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Civil Engineering Testing Laboratory

Triaxial Compression Test Results

Project:	**MOONLIGHT**	Date Tested:	**26/05/2011**
Batch No.:	**1039/F02/05/2011**	Laboratory Number:	**C372**
Field Sample Number:	**TP 27**	Depth (m):	-

This test was carried out in accordance with BS 1377:Part 8:1990 Clause 4,5,6,7

Remarks:	A Consolidated Undrained test on a remoulded sample tested saturated. Multistage Loading.

Test No. 2

SATURATION DATA

Saturation method: Alternating increments of cell- & back pressure		
Pressure increments applied (kPa): 50,70,100,100,100		Differential pressure (kPa): 10.0
Final cell pressure (kPa): 453.0	Final back pressure (kPa): 443.0	Final B parameter: 0.95

CONSOLIDATION DATA

Effective cons. Stress (kPa): 99.7 t100 (minutes): 60 Side drains fitted: No

	Height mm	Diameter mm	Area mm^2	Moisture Content %	Dry Unit Weight	Void Ratio	Saturation %	Specific Gravity
INITIAL (Before saturation)	* 92.74	* 51.70	2099.31	8.2	1.785	0.6646	37	2.971 Determined
CONSOLIDATED	92.27	51.44	2077.94	21.9	1.813	0.6391	102	
FINAL (After shear)	85.31	53.49	2247.42	21.9	1.812	0.6392	102	

Initial pore pressure (kPa): 443.3 Final pore pressure (kPa): 443.2 Pore pressure dissipation: 33%

*: Measured dimensions; all other dimensions are calculated.

SHEAR DATA

Rate of strain (%/hour): 9

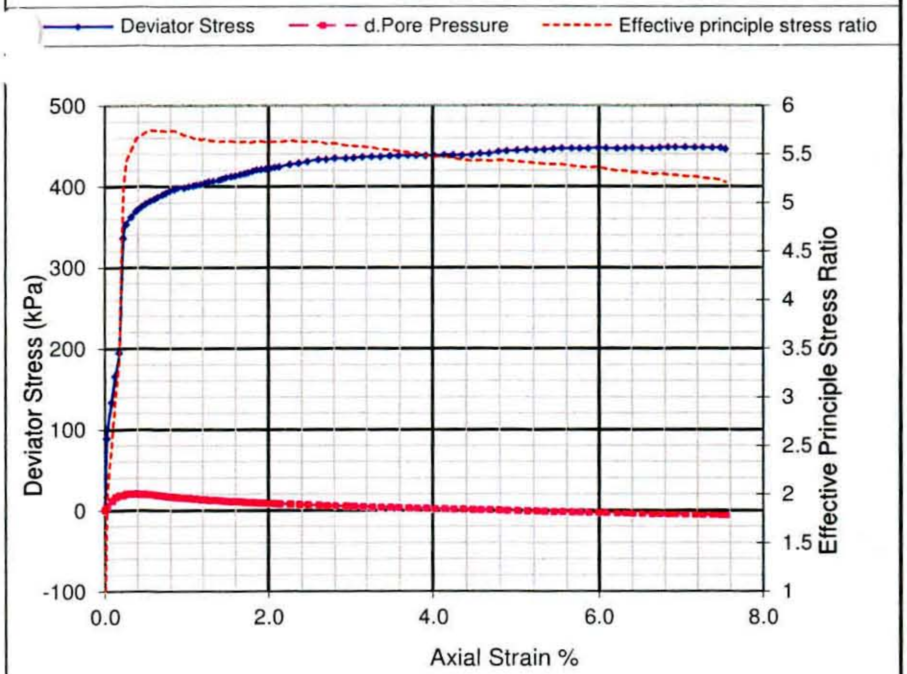
Initial pore pressure (kPa): 443.3 Initial effective stress (kPa): 99.7

Failure Criterion: **Max. Effective Principle Stress Ratio**

		Principle Stresses (kPa)			
Axial strain at failure (%):	0.60				
Deviator stress (kPa):	384.2				
Excess pore pressure (kPa):	18.6	σ_1	σ_1'	σ_3	σ_3'
Effective principle stress ratio:	5.741	483.9	465.2	99.7	81.0

Deviator stress corrections: Membrane correction: 1.10250856561531 kPa

Deviator Stress and dPore Pressure vs Strain



Specimen Failure

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Triaxial Compression Test Results

Project:	**MOONLIGHT**	Date Tested:	**26/05/2011**
Batch No.:	**1039/F02/05/2011**	Laboratory Number:	**C372**
Field Sample Number:	**TP 27**	Depth (m):	**-**

This test was carried out in accordance with BS 1377:Part 8:1990 Clause 4,5,6,7

Remarks:	A Consolidated Undrained test on a remoulded sample tested saturated. Multistage Loading.

Test No. 3

SATURATION DATA

Saturation method: Alternating increments of cell- & back pressure		
Pressure increments applied (kPa): 50,70,100,100,100		Differential pressure (kPa): 10.0
Final cell pressure (kPa): 453.0	Final back pressure (kPa): 443.0	Final B parameter: 0.95

CONSOLIDATION DATA

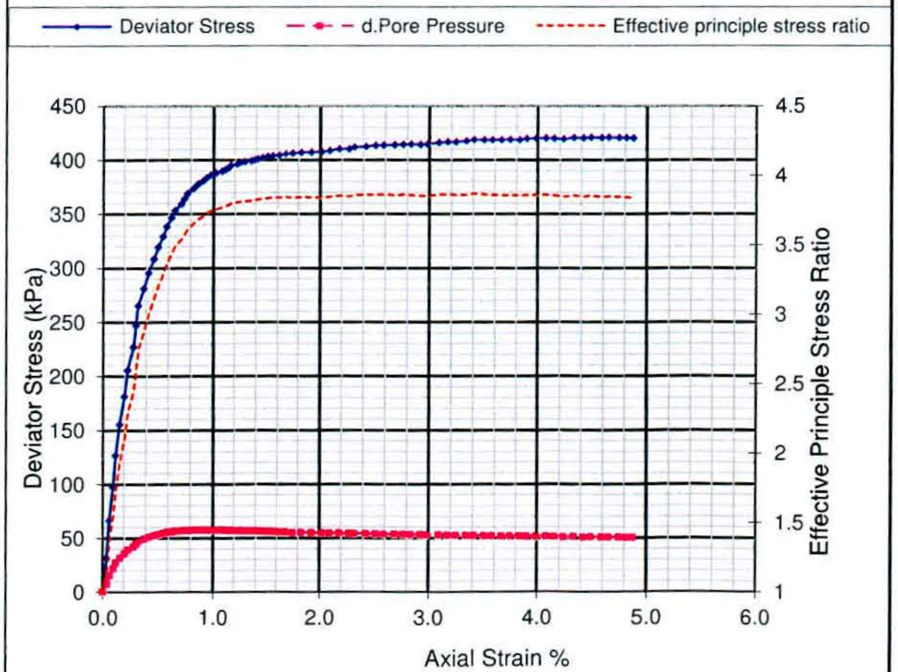
Effective cons. Stress (kPa): 198.2	t100 (minutes): 120						Side drains fitted: No	
	Height mm	Diameter mm	Area mm^2	Moisture Content %	Dry Unit Weight	Void Ratio	Saturation %	Specific Gravity
INITIAL (Before saturation)	* 85.30	* 53.49	2247.42	8.2	1.813	0.6390	38	2.971 Determined
CONSOLIDATED	84.46	52.96	2202.95	20.3	1.868	0.5903	102	
FINAL (After shear)	80.34	54.30	2315.88	20.3	1.868	0.5907	102	
Initial pore pressure (kPa): 443.2			Final pore pressure (kPa): 443.0			Pore pressure dissipation: 100%		
*: Measured dimensions; all other dimensions are calculated.								

SHEAR DATA

Rate of strain (%/hour):	4.8				
Initial pore pressure (kPa): 444.8	Initial effective stress (kPa): 198.2				
Failure Criterion:	**Max. Effective Principle Stress Ratio**				
Axial strain at failure (%):	3.41				
Deviator stress (kPa):	418.7	Principle Stresses (kPa)			
Excess pore pressure (kPa):	52.0	σ_1	σ_1'	σ_3	σ_3'
Effective principle stress ratio:	3.864	616.9	564.9	198.2	146.2

Deviator stress corrections: Membrane correction: 1.0655602327262 kPa

Deviator Stress and dPore Pressure vs Strain



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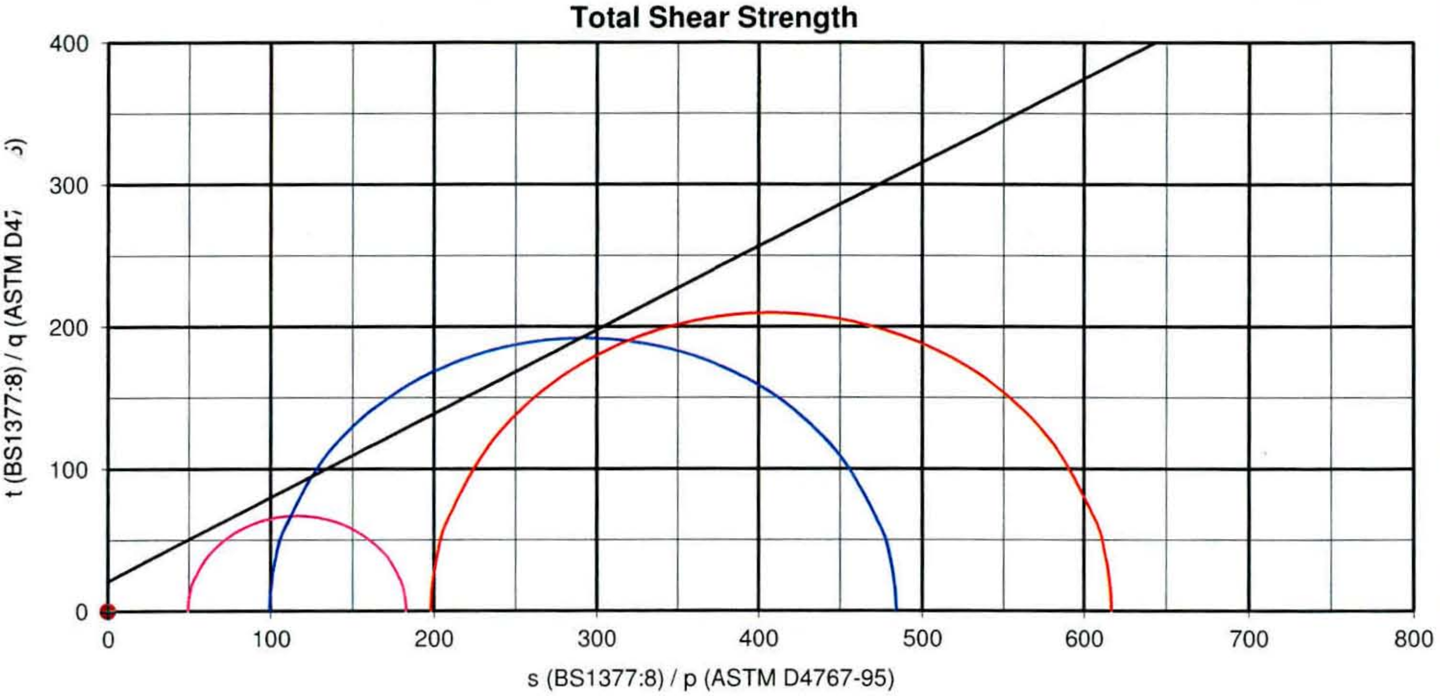
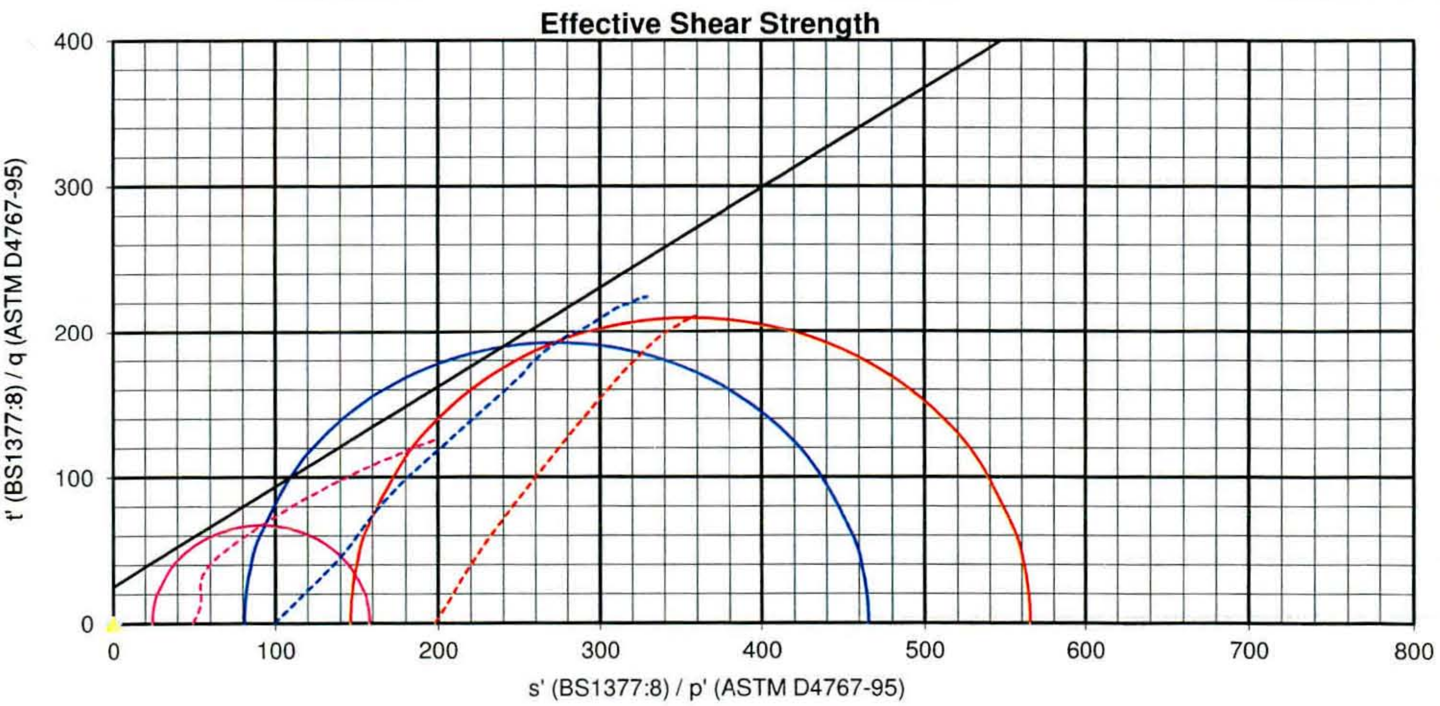
Triaxial Compression Test Results

Project:	MOONLIGHT	Date Tested:	26/05/2011
Proj.No.:	1039/F02/05/2011	Laboratory Number:	C372
Field Sample Reference:	TP 27	Depth (m):	-

Mohr Stress Circles

	COHESION (kPa)	FRICTION ANGLE
TOTAL STRESSES	21	31
EFFECTIVE STRESSES	25	34





A Consolidated Undrained test on a remoulded sample tested saturated.

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Consolidation vs Square Root Time

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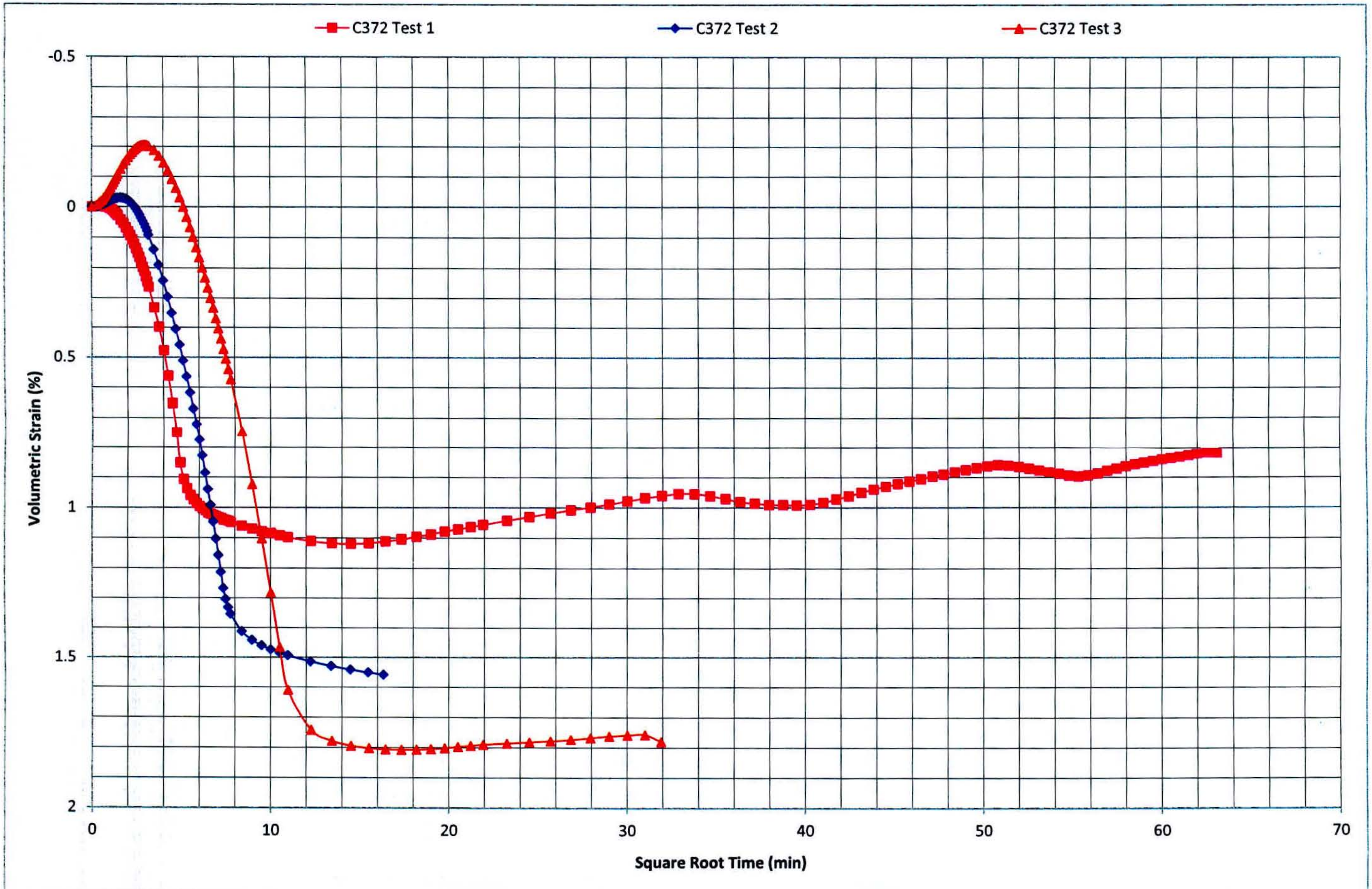

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Triaxial Compression Test Results

Project:	**MOONLIGHT**	Date Tested:	**26/05/2011**
Batch No.:	**1039/F02/05/2011**	Laboratory Number:	**C373**
Field Sample Number:	**TP 22**	Depth (m):	**-**

This test was carried out in accordance with BS 1377:Part 8:1990 Clause 4,5,6,7

Remarks: A Consolidated Undrained test on a remoulded sample tested saturated.

Test No. 1

SATURATION DATA

Saturation method: Alternating increments of cell- & back pressure		
Pressure increments applied (kPa): 50,70,100,100,100		Differential pressure (kPa): 10.0
Final cell pressure (kPa): 355.0	Final back pressure (kPa): 345.0	Final B parameter: 0.95

CONSOLIDATION DATA

Effective cons. Stress (kPa): 53.2 t100 (minutes): 3.7 Side drains fitted: No

	Height mm	Diameter mm	Area mm^2	Moisture Content %	Dry Unit Weight	Void Ratio	Saturation %	Specific Gravity
TIAL (Before saturation)	* 100.00	* 50.00	1963.50	6.9	2.084	0.3367	57	2.785 Assumed
ONSOLIDATED	99.81	49.91	1956.16	11.8	2.095	0.3292	100	
FINAL (After shear)	92.86	51.74	2102.58	11.8	2.095	0.3292	100	

Initial pore pressure (kPa): 383.1 Final pore pressure (kPa): 345.0 Pore pressure dissipation: 100%

*: Measured dimensions; all other dimensions are calculated.

SHEAR DATA

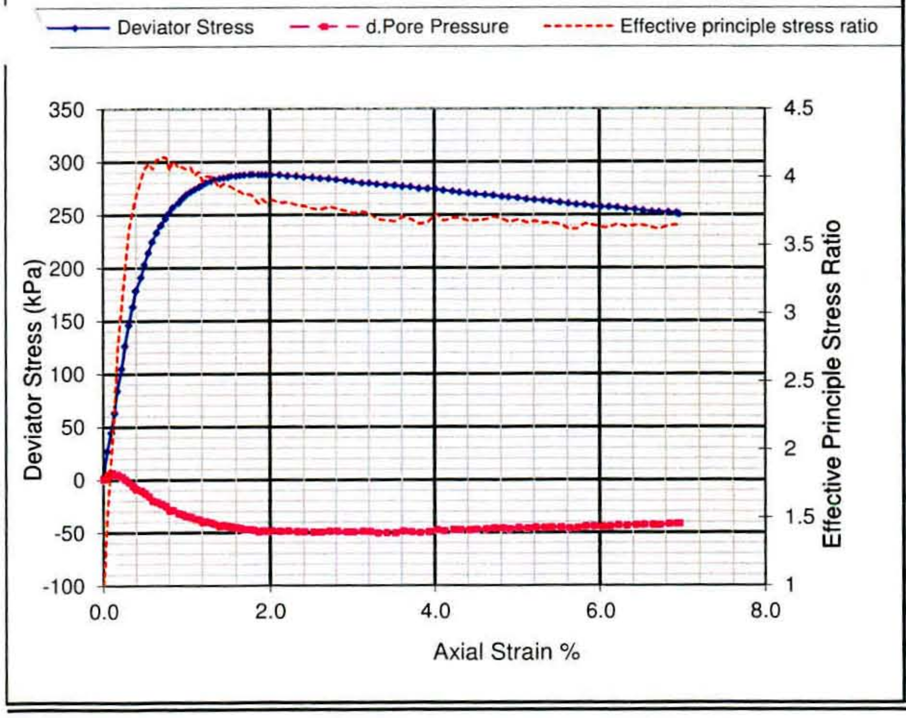
Rate of strain (%/hour): 9
Initial pore pressure (kPa): 341.8 Initial effective stress (kPa): 53.2

Failure Criterion: Max. Effective Principle Stress Ratio

Axial strain at failure (%):	0.71				
Deviator stress (kPa):	240.2	Principle Stresses (kPa)			
Excess pore pressure (kPa):	-23.2	σ1	σ1'	σ3	σ3'
Effective principle stress ratio:	4.142	293.4	316.7	53.2	76.5

Deviator stress corrections: Membrane correction: 1.14 kPa

Deviator Stress and dPore Pressure vs Strain



Specimen Failure

See Test No.3

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Triaxial Compression Test Results

Project:	**MOONLIGHT**	Date Tested:	**26/05/2011**
Batch No.:	**1039/F02/05/2011**	Laboratory Number:	**C373**
Field Sample Number:	**TP 22**	Depth (m):	-

This test was carried out in accordance with BS 1377:Part 8:1990 Clause 4,5,6,7

Remarks:	A Consolidated Undrained test on a remoulded sample tested saturated. Multistage Loading.

Test No. 2

SATURATION DATA

Saturation method: Alternating increments of cell- & back pressure		
Pressure increments applied (kPa): 50,70,100,100,100		Differential pressure (kPa): 10.0
Final cell pressure (kPa): 352.0	Final back pressure (kPa): 342.0	Final B parameter: 0.95

CONSOLIDATION DATA

Effective cons. Stress (kPa): 99.1 t100 (minutes): 58 Side drains fitted: No

	Height mm	Diameter mm	Area mm^2	Moisture Content %	Dry Unit Weight	Void Ratio	Saturation %	Specific Gravity
INITIAL (Before saturation)	* 92.86	* 51.74	2102.58	6.9	2.095	0.3292	59	2.785 Assumed
CONSOLIDATED	92.58	51.58	2089.59	11.3	2.115	0.3169	100	
FINAL (After shear)	85.63	53.63	2259.15	11.3	2.115	0.3169	100	

Initial pore pressure (kPa): 342.1 Final pore pressure (kPa): 342.0 Pore pressure dissipation: 100%

*: Measured dimensions; all other dimensions are calculated.

SHEAR DATA

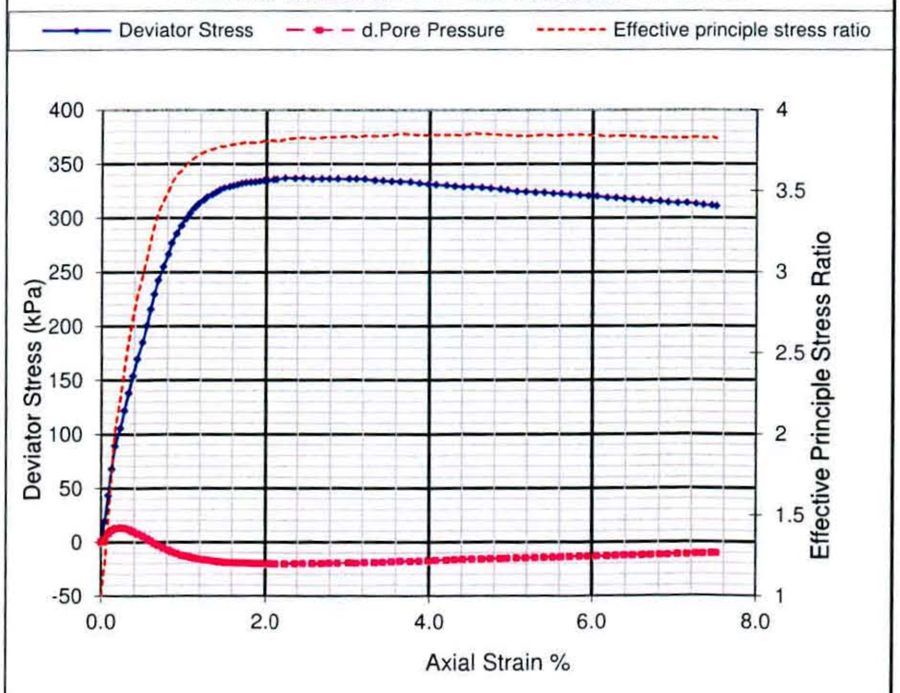
Rate of strain (%/hour): 9
Initial pore pressure (kPa): 342.9 Initial effective stress (kPa): 99.1

Failure Criterion: **Max. Deviator Stress**

		Principle Stresses (kPa)			
Axial strain at failure (%):	2.24				
Deviator stress (kPa):	337.1				
Excess pore pressure (kPa):	-20.5	σ_1	σ_1'	σ_3	σ_3'
Effective principle stress ratio:	3.818	436.2	456.7	99.1	119.6

Deviator stress corrections: Membrane correction: 1.10164962459034 kPa

Deviator Stress and dPore Pressure vs Strain



Specimen Failure

See Test No.3

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Triaxial Compression Test Results

Project:	**MOONLIGHT**	Date Tested:	**26/05/2011**
Batch No.:	**1039/F02/05/2011**	Laboratory Number:	**C373**
Field Sample Number:	**TP 22**	Depth (m):	**-**

This test was carried out in accordance with BS 1377:Part 8:1990 Clause 4,5,6,7

Remarks: A Consolidated Undrained test on a remoulded sample tested saturated. Multistage Loading.

Test No. 3

SATURATION DATA

Saturation method: Alternating increments of cell- & back pressure		
Pressure increments applied (kPa): 50,70,100,100,100		Differential pressure (kPa): 10.0
Final cell pressure (kPa): 351.0	Final back pressure (kPa): 341.0	Final B parameter: 0.95

CONSOLIDATION DATA

Effective cons. Stress (kPa): 199.3 t100 (minutes): 120 Side drains fitted: No

	Height mm	Diameter mm	Area mm^2	Moisture Content %	Dry Unit Weight	Void Ratio	Saturation %	Specific Gravity
INITIAL (Before saturation)	* 85.63	* 53.63	2259.15	6.9	2.115	0.3169	61	2.785 Assumed
CONSOLIDATED	85.11	53.31	2231.90	10.5	2.154	0.2931	100	
FINAL (After shear)	79.19	55.27	2398.85	10.5	2.154	0.2932	100	

Initial pore pressure (kPa): 341.6 Final pore pressure (kPa): 341.5 Pore pressure dissipation: 17%

*: Measured dimensions; all other dimensions are calculated.

SHEAR DATA

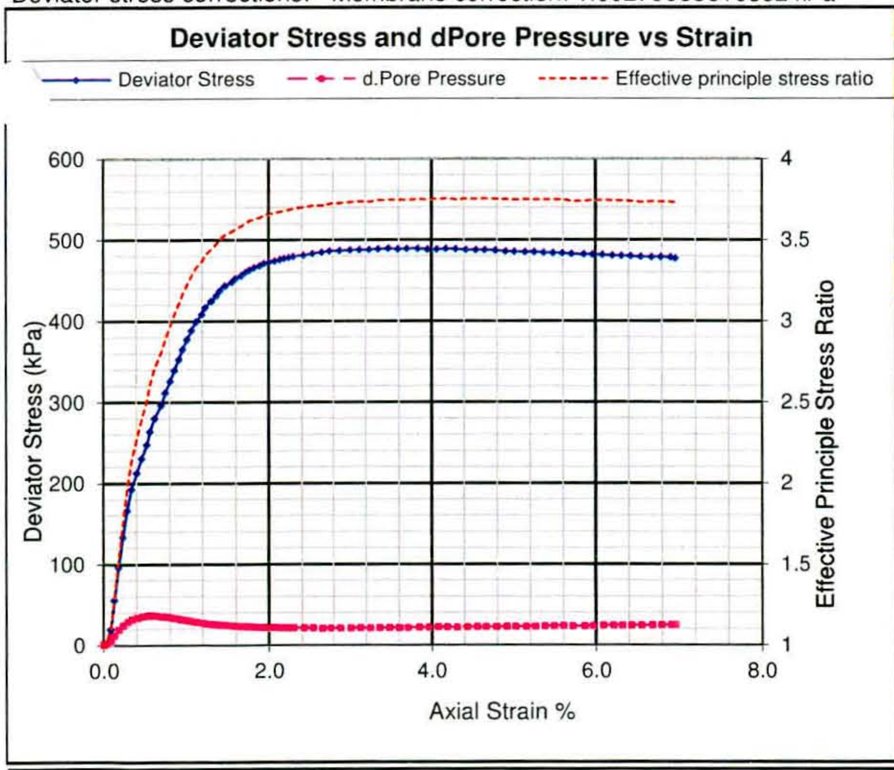
Rate of strain (%/hour): 4.8

Initial pore pressure (kPa): 341.7 Initial effective stress (kPa): 199.3

Failure Criterion: **Max. Deviator Stress**

		Principle Stresses (kPa)			
Axial strain at failure (%):	3.48				
Deviator stress (kPa):	489.4				
Excess pore pressure (kPa):	20.9	σ_1	σ_1'	σ_3	σ_3'
Effective principle stress ratio:	3.743	688.6	667.8	199.3	178.4

Deviator stress corrections: Membrane correction: 1.06279063610362 kPa



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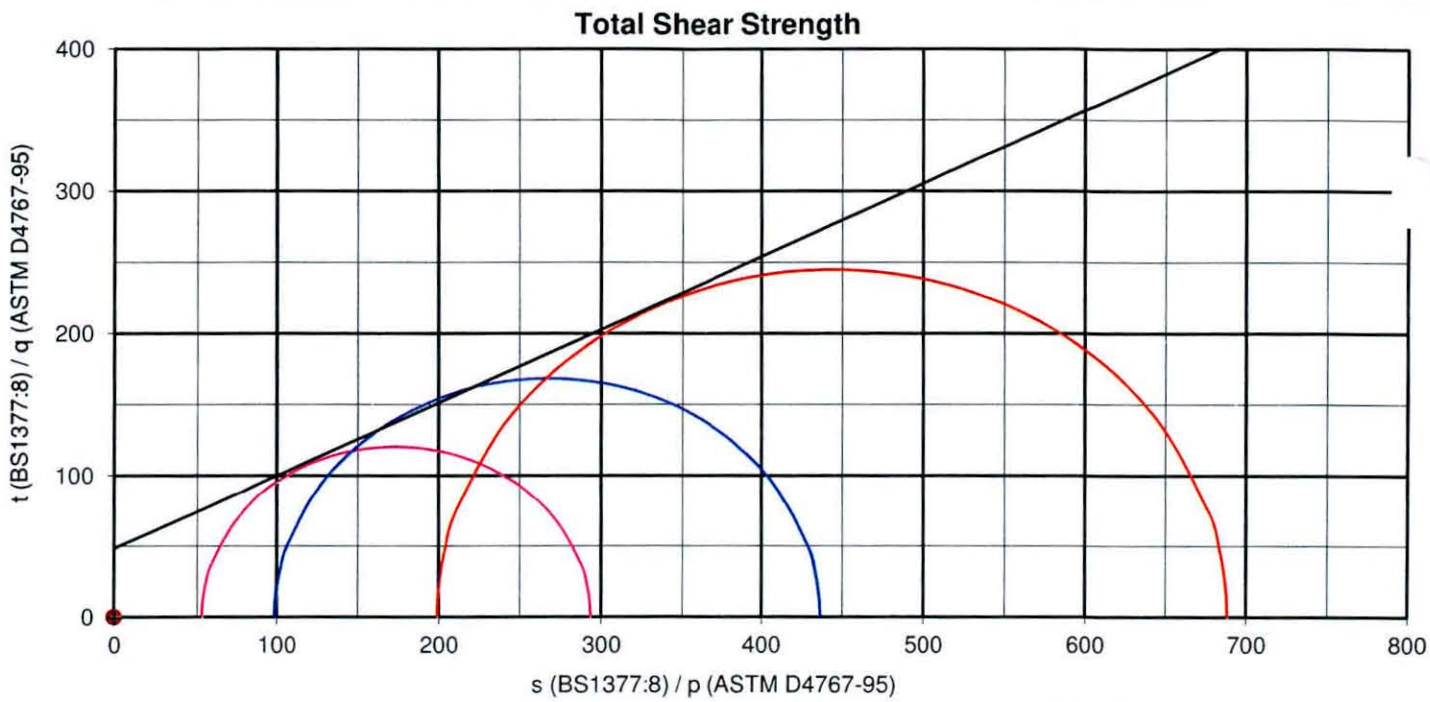
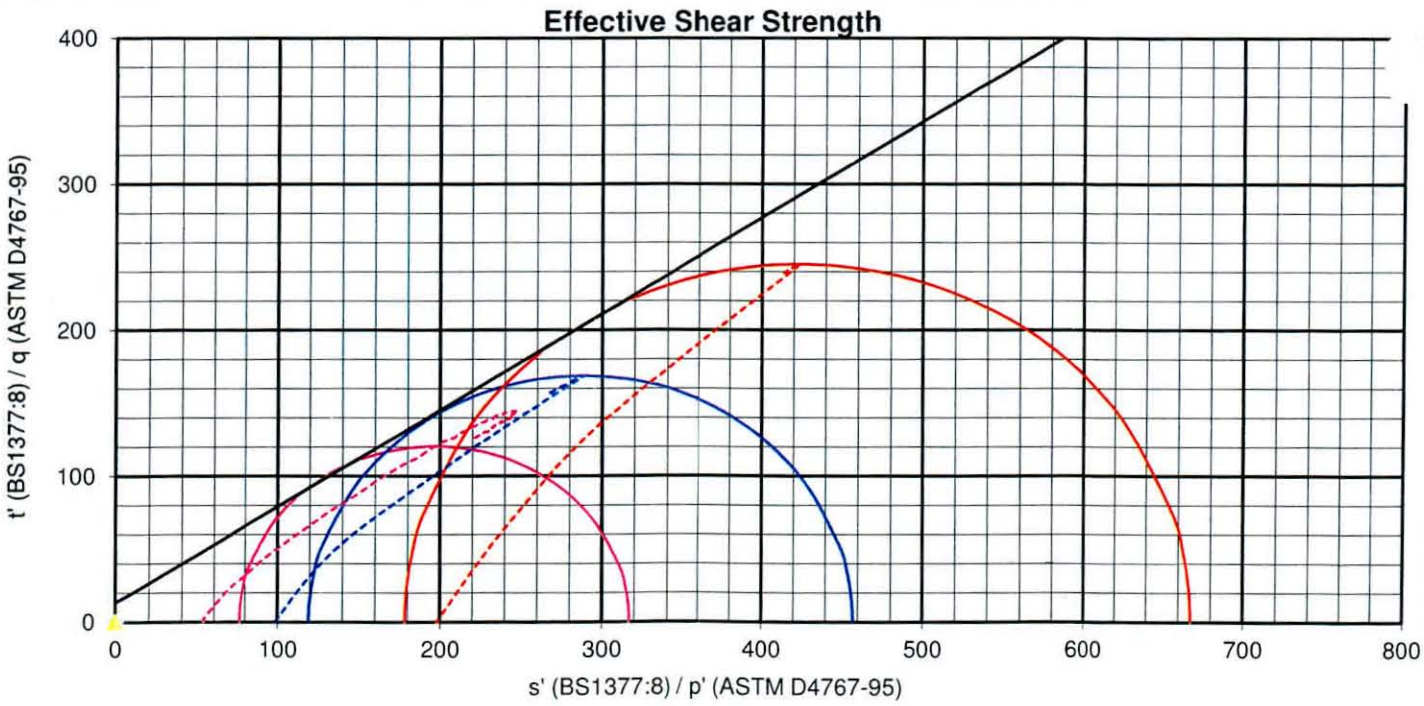
Triaxial Compression Test Results

Project:	MOONLIGHT	Date Tested:	26/05/2011
Proj.No.:	1039/F02/05/2011	Laboratory Number:	C373
Field Sample Reference:	TP 22	Depth (m):	-

Mohr Stress Circles

	COHESION (kPa)	FRICTION ANGLE
TOTAL STRESSES	48	27
EFFECTIVE STRESSES	13	33

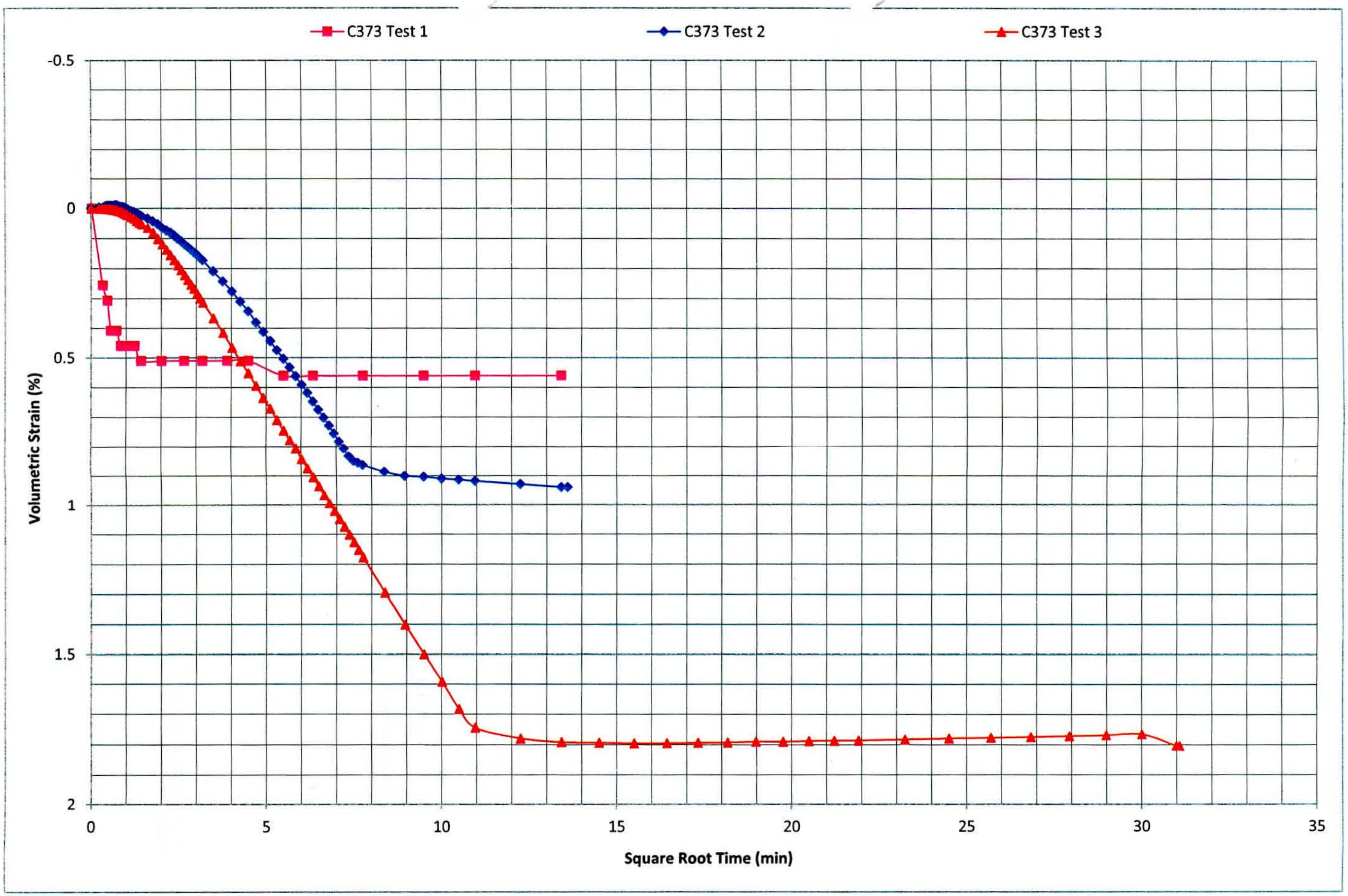




A Consolidated Undrained test on a remoulded sample tested saturated.

Consolidation vs Square Root Time

Civilab



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Flexible Wall Constant Head Permeability Test Results

PROJECT:	MOONLIGHT	DATE :	15/06/2011
PROJECT No.:	F02/05/2011		

Field Sample Number	Sample Depth in metres	Moisture Content (%)		Dry Density (Kg/m^3)	Co-efficient of Permeability (m/s)		
		Before Test	After Test		Range Minimum	Range Maximum	Average
TP 27 (C372)	-	15.4	19.7	1782	7.4E-10	1.6E-09	**1.1E-09**
TP 22 (C373)	-	7.8	12.3	2057	9.3E-07	1.3E-06	**1.1E-06**

REMARKS :
Remoulded samples
Effective cell pressure 100kPa.
Pressure Difference = 20 kPa

Investment Facility Company 842 (Pty) Limited trading as Civilab. Registration No: 98/19071/07

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CRUMB TEST RESULTS

Project : MOONLIGHT	
Project No. : 1039/F02/05/2011	Date : 19 MAY 2011

Lab. Sample Ref.	Field Sample Ref.	Depth (m)	Dispersive Grade
C372	TP 27	-	3
C373	TP 22	-	1

Remarks:

Grade 1 - Non Dispersive
Grade 2 - Intermediate
Grade 3 - Dispersive
Grade 4 - Dispersive

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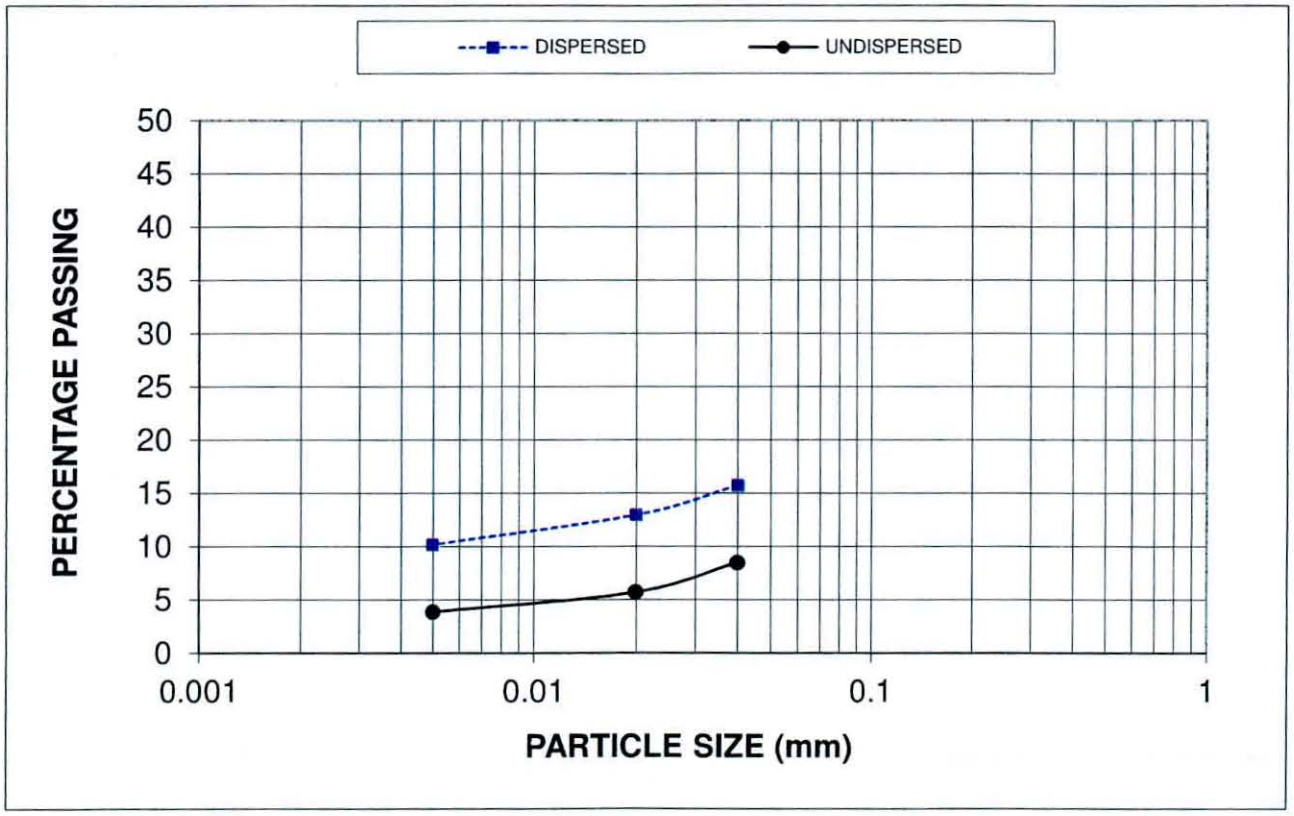
Civil Engineering Testing Laboratories

Double Hydrometer Test Result

Project:	MOONLIGHT		
Project No.:	F02/05/2011	Date:	19/05/2011
Field Reference:	TP 27	Laboratory Ref.:	C372
Depth (m):	-	Remarks:	

% DISPERSION: 38



NOTE:

The sample was tested according to ASTM test method D4221- 99
The results relate only to the sample tested.
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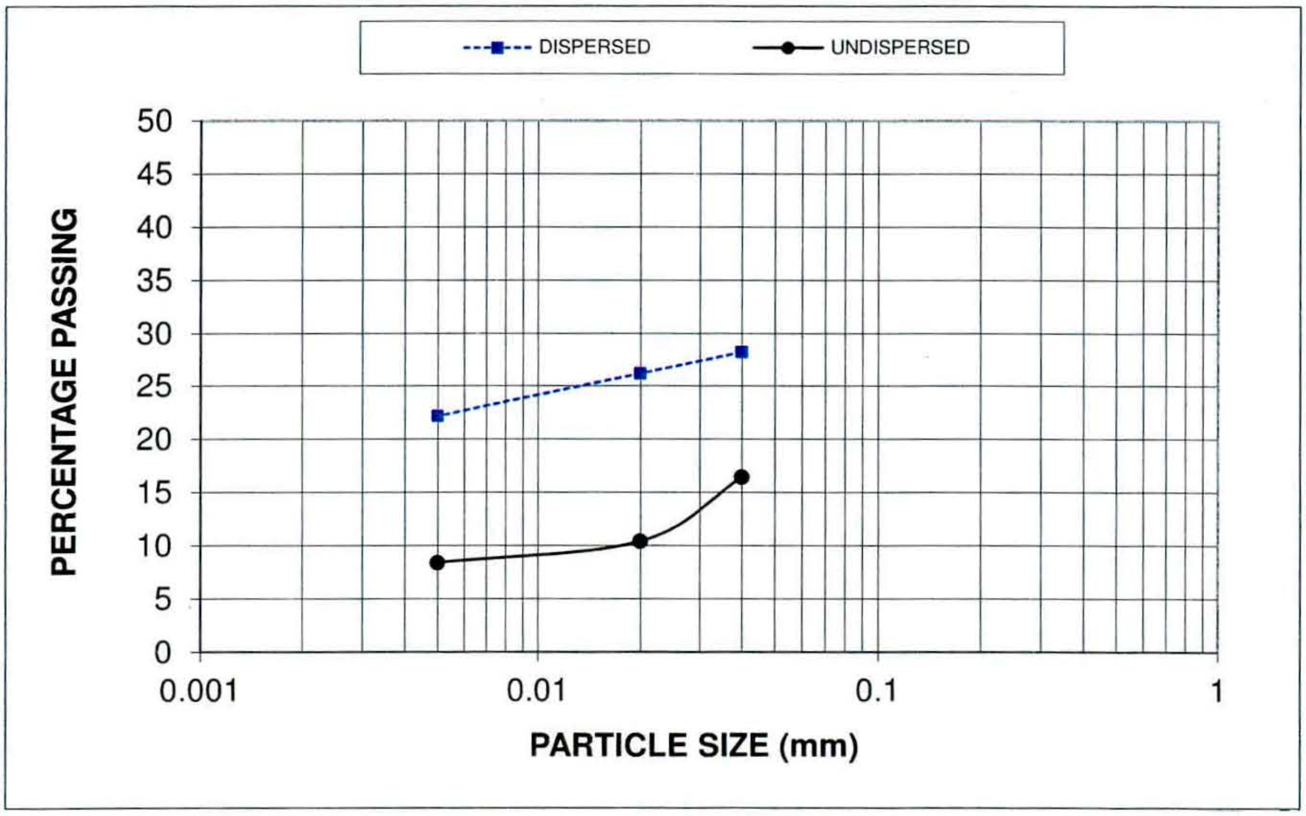
Double Hydrometer Test Result

Project:	MOONLIGHT		
Project No.:	F02/05/2011	Date:	19/05/2011
Field Reference:	TP 22	Laboratory Ref.:	C373
Depth (m):	-	Remarks:	

% DISPERSION: 38



NOTE:

The sample was tested according to ASTM test method D4221- 99
The results relate only to the sample tested.
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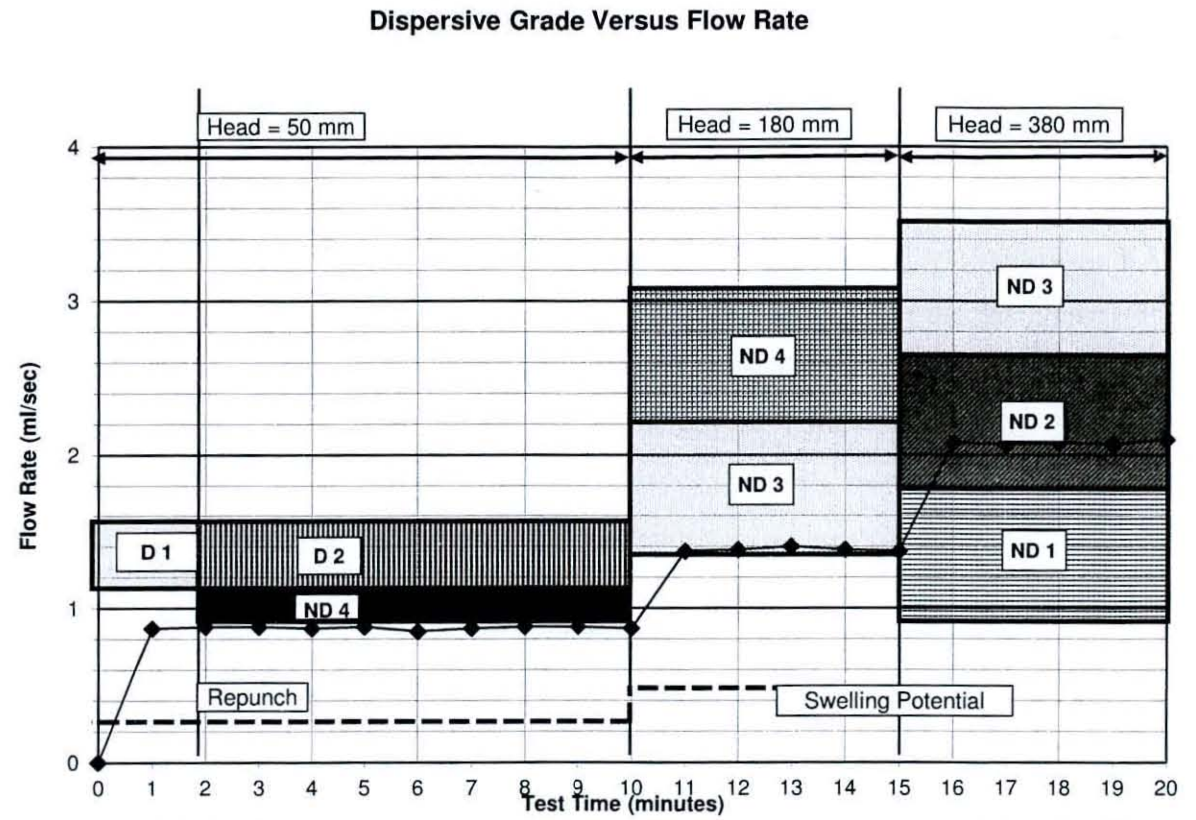
Dispersive Grade Versus Flow Rate

PROJECT:	MOONLIGHT	DATE:	19/05/2011
PROJECT NUMBER:	F02/05/2011	LAB REFERENCE:	C372
FIELD REFERENCE:	TP 27	DEPTH:	-

DRY DENS:	**1675** kg/m^3	MOISTURE CONTENT:	**17.9** %
Dispersive Grade Classification:		**ND 2**	



Hole size after test: 0 mm

Effluent Turbidity **Dispersive Grade Classification**

50 mm	Colour: Clear		D 1	Dispersive
	Particles: None		D 2	
180 mm	Colour: Clear		ND 4	Intermediate
	Particles: None		ND 3	
380 mm	Colour: Clear		ND 2	Non Dispersive
	Particles: None		ND 1	

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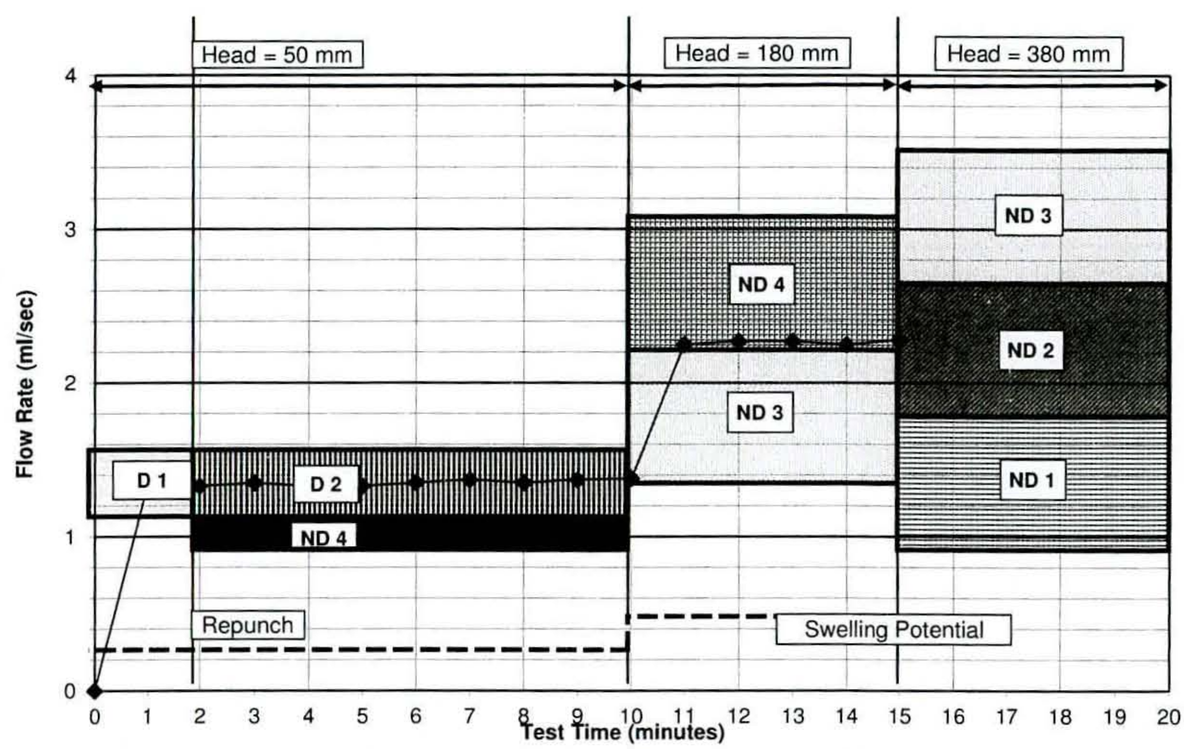
Dispersive Grade Versus Flow Rate

PROJECT:	MOONLIGHT	DATE:	19/05/2011
PROJECT NUMBER:	F02/05/2011	LAB REFERENCE:	C373
FIELD REFERENCE:	TP 22	DEPTH:	-

DRY DENS:	**2042** kg/m^3	MOISTURE CONTENT:	**10.6** %
Dispersive Grade Classification:		**ND 4**	



Hole size after test: 1 mm

	Effluent Turbidity		**Dispersive Grade Classification**
50 mm	Colour: Clear Particles: None	D 1 D 2	Dispersive
180 mm	Colour: Clear Particles: None	ND 4 ND 3	Intermediate
380 mm	Colour: Particles:	ND 2 ND 1	Non Dispersive

APPENDIX D: STAGE CAPACITY CALCULATION FOR THE TSF

Metago stage capacity spreadsheet and curve as at May 2011.

Metago Environmental Engineers (Pty) Ltd

APPENDIX E: SEEPAGE AND STABILITY ANALYSES

"***Seepage and Stability Analysis of the Tailings Storage Facility for the Proposed Moonlight Iron Ore Project***", Metago Environmental Engineers, Project No. T020-04, Report No. 2, May 2011.

Metago

SEEPAGE AND STABILITY ANALYSIS OF THE TAILINGS STORAGE FACILITY FOR THE PROPOSED MOONLIGHT IRON ORE PROJECT

Prepared For

Ferrum Crescent Limited

METAGO PROJECT NUMBER: T020-04

REPORT NO. 2

May 2011

Seepage and Stability Analysis of the Tailings Storage Facility for the Proposed Moonlight Iron Ore Project

Prepared For

Ferrum Crescent Limited

METAGO PROJECT NUMBER: T020-04

REPORT NO. 2

May 2011

DOCUMENT INFORMATION

Title	Seepage and Stability Analysis of the Tailings Storage Facility for the Proposed Moonlight Iron Ore Project
Project Manager	Stephen van Niekerk (PrEng)
Project Manager e-mail	svanniekerk@metago.co.za
Author	Malcolm Maber
Reviewer	Stephen van Niekerk (PrEng)
Client	Ferrum Crescent Limited
Date last printed	09/06/2011 02:07:00 PM
Date last saved	24/05/2011 09:51:00 AM
Comments	
Keywords	Ferrum Crescent, Turquoise Moon, Moonlight Iron
Project Number	T020-04
Report Number	2
Status	Final
Issue Date	May 2011

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PRELIMINARY DESIGN OF THE TAILINGS STORAGE FACILITY FOR THE PROPOSED MOONLIGHT IRON ORE PROJECT

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PRELIMINARY DESIGN OF THE TAILINGS STORAGE FACILITY FOR THE PROPOSED MOONLIGHT IRON ORE PROJECT

1 INTRODUCTION

Metago Environmental Engineers (Pty) Ltd (Metago) was requested by Turquoise Moon Trading 157 (Pty) Ltd (Turquoise Moon) on behalf of Ferrum Crescent Limited (Ferrum) to compile the tailings section of the EIA/EMP report for the proposed Moonlight Iron Ore project.

The proposed mining project will target the underground iron ore mineralisation areas by means of an open pit mine, and will involve the establishment of new infrastructure typically associated with an iron ore mine and ore processing plant, including a new tailings storage facility (TSF), return water facility and associated infrastructure.

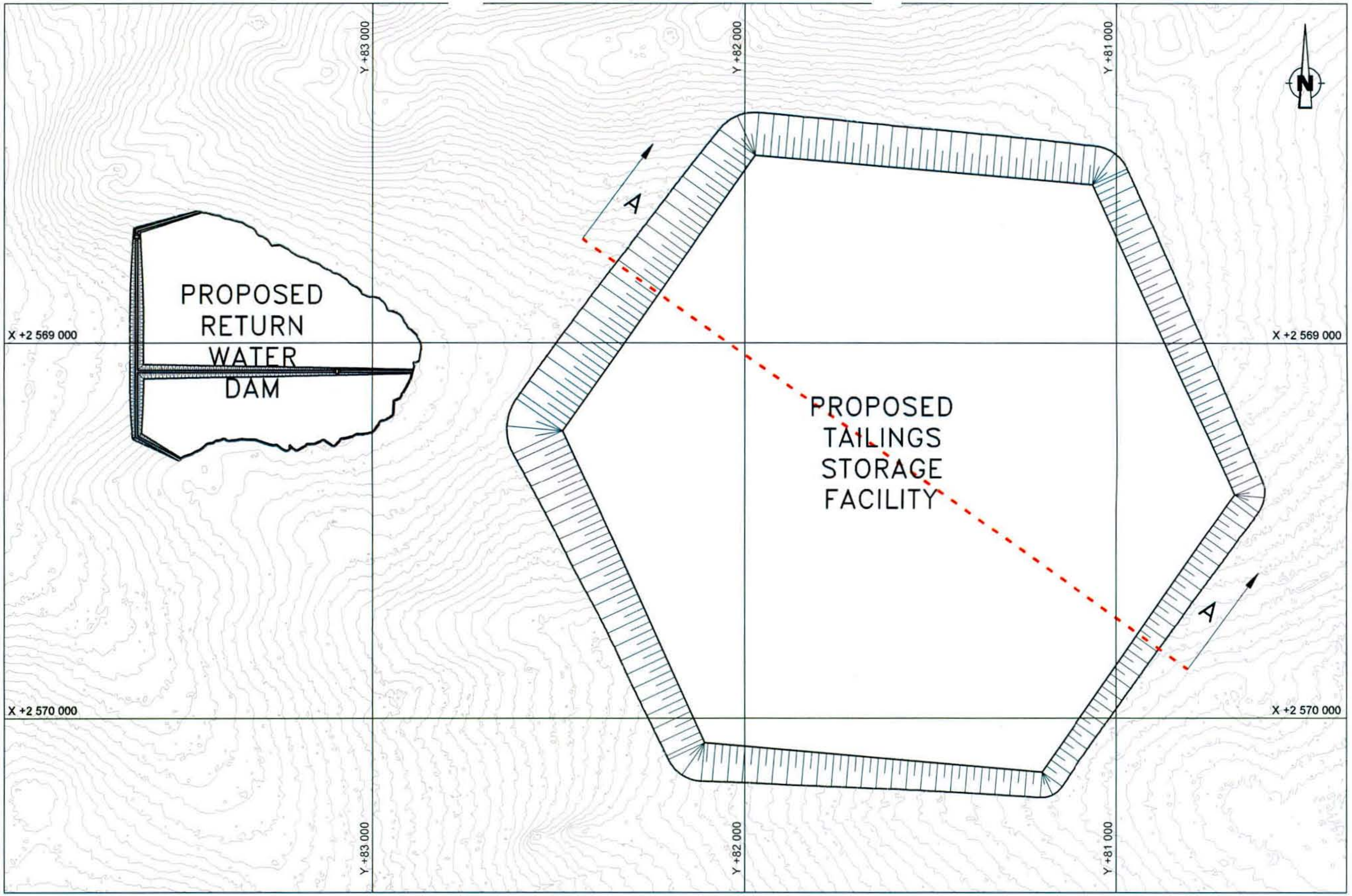
This report documents the findings from the seepage and slope stability analyses conducted for the preliminary design of the TSF for the proposed mining project. The plan view of the TSF is shown in Figure 1-1.

The seepage and stability analyses were carried out using the SEEP/W and SLOPE/W programmes respectively, and these are part of the GeoStudio 2007 suit of programmes.

1.1 SEEPAGE ANALYSES

The seepage analyses were conducted to estimate the likely seepage flux from the TSF into the underlying in-situ (foundation) materials and to assess the positioning of the under-drains to ensure that the phreatic surface is sufficiently drawn down from a stability perspective i.e. control the phreatic surface within the TSF and to prevent daylighting of the phreatic surface on the outer slopes of the TSF/starter walls.

The analyses were undertaken on a TSF cross section simulating the final design height i.e. final height to which the tailings will be placed. The period prior to this (commissioning and operational phase) and the period after decommissioning (draw down phase) have not been analysed.



Metago Environmental Engineers (Pty) Ltd
Consulting Engineers & Scientists

MOONLIGHT IRON ORE PROJECT
TAILINGS STORAGE FACILITY (TSF) LAYOUT

Date :	16052011	Scale :	NTS
Project No :	T020-04	FIGURE 1-1	

Ten cases were analysed taking cognisance of:

- Top surface pool sizes, and
- The functionality of the under-drainage system (operational and non-operational).

The pool size has been estimated as a percentage of the available basin surface area. The pool sizes considered were 25%, 35%, 50%, 65% and 75%. The maximum seepage flux into the foundation material has been determined for each case. The pore-water pressure results, for selected pool sizes were used in the stability analysis.

1.2 SLOPE STABILITY ANALYSES

The slope stability analyses were conducted to assess the performance of the selected side slope configuration of the TSF. During operations, tailings will be placed at an average side slope of 1V (vertical) to 4H (horizontal). The relatively flat side slope has been selected to ensure long term stability of the TSF (post closure) and to facilitate the ease of vegetation establishment during operations and at closure.

The stability analyses were undertaken considering pool sizes of 35% (considered to be the normal operating pool size) and 75% (worst case scenario). The functionality of the under-drainage system was also considered.

1.3 TERMS OF REFERENCE AND SCOPE OF WORK

The terms of reference for the analyses were as follows:

- To estimate the likely seepage volume into the underlying (foundation) materials.
- To ensure that the proposed position of the under-drains is adequate to control the phreatic surface.
- Calculate the safety factor for the critical section under normal operating conditions and under realistic abnormal operations (e.g. large pond).

2 SEEPAGE ANALYSES

2.1 AVAILABLE INFORMATION AND REFERENCES

The following reports are relevant to this investigation and have been used as a source of information for this study:

- **Metago Report T020-04, Report No. 1**, Preliminary Design of the Tailings Storage Facility for the Proposed Moonlight Iron Ore Project, May 2011
- **SEEP/W (2004),** Stability Modeling with SEEP/W 2004- An Engineering Methodology, First Edition (User's Guide), Geo-Slope International Ltd., Calgary, Alberta, Canada.
- **SEEP/W (2008),** Seepage Modeling with SEEP/W 2007- An Engineering Methodology, Third Edition (User's Guide), Geo-Slope International Ltd., Calgary, Alberta, Canada.

2.2 SEEP/W SOFTWARE SUMMARY

Seepage analyses were conducted using the finite element software SEEP/W 2007. This software is capable of analysing seepage through a two dimensional section using a finite element solution to the differential equation (Equation 1) that states that the sum of the rates of change of flows in the x- and y-directions plus the external applied flux is equal to the rate of change of the volumetric water content with respect to time. Under steady state conditions, the flux entering and leaving an elemental volume is the same at all times, reducing the right hand side of the equation to zero (Seep/W, 2008).

EQUATION 1

$$\frac{\partial}{\partial x}\left(K_x \cdot \frac{\partial H}{\partial x}\right)+\frac{\partial}{\partial y}\left(K_y \cdot \frac{\partial H}{\partial y}\right)+Q=\frac{\partial \Theta}{\partial t}$$

Where:

H is the total Head;

K_x is the permeability in the x- direction;

K_y is the permeability in the y- direction;

Q is the applied boundary flux;

Θ is the volumetric water content; and

t is time.

This software allows for defining the geometry of the problem, and structured or unstructured meshing for generation of the suitable finite elements. Material properties and boundary conditions are user defined. Steady state and transient seepage analyses can be carried out.

SEEP/W presents the results visually or in tables for a number of parameters including equipotentials, flow vectors, the phreatic surface position and volumetric water content.

2.3 GEOMETRY

The seepage analyses were carried out on the final design height (984.0 mamsl) TSF profile, cross-section A-A indicated in Figure 1-1 and shown in Figure 2-1. The TSF is a ring dyke impoundment with the natural underlying topography of the proposed site sloping towards the west. The TSF outer slope has been modelled at 1V:4H, the starter wall embankment slopes (inner and outer) were modelled at 1V:3H. The basin of the TSF has been modelled at a slope of 1V:500H. A toe drain (5m wide) is positioned at the inner toe of the starter wall and the toe of the TSF on the upstream flank. A blanket drain (10m wide) is positioned directly below the final crest of the TSF at Life of Mine. The simulated pools are positioned centrally on the top basin surface area.

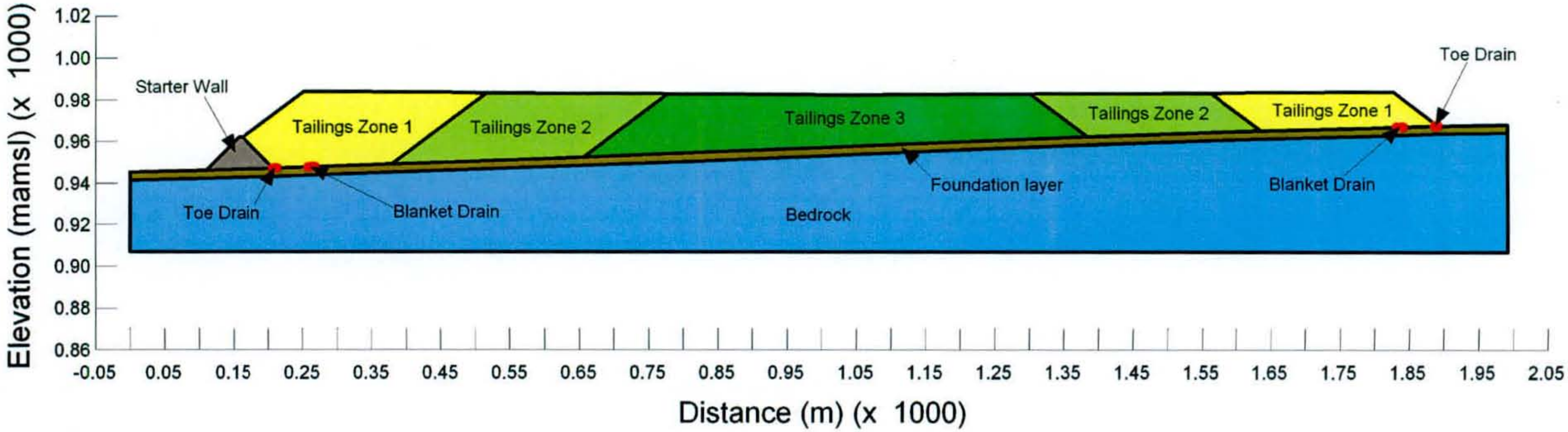
The operation and development of the TSF is expected to result in the material zones shown in Figure 2-1 (discussed further in Section 2.4 below). The analysis includes for a silty sand foundation layer underlain by bedrock. Since the model is a two dimensional model but the seepage takes place over the entire footprint (i.e. a three dimensional problem) the results from the two dimensional model are factored to estimate seepage from the entire TFS footprint using Equation 2 below.

EQUATION 2 SHAPE FACTOR CALCULATION

$$Shape\ Factor = \frac{Depositional\ Area}{Base\ area\ of\ CrossSection} = \frac{2\,736\,334\ \mathrm{m}^2}{1782\ \mathrm{m}^2} = 1536$$

Thus to estimate the total seepage from the entire footprint, the seepage flux through the base of the section analysed was multiplied by 1536.

FIGURE 2-1: TSF CROSS SECTION A-A



2.4 MATERIAL PROPERTIES

A "saturated/unsaturated" SEEP/W material model was chosen for the analyses. This model requires the following inputs for each material type:

- the hydraulic conductivity functions, and
- the hydraulic conductivity ratios (the ratio of the hydraulic conductivity in the y-coordinate direction to the hydraulic conductivity in the x-coordinate direction).

The three material zones shown in Figure 2-1 were introduced in the model to simulate the variation in material properties resulting from the anticipated gravitational segregation along the tailings beach, which is expected to occur during tailings deposition by spigotting

As a result of hydraulic deposition, the tailings particles tend to orientate themselves in such a way that the horizontal permeability is greater than the vertical permeability. In addition, as a result of beaching variations, coarse layers of material alternate with finer layers. These factors give rise to an effective higher horizontal permeability "K_x" compared to the vertical permeability "K_y". The outer Zone 1 exhibit high permeability and behave like fine sand or silty sand. From Zone 2 to Zone 3, tailings are progressively less permeable and exhibit fine silt or even clayey silt behaviour the closer it lies to the pool / penstock intake structure.

The hydraulic conductivity functions, conductivity ratios and geotechnical parameters for the tailings materials (respective zones) were assumed based on experience and published literature. The selected parameters are considered to be conservative and should however be confirmed in the detailed design phase of the project by laboratory testing on representative samples.

The foundation layer has been modelled as a silty sand (based on initial site observations) (3m thick) underlain by bedrock. It is assumed that the starter wall will be constructed from the in-situ foundation material sourced from the TSF basin i.e. similar geotechnical properties as that of the foundation layer but with decreased vertical permeability due to compaction of the material.

The material properties used in the models are summarised in Table 2-1. The material properties should be confirmed in the detailed design phase of the project by laboratory testing on representative samples.

TABLE 2-1: SEEPAGE ANALYSIS MATERIAL PROPERTIES

Material		K_x -Horizontal (m/s)	K_v -Vertical (m/s)	K_y/K_x
Tailings	Zone 1 - High Permeability Tailings	2.0×10^{-6}	1.0×10^{-7}	1/20
	Zone 2 - Medium Permeability Tailings	5.0×10^{-7}	5.0×10^{-8}	1/10
	Zone 3 - Low Permeability Tailings	2.5×10^{-8}	5.0×10^{-9}	1/5
Civil Works	Starter Walls	1.0×10^{-8}	1.0×10^{-9}	1/10
Foundation	Insitu silty sand	5.0×10^{-6}	1.0×10^{-6}	1/5
	Bedrock	1.0×10^{-7}	1.0×10^{-7}	1

2.5 CASES ANALYSED

The ten different cases summarised in Table 2-2 were modelled to assess the positioning and efficiency of the under-drainage system to efficiently drawdown the phreatic surface in the outer zone of the TSF as well as estimating the seepage flux into the foundation layer for environmental purposes i.e. input into contaminant flow modelling. The main characteristics of these models are discussed below:

TABLE 2-2: SUMMARY DESCRIPTION OF SEEPAGE ANALYSIS - CASES MODELLED

Case	Pool Size	Toe and Blanket drain
1	25%	Non Operational
2	25%	Operational
3	35%	Non Operational
4	35%	Operational
5	50%	Non Operational
6	50%	Operational
7	65%	Non Operational
8	65%	Operational
9	75%	Non Operational
10	75%	Operational

2.6 SEEPAGE ANALYSIS RESULTS

A full set of result figures for the seepage analyses is included in Appendix A. These figures show the position of the predicted phreatic surface (solid blue line) and seepage flux into the foundation layer (blue arrows along foundation layer and flow rate m^3/sec per meter width). The unit seepage flux quantities obtained from the models are summarised in Table 2-3:

TABLE 2-3: SEEPAGE UNIT FLUX VALUES

CASE	FOUNDATION (m^3/s)
1	5.93E-07
2	6.39E-07
3	1.00E-06
4	1.11E-06
5	1.64E-06
6	2.03E-06
7	2.07E-06
8	3.24E-06
9	2.55E-06
10	6.33E-05

2.7 DISCUSSION AND CONCLUSION

2.7.1 DRAIN POSITIONING

The results indicate that the 5m wide toe drain and 10m wide blanket drain (located directly below the final crest of the TSF at Life of Mine) should adequately control the phreatic surface along the outer perimeter of the TSF.

2.7.2 PHREATIC SURFACE POSITION

Generally, under normal operating conditions with the under-drainage system operational, the phreatic surface is adequately drawn down. If the drainage system failed (i.e. non-operational under-drainage), and for pool sizes greater than 50%, the phreatic surface would daylight on the TSF slope at the top of the starter wall.

2.7.3 SEEPAGE FLUX TO GROUNDWATER

The likely range of long term seepage fluxes to the TSF foundation is summarised in Table 2-4 below.

TABLE 2-4: MAXIMUM SEEPAGE FLUX TO THE GROUND

CONDITION	TOTAL FOOTPRINT (m^3/day)
35% Pool, Drainage system operational (Normal operating conditions) (Case 4)	148
75% Pool, Drainage system operational (Worst case scenario) (Case 10)	840

The pool size at the top must be kept as small as practical to reduce the seepage quantities to the ground.

3 SLOPE STABILITY ANALYSES

3.1 AVAILABLE INFORMATION AND REFERENCES

The following reports are relevant to this investigation and have been used as a source of information for this study:

- **Metago Report T020-04, Report No. 1**, Preliminary Design of the Tailings Storage Facility for the Proposed Moonlight Iron Ore Project, May 2011
- **SLOPE/W (2008),** Stability Modeling with SLOPE/W 2007- An Engineering Methodology, Third Edition (User's Guide), Geo-Slope International Ltd., Calgary, Alberta, Canada.

3.2 SLOPE/W SOFTWARE SUMMARY

The slope stability analyses were done using slope stability software SLOPE/W 2007 from GEO-SLOPE. Using limit equilibrium, this software can model heterogeneous soil types, complex stratigraphic and slip surface geometry, and variable pore-water pressure conditions using a large selection of soil models. This software allows for both deterministic and probabilistic input parameters. Generally, in SLOPE/W the critical slip surface is first determined based on the mean value of the input parameters using a chosen factor of safety method (of analysis). Probabilistic analysis is then performed on the critical slip surface, taking into consideration the variability of the input parameters. For more information on the software algorithms, the reader is referred to the SLOPE/W online help facility and user manual.

3.3 GEOMETRY AND MATERIAL PROPERTIES

3.3.1 GEOMETRY

The slope stability analyses were also carried out on the TSF profile section A-A described in Section 2.3.

3.3.2 MATERIALS PROPERTIES

The geotechnical parameters for the various materials have been estimated based on experience and published literature. The selected parameters used in the stability analyses are summarised in Table 3-1.

The material properties should be confirmed in the detailed design phase of the project by laboratory testing on representative samples.

TABLE 3-1: MATERIAL PROPERTIES INPUT FOR SLOPE/W

DESCRIPTION	BULK UNIT WEIGHT (KN/M3)	SATURATED UNIT WEIGHT (KN/M3)	APPARENT COHESION (C')	FRICTION ANGLE (DEGREES)
Tailings Zone 1	24.58	26.71	0	32
Tailings Zone 1	22.12	25.02	0	32
Tailings Zone 1	20.11	23.63	0	32
Starter Wall	20.04	21.02	0	32
Foundation layer	18.70	20.27	0	30
Bedrock	18.70	20.27	50	40

3.4 METHOD OF ANALYSIS

3.4.1 FACTOR OF SAFETY METHOD

The Morgenstern-Price factor of safety method was chosen for these analyses. This method ensures force equilibrium in both x- and y-directions, and moment equilibrium for the succession of slices into which the failure mass is divided.

3.4.2 SLIP SURFACE DETERMINATION

This analysis considered deep seated failure which is commonly used in industry to assess the stability of a TSF slope i.e. surface sloughing and local failure has not been considered as part of this study (but should be undertaken in the detailed design phase of the project). The slip surfaces were developed by defining entry/exit areas for the start and end points of the slip surfaces. The position of the critical slip surface with the lowest factor of safety was determined deterministically through a trial procedure. The critical slip surface was then further optimised to obtain the lowest possible factor of safety.

3.4.3 PORE-WATER PRESSURES

Finite element computed pore-water pressures were imported from the previous seepage analyses conducted for this TSF (Discussed in Section 2).

3.4.4 CASES ANALYSED

Slope stability analyses were limited to the downstream slope (i.e. highest section) and were undertaken with simulated pool sizes of 35% and 75%, with both considering the functionality of the under-drainage system.

As stated above, the pore water pressure regime, including the position of the phreatic surface, has been imported from the seepage analysis. A pool size of 35% is considered to be adequate for normal operating conditions and 75% as a worst case scenario.

3.5 SLOPE/W Results

The results from the slope stability analyses are summarised in Table 3-2. The result figures showing analysed slip surfaces are included in Appendix B.

TABLE 3-2: SLOPE STABILITY RESULTS

Case	Pool Size	Toe and Blanket Drain	Factor of Safety
3	35%	Non Operational	1.971
4	35%	Operational	2.128
9	75%	Non Operational	1.561
10	75%	Operational	2.125

3.6 Discussion and Conclusion

The minimum factor of safety (FoS) is acceptable for all modelled cases as it is greater than the recommended 1.3. The minimum factor of safety of 1.3 is the industry accepted norm for TSF slopes – see Appendix C for general notes regarding TSF slope failures.

For the normal operating conditions (Case 4) – pool size, 35% and drains operational – the factor of safety is 2.128. For the worst case scenario (Case 10) – pool size, 75% and the drains operational – the factor of safety reduces to 2.125 i.e. the size of the pool does not significantly influence the factor of safety of the TSF, provided the drains are operational.

For the abnormal operating conditions (Case 3) – pool size, 35% and drains non-operational – the factor of safety reduces to 1.971. For the worst case scenario (Case 9) – pool size, 75% and the drains non-operational – the factor of safety significantly reduces to 1.561 i.e. the size of the pool does significantly influence the factor of safety of the TSF, in the event of the drains being non-operational.

Furthermore, the non-operation of the drains results in the phreatic surface daylighting on the slope of the TSF, that will significantly increase the likelihood of sloughing on the outer TSF slopes. Also the possibility of a piping failure of the TSF (i.e. internal erosion of tailings between the supernatant pool and the outer TSF slope) significantly increases.

4 RECOMMENDATIONS

4.1 SEEPAGE

The following recommendations arise from the seepage study:

- The positioning of the under-drainage system is adequate for the control of the phreatic surface. The sizing of the drains (5m wide toe and 10m wide blanket drain) should be assessed in the detailed design phase to ensure that the outlet piping is adequately sized and that the selected drain widths are optimized.
- The permeability of the near surface foundation soils and tailings should be confirmed through laboratory testing and field infiltration tests during the detailed design and operational phase, since the tailings zones and material properties may differ significantly from the assumed values.
- Predicted seepage losses need to be confirmed once the infiltration testing is complete.
- Drain functionality should be monitored throughout the life of the TSF. Separation of the blanket drain and toe drain collection pipes is recommended to assist in diagnosis of a drain malfunction.
- Piezometric heads and drainage volumes must be monitored at least monthly to ensure safe operating phreatic surface conditions.
- During the detailed design phase, transient analysis should be carried out to assess the time it takes for the phreatic surface under normal conditions within the TSF to respond to abnormal conditions.

4.2 SLOPE STABILITY

The following recommendations are made with respect to the slope stability:

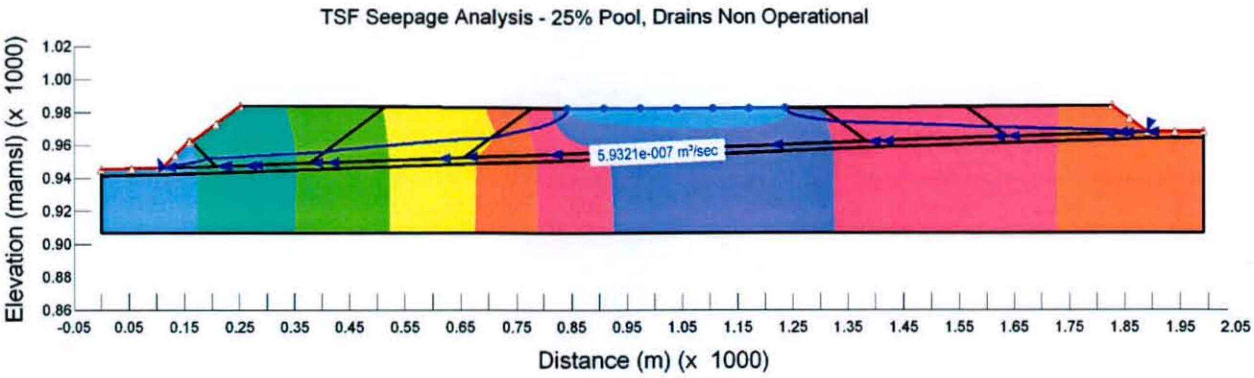
- The pond size should be minimised at all times through the provision of adequately sized off-dam water storage facilities, and ensuring proper functioning of drains and the decant system.
- The detailed design phase should undertake a probabilistic and sensitivity analysis to assess the impact of the variation of the material parameters.

Malcolm Maber **Stephen van Niekerk**
(Author) **(Project Reviewer)**

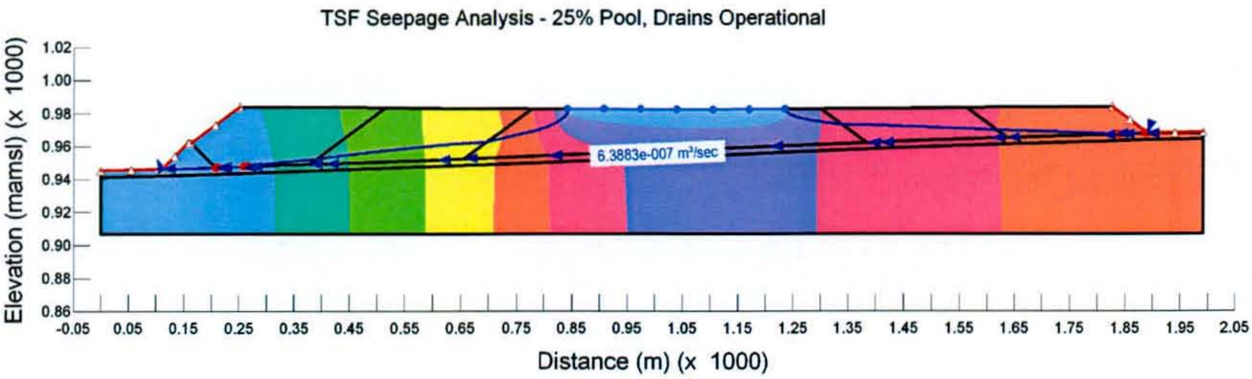
Metago Environmental Engineers (Pty) Ltd

APPENDIX A: SEEPAGE ANALYSIS OUTPUT SHEETS

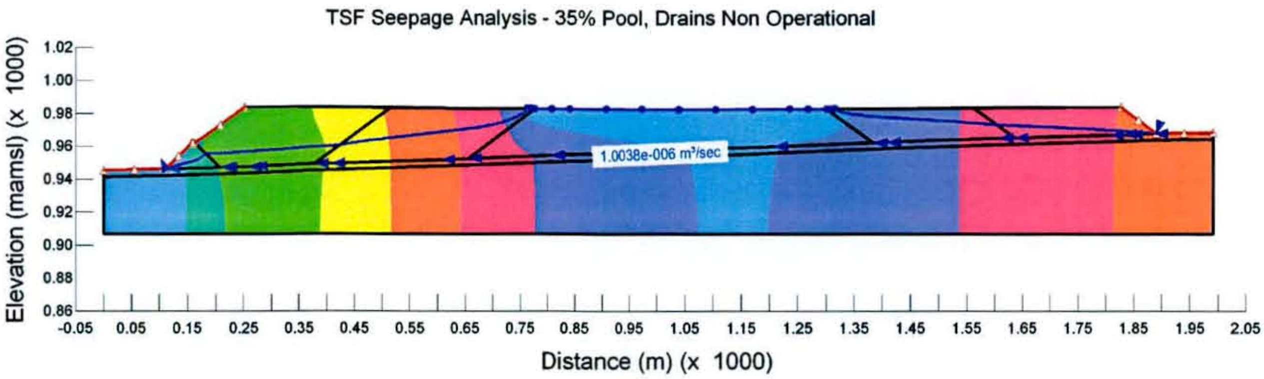
SEEPAGE ANALYSIS - CASE 1



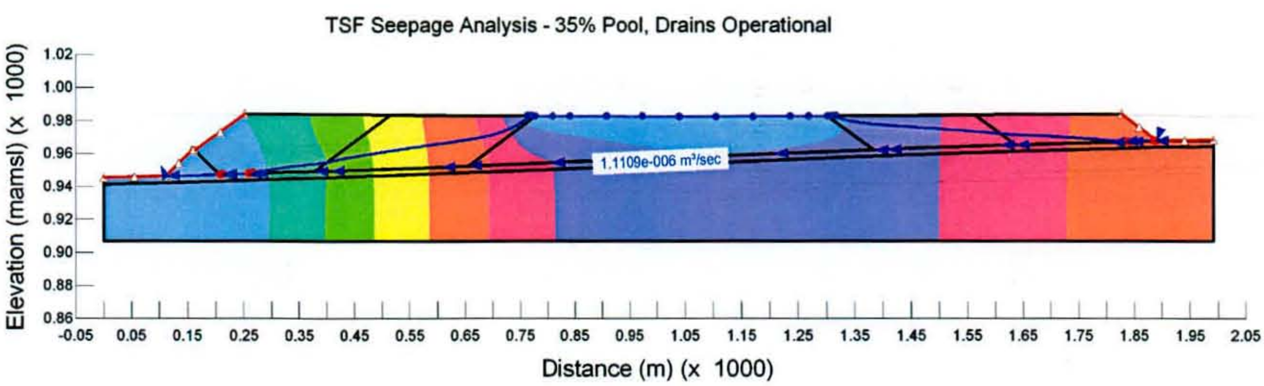
SEEPAGE ANALYSIS - CASE 2



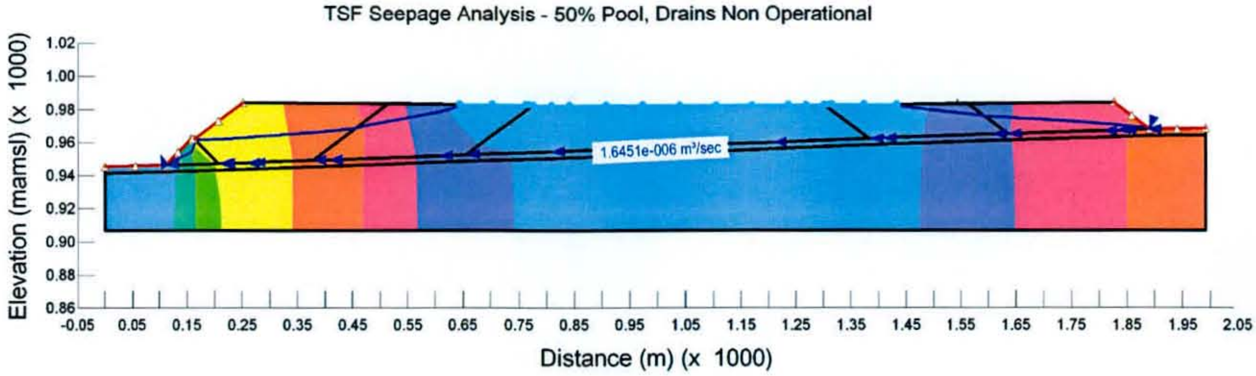
SEEPAGE ANALYSIS - CASE 3



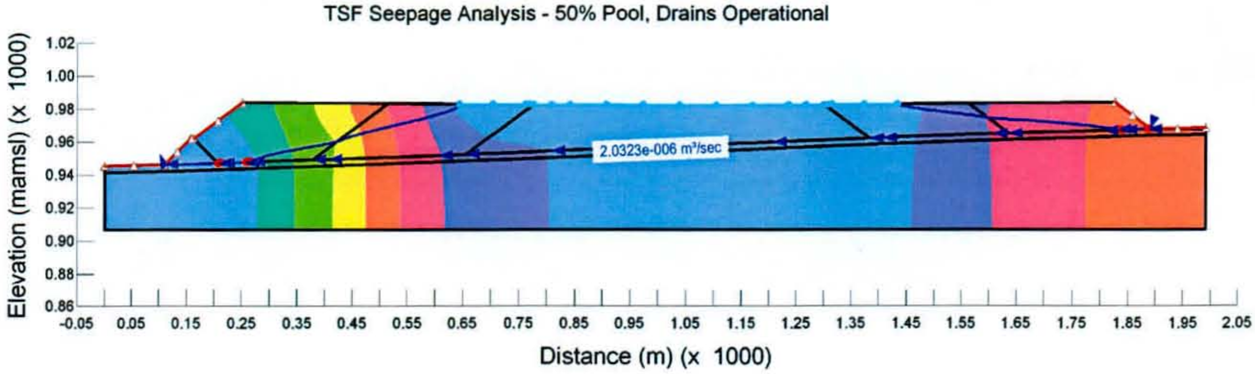
SEEPAGE ANALYSIS - CASE 4



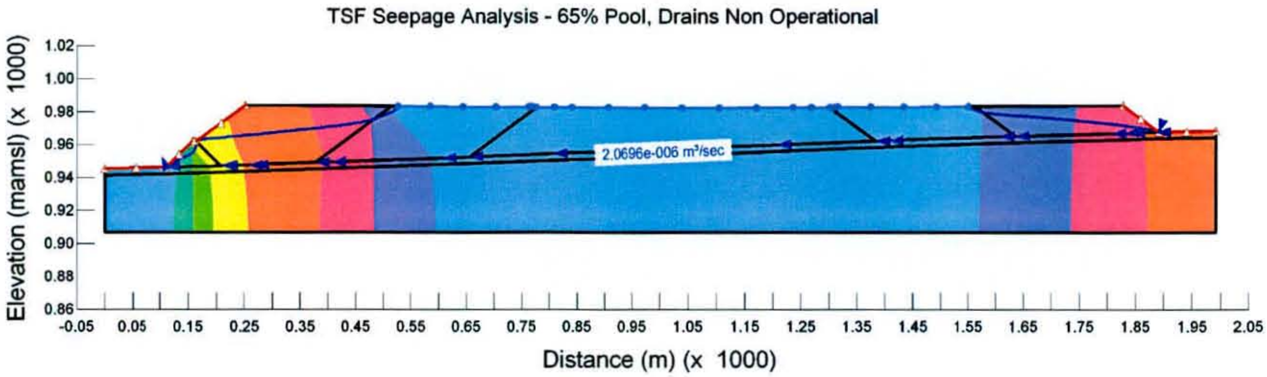
SEEPAGE ANALYSIS - CASE 5



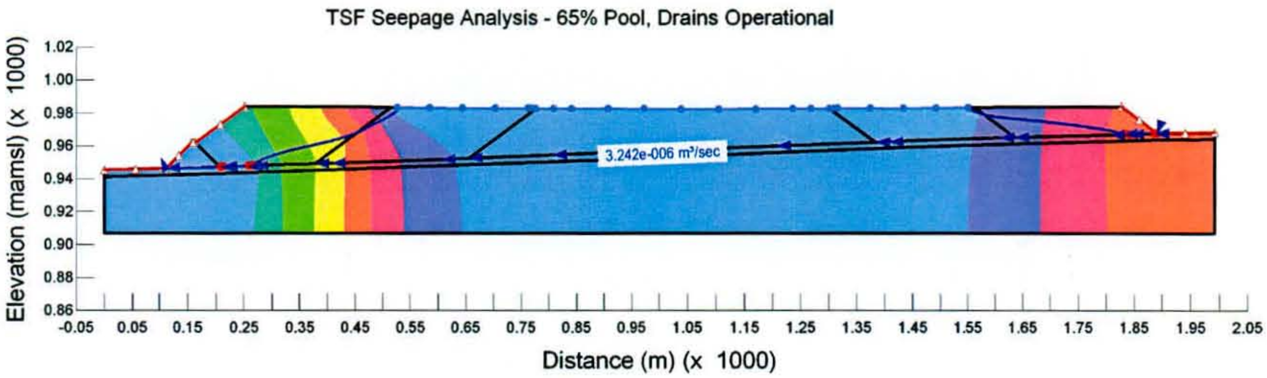
SEEPAGE ANALYSIS - CASE 6



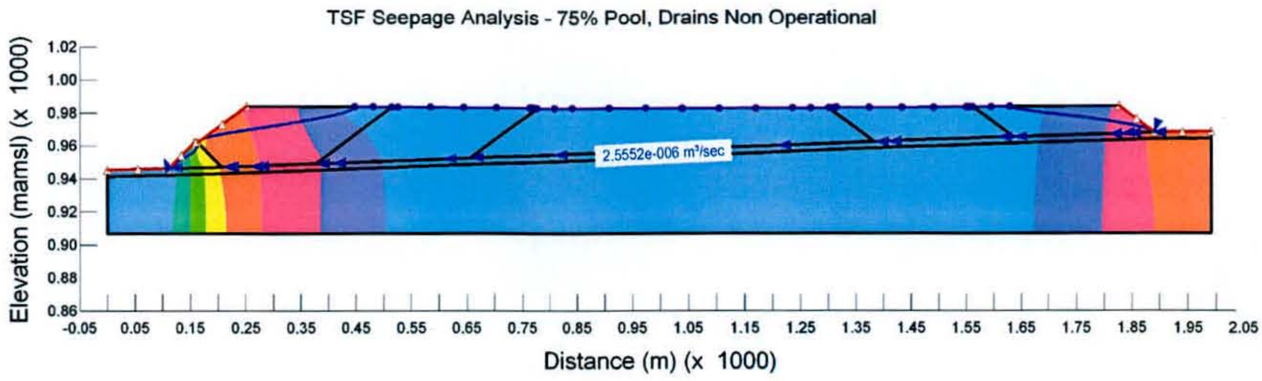
SEEPAGE ANALYSIS - CASE 7



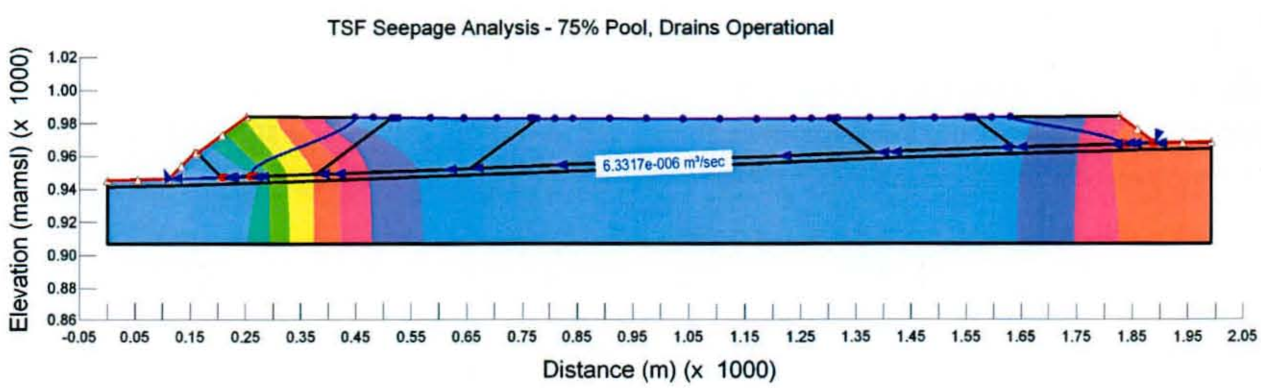
SEEPAGE ANALYSIS - CASE 8



SEEPAGE ANALYSIS - CASE 9

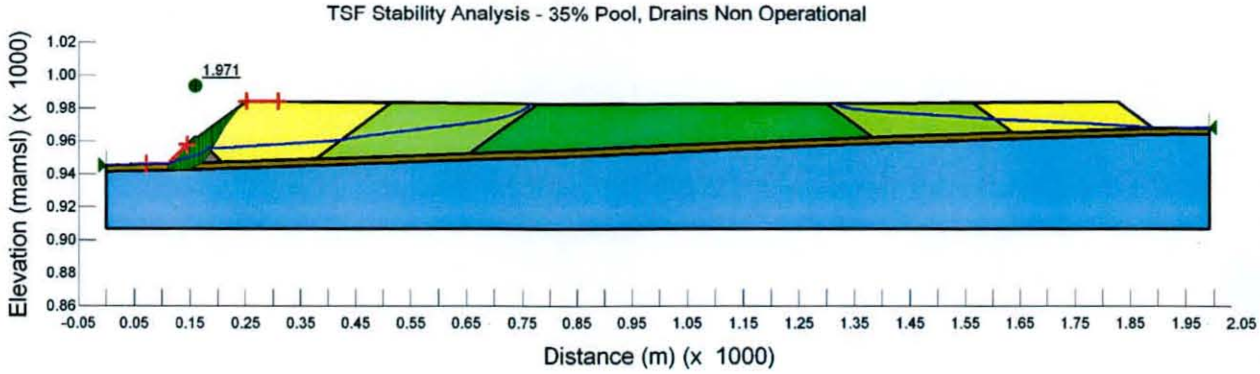


SEEPAGE ANALYSIS - CASE 10

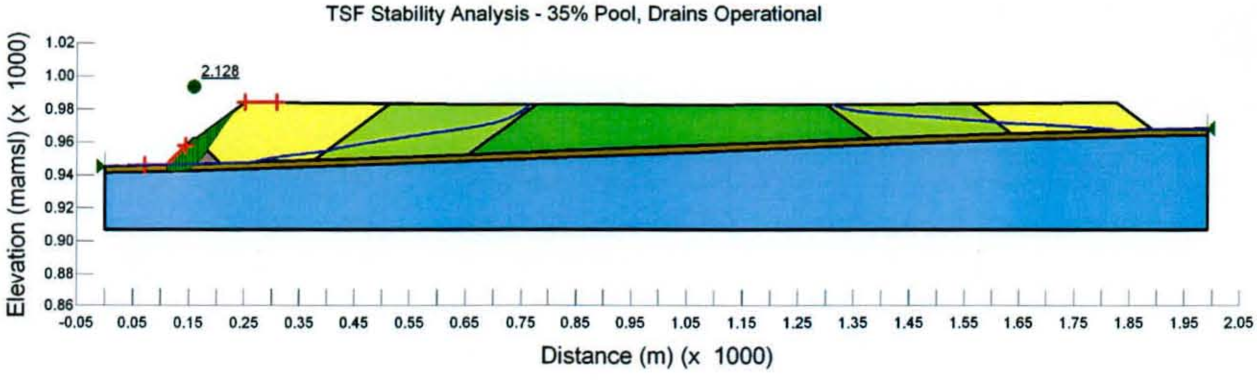


APPENDIX B: SLOPE STABILITY ANALYSIS OUTPUT SHEETS

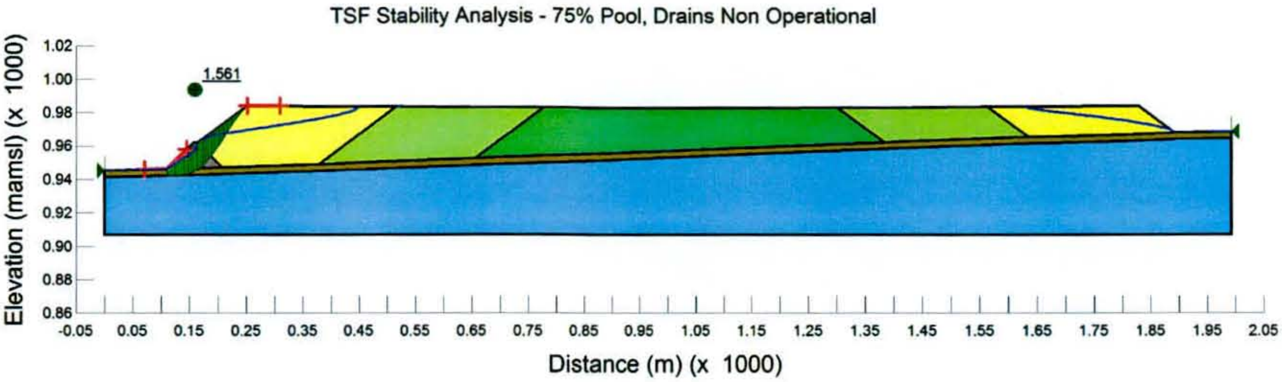
STABILITY ANALYSIS - CASE 3



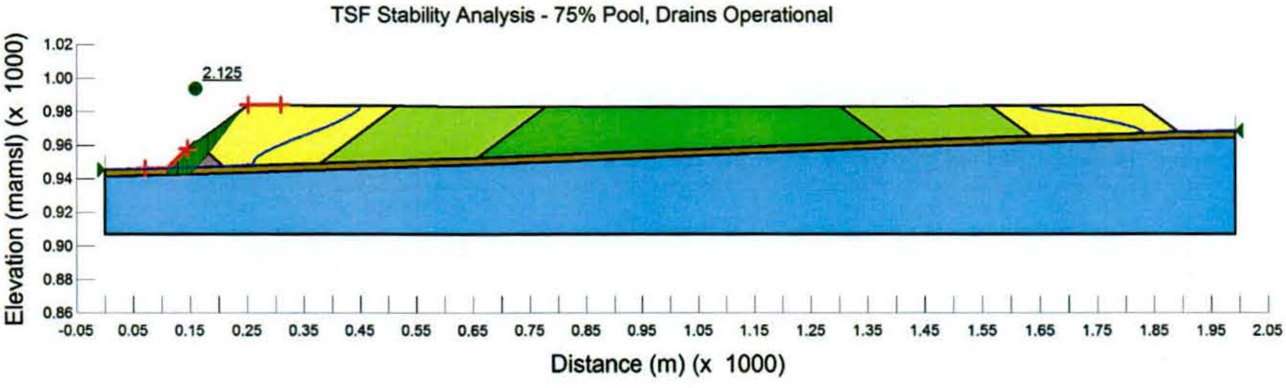
STABILITY ANALYSIS - CASE 4



STABILITY ANALYSIS - CASE 9



STABILITY ANALYSIS - CASE 10



APPENDIX C: NOTES - TSF SLOPE FAILURES

TSF Slope Failures

Generally, a TSF failure does not occur because of a single fault but rather a series of faults acting together, that ultimately result in either:

- An overtopping of the embankment by the supernatant pond,
- A classical slip circle or wedge type failure, or
- A piping (internal erosion) failure between the supernatant pond and the outer slope of the TSF.

Any of the above faults can result in the liquefaction of a significant portion of the tailings material (i.e. tailings flow slide). The consequence of a tailings flow slide is often catastrophic as it affects a significant area downstream of the TSF.

The key variables that affect the stability of a TSF are:

- The location of the phreatic surface (i.e. increasing the pore water pressure along the failure surface reduces the effective shear strength along the failure surface and hence reduces the stability of the TSF).
- The strength of the materials through which a failure surface passes (e.g. reducing the effective friction angle and/or effective cohesion of a material along the failure surface reduces the stability of the TSF).
- The bulk density of materials above the failure surface (i.e. denser materials above the failure surface increase the failure moment and force equilibrium, and hence reduce the stability of the TSF. The bulk density of material increases as a function of the moisture content).

Stability analyses show that the distance from the pond edge to the embankment is a critical factor in determining the risk of failure. It is therefore recommended that water ponding close to the crest be avoided at all times, and careful water management at the TSF be undertaken.

The overtopping failure risk can be mitigated through the timeous construction of wall lifts. This in turn requires that the shear strength and trafficability of the material over which construction activities are to take place is sufficient to allow this activity. The TSF design is based on a maximum rate of rise of 1.0 m/yr which based on experience, is considered adequate to achieve acceptable shear strength for construction purposes in the area concerned.

A more comprehensive analysis of the modes of failure should be conducted during the detailed design phase including:

- Tailings liquefaction potential
- Layering risk and mitigation
- Slope stability assessment taking cognisance of material variability

Acceptable Factor of Safety

The Chamber of Mines Guidelines (1996) recommends the following for slope stability of TSF's:

- The factor of safety should be greater than 1.3 for regularly monitored TSF's, and
- The factor of safety for an abandoned side slope e.g. TSF at closure, should be greater than 1.5.

The lower factor of safety (1.3) is accepted with the assumption that the TSF will be under continuous supervision, and that any signs of distress in the TSF will be noticed early on and any necessary remedial measures timeously undertaken.

Probabilistic Slope Stability Analyses

With a probabilistic analysis, two useful indices are available to quantify the stability or the risk level of a slope. These two indices are known as the probability of failure and the reliability index.

- The level of uncertainty associated with a slope is dependent on the level of uncertainty of a range of parameters affecting the slope stability as mentioned above.

The factor of safety obtained using a deterministic approach fails to recognise the level of uncertainty associated with these parameters (especially at the preliminary stages of the design). There is no direct relationship between the deterministic factor of safety and probability of failure. A slope with a higher factor of safety may not necessary be more stable than a slope with a lower factor of safety. For example, a slope with factor of safety of 1.5 and standard deviation of 0.5 may have a much higher probability of failure than a slope with a factor of safety of 1.2 and standard deviation of 0.1. It is therefore suggested that the criteria for probability of failure should be applied in addition to a deterministic factor of safety approach.

The risk level, or probability of failure that can be tolerated, depends on the level of risk that stakeholders (including downstream property owners, authorities, the mine owner and consultants) are willing to accept. This may differ between the operational phase and post closure. The probability of failure is determined by counting the number of safety factors below 1.0 and then taking this number as a percentage of the total number of converged Monte Carlo trials.

Guidelines for the acceptable probability of failure for side slope failure documented in the literature (Cole, 1993) indicate that the probability of failure should not be higher than between 0.07% (1:1,430) and 0.007% (1:14,300) for short term and medium term (semi-permanent) slopes respectively. For long term slopes (i.e. at closure) the minimum acceptable probability of failure is considered to be 0.0007% (1:143,000). TSF side slopes can be considered to fall into Cole's definition of side slopes.

A criteria for using output distribution for assessing the consequences of slope failure also documented in the literature by Kok Shien, N, (2005) is shown in Table C-1. These criteria associate acceptable levels of probability of failure with various design conditions.

TABLE C-1: PROBABILITY OF FAILURE CRITERIA FOR SLOPE

CONDITIONS	CRITERIA FOR PROBABILITY OF FAILURE
Temporary structures with low repair cost	0.1
Existing large cut on interstate highway	0.01
Acceptable in most cases EXCEPT if lives may be lost	0.001
Acceptable for all slopes	0.0001
Unnecessarily low	0.00001

The reliability index describes the stability by the number of standard deviations separating the mean factor from its defined value of 1.0. Slopes with relative high reliability index will be expected to perform their function well. Slopes with low reliability index will be expected to perform poorly and present major rehabilitation problems. The target reliability values shown in Table C-2 are proposed by US Army (1999).

TABLE C-2: TARGET RELIABILITY INDICES (US ARMY, 1999)

EXPECTED PERFORMANCE LEVEL	RELIABILITY INDEX	PROBABILITY OF UNSATISFACTORY PERFORMANCE
High	5	0.0000003
Good	4	0.00003
Above average	3	0.001
Below average	2.5	0.006
Poor	2	0.023
Unsatisfactory	1.5	0.07
Hazardous	1	0.16

Note: Probability of unsatisfactory performance is the probability that the value of performance function will approach the limit state, or that an unsatisfactory event will occur. For example, if the performance function is defined in terms of slope instability, and the probability of unsatisfactory performed function is defined in terms of slope stability, and the probability of unsatisfactory performance is 0.023, then 23 of every 1000 instabilities will result in damage which causes a safety hazard.

In general, it is expected that the estimated factors of safety and probabilities of failure will improve once the TSF is decommissioned (i.e. post closure) as the phreatic surface dissipates and the tailings material further consolidates.

Sensitivity Study

A sensitivity analysis is equivalent to a probabilistic analysis. In SLOPE/W, this is performed by selecting parameters in an ordered fashion using a Uniform Probability Distribution function instead of a random selection process.

Metago (part of the SLR Group)

SLR

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RECORD OF REPORT DISTRIBUTION

Project Number:	T020-04
Title:	Preliminary Design of the Tailings Storage Facility for the Proposed Moonlight Iron Ore Project
Report Number:	1 - Final
Proponent:	Ferrum Crescent Limited

Name	Entity	Copy No.	Date issued	Issuer

APPENDIX V: CLOSURE COST CALCULATION STUDY

Specialist report prepared by Metago, June 2011

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Project Reference: T020-02 22 June 2011

Proposed Moonlight Iron Ore Project

CALCULATION OF THE FINANCIAL CLOSURE LIABILITY ASSOCIATED WITH PROPOSED MOONLIGHT IRON ORE MINE PROJECT

1. INTRODUCTION

This financial closure liability calculation is an initial estimate that has been prepared by Metago and submitted as part of the *Environmental Impact Assessment and Environmental Management Programme* for the proposed Moonlight Iron Ore Project, prepared for Turquoise Moon Trading 157 (Pty) Limited (Metago Project T020-02, Report No. 4, July 2011).

The calculations of the financial closure liability associated with the proposed Moonlight Iron Ore Project (Moonlight), as at December 2013 and at life of mine (plus 32 Years i.e. at December 2045)) have been completed in accordance with the *Guideline Document for the Evaluation of the Quantum of Closure-Related Financial Provision Provided by a Mine* as published by the Department of Minerals and Energy (DME), dated January 2005.

The DME is now known as the Department of Mineral Resources (DMR).

2. INPUT TO THE FINANCIAL CLOSURE LIABILITY CALCULATION

The DMR procedure for calculating financial closure liability is summarised as follows:

- Step 1: Determine the primary mineral and saleable mineral by-products.
- Step 2: Determine the risk class of the mine.
- Step 3: Determine the area sensitivity in which the mine is located.
- Step 4.1: Determine the level of information available for calculating the financial liability.
- Step 4.2: Determine the closure components associated with the mine.
- Step 4.3: Determine the unit rates for the associated closure components.
- Step 4.4: Determine and apply various weighting factors (site specific).
- Step 4.5: Identify the areas of disturbance.
- Step 4.6: Identify any specialist studies required.
- Step 4.7: Calculate the closure liability using the DMR template provided.

The areas shaded in grey in the following sub-chapters are the values/information used in the calculation of the financial liability associated with the proposed Moonlight Project.

2.1. STEP 1: MINE TYPE AND SALEABLE MINERAL BY-PRODUCT

DMR require that the type of mineral mined or processed, and the saleable mineral by-products (not trace elements) be identified.

The primary mineral at the proposed Moonlight Project is iron. There are no saleable mineral by-products from the mining or plant operations.

Mine/Process type	Iron Ore – Opencast
Saleable mineral by-product	N/A

2.2. STEP 2: RISK RANKING

According to the DMR guideline, the proposed Moonlight Project (due to its minerals mined (Iron Ore), tonnages (greater than 10,000 tonnes per month), processing plant and plant waste (tailings)) is classified as a Class A – High risk facility.

The risk ranking class is used later to determine the multiplication factors applied to the master rate (see Step 4.3).

Primary risk ranking	Class A – High risk (Large mine, greater than 10,000 tonnes per month) *
Revised risk ranking	N/A

* Class A – High Risk = A high probability of occurrence of an impact with a severe consequence.

2.3. STEP 3: ENVIRONMENTAL SENSITIVITY OF THE MINE AREA

The proposed Moonlight Project is overall classified as having a High environmental sensitivity based on the classification criteria tabled overleaf:

- A medium to high biophyiscial sensitivity (based on the relatively pristine pre-mining environment of the project area).
- A medium social sensitivity (based on the proximity of the project area to local communities).
- A medium to high economic sensitivity (based on the project area's existing economic activity i.e. game farming, hunting and tourism).

The environmental sensitivity ranking is used later to determine the multiplication factors applied to the master rate (see Step 4.3).

Sensitivity*	Sensitivity Criteria		
	Biophysical	Social	Economic
Low	• Largely disturbed from natural state, • Limited natural fauna and flora remains, • Exotic plant species evident, • Unplanned development, • Water resources disturbed and impaired.	• The local communities are not within sighting distance of the mining operation, • Lightly inhabited area (rural).	• The area is insensitive to development, • The area is not a major source of income to the local communities.
Medium	• Mix of natural and exotic fauna and flora, • Development is a mix of disturbed and undisturbed areas, within an overall planned framework, • Water resources are well controlled.	• The local communities are in proximity of the mining operation (within sighting distance), • Peri-urban area with density aligned with a development framework, • Area developed with an established infrastructure.	• The area has a balanced economic development where a degree of income for the local communities is derived from the area, • The economic activity could be influenced by indiscriminate development.
High	• Largely in natural state, • Vibrant fauna and flora, with species diversity and abundance matching the nature of the area, • Well planned development, • Area forms part of an overall ecological regime of conservation value, • Water resources emulate their original state.	• The local communities are in close proximity of the mining operation (on the boundary of the mine), • Densely inhabited area (urban/dense settlements), • Developed and well-established communities.	• The local communities derive the bulk of their income directly from the area, • The area is sensitive to development that could compromise the existing economic activity.

2.4. STEP 4.1: LEVEL OF INFORMATION AVAILABLE

The level of information available allows DMR to either accept (and/or independently review) the financial closure liability submitted, otherwise follow the 'rule-based' approach.

Extensive	Information available must include the following: • An Approved EMP, or in the process of being approved, • A detailed Closure Plan based on the EMP, • A detailed breakdown of costs envisaged for rehabilitation and closure.
Limited*	Information available is less comprehensive than that given above

* Limited information available requires that DMR follow the 'rule-based' approach (see Step 4.3).

Since no detailed Closure Plan for the proposed Moonlight Project has been developed and/or approved by the relevant Authorities, and hence no detailed breakdown of costs prepared and sufficiently motivated, the step-by-step 'rule-based' DMR approach for calculating closure liability should be followed.

2.5. STEP 4.2: CLOSURE COMPONENTS TO BE USED

The closure components relevant to the site-specific conditions are determined from the list provided below.

No.	Description of Closure Components*	Applicable
1	Dismantling of processing plant & related structures (incl. overland conveyors & power lines)	Yes
2 (A)	Demolition of steel buildings & structures	No
2 (B)	Demolition of reinforced concrete buildings & structures	Yes
3	Rehabilitation of access roads	Yes
4 (A)	Demolition & rehabilitation of electrified railway lines	No
4 (B)	Demolition & rehabilitation of non electrified railway lines	No
5	Demolition of housing &/or administration facilities	Yes
6	Opencast rehabilitation including final voids & ramps	Yes
7	Sealing of shafts, adits & inclines	No
8 (A)	Rehabilitation of overburden & spoils	Yes
8 (B)	Rehabilitation of processing waste deposits & evaporation ponds (basic, salt producing waste)	Yes
8 (C)	Rehabilitation of processing waste deposits & evaporation ponds (acidic, metal-rich waste)	No
9	Rehabilitation of subsided areas	No
10	General surface rehabilitation	Yes
11	River diversions	No
12	Fencing (i.e. high level security perimeter fencing)	Yes
13	Water management	Yes
14	2 to 3 years of maintenance & aftercare	Yes

* The Closure Components selected are in-line with the decommissioning and closure objectives detailed in the *Environmental Impact Assessment and Environmental Management Programme* for the proposed Moonlight Iron Ore Project, prepared for Turquoise Moon Trading 157 (Pty) Limited (Metago Project T020-02, Report No. 4, July 2011).

It is important to note that Item 6 - Opencast rehabilitation (including final voids and ramps) <u>does not allow for backfilling of the void</u>, but only makes provision for the sloping of the pit walls to 1V:3H i.e. making the voids safe for humans and domestic animals.

Further details of the DMR closure components as provided by the DMR are summarised in Appendix C.

2.6. STEP 4.3: UNIT RATES FOR CLOSURE COMPONENTS

The unit (Master) rates for each closure component is taken from the DMR guideline (and inflated by the Consumer Price Index (CPI) to account for escalation since January 2005) and a Multiplication Factor applied depending on the Risk Ranking and the Environmental Sensitivity.

The average annual percentage change in the CPI as provided by Statistics South Africa is:

- January 2005 to December 2005, 3.4 %
- January 2006 to December 2006, 4.6 %
- January 2007 to December 2007, 7.2 %
- January 2008 to December 2008, 11.5 %
- January 2009 to December 2009, 7.1 %
- January 2010 to December 2010, 4.3 %
- January 2011 to April 2011, 3.93%

i.e. a total of 50.1 % since January 2005 (i.e. 1.034 x 1.046 x 1.072 ... etc.).

No.	Description	Unit	Master Rate (at June 2011)	Multiplication Factor *
1	Dismantling of process plant & related structures (incl. overland conveyors & power lines)	m^3	R 10.24	1.00
2 (A)	Demolition of steel buildings & structures	m^2	R 142.57	1.00
2 (B)	Demolition of reinforced concrete buildings & structures	m^2	R 210.11	1.00
3	Rehabilitation of access roads	m^2	R 25.51	1.00
4 (A)	Demolition & rehabilitation of electrified railway lines	m	R 247.63	1.00
4 (B)	Demolition & rehabilitation of non electrified railway lines	m	R 135.07	1.00
5	Demolition of housing &/or administration facilities	m^2	R 285.15	1.00
6	Opencast rehabilitation including final voids & ramps	Ha	R 145,124.46	1.00
7	Sealing of shafts, adits & inclines	Ha	R 76.54	1.00
8 (A)	Rehabilitation of overburden & spoils	Ha	R 99,651.13	1.00
8 (B)	Rehabilitation of processing waste deposits & evaporation ponds (basic, salt producing waste)	Ha	R 124,113.68	1.00
8 (C)	Rehabilitation of processing waste deposits & evaporation ponds (acidic, metal-rich waste)	Ha	R 360,484.95	1.00
9	Rehabilitation of subsided areas	Ha	R 83,442.81	1.00
10	General surface rehabilitation	Ha	R 78,940.50	1.00
11	River diversions	Ha	R 78,940.50	1.00
12	Fencing	m	R 90.05	1.00
13	Water management	Ha	R 30,015.40	1.00
14	2 to 3 years of maintenance & aftercare	Ha	R 10,505.39	1.00

* Multiplication factor based on Risk Ranking = Class A and Environmental Sensitivity = High.

2.7. STEP 4.4: WEIGHTING FACTORS TO BE USED

Weighting Factors based on the specific mine/process location are selected from the tables below.

Nature of the terrain/accessibility	Flat – Generally flat over the mine area	Undulating - A mix of sloped and undulating areas within the mine area	Rugged – Steep natural ground slopes (greater than 1:6) over the majority of the mine area
Weighting Factor 1	1.00	1.10	1.20

Proximity to urban area where goods and services are supplied	Urban – Within a developed urban area	Peri-urban – Less than 150 km from a developed urban area	Remote – Greater than 150 km from a developed urban area
Weighting Factor 2	1.00	1.05	1.10

2.8. STEP 4.5: AREAS OF DISTURBANCE

The proposed Moonlight project area of disturbance is shown in Appendix A.

The areas of disturbance for the proposed Moonlight Project consist of:

- Open pit,
- Waste rock dumps and topsoil stockpiles,
- Tailings storage facility,
- Ore processing plant,
- Mining complex,
- Construction administration and laydown area,
- Access and haul roads, and
- Powerlines, pipelines and other support infrastructure.

It is currently assumed that all infrastructure will be demolished and no handover of any facilities (for post closure use) has been allowed for.

The increase in financial liability over the life of mine is largely due to continued mine operation/production that results in an ever increasing footprint for the open pit, waste dump and tailings storage facility (TSF) areas, and is summarised in the table overleaf.

Date	Year	Open Pit		Waste Dumps		TSF		Increase in all Areas (A+B+C)
		Increase in Area (A)	Total Area	Increase in Area (B)	Total Area	Increase in Area (C)	Total Area	
Construction Phase								
December 2013	1	n/a	0	n/a	0	n/a	0	0
December 2014	2	n/a	0	n/a	0	40.00	40.00 *	40.00
Operations Phase								
December 2015	3	12.87	12.87	10.56	10.56	0.00	40.00 **	23.43
December 2016	4	25.74	38.61	10.56	31.68	40.75	80.75	77.05
December 2017	5	0.71	39.32	0.57	32.25	64.90	145.65	66.18
December 2018	6	0.76	40.08	0.64	32.89	41.34	186.99	42.74
December 2019	7	0.85	40.93	0.70	33.59	24.53	211.52	26.08
December 2020	8	95.73	136.66	78.52	112.11	22.57	234.09	196.82
December 2021	9	5.57	142.23	4.58	116.69	16.09	250.18	26.24
December 2022	10	34.15	176.38	28.02	144.71	0.24	250.42	62.41
December 2023	11	5.58	181.96	4.57	149.28	0	250.42	10.15
December 2024	12	16.73	198.69	13.72	163.00	0	250.42	30.45
December 2025	13	7.79	206.48	6.40	169.40	0	250.42	14.19
December 2045	33 (LOM)	79.35	285.83	65.10	234.5	0	250.42	144.45

* In Year 2, TSF area allocated under closure component 10 - General surface rehabilitation.

** In Year 3, TSF area allocated under closure component 8 (B) – Rehabilitation of processing waste deposits & evaporation ponds (basic, salt producing waste).

2.9. STEP 4.6: IDENTIFY CLOSURE COSTS FROM SPECIALIST STUDIES

The risk ranking identifies what type of specialist studies should be carried out to ensure successful closure of the mine and/or process operation.

Risk Ranking	Specialist Studies
Class A (High risk)	• Water pollution potential studies • Overall quantified risk assessment
Class B (Medium risk)	• Screening level risk assessment
Class C (Low risk)	

3. STEP 4.7: CALCULATE THE CLOSURE LIABILITY

The financial closure liability associated with the proposed Moonlight Project (as at December 2013 and at life of mine (plus 32 Years i.e. at December 2045) has been calculated to be R 7,516,457 (including VAT) and R 225,875,808 (including VAT) respectively. All amounts calculated are at Net Present Value (NPV) as at June 2011. The liability calculations are provided in Appendix B.

The financial closure liability associated with the proposed Moonlight Project for the first ten years of operation have also been calculated, and are summarised in the table below. The calculations are provided in Appendix B.

Date	Year	Financial Liability incurred during the year (incl. VAT)	Progressive Financial Liability (Incl. VAT)	Progressive Liability expressed as a % of LOM Liability
Construction Phase				
December 2013	1 *	R 7 516 457	R 7 516 457	3.3 %
December 2014	2	R 34 461 116	R 41 977 573	18.6 %
Operations Phase				
December 2015	3	R 20 874 819	R 62 852 392	27.8 %
December 2016	4	R 19 781 909	R 82,634,301	36.6 %
December 2017	5	R 14,920,738	R 97,555,039	43.2 %
December 2018	6	R 9,638,185	R 107,193,224	47.5 %
December 2019	7	R 5,889,224	R 113,082,448	50.1 %
December 2020	8	R 46,166,799	R 159,249,247	70.5 %
December 2021	9	R 6,014,666	R 165,263,913	73.2 %
December 2022	10	R 14,711,608	R 179,975,521	79.7 %
December 2023	11	R 2,392,111	R 182,367,632	80.7 %
December 2024	12	R 7,180,150	R 189,547,782	83.9 %
December 2025	13	R 3,346,732	R 192,894,514	85.4 %
December 2045	33 (LOM)	R 32,981,294	R 225,875,808	100.0 %

* Assumes 30% of the pre-production construction work completed in Year 1.

The financial liabilities calculated, as per the DMR *Guideline Document for the Evaluation of the Quantum of Closure-Related Financial Provision Provided by a Mine*, are considered to be Class 1 estimates (with an accuracy between +25% and -15%) based on the overall generic approach as stipulated by the DMR Guideline Document.

4. CONCLUSION

The financial closure liability associated with the proposed Moonlight Project (as at December 2013 and at life of mine (plus 32 Years i.e. at December 2045) has been calculated to be R 7,516,457 (NPV including VAT) and R 225,875,808 (NPV including VAT) respectively, as per the *Guideline Document for the Evaluation of the Quantum of Closure-Related Financial Provision Provided by a Mine* published by the Department of Mineral Resources (DMR).

The financial closure liability associated with the proposed Moonlight Project for the first ten years of operation have also been calculated, and are summarised in the table above.

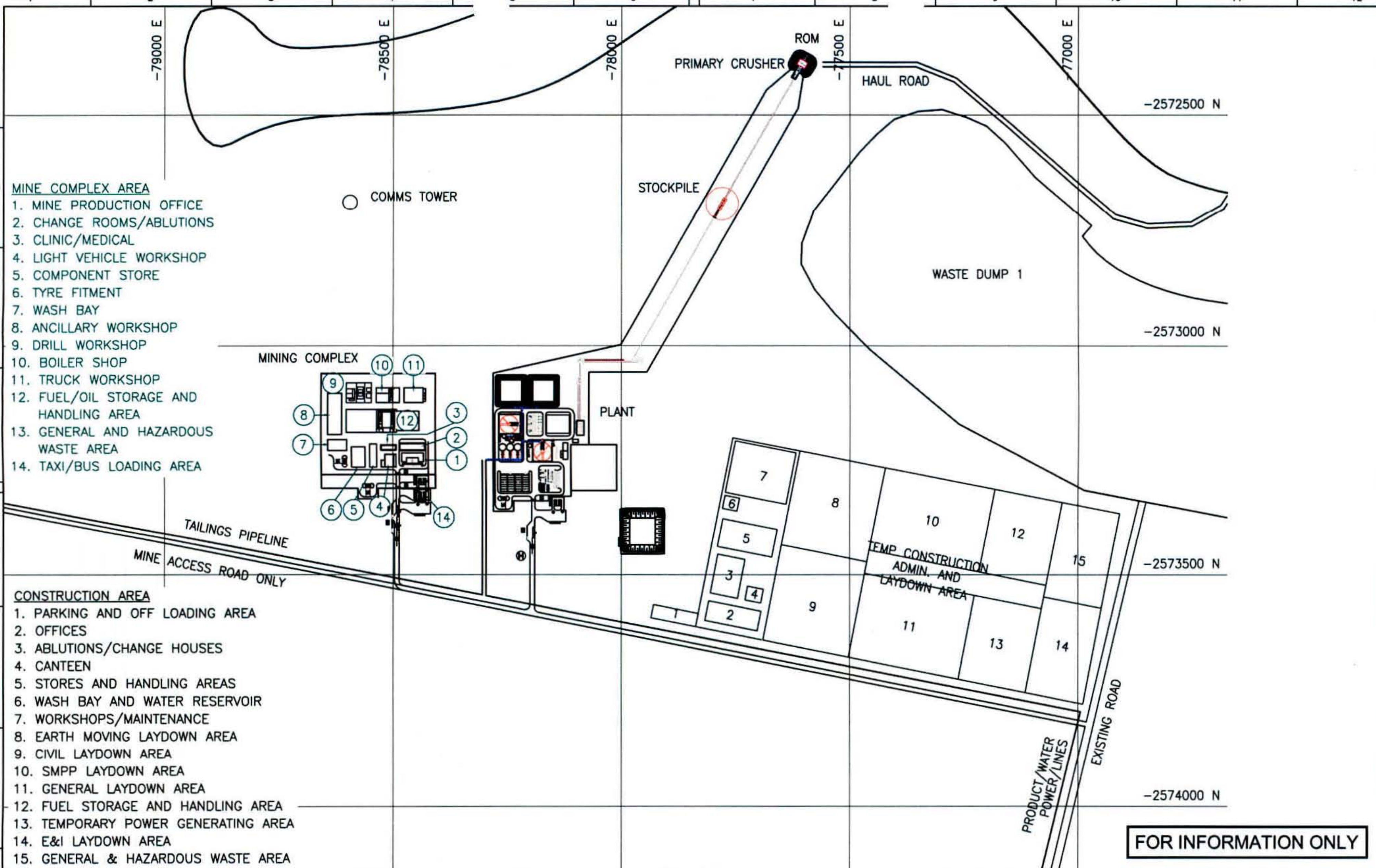
The calculated liabilities are considered to be Class 1 estimates (with an accuracy between +25% and -15%) based on the overall generic approach as stipulated by the DMR Guideline Document.

The financial liabilities only consider the routine costs associated with decommissioning of plant and infrastructure, the restoration of any environmental damage caused predominantly at the pre-production stage, the surface rehabilitation (shaping and vegetating) of waste deposits and material stockpiles, making voids and open pits "safe", and the maintenance and aftercare of all the rehabilitated areas.

Site specific aspects such as surface and groundwater remediation have not been costed at this stage – the likelihood of such remediation would only be identified during the ongoing operation of the mine through surface and groundwater monitoring and/or by carrying out risk assessment and water pollution potential studies.

Stephen van Niekerk (Pr Eng)
For Metago Environmental Engineers (Pty) Ltd

APPENDIX A: Areas of Disturbance for the proposed Moonlight Project



No.	BY	DATE	REVISION	CHECKED	APPROV.
G	D.P.M.	27.5.11	CONSTRUCTION CAMP DETAILS ADDED		
F	G.B.	23.5.11	DETAILS FOR TEMP. CONSTRUCTION AREA ADDED		
E	G.B.	12.5.11	UPDATED TO COMMENTS		
D	G.B.	5.5.11	UPDATED		
C	G.B.	5.4.11	PLANT POSITION ALTERED / DUMP SIZE ALTERED		
B	G.B.	28.2.11	PLANT POSITION ALTERED		

	BY	DATE
PROJECT APPR.		
DESIGN APPR.		
DESIGNED		
CHECKED		
DRAWN	G.BAXENDALE	25.02.2011

amec

SCALE 1:10000

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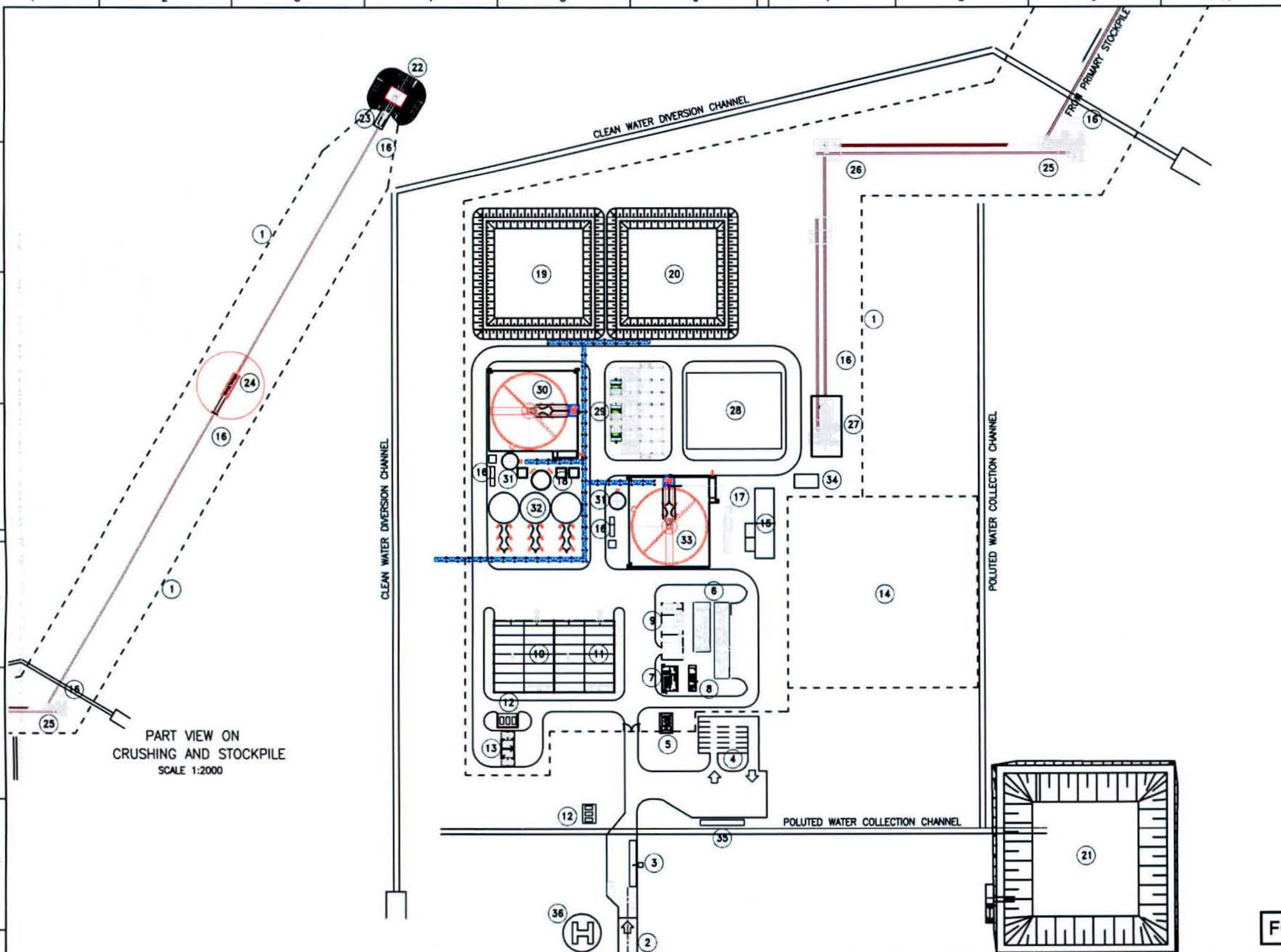
TITLE FIGURE 16
MOONLIGHT IRON ORE PROJECT
CONSTRUCTION AND
MINING COMPLEX AREAS

PROJECT No. S2159 | DRG SIZE A1 | DRAWING No. S2159-03000-05-121-001 | REV No. G

DRAWING No. | REFERENCE DRAWINGS



1. SECURITY FENCE
2. ACCESS ROAD
3. WEIGH BRIDGE
4. PARKING
5. ACCESS CONTROL/SECURITY
6. ADMINISTRATION/TRAINING
7. CHANGE HOUSE
8. TEA ROOM
9. LABORATORY
10. WORKSHOP
11. STORES
12. WASTE SKIP AREA
13. DIESEL STORAGE/REFULEING
14. SWITCH YARD
15. MAIN SUB-STATION
16. SUB-STATION/MCC
17. CONTROL ROOM
18. WATER TREATMENT
19. PROCESS WATER DAM
20. RAW WATER DAM
21. POLUTION CONTROL DAM
22. ROM PAD
23. PRIMARY CRUSHING
24. PRIMARY STOCKPILE
25. SECONDARY/TERTIARY CRUSHING/SCREENING
26. SCREENING
27. QUATINARY CRUSHING
28. MAGNETIC SEPARATION
29. MILLING
30. PROCESS THICHENING
31. PROCESS WATER
32. PRODUCT STORAGE/PUMPING
33. TAILINGS THICKENING
34. SEWAGE PLANT
35. BUS/TAXI STOP
36. HELI PAD

FOR INFORMATION ONLY

DRAWING No.	REFERENCE DRAWINGS

amec

No.	BY	DATE	REVISION	CHECKED	APPROV.
F	G.B.	23.5.11	PART VIEW AND STORM WATER DRAINS ADDED		
E	G.B.	5.5.11	UPDATED		
D	G.B.	5.4.11	UPDATED TO NEW PLANT POSITION		
C	G.B.	28.2.11	UPDATED TO SUIT NEW PLANT POSITION		
B	G.B.	23.2.11	UPDATED TO SUIT SITE		
A	G.B.	21.2.11	FOR INFORMATION ONLY		

	BY	DATE
PROJECT APPR.		
DESIGN APPR.		
DESIGNED		
CHECKED		
DRAWN	BAXENDALE	21.2.2011

SCALE 1:1000

CLIENT FERRUM CRESCENT LTD

TITLE FIGURE 17
MOONLIGHT IRON ORE PROJECT
PROCESSING PLANT
LAYOUT

PROJECT No. S2159 | DRG SIZE A1 | DRAWING No. S2159-03000-05-121-002 | REV No. F

APPENDIX B: Closure Liability Calculations for the proposed Moonlight Project

Template for "rules-based" approach of the quantum for financial provision

Escalation Factor
1.50077

CALCULATION OF THE QUANTUM

Area: ***Turquoise Moon - Year 1***

No.	Description:	Unit:	Operational Area	A Quantity	B Master rate	C Multiplication factor	D Weighting factor 1	E=A*B*C*D Amount (Rands)	
				Step 4.5	Step 4.3	Step 4.3	Step 4.4		
1	Dismantling of processing plant & related structures (incl. overland conveyors & power lines)	m^3	Secondary /Tertiary Crushing/Screening, Screening, Quatinary Crushing, Magnetic Separation, Milling, Process Thickening, Tailings Thickening, Process Water & Product Storage	24289.48	R 10.24	1	1	R 248 608.90	5.13%
2 (A)	Demolition of steel buildings & structures	m^2	N/A	0.00	R 142.57	1	1	R 0.00	0.00%
2 (B)	Demolition of reinforced concrete buildings & structures	m^2	Workshop & Stores	733.36	R 210.11	1	1	R 154 085.39	3.18%
		m^2	Sewage Plant	28.52	R 210.11	1	1	R 5 992.23	0.12%
		m^2	Tailings Thickening	385.05	R 210.11	1	1	R 80 903.02	1.67%
		m^2	Process Thickening	385.05	R 210.11	1	1	R 80 903.02	1.67%
		m^2	Product Storage/Pumping	260.75	R 210.11	1	1	R 54 785.95	1.13%
		m^2	Water Treatment	42.96	R 210.11	1	1	R 9 026.80	0.19%
		m^2	Milling	388.41	R 210.11	1	1	R 81 608.16	1.68%
		m^2	Magnetic Separation	619.28	R 210.11	1	1	R 130 116.52	2.69%
		m^2	Quatinary Separation	190.13	R 210.11	1	1	R 39 948.07	0.82%
		m^2	Screening	47.53	R 210.11	1	1	R 9 987.03	0.21%
		m^2	Secondary /Tertiary Crushing/Screening	57.04	R 210.11	1	1	R 11 984.40	0.25%
		m^2	Pollution Control Dam	33.95	R 210.11	1	1	R 7 133.62	0.15%
		m^2	Conveyor Belt Foundations	167.23	R 210.11	1	1	R 35 137.19	0.73%
		m^2	Mining Complex	1 466.73	R 210.11	1	1	R 308 170.79	6.36%
3	Rehabilitation of access roads	m^2	TSF Area	0.00	R 25.51	1	1	R 0.00	0.00%
		m^2	Processing Plant Area	4 359.44	R 25.51	1	1	R 111 222.79	2.30%
		m^2	Haul Roads	0.00	R 25.51	1	1	R 0.00	0.00%
		m^2	Mining Complex	586.69	R 25.51	1	1	R 14 968.30	0.31%
4 (A)	Demolition & rehabilitation of electrified railway lines	m	N/A	0.00	R 247.63	1	1	R 0.00	0.00%
4 (B)	Demolition & rehabilitation of non electrified railway lines	m	N/A	0.00	R 135.07	1	1	R 0.00	0.00%
5	Demolition of housing &/or administration facilities	m^2	Access Control & Security	23.77	R 285.15	1	1	R 6 776.79	0.14%
		m^2	Administration	168.40	R 285.15	1	1	R 48 019.21	0.99%
		m^2	Change House	35.31	R 285.15	1	1	R 10 068.52	0.21%
		m^2	Tea Room	17.66	R 285.15	1	1	R 5 034.26	0.10%
		m^2	Laboratory	61.11	R 285.15	1	1	R 17 426.32	0.36%
		m^2	Control Room	32.59	R 285.15	1	1	R 9 294.00	0.19%
		m^2	Mining Complex	586.69	R 285.15	1	1	R 167 292.71	3.45%
6	Opencast rehabilitation including final voids & ramps	ha	Opencast Pit	0.00	R 145 124.46	1	1	R 0.00	0.00%
7	Sealing of shafts, adits & inclines	m^3	N/A	0.00	R 76.54	1	1	R 0.00	0.00%
8 (A)	Rehabilitation of overburden & spoils	ha	Waste Dump 1	0.00	R 99 651.13	1	1	R 0.00	0.00%
			Waste Dump 2	0.00	R 99 651.13	1	1	R 0.00	0.00%
8 (B)	Rehabilitation of processing waste deposits & evaporation ponds (basic, salt producing waste)	ha	SWD & RWD	0.00	R 124 113.68	1	1	R 0.00	0.00%
		ha	TSF - Basin	0.00	R 124 113.68	1	1	R 0.00	0.00%
		ha	TSF - Side Slopes	0.00	R 0.00	1	1	R 0.00	0.00%
		ha	Process Water Dam	0.15	R 124 113.68	1	1	R 18 541.21	0.38%
		ha	Raw Water Dam	0.15	R 124 113.68	1	1	R 18 541.21	0.38%
		ha	Pollution Control Dam	0.23664	R 124 113.68	1	1	R 29 370.26	0.61%
8 (C)	Rehabilitation of processing waste deposits & evaporation ponds (acidic, metal-rich waste)	ha	N/A	0.00	R 360 484.95	1	1	R 0.00	0.00%
9	Rehabilitation of subsided areas	ha	N/A	0.00	R 83 442.81	1	1	R 0.00	0.00%
10	General surface rehabilitation	ha	Surrounding Areas of TSF	0.00	R 0.00	1	1	R 0.00	0.00%
		ha	Topsoil Stockpiles	0.00	R 78 940.50	1	1	R 0.00	0.00%
		ha	Mining Complex	1.96	R 78 940.50	1	1	R 154 378.89	3.19%
		ha	Construction Admin & Laydown	30.78	R 78 940.50	1	1	R 2 430 038.09	50.17%
		ha	Concrete Areas	0.00	R 78 940.50	1	1	R 0.00	0.00%
		ha	Additional Concrete Areas	0.04	R 78 940.50	1	1	R 3 110.86	0.06%
		ha	Access Roads	0.49	R 78 940.50	1	1	R 39 045.01	0.81%
11	River diversions (to be decommissioned)	ha	N/A	0.00	R 78 940.50	1	1	R 0.00	0.00%
12	Fencing	m	Processing Plant Area	915.41	R 90.05	1	1	R 82 429.38	1.70%
13	Water management	ha	Pollution Control Dam	0.24	R 30 015.40	1	1	R 7 102.84	0.15%
		ha	Open Cast Voids & Ramps	0.00	R 30 015.40	1	1	R 0.00	0.00%
14	2 to 3 years of maintenance & aftercare	ha	Operational TSF, Surrounding Areas & Concrete Areas	0.00	R 10 505.39	1	1	R 0.00	0.00%
		ha	Reinforced Concrete Buildings	0.23	R 10 505.39	1	1	R 2 422.04	0.05%
		ha	Administration	0.09	R 10 505.39	1	1	R 972.31	0.02%
		ha	Overburden & Spoils	0.00	R 10 505.39	1	1	R 0.00	0.00%
		ha	Evaporation Ponds	0.54	R 10 505.39	1	1	R 5 624.77	0.12%
		ha	Processing Plant Area	0.26	R 10 505.39	1	1	R 2 779.05	0.06%
		ha	General Surface Rehabilitation	33.27	R 10 505.39	1	1	R 349 543.92	7.22%
15 (A)	Specialist study (Water pollution potential study)	SUM	All Areas	0.00	R 500 000.00	1	1	R 0.00	0.00%
15 (B)	Specialist study (Overall quantified risk assessment)	SUM	All Areas	0.00	R 300 000.00	1	1	R 0.00	0.00%
15 (C)	Concrete Slabs & Light Structures	m^2	Silt Trap	0.00	R 130.00	1	1	R 0.00	0.00%
		m^2	Energy Dissipator	0.00	R 130.00	1	1	R 0.00	0.00%
		m^2	Solution Trench	0.00	R 130.00	1	1	R 0.00	0.00%
		m^2	Helicopter Pad	106.65	R 130.00	1	1	R 13 864.50	0.29%
		m^2	Waste Skip Area	43.46	R 130.00	1	1	R 5 649.62	0.12%
		m^2	Weigh Bridge	31.24	R 130.00	1	1	R 4 060.68	0.08%
		m^2	Diesel Storage/Refueling	46.45	R 130.00	1	1	R 6 038.02	0.12%
		m^2	Main Substation	134.45	R 130.00	1	1	R 17 478.51	0.36%
		m^2	Sub-Station/MCC	31.84	R 130.00	1	1	R 4 138.68	0.09%
							Sub Total 1 (Sum of items 1 to 15 Above)	R 4 843 623.83	100.00%
1	Preliminary and general	12.5% of Subtotal 1				**Weighting factor 2 (step 4.4)**	1.05	R 635 725.63	
2	Administration & supervision costs	6.0% of Subtotal 1						R 290 617.43	
3	Engineering drawings & specifications	2.0% of Subtotal 1						R 96 872.48	
4	Engineering & procurement of specialist work	2.5% of Subtotal 1						R 121 090.60	
5	Development of a closure plan	2.5% of Subtotal 1						R 121 090.60	
6	Final groundwater modeling								
							Sub Total 2 (Subtotal 1 plus sum of management & administrative items, 1 to 6 above)	R 6 109 020.56	
7	Contingency	10.0% of Subtotal 1						R 484 362.38	
							Sub Total 3 (Subtotal 2 plus contingency)	R 6 593 382.94	
8	VAT	14.0% of Subtotal 3						R 923 073.61	
							GRAND TOTAL (Subtotal 3 plus VAT)	R 7 516 456.55	

Escalation Factor
1.50077

Template for "rules-based" approach of the quantum for financial provision

CALCULATION OF THE QUANTUM

Area: *Turquoise Moon - Year 2*

No.	Description:	Unit:	Operational Area	A Quantity	B Master rate	C Multiplication factor	D Weighting factor 1	E=A*B*C*D Amount (Rands)	
				Step 4.5	Step 4.3	Step 4.3	Step 4.4		
1	Dismantling of processing plant & related structures (incl. overland conveyors & power lines)	m^3	Secondary /Tertiary Crushing/Screening, Screening, Quatinary Crushing, Magnetic Separation, Milling, Process Thickening, Tailings Thickening, Process Water & Product Storage	90470.13	R 10.24	1	1	R 925 984.49	3.42%
2 (A)	Demolition of steel buildings & structures	m^2	N/A	0.00	R 142.57	1	1	R 0.00	0.00%
2 (B)	Demolition of reinforced concrete buildings & structures	m^2	Workshop & Stores	2 444.55	R 210.11	1	1	R 513 617.97	1.90%
		m^2	Sewage Plant	95.07	R 210.11	1	1	R 19 974.11	0.07%
		m^2	Tailings Thickening	1 283.52	R 210.11	1	1	R 269 676.72	1.00%
		m^2	Process Thickening	1 283.52	R 210.11	1	1	R 269 676.72	1.00%
		m^2	Product Storage/Pumping	869.17	R 210.11	1	1	R 182 619.82	0.68%
		m^2	Water Treatment	143.21	R 210.11	1	1	R 30 089.33	0.11%
		m^2	Milling	1 294.70	R 210.11	1	1	R 272 027.20	1.01%
		m^2	Magnetic Separation	2 064.23	R 210.11	1	1	R 433 721.75	1.60%
		m^2	Quatinary Separation	633.77	R 210.11	1	1	R 133 160.23	0.49%
		m^2	Screening	158.44	R 210.11	1	1	R 33 290.11	0.12%
		m^2	Secondary /Tertiary Crushing/Screening	190.13	R 210.11	1	1	R 39 948.01	0.15%
		m^2	Pollution Control Dam	113.17	R 210.11	1	1	R 23 778.74	0.09%
		m^2	Conveyor Belt Foundations	557.45	R 210.11	1	1	R 117 123.96	0.43%
		m^2	Mining Complex	16 296.97	R 210.11	1	1	R 3 424 119.88	12.66%
3	Rehabilitation of access roads	m^2	TSF Area	49 855.00	R 25.51	1	1	R 1 271 955.10	4.70%
		m^2	Processing Plant Area	14 531.47	R 25.51	1	1	R 370 742.63	1.37%
		m^2	Haul Roads	19 148.94	R 25.51	1	1	R 488 548.53	1.81%
		m^2	Mining Complex	6 518.79	R 25.51	1	1	R 166 314.39	0.61%
4 (A)	Demolition & rehabilitation of electrified railway lines	m	N/A	0.00	R 247.63	1	1	R 0.00	0.00%
4 (B)	Demolition & rehabilitation of non electrified railway lines	m	N/A	0.00	R 135.07	1	1	R 0.00	0.00%
5	Demolition of housing &/or administration facilities	m^2	Access Control & Security	79.22	R 285.15	1	1	R 22 589.29	0.08%
		m^2	Administration	561.34	R 285.15	1	1	R 160 064.02	0.59%
		m^2	Change House	117.70	R 285.15	1	1	R 33 561.72	0.12%
		m^2	Tea Room	58.85	R 285.15	1	1	R 16 780.86	0.06%
		m^2	Laboratory	203.71	R 285.15	1	1	R 58 087.72	0.21%
		m^2	Control Room	108.65	R 285.15	1	1	R 30 980.00	0.11%
		m^2	Mining Complex	6 518.79	R 285.15	1	1	R 1 858 807.94	6.87%
6	Opencast rehabilitation including final voids & ramps	ha	Opencast Pit	0.00	R 145 124.46	1	1	R 0.00	0.00%
7	Sealing of shafts, adits & inclines	m^3	N/A	0.00	R 76.54	1	1	R 0.00	0.00%
8 (A)	Rehabilitation of overburden & spoils	ha	Waste Dump 1	0.00	R 99 651.13	1	1	R 0.00	0.00%
			Waste Dump 2	0.00	R 99 651.13	1	1	R 0.00	0.00%
8 (B)	Rehabilitation of processing waste deposits & evaporation ponds (basic, salt producing waste)	ha	SWD & RWD	0.00	R 124 113.68	1	1	R 0.00	0.00%
		ha	TSF - Basin	0.00	R 124 113.68	1	1	R 0.00	0.00%
		ha	Process Water Dam	0.00	R 124 113.68	1	1	R 0.00	0.00%
		ha	Raw Water Dam	0.00	R 124 113.68	1	1	R 0.00	0.00%
		ha	Pollution Control Dam	0	R 124 113.68	1	1	R 0.00	0.00%
8 (C)	Rehabilitation of processing waste deposits & evaporation ponds (acidic, metal-rich waste)	ha	N/A	0.00	R 360 484.95	1	1	R 0.00	0.00%
9	Rehabilitation of subsided areas	ha	N/A	0.00	R 83 442.81	1	1	R 0.00	0.00%
10	General surface rehabilitation	ha	TSF Area	118.39	R 0.00	1	1	R 0.00	0.00%
		ha	Topsoil Stockpiles	48.27	R 78 940.50	1	1	R 3 810 206.78	14.09%
		ha	Mining Complex	6.52	R 78 940.50	1	1	R 514 596.30	1.90%
		ha	Construction Admin & Laydown	30.78	R 78 940.50	1	1	R 2 430 038.09	8.98%
		ha	Concrete Areas	2.61	R 78 940.50	1	1	R 205 753.68	0.76%
		ha	Additional Concrete Areas	0.13	R 78 940.50	1	1	R 10 369.55	0.04%
		ha	Access Roads	9.01	R 78 940.50	1	1	R 710 892.30	2.63%
11	River diversions (to be decommissioned)	ha	N/A	0.00	R 78 940.50	1	1	R 0.00	0.00%
12	Fencing	m	Processing Plant Area	3 051.37	R 90.05	1	1	R 274 764.61	1.02%
13	Water management	ha	Pollution Control Dam	0.79	R 30 015.40	1	1	R 23 676.15	0.09%
		ha	Open Cast Voids & Ramps	0.00	R 30 015.40	1	1	R 0.00	0.00%
14	2 to 3 years of maintenance & aftercare	ha	TSF, Surrounding Areas & Concrete Areas	194.26	R 10 505.39	1	1	R 2 040 743.28	7.54%
		ha	Reinforced Concrete Buildings	1.91	R 10 505.39	1	1	R 20 057.90	0.07%
		ha	Administration	0.76	R 10 505.39	1	1	R 8 034.79	0.03%
		ha	Overburden & Spoils	0.00	R 10 505.39	1	1	R 0.00	0.00%
		ha	Evaporation Ponds	0.00	R 10 505.39	1	1	R 0.00	0.00%
		ha	Processing Plant Area	0.85	R 10 505.39	1	1	R 8 908.40	0.03%
		ha	General Surface Rehabilitation	215.70	R 10 505.39	1	1	R 2 266 033.44	8.38%
15 (A)	Specialist study (Water pollution potential study)	SUM	All Areas	0.00	R 500 000.00	1	1	R 0.00	0.00%
15 (B)	Specialist study (Overall quantified risk assessment)	SUM	All Areas	0.00	R 300 000.00	1	1	R 0.00	0.00%
15 (C)	Concrete Slabs & Light Structures	m^2	Silt Trap	1 153.20	R 130.00	1	1	R 149 916.00	0.55%
		m^2	Energy Dissipator	108.00	R 130.00	1	1	R 14 040.00	0.05%
		m^2	Solution Trench	24 803.20	R 130.00	1	1	R 3 224 416.00	11.92%
		m^2	Helicopter Pad	355.50	R 130.00	1	1	R 46 215.00	0.17%
		m^2	Waste Skip Area	144.86	R 130.00	1	1	R 18 832.06	0.07%
		m^2	Weigh Bridge	104.12	R 130.00	1	1	R 13 535.60	0.05%
		m^2	Diesel Storage/Refueling	154.82	R 130.00	1	1	R 20 126.73	0.07%
		m^2	Main Substation	448.17	R 130.00	1	1	R 58 261.71	0.22%
		m^2	Sub-Station/MCC	106.12	R 130.00	1	1	R 13 795.60	0.05%
							Sub Total 1 (Sum of items 1 to 15 Above)	R 27 050 455.23	100.00%
1	Preliminary and general	12.5% of Subtotal 1				**Weighting factor 2 (step 4.4)**	1.05	R 3 550 372.25	
2	Administration & supervision costs	6.0% of Subtotal 1						R 1 623 027.31	
3	Engineering drawings & specifications	2.0% of Subtotal 1						R 541 009.10	
4	Engineering & procurement of specialist work	2.5% of Subtotal 1						R 676 261.38	
5	Development of a closure plan	2.5% of Subtotal 1						R 676 261.38	
6	Final groundwater modeling								
							Sub Total 2 (Subtotal 1 plus sum of management & administrative items, 1 to 6 above)	R 34 117 386.65	
7	Contingency	10.0% of Subtotal 1						R 2 705 045.52	
							Sub Total 3 (Subtotal 2 plus contingency)	R 36 822 432.18	
8	VAT	14.0% of Subtotal 3						R 5 155 140.50	
							GRAND TOTAL (Subtotal 3 plus VAT)	R 41 977 572.68	

Template for "rules-based" approach of the quantum for financial provision

Escalation Factor 1.50077

CALCULATION OF THE QUANTUM

Area: *Turquoise Moon - Year 3*

No.	Description:	Unit:	Operational Area	A Quantity	B Master rate	C Multiplication factor	D Weighting factor 1	E=A*B*C*D Amount (Rands)	
				Step 4.5	Step 4.3	Step 4.3	Step 4.4		
1	Dismantling of processing plant & related structures (incl. overland conveyors & power lines)	m^3	Secondary /Tertiary Crushing/Screening, Screening, Quatinary Crushing, Magnetic Separation, Milling, Process Thickening, Tailings Thickening, Process Water & Product Storage	90470.13	R 10.24	1	1	R 925,984.49	2.29%
2 (A)	Demolition of steel buildings & structures	m^2	N/A	0.00	R 142.57	1	1	R 0.00	0.00%
2 (B)	Demolition of reinforced concrete buildings & structures	m^2	Workshop & Stores	2,444.55	R 210.11	1	1	R 513,617.97	1.27%
		m^2	Sewage Plant	95.07	R 210.11	1	1	R 19,974.11	0.05%
		m^2	Tailings Thickening	1,283.52	R 210.11	1	1	R 269,676.72	0.67%
		m^2	Process Thickening	1,283.52	R 210.11	1	1	R 269,676.72	0.67%
		m^2	Product Storage/Pumping	869.17	R 210.11	1	1	R 182,619.82	0.45%
		m^2	Water Treatment	143.21	R 210.11	1	1	R 30,089.33	0.07%
		m^2	Milling	1,294.70	R 210.11	1	1	R 272,027.20	0.67%
		m^2	Magnetic Separation	2,064.28	R 210.11	1	1	R 433,721.75	1.07%
		m^2	Quatinary Separation	633.77	R 210.11	1	1	R 133,160.23	0.33%
		m^2	Screening	158.44	R 210.11	1	1	R 33,290.11	0.08%
		m^2	Secondary /Tertiary Crushing/Screening	190.13	R 210.11	1	1	R 39,948.01	0.10%
		m^2	Pollution Control Dam	113.17	R 210.11	1	1	R 23,778.74	0.06%
		m^2	Conveyor Belt Foundations	557.45	R 210.11	1	1	R 117,123.96	0.29%
		m^2	Mining Complex	16,296.97	R 210.11	1	1	R 3,424,119.88	8.45%
3	Rehabilitation of access roads	m^2	TSF Area	49,855.00	R 25.51	1	1	R 1,271,955.10	3.14%
		m^2	Processing Plant Area	14,531.47	R 25.51	1	1	R 370,742.63	0.92%
		m^2	Haul Roads	19,148.94	R 25.51	1	1	R 488,548.53	1.21%
		m^2	Mining Complex	6,518.79	R 25.51	1	1	R 166,314.39	0.41%
4 (A)	Demolition & rehabilitation of electrified railway lines	m	N/A	0.00	R 247.63	1	1	R 0.00	0.00%
4 (B)	Demolition & rehabilitation of non electrified railway lines	m	N/A	0.00	R 135.07	1	1	R 0.00	0.00%
5	Demolition of housing &/or administration facilities	m^2	Access Control & Security	79.22	R 285.15	1	1	R 22,589.29	0.06%
		m^2	Administration	561.34	R 285.15	1	1	R 160,064.02	0.40%
		m^2	Change House	117.70	R 285.15	1	1	R 33,561.72	0.08%
		m^2	Tea Room	58.85	R 285.15	1	1	R 16,780.86	0.04%
		m^2	Laboratory	203.71	R 285.15	1	1	R 58,087.72	0.14%
		m^2	Control Room	108.65	R 285.15	1	1	R 30,980.00	0.08%
		m^2	Mining Complex	6,518.79	R 285.15	1	1	R 1,858,807.94	4.59%
6	Opencast rehabilitation including final voids & ramps	ha	Opencast Pit	12.87	R 145,124.46	1	1	R 1,867,751.79	4.61%
7	Sealing of shafts, adits & inclines	m^3	N/A	0.00	R 76.54	1	1	R 0.00	0.00%
8 (A)	Rehabilitation of overburden & spoils	ha	Waste Dump 1	5.00	R 99,651.13	1	1	R 498,255.64	1.23%
			Waste Dump 2	5.56	R 99,651.13	1	1	R 554,060.27	1.37%
8 (B)	Rehabilitation of processing waste deposits & evaporation ponds (basic, salt producing waste)	ha	SWD & RWD	39.21	R 124,113.68	1	1	R 4,866,993.81	12.02%
		ha	TSF - Basin	40.00	R 124,113.68	1	1	R 4,964,547.16	12.26%
		ha	Process Water Dam	0.50	R 124,113.68	1	1	R 61,804.03	0.15%
		ha	Raw Water Dam	0.50	R 124,113.68	1	1	R 61,804.03	0.15%
		ha	Pollution Control Dam	0.7888	R 124,113.68	1	1	R 97,900.87	0.24%
8 (C)	Rehabilitation of processing waste deposits & evaporation ponds (acidic, metal-rich waste)	ha	N/A	0.00	R 360,484.95	1	1	R 0.00	0.00%
9	Rehabilitation of subsided areas	ha	N/A	0.00	R 83,442.81	1	1	R 0.00	0.00%
10	General surface rehabilitation	ha	Surrounding Areas of TSF	37.40	R 0.00	1	1	R 0.00	0.00%
		ha	Topsoil Stockpiles	48.27	R 78,940.50	1	1	R 3,810,206.78	9.41%
		ha	Mining Complex	6.52	R 78,940.50	1	1	R 514,596.30	1.27%
		ha	Construction Admin & Laydown	30.78	R 78,940.50	1	1	R 2,430,038.09	6.00%
		ha	Concrete Areas	2.61	R 78,940.50	1	1	R 205,753.68	0.51%
		ha	Additional Concrete Areas	0.13	R 78,940.50	1	1	R 10,369.55	0.03%
		ha	Access Roads	9.01	R 78,940.50	1	1	R 710,892.30	1.76%
11	River diversions (to be decommissioned)	ha	N/A	0.00	R 78,940.50	1	1	R 0.00	0.00%
12	Fencing	m	Processing Plant Area	3,051.37	R 90.05	1	1	R 274,764.61	0.68%
13	Water management	ha	Pollution Control Dam	0.79	R 30,015.40	1	1	R 23,676.15	0.06%
		ha	Open Cast Voids & Ramps	12.87	R 30,015.40	1	1	R 386,298.20	0.95%
14	2 to 3 years of maintenance & aftercare	ha	Operational TSF, Surrounding Areas & Concrete Areas	192.48	R 10,505.39	1	1	R 2,022,085.71	4.99%
		ha	Reinforced Concrete Buildings	1.91	R 10,505.39	1	1	R 20,057.90	0.05%
		ha	Administration	0.76	R 10,505.39	1	1	R 8,034.79	0.02%
		ha	Overburden & Spoils	10.56	R 10,505.39	1	1	R 110,936.92	0.27%
		ha	Evaporation Ponds	81.00	R 10,505.39	1	1	R 850,923.21	2.10%
		ha	Processing Plant Area	0.85	R 10,505.39	1	1	R 8,908.40	0.02%
		ha	General Surface Rehabilitation	134.71	R 10,505.39	1	1	R 1,415,201.91	3.49%
15 (A)	Specialist study (Water pollution potential study)	SUM	All Areas	0.00	R 500,000.00	1	1	R 0.00	0.00%
15 (B)	Specialist study (Overall quantified risk assessment)	SUM	All Areas	0.00	R 300,000.00	1	1	R 0.00	0.00%
15 (C)	Concrete Slabs & Light Structures	m^2	Silt Trap	1,153.20	R 130.00	1	1	R 149,916.00	0.37%
		m^2	Energy Dissipator	108.00	R 130.00	1	1	R 14,040.00	0.03%
		m^2	Solution Trench	24,803.20	R 130.00	1	1	R 3,224,416.00	7.96%
		m^2	Helicopter Pad	355.50	R 130.00	1	1	R 46,215.00	0.11%
		m^2	Waste Skip Area	144.86	R 130.00	1	1	R 18,832.06	0.05%
		m^2	Weigh Bridge	104.12	R 130.00	1	1	R 13,535.60	0.03%
		m^2	Diesel Storage/Refueling	154.82	R 130.00	1	1	R 20,126.73	0.05%
		m^2	Main Substation	448.17	R 130.00	1	1	R 58,261.71	0.14%
		m^2	Sub-Station/MCC	106.12	R 130.00	1	1	R 13,795.60	0.03%
							Sub Total 1 (Sum of items 1 to 15 Above)	R 40,502,242.04	100.00%
1	Preliminary and general		12.5% of Subtotal 1			**Weighting factor 2 (step 4.4)**	1.05	R 5,315,919.27	
2	Administration & supervision costs		6.0% of Subtotal 1					R 2,430,134.52	
3	Engineering drawings & specifications		2.0% of Subtotal 1					R 810,044.84	
4	Engineering & procurement of specialist work		2.5% of Subtotal 1					R 1,012,556.05	
5	Development of a closure plan		2.5% of Subtotal 1					R 1,012,556.05	
6	Final groundwater modeling								
			(Subtotal 1 plus sum of management & administrative items, 1 to 6 above)				**Sub Total 2**	R 51,083,452.78	
7	Contingency		10.0% of Subtotal 1					R 4,050,224.20	
							Sub Total 3 (Subtotal 2 plus contingency)	R 55,133,676.98	
8	VAT		14.0% of Subtotal 3					R 7,718,714.78	
							GRAND TOTAL (Subtotal 3 plus VAT)	R 62,852,391.76	

Escalation Factor 1.50077

Template for "rules-based" approach of the quantum for financial provision

CALCULATION OF THE QUANTUM

Area: *Turquoise Moon - Year 4*

No.	Description:	Unit:	Operational Area	A Quantity	B Master rate	C Multiplication factor	D Weighting factor 1	E=A*B*C*D Amount (Rands)	
				Step 4.5	Step 4.3	Step 4.3	Step 4.4		
1	Dismantling of processing plant & related structures (incl. overland conveyors & power lines)	m^3	Secondary /Tertiary Crushing/Screening, Screening, Quatinary Crushing, Magnetic Separation, Milling, Process Thickening, Tailings Thickening, Process Water & Product Storage	90470.13	R 10.24	1	1	R 925 984.49	1.74%
2 (A)	Demolition of steel buildings & structures	m^2	N/A	0.00	R 142.57	1	1	R 0.00	0.00%
2 (B)	Demolition of reinforced concrete buildings & structures	m^2	Workshop & Stores	2 444.55	R 210.11	1	1	R 513 617.97	0.96%
		m^2	Sewage Plant	95.07	R 210.11	1	1	R 19 974.11	0.04%
		m^2	Tailings Thickening	1 283.52	R 210.11	1	1	R 269 676.72	0.51%
		m^2	Process Thickening	1 283.52	R 210.11	1	1	R 269 676.72	0.51%
		m^2	Product Storage/Pumping	869.17	R 210.11	1	1	R 182 619.82	0.34%
		m^2	Water Treatment	143.21	R 210.11	1	1	R 30 089.33	0.06%
		m^2	Milling	1 294.70	R 210.11	1	1	R 272 027.20	0.51%
		m^2	Magnetic Separation	2 064.28	R 210.11	1	1	R 433 721.75	0.81%
		m^2	Quatinary Separation	633.77	R 210.11	1	1	R 133 160.23	0.25%
		m^2	Screening	158.44	R 210.11	1	1	R 33 290.11	0.06%
		m^2	Secondary /Tertiary Crushing/Screening	190.13	R 210.11	1	1	R 39 948.01	0.08%
		m^2	Pollution Control Dam	113.17	R 210.11	1	1	R 23 778.74	0.04%
		m^2	Conveyor Belt Foundations	557.45	R 210.11	1	1	R 117 123.96	0.22%
		m^2	Mining Complex	16 296.97	R 210.11	1	1	R 3 424 119.88	6.43%
3	Rehabilitation of access roads	m^2	TSF Area	49 855.00	R 25.51	1	1	R 1 271 955.10	2.39%
		m^2	Processing Plant Area	14 531.47	R 25.51	1	1	R 370 742.63	0.70%
		m^2	Haul Roads	19 148.94	R 25.51	1	1	R 488 548.53	0.92%
		m^2	Mining Complex	6 518.79	R 25.51	1	1	R 166 314.39	0.31%
4 (A)	Demolition & rehabilitation of electrified railway lines	m	N/A	0.00	R 247.63	1	1	R 0.00	0.00%
4 (B)	Demolition & rehabilitation of non electrified railway lines	m	N/A	0.00	R 135.07	1	1	R 0.00	0.00%
5	Demolition of housing &/or administration facilities	m^2	Access Control & Security	79.22	R 285.15	1	1	R 22 589.29	0.04%
		m^2	Administration	561.34	R 285.15	1	1	R 160 064.02	0.30%
		m^2	Change House	117.70	R 285.15	1	1	R 33 561.72	0.06%
		m^2	Tea Room	58.85	R 285.15	1	1	R 16 780.86	0.03%
		m^2	Laboratory	203.71	R 285.15	1	1	R 58 087.72	0.11%
		m^2	Control Room	108.65	R 285.15	1	1	R 30 980.00	0.06%
		m^3	Mining Complex	6 518.79	R 285.15	1	1	R 1 858 807.94	3.49%
6	Opencast rehabilitation including final voids & ramps	ha	Opencast Pit	38.61	R 145 124.46	1	1	R 5 602 965.11	10.52%
7	Sealing of shafts, adits & inclines	m^3	N/A	0.00	R 76.54	1	1	R 0.00	0.00%
8 (A)	Rehabilitation of overburden & spoils	ha	Waste Dump 1	15.41	R 99 651.13	1	1	R 1 535 544.99	2.88%
			Waste Dump 2	16.27	R 99 651.13	1	1	R 1 620 853.07	3.04%
8 (B)	Rehabilitation of processing waste deposits & evaporation ponds (basic, salt producing waste)	ha	SWD & RWD	39.21	R 124 113.68	1	1	R 4 866 993.81	9.14%
		ha	TSF - Basin	80.75	R 124 113.68	1	1	R 10 022 216.81	18.82%
		ha	Process Water Dam	0.50	R 124 113.68	1	1	R 61 804.03	0.12%
		ha	Raw Water Dam	0.50	R 124 113.68	1	1	R 61 804.03	0.12%
		ha	Pollution Control Dam	0.7888	R 124 113.68	1	1	R 97 900.87	0.18%
8 (C)	Rehabilitation of processing waste deposits & evaporation ponds (acidic, metal-rich waste)	ha	N/A	0.00	R 360 484.95	1	1	R 0.00	0.00%
9	Rehabilitation of subsided areas	ha	N/A	0.00	R 83 442.81	1	1	R 0.00	0.00%
10	General surface rehabilitation	ha	Surrounding Areas of TSF	37.40	R 0.00	1	1	R 0.00	0.00%
		ha	Topsoil Stockpiles	48.27	R 78 940.50	1	1	R 3 810 206.78	7.16%
		ha	Mining Complex	6.52	R 78 940.50	1	1	R 514 596.30	0.97%
		ha	Construction Admin & Laydown	30.78	R 78 940.50	1	1	R 2 430 038.09	4.56%
		ha	Concrete Areas	2.61	R 78 940.50	1	1	R 205 753.68	0.39%
		ha	Additional Concrete Areas	0.13	R 78 940.50	1	1	R 10 369.55	0.02%
		ha	Access Roads	9.01	R 78 940.50	1	1	R 710 892.30	1.34%
11	River diversions (to be decommissioned)	ha	N/A	0.00	R 78 940.50	1	1	R 0.00	0.00%
12	Fencing	m	Processing Plant Area	3 051.37	R 90.05	1	1	R 274 764.61	0.52%
13	Water management	ha	Pollution Control Dam	0.79	R 30 015.40	1	1	R 23 676.15	0.04%
		ha	Open Cast Voids & Ramps	38.61	R 30 015.40	1	1	R 1 158 834.56	2.18%
14	2 to 3 years of maintenance & aftercare	ha	Operational TSF, Surrounding Areas & Concrete Areas	233.23	R 10 505.39	1	1	R 2 450 183.50	4.60%
		ha	Reinforced Concrete Buildings	1.91	R 10 505.39	1	1	R 20 057.90	0.04%
		ha	Administration	0.76	R 10 505.39	1	1	R 8 034.79	0.02%
		ha	Overburden & Spoils	31.67	R 10 505.39	1	1	R 332 752.81	0.62%
		ha	Evaporation Ponds	121.75	R 10 505.39	1	1	R 1 279 021.00	2.40%
		ha	Processing Plant Area	0.85	R 10 505.39	1	1	R 8 908.40	0.02%
		ha	General Surface Rehabilitation	134.71	R 10 505.39	1	1	R 1 415 201.91	2.66%
15 (A)	Specialist study (Water pollution potential study)	SUM	All Areas	0.00	R 500 000.00	1	1	R 0.00	0.00%
15 (B)	Specialist study (Overall quantified risk assessment)	SUM	All Areas	0.00	R 300 000.00	1	1	R 0.00	0.00%
15 (C)	Concrete Slabs & Light Structures	m^2	Silt Trap	1 153.20	R 130.00	1	1	R 149 916.00	0.28%
		m^2	Energy Dissipator	108.00	R 130.00	1	1	R 14 040.00	0.03%
		m^2	Solution Trench	24 803.20	R 130.00	1	1	R 3 224 416.00	6.06%
		m^2	Helicopter Pad	355.50	R 130.00	1	1	R 46 215.00	0.09%
		m^2	Waste Skip Area	144.86	R 130.00	1	1	R 18 832.06	0.04%
		m^2	Weigh Bridge	104.12	R 130.00	1	1	R 13 535.60	0.03%
		m^2	Diesel Storage/Refueling	154.82	R 130.00	1	1	R 20 126.73	0.04%
		m^2	Main Substation	448.17	R 130.00	1	1	R 58 261.71	0.11%
		m^2	Sub-Station/MCC	106.12	R 130.00	1	1	R 13 795.60	0.03%
							Sub Total 1 (Sum of items 1 to 15 Above)	R 53 249 755.01	100.00%
1	Preliminary and general		12.5% of Subtotal 1			Weighting factor 2 (step 4.4)	1.05	R 6 989 030.35	
2	Administration & supervision costs		6.0% of Subtotal 1					R 3 194 985.30	
3	Engineering drawings & specifications		2.0% of Subtotal 1					R 1 064 995.10	
4	Engineering & procurement of specialist work		2.5% of Subtotal 1					R 1 331 243.88	
5	Development of a closure plan		2.5% of Subtotal 1					R 1 331 243.88	
6	Final groundwater modeling								
							Sub Total 2 (Subtotal 1 plus sum of management & administrative items, 1 to 6 above)	R 67 161 253.51	
7	Contingency		10.0% of Subtotal 1					R 5 324 975.50	
							Sub Total 3 (Subtotal 2 plus contingency)	R 72 486 229.01	
8	VAT		14.0% of Subtotal 3					R 10 148 072.06	
							GRAND TOTAL (Subtotal 3 plus VAT)	R 82 634 301.08	

Escalation Factor
1.50077

Template for "rules-based" approach of the quantum for financial provision

CALCULATION OF THE QUANTUM

Area: *Turquoise Moon - Year 5*

No.	Description:	Unit:	Operational Area	A Quantity	B Master rate	C Multiplication factor	D Weighting factor 1	E=A*B*C*D Amount (Rands)	
				Step 4.5	Step 4.3	Step 4.3	Step 4.4		
1	Dismantling of processing plant & related structures (incl. overland conveyors & power lines)	m^3	Secondary /Tertiary Crushing/Screening, Screening, Quatinary Crushing, Magnetic Separation, Milling, Process Thickening, Tailings Thickening, Process Water & Product Storage	90470.13	R 10.24	1	1	R 925 984.49	1.47%
2 (A)	Demolition of steel buildings & structures	m^2	N/A	0.00	R 142.57	1	1	R 0.00	0.00%
2 (B)	Demolition of reinforced concrete buildings & structures	m^2	Workshop & Stores	2 444.55	R 210.11	1	1	R 513 617.97	0.82%
		m^2	Sewage Plant	95.07	R 210.11	1	1	R 19 974.11	0.03%
		m^2	Tailings Thickening	1 283.52	R 210.11	1	1	R 269 676.72	0.43%
		m^2	Process Thickening	1 283.52	R 210.11	1	1	R 269 676.72	0.43%
		m^2	Product Storage/Pumping	869.17	R 210.11	1	1	R 182 619.82	0.29%
		m^2	Water Treatment	143.21	R 210.11	1	1	R 30 089.33	0.05%
		m^2	Milling	1 294.70	R 210.11	1	1	R 272 027.20	0.43%
		m^2	Magnetic Separation	2 064.28	R 210.11	1	1	R 433 721.75	0.69%
		m^2	Quatinary Separation	633.77	R 210.11	1	1	R 133 160.23	0.21%
		m^2	Screening	158.44	R 210.11	1	1	R 33 290.11	0.05%
		m^2	Secondary /Tertiary Crushing/Screening	190.13	R 210.11	1	1	R 39 948.01	0.06%
		m^2	Pollution Control Dam	113.17	R 210.11	1	1	R 23 778.74	0.04%
		m^2	Conveyor Belt Foundations	557.45	R 210.11	1	1	R 117 123.96	0.19%
		m^2	Mining Complex	16 296.97	R 210.11	1	1	R 3 424 119.88	5.45%
3	Rehabilitation of access roads	m^2	TSF Area	49 855.00	R 25.51	1	1	R 1 271 955.10	2.02%
		m^2	Processing Plant Area	14 531.47	R 25.51	1	1	R 370 742.63	0.59%
		m^2	Haul Roads	19 148.94	R 25.51	1	1	R 488 548.53	0.78%
		m^2	Mining Complex	6 518.79	R 25.51	1	1	R 166 314.39	0.26%
4 (A)	Demolition & rehabilitation of electrified railway lines	m	N/A	0.00	R 247.63	1	1	R 0.00	0.00%
4 (B)	Demolition & rehabilitation of non electrified railway lines	m	N/A	0.00	R 135.07	1	1	R 0.00	0.00%
5	Demolition of housing &/or administration facilities	m^2	Access Control & Security	79.22	R 285.15	1	1	R 22 589.29	0.04%
		m^2	Administration	561.34	R 285.15	1	1	R 160 064.02	0.25%
		m^2	Change House	117.70	R 285.15	1	1	R 33 561.72	0.05%
		m^2	Tea Room	58.85	R 285.15	1	1	R 16 780.86	0.03%
		m^2	Laboratory	203.71	R 285.15	1	1	R 58 087.72	0.09%
		m^2	Control Room	108.65	R 285.15	1	1	R 30 980.00	0.05%
		m^2	Mining Complex	6 518.79	R 285.15	1	1	R 1 858 807.94	2.96%
6	Opencast rehabilitation including final voids & ramps	ha	Opencast Pit	39.32	R 145 124.46	1	1	R 5 705 742.25	9.08%
7	Sealing of shafts, adits & inclines	m^3	N/A	0.00	R 76.54	1	1	R 0.00	0.00%
8 (A)	Rehabilitation of overburden & spoils	ha	Waste Dump 1	15.69	R 99 651.13	1	1	R 1 563 712.03	2.49%
			Waste Dump 2	16.56	R 99 651.13	1	1	R 1 650 584.94	2.63%
8 (B)	Rehabilitation of processing waste deposits & evaporation ponds (basic, salt producing waste)	ha	SWD & RWD	39.21	R 124 113.68	1	1	R 4 866 993.81	7.74%
		ha	TSF - Basin	145.65	R 124 113.68	1	1	R 18 077 641.39	28.76%
		ha	Process Water Dam	0.50	R 124 113.68	1	1	R 61 804.03	0.10%
		ha	Raw Water Dam	0.50	R 124 113.68	1	1	R 61 804.03	0.10%
		ha	Pollution Control Dam	0.7888	R 124 113.68	1	1	R 97 900.87	0.16%
8 (C)	Rehabilitation of processing waste deposits & evaporation ponds (acidic, metal-rich waste)	ha	N/A	0.00	R 360 484.95	1	1	R 0.00	0.00%
9	Rehabilitation of subsided areas	ha	N/A	0.00	R 83 442.81	1	1	R 0.00	0.00%
10	General surface rehabilitation	ha	Surrounding Areas of TSF	37.40	R 0.00	1	1	R 0.00	0.00%
		ha	Topsoil Stockpiles	48.35	R 78 940.50	1	1	R 3 817 113.20	6.07%
		ha	Mining Complex	6.52	R 78 940.50	1	1	R 514 596.30	0.82%
		ha	Construction Admin & Laydown	30.78	R 78 940.50	1	1	R 2 430 038.09	3.87%
		ha	Concrete Areas	2.61	R 78 940.50	1	1	R 205 753.68	0.33%
		ha	Additional Concrete Areas	0.13	R 78 940.50	1	1	R 10 369.55	0.02%
		ha	Access Roads	9.01	R 78 940.50	1	1	R 710 892.30	1.13%
11	River diversions (to be decommissioned)	ha	N/A	0.00	R 78 940.50	1	1	R 0.00	0.00%
12	Fencing	m	Processing Plant Area	3 051.37	R 90.05	1	1	R 274 764.61	0.44%
13	Water management	ha	Pollution Control Dam	0.79	R 30 015.40	1	1	R 23 676.15	0.04%
		ha	Opencast Pit	39.32	R 30 015.40	1	1	R 1 180 091.47	1.88%
14	2 to 3 years of maintenance & aftercare	ha	Operational TSF, Surrounding Areas & Concrete Areas	298.13	R 10 505.39	1	1	R 3 132 021.13	4.98%
		ha	Reinforced Concrete Buildings	1.91	R 10 505.39	1	1	R 20 057.90	0.03%
		ha	Administration	0.76	R 10 505.39	1	1	R 8 034.79	0.01%
		ha	Overburden & Spoils	32.26	R 10 505.39	1	1	R 338 856.61	0.54%
		ha	Evaporation Ponds	186.65	R 10 505.39	1	1	R 1 960 858.63	3.12%
		ha	Processing Plant Area	0.85	R 10 505.39	1	1	R 8 908.40	0.01%
		ha	General Surface Rehabilitation	134.80	R 10 505.39	1	1	R 1 416 121.01	2.25%
15 (A)	Specialist study (Water pollution potential study)	SUM	All Areas	0.00	R 500 000.00	1	1	R 0.00	0.00%
15 (B)	Specialist study (Overall quantified risk assessment)	SUM	All Areas	0.00	R 300 000.00	1	1	R 0.00	0.00%
15 (C)	Concrete Slabs & Light Structures	m^2	Silt Trap	1 153.20	R 130.00	1	1	R 149 916.00	0.24%
		m^2	Energy Dissipator	108.00	R 130.00	1	1	R 14 040.00	0.02%
		m^2	Solution Trench	24 803.20	R 130.00	1	1	R 3 224 416.00	5.13%
		m^2	Helicopter Pad	355.50	R 130.00	1	1	R 46 215.00	0.07%
		m^2	Waste Skip Area	144.86	R 130.00	1	1	R 18 832.06	0.03%
		m^2	Weigh Bridge	104.12	R 130.00	1	1	R 13 535.60	0.02%
		m^2	Diesel Storage/Refueling	154.82	R 130.00	1	1	R 20 126.73	0.03%
		m^2	Main Substation	448.17	R 130.00	1	1	R 58 261.71	0.09%
		m^2	Sub-Station/MCC	106.12	R 130.00	1	1	R 13 795.60	0.02%
							Sub Total 1 (Sum of items 1 to 15 Above)	R 62 864 717.13	100.00%

1	Preliminary and general	12.5% of Subtotal 1	**Weighting factor 2 (step 4.4)**	1.05	R 8 250 994.12
2	Administration & supervision costs	6.0% of Subtotal 1			R 3 771 883.03
3	Engineering drawings & specifications	2.0% of Subtotal 1			R 1 257 294.34
4	Engineering & procurement of specialist work	2.5% of Subtotal 1			R 1 571 617.93
5	Development of a closure plan	2.5% of Subtotal 1			R 1 571 617.93
6	Final groundwater modeling				
				Sub Total 2 (Subtotal 1 plus sum of management & administrative items, 1 to 6 above)	R 79 288 124.49
7	Contingency	10.0% of Subtotal 1			R 6 286 471.71
				Sub Total 3 (Subtotal 2 plus contingency)	R 85 574 596.20
8	VAT	14.0% of Subtotal 3			R 11 980 443.47
				GRAND TOTAL (Subtotal 3 plus VAT)	R 97 555 039.67

Escalation Factor
1.50077

Template for "rules-based" approach of the quantum for financial provision

CALCULATION OF THE QUANTUM

Area: *Turquoise Moon - Year 6*

No.	Description:	Unit:	Operational Area	A Quantity	B Master rate	C Multiplication factor	D Weighting factor 1	E=A*B*C*D Amount (Rands)	
				Step 4.5	Step 4.3	Step 4.3	Step 4.4		
1	Dismantling of processing plant & related structures (incl. overland conveyors & power lines)	m^3	Secondary /Tertiary Crushing/Screening, Screening, Quatinary Crushing, Magnetic Separation, Milling, Process Thickening, Tailings Thickening, Process Water & Product Storage	90470.13	R 10.24	1	1	R 925 984.49	1.34%
2 (A)	Demolition of steel buildings & structures	m^2	N/A	0.00	R 142.57	1	1	R 0.00	0.00%
2 (B)	Demolition of reinforced concrete buildings & structures	m^2	Workshop & Stores	2 444.55	R 210.11	1	1	R 513 617.97	0.74%
		m^2	Sewage Plant	95.07	R 210.11	1	1	R 19 974.11	0.03%
		m^2	Tailings Thickening	1 283.52	R 210.11	1	1	R 269 676.72	0.39%
		m^2	Process Thickening	1 283.52	R 210.11	1	1	R 269 676.72	0.39%
		m^2	Product Storage/Pumping	869.17	R 210.11	1	1	R 182 619.82	0.26%
		m^2	Water Treatment	143.21	R 210.11	1	1	R 30 089.33	0.04%
		m^2	Milling	1 294.70	R 210.11	1	1	R 272 027.20	0.39%
		m^2	Magnetic Separation	2 064.28	R 210.11	1	1	R 433 721.75	0.63%
		m^2	Quatinary Separation	633.77	R 210.11	1	1	R 133 160.23	0.19%
		m^2	Screening	158.44	R 210.11	1	1	R 33 290.11	0.05%
		m^2	Secondary /Tertiary Crushing/Screening	190.13	R 210.11	1	1	R 39 948.01	0.06%
		m^2	Pollution Control Dam	113.17	R 210.11	1	1	R 23 778.74	0.03%
		m^2	Conveyor Belt Foundations	557.45	R 210.11	1	1	R 117 123.96	0.17%
		m^2	Mining Complex	16 296.97	R 210.11	1	1	R 3 424 119.88	4.96%
3	Rehabilitation of access roads	m^2	TSF Area	49 855.00	R 25.51	1	1	R 1 271 955.10	1.84%
		m^2	Processing Plant Area	14 531.47	R 25.51	1	1	R 370 742.63	0.54%
		m^2	Haul Roads	19 148.94	R 25.51	1	1	R 488 548.53	0.71%
		m^2	Mining Complex	6 518.79	R 25.51	1	1	R 166 314.39	0.24%
4 (A)	Demolition & rehabilitation of electrified railway lines	m	N/A	0.00	R 247.63	1	1	R 0.00	0.00%
4 (B)	Demolition & rehabilitation of non electrified railway lines	m	N/A	0.00	R 135.07	1	1	R 0.00	0.00%
5	Demolition of housing &/or administration facilities	m^2	Access Control & Security	79.22	R 285.15	1	1	R 22 589.29	0.03%
		m^2	Administration	561.34	R 285.15	1	1	R 160 064.02	0.23%
		m^2	Change House	117.70	R 285.15	1	1	R 33 561.72	0.05%
		m^2	Tea Room	58.85	R 285.15	1	1	R 16 780.86	0.02%
		m^2	Laboratory	203.71	R 285.15	1	1	R 58 087.72	0.08%
		m^2	Control Room	108.65	R 285.15	1	1	R 30 980.00	0.04%
		m^2	Mining Complex	6 518.79	R 285.15	1	1	R 1 858 807.94	2.69%
6	Opencast rehabilitation including final voids & ramps	ha	Opencast Pit	40.08	R 145 124.46	1	1	R 5 817 226.86	8.42%
7	Sealing of shafts, adits & inclines	m^3	N/A	0.00	R 76.54	1	1	R 0.00	0.00%
8 (A)	Rehabilitation of overburden & spoils	ha	Waste Dump 1	16.00	R 99 651.13	1	1	R 1 594 265.43	2.31%
			Waste Dump 2	16.89	R 99 651.13	1	1	R 1 682 835.75	2.44%
8 (B)	Rehabilitation of processing waste deposits & evaporation ponds (basic, salt producing waste)	ha	SWD & RWD	39.21	R 124 113.68	1	1	R 4 866 993.81	7.05%
		ha	TSF - Basin	186.99	R 124 113.68	1	1	R 23 207 619.67	33.60%
		ha	Process Water Dam	0.50	R 124 113.68	1	1	R 61 804.03	0.09%
		ha	Raw Water Dam	0.50	R 124 113.68	1	1	R 61 804.03	0.09%
		ha	Pollution Control Dam	0.7888	R 124 113.68	1	1	R 97 900.87	0.14%
8 (C)	Rehabilitation of processing waste deposits & evaporation ponds (acidic, metal-rich waste)	ha	N/A	0.00	R 360 484.95	1	1	R 0.00	0.00%
9	Rehabilitation of subsided areas	ha	N/A	0.00	R 83 442.81	1	1	R 0.00	0.00%
10	General surface rehabilitation	ha	Surrounding Areas of TSF	37.40	R 0.00	1	1	R 0.00	0.00%
		ha	Topsoil Stockpiles	48.45	R 78 940.50	1	1	R 3 824 604.74	5.54%
		ha	Mining Complex	6.52	R 78 940.50	1	1	R 514 596.30	0.74%
		ha	Construction Admin & Laydown	30.78	R 78 940.50	1	1	R 2 430 038.09	3.52%
		ha	Concrete Areas	2.61	R 78 940.50	1	1	R 205 753.68	0.30%
		ha	Additional Concrete Areas	0.13	R 78 940.50	1	1	R 10 369.55	0.02%
		ha	Access Roads	9.01	R 78 940.50	1	1	R 710 892.30	1.03%
11	River diversions (to be decommissioned)	ha	N/A	0.00	R 78 940.50	1	1	R 0.00	0.00%
12	Fencing	m	Processing Plant Area	3 051.37	R 90.05	1	1	R 274 764.61	0.40%
13	Water management	ha	Pollution Control Dam	0.79	R 30 015.40	1	1	R 23 676.15	0.03%
		ha	Opencast Pit	40.08	R 30 015.40	1	1	R 1 203 149.30	1.74%
14	2 to 3 years of maintenance & aftercare	ha	Operational TSF, Surrounding Areas & Concrete Areas	339.47	R 10 505.39	1	1	R 3 566 239.37	5.16%
		ha	Reinforced Concrete Buildings	1.91	R 10 505.39	1	1	R 20 057.90	0.03%
		ha	Administration	0.76	R 10 505.39	1	1	R 8 034.79	0.01%
		ha	Overburden & Spoils	32.89	R 10 505.39	1	1	R 345 477.53	0.50%
		ha	Evaporation Ponds	227.99	R 10 505.39	1	1	R 2 395 076.87	3.47%
		ha	Processing Plant Area	0.85	R 10 505.39	1	1	R 8 908.40	0.01%
		ha	General Surface Rehabilitation	134.89	R 10 505.39	1	1	R 1 417 117.99	2.05%
15 (A)	Specialist study (Water pollution potential study)	SUM	All Areas	0.00	R 500 000.00	1	1	R 0.00	0.00%
15 (B)	Specialist study (Overall quantified risk assessment)	SUM	All Areas	0.00	R 300 000.00	1	1	R 0.00	0.00%
15 (C)	Concrete Slabs & Light Structures	m^2	Silt Trap	1 153.20	R 130.00	1	1	R 149 916.00	0.22%
		m^2	Energy Dissipator	108.00	R 130.00	1	1	R 14 040.00	0.02%
		m^2	Solution Trench	24 803.20	R 130.00	1	1	R 3 224 416.00	4.67%
		m^2	Helicopter Pad	355.50	R 130.00	1	1	R 46 215.00	0.07%
		m^2	Waste Skip Area	144.86	R 130.00	1	1	R 18 832.06	0.03%
		m^2	Weigh Bridge	104.12	R 130.00	1	1	R 13 535.60	0.02%
		m^2	Diesel Storage/Refueling	154.82	R 130.00	1	1	R 20 126.73	0.03%
		m^2	Main Substation	448.17	R 130.00	1	1	R 58 261.71	0.08%
		m^2	Sub-Station/MCC	106.12	R 130.00	1	1	R 13 795.60	0.02%
							Sub Total 1 (Sum of items 1 to 15 Above)	R 69 075 587.98	100.00%
1	Preliminary and general		12.5% of Subtotal 1			**Weighting factor 2 (step 4.4)**	1.05	R 9 066 170.92	
2	Administration & supervision costs		6.0% of Subtotal 1					R 4 144 535.28	
3	Engineering drawings & specifications		2.0% of Subtotal 1					R 1 381 511.76	
4	Engineering & procurement of specialist work		2.5% of Subtotal 1					R 1 726 889.70	
5	Development of a closure plan		2.5% of Subtotal 1					R 1 726 889.70	
6	Final groundwater modeling								
							Sub Total 2 (Subtotal 1 plus sum of management & administrative items, 1 to 6 above)	R 87 121 585.34	
7	Contingency		10.0% of Subtotal 1					R 6 907 558.80	
							Sub Total 3 (Subtotal 2 plus contingency)	R 94 029 144.14	
8	VAT		14.0% of Subtotal 3					R 13 164 080.18	
							GRAND TOTAL (Subtotal 3 plus VAT)	R 107 193 224.32	

Escalation Factor 1.50077

Template for "rules-based" approach of the quantum for financial provision

CALCULATION OF THE QUANTUM

Area: ***Turquoise Moon - Year 7***

No.	Description:	Unit:	Operational Area	A Quantity	B Master rate	C Multiplication factor	D Weighting factor 1	E=A*B*C*D Amount (Rands)	
				Step 4.5	Step 4.3	Step 4.3	Step 4.4		
1	Dismantling of processing plant & related structures (incl. overland conveyors & power lines)	m^3	Secondary /Tertiary Crushing/Screening, Screening, Quatinary Crushing, Magnetic Separation, Milling, Process Thickening, Tailings Thickening, Process Water & Product Storage	90470.13	R 10.24	1	1	R 925 984.49	1.27%
2 (A)	Demolition of steel buildings & structures	m^2	N/A	0.00	R 142.57	1	1	R 0.00	0.00%
2 (B)	Demolition of reinforced concrete buildings & structures	m^2	Workshop & Stores	2 444.55	R 210.11	1	1	R 513 617.97	0.70%
		m^2	Sewage Plant	95.07	R 210.11	1	1	R 19 974.11	0.03%
		m^2	Tailings Thickening	1 283.52	R 210.11	1	1	R 269 676.72	0.37%
		m^2	Process Thickening	1 283.52	R 210.11	1	1	R 269 676.72	0.37%
		m^2	Product Storage/Pumping	869.17	R 210.11	1	1	R 182 619.82	0.25%
		m^2	Water Treatment	143.21	R 210.11	1	1	R 30 089.33	0.04%
		m^2	Milling	1 294.70	R 210.11	1	1	R 272 027.20	0.37%
		m^2	Magnetic Separation	2 064.28	R 210.11	1	1	R 433 721.75	0.60%
		m^2	Quatinary Separation	633.77	R 210.11	1	1	R 133 160.23	0.18%
		m^2	Screening	158.44	R 210.11	1	1	R 33 290.11	0.05%
		m^2	Secondary /Tertiary Crushing/Screening	190.13	R 210.11	1	1	R 39 948.01	0.05%
		m^2	Pollution Control Dam	113.17	R 210.11	1	1	R 23 778.74	0.03%
		m^2	Conveyor Belt Foundations	557.45	R 210.11	1	1	R 117 123.96	0.16%
		m^2	Mining Complex	16 296.97	R 210.11	1	1	R 3 424 119.88	4.70%
3	Rehabilitation of access roads	m^2	TSF Area	49 855.00	R 25.51	1	1	R 1 271 955.10	1.75%
		m^2	Processing Plant Area	14 531.47	R 25.51	1	1	R 370 742.63	0.51%
		m^2	Haul Roads	19 148.94	R 25.51	1	1	R 488 548.53	0.67%
		m^2	Mining Complex	6 518.79	R 25.51	1	1	R 166 314.39	0.23%
4 (A)	Demolition & rehabilitation of electrified railway lines	m	N/A	0.00	R 247.63	1	1	R 0.00	0.00%
4 (B)	Demolition & rehabilitation of non electrified railway lines	m	N/A	0.00	R 135.07	1	1	R 0.00	0.00%
5	Demolition of housing &/or administration facilities	m^2	Access Control & Security	79.22	R 285.15	1	1	R 22 589.29	0.03%
		m^2	Administration	561.34	R 285.15	1	1	R 160 064.02	0.22%
		m^2	Change House	117.70	R 285.15	1	1	R 33 561.72	0.05%
		m^2	Tea Room	58.85	R 285.15	1	1	R 16 780.86	0.02%
		m^2	Laboratory	203.71	R 285.15	1	1	R 58 087.72	0.08%
		m^2	Control Room	108.65	R 285.15	1	1	R 30 980.00	0.04%
		m^2	Mining Complex	6 518.79	R 285.15	1	1	R 1 858 807.94	2.55%
6	Opencast rehabilitation including final voids & ramps	ha	Opencast Pit	40.93	R 145 124.46	1	1	R 5 940 524.60	8.15%
7	Sealing of shafts, adits & inclines	m^3	N/A	0.00	R 76.54	1	1	R 0.00	0.00%
8 (A)	Rehabilitation of overburden & spoils	ha	Waste Dump 1	16.34	R 99 651.13	1	1	R 1 628 056.33	2.23%
			Waste Dump 2	17.25	R 99 651.13	1	1	R 1 718 503.92	2.36%
8 (B)	Rehabilitation of processing waste deposits & evaporation ponds (basic, salt producing waste)	ha	SWD & RWD	39.21	R 124 113.68	1	1	R 4 866 993.81	6.68%
		ha	TSF - Basin	211.52	R 124 113.68	1	1	R 26 252 264.74	36.03%
		ha	Process Water Dam	0.50	R 124 113.68	1	1	R 61 804.03	0.08%
		ha	Raw Water Dam	0.50	R 124 113.68	1	1	R 61 804.03	0.08%
		ha	Pollution Control Dam	0.7888	R 124 113.68	1	1	R 97 900.87	0.13%
8 (C)	Rehabilitation of processing waste deposits & evaporation ponds (acidic, metal-rich waste)	ha	N/A	0.00	R 360 484.95	1	1	R 0.00	0.00%
9	Rehabilitation of subsided areas	ha	N/A	0.00	R 83 442.81	1	1	R 0.00	0.00%
10	General surface rehabilitation	ha	Surrounding Areas of TSF	37.40	R 0.00	1	1	R 0.00	0.00%
		ha	Topsoil Stockpiles	48.55	R 78 940.50	1	1	R 3 832 890.11	5.26%
		ha	Mining Complex	6.52	R 78 940.50	1	1	R 514 596.30	0.71%
		ha	Construction Admin & Laydown	30.78	R 78 940.50	1	1	R 2 430 038.09	3.33%
		ha	Concrete Areas	2.61	R 78 940.50	1	1	R 205 753.68	0.28%
		ha	Additional Concrete Areas	0.13	R 78 940.50	1	1	R 10 369.55	0.01%
		ha	Access Roads	9.01	R 78 940.50	1	1	R 710 892.30	0.98%
11	River diversions (to be decommissioned)	ha	N/A	0.00	R 78 940.50	1	1	R 0.00	0.00%
12	Fencing	m	Processing Plant Area	3 051.37	R 90.05	1	1	R 274 764.61	0.38%
13	Water management	ha	Pollution Control Dam	0.79	R 30 015.40	1	1	R 23 676.15	0.03%
		ha	Opencast Pit	40.93	R 30 015.40	1	1	R 1 228 650.38	1.69%
14	2 to 3 years of maintenance & aftercare	ha	Operational TSF, Surrounding Areas & Concrete Areas	364.00	R 10 505.39	1	1	R 3 823 948.14	5.25%
		ha	Reinforced Concrete Buildings	1.91	R 10 505.39	1	1	R 20 057.90	0.03%
		ha	Administration	0.76	R 10 505.39	1	1	R 8 034.79	0.01%
		ha	Overburden & Spoils	33.58	R 10 505.39	1	1	R 352 800.03	0.48%
		ha	Evaporation Ponds	252.52	R 10 505.39	1	1	R 2 652 785.64	3.64%
		ha	Processing Plant Area	0.85	R 10 505.39	1	1	R 8 908.40	0.01%
		ha	General Surface Rehabilitation	135.00	R 10 505.39	1	1	R 1 418 220.60	1.95%
15 (A)	Specialist study (Water pollution potential study)	SUM	All Areas	0.00	R 500 000.00	1	1	R 0.00	0.00%
15 (B)	Specialist study (Overall quantified risk assessment)	SUM	All Areas	0.00	R 300 000.00	1	1	R 0.00	0.00%
15 (C)	Concrete Slabs & Light Structures	m^2	Silt Trap	1 153.20	R 130.00	1	1	R 149 916.00	0.21%
		m^2	Energy Dissipator	108.00	R 130.00	1	1	R 14 040.00	0.02%
		m^2	Solution Trench	24 803.20	R 130.00	1	1	R 3 224 416.00	4.42%
		m^2	Helicopter Pad	355.50	R 130.00	1	1	R 46 215.00	0.06%
		m^2	Waste Skip Area	144.86	R 130.00	1	1	R 18 832.06	0.03%
		m^2	Weigh Bridge	104.12	R 130.00	1	1	R 13 535.60	0.02%
		m^2	Diesel Storage/Refueling	154.82	R 130.00	1	1	R 20 126.73	0.03%
		m^2	Main Substation	448.17	R 130.00	1	1	R 58 261.71	0.08%
		m^2	Sub-Station/MCC	106.12	R 130.00	1	1	R 13 795.60	0.02%
							Sub Total 1 (Sum of items 1 to 15 Above)	R 72 870 618.96	100.00%
1	Preliminary and general		12.5% of Subtotal 1			**Weighting factor 2 (step 4.4)**	1.05	R 9 564 268.74	
2	Administration & supervision costs		6.0% of Subtotal 1					R 4 372 237.14	
3	Engineering drawings & specifications		2.0% of Subtotal 1					R 1 457 412.38	
4	Engineering & procurement of specialist work		2.5% of Subtotal 1					R 1 821 765.47	
5	Development of a closure plan		2.5% of Subtotal 1					R 1 821 765.47	
6	Final groundwater modeling								
							Sub Total 2 (Subtotal 1 plus sum of management & administrative items, 1 to 6 above)	R 91 908 068.16	
7	Contingency		10.0% of Subtotal 1					R 7 287 061.90	
							Sub Total 3 (Subtotal 2 plus contingency)	R 99 195 130.06	
8	VAT		14.0% of Subtotal 3					R 13 887 318.21	
							GRAND TOTAL (Subtotal 3 plus VAT)	R 113 082 448.27	

Template for "rules-based" approach of the quantum for financial provision

CALCULATION OF THE QUANTUM

Escalation Factor 1.50077

Area: *Turquoise Moon - Year 8*

No.	Description:	Unit:	Operational Area	A Quantity	B Master rate	C Multiplication factor	D Weighting factor 1	E=A*B*C*D Amount (Rands)	
				Step 4.5	Step 4.3	Step 4.3	Step 4.4		
1	Dismantling of processing plant & related structures (incl. overland conveyors & power lines)	m^3	Secondary /Tertiary Crushing/Screening, Screening, Quatinary Crushing, Magnetic Separation, Milling, Process Thickening, Tailings Thickening, Process Water & Product Storage	90470.13	R 10.24	1	1	R 925 984.49	0.90%
2 (A)	Demolition of steel buildings & structures	m^2	N/A	0.00	R 142.57	1	1	R 0.00	0.00%
2 (B)	Demolition of reinforced concrete buildings & structures	m^2	Workshop & Stores	2 444.55	R 210.11	1	1	R 513 617.97	0.50%
		m^2	Sewage Plant	95.07	R 210.11	1	1	R 19 974.11	0.02%
		m^2	Tailings Thickening	1 283.52	R 210.11	1	1	R 269 676.72	0.26%
		m^2	Process Thickening	1 283.52	R 210.11	1	1	R 269 676.72	0.26%
		m^2	Product Storage/Pumping	869.17	R 210.11	1	1	R 182 619.82	0.18%
		m^2	Water Treatment	143.21	R 210.11	1	1	R 30 089.33	0.03%
		m^2	Milling	1 294.70	R 210.11	1	1	R 272 027.20	0.27%
		m^2	Magnetic Separation	2 064.28	R 210.11	1	1	R 433 721.75	0.42%
		m^2	Quatinary Separation	633.77	R 210.11	1	1	R 133 160.23	0.13%
		m^2	Screening	158.44	R 210.11	1	1	R 33 290.11	0.03%
		m^2	Secondary /Tertiary Crushing/Screening	190.13	R 210.11	1	1	R 39 948.01	0.04%
		m^2	Pollution Control Dam	113.17	R 210.11	1	1	R 23 778.74	0.02%
		m^2	Conveyor Belt Foundations	557.45	R 210.11	1	1	R 117 123.96	0.11%
		m^2	Mining Complex	16 296.97	R 210.11	1	1	R 3 424 119.88	3.34%
3	Rehabilitation of access roads	m^2	TSF Area	49 855.00	R 25.51	1	1	R 1 271 955.10	1.24%
		m^2	Processing Plant Area	14 531.47	R 25.51	1	1	R 370 742.63	0.36%
		m^2	Haul Roads	19 148.94	R 25.51	1	1	R 488 548.53	0.48%
		m^2	Mining Complex	6 518.79	R 25.51	1	1	R 166 314.39	0.16%
4 (A)	Demolition & rehabilitation of electrified railway lines	m	N/A	0.00	R 247.63	1	1	R 0.00	0.00%
4 (B)	Demolition & rehabilitation of non electrified railway lines	m	N/A	0.00	R 135.07	1	1	R 0.00	0.00%
5	Demolition of housing &/or administration facilities	m^2	Access Control & Security	79.22	R 285.15	1	1	R 22 589.29	0.02%
		m^2	Administration	561.34	R 285.15	1	1	R 160 064.02	0.16%
		m^2	Change House	117.70	R 285.15	1	1	R 33 561.72	0.03%
		m^2	Tea Room	58.85	R 285.15	1	1	R 16 780.86	0.02%
		m^2	Laboratory	203.71	R 285.15	1	1	R 58 087.72	0.06%
		m^2	Control Room	108.65	R 285.15	1	1	R 30 980.00	0.03%
		m^2	Mining Complex	6 518.79	R 285.15	1	1	R 1 858 807.94	1.81%
6	Opencast rehabilitation including final voids & ramps	ha	Opencast Pit	136.66	R 145 124.46	1	1	R 19 832 476.37	19.33%
7	Sealing of shafts, adits & inclines	m^3	N/A	0.00	R 76.54	1	1	R 0.00	0.00%
8 (A)	Rehabilitation of overburden & spoils	ha	Waste Dump 1	54.54	R 99 651.13	1	1	R 5 435 275.63	5.30%
			Waste Dump 2	57.57	R 99 651.13	1	1	R 5 737 235.47	5.59%
8 (B)	Rehabilitation of processing waste deposits & evaporation ponds (basic, salt producing waste)	ha	SWD & RWD	39.21	R 124 113.68	1	1	R 4 866 993.81	4.74%
		ha	TSF - Basin	234.09	R 124 113.68	1	1	R 29 054 081.40	28.31%
		ha	Process Water Dam	0.50	R 124 113.68	1	1	R 61 804.03	0.06%
		ha	Raw Water Dam	0.50	R 124 113.68	1	1	R 61 804.03	0.06%
		ha	Pollution Control Dam	0.7888	R 124 113.68	1	1	R 97 900.87	0.10%
8 (C)	Rehabilitation of processing waste deposits & evaporation ponds (acidic, metal-rich waste)	ha	N/A	0.00	R 360 484.95	1	1	R 0.00	0.00%
9	Rehabilitation of subsided areas	ha	N/A	0.00	R 83 442.81	1	1	R 0.00	0.00%
10	General surface rehabilitation	ha	Surrounding Areas of TSF	37.40	R 0.00	1	1	R 0.00	0.00%
		ha	Topsoil Stockpiles	60.38	R 78 940.50	1	1	R 4 766 401.57	4.64%
		ha	Mining Complex	6.52	R 78 940.50	1	1	R 514 596.30	0.50%
		ha	Construction Admin & Laydown	30.78	R 78 940.50	1	1	R 2 430 038.09	2.37%
		ha	Concrete Areas	2.61	R 78 940.50	1	1	R 205 753.68	0.20%
		ha	Additional Concrete Areas	0.13	R 78 940.50	1	1	R 10 369.55	0.01%
		ha	Access Roads	9.01	R 78 940.50	1	1	R 710 892.30	0.69%
11	River diversions (to be decommissioned)	ha	N/A	0.00	R 78 940.50	1	1	R 0.00	0.00%
12	Fencing	m	Processing Plant Area	3 051.37	R 90.05	1	1	R 274 764.61	0.27%
13	Water management	ha	Pollution Control Dam	0.79	R 30 015.40	1	1	R 23 676.15	0.02%
		ha	Opencast Pit	136.66	R 30 015.40	1	1	R 4 101 856.54	4.00%
14	2 to 3 years of maintenance & aftercare	ha	Operational TSF, Surrounding Areas & Concrete Areas	386.57	R 10 505.39	1	1	R 4 061 103.12	3.96%
		ha	Reinforced Concrete Buildings	1.91	R 10 505.39	1	1	R 20 057.90	0.02%
		ha	Administration	0.76	R 10 505.39	1	1	R 8 034.79	0.01%
		ha	Overburden & Spoils	112.12	R 10 505.39	1	1	R 1 177 824.97	1.15%
		ha	Evaporation Ponds	275.09	R 10 505.39	1	1	R 2 889 940.62	2.82%
		ha	Processing Plant Area	0.85	R 10 505.39	1	1	R 8 908.40	0.01%
		ha	General Surface Rehabilitation	146.82	R 10 505.39	1	1	R 1 542 452.16	1.50%
15 (A)	Specialist study (Water pollution potential study)	SUM	All Areas	0.00	R 500 000.00	1	1	R 0.00	0.00%
15 (B)	Specialist study (Overall quantified risk assessment)	SUM	All Areas	0.00	R 300 000.00	1	1	R 0.00	0.00%
15 (C)	Concrete Slabs & Light Structures	m^2	Silt Trap	1 153.20	R 130.00	1	1	R 149 916.00	0.15%
		m^2	Energy Dissipator	108.00	R 130.00	1	1	R 14 040.00	0.01%
		m^2	Solution Trench	24 803.20	R 130.00	1	1	R 3 224 416.00	3.14%
		m^2	Helicopter Pad	355.50	R 130.00	1	1	R 46 215.00	0.05%
		m^2	Waste Skip Area	144.86	R 130.00	1	1	R 18 832.06	0.02%
		m^2	Weigh Bridge	104.12	R 130.00	1	1	R 13 535.60	0.01%
		m^2	Diesel Storage/Refueling	154.82	R 130.00	1	1	R 20 126.73	0.02%
		m^2	Main Substation	448.17	R 130.00	1	1	R 58 261.71	0.06%
		m^2	Sub-Station/MCC	106.12	R 130.00	1	1	R 13 795.60	0.01%
							Sub Total 1 (Sum of items 1 to 15 Above)	R 102 620 622.31	100.00%
1	Preliminary and general	12.5% of Subtotal 1				**Weighting factor 2 (step 4.4)**	1.05	R 13 468 956.68	
2	Administration & supervision costs	6.0% of Subtotal 1						R 6 157 237.34	
3	Engineering drawings & specifications	2.0% of Subtotal 1						R 2 052 412.45	
4	Engineering & procurement of specialist work	2.5% of Subtotal 1						R 2 565 515.56	
5	Development of a closure plan	2.5% of Subtotal 1						R 2 565 515.56	
6	Final groundwater modeling								
							Sub Total 2 (Subtotal 1 plus sum of management & administrative items, 1 to 6 above)	R 129 430 259.89	
7	Contingency	10.0% of Subtotal 1						R 10 262 062.23	
							Sub Total 3 (Subtotal 2 plus contingency)	R 139 692 322.12	
8	VAT	14.0% of Subtotal 3						R 19 556 925.10	
							GRAND TOTAL (Subtotal 3 plus VAT)	R 159 249 247.21	

Escalation Factor
1.50077

Template for "rules-based" approach of the quantum for financial provision

CALCULATION OF THE QUANTUM

Area: *Turquoise Moon - Year 9*

No.	Description:	Unit:	Operational Area	A Quantity	B Master rate	C Multiplication factor	D Weighting factor 1	E=A*B*C*D Amount (Rands)	
				Step 4.5	Step 4.3	Step 4.3	Step 4.4		
1	Dismantling of processing plant & related structures (incl. overland conveyors & power lines)	m^3	Secondary /Tertiary Crushing/Screening, Screening, Quatinary Crushing, Magnetic Separation, Milling, Process Thickening, Tailings Thickening, Process Water & Product Storage	90470.13	R 10.24	1	1	R 925 984.49	0.87%
2 (A)	Demolition of steel buildings & structures	m^2	N/A	0.00	R 142.57	1	1	R 0.00	0.00%
2 (B)	Demolition of reinforced concrete buildings & structures	m^2	Workshop & Stores	2 444.55	R 210.11	1	1	R 513 617.97	0.48%
		m^2	Sewage Plant	95.07	R 210.11	1	1	R 19 974.11	0.02%
		m^2	Tailings Thickening	1 233.52	R 210.11	1	1	R 269 676.72	0.25%
		m^2	Process Thickening	1 233.52	R 210.11	1	1	R 269 676.72	0.25%
		m^2	Product Storage/Pumping	869.17	R 210.11	1	1	R 182 619.82	0.17%
		m^2	Water Treatment	143.21	R 210.11	1	1	R 30 089.33	0.03%
		m^2	Milling	1 294.70	R 210.11	1	1	R 272 027.20	0.26%
		m^2	Magnetic Separation	2 064.28	R 210.11	1	1	R 433 721.75	0.41%
		m^2	Quatinary Separation	633.77	R 210.11	1	1	R 133 160.23	0.13%
		m^2	Screening	158.44	R 210.11	1	1	R 33 290.11	0.03%
		m^2	Secondary /Tertiary Crushing/Screening	190.13	R 210.11	1	1	R 39 948.01	0.04%
		m^2	Pollution Control Dam	113.17	R 210.11	1	1	R 23 778.74	0.02%
		m^2	Conveyor Belt Foundations	557.45	R 210.11	1	1	R 117 123.96	0.11%
		m^2	Mining Complex	16 296.97	R 210.11	1	1	R 3 424 119.88	3.22%
3	Rehabilitation of access roads	m^2	TSF Area	49 855.00	R 25.51	1	1	R 1 271 955.10	1.19%
		m^2	Processing Plant Area	14 531.47	R 25.51	1	1	R 370 742.63	0.35%
		m^2	Haul Roads	19 148.94	R 25.51	1	1	R 488 548.53	0.46%
		m^2	Mining Complex	6 518.79	R 25.51	1	1	R 166 314.39	0.16%
4 (A)	Demolition & rehabilitation of electrified railway lines	m	N/A	0.00	R 247.63	1	1	R 0.00	0.00%
4 (B)	Demolition & rehabilitation of non electrified railway lines	m	N/A	0.00	R 135.07	1	1	R 0.00	0.00%
5	Demolition of housing &/or administration facilities	m^2	Access Control & Security	79.22	R 285.15	1	1	R 22 589.29	0.02%
		m^2	Administration	561.34	R 285.15	1	1	R 160 064.02	0.15%
		m^2	Change House	117.70	R 285.15	1	1	R 33 561.72	0.03%
		m^2	Tea Room	58.85	R 285.15	1	1	R 16 780.86	0.02%
		m^2	Laboratory	203.71	R 285.15	1	1	R 58 087.72	0.05%
		m^2	Control Room	108.65	R 285.15	1	1	R 30 980.00	0.03%
		m^2	Mining Complex	6 518.79	R 285.15	1	1	R 1 858 807.94	1.75%
6	Opencast rehabilitation including final voids & ramps	ha	Opencast Pit	142.23	R 145 124.46	1	1	R 20 640 906.68	19.38%
7	Sealing of shafts, adits & inclines	m^3	N/A	0.00	R 76.54	1	1	R 0.00	0.00%
8 (A)	Rehabilitation of overburden & spoils	ha	Waste Dump 1	56.77	R 99 651.13	1	1	R 5 656 833.52	5.31%
			Waste Dump 2	59.92	R 99 651.13	1	1	R 5 971 102.13	5.61%
8 (B)	Rehabilitation of processing waste deposits & evaporation ponds (basic, salt producing waste)	ha	SWD & RWD	39.21	R 124 113.68	1	1	R 4 866 993.81	4.57%
		ha	TSF - Basin	250.18	R 124 113.68	1	1	R 31 051 231.84	29.16%
		ha	Process Water Dam	0.50	R 124 113.68	1	1	R 61 804.03	0.06%
		ha	Raw Water Dam	0.50	R 124 113.68	1	1	R 61 804.03	0.06%
		ha	Pollution Control Dam	0.7888	R 124 113.68	1	1	R 97 900.87	0.09%
8 (C)	Rehabilitation of processing waste deposits & evaporation ponds (acidic, metal-rich waste)	ha	N/A	0.00	R 360 484.95	1	1	R 0.00	0.00%
9	Rehabilitation of subsided areas	ha	N/A	0.00	R 83 442.81	1	1	R 0.00	0.00%
10	General surface rehabilitation	ha	Surrounding Areas of TSF	37.40	R 0.00	1	1	R 0.00	0.00%
		ha	Topsoil Stockpiles	61.07	R 78 940.50	1	1	R 4 820 726.47	4.53%
		ha	Mining Complex	6.52	R 78 940.50	1	1	R 514 596.30	0.48%
		ha	Construction Admin & Laydown	30.78	R 78 940.50	1	1	R 2 430 038.09	2.28%
		ha	Concrete Areas	2.61	R 78 940.50	1	1	R 205 753.68	0.19%
		ha	Additional Concrete Areas	0.13	R 78 940.50	1	1	R 10 369.55	0.01%
		ha	Access Roads	9.01	R 78 940.50	1	1	R 710 892.30	0.67%
11	River diversions (to be decommissioned)	ha	N/A	0.00	R 78 940.50	1	1	R 0.00	0.00%
12	Fencing	m	Processing Plant Area	3 051.37	R 90.05	1	1	R 274 764.61	0.26%
13	Water management	ha	Pollution Control Dam	0.79	R 30 015.40	1	1	R 23 676.15	0.02%
		ha	Opencast Pit	142.23	R 30 015.40	1	1	R 4 269 060.33	4.01%
14	2 to 3 years of maintenance & aftercare	ha	Operational TSF, Surrounding Areas & Concrete Areas	402.66	R 10 505.39	1	1	R 4 230 148.50	3.97%
		ha	Reinforced Concrete Buildings	1.91	R 10 505.39	1	1	R 20 057.90	0.02%
		ha	Administration	0.76	R 10 505.39	1	1	R 8 034.79	0.01%
		ha	Overburden & Spoils	116.69	R 10 505.39	1	1	R 1 225 836.59	1.15%
		ha	Evaporation Ponds	291.18	R 10 505.39	1	1	R 3 058 986.00	2.87%
		ha	Processing Plant Area	0.85	R 10 505.39	1	1	R 8 908.40	0.01%
		ha	General Surface Rehabilitation	147.51	R 10 505.39	1	1	R 1 549 681.71	1.46%
15 (A)	Specialist study (Water pollution potential study)	SUM	All Areas	0.00	R 500 000.00	1	1	R 0.00	0.00%
15 (B)	Specialist study (Overall quantified risk assessment)	SUM	All Areas	0.00	R 300 000.00	1	1	R 0.00	0.00%
15 (C)	Concrete Slabs & Light Structures	m^2	Silt Trap	1 153.20	R 130.00	1	1	R 149 916.00	0.14%
		m^2	Energy Dissipator	108.00	R 130.00	1	1	R 14 040.00	0.01%
		m^2	Solution Trench	24 803.20	R 130.00	1	1	R 3 224 416.00	3.03%
		m^2	Helicopter Pad	355.50	R 130.00	1	1	R 46 215.00	0.04%
		m^2	Waste Skip Area	144.86	R 130.00	1	1	R 18 832.06	0.02%
		m^2	Weigh Bridge	104.12	R 130.00	1	1	R 13 535.60	0.01%
		m^2	Diesel Storage/Refueling	154.82	R 130.00	1	1	R 20 126.73	0.02%
		m^2	Main Substation	448.17	R 130.00	1	1	R 58 261.71	0.05%
		m^2	Sub-Station/MCC	106.12	R 130.00	1	1	R 13 795.60	0.01%
							Sub Total 1 (Sum of items 1 to 15 Above)	R 106 496 488.24	100.00%
1	Preliminary and general	12.5% of Subtotal 1				Weighting factor 2 (step 4.4)	1.05	R 13 977 664.08	
2	Administration & supervision costs	6.0% of Subtotal 1						R 6 389 789.29	
3	Engineering drawings & specifications	2.0% of Subtotal 1						R 2 129 929.76	
4	Engineering & procurement of specialist work	2.5% of Subtotal 1						R 2 662 412.21	
5	Development of a closure plan	2.5% of Subtotal 1						R 2 662 412.21	
6	Final groundwater modeling								
							Sub Total 2 (Subtotal 1 plus sum of management & administrative items, 1 to 6 above)	R 134 318 695.80	
7	Contingency	10.0% of Subtotal 1						R 10 649 648.82	
							Sub Total 3 (Subtotal 2 plus contingency)	R 144 968 344.62	
8	VAT	14.0% of Subtotal 3						R 20 295 568.25	
							GRAND TOTAL (Subtotal 3 plus VAT)	R 165 263 912.87	

Escalation Factor
1.50077

Template for "rules-based" approach of the quantum for financial provision

CALCULATION OF THE QUANTUM

Area: ***Turquoise Moon - Year 10***

No.	Description:	Unit:	Operational Area	A Quantity	B Master rate	C Multiplication factor	D Weighting factor 1	E=A*B*C*D Amount (Rands)	
				Step 4.5	Step 4.3	Step 4.3	Step 4.4		
1	Dismantling of processing plant & related structures (incl. overland conveyors & power lines)	m^3	Secondary /Tertiary Crushing/Screening, Screening, Quatinary Crushing, Magnetic Separation, Milling, Process Thickening, Tailings Thickening, Process Water & Product Storage	90470.13	R 10.24	1	1	R 925 984.49	0.80%
2 (A)	Demolition of steel buildings & structures	m^2	N/A	0.00	R 142.57	1	1	R 0.00	0.00%
2 (B)	Demolition of reinforced concrete buildings & structures	m^2	Workshop & Stores	2 444.55	R 210.11	1	1	R 513 617.97	0.44%
		m^2	Sewage Plant	95.07	R 210.11	1	1	R 19 974.11	0.02%
		m^2	Tailings Thickening	1 283.52	R 210.11	1	1	R 269 676.72	0.23%
		m^2	Process Thickening	1 283.52	R 210.11	1	1	R 269 676.72	0.23%
		m^2	Product Storage/Pumping	869.17	R 210.11	1	1	R 182 619.82	0.16%
		m^2	Water Treatment	143.21	R 210.11	1	1	R 30 089.33	0.03%
		m^2	Milling	1 294.70	R 210.11	1	1	R 272 027.20	0.23%
		m^2	Magnetic Separation	2 064.28	R 210.11	1	1	R 433 721.75	0.37%
		m^2	Quatinary Separation	633.77	R 210.11	1	1	R 133 160.23	0.11%
		m^2	Screening	158.44	R 210.11	1	1	R 33 290.11	0.03%
		m^2	Secondary /Tertiary Crushing/Screening	190.13	R 210.11	1	1	R 39 948.01	0.03%
		m^2	Pollution Control Dam	113.17	R 210.11	1	1	R 23 778.74	0.02%
		m^2	Conveyor Belt Foundations	557.45	R 210.11	1	1	R 117 123.96	0.10%
		m^2	Mining Complex	16 296.97	R 210.11	1	1	R 3 424 119.88	2.95%
3	Rehabilitation of access roads	m^2	TSF Area	49 855.00	R 25.51	1	1	R 1 271 955.10	1.10%
		m^2	Processing Plant Area	14 531.47	R 25.51	1	1	R 370 742.63	0.32%
		m^2	Haul Roads	19 148.94	R 25.51	1	1	R 488 548.53	0.42%
		m^2	Mining Complex	6 518.79	R 25.51	1	1	R 166 314.39	0.14%
4 (A)	Demolition & rehabilitation of electrified railway lines	m	N/A	0.00	R 247.63	1	1	R 0.00	0.00%
4 (B)	Demolition & rehabilitation of non electrified railway lines	m	N/A	0.00	R 135.07	1	1	R 0.00	0.00%
5	Demolition of housing &/or administration facilities	m^2	Access Control & Security	79.22	R 285.15	1	1	R 22 589.29	0.02%
		m^2	Administration	561.34	R 285.15	1	1	R 160 064.02	0.14%
		m^2	Change House	117.70	R 285.15	1	1	R 33 561.72	0.03%
		m^2	Tea Room	58.85	R 285.15	1	1	R 16 780.86	0.01%
		m^2	Laboratory	203.71	R 285.15	1	1	R 58 087.72	0.05%
		m^2	Control Room	108.65	R 285.15	1	1	R 30 980.00	0.03%
		m^2	Mining Complex	6 518.79	R 285.15	1	1	R 1 858 807.94	1.60%
6	Opencast rehabilitation including final voids & ramps	ha	Opencast Pit	176.38	R 145 124.46	1	1	R 25 597 385.86	22.07%
7	Sealing of shafts, adits & inclines	m^3	N/A	0.00	R 76.54	1	1	R 0.00	0.00%
8 (A)	Rehabilitation of overburden & spoils	ha	Waste Dump 1	70.40	R 99 651.13	1	1	R 7 015 203.00	6.05%
			Waste Dump 2	74.31	R 99 651.13	1	1	R 7 404 936.60	6.38%
8 (B)	Rehabilitation of processing waste deposits & evaporation ponds (basic, salt producing waste)	ha	SWD & RWD	39.21	R 124 113.68	1	1	R 4 866 993.81	4.20%
		ha	TSF - Basin	250.4225	R 124 113.68	1	1	R 31 080 857.78	26.80%
		ha	Process Water Dam	0.50	R 124 113.68	1	1	R 61 804.03	0.05%
		ha	Raw Water Dam	0.50	R 124 113.68	1	1	R 61 804.03	0.05%
		ha	Pollution Control Dam	0.7888	R 124 113.68	1	1	R 97 900.87	0.08%
8 (C)	Rehabilitation of processing waste deposits & evaporation ponds (acidic, metal-rich waste)	ha	N/A	0.00	R 360 484.95	1	1	R 0.00	0.00%
9	Rehabilitation of subsided areas	ha	N/A	0.00	R 83 442.81	1	1	R 0.00	0.00%
10	General surface rehabilitation	ha	Surrounding Areas of TSF	37.40	R 0.00	1	1	R 0.00	0.00%
		ha	Topsoil Stockpiles	65.29	R 78 940.50	1	1	R 5 153 791.99	4.44%
		ha	Mining Complex	6.52	R 78 940.50	1	1	R 514 596.30	0.44%
		ha	Construction Admin & Laydown	30.78	R 78 940.50	1	1	R 2 430 038.09	2.10%
		ha	Concrete Areas	2.61	R 78 940.50	1	1	R 205 753.68	0.18%
		ha	Additional Concrete Areas	0.13	R 78 940.50	1	1	R 10 369.55	0.01%
		ha	Access Roads	9.01	R 78 940.50	1	1	R 710 892.30	0.61%
11	River diversions (to be decommissioned)	ha	N/A	0.00	R 78 940.50	1	1	R 0.00	0.00%
12	Fencing	m	Processing Plant Area	3 051.37	R 90.05	1	1	R 274 764.61	0.24%
13	Water management	ha	Pollution Control Dam	0.79	R 30 015.40	1	1	R 23 676.15	0.02%
		ha	Opencast Pit	176.38	R 30 015.40	1	1	R 5 294 185.29	4.56%
14	2 to 3 years of maintenance & aftercare	ha	Operational TSF, Surrounding Areas & Concrete Areas	402.90	R 10 505.39	1	1	R 4 232 656.14	3.65%
		ha	Reinforced Concrete Buildings	1.91	R 10 505.39	1	1	R 20 057.90	0.02%
		ha	Administration	0.76	R 10 505.39	1	1	R 8 034.79	0.01%
		ha	Overburden & Spoils	144.71	R 10 505.39	1	1	R 1 520 195.44	1.31%
		ha	Evaporation Ponds	291.42	R 10 505.39	1	1	R 3 061 493.64	2.64%
		ha	Processing Plant Area	0.85	R 10 505.39	1	1	R 8 908.40	0.01%
		ha	General Surface Rehabilitation	151.73	R 10 505.39	1	1	R 1 594 006.02	1.37%
15 (A)	Specialist study (Water pollution potential study)	SUM	All Areas	0.00	R 500 000.00	1	1	R 0.00	0.00%
15 (B)	Specialist study (Overall quantified risk assessment)	SUM	All Areas	0.00	R 300 000.00	1	1	R 0.00	0.00%
15 (C)	Concrete Slabs & Light Structures	m^2	Silt Trap	1 153.20	R 130.00	1	1	R 149 916.00	0.13%
		m^2	Energy Dissipator	108.00	R 130.00	1	1	R 14 040.00	0.01%
		m^2	Solution Trench	24 803.20	R 130.00	1	1	R 3 224 416.00	2.78%
		m^2	Helicopter Pad	355.50	R 130.00	1	1	R 46 215.00	0.04%
		m^2	Waste Skip Area	144.86	R 130.00	1	1	R 18 832.06	0.02%
		m^2	Weigh Bridge	104.12	R 130.00	1	1	R 13 535.60	0.01%
		m^2	Diesel Storage/Refueling	154.82	R 130.00	1	1	R 20 126.73	0.02%
		m^2	Main Substation	448.17	R 130.00	1	1	R 58 261.71	0.05%
		m^2	Sub-Station/MCC	106.12	R 130.00	1	1	R 13 795.60	0.01%
							Sub Total 1 (Sum of items 1 to 15 Above)	R 115 976 686.22	100.00%
1	Preliminary and general		12.5% of Subtotal 1			**Weighting factor 2 (step 4.4)**	1.05	R 15 221 940.07	
2	Administration & supervision costs		6.0% of Subtotal 1					R 6 958 601.17	
3	Engineering drawings & specifications		2.0% of Subtotal 1					R 2 319 533.72	
4	Engineering & procurement of specialist work		2.5% of Subtotal 1					R 2 899 417.16	
5	Development of a closure plan		2.5% of Subtotal 1					R 2 899 417.16	
6	Final groundwater modeling								
							Sub Total 2 (Subtotal 1 plus sum of management & administrative items, 1 to 6 above)	R 146 275 595.49	
7	Contingency		10.0% of Subtotal 1					R 11 597 668.62	
							Sub Total 3 (Subtotal 2 plus contingency)	R 157 873 264.12	
8	VAT		14.0% of Subtotal 3					R 22 102 256.98	
							GRAND TOTAL (Subtotal 3 plus VAT)	R 179 975 521.09	

Escalation Factor
1.50077

Template for "rules-based" approach of the quantum for financial provision

CALCULATION OF THE QUANTUM

Area: *Turquoise Moon - Year 11*

No.	Description:	Unit:	Operational Area	A Quantity	B Master rate	C Multiplication factor	D Weighting factor 1	E=A*B*C*D Amount (Rands)	
				Step 4.5	Step 4.3	Step 4.3	Step 4.4		
1	Dismantling of processing plant & related structures (incl. overland conveyors & power lines)	m^3	Secondary /Tertiary Crushing/Screening, Screening, Quatinary Crushing, Magnetic Separation, Milling, Process Thickening, Tailings Thickening, Process Water & Product Storage	90470.13	R 10.24	1	1	R 925 984.49	0.79%
2 (A)	Demolition of steel buildings & structures	m^2	N/A	0.00	R 142.57	1	1	R 0.00	0.00%
2 (B)	Demolition of reinforced concrete buildings & structures	m^2	Workshop & Stores	2 444.55	R 210.11	1	1	R 513 617.97	0.44%
		m^2	Sewage Plant	95.07	R 210.11	1	1	R 19 974.11	0.02%
		m^2	Tailings Thickening	1 283.52	R 210.11	1	1	R 269 676.72	0.23%
		m^2	Process Thickening	1 283.52	R 210.11	1	1	R 269 676.72	0.23%
		m^2	Product Storage/Pumping	869.17	R 210.11	1	1	R 182 619.82	0.16%
		m^2	Water Treatment	143.21	R 210.11	1	1	R 30 089.33	0.03%
		m^2	Milling	1 294.70	R 210.11	1	1	R 272 027.20	0.23%
		m^2	Magnetic Separation	2 064.28	R 210.11	1	1	R 433 721.75	0.37%
		m^2	Quatinary Separation	633.77	R 210.11	1	1	R 133 160.23	0.11%
		m^2	Screening	158.44	R 210.11	1	1	R 33 290.11	0.03%
		m^2	Secondary /Tertiary Crushing/Screening	190.13	R 210.11	1	1	R 39 948.01	0.03%
		m^2	Pollution Control Dam	113.17	R 210.11	1	1	R 23 778.74	0.02%
		m^2	Conveyor Belt Foundations	557.45	R 210.11	1	1	R 117 123.96	0.10%
		m^2	Mining Complex	16 296.97	R 210.11	1	1	R 3 424 119.88	2.91%
3	Rehabilitation of access roads	m^2	TSF Area	49 855.00	R 25.51	1	1	R 1 271 955.10	1.08%
		m^2	Processing Plant Area	14 531.47	R 25.51	1	1	R 370 742.63	0.32%
		m^2	Haul Roads	19 148.94	R 25.51	1	1	R 488 548.53	0.42%
		m^2	Mining Complex	6 518.79	R 25.51	1	1	R 166 314.39	0.14%
4 (A)	Demolition & rehabilitation of electrified railway lines	m	N/A	0.00	R 247.63	1	1	R 0.00	0.00%
4 (B)	Demolition & rehabilitation of non electrified railway lines	m	N/A	0.00	R 135.07	1	1	R 0.00	0.00%
5	Demolition of housing &/or administration facilities	m^2	Access Control & Security	79.22	R 285.15	1	1	R 22 589.29	0.02%
		m^2	Administration	561.34	R 285.15	1	1	R 160 064.02	0.14%
		m^2	Change House	117.70	R 285.15	1	1	R 33 561.72	0.03%
		m^2	Tea Room	58.85	R 285.15	1	1	R 16 780.86	0.01%
		m^2	Laboratory	203.71	R 285.15	1	1	R 58 087.72	0.05%
		m^2	Control Room	108.65	R 285.15	1	1	R 30 980.00	0.03%
		m^2	Mining Complex	6 518.79	R 285.15	1	1	R 1 858 807.94	1.58%
6	Opencast rehabilitation including final voids & ramps	ha	Opencast Pit	181.96	R 145 124.46	1	1	R 26 406 266.06	22.47%
7	Sealing of shafts, adits & inclines	m^3	N/A	0.00	R 76.54	1	1	R 0.00	0.00%
8 (A)	Rehabilitation of overburden & spoils	ha	Waste Dump 1	72.62	R 99 651.13	1	1	R 7 236 884.18	6.16%
			Waste Dump 2	76.66	R 99 651.13	1	1	R 7 638 933.41	6.50%
8 (B)	Rehabilitation of processing waste deposits & evaporation ponds (basic, salt producing waste)	ha	SWD & RWD	39.21	R 124 113.68	1	1	R 4 866 993.81	4.14%
		ha	TSF - Basin	250.4225	R 124 113.68	1	1	R 31 080 857.78	26.45%
		ha	Process Water Dam	0.50	R 124 113.68	1	1	R 61 804.03	0.05%
		ha	Raw Water Dam	0.50	R 124 113.68	1	1	R 61 804.03	0.05%
		ha	Pollution Control Dam	0.7888	R 124 113.68	1	1	R 97 900.87	0.08%
8 (C)	Rehabilitation of processing waste deposits & evaporation ponds (acidic, metal-rich waste)	ha	N/A	0.00	R 360 484.95	1	1	R 0.00	0.00%
9	Rehabilitation of subsided areas	ha	N/A	0.00	R 83 442.81	1	1	R 0.00	0.00%
10	General surface rehabilitation	ha	Surrounding Areas of TSF	37.40	R 0.00	1	1	R 0.00	0.00%
		ha	Topsoil Stockpiles	65.98	R 78 940.50	1	1	R 5 208 147.13	4.43%
		ha	Mining Complex	6.52	R 78 940.50	1	1	R 514 596.30	0.44%
		ha	Construction Admin & Laydown	30.78	R 78 940.50	1	1	R 2 430 038.09	2.07%
		ha	Concrete Areas	2.61	R 78 940.50	1	1	R 205 753.68	0.18%
		ha	Additional Concrete Areas	0.13	R 78 940.50	1	1	R 10 369.55	0.01%
		ha	Access Roads	9.01	R 78 940.50	1	1	R 710 892.30	0.60%
11	River diversions (to be decommissioned)	ha	N/A	0.00	R 78 940.50	1	1	R 0.00	0.00%
12	Fencing	m	Processing Plant Area	3 051.37	R 90.05	1	1	R 274 764.61	0.23%
13	Water management	ha	Pollution Control Dam	0.79	R 30 015.40	1	1	R 23 676.15	0.02%
		ha	Opencast Pit	181.96	R 30 015.40	1	1	R 5 461 482.12	4.65%
14	2 to 3 years of maintenance & aftercare	ha	Operational TSF, Surrounding Areas & Concrete Areas	402.90	R 10 505.39	1	1	R 4 232 656.14	3.60%
		ha	Reinforced Concrete Buildings	1.91	R 10 505.39	1	1	R 20 057.90	0.02%
		ha	Administration	0.76	R 10 505.39	1	1	R 8 034.79	0.01%
		ha	Overburden & Spoils	149.28	R 10 505.39	1	1	R 1 568 233.78	1.33%
		ha	Evaporation Ponds	291.42	R 10 505.39	1	1	R 3 061 493.64	2.61%
		ha	Processing Plant Area	0.85	R 10 505.39	1	1	R 8 908.40	0.01%
		ha	General Surface Rehabilitation	152.42	R 10 505.39	1	1	R 1 601 239.60	1.36%
15 (A)	Specialist study (Water pollution potential study)	SUM	All Areas	0.00	R 500 000.00	1	1	R 0.00	0.00%
15 (B)	Specialist study (Overall quantified risk assessment)	SUM	All Areas	0.00	R 300 000.00	1	1	R 0.00	0.00%
15 (C)	Concrete Slabs & Light Structures	m^2	Silt Trap	1 153.20	R 130.00	1	1	R 149 916.00	0.13%
		m^2	Energy Dissipator	108.00	R 130.00	1	1	R 14 040.00	0.01%
		m^2	Solution Trench	24 803.20	R 130.00	1	1	R 3 224 416.00	2.74%
		m^2	Helicopter Pad	355.50	R 130.00	1	1	R 46 215.00	0.04%
		m^2	Waste Skip Area	144.86	R 130.00	1	1	R 18 832.06	0.02%
		m^2	Weigh Bridge	104.12	R 130.00	1	1	R 13 535.60	0.01%
		m^2	Diesel Storage/Refueling	154.82	R 130.00	1	1	R 20 126.73	0.02%
		m^2	Main Substation	448.17	R 130.00	1	1	R 58 261.71	0.05%
		m^2	Sub-Station/MCC	106.12	R 130.00	1	1	R 13 795.60	0.01%
							Sub Total 1 (Sum of items 1 to 15 Above)	R 117 518 168.29	100.00%

1	Preliminary and general	12.5% of Subtotal 1	**Weighting factor 2 (step 4.4)**	1.05	R 15 424 259.59
2	Administration & supervision costs	6.0% of Subtotal 1			R 7 051 090.10
3	Engineering drawings & specifications	2.0% of Subtotal 1			R 2 350 363.37
4	Engineering & procurement of specialist work	2.5% of Subtotal 1			R 2 937 954.21
5	Development of a closure plan	2.5% of Subtotal 1			R 2 937 954.21
6	Final groundwater modeling				
				Sub Total 2 (Subtotal 1 plus sum of management & administrative items, 1 to 6 above)	R 148 219 789.76
7	Contingency	10.0% of Subtotal 1			R 11 751 816.83
				Sub Total 3 (Subtotal 2 plus contingency)	R 159 971 606.59
8	VAT	14.0% of Subtotal 3			R 22 396 024.92
				GRAND TOTAL (Subtotal 3 plus VAT)	R 182 367 631.51

Template for "rules-based" approach of the quantum for financial provision

CALCULATION OF THE QUANTUM

Escalation Factor 1.50077

Area: ***Turquoise Moon - Year 12***

No.	Description:	Unit:	Operational Area	A Quantity	B Master rate	C Multiplication factor	D Weighting factor 1	E=A*B*C*D Amount (Rands)	
				Step 4.5	Step 4.3	Step 4.3	Step 4.4		
1	Dismantling of processing plant & related structures (incl. overland conveyors & power lines)	m^3	Secondary /Tertiary Crushing/Screening, Screening, Quatinary Crushing, Magnetic Separation, Milling, Process Thickening, Tailings Thickening, Process Water & Product Storage	90470.13	R 10.24	1	1	R 925 984.49	0.76%
2 (A)	Demolition of steel buildings & structures	m^2	N/A	0.00	R 142.57	1	1	R 0.00	0.00%
2 (B)	Demolition of reinforced concrete buildings & structures	m^2	Workshop & Stores	2 444.55	R 210.11	1	1	R 513 617.97	0.42%
		m^2	Sewage Plant	95.07	R 210.11	1	1	R 19 974.11	0.02%
		m^2	Tailings Thickening	1 283.52	R 210.11	1	1	R 269 676.72	0.22%
		m^2	Process Thickening	1 283.52	R 210.11	1	1	R 269 676.72	0.22%
		m^2	Product Storage/Pumping	869.17	R 210.11	1	1	R 182 619.82	0.15%
		m^2	Water Treatment	143.21	R 210.11	1	1	R 30 089.33	0.02%
		m^2	Milling	1 294.70	R 210.11	1	1	R 272 027.20	0.22%
		m^2	Magnetic Separation	2 064.28	R 210.11	1	1	R 433 721.75	0.36%
		m^2	Quatinary Separation	633.77	R 210.11	1	1	R 133 160.23	0.11%
		m^2	Screening	158.44	R 210.11	1	1	R 33 290.11	0.03%
		m^2	Secondary /Tertiary Crushing/Screening	190.13	R 210.11	1	1	R 39 948.01	0.03%
		m^2	Pollution Control Dam	113.17	R 210.11	1	1	R 23 778.74	0.02%
		m^2	Conveyor Belt Foundations	557.45	R 210.11	1	1	R 117 123.96	0.10%
		m^2	Mining Complex	16 296.97	R 210.11	1	1	R 3 424 119.88	2.80%
3	Rehabilitation of access roads	m^2	TSF Area	49 855.00	R 25.51	1	1	R 1 271 955.10	1.04%
		m^2	Processing Plant Area	14 531.47	R 25.51	1	1	R 370 742.63	0.30%
		m^2	Haul Roads	19 148.94	R 25.51	1	1	R 488 548.53	0.40%
		m^2	Mining Complex	6 518.79	R 25.51	1	1	R 166 314.39	0.14%
4 (A)	Demolition & rehabilitation of electrified railway lines	m	N/A	0.00	R 247.63	1	1	R 0.00	0.00%
4 (B)	Demolition & rehabilitation of non electrified railway lines	m	N/A	0.00	R 135.07	1	1	R 0.00	0.00%
5	Demolition of housing &/or administration facilities	m^2	Access Control & Security	79.22	R 285.15	1	1	R 22 589.29	0.02%
		m^2	Administration	561.34	R 285.15	1	1	R 160 064.02	0.13%
		m^2	Change House	117.70	R 285.15	1	1	R 33 561.72	0.03%
		m^2	Tea Room	58.85	R 285.15	1	1	R 16 780.86	0.01%
		m^2	Laboratory	203.71	R 285.15	1	1	R 58 087.72	0.05%
		m^2	Control Room	108.65	R 285.15	1	1	R 30 980.00	0.03%
		m^2	Mining Complex	6 518.79	R 285.15	1	1	R 1 858 807.94	1.52%
6	Opencast rehabilitation including final voids & ramps	ha	Opencast Pit	198.69	R 145 124.46	1	1	R 28 834 198.26	23.61%
7	Sealing of shafts, adits & inclines	m^3	N/A	0.00	R 76.54	1	1	R 0.00	0.00%
8 (A)	Rehabilitation of overburden & spoils	ha	Waste Dump 1	79.30	R 99 651.13	1	1	R 7 902 281.71	6.47%
			Waste Dump 2	83.70	R 99 651.13	1	1	R 8 341 297.47	6.83%
8 (B)	Rehabilitation of processing waste deposits & evaporation ponds (basic, salt producing waste)	ha	SWD & RWD	39.21	R 124 113.68	1	1	R 4 866 993.81	3.98%
		ha	TSF - Basin	250.4225	R 124 113.68	1	1	R 31 080 857.78	25.45%
		ha	Process Water Dam	0.50	R 124 113.68	1	1	R 61 804.03	0.05%
		ha	Raw Water Dam	0.50	R 124 113.68	1	1	R 61 804.03	0.05%
		ha	Pollution Control Dam	0.7888	R 124 113.68	1	1	R 97 900.87	0.08%
8 (C)	Rehabilitation of processing waste deposits & evaporation ponds (acidic, metal-rich waste)	ha	N/A	0.00	R 360 484.95	1	1	R 0.00	0.00%
9	Rehabilitation of subsided areas	ha	N/A	0.00	R 83 442.81	1	1	R 0.00	0.00%
10	General surface rehabilitation	ha	Surrounding Areas of TSF	37.40	R 0.00	1	1	R 0.00	0.00%
		ha	Topsoil Stockpiles	68.04	R 78 940.50	1	1	R 5 371 299.33	4.40%
		ha	Mining Complex	6.52	R 78 940.50	1	1	R 514 596.30	0.42%
		ha	Construction Admin & Laydown	30.78	R 78 940.50	1	1	R 2 430 038.09	1.99%
		ha	Concrete Areas	2.61	R 78 940.50	1	1	R 205 753.68	0.17%
		ha	Additional Concrete Areas	0.13	R 78 940.50	1	1	R 10 369.55	0.01%
		ha	Access Roads	9.01	R 78 940.50	1	1	R 710 892.30	0.58%
11	River diversions (to be decommissioned)	ha	N/A	0.00	R 78 940.50	1	1	R 0.00	0.00%
12	Fencing	m	Processing Plant Area	3 051.37	R 90.05	1	1	R 274 764.61	0.22%
13	Water management	ha	Pollution Control Dam	0.79	R 30 015.40	1	1	R 23 676.15	0.02%
		ha	Opencast Pit	198.69	R 30 015.40	1	1	R 5 963 639.76	4.88%
14	2 to 3 years of maintenance & aftercare	ha	Operational TSF, Surrounding Areas & Concrete Areas	402.90	R 10 505.39	1	1	R 4 232 656.14	3.47%
		ha	Reinforced Concrete Buildings	1.91	R 10 505.39	1	1	R 20 057.90	0.02%
		ha	Administration	0.76	R 10 505.39	1	1	R 8 034.79	0.01%
		ha	Overburden & Spoils	163.00	R 10 505.39	1	1	R 1 712 425.52	1.40%
		ha	Evaporation Ponds	291.42	R 10 505.39	1	1	R 3 061 493.64	2.51%
		ha	Processing Plant Area	0.85	R 10 505.39	1	1	R 8 908.40	0.01%
		ha	General Surface Rehabilitation	154.49	R 10 505.39	1	1	R 1 622 951.87	1.33%
15 (A)	Specialist study (Water pollution potential study)	SUM	All Areas	0.00	R 500 000.00	1	1	R 0.00	0.00%
15 (B)	Specialist study (Overall quantified risk assessment)	SUM	All Areas	0.00	R 300 000.00	1	1	R 0.00	0.00%
15 (C)	Concrete Slabs & Light Structures	m^2	Silt Trap	1 153.20	R 130.00	1	1	R 149 916.00	0.12%
		m^2	Energy Dissipator	108.00	R 130.00	1	1	R 14 040.00	0.01%
		m^2	Solution Trench	24 803.20	R 130.00	1	1	R 3 224 416.00	2.64%
		m^2	Helicopter Pad	355.50	R 130.00	1	1	R 46 215.00	0.04%
		m^2	Waste Skip Area	144.86	R 130.00	1	1	R 18 832.06	0.02%
		m^2	Weigh Bridge	104.12	R 130.00	1	1	R 13 535.60	0.01%
		m^2	Diesel Storage/Refueling	154.82	R 130.00	1	1	R 20 126.73	0.02%
		m^2	Main Substation	448.17	R 130.00	1	1	R 58 261.71	0.05%
		m^2	Sub-Station/MCC	106.12	R 130.00	1	1	R 13 795.60	0.01%
							Sub Total 1 (Sum of items 1 to 15 Above)	R 122 145 075.94	100.00%
1	Preliminary and general		12.5% of Subtotal 1			**Weighting factor 2 (step 4.4)**	1.05	R 16 031 541.22	
2	Administration & supervision costs		6.0% of Subtotal 1					R 7 328 704.56	
3	Engineering drawings & specifications		2.0% of Subtotal 1					R 2 442 901.52	
4	Engineering & procurement of specialist work		2.5% of Subtotal 1					R 3 053 626.90	
5	Development of a closure plan		2.5% of Subtotal 1					R 3 053 626.90	
6	Final groundwater modeling								
							Sub Total 2 (Subtotal 1 plus sum of management & administrative items, 1 to 6 above)	R 154 055 477.02	
7	Contingency		10.0% of Subtotal 1					R 12 214 507.59	
							Sub Total 3 (Subtotal 2 plus contingency)	R 166 269 984.62	
8	VAT		14.0% of Subtotal 3					R 23 277 797.85	
							GRAND TOTAL (Subtotal 3 plus VAT)	R 189 547 782.46	

Template for "rules-based" approach of the quantum for financial provision

Escalation Factor 1.50077

CALCULATION OF THE QUANTUM

Area: *Turquoise Moon - Year 13*

No.	Description:	Unit:	Operational Area	A Quantity	B Master rate	C Multiplication factor	D Weighting factor 1	E=A*B*C*D Amount (Rands)	
				Step 4.5	Step 4.3	Step 4.3	Step 4.4		
1	Dismantling of processing plant & related structures (incl. overland conveyors & power lines)	m^3	Secondary /Tertiary Crushing/Screening, Screening, Quatinary Crushing, Magnetic Separation, Milling, Process Thickening, Tailings Thickening, Process Water & Product Storage	90470.13	R 10.24	1	1	R 925 984.49	0.74%
2 (A)	Demolition of steel buildings & structures	m^2	N/A	0.00	R 142.57	1	1	R 0.00	0.00%
2 (B)	Demolition of reinforced concrete buildings & structures	m^2	Workshop & Stores	2 444.55	R 210.11	1	1	R 513 617.97	0.41%
		m^2	Sewage Plant	95.07	R 210.11	1	1	R 19 974.11	0.02%
		m^2	Tailings Thickening	1 283.52	R 210.11	1	1	R 269 676.72	0.22%
		m^2	Process Thickening	1 283.52	R 210.11	1	1	R 269 676.72	0.22%
		m^2	Product Storage/Pumping	869.17	R 210.11	1	1	R 182 619.82	0.15%
		m^2	Water Treatment	143.21	R 210.11	1	1	R 30 089.33	0.02%
		m^2	Milling	1 294.70	R 210.11	1	1	R 272 027.20	0.22%
		m^2	Magnetic Separation	2 064.28	R 210.11	1	1	R 433 721.75	0.35%
		m^2	Quatinary Separation	633.77	R 210.11	1	1	R 133 160.23	0.11%
		m^2	Screening	158.44	R 210.11	1	1	R 33 290.11	0.03%
		m^2	Secondary /Tertiary Crushing/Screening	190.13	R 210.11	1	1	R 39 948.01	0.03%
		m^2	Pollution Control Dam	113.17	R 210.11	1	1	R 23 778.74	0.02%
		m^2	Conveyor Belt Foundations	557.45	R 210.11	1	1	R 117 123.96	0.09%
		m^2	Mining Complex	16 296.97	R 210.11	1	1	R 3 424 119.88	2.75%
3	Rehabilitation of access roads	m^2	TSF Area	49 855.00	R 25.51	1	1	R 1 271 955.10	1.02%
		m^2	Processing Plant Area	14 531.47	R 25.51	1	1	R 370 742.63	0.30%
		m^2	Haul Roads	19 148.94	R 25.51	1	1	R 488 548.53	0.39%
		m^2	Mining Complex	6 518.79	R 25.51	1	1	R 166 314.39	0.13%
4 (A)	Demolition & rehabilitation of electrified railway lines	m	N/A	0.00	R 247.63	1	1	R 0.00	0.00%
4 (B)	Demolition & rehabilitation of non electrified railway lines	m	N/A	0.00	R 135.07	1	1	R 0.00	0.00%
5	Demolition of housing &/or administration facilities	m^2	Access Control & Security	79.22	R 285.15	1	1	R 22 589.29	0.02%
		m^2	Administration	561.34	R 285.15	1	1	R 160 064.02	0.13%
		m^2	Change House	117.70	R 285.15	1	1	R 33 561.72	0.03%
		m^2	Tea Room	58.85	R 285.15	1	1	R 16 780.86	0.01%
		m^2	Laboratory	203.71	R 285.15	1	1	R 58 087.72	0.05%
		m^2	Control Room	108.65	R 285.15	1	1	R 30 980.00	0.02%
		m^2	Mining Complex	6 518.79	R 285.15	1	1	R 1 858 807.94	1.50%
6	Opencast rehabilitation including final voids & ramps	ha	Opencast Pit	206.48	R 145 124.46	1	1	R 29 965 878.79	24.11%
7	Sealing of shafts, adits & inclines	m^3	N/A	0.00	R 76.54	1	1	R 0.00	0.00%
8 (A)	Rehabilitation of overburden & spoils	ha	Waste Dump 1	82.41	R 99 651.13	1	1	R 8 212 429.34	6.61%
			Waste Dump 2	86.99	R 99 651.13	1	1	R 8 668 675.54	6.97%
8 (B)	Rehabilitation of processing waste deposits & evaporation ponds (basic, salt producing waste)	ha	SWD & RWD	39.21	R 124 113.68	1	1	R 4 866 993.81	3.92%
		ha	TSF - Basin	250.4225	R 124 113.68	1	1	R 31 080 857.78	25.00%
		ha	Process Water Dam	0.50	R 124 113.68	1	1	R 61 804.03	0.05%
		ha	Raw Water Dam	0.50	R 124 113.68	1	1	R 61 804.03	0.05%
		ha	Pollution Control Dam	0.7888	R 124 113.68	1	1	R 97 900.87	0.08%
8 (C)	Rehabilitation of processing waste deposits & evaporation ponds (acidic, metal-rich waste)	ha	N/A	0.00	R 360 484.95	1	1	R 0.00	0.00%
9	Rehabilitation of subsided areas	ha	N/A	0.00	R 83 442.81	1	1	R 0.00	0.00%
10	General surface rehabilitation	ha	Surrounding Areas of TSF	37.40	R 0.00	1	1	R 0.00	0.00%
		ha	Topsoil Stockpiles	69.01	R 78 940.50	1	1	R 5 447 346.01	4.38%
		ha	Mining Complex	6.52	R 78 940.50	1	1	R 514 596.30	0.41%
		ha	Construction Admin & Laydown	30.78	R 78 940.50	1	1	R 2 430 038.09	1.95%
		ha	Concrete Areas	2.61	R 78 940.50	1	1	R 205 753.68	0.17%
		ha	Additional Concrete Areas	0.13	R 78 940.50	1	1	R 10 369.55	0.01%
		ha	Access Roads	9.01	R 78 940.50	1	1	R 710 892.30	0.57%
11	River diversions (to be decommissioned)	ha	N/A	0.00	R 78 940.50	1	1	R 0.00	0.00%
12	Fencing	m	Processing Plant Area	3 051.37	R 90.05	1	1	R 274 764.61	0.22%
13	Water management	ha	Pollution Control Dam	0.79	R 30 015.40	1	1	R 23 676.15	0.02%
		ha	Opencast Pit	206.48	R 30 015.40	1	1	R 6 197 699.85	4.99%
14	2 to 3 years of maintenance & aftercare	ha	Operational TSF, Surrounding Areas & Concrete Areas	402.90	R 10 505.39	1	1	R 4 232 656.14	3.41%
		ha	Reinforced Concrete Buildings	1.91	R 10 505.39	1	1	R 20 057.90	0.02%
		ha	Administration	0.76	R 10 505.39	1	1	R 8 034.79	0.01%
		ha	Overburden & Spoils	169.40	R 10 505.39	1	1	R 1 779 634.55	1.43%
		ha	Evaporation Ponds	291.42	R 10 505.39	1	1	R 3 061 493.64	2.46%
		ha	Processing Plant Area	0.85	R 10 505.39	1	1	R 8 908.40	0.01%
		ha	General Surface Rehabilitation	155.45	R 10 505.39	1	1	R 1 633 072.15	1.31%
15 (A)	Specialist study (Water pollution potential study)	SUM	All Areas	0.00	R 500 000.00	1	1	R 0.00	0.00%
15 (B)	Specialist study (Overall quantified risk assessment)	SUM	All Areas	0.00	R 300 000.00	1	1	R 0.00	0.00%
15 (C)	Concrete Slabs & Light Structures	m^2	Silt Trap	1 153.20	R 130.00	1	1	R 149 916.00	0.12%
		m^2	Energy Dissipator	108.00	R 130.00	1	1	R 14 040.00	0.01%
		m^2	Solution Trench	24 803.20	R 130.00	1	1	R 3 224 416.00	2.59%
		m^2	Helicopter Pad	355.50	R 130.00	1	1	R 46 215.00	0.04%
		m^2	Waste Skip Area	144.86	R 130.00	1	1	R 18 832.06	0.02%
		m^2	Weigh Bridge	104.12	R 130.00	1	1	R 13 535.60	0.01%
		m^2	Diesel Storage/Refueling	154.82	R 130.00	1	1	R 20 126.73	0.02%
		m^2	Main Substation	448.17	R 130.00	1	1	R 58 261.71	0.05%
		m^2	Sub-Station/MCC	106.12	R 130.00	1	1	R 13 795.60	0.01%
							Sub Total 1 (Sum of items 1 to 15 Above)	R 124 301 718.24	100.00%
1	Preliminary and general		12.5% of Subtotal 1			Weighting factor 2 (step 4.4)	1.05	R 16 314 600.52	
2	Administration & supervision costs		6.0% of Subtotal 1					R 7 458 103.09	
3	Engineering drawings & specifications		2.0% of Subtotal 1					R 2 486 034.36	
4	Engineering & procurement of specialist work		2.5% of Subtotal 1					R 3 107 542.96	
5	Development of a closure plan		2.5% of Subtotal 1					R 3 107 542.96	
6	Final groundwater modeling								
							Sub Total 2 (Subtotal 1 plus sum of management & administrative items, 1 to 6 above)	R 156 775 542.13	
7	Contingency		10.0% of Subtotal 1					R 12 430 171.82	
							Sub Total 3 (Subtotal 2 plus contingency)	R 169 205 713.96	
8	VAT		14.0% of Subtotal 3					R 23 688 799.95	
							GRAND TOTAL (Subtotal 3 plus VAT)	R 192 894 513.91	

APPENDIX C: Details of DMR Closure Components

1. INTRODUCTION

Generally accepted closure methods, based on experience in the field, have been used as the basis for determining the Master rates for the various closure components in the DMR "rules-based" approach.

The details enclosed in the approved EMP will however take precedence over these generally accepted closure methods.

2. GENERALLY ACCEPTED CLOSURE METHODS USED TO DETERMINE THE DMR MASTER RATE

2.1. COMPONENT 1: PROCESSING PLANT

The common method of valuation to determine the Master rate for processing plants is that:

- All infrastructure and concrete buildings should be broken down to natural ground and buri adjacent to the plant site,
- Foundations, structures and conveyors should be broken down to natural ground level,
- The areas are to be covered with 1,0m subsoil, top soiled with 300mm of topsoil and vegetation established, or as noted in the relevant EMP,
- The monitoring and maintenance of these areas has been costed under the appropriate areas,
- Top soiling and vegetation for the areas are included under general surface rehabilitation,
- No credits are allowed for scrap steel and equipment that can be re-used or sold.

2.2. COMPONENTS 2(A) AND 2 (B): STEEL AND REINFORCED CONCRETE BUILDINGS AND STRUCTURES

The common method of valuation to determine the Master rate for steel and reinforced concrete buildings and structures is that:

- All structures should be demolished to 1m below ground level,
- The rubble is to be buried adjacent to the sites, provided this adheres to the National Waste Management Strategy,
- Silos should be imploded and buried,
- The areas should be shaped, top soiled with 300mm of topsoil and vegetated or as stated in the relevant EMP document,
- Monitoring and maintenance is costed in the relevant areas,

2.3. COMPONENT 3: ACCESS ROADS

(No details provided in DMR guideline)

2.4. COMPONENT 4 (A) AND 4 (B): RAILWAYS

The valuation of the removal of railway lines is based on:-

- The removal of the ballast, sleepers and rail,
- All culverts, bridges and structures are to remain,
- No rehabilitation to the general earthworks, neither cut nor fill,
- Removal of the electrification of the railway lines, including sub-stations and signalling,
- General clean up and making certain of adequate drainage,
- No credit is allowed for second-hand rail and ballast.

2.5. COMPONENT 5: HOUSING AND ADMINISTRATION FACILITIES

Same as for Component 2(A) and 2(B): Steel and Reinforced Concrete Buildings and Structures

2.6. COMPONENT 6: OPENCAST REHABILITATION

Some form of beneficial land use is desirable after mining. Hence, in-filling of opencast pits is advocated in order to facilitate post-mining beneficial land use. In-filling normally constitutes the following modes of action:

- Concurrent in-filling and subsequent spoils rehabilitation as routinely conducted for opencast pits on collieries.
- In-filling by obtaining material from adjacent opencast pits and/or other parts of the same opencast pit as routinely conducted on iron ore mines.

Difficulties could be experienced with concurrent infilling in those cases where the ore body is limited to a single opencast pit and various grades of ore need to be sourced from the pit. This requires access to the full pit and in-filling could sterilise ore reserves. In these cases rehabilitation should be facilitated as follows:

- Excess material from the opencast pit is deposited in close proximity to the pit for in-filling of the opencast pit once the ore body has been removed.
- Excess material is deposited in such a manner in relation to the opencast pit that mine residue deposit rehabilitation can be conducted with respect to this material. In this case the opencast pit perimeter walls must still be rendered safe for humans and domestic animals. This is normally achieved by means of the following:

- Sloping the perimeter walls of the opencast pit at 1:3 (18º) to the pit floor or to the stable groundwater level that could establish within a reasonable period within the opencast pit.

- Providing enviro berms along the opencast pit perimeter when perimeter wall flattening is not feasible as in those cases where opencast mining has been conducted on steep mountain sides.

Notwithstanding the above, owing to removal of the mined product off-site, notably less material remains on site for pit in-filling than was originally removed from the opencast pit. This could be despite bulking of the removed material. Hence final voids with respect to most opencast pits would be unavoidable. These voids should be addressed in the same manner as making the opencast pit safe as described above.

2.7. COMPONENT 7: SEALING OF SHAFTS, ADITS AND INCLINES

The sealing of vertical and incline shafts are primarily a safety consideration and this should L conducted in such a manner that potential safety risks are largely obviated.

Normally, inert building rubble arising from the demolition of surface infrastructure should be deposited into the shafts. A mass concrete cap of 1 000 mm thickness is placed onto the building rubble deposited into the shaft. It should be noted that, in specific circumstances, dedicated engineering design and specification of these caps could be required.

Allowance should also be made for methane venting of the underground mine workings with a methane formation potential by means of strategically placed venting boreholes.

2.8. COMPONENTS 8 (A), 8 (B) AND 8 (C): OVERBURDEN AND SPOILS, PROCESS PLANT WASTE: BASIC, SALT-PRODUCING AND PROCESS PLANT WASTE: ACIDIC, METAL-RICH.

2.8.1. Component 8A: Overburden and spoils

Overburden and spoils normally have a low pollution potential and hence only need to be shaped to create a stable landform. The Master rate thus includes shaping and grassing/vegetation of the overburden and spoils.

2.8.2. Component 8B: Process plant waste: basic, salt-producing

The Master rate for basic, salt-producing process plant waste includes shaping and grassing/ vegetation of the dumps as well as establishing an armoured cover on the reshaped surface of the dump.

2.8.3. Component 8C: Process plant waste: acidic, metal-rich

The Generally accepted closure methods for acidic, metal-rich plant waste are primarily aimed at the following:

- Limiting seepage of contaminants from the processing waste deposit
- Prevention of contaminated seepage entering local surface and groundwater sources.

The Master rate includes allowances for slope modification, armouring and evaporative covers, lined pollution control dams and lined cut-off trenches.

2.8.4. Closure elements specific to 8 (A), 8 (B) or 8 (C)

Generally, average modified outer slopes of 1:3 (18°) are required. Although not specifically stated, benches at regular intervals are also required. This should ensure that the modified outer slopes between benches do not exceed 35 to 40 m in order to curb stormwater flow velocities on the outer slopes. Benches should be at least 5 m wide, sloping inwards at a slope of about 1:10.

Current generally accepted closure methods allows for a dedicated cover to be provided on the modified outer slopes of the residue deposit. The cover has to fulfil the following primary functions:

- Protection of the integrity/stability of the modified outer slope.
- Limiting the ingress of air and water into residue material that has the potential to contaminate local groundwater by means of contaminated seepage arising from the footprint area of the deposit.
- Separation of the deposited residue from uncontaminated surface runoff arising from the outer slopes of the residue deposit.
- Contribution to the aesthetic appeal of the rehabilitated residue deposit.

Covers fulfilling the above functions could be of varying nature, comprising of natural and/or synthetic material. If natural materials are to be used, current practice allows for an evaporative cover, varying in thickness between 750 and 1 000 mm, with an outer cover layer of 300 m thickness of armouring or topsoil with vegetation. The armouring also requires vegetation, but this is not essential for the long-term integrity of the outer cover layer. Depending on the nature of the deposited material covered, capillary breaker layers between the evaporative cover and the deposited material could also be required.

Current generally accepted closure methods indicates that operational pollution control dams are properly lined to prevent the migration of the contaminated water impounded in the dam to the shallow groundwater or the nearby receiving surface water environment. Mostly, synthetic (HDPE) liners are provided for this purpose. However, these liners have a finite life and eventual failure of these liners would result in the salts and other contaminants that accumulated in the pollution control dam(s) over the years to be dissipated into the receiving water environment. Hence, from a holistic view the provision of a pollution control dam served a limited function, only postponing the release of contaminants into the receiving water environment. However, contaminant release has been spread-out over a period of about 50 years, starting from mine residue deposit rehabilitation to final disintegration of the liner in the pollution control dam(s). This situation would most likely allow for an acceptable residual impact, with salt/contaminant release into the receiving water environment at a rate that does not exceed the "natural" assimilative capacity of the receiving water resource. The only exception could be extremely sensitive water resources.

Stormwater runoff arising from the upper and outer slopes of the rehabilitated residue deposit should be managed for the following primary reasons:

- Prevention of uncontrolled runoff from the residue deposit, thereby creating surface erosion and resultant damage to the cover and under extreme cases exposing the deposited material.

- Routing of the runoff arising from the rehabilitated residue deposit into the surrounding surface water drainage regime in a manner that would limit the creation of secondary erosion in the receiving surface water environment and/or possible damage to downstream surface infrastructure.

- Allowing for the control routing of the runoff collected on the rehabilitated residue deposit across cut-off, seepage or solution trenches provided to handle excess contaminated seepage from the residue deposit.

In addition to the above, upslope stormwater diversion measures could also be required to route upslope runoff past the residue deposit to prevent possible cover damage and other specific local drainage requirements. Toe paddocks could also be required along the outer perimeter toe of the rehabilitated residue deposit to capture sediment arising from the cover material whilst vegetation on the cover is still in the process of establishment.

Current practice allows for two broad approaches to handle runoff arising from the rehabilitated residue deposit. These are as follows:

- Collection of the runoff arising from the benches in chutes to route this water to the toe of the residue deposit. Chutes must be constructed from concrete or other suitable material to cater for the high flow velocities that could be encountered.

- Collection of runoff arising from the modified outer slopes on the benches itself and allowing this water to evaporate on the benches. Under these circumstances bench width could be wider than the normal 5 m width, with parapet walls provided on the outer edges of the benches. These walls must be designed for at least the 1:200 year rainfall events. The residue deposit material must also be suitable for this type of stormwater contaminant and must not be susceptible to slumping under saturated conditions.

In very sensitive environmental situations and/or where the seepage from the residue deposit could be highly contaminated, a cut-off drain around the perimeter of the residue deposit may be required. Abstraction of the seepage collected in the cut-of drain by means of pumps at predetermined spac would be required. The collected seepage has to be routed to a pollution control dam for disposal.

2.9. COMPONENT 9: SUBSIDED AREAS

(No details provided in DMR guideline, but presumed to be similar to Component 10: General Surface Rehabilitation)

2.10. COMPONENT 10: GENERAL SURFACE REHABILITATION

Final surface rehabilitation of areas disturbed by mining and related activities should be aligned to the selected final land use.

Irrespective of the final land use, general surface rehabilitation normally should ensure the following:

- Surface topography that emulates the surrounding areas and aligned to the general landscape character. Steep slopes in excess of 6 percent should also be avoided if possible.

- Landscaping that would facilitate surface runoff and result in free draining areas. If possible, the drainage lines should be reinstated.
- An area without unnecessary remnants of structures and surface infrastructure to give the rehabilitated area a "neat" appearance. Special attention must be given to shape and/or removal of heaps of excess material being the legacy of prolonged mining and related activity.
- An area suitable for revegetation.

The unit cost for general rehabilitation allows for shaping and landscaping of disturbed areas. The Master rate allows for the shaping of material to a depth/thickness of about 500 mm. An extra over allowance in the unit cost of 50 percent has been made to cover the removal and/or destruction of surface infrastructure remnants and/or other undesirable objects such as trees, foundations, concrete slabs, etc.

2.11. COMPONENT 11: RIVER DIVERSIONS

Although not desirable, river diversions are unavoidable in some cases to allow mining, especially opencast mining, to proceed.

Wetland areas are normally associated with river diversions and during the operational period some form of riparian habitat could most likely have established within the stream diversion area. Hence considerations should be given whether a stream diversion should be changed at mine closure. This could require dedicated assessments to guide decision-making in this regard. Moreover, removal of stream diversions could result in stream flow over mined areas that could result in undesirable water quality effects.

In the event that river diversions should be removed at closure, the Master rate is the same as for general surface rehabilitation.

2.12. COMPONENT 12: FENCING

(No details provided in DMR guideline)

2.13. COMPONENT 13: WATER MANAGEMENT

Current practice is to provide in-pit evaporation dams for opencast pits. Ideally these dams should coincide with pit final voids. The dams should be sized that groundwater inflow into the pit plus rehabilitated spoils recharge can be evaporated from the dam. The dam perimeter as in the case of opencast pits must be shaped to render it safe. The same approach as for opencast pits is generally followed.

Underground mine workings has the potential to eventually fill up with water and decant. Depending on the decant mode and the type of product mined, this water could be of a poor quality. Hence provision should be made to collect and handle this water to limit degradation of water resources in the vicinity of potential decant. Collection and neutralisation (with associated metal removal) is an established management practice to deal with this water. However, the elevated salt content normally associated with this water is still a matter of concern. Hence, advanced treatment such as desalination of this water is currently considered and in some cases pilot pants have been established to assess feasibility.

Treatment technologies not producing brine are currently favoured. However, this is not possible with all types of excess mine water.

It should be noted that the filling of a mine could involve a notable period of time and the required treatment capacity to handle the excess mine water could only be required decades after mine closure. Hence the future implementation of these plants most likely by third parties should also receive consideration.

Note: Costs associated with brine producing treatment technologies were also assessed. Although the capital costs associated with these technologies could be lower than for non-brine producing technologies, the operating and maintenance costs are notably higher. Hence the overall costs for water management and treatment in the guideline document are not notably different, based on the water treatment method, to warrant distinction.

2.14. COMPONENT 14: MAINTENANCE AND AFTERCARE

Maintenance and aftercare is planned for 2 to 3 years after mine production ceases, and covers:

- Annually fertilising of rehabilitated areas,
- Monitoring of surface and subsurface water quality surface,
- Control of wattle and all other alien plants,
- General maintenance, including rehabilitation of cracks and subsidence.

APPENDIX W: CLIMATIC WATER BALANCE

Specialist report prepared by Metago, June 2011

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Moonlight Iron Ore

PRELIMINARY WATER BALANCE FOR THE PROPOSED MOONLIGHT IRON ORE PROJECT

1. INTRODUCTION

This report documents the preliminary site wide monthly climatic water balance for the proposed Moonlight Iron Ore Project.

The preliminary water balance model covers water consumption and reticulation of the following components of the project:

- Rainfall and storm water runoff,
- Open pit mining operations (underground fissure water),
- Storm water dams (seepage and evaporative losses).
- Plant operations (various plant water losses and water losses in the discard material), and
- Tailings storage facility (interstitial lock up in tailings and seepage losses).

The preliminary water balance model presented represents long term averaged flows rather than instantaneous or peak flow rates. The purpose of the report is to establish a preliminary site wide water balance from an environmental and overall water use perspective. To this end, the water balance makes a number of simplifying assumptions and is not intended for use in sizing and detailed design of individual flow lines.

2. METHODOLOGY

Since the Moonlight Project area is particularly water scarce, and hence the water demand of the mine critical, both the conservative tailings tonnage (355,550 dry tonnes per month (tpm) and the anticipated tailings tonnage (274,260 dry tpm) have been assessed.

The preliminary water balance model emphasises the following water use protocol: prevent pollution, recycle/reuse of all the process water, treat water where required, and no planned discharge.

3. CLIMATIC DATA

The climatic data used in the preliminary monthly water balance is given below:

Month	Marnitz Weather Station (A5E001)	
	Average Rainfall Depth (mm)	**Average Lake Evaporation (mm)**
January	84.5	177.4
February	67.5	142.1
March	45.6	149.7
April	34.6	115.2
May	6.9	96.2
June	3.2	78.4
July	1.4	89.8
August	2.7	120.4
September	10.4	155.3
October	33.4	184.4
November	62.5	178.4
December	66.7	166.2
TOTAL	**419.4**	**1653.6**
Month	**Average Rainfall Depth (mm)**	**Average Lake Evaporation (mm)**
Average (Mar to Apr) & (Sep to Oct)	31.0	151.2
Wet Season (Nov to Feb)	70.3	166.0
Dry Season (May to Aug)	3.6	96.2

4. OPEN PIT DATA

Seepage into the open pit has conservatively been estimated at 350 m^3 per day (or 10,500 m^3 per month) based on the hydrogeological investigation (see *Hydrogeological Investigation and Impact Assessment for the Proposed Mining Activities – Moonlight Iron Ore Project*, Metago Water Geosciences, Report 001/0132, May 2011).

Seepage losses from the open pit, as well as, evaporative losses are assumed to be zero and/or negligable.

Storm water falling (and hence captured) on the open pit area has been included in the overall storm water runoff that is channelled to both the South and Central storm water dams.

5. STORM WATER DAMS DATA

Two unlined storm water dams (Central and South) have been provided for at the proposed Moonlight Iron Ore Project. The storm water data used in the preliminary water balance is presented below:

Facility	Information Used
Central Storm Water Dam (Central SWD)	• Total catchment area = Approximately 3,137,915 m^2 (with 30% runoff) • Central SWD area = Approximately 138,400 m^2 (with 100% runoff) • Evaporation water losses = 7,303 m^3 / month (during average months) = 22,908 m^3 / month (during wet months) = 1,328 m^3 / month (during dry months) • Seepage water losses = 1,256 m^3 / month (during average months, Central SWD storing some water) = 3,588 m^3 / month (during wet months, Central SWD storing significant amount of water) = 359 m^3 / month (during dry months, Central SWD mainly empty)
South Storm Water Dam (South SWD)	• Total catchment area = Approximately 3,583,300 m^2 (with 30% runoff) • Central SWD area = Approximately 158,300 m^2 (with 100% runoff) • Evaporation water losses = 8,350 m^3 / month (during average months) = 26,195 m^3 / month (during wet months) = 1,518 m^3 / month (during dry months) • Seepage water losses = 1,436 m^3 / month (during average months, Central SWD storing some water) = 4,103 m^3 / month (during wet months, Central SWD storing significant amount of water) = 410 m^3 / month (during dry months, Central SWD mainly empty)

6. PLANT DATA

Discard water losses (i.e. water retained with the discard) have been estimated to be 425 m^3/month (5,100 m^3/year).

Other plant water losses (mainly as evaporation from the thickener, losses associated with concentrate pumping and water used for dust suppression) have been estimated to be 1,255 m^3/month (15,060 m^3/year).

Both the conservative tailings tonnage (355,550 dry tonnes per month (tpm) and the anticipated tailings tonnage (274,260 dry tpm) have been assessed in the preliminary water balance model.

The tailings will be pumped to the TSF at a slurry density of approximately 1.71 tonnes per m^3, which equates to 55 % solids by mass at a particle specific gravity of 4.1. Therefore, for a tailings delivery of 355,500 dry tpm, the water delivery equates to roughly 291,874 m^3 per month. Similarly, for a tailings delivery of 274,260 dry tpm, the water delivery equates to roughly 225,174 m^3 per month.

7. TSF DATA

The tailings storage facility (TSF) data, for 355,500 tpm tailings, used in the preliminary water balance is presented below:

Facility	Information Used
Tailings Storage Facility (TSF) **For 355,500 tpm tailings**	• Total catchment area = 2,343,815 m^2 (LOM basin) and 629,712 m^2 (LOM slopes). • Supernatant pool area = 500,952 m^2 (with 100% runoff) • Dry tailings area = 1,523,480 m^2 (with 50% average runoff) • Wet tailings area = 319,368 m^2 (with 100% average runoff) • Evaporation water losses = 127,754 m^3 / month (during average months) = 140,259 m^3 / month (during wet months) = 81,283 m^3 / month (during dry months) • Seepage water losses = 4,500 m^3 / month • Interstitial lock-up water losses = 91,043 m^3 / month (or 31% of total incoming slurry water)
Return Water Dam (RWD) & Storm water Dam (SWD) **For 355,500 tpm tailings**	• Total catchment area = 1,718,127 m^2 • RWD/SWD area = 329,945 m^2 (with 100% runoff) • Veld, road servitude and TSF paddocks etc. = 1,388,182 m^2 (with 30% runoff) • Evaporation water losses = 28,270 m^3 / month (during average months) = 54,771 m^3 / month (during wet months) = 12,696 m^3 / month (during dry months) • Seepage water losses = 2,102 m^3 / month (during average months, SWD storing some water) = 5,749 m^3 / month (during wet months, SWD storing significant amount of water) = 575 m^3 / month (during dry months, SWD mainly empty)