PROPOSED

KANGALA COLLIERY

CONCEPTUAL STUDY REPORT

Ref: 602 Kangala
Date: 29June 2010
Tel: (011) 476-4266
Cell: 0826 10 12 23
www.alanrobinson.co.za

ALAN ROBINSON
CONSULTING GEOTECHNICAL ENGINEERS
P O BOX 2861
NORTHCLIFF
2115

PROPOSED

KANGALA COLLIERY

CONCEPTUAL STUDY REPORT

CONTENTS

PROPOSED
KANGALA COLLIERY

CONCEPTUAL STUDY REPORT

EXECUTIVE SUMMARY

A Conceptual Design has been carried out on the proposed civil infrastructure for the 10 million tons of discard and slurry produced at the proposed Kangala Coal mine near Delmas. The purpose of this report is to provide design information for the conceptual phase of the project.

This report specifically covers the conceptual design of the discard dump and associated storm water control measures, using the preliminary assessment of the flood lines in the vicinity of the open pits, and discards heaps, as provided by Digby Wells Associates (DWA).

The discard facilities for the 15 years life of the mine (LOM) have been sized for 10 million tons of coarse and fine discard. The dump will be operated as a co-disposal facility.

An alternative option to consider is to only transfer to the discard disposal facility the minimum amount of material required to build the slimes ponds. With approval the remainder of the coarse discard can be returned to the open pit, and used as fill material. The effect of this option is that the overall footprint of the discard facility is significantly reduced. This option could be studied further during the feasibility phase, in consultation with the environmental consultants.

In terms of the flood lines, the pits which are affected by the adjacent rivers should either be curtailed in footprint size, or measures taken to improve safety in the pit by the construction of berms along the perimeter, or river realignments to cater for the 1:50 year storm flows.

An assessment of the water balance of the discard facility, and the two open pits will be carried out as part of the preliminary design phase of the project.

A composite seepage barrier with lining and under drains will be placed beneath the discard facility to prevent seepage from reaching the underlying Dolomitic aquifer.

The return water dams will be HDPE lined to minimize seepage, and to contain all storm water runoff from the average rainfall, plus the 1:100 year 24 hour storm, with 0,8m freeboard.

A cost estimate for the infrastructure will be presented at the Preliminary Design stage to give some indication of the expected construction costs for the various facilities related to the discard handling.

- O O -

PROPOSED
KANGALA COLLIERY

CONCEPTUAL STUDY REPORT

1. SCOPE OF WORK

A Conceptual Design has been carried out on the civil infrastructure for the 10 million tons of discard and slurry produced at the proposed Kangala Coal mine near Delmas. The purpose of this report is to provide Conceptual Design information for this project, for the 15 years LOM.

This report specifically covers the conceptual design of the discard dump and associated storm water control measures, together with a preliminary assessment of the flood lines in the vicinity of the open pits, and discards heaps, as provided by DWA.

An alternative option to consider is to only transfer to the discard disposal facility the minimum amount of material required to build the slimes ponds. With approval from the Department of Mineral and Energy (DME) the remainder of the coarse discard can be returned to the open pit and used as fill material. The effect of this option is that the overall footprint of the discard facility is significantly reduced. This option could be studied further during the pre-feasibility phase, in consultation with the environmental consultants.

2. SITE SELECTION AND SIZING

The rationale for the selection of the location of the discard dump is as follows:

- There is a high level of confidence that the selected areas do not fall within areas of mineable resources
- The areas are in close proximity to the proposed location of the processing plant and possible rail loop
- The topography is suitable in terms of surface gradients to accommodate pollution control measures
- The areas are unaffected by wet lands and associated flood plains

3. DESIGN CRITERIA

- Dump Slope 1:2,8
- Max Dump Height (m) 26
- Design Storm recurrence 1:50
- Min. factor of safety 1,3
- Slurry pool free board (m) 1,0
- Slurry Density (t/m^3) 1,15
- Discard Density (t/m^3) 1,95
- Discard Capacity (x 10^6 tons) 10
- Slurry (%) 10
- Product Yield (%) 57
- Plant on Coal (hours pa) 6000
- ROM (x 10^6 tpa) 1,5

4. WASTE DISPOSAL

The waste disposal area has been designed to hold the slurry pool within an outer wall of coarse discard. The various components and layout are shown on the drawings and comprise the following:

- Clean water diversion trench/bund wall
- Dirty water/leachate interception drains and filters
- Return Water Dam

4.1 Production Rates

The co-disposal facility has been sized to contain 10 million tons of coarse and fine discard. The quantities of deposition and properties are given below based on 10% slurry.

Based on 1,5 million tpa ROM, with a 57% product yield, the lump discard quantity is 495 000 tpa, and slurry is 150000 tpa. Thus the life of the proposed dumps is 15 years.

4.2 Construction

The "footprint" of the discard area is approximately 32 ha in extent, and the outer coarse wall is to be constructed in phases so as to maintain stability and freeboard at all times.

The drawings in Appendix A provide details of the proposed layout, which involve the following:

Phase I – Construct a compacted earth wall to act as a starter wall on the north-eastern perimeter of the proposed slurry pool.

Phase II – Raise the main body of the coarse discard by making use of a lower "bench" to maintain stability.

Phase III – Place the final "outer" zone of the coarse discard, to the "footprint" shown on the drawings.

The maximum height of the dump is in the order of 30m which may be placed in two platforms within 1:2,8 side slopes . The factors of safety will remain in line with accepted practice.

Piezometers will be used during construction to monitor porewater pressure levels, for stability evaluation.

5. HYDROLOGY

5.1 Flood lines

Preliminary Flood lines have been produced by DWA for reaches, where the open cast area and dump area is adjacent to rivers.

The design storm intensities and average rainfall, given in the tables below, will be reviewed as part of the preliminary design.

TABLE 1

Maximum rainfall intensities

24 Hour rainfall depths (mm)		
1:20 Year	1:50 Year	1:100 Year
118	146	170

Where necessary the pits should be realigned or protected with earth berms to contain the flood water encroachment, but it will at all times remain at least beyond the regulation 100m limit from the valley centre.

5.2 Surface Water

The table below summarises typical rainfall and evaporation data for the Delmas area, which will be reviewed at the preliminary design stage.

TABLE 2

Average monthly rainfall and evaporation - mm

Month	Rainfall	Evaporation
January	124	230
February	97	175
March	74	186
April	46	147
May	17	128
June	8	96
July	8	85
August	8	122
September	26	134
October	72	171
November	116	239
December	114	237
Total	**710**	**1950**

6. DESIGN OF DISCARD DUMP

6.1 Water Balance and Decant System

A water balance will be carried out to assess the water utilisation at the site, and how the proposed co-disposal area will interact with this resource, as part of the preliminary design phase.

A penstock outlet will be constructed within the slurry pond and the "free" water decanted into the Pollution Control Dam (PCD) through a 400mm steel pipe laid to a fall of at least 1:200.

6.2 Seepage Control

Because some seepage is likely to occur through the base of the discard area, a composite liner and drainage will be provided for the leachate which will then be led into the PCD, from where it will be pumped back to the plant for reuse. (See drawings for details).

6.3 Storm water Control

As shown on the drawing the open drains and berms separate the 1:100 "clean" water runoff, from the 1:50 "dirty" water, to divert clean run-off around the PCD's and discard dumps.

The PCD's will be sized to collect the average dirty run-off from the dump and expected ingress into the open cast areas, plus the 1:100 24 hour storm. It will also act as a

reservoir for the plant water requirements.

6.4 Capping

In order to assist in the dump rehabilitation, and prevention of spontaneous combustion, the discard will be covered with top soil, as the dump is constructed, as shown on the drawings.

7. OPEN PITS

The open cast areas which are envisaged will be treated as described below.

7.1 Water Balance

The water which accumulates in the open pit as a result of seepage and rainfall will be pumped to surface, routed through the relevant PCD and pumped back to the plant.

7.2 Storm water Control

As shown on the drawing the open drains and berms separate the "clean" from the "dirty" water, as described above.

7.3 Seepage

The groundwater seepage into each pit will be quantified by DWA. This may be up to 1000m3/day. The PCD's will be sized to ensure that it can accommodate this inflow.

8. POLLUTION CONTROL DAMS

8.1 Seepage Control

The PCD's will be lined with a 2,0 mm HDPE liner, underlain by subsurface drainage to intercept any leakage, which will be pumped back into the dam.

8.2 Storm water Control

The storage spaces will be formed by excavating into the virgin subsoils, to create the

required capacity, in a balanced "cut and fill" operation.

All the dirty water run-off which accumulates on and around the dumps, plant and within the pits will find its way into the dams, and storm water will only be stored within the slurry pond in an emergency.

The PCD sizing will be carried out as part of the Preliminary Design and will allow for plant usage.

A Spillway will be provided for from each dam, to cater for the unlikely event of an overflow occurring.

The dams will be separated into individual compartments to assist in cleaning, and water will be allowed to flow between each dam through valved pipelines.

9. RECOMMENDATION

A Geotechnical investigation should be undertaken as part of the **detailed** design of the PCD's, and discard facilities.

10. CAPEX COSTING

A cost estimate will be given for the various components of the infrastructure, during the Preliminary Design stage.

11. RISK

The following risks should be taken into account during the design:

11.1 Flood Lines – these have been presented based on 20m contours, and will need to be refined when aerial survey data is available.

11.2 Geotechnical Conditions – the maximum dump height and footprint as well as the positions of the PCD's may need to change, based on the soil conditions encountered on site.

12. CLOSURE ASPECTS

The following extract is taken from the Best Practice Guidelines (BPG 5):

Underground and opencast mine workings will fill up either partially or completely with water over time (slow or fast depending on geohydrological setting) and this water will be contaminated (either for a limited time or in perpetuity). A key element influencing the risk that these processes pose to the water resource is whether or not this contaminated water will decant into the underground aquifers or into the surface water resource and to what extent the natural water resource can assimilate this contamination. The mine workings must, therefore, be considered to pose a potential water related risk until shown otherwise by way of a suitable semi-quantitative or fully quantitative geohydrological and geochemical assessment – see **BPG A5: Water Management for Surface Mines and BPG A6: Water Management for Underground Mines.**

An understanding is required that mine closure is not about greening, but rather long-term pollution control and risk / hazard management. This involves consideration of a range of issues, and a range of possible management strategies.

AW Robinson Pr Eng

APPENDIX A
DRAWINGS

Drawing No.	Title
602/100 Rev 0	Locality Plan (As per DWA)
602/101 Rev 0	Discard Dump and Drain Layout Plan
602/123 Rev 0	Dump 1 Typical Cross Sections
602/201 Rev 0	PCD Typical Construction Details
602/202 Rev 0	PCD Typical HDPE Details

APPENDIX B
CAPEX COSTING (To be completed during the preliminary design stage)

		COST
1.	Clearing and grubbing on site	
2.	Clay cut off drain around dump	
3.	Bulk earthwork for PCD	
4.	Bulk earthwork for discard dump	
5.	Clean water drainage and river diversions and gabions	
6.	Dirty water drainage around dump and pits	
7.	Discard dump under drainage system	
8.	HDPE liner	
9.	PCD under draining system	
10.	Penstock and decant system	
11.	Access road around dump	
12.	Fencing around discard dump	
13.	PCD silt trap at pollution control dam	
14.	Manholes	
	TOTAL	
	P & G 15%	
	CONTINGENCIES 15%	
	GRAND TOTAL (EX VAT)	