Project Reference: 7YA.01053.00001

5 November 2015

COZA Iron Ore Project (Driehoekspan and Thaakwaneng)
COZA Mining (Pty) Ltd

CALCULATION OF THE FUTURE FINANCIAL CLOSURE LIABILITIES FOR THE PROPOSED COZA IRON ORE PROJECT

1. INTRODUCTION

These financial closure liability calculations are initial estimates that have been prepared by SLR Consulting (Pty) Ltd and submitted as part of the EIA/EMP Report for the COZA Iron Ore Project (see SLR report, *Environmental Impact Assessment and Environmental Management Programme Report for the COZA Iron Ore Project on Farms Driehoekspan 435 and Thaakwaneng 675*, Project Reference 755.01053.00001, November 2015, prepared for COZA Mining (Pty) Ltd).

These financial closure liability calculations have been prepared using the infrastructure data and layouts as described in the EIA and EMP Report, as well as, the conceptual study report (see COZA Mining report, *COZA Iron Ore Project Concept Phase*, February 2015).

These financial closure liability calculations have been calculated as per the *Guideline Document for the Evaluation of the Quantum of Closure-Related Financial Provision Provided by a Mine* as originally published by the Department of Minerals and Energy (DME) [1], dated January 2005.

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.

[1] The DME is now known as the Department of Mineral Resources (DMR)

- 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 closure liability associated with the COZA Iron Ore 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.

Mine/Process type	Iron ore mine – Open pit operations
Saleable mineral by-product	N/A

2.2. STEP 2: RISK RANKING

According to the DMR guideline, the COZA Iron Ore Project (due to its minerals mined (iron oxide material) and no generation of plant waste/tailings) will be classified as a Class C – Low 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 C [2] – Low risk (Iron ore mine (oxide) generating no plant waste)
Revised risk ranking	N/A

2.3. STEP 3: ENVIRONMENTAL SENSITIVITY OF THE MINE AREA

The COZA Iron Ore Project is classified as having a Medium environmental sensitivity based on the classification criteria below:

- A medium biophysical sensitivity (based on the pre-mining environment of the proposed project area).
- A low social sensitivity (based on the proximity of the proposed project area to local communities).
- A low to medium economic sensitivity (based on the area's existing economic activity).

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

[2] Class C – Low risk = A low probability of occurrence of an impact with a negligible consequence.

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 [3]	Information available is less comprehensive than that given above

Since no detailed Closure Plan for the COZA Iron Ore 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.

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

2.5. STEP 4.2: CLOSURE COMPONENTS TO BE USED

The closure components relevant to the COZA Iron Ore Project are identified from the list below.

No.	Description of Closure Components [4]	Applicable
1	Dismantling of processing plant & related structures (incl. overland conveyors & power lines)	No
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	No
6	Opencast rehabilitation including final voids & ramps [5]	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)	No
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	No
14	2 to 3 years of maintenance & aftercare	Yes

Further details of the DMR specified closure components listed above are provided in Appendix C.

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[4] The Closure Components selected (except Item 6 – Opencast rehabilitation) are in-line with the decommissioning and closure objectives detailed in the *Environmental Impact Assessment and Environmental Management Programme Report for the COZA Iron Ore Project on Farms Driehoekspan 435 and Thaakwaneng 675* (SLR Project Reference 755.01053.00001, November 2015), prepared for COZA Mining (Pty) Ltd.

[5] Opencast rehabilitation only makes provision for perimeter berms and/or sloping of the pit walls to 1V:3H (i.e. making the pit void safe for humans and domestic animals). Backfilling of the pit void has therefore not been costed in this financial closure liability estimate. COZA Mining will only backfill the pit void at life of mine.

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 to December										
2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015** [6]
3.4%	4.6%	7.2%	11.5%	7.1%	4.3%	5.0%	5.6%	5.7%	6.1%	3.4%

i.e. a total of 85.7% since January 2005 (i.e. 1.034 x 1.046 x 1.072 … etc.).

No.	Description	Unit	Master Rate (at October 2015)	Multiplication Factor [7]
1	Dismantling of process plant & related structures (incl. overland conveyors & power lines)	m^3	R 12.66	1.00
2 (A)	Demolition of steel buildings & structures	m^2	R 176.39	1.00
2 (B)	Demolition of reinforced concrete buildings & structures	m^2	R 259.95	1.00
3	Rehabilitation of access roads	m^2	R 31.57	1.00
4 (A)	Demolition & rehabilitation of electrified railway lines	m	R 306.37	1.00
4 (B)	Demolition & rehabilitation of non electrified railway lines	m	R 167.11	1.00
5	Demolition of housing &/or administration facilities	m^2	R 352.79	1.00
6	Opencast rehabilitation including final voids & ramps	Ha	R 179,550.35	0.52
7	Sealing of shafts, adits & inclines	m^3	R 94.70	1.00
8 (A)	Rehabilitation of overburden & spoils	Ha	R 123,290.00	1.00
8 (B)	Rehabilitation of processing waste deposits & evaporation ponds (basic, salt producing waste)	Ha	R 153,555.47	1.00
8 (C)	Rehabilitation of processing waste deposits & evaporation ponds (acidic, metal-rich waste)	Ha	R 445,997.87	0.66
9	Rehabilitation of subsided areas	Ha	R 103,236.81	1.00
10	General surface rehabilitation	Ha	R 97,666.48	1.00
11	River diversions	Ha	R 97,666.48	1.00
12	Fencing	m	R 111.41	1.00
13	Water management	Ha	R 37,135.54	0.25
14	2 to 3 years of maintenance & aftercare (active)	Ha	R 12,997.44	1.00

[6] CPI for January to September only.

[7] Multiplication factor based on Risk Ranking = Class C and Environmental Sensitivity = Medium.

2.7. STEP 4.4: WEIGHTING FACTORS TO BE USED

Weighting Factors based on the specific mine location are selected from the tables overleaf.

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 areas of disturbance associated with the COZA Iron Ore Project are shown in Appendix A, and include:

- Pit area;
- Waste rock dump and topsoil stockpile;
- Stormwater dam;
- Explosives magazine;
- ROM and product stockpile area (including crusher);
- Admin area (including offices, generator, fuel storage, HMV washbay and HMV parking/service bays); and
- Access and haul roads.

The closure liability calculations are based on the following assumptions:

- No allowance for salvage and recycled/scrap material has been considered; and
- All infrastructure will be demolished and no handover of any facilities (for post closure use) has been allowed for.

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 COZA Iron Ore Project (as at life of mine, LOM, or approximately December 2022) is R 10,786,265 (including VAT). All amounts calculated are at Current Value (CV) as at October 2015. The liability calculations are provided in Appendix B.

The financial closure liabilities for the COZA Iron Ore Project over the life of mine (at CV) are summarised in the table below. There is no decrease or increase in the financial closure liability over the life of mine since there is no additional infrastructure constructed during the life of mine, and the open pit area remains unchanged after the end of the first year (i.e. pit only gets deeper).

Time-frame	Date	Financial Liability Calculations based on the following activities	Financial Liability incurred during the year (incl. VAT)	Progressive Financial Liability (incl. VAT)	Progressive Liability as a % of LOM liability
End of Year 1	Dec 2017	Pre-stripping at open pit complete and mine production started	R 10,786,265	R 10,786,265	100 %
End of Year 2	Dec 2018	Ongoing mine production and open pit development	R 0	R 10,786,265	100 %
End of Year 3	Dec 2019	Ongoing mine production and open pit development	R 0	R 10,786,265	100 %
End of Year 4	Dec 2020	Ongoing mine production and open pit development	R 0	R 10,786,265	100 %
End of Year 5	Dec 2021	Ongoing mine production and open pit development	R 0	R 10,786,265	100 %
End of Year 6	Dec 2022	LOM, end of mine operations	R 0	R 10,786,265	100 %

The financial closure 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, as well as, the pre-feasibility details currently available for the COZA Iron Ore Project.

Note: The backfilling and rehabilitation of the remaining pit void (at LOM, or in the event of premature closure) has not been costed in these financial closure liability estimates. Provision for backfilling and rehabilitation of the remaining pit void must therefore be accounted for by COZA Mining in the operations expenditure of the COZA Iron Ore Project.

4. CONCLUSION

1) The financial closure liability associated with the COZA Iron Ore Project, as at approximately December 2045 (LOM) has been calculated to be R 10,786,265 (CV at October 2015, incl. VAT) as per the *Guideline Document for the Evaluation of the Quantum of Closure-Related Financial Provision Provided by a Mine* as published by the Department of Mineral Resources (DMR).

2) The closure liability calculations assume that all infrastructure will be demolished and no handover of any facilities for post closure use has been allowed for. Furthermore, the mine infrastructure is assumed to have zero salvage value.

3) The calculated liability is considered to be Class 1 estimate (with an accuracy between +25% and -15%) based on the overall generic approach as stipulated by the DMR Guideline Document, as well as, the conceptual design details currently available for the COZA Iron Ore Project.

4) The backfilling and rehabilitation of the remaining pit void (at LOM, or in the event of premature closure) has not been costed in these financial closure liability estimates. Provision for backfilling and rehabilitation of the remaining pit void must therefore be accounted for by COZA Mining in the operations expenditure of the COZA Iron Ore Project.

5) The financial closure 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 vegetation) of waste deposits and material stockpiles, making the remaining open pit void safe, and the maintenance and aftercare of all the rehabilitated sites.

6) 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.

7) The financial closure liabilities do not make allowance for the development of a detailed closure plan, final groundwater modelling, drafting of engineering drawings and specifications, procurement of specialist work, and any administration and site supervision costs. These expenses should therefore be accounted for by COZA Mining in the operations expenditure of the COZA Iron Ore Project.

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For SLR Consulting (Africa) (Pty) Ltd

APPENDIX A: Areas of Disturbance for the COZA Iron Ore Project

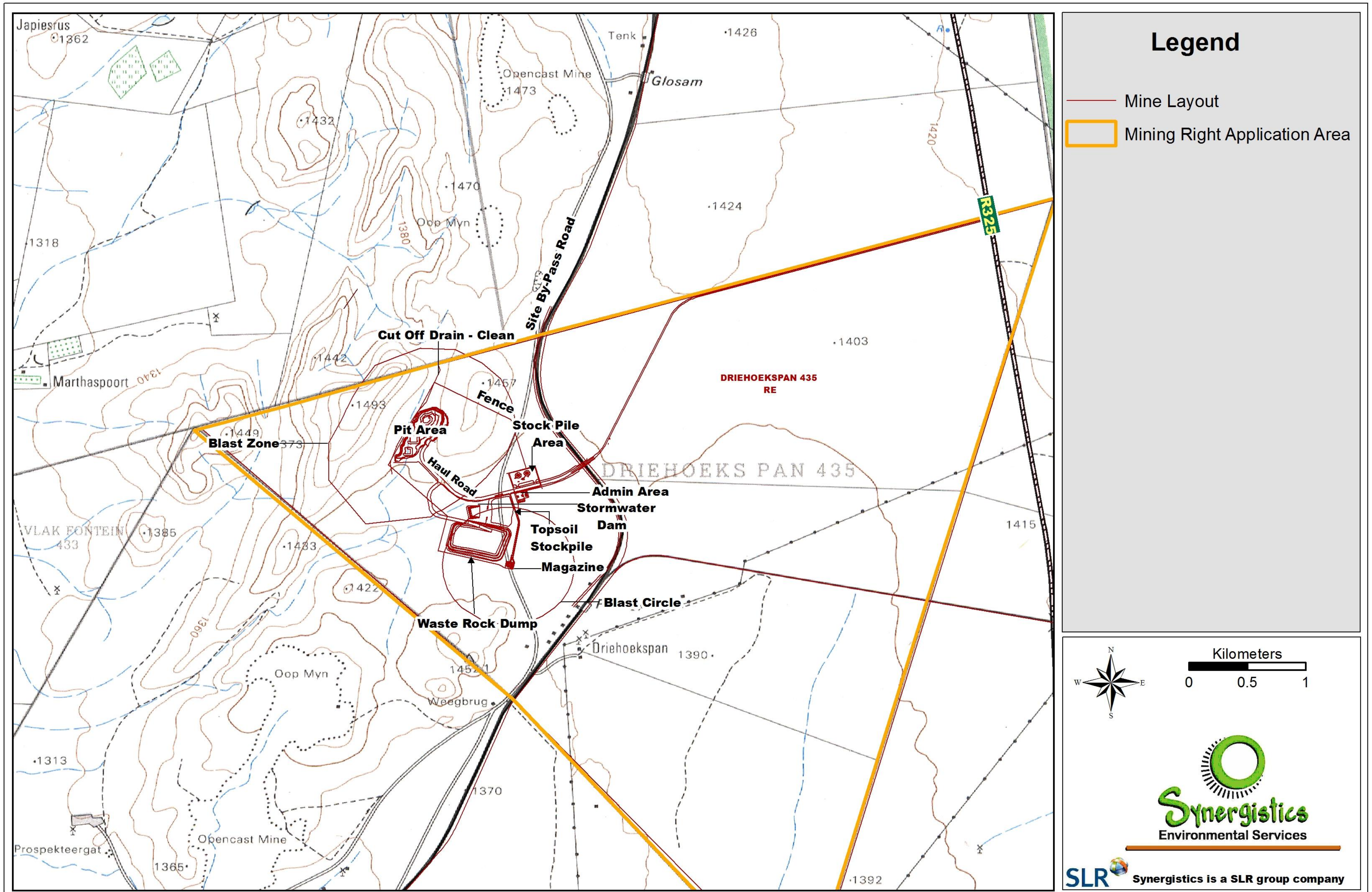

Figure 1.1 Driehoekspan Mine Layout	**SO707**	Coordinate System DMS	
		Spheroid WGS84	Central Meridian LO23

APPENDIX B: Financial Closure Liability Calculations for the COZA Iron Ore Project (as at October 2015)

- **End of Year 1 (December 2017), and**
- **End of Year 6, LOM (December 2022).**

CALCULATION OF THE QUANTUM

Area	*Closure Liability Estimate - COZA Iron Ore Project (Driehoekspan and Thaakwaneng), 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	N/A	0	R 12.66	1	1	R 0.00
2 (A)	Demolition of steel buildings & structures	m^2	N/A	0	R 176.39	1	1	R 0.00
2 (B)	Demolition of reinforced concrete buildings & structures	m^2	Crusher area	225	R 259.95	1	1	R 58 488.48
		m^2	Admin area - washbay, fuel storage	270	R 259.95	1	1	R 70 186.18
3	Rehabilitation of access roads	m^2	Access roads	38 800	R 31.57	1	1	R 1 224 730.21
		m^2	Haul roads	60 000	R 31.57	1	1	R 1 893 912.69
4 (A)	Demolition & rehabilitation of electrified railway lines	m	N/A	0	R 306.37	1	1	R 0.00
4 (B)	Demolition & rehabilitation of non electrified railway lines	m	N/A	0	R 167.11	1	1	R 0.00
5	Demolition of housing &/or administration facilities	m^2	N/A	0	R 352.79	1	1	R 0.00
6	Opencast rehabilitation including final voids & ramps	ha	Open pit	8.80	R 179 550.35	0.52	1	R 821 248.94
7	Sealing of shafts, adits & inclines	m^3	N/A	0	R 94.70	1	1	R 0.00
8 (A)	Rehabilitation of overburden & spoils	ha	Waste rock dump	14.00	R 123 290.00	1	1	R 1 726 060.04
8 (B)	Rehabilitation of processing waste deposits & evaporation ponds (basic, salt producing waste)	ha	N/A	0	R 153 555.47	1	1	R 0.00
8 (C)	Rehabilitation of processing waste deposits & evaporation ponds (acidic, metal-rich waste)	ha	N/A	0	R 445 997.87	0.66	1	R 0.00
9	Rehabilitation of subsided areas	ha	N/A	0	R 103 236.81	1	1	R 0.00
10	General surface rehabilitation, including grassing of all denuded areas	ha	Stockpile area	3.40	R 97 666.48	1	1	R 332 066.03
		ha	Admin area	0.64	R 97 666.48	1	1	R 62 311.21
		ha	Magazine area	0.53	R 97 666.48	1	1	R 51 274.90
		ha	Topsoil stockpile area	4.03	R 97 666.48	1	1	R 393 107.57
		ha	Stormwater dam	1.10	R 97 666.48	1	1	R 107 433.13
11	River diversions (to be decommissioned)	ha	N/A	0.00	R 97 666.48	1	1	R 0.00
12	Fencing	m	Fencing at stockpile and admin area	1 105	R 111.41	1	1	R 123 104.32
13	Water management	ha	N/A	0	R 37 135.54	0.25	1	R 0.00
14	2 to 3 years of active maintenance & aftercare	ha	Rehabilitated areas	32.48	R 12 997.44	1	1	R 422 208.84
15 (A)	Specialist study (Screening level risk assessment)	SUM	All Areas	1	R 100 000.00	1	1	R 100 000.00
							Subtotal 1 (Sum of items 1 to 15 Above)	R 7 386 132.54
16	Multiply Subtotal 1 by Weighting factor 2 (step 4.4)	**Weighting factor 2, WF 2 (step 4.4)**			1.05		**Subtotal 2** (Subtotal 1 x WF 2)	R 7 755 439.16
17	Preliminary and General	12.0% of Subtotal 2						R 930 652.70
18	Contingency	10.0% of Subtotal 2						R 775 543.92
							Subtotal 3 (Subtotal 2 plus P&G's and contingency)	R 9 461 635.78
19	VAT	14.0% of Subtotal 3						R 1 324 629.01
							GRAND TOTAL (Subtotal 3 plus VAT)	R 10 786 264.79

CALCULATION OF THE QUANTUM								
Area	***Closure Liability Estimate - COZA Iron Ore Project (Driehoekspan and Thaakwaneng), 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	N/A	0	R 12.66	1	1	R 0.00
2 (A)	Demolition of steel buildings & structures	m^2	N/A	0	R 176.39	1	1	R 0.00
2 (B)	Demolition of reinforced concrete buildings & structures	m^2	Crusher area	225	R 259.95	1	1	R 58 488.48
		m^2	Admin area - washbay, fuel storage	270	R 259.95	1	1	R 70 186.18
3	Rehabilitation of access roads	m^2	Access roads	38 800	R 31.57	1	1	R 1 224 730.21
		m^2	Haul roads	60 000	R 31.57	1	1	R 1 893 912.69
4 (A)	Demolition & rehabilitation of electrified railway lines	m	N/A	0	R 306.37	1	1	R 0.00
4 (B)	Demolition & rehabilitation of non electrified railway lines	m	N/A	0	R 167.11	1	1	R 0.00
5	Demolition of housing &/or administration facilities	m^2	N/A	0	R 352.79	1	1	R 0.00
6	Opencast rehabilitation including final voids & ramps	ha	Open pit	8.80	R 179 550.35	0.52	1	R 821 248.94
7	Sealing of shafts, adits & inclines	m^3	N/A	0	R 94.70	1	1	R 0.00
8 (A)	Rehabilitation of overburden & spoils	ha	Waste rock dump	14.00	R 123 290.00	1	1	R 1 726 060.04
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		ha	Admin area	0.64	R 97 666.48	1	1	R 62 311.21
		ha	Magazine area	0.53	R 97 666.48	1	1	R 51 274.90
		ha	Topsoil stockpile area	4.03	R 97 666.48	1	1	R 393 107.57
		ha	Stormwater dam	1.10	R 97 666.48	1	1	R 107 433.13
11	River diversions (to be decommissioned)	ha	N/A	0.00	R 97 666.48	1	1	R 0.00
12	Fencing	m	Fencing at stockpile and admin area	1 105	R 111.41	1	1	R 123 104.32
13	Water management	ha	N/A	0	R 37 135.54	0.25	1	R 0.00
14	2 to 3 years of active maintenance & aftercare	ha	Rehabilitated areas	32.48	R 12 997.44	1	1	R 422 208.84
15 (A)	Specialist study (Screening level risk assessment)	SUM	All Areas	1	R 100 000.00	1	1	R 100 000.00
							Subtotal 1 (Sum of items 1 to 15 Above)	R 7 386 132.54
16	Multiply Subtotal 1 by Weighting factor 2 (step 4.4)	**Weighting factor 2, WF 2 (step 4.4)**			1.05		**Subtotal 2** (Subtotal 1 x WF 2)	R 7 755 439.16
17	Preliminary and General	12.0% of Subtotal 2						R 930 652.70
18	Contingency	10.0% of Subtotal 2						R 775 543.92
							Subtotal 3 (Subtotal 2 plus P&G's and contingency)	R 9 461 635.78
19	VAT	14.0% of Subtotal 3						R 1 324 629.01
							GRAND TOTAL (Subtotal 3 plus VAT)	R 10 786 264.79

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 buried 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 be 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 spacing 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.