehabilitated mine areas it must be slowed down by installing temporary sediment traps, such as small sand bag impoundments. These impounding structures must still allow all water to return to the natural river channels, and may not be used to capture additional water for agricultural purposed.

- Mining activities must be reduced after large rainfall events when the soils are wet. No driving off of designated hardened roads may occur immediately following large rainfall events until soils have dried out and the risk of bogging down has decreased.

- Areas cleared of vegetation must weekly be monitored, after larger rainfall events, to determine where erosion may initiate. These areas must be reinstated by modifying the soil micro-topography and revegetation or implementing soil erosion control efforts accordingly.

- All bare areas, due to mining, must be revegetated as soon as possible with a cover crop to bind the soil and limit erosion potential.

- Site management must implement good housekeeping practices and prevent leakage of hydrocarbons or other chemicals, and strictly prohibit littering of any kind.

- The storm water management plan must be reviewed biennially and adjusted to reflect the specific site conditions relating to storm water control.

7. REHABILITATION

Rehabiliation of the mining area must be in accordance with the closure objectives and actions listed in the EMPR and Closure Plan of the mine. In the medium term, progressive rehabilitation of mined areas must be done and must include the following closure objectives:

- The bench height may not exceed 10 m, the width must be 20 m, and an over slope angle of ~16° must be maintained (bench face angle of ~27°).
- Replace the stockpiled topsoil evenly over the mined-out area to a depth of 500 – 1 000mm;
- Reduce any steep slopes at the edges of excavations to a minimum and profile it to blend with the surrounding topography;
- Seed the reinstated area with a seed mix of native seeds including annuals and perennials to diversify rooting depths;
- Control invasive plant species for at least one growth season;
- Monitor the area for erosion until vegetation established.

Upon final closure of the mine, the Right Holder will commence with the reinstatement of the final layer and removal of the chemical toilet from site. The right holder will also comply with the minimum closure objectives as prescribed by DMRE and listed in the Closure Plan (attached as Appendix M to the Environmental Impact Assessment Report).

8. SIGNATURE OF AUTHOR

NAME	SIGNATURE	DATE
Christine Fouche		13 January 2022