

BEESHOEK

WASTE ROCK DUMP REVIEW

SUMMARY REPORT

DRAFT

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List of Report Abbreviations and Definitions

Abbreviations:

ABGM	:	ABGM PTY LTD (Consultant)
MSO	:	Mineable Shape Optimiser (Software)
LOM	:	Life-of-Mine
QA/QC	:	Quality Assurance/Quality Control
NPV	:	Net Present Value
Ogl	:	Original ground level
ROM	:	Run-of-Mine (Mined Ore)
SR	:	Stripping Ratio
Fe In-Situ	:	In-situ Resource metal grade (Fe)
Fe ROM	:	Mining grade/Mill Feed Grade
NPV Scheduler	:	Mine Scheduling and optimisation software
Whittle	:	Mine Optimisation Software
Datamine Studio	:	Geological and Mine planning Software
PEA	:	Preliminary Economic Assessment – study
PFS	:	Preliminary feasibility study
DFS	:	Definitive feasibility study
SAMREC	:	South African Mineral Reporting Codes
RoM	:	Run of Mine (modified ore mined and processed)

Definitions:

Ramp	:	Access road within an open pit
Bench	:	Height of mining ground between safety berms
Berm	:	Catchment area to be left intact for safety and stability
Flitch	:	Interim mining cut or sub-mining bench
Batter angle	:	Bench angle or mining face angle
High Level	:	Less detailed –desktop study level of accuracy

TABLE OF CONTENTS

1. Summary of Review	5
1.1 General	5
1.2 Data and parameters considered	5
1.3 Key criteria for WRD	5
1.4 Waste Rock Dump Designs Reviewed	6
1.5 Geotechnical Review of the WRD designs	12
1.5.1 General	12
1.5.2 Geotechnical Summary	13
2. Summary of Conclusions	14
3. Annexure A	16

TABLE OF FIGURES

Figure 1-1: GF and HF Waste Rock Dump (WRD) Designs - Plan view	6
Figure 1-2: GF Dump North-South Section view (Profile)	7
Figure 1-3: GF Dump East-West Section Profile	7
Figure 1-4: GF Waste Rock Dump Design Criteria	7
Figure 1-5: HF WRD Dump North-South Section Profile	8
Figure 1-6: HF WRD East-West Section Profile	8
Figure 1-7: HF WRD Design Criteria	8
Figure 1-8: Village WRD South Design	9
Figure 1-9: Village WRD South Design Criteria	9
Figure 1-10: Village WRD North Designs	10
Figure 1-11: Village WRD North Design Criteria	10
Figure 1-12: East Pit WRD design	11
Figure 1-13: East Dump (Section Profiles)	11

LIST OF TABLES

Table 1-1: WRD Factors of Safety (FoS)	13
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1. Summary of Review

1.1 General

ABGM PTY LTD - Australia (ABGM) are involved in all the planning activities (medium- and long-range planning) for Beeshoek Mine's deposits. This report is a brief summary of a review completed for the Waste Rock Dump (WRD) designs of Beeshoek mine.

1.2 Data and parameters considered

Beeshoek mine supplied all the topography data, mined survey files and a series of WRD designs completed. The purpose of this report is to review all the supplied data and also obtain a geotechnical analysis of these rock dump designs to finally conclude on the appropriateness of the WRD designs. The following data was received:

- All the topography data as at end of June 2020;
- An updated geotechnical report "Assmang – Beeshoek, Waste Rock Dump Design validation" compiled by Mr. Franz Bruwer of Middindi Consulting PTY LTD;
- All the existing topography data including WRD as they are at end of June 2020;
- 3D DXF solids files of each WRD design.

The data was generally assumed to be in good order. ABGM do however strongly recommend that where new dumps are being placed or where existing WRDs are extended or enlarged, that the Asset Optimization study be reviewed as some of the older open pit areas (thought to have been depleted) do come back into profitable mine plans with export iron ore price assumptions.

ABGM furthermore strongly recommend that where WRD are to be placed over un-mined ground, that these areas be explored to ensure there are no potential future resources that might be covered and therefore possibly rendered sub-economical with any new WRD or extensions of WRD designs.

1.3 Key criteria for WRD

The key criteria when developing WRD designs are typically:

- Angle of rock repose (WRD bench face angle modelled). A good guide for WRD designs is 34 to 36 degrees but could vary depending on the type of waste rock material being dumped and the soil/WRD floor stability but also based on the potential risk factors associated with the location of the WRD;
- Large WRD lift heights – generally 15m to 20m lift heights but where topography is undulating lift heights might be as high as 20m to 30m. A good standard would be approximately 20m lift heights to minimise the potential failure consequence and volume of failure;
- Overall WRD slope is another important design consideration and should also consider the WRD rehabilitation which are mostly dozing, profiling soiling and seeding. If the overall slope is steep it will require a lot more effort and cost to rehabilitate the WRD.

1.4 Waste Rock Dump Designs Reviewed

The WRD's consists of a mixture of material as a result of the various lithology's that make up the waste material at Beeshoek. Based on historic drilling conducted at the mine, the rock mass is made up of the following geological units:

- Overburden;
- Calcrete;
- Paling Shale;
- Quartzites;
- Sishen Shales;
- Banded Iron Stone;
- Manganese;
- Chert Breccia;
- Dolomite.

The following WRD designs were reviewed:

- GF Dump;
- HF Dump;
- East Pit Dump;
- Village Pit Dump South;
- Village Pit Dump North.

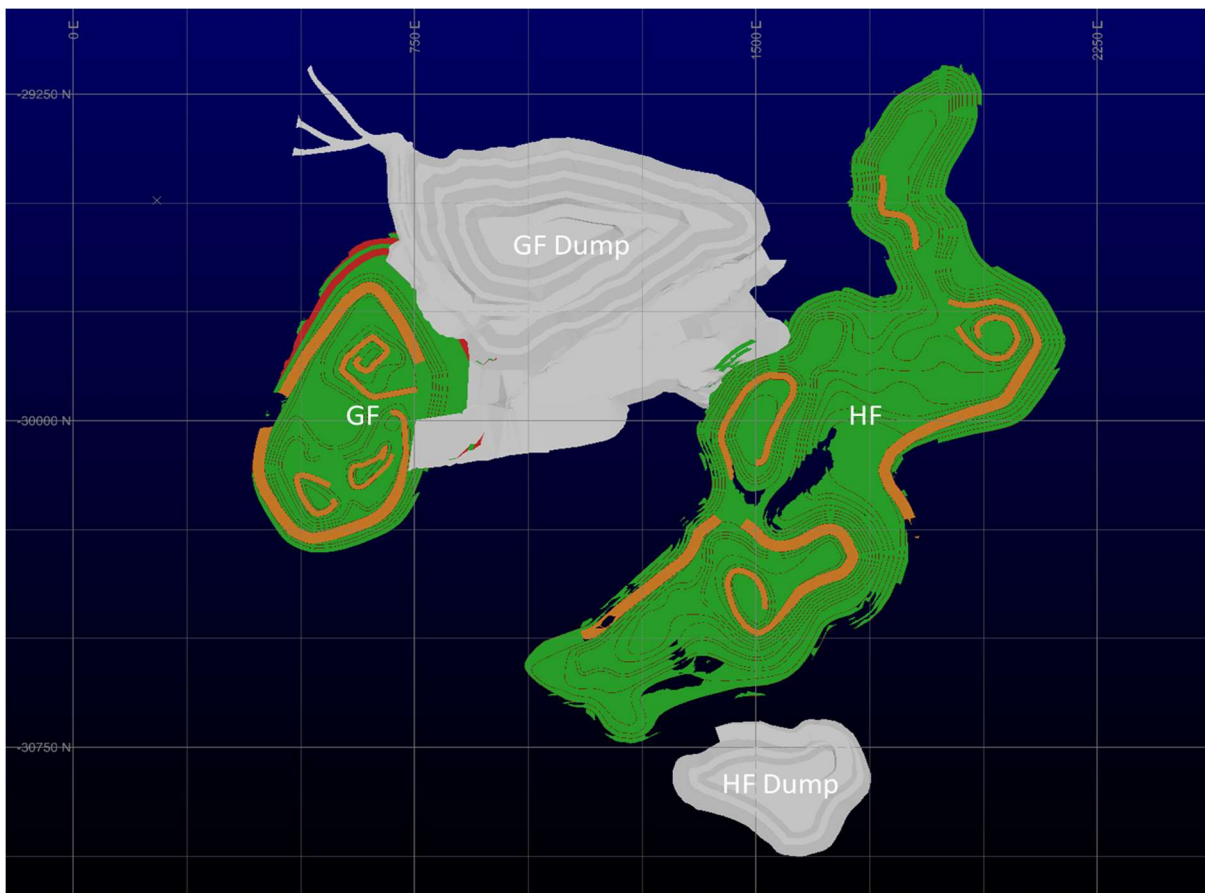


Figure 1-1: GF and HF Waste Rock Dump (WRD) Designs - Plan view

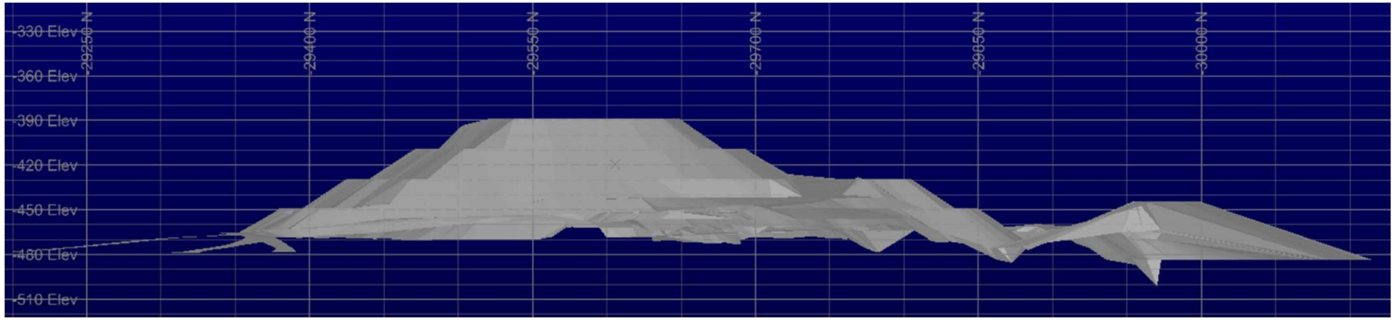


Figure 1-2: GF Dump North-South Section view (Profile)

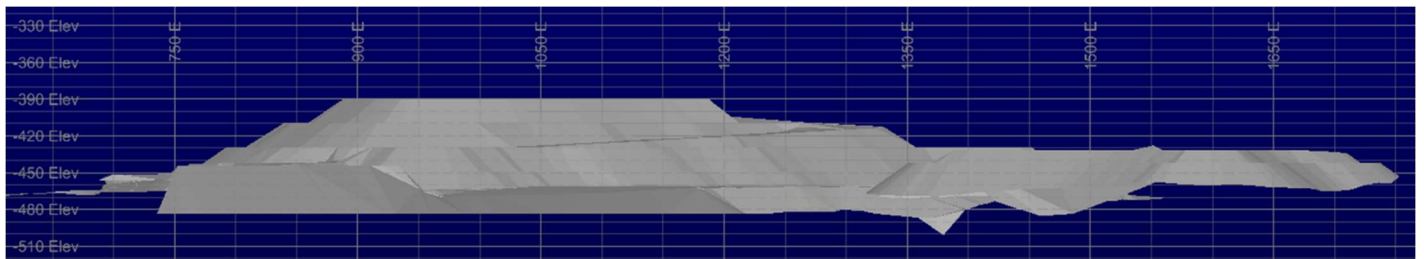


Figure 1-3: GF Dump East-West Section Profile

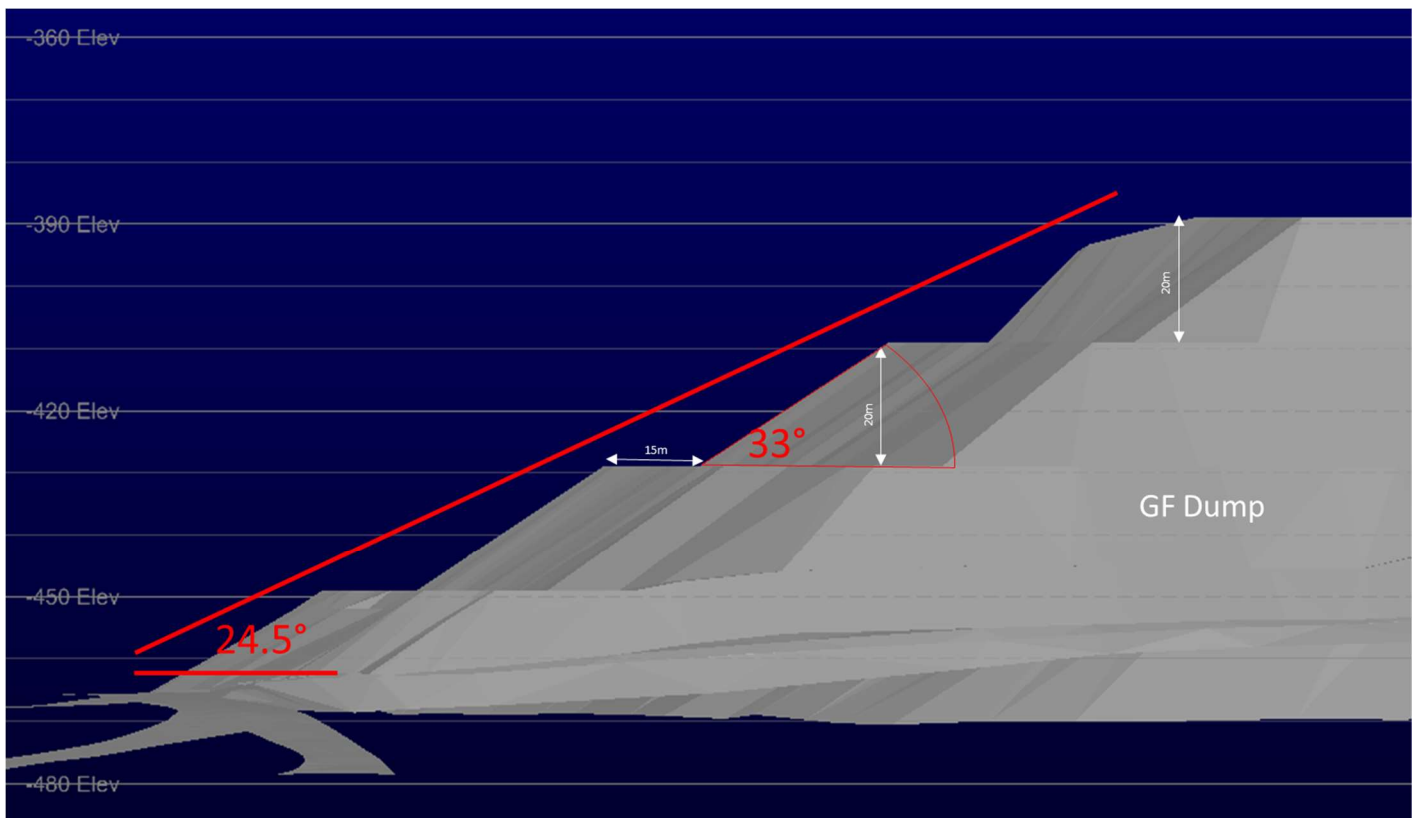


Figure 1-4: GF Waste Rock Dump Design Criteria

The GF WRD is a large rock dump and have a maximum height of approximately 81.5m. The design criteria are in-line with typical WRD designs and the angle of repose seems very reasonable. The average total slope of the WRD design angle is approximately 24.5 degrees, with bench angles (repose) of approximately 33.7 degrees.

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Page 7 of 16

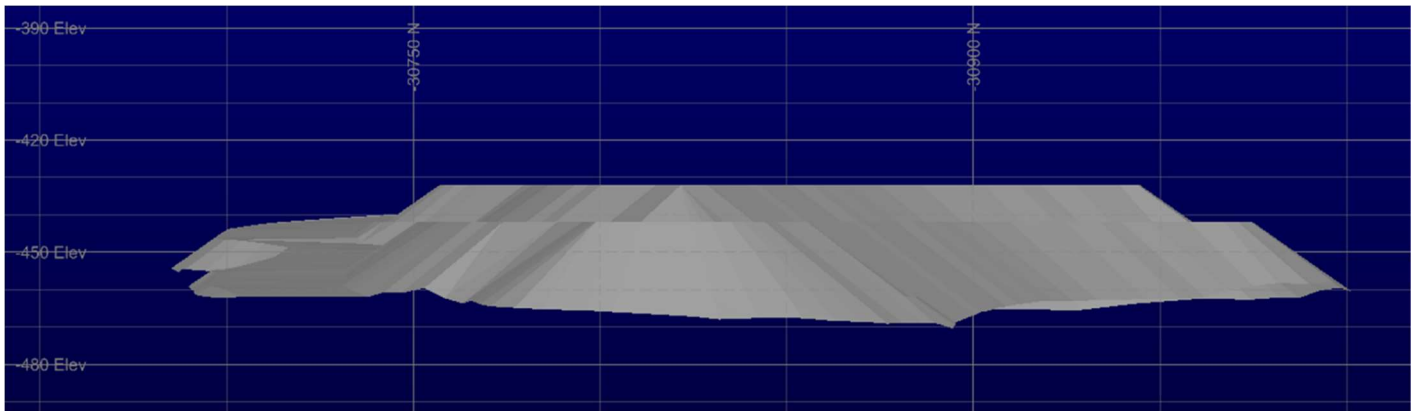


Figure 1-5: HF WRD Dump North-South Section Profile

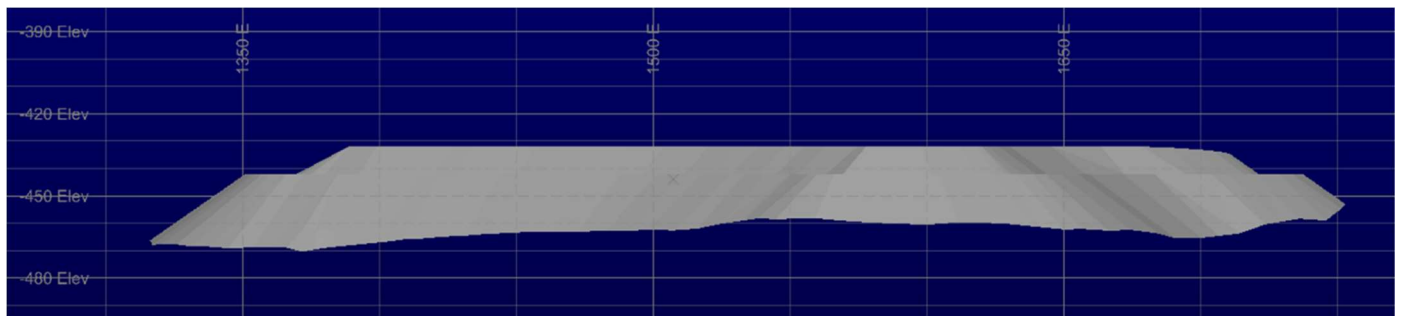


Figure 1-6: HF WRD East-West Section Profile

The HF WRD have a maximum height of approximately 40m with the average dump height of approximately 38.37m. The design criteria are in-line with typical WRD design criteria and the angle of repose seems very reasonable. The average total slope angle is approximately 26.8 degrees, with bench angles (repose) of approximately 34.5 degrees. There seems to be potential for more waste to be placed on another lift on this WRD and the berm width and top lift face angle could be optimised to add more rock onto this dump if needed.

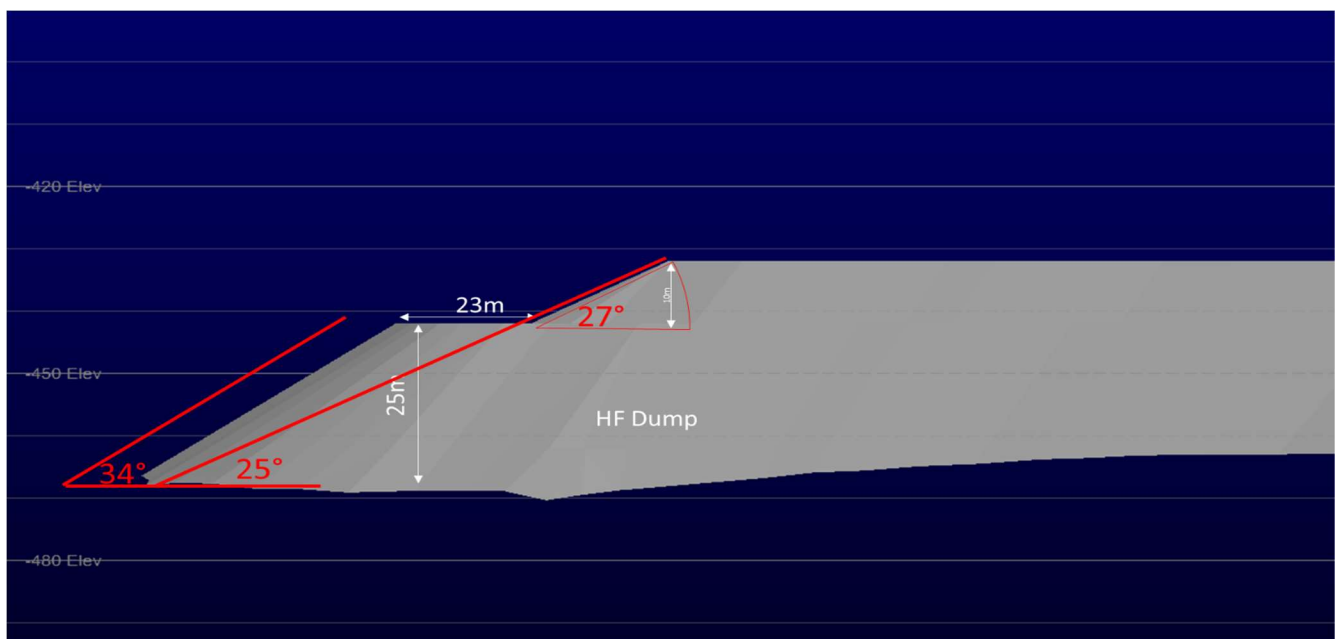


Figure 1-7: HF WRD Design Criteria

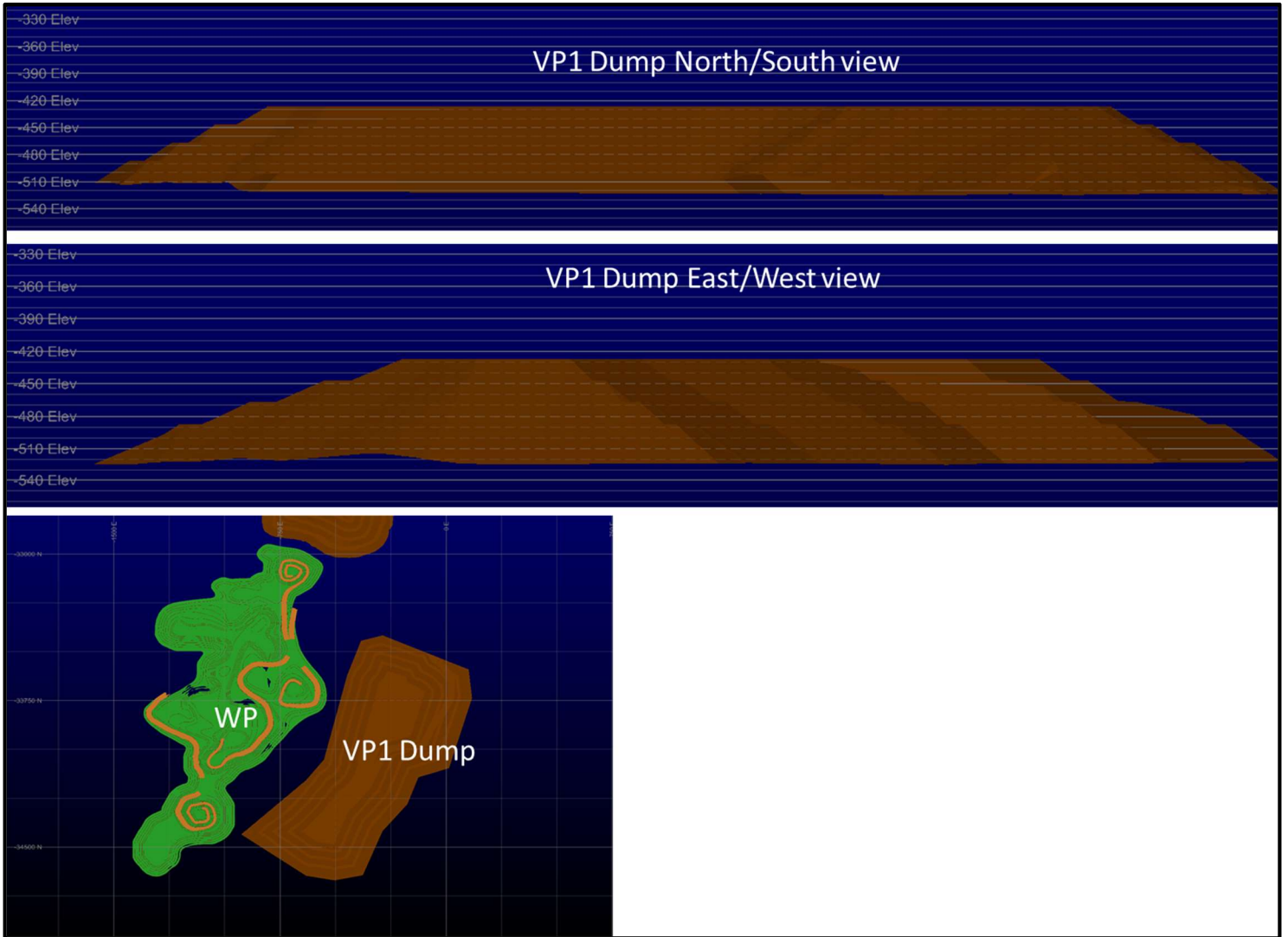


Figure 1-8: Village WRD South Design

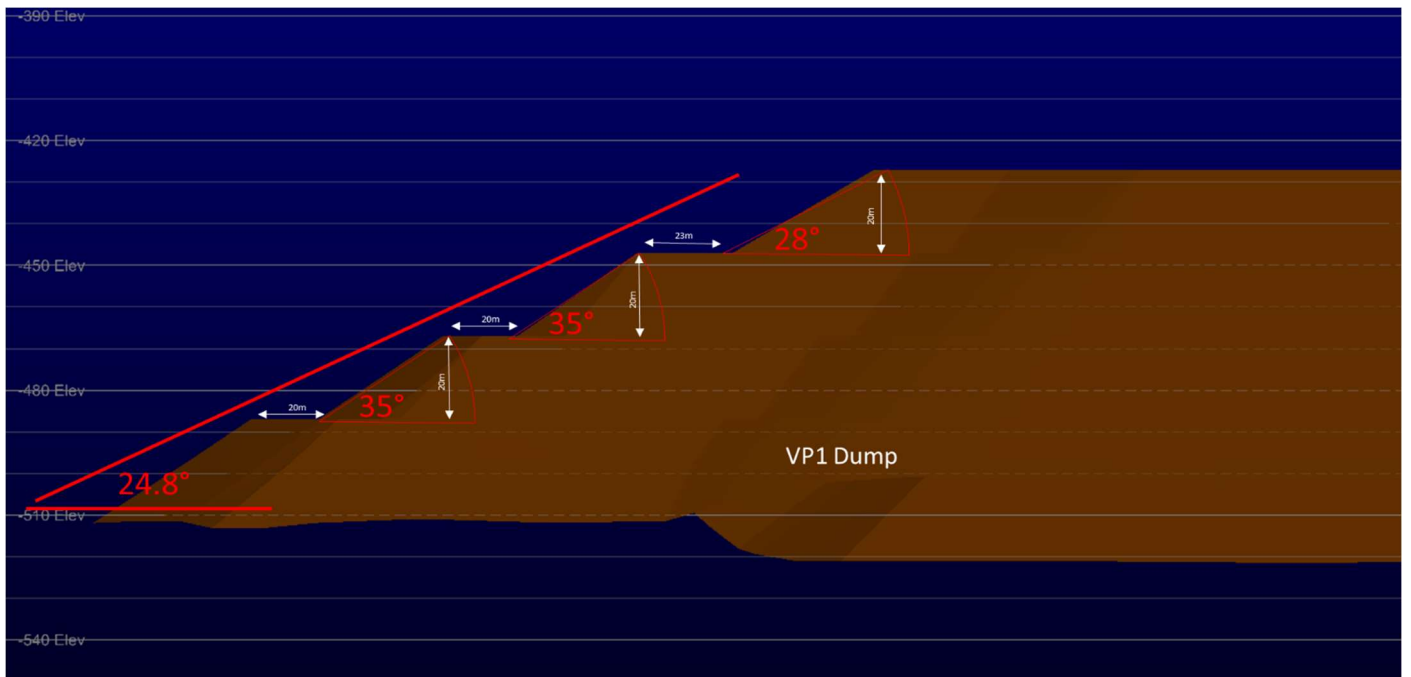


Figure 1-9: Village WRD South Design Criteria

Beeshoek Mine – Waste Rock Dump (WRD) Design Review

Village WRD South design criteria are very reasonable and within the expected design criteria for rock dumps.

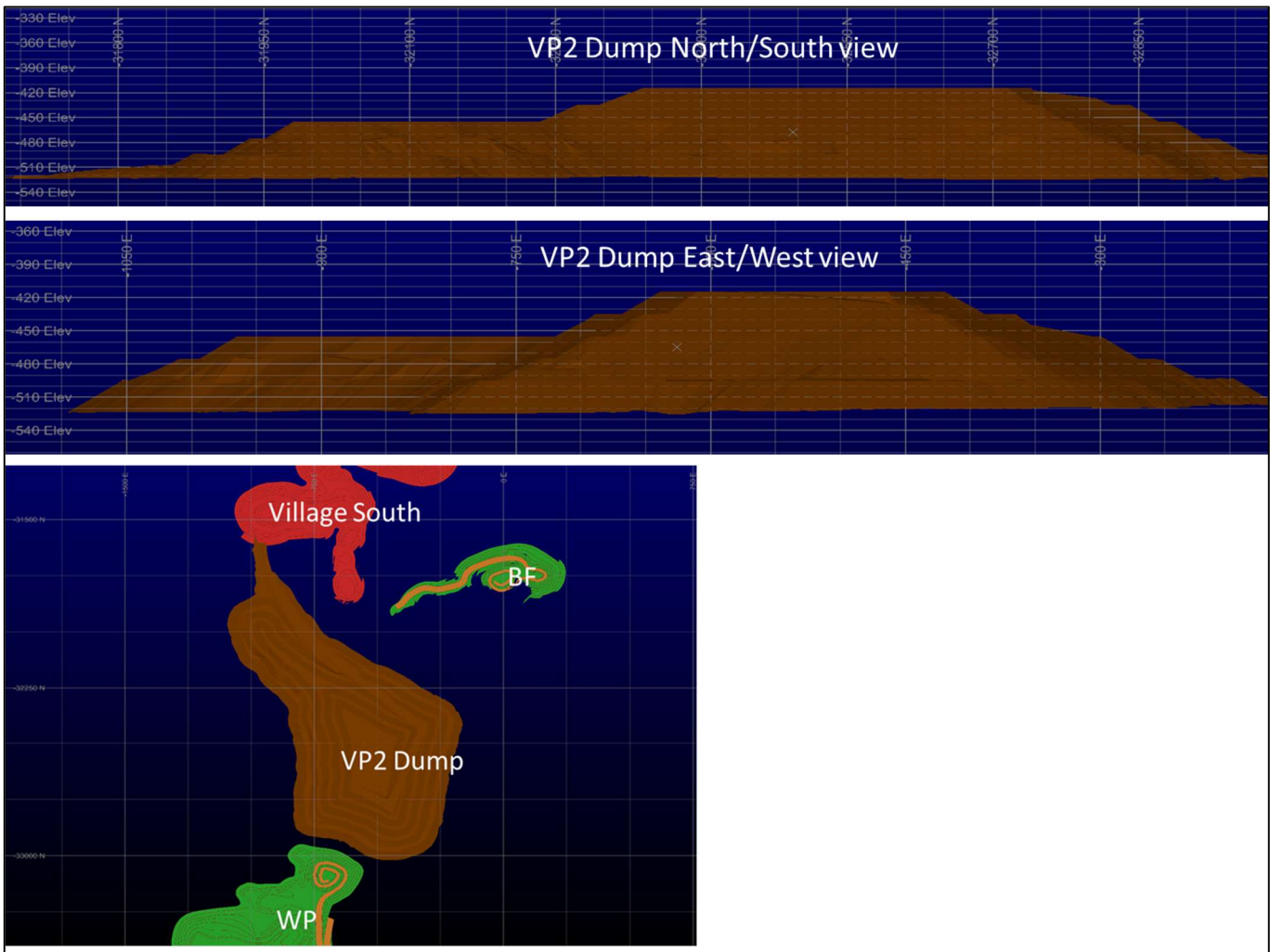


Figure 1-10: Village WRD North Designs

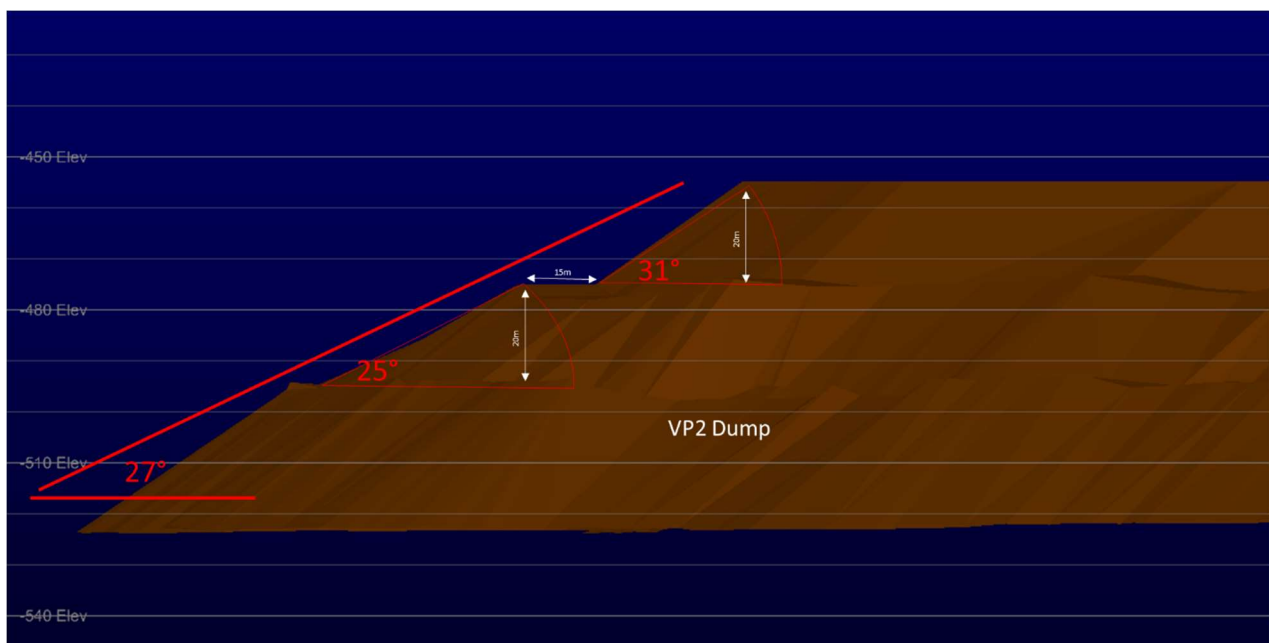


Figure 1-11: Village WRD North Design Criteria

The Village WRD North design are also deemed reasonable and within the expected WRD design criteria. The Village North and South WRD's have a maximum height of approximately 110.82m and 97.6m respectively. The design criteria are in-line with typical WRD designs and the angle of repose seems very reasonable. The average total slope on design angle is approximately 26.2 and 26.5 degrees for Village North and Village South WRD respectively. The average bench angles (repose) of approximately 34.8 and 35.4 degrees for Village North and South WRD, respectively.

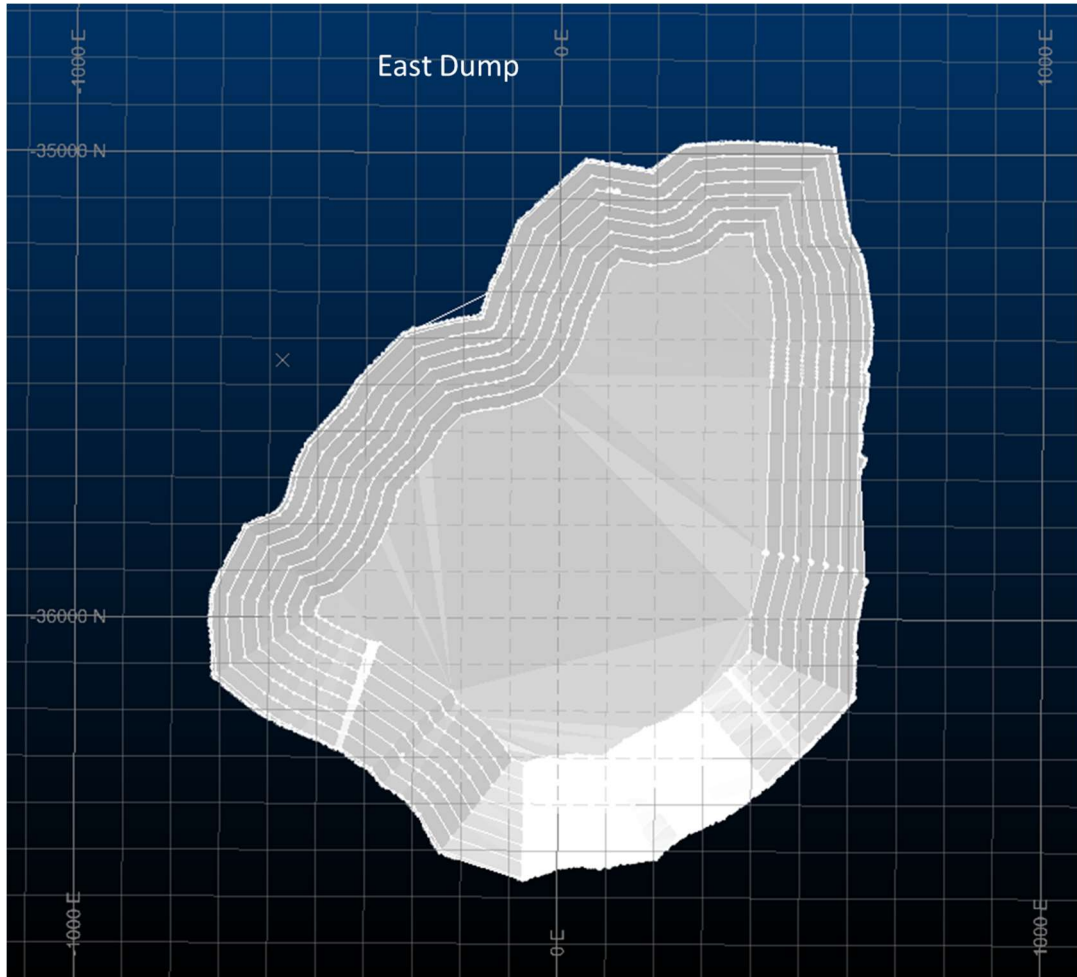


Figure 1-12: East Pit WRD design

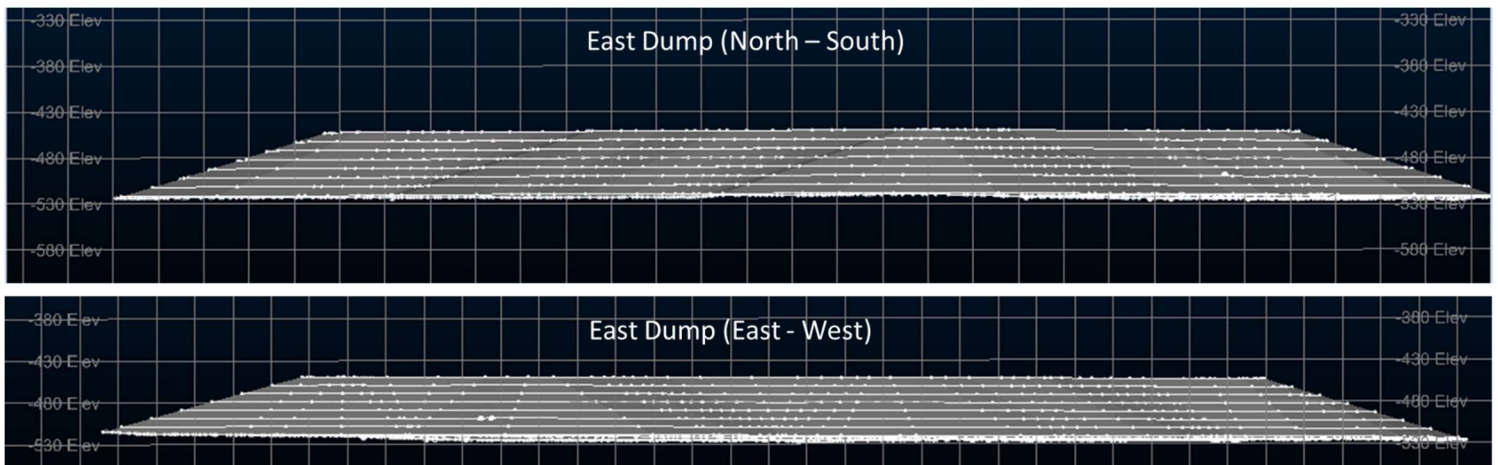


Figure 1-13: East Dump (Section Profiles)

East dump also abides by reasonable WRD design criteria. The East Pit WRD design is deemed reasonable and within the expected WRD design criteria. The East Pit WRD have a maximum height of approximately 93.52m. The design criteria are in-line with typical WRD design and the angle of repose seems very reasonable. The average total design slope angle is approximately 20.4 degrees, with bench angles (repose) of approximately 35.0 degrees.

Waste Rock Dump	Elevation Min	Elevation Max	Max Thickness / Height (m)	Bench Width	Approximate Average Bench / Repose On Design Angle	Approximate Total Rehabilitated Slope Angle	Approximate Average Total Slope On Design Angle
EP	-525.5	-432	93.5		35.0	-	20.4
EP-Rehab	-526.3	-432	94.4		-	17.9	-
GF	-469.3	-389	80.3		33.7	-	24.5
GF-Rehab	-469.3	-389	80.3		-	18.0	-
HF	-470.3	-432	40.0		34.5	-	26.8
HF-Rehab	-494.6	-432	62.6		-	18.0	-
VP North	-525.7	-414.9	110.8		34.8	-	26.2
VP North-Rehab	-525.1	-454.9	70.2		-	17.8	-
VP South	-524.6	-427	97.6		35.4	-	26.5
VP South-Rehab	-532.5	-427	105.5		-	17.9	-

All WRD's indicated and analysed above for Beeshoek Mine Pty Ltd, will consider the methods and measures necessary to be applied at the appropriate time when rehabilitation is started on each of the WRD's to ensure water runoff is optimally managed.

The WRD designs and WRD dump rehabilitation design plans for each of the WRD's is included in Annexure A. The designs include the below information for each:

- Footprints of the designs, pre-rehabilitation and post -rehabilitation;
- Overlay of WRD designs;
- Overlay of WRD rehabilitation designs;
- Sections of the designs, pre-rehabilitation and post –rehabilitation;
- Overlay of WRD designs including contours for water run-off management;
- Overlay of WRD rehabilitation designs including contours for water run-off management.

1.5 Geotechnical Review of the WRD designs

Middindi Consulting PTY LTD completed a Waste Rock Dump Design review (geotechnical review) of the main five (5) WRD designs of Beeshoek mine. The following sub-sections and paragraphs are directly referring to the Middindi report (“Assmang – Beeshoek, Waste Rock Dump Design validation” compiled by Mr. Franz Bruwer of Middindi Consulting PTY LTD”).

1.5.1 General

The WRD's at Beeshoek was designed using industry guidelines, however, was never validated by a Mining Geotechnical Engineer. The purpose of this study is to individually assess the stability of the five dumps using numerical analysis, to subsequently determine

whether the designs will ensure long-term stability. The WRD's are located on both North and South Mine and consist of the following:

- East Pit Dump;
- GF Dump;
- HF Dump;
- Village Pit South Dump;
- Village Pit North Dump.

1.5.2 Geotechnical Summary

The analysis indicated that the five WRD's at Beeshoek are well within the required limits for long term stability. To reduce the need for assumptions and ensure a high level of confidence in the analysis, conservative material parameters were selected for the models. The minimum safety factor required for long-term stability is 1.3, as taken from the work conducted by Stacey (2009). The safety factors obtained for each of the sections taken along the dumps are summarised below. The following table

Waste Rock Dump	Safety Factor (Section along ramp)	Safety Factor (Section away from ramp)
East Pit Dump	1.769	1.702
GF Dump	1.385	1.517
HF Dump	2.971	1.500
Village Pit Dump 1	1.741	1.448
Village Pit Dump 2	2.026	1.530

Table 1-1: WRD Factors of Safety (FoS)

2. Summary of Conclusions

The pertinent review summaries are:

- The WRD designs all proved to be reasonable and within the typical design criteria that would be deemed industry standard;
- The WRD designs were also completed to a reasonable design standard (for WRD designs);
- It is important to review the WRD designs and the actual resultant WRD lifts as deviations in high lifts might pose risks;
- ABGM would strongly advocate the Beeshoek have continuous WRD rock movement monitoring and observations;
- Beeshoek is in the process of optimising all of the Mineral Assets and it is conceivable that there might be the requirement to either move small parts of the WRD or possible adjust the designs somewhat to cater for possible open pit design expansions.

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Signature

23 January 2021

Date

3. Annexure A