TECHNICAL MEMORANDUM

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TO:	Mr. Nevin Rajasakran	**DATE:**	18 February 2015
FROM:	Sifiso Dlamini	**JOB NO:**	13096
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RE:	Koffiefontein mine fine residue facility site screening assessment		

Pedra Diamonds Koffiefontein mine appointed Zitholele Consulting (Zitholele) to carry out the conceptual design of the new fine residue storage facility (FRSF). The location of the FRSF will be assessed with the primary focus of identifying site alternatives within the mine boundary by through assessing sites that were identified and recommended by the mine environmental and engineering teams and also the additional sites identified by the Zitholele design team.

The approach Zitholele will follow in order to select the preferred site will be as follows and diagrammatically shown in Figure 1:

- Complete a site screening study of the site options identified to eliminate the sites that do not comply with the general requirements;
- Site selection workshop to identify the preferred and the second best sites based on the remaining sites from the screening process. This will involve a site ranking and rating to identify the most likely socially and environmentally acceptable sites and also the technical or engineering assessment and suitability of each site.

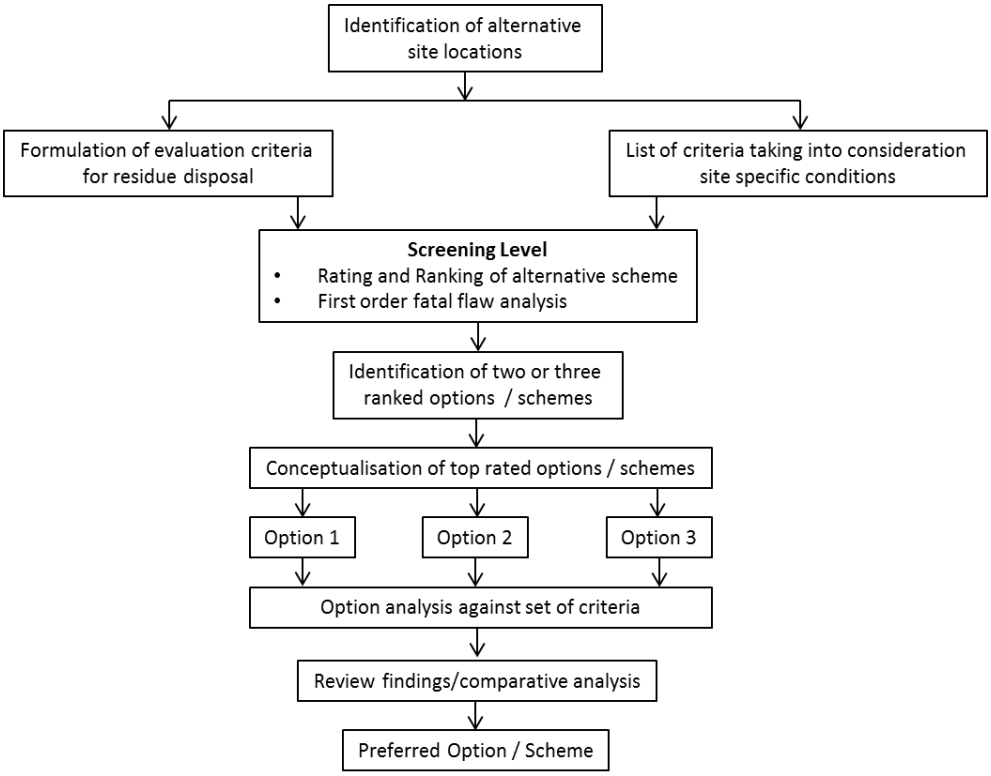

Figure 1: Screening and site selection of preferred site option process

Design criteria

The preliminary criterion to be adopted for the screening study considers the basic requirements of the FRSF including the life of mine, plant throughput, and expansion and phasing potential of the site, etc. The design criteria information is benchmarked against the operating philosophy of the existing FRSF and experience on similar projects.

Parameter	Value
Life of mine	20 years
Deposition rate	Nominal = 62 400 tpm Average = 125 000 tpm Maximum = 208 334 tpm
Total tonnage	Nominal = 15 Mt Average = 30 Mt Maximum = 50 Mt

Rate of rise	1 m/yr
Dry density	1.2 t/m^3
*Footprint size requirements	Nominal = 62.4 ha Average = 125 ha Maximum = 209 ha
FRSF embankment raise	Upstream, self-raise
Deposition method	Spiggot
Return water dam requirements	Use existing RWD
Applicable standards	SANS 0286

*These values only consider the basin footprint and without the height requirements of the FRSF.

From discussions with the mine engineering team during the site visit, it was noted that the plant is currently operating at a throughput of 1.5 Mtpa but was designed for a throughput of 2.5 Mtpa. At a later stage, the decision may be taken to reprocess the TSF's and improving the capability of the plant, to ultimately allow for 2.5 Mtpa throughput. Therefore the new FRSF needs to be flexible to extension, in a phased approach to allow for the additional storage capacity for the life of mine.

For the site screening exercise, it was assumed that the existing return water dam (RWD) is adequate for the FRSF expansion. This assumptions needs to be checked via the water balance, more specifically when the tonnage profile is increased when the plant is operating at optimal capacity to ensure that the facility complies to the requirements of the National Water Act No.36 of 1998 – GN704. However, there is an opportunity to create additional capacity by raising or creating an embankment around the dam. If the capacity of the RWD is inadequate, the inlet of the facility needs to be evaluated as well.

Site alternatives

A total of five sites have been identified to be assessed through the screening process, as shown in Figure 2

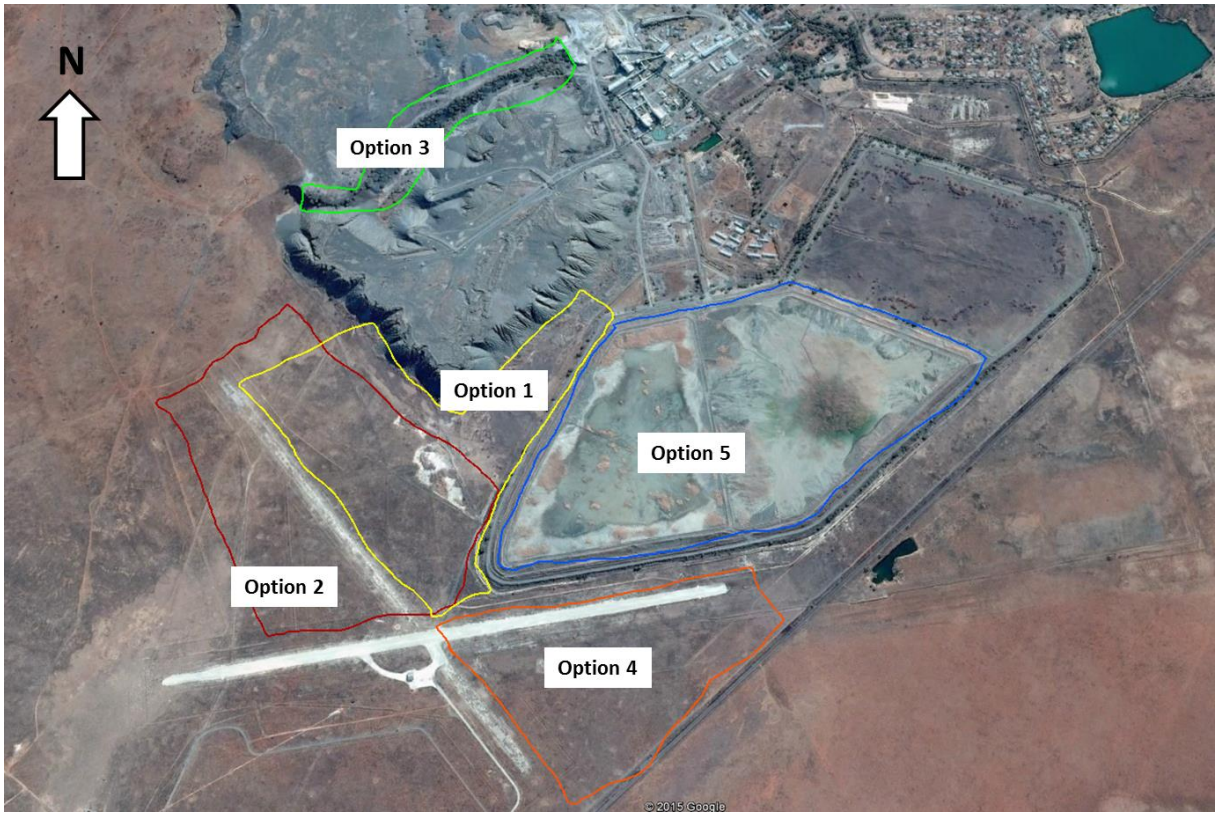

Figure 2: FRSF site alternatives for screening study

Option 1: Located approximately 1.3 km south west of the plant, between the mines tailings storage facilities (TSF) and existing FRSF. This site is 41 ha in size.

Option 2: Located 1.6 km south west of the plant, west of the TSF and existing FRSF. This option is 52 ha in size.

Option 3: Located approximately 0.5 km west of the plant, flanked by the mines tailings storage facilities (TSFs) and 27 ha.

Option 4: This site is 2 km from the plant, south of the existing FRSF and adjacent to the N1 road, and located on the eastern section of the landing strip. The footprint is 53 ha.

Option 5: This alternative is the raise of the existing FRSF to a much higher elevation than currently planned and designed for. The facility is located 1 km south west of the plant and is 87 ha in size.

Note that the distances from the plant are based on the distance from the central part of the sites to the thickener of the plant.

FRSF options technical screening

The FRSF site options will be technically assessed and screened based on the preliminary review of the geology and topographic mapping for the area. At this stage each option will be reviewed with respect to site suitability and engineering elements such as distance from plant site and ease of expansion or phasing to assist in deferring excessive capital

expenditure, while taking operation of the facility into consideration. The sites will be screened with respect to the following broad environmental, social and technical characteristics:

- Engineering
    - Geological/hydrogeological factors
    - Geotechnical factors
    - Area requirements
    - Topography
    - Accessibility
    - Required storage capacity for the life-of-mine fine residue production
    - Potential for FRSF expansion
    - Distance from the plant
    - Low consequence of failure
    - Infrastructure upgrade or requirements
    - Sterilising of future ore / tailings material
- Environmental
    - Impact on the natural environment
    - Impact on social environment/position of the local communities.
    - Location within the same sub-catchment area of other mine facilities to limit the area impacted
    - FRSF's Catchment areas
    - Zone of influence
- Social
    - Surrounding communities
    - Wind direction and impact
    - Groundwater impact to the surrounding communities
    - Zone of influence

Catchment Area

The catchment area outside of the FRSF is used as an indicator of the quantity of surface water control features required, such as diversion trenches and spillways required to protect the natural water quality. Variations in topography and hydrology also influence the requirement for water control features. Due to no agricultural land and activities within the FRSF alternatives catchments, the incidence of suspended sediments within flood runoff water is envisaged to be low.

Geotechnical and geological conditions

Distance to the plant

Distance from the plant reflects the cost for providing pipes to deliver the slimes from the thickener underflow to the FRSF and also the return of supernatant from the FRSF to the existing RWD including the associated pumps.

Expansion ease and other factors

Ease of expansion is the ability of the FRSF to store additional fine residue (with higher embankment elevations or and larger footprint) provided the facility will meet the storage capacity requirement of 15 Mt. It also indicates the ability of the FRSF to handle variations in storage capacity due topographical errors, fines density, decisions in terms of re-mining the existing FRSF, etc. In terms of access, all sites have good access with minimal obstruction to access, except option 3, which may be hindered from access by the two TSF's.

FRSF site alternatives environmental screening

Characteristics	**Option 1**	**Option 2**	**Option 3**	**Option 4**	**Option 5**
Footprint size	41 ha	52 ha	27 ha	53 ha	87 ha
Distance from the plant	1.3 km	1.6 km	0.5 km	2 km	1 km
Topography	Fairly flat	Fairly flat	Fairly flat	Fairly flat	Fairly flat
Founding conditions					
Expansion potential	Yes	Yes	No	Yes	No
*Surrounding infrastructure	TSF and slimes dam	TSF and slimes dam	TSFs and plant	N1 road and slimes dam	TSF, east compartment slimes dam and plant
Phased development	Feasible	Feasible	Not Feasible	Feasible	Not Feasible / Not applicable
Vegetation					
Consequence of failure (Impact)	Moderate	Moderate	High	Low	Moderate

Tailings disposal options preliminary assessment

It is recommended that the current disposal method (hydraulic disposal, spray bar method) is adopted for the new FRSF system because of the following

- Changing the disposal method has the consequence of additional plant infrastructure meaning capital requirements for this infrastructure. For example, for thickened tailings, either a paste plant or a deep cone thickener, with associated PD pumps and pipelines would be required if this disposal method is adopted, even though the make-up water for the plant would be reduced.
- Additional training of FRSF operating stuff would require additional training on the different deposition method and risk associated with the facility
- Utilising the existing slurry pumping system will be eliminated

References

"Fine Residue Storage Facility Preliminary Life of Facility Assessment" Technical Memorandum TM 5336 02 2013, 4 March 2014

"The Engineering Design, Operation and Closure of Metalliferous, Diamond and Coal Residue Deposits" Volume 1/1979 (Revised 1983 and 1995) Chamber of Mines of South Africa, March 1996.

"Code of Practise: Mine Residue" South African National Standards (SANS) 0286, 18 September 1998.

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