MAMATWAN MINE: FINANCIAL PROVISION FOR THE CHANGES TO THE INFRASTRUCTURE LAYOUT AND ACTIVITIES

Mamatwan Mine

Prepared for: Hotazel Manganese Mines (Pty) Ltd

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EXECUTIVE SUMMARY

INTRODUCTION

South32 operates the open pit manganese Mamatwan Mine (MMT) (that forms part of the legal entity Hotazel Manganese Mines (Pty) Ltd) located approximately 25km to the south of Hotazel in the John Taolo Gaetsewe District Municipality and Joe Morolong Local Municipality of the Northern Cape Province of South Africa.

MMT is proposing on amending their approved Environmental Management Programme report (EMPr) to cater for layout/activity changes that have already taken place at MMT, as well as proposed layout/activity changes (referred to as the Changes to the Infrastructure Layout and Activities at MMT).

Layout /activity changes that have already taken place include:

- expansion of the north and south-eastern waste rock dumps;
- changes to the rehabilitation criteria of waste rock dumps;
- expansion of the product stockyard;
- establishment of potable and process water-storage facilities; and
- expansion of an existing road.

Proposed layout/activity changes include:

- establishment of a top-cut stockpile and associated mobile crushing and screening plant;
- establishment of stormwater management infrastructure;
- changes to all waste rock dump heights (excluding rehabilitated waste rock dumps);
- establishment of a pipeline to transfer water abstracted from the decommissioned Middelplaats Mine to MMT;
- upgrading the railway and railway loadout station;
- sale of waste rock as aggregate; and
- re-processing of material located in Adams Pit.

PRELIMINARY CLOSURE PLAN OBJECTIVES

The preliminary closure plan objectives and principles for MMT include the following:

- that environmental damage is minimised to the extent that it is acceptable to all parties involved;
- that contamination beyond the mine site by groundwater movement and wind will be prevented;
- that mine closure is achieved efficiently, cost effectively and in compliance with the law;
- that the social and economic impacts resulting from mine closure are managed in such a way that negative socio-economic impacts are minimised;
- the Adams open pit will be backfilled to 25m below original surface level; and
- rehabilitate the land to achieve an end use of grazing to the extent reasonably possible.

LEGAL FRAMEWORK

This preliminary closure plan has been prepared in accordance with the National Environmental Management Act (NEMA) (107/1998) - Financial Provisioning Regulations, 2015 (GNR 1147, 2015). The financial provision was calculated as per the methodology used by South32 for the calculation of existing closure liabilities at MMT (South32, 2019) that uses site-specific decommissioning and rehabilitation rates.

This project also includes the authorisation of specific water uses in terms of Section 21 of the National Water Act (NWA) (No. 36 of 1998) – Procedural Requirements for Water Use Licence (WUL) applications (GNR 267,

2017). These regulations outline the minimum content (Appendix 7 of GNR 267) required for a mine closure and/or rehabilitation report. This report therefore also takes cognisance of these requirements.

The table below details the requirements of GNR 1147 (NEMA) and GNR 267 (NWA) and the relevant sections in the report where these requirements are addressed.

Applicable legislation		Relevant section in the report
GNR 1147 – Appendix 3, 4 and 5		
Annual Rehabilitation Report (Appendix 3)		
3(a)-(g)	Annual rehabilitation plan	Section 14
Closure Plan (Appendix 4)		
3(a)	Details of the specialists	Section 2
3(b)(i)	Material information	Section 3.1
3(b)(ii)	Environmental and social context	Section 3.3
3(b)(iii)	Stakeholder issues and comments	Section 3.4
3(b)(iv)	Mining plan and schedule	Section 4
3(c)(i)	Risk assessment methodology	Section 5.1
3(c)(ii)	Identification of indicators	Section 5.3
3(c)(iii)	Strategies to manage/mitigate risks	Section 5.2
3(c)(iv)	Re-assessment of risks	Section 5.4
3(c)(v)	Changes to risk assessment results	n/a – no changes deemed necessary
3(d)(i)	Legal and governance framework	Section 6.1
3(d)(ii)	Closure vision and objectives	Section 6.2
3(d)(iii)	Evaluation of alternatives	Section
3(d)(iv)	Motivation for closure option	Section 6.4
3(d)(v)	Motivation for closure period	Section 6.5
3(d)(vi)	Details of ongoing research	Section 6.6
3(d)(vii)	Assumptions made for closure	Section 6.7
3(e)(i)	Post-mining land use	Section 7
3(e)(ii)	Map of post-mining land use	n/a – no amendments to post-mining land use map
3(f)(i)	Specific technical solutions	Section 8
3(f)(ii)	Threats and uncertainties	Section 8
3(g)(i)&(iii)	Schedule of actions	Section 9
3(g)(ii)	Assumptions and drivers	Sections 6.7
3(h)(i)-(iii)	Organisational capacity and structure	Section 10
3(i)	Indication of gaps	Section 11
3(j)	Relinquishment criteria	Section 12
3(k)(i)	Closure cost estimate & accuracy	Section 13
3(k)(ii)	Closure cost estimate methodology	Section 13.2

3(k)(iii)	Annual updates	Section 13.3
3(l)(i)-(iii)	Monitoring, auditing and reporting	Section 15
3(m)	Amendments to the closure plan	n/a – no amendments deemed necessary
Environmental Risk Assessment (Appendix 5)		
(a)	Details of the specialists	Section 2
(b)(i)	Risk assessment methodology	Section 5.1
(b)(ii)	Latent risk substantiation	Section 5.5
(b)(iii)	Risk drivers	Section 5.3
(b)(iv)	Expected timeframe	n/a – no latent risks identified
(b)(v)	Risk triggers	n/a – no latent risks identified
(b)(vi)	Risk assessment results	Section 5.2
(b)(vii)	Changes to risk assessment results	Section 5.4
(c)(i)	Monitoring to inform management	Section 15
(c)(ii)-(iv)	Alternative mitigation measures following impacts	n/a – no changes to risk identified
(d)(i)-(iii)	Cost estimation and accuracy	Section 13
(e)	Monitoring, auditing and reporting	Section 15
GN 267 – Annexure D7		
1.	Introduction	Section 1
1.1	Background	Section 1
1.2	Objectives of report	Section 1
2.	Project Description	Section 33.3
2.1	Locality	Section 3.1
2.2.	Environment	Section 3.3
2.3	Community	Section 3
2.4	Mine plan and infrastructure	Section 4
3.	Legal obligation and comments	Section 6.1
3.1	Legislation	Section 6.1
4.	Closure planning	Section 6
4.1	Site-specific closure and activity	Section 8
5.	Rehabilitation and closure activities	Section 7 and Section 8
5.1	Progressive rehabilitation	Section 14
5.2	Decommission and establishment	Section 8
6.	Maintenance and monitoring	Section 15
6.1	Vegetation and establishment and soil nutrients	Section 8
6.2	Groundwater monitoring	Section 15
6.3	Surface water monitoring	Section 15
6.4	Record-keeping and reporting	Section 5.4
7.	Rehabilitation and Closure Annexure	Not applicable

8.	Detailed closure costing	Section 13

FINANCIAL PROVISION

The calculated financial provision in this report is an addendum to the existing South32 financial provision for MMT (South32, 2019), and only incorporates the proposed layout/activity changes at MMT. Layout/activity changes that have already taken place (and are not part of the approved EMPr) have been previously included in the South32 financial provision.

The proposed layout/activity changes at MMT that have been costed as part of the financial provision of this report include:

- the top-cut stockpile area and associated mobile crushing and screening plant;
- stormwater management infrastructure (i.e. concrete lined channels);
- the abstraction pipeline from the decommissioned Middelplaats Mine to MMT;
- the railway loop and railway loadout station;
- product stockpile area in the railway loop; and
- disturbed areas associated with the contractor's laydown areas, roads and security infrastructure.

The closure cost calculation for the proposed layout/activity changes at MMT amounts to **R 13,900,305 (excluding VAT).** This amount will be incorporated into the overall MMT mine-closure plan and the annual financial provision updates.

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ACRONYMS AND ABBREVIATIONS

Acronyms / Abbreviations	Definition
CPAP	Contract Price Adjustment Provision
CPI	Consumer Price Index
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme report
GNR	Government Notice Regulation
HMM	Hotazel Manganese Mines (Pty) Ltd
IRP	Integrated Regulatory Process
LFA	Landscape Function Analysis
MMT	Mamatwan Mine
NEMA	National Environmental Management Act (Act 107 of 1998)
NWA	National Water Act (Act 36 of 1998)
PCD	Pollution Control Dam
SLR	SLR Consulting (South Africa) (Pty) Ltd
WRD	Waste Rock Dump
WUL	Water Use Licence

1. INTRODUCTION

South32 operates the open pit manganese Mamatwan Mine (MMT) (that forms part of the legal entity Hotazel Manganese Mines (Pty) Ltd (HMM)) located approximately 25km to the south of the town Hotazel in the John Taolo Gaetsewe District Municipality and Joe Morolong Local Municipality of the Northern Cape Province of South Africa.

MMT is proposing on amending their approved EMPr to cater for layout/activity changes that have already taken place at MMT, as well as proposed layout/activity changes (referred to as the Changes to the Infrastructure Layout and Activities at MMT).

SLR Consulting (South Africa) (Pty) Ltd (SLR), an independent firm of environmental consultants, has been appointed by South32 to prepare the preliminary closure plan and financial provision associated with the proposed project (Changes to the Infrastructure Layout and Activities at MMT).

The objectives of the preliminary closure plan and financial provision are to determine the costs associated with the management, rehabilitation and remediation of environmental impacts as a result of the changes to infrastructure and activities at the MMT. This also includes the determination of potential latent or residual environmental impacts (if relevant) that may become known in the future.

2. SPECIALIST INPUT

2.1 SPECIALISTS WHO PREPARED THE FINANCIAL PROVISION

The details of the persons who prepared this financial provision report are provided in Table 2-1 below.

Table 2-1: Details of the persons who prepared this report

Details	Professional Engineer and author	Environmental Assessment Practitioner and reviewer
Company:	SLR	SLR
Name:	Stephen van Niekerk	Natasha Smyth
Tel No.:	011 467 0945	011 467 0945
E-mail:	svanniekerk@slrconsulting.com	nsmyth@slrconsulting.com

2.2 EXPERTISE OF THE SPECIALISTS

Stephen van Niekerk is a technical director at SLR, holds a MSc Engineering degree, has over 20 years of relevant experience and is registered as a Professional Engineer (#20010256) with the Engineering Council of South Africa (ECSA). Natasha Smyth holds a BSc Honours degree in Geography and Environmental Management and has over 12 years of relevant experience in the assessment of impacts associated with mining operations.

Copies of the specialists' curricula vitae are attached in Appendix A.

2.3 DECLARATION OF INDEPENDENCE

We, Stephen van Niekerk and Natasha Smyth, hereby declare that we are independent consultants, who have no interest or personal gains in this proposed project whatsoever, except receiving fair payment for rendering an independent professional service.

3. CONTEXT OF THE PROJECT

3.1 MATERIAL INFORMATION

The layout and activity changes that HMM has implemented or are proposing at the MMT are summarised in Table 3-1 below.

Table 3-1: Overview of layout and activity changes

Project component	Overview
Layout/activity changes that have already taken place	
Expansion of the north and south-eastern waste rock dumps	South32 is committed to undertake rehabilitation concurrent with mining operations as per the approved 2005 EMPR. As part of rehabilitation, the north-eastern WRD and the south-eastern WRD footprints were extended in order to enable a reduction in the steepness of the side wall slope.
Changes to the rehabilitation criteria of waste rock dumps	The approved 2005 EMPR committed South32 to rehabilitate the WRDs to a 1:3 slopes. As part of rehabilitation trials, the northeasters WRD was shaped to 1:5 slopes with 2 m high stormwater interception bench drains constructed at approximately 40 m intervals along the slopes. Significantly less erosion was associated with the change to the rehabilitation strategy and this approach will be implemented for all future WRD rehabilitation. It follows that as part of the proposed project it is proposed to change the rehabilitation criteria detailed in the EMPR.
Expansion of the product stockyard	The approved 2005 EMPR makes provision for a product stockyard. Within this approved stockyard area various materials such as coal, coke, ROM, DMS discard, sinter and product (varying in grades) can be stockpiled. As output has increased there has been a need for additional space to store larger volumes of material. The project stockyard area has been extended within the overall existing plant area.
Proposed layout/activity changes	
Establishment of a top-cut stockpile and associated mobile crushing and screening plant	Top-cut material has historically been discarded onto a current WRD (Central WRD) because of its lower manganese content. Following investigations done by South32, the viability of selling top cut material (also referred to as low grade product) was realised. It follows that additional storage space is required to stockpile the top-cut material. The top-cut material will require crushing and screening prior to being sent to the sinter plant. The proposed project includes the establishment of a mobile crushing and screening plant adjacent to the stockpile area. After processing at the sinter plant, the low-grade product will be sold to local and/or international markets. The top-cut stockpile and processing footprint area will reach 34 ha in extent and located to the east of the eastern WRD, extending to the property boundary adjacent to the R380.
Establishment of stormwater management infrastructure	The proposed project will include the upgrade of the existing stormwater management system to accommodate dirty water runoff within the mine area, to flow across the site as surface flow before discharging into lined storage facilities. These upgrades include the optimization of pollution control dams, conveyance and earth cut-off channel infrastructure.
Changes to all waste rock dump heights (excluding rehabilitated waste rock dumps)	The approved 2005 EMPR specifies that the height of the waste rock dumps WRDs) is 50 m above natural ground level. MMT is proposing to increase this to 80 m in order to provide additional capacity for the disposal of waste rock.

Project component	Overview
	The definition of 'expansion' includes modifications or alterations which result in increases to the capacity of a facility. Increasing the height of the WRDs above what is provided for in the approved 2005 EMPR will provide for greater capacity. The height increase would not be applied to rehabilitated WRDs.
Establishment of a pipeline to transfer water abstracted from the decommissioned Middelplaats Mine to MMT	MMT is proposing to source water from the decommissioned Middelplaats Mine for back-up purposes in the event of process water shortages at the mine. The underground workings of the decommissioned Middelplaats mine are flooded and as such MMT is proposing on abstraction this water via two boreholes that still need to be drilled. A pipeline to transfer the water from the decommissioned Middelplaats Mine to the MMT will need to be established. It is anticipated that the pipeline will be an HDPE pipe with a diameter of 260 mm and will be located above ground.
Upgrading the railway and railway loadout station	South32 has a Manganese Export Corridor Allocation on the Transnet Freight Rail (TFR) manganese line between Hotazel, in the Northern Cape, and Coega, in the Eastern Cape. In order to decrease train loading inefficiencies and meet the manganese export capacity as expanded by TFR, an increase in the loading rate of trains at the MMT is proposed. In addition, MMT proposes the upgrade of the existing loadout station and conveyor to improve the loading capacity and time. Further to this a proposed new railway siding will be constructed immediately west of the R380 and will contain the supporting infrastructure (example offices, parking, laydown areas).
Sale of waste rock as aggregate	The approved 2005 EMPR makes provision for the storage of waste rock along the eastern and southern side of the open pit. WRDs established on site include the north-eastern, the central, the south-eastern, the south WRD's; the Adams rehabilitated WRDs and the Sinterfontein WRD. MMT is committed to partially backfilling the open pit with waste rock and concurrently rehabilitating WRD's that will remain on surface in perpetuity. MMT is proposing on selling some of the waste rock that would have remained on surface in perpetuity as aggregate to third parties.
Re-processing of material located in Adams Pit	Adams Pit contains numerous materials that have been stockpiled or disposed in the pit since the Adams Pit was decommissioned in the 1980s. The materials include tailings, slimes, general waste, sinter de-dust, plant spillages and DMS grit. MMT is proposing on re-processing the tailings, DMS grit, sinter de-dust and plant spillages currently stockpiled within as part of rehabilitation of the pit. Market depending, it is anticipated that a maximum of 40 000 tons of material could be sold to third parties per month. The re-processing of the material stored in would include: • The use of an excavator to remove the material located in the ; • The use of a new temporary mobile screen to remove unwanted material (general waste and sinter de-dust bags) and screen the material into different size fractions; • The material would be transported by truck to dispatch using road or rail, for sale to third parties; • Unwanted material (general waste and sinter de-dust bags) will be deposited at the designated MMT waste disposal site; and

Project component	Overview
	• Waste rock will be used to backfill the open pit as part of rehabilitation.

3.2 FINANCIAL PROVISIONING REGULATIONS

This preliminary closure plan has been prepared in accordance with the National Environmental Management Act (NEMA) (107/1998) - Financial Provisioning Regulations, 2015 (GNR 1147, 2015).

The financial provision in this report has been calculated as per the methodology used by South32 for the calculation of existing closure liabilities at MMT (South32, 2019) that uses site-specific decommissioning and rehabilitation rates. The calculated financial provision in this report is an addendum to the existing South32 financial provision for MMT (South32, 2019), and only incorporates the proposed layout/activity changes at MMT. Layout/activity changes that have already taken place (and are not part of the approved EMPr) have been previously included in the existing South32 financial provision for MMT.

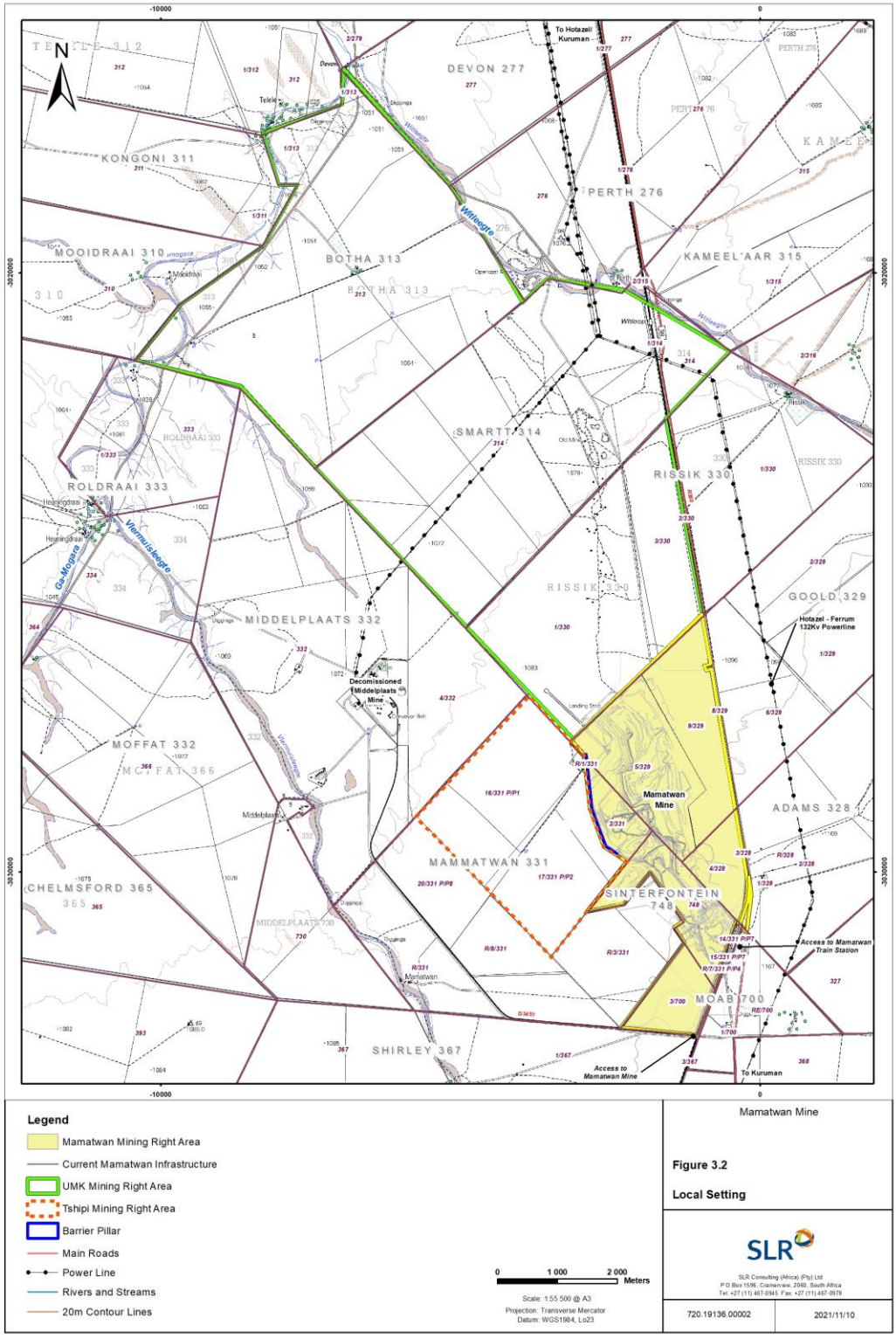

Figure 1: Local Setting taken from EIAR (figure 3.2)

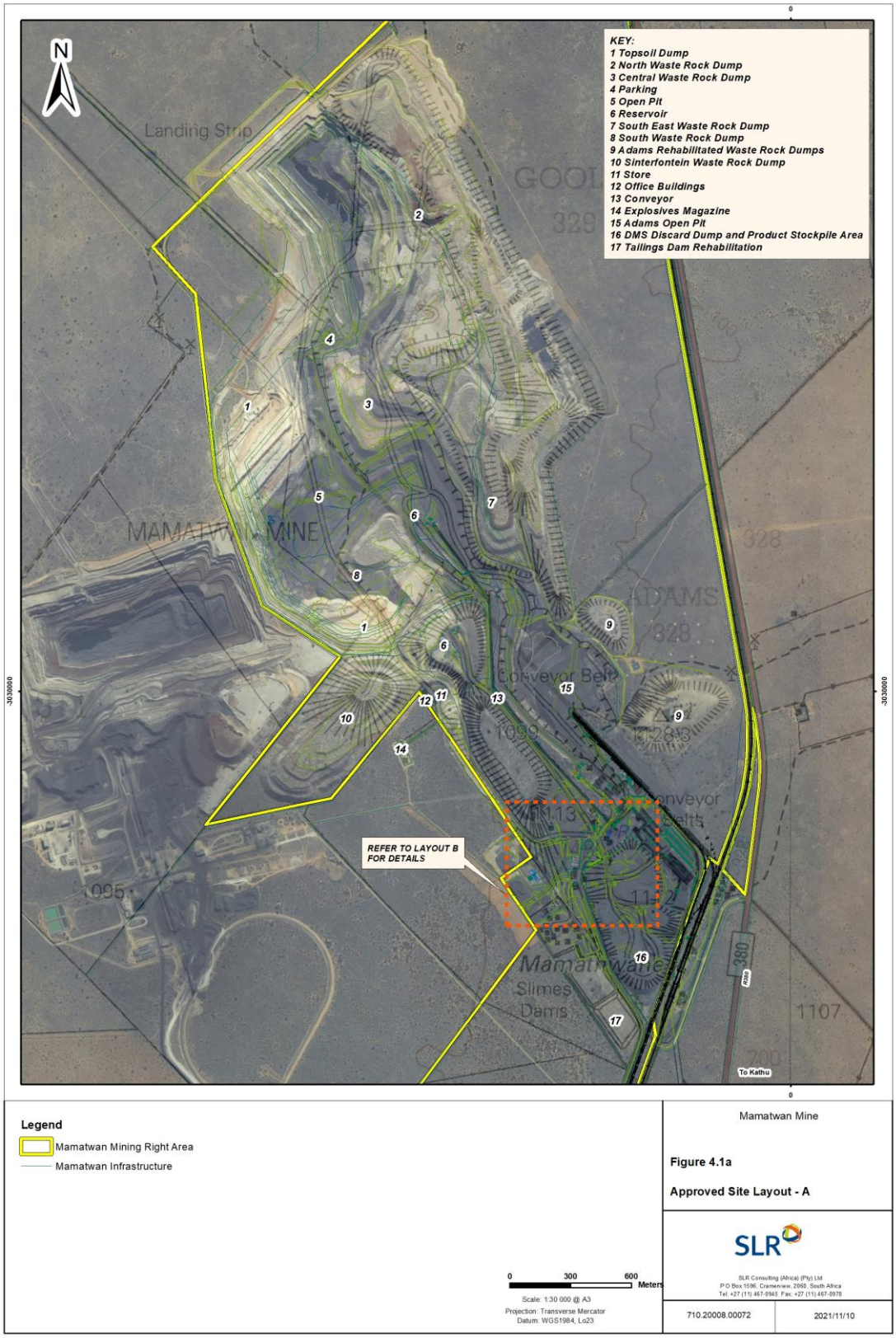

Figure 2: Site layout taken from EIAR (figure 4.1)

3.3 ENVIRONMENTAL AND SOCIO-ECONOMIC OVERVIEW

The information in this section provides a summary of the environmental and socio-economic baseline situation that is likely to be influenced by the proposed project. Information in this section was sourced from the Environmental Impact Assessment (EIA) report compiled for the proposed project (SLR, 2021).

Table 3-2: Overview of environmental and socio-economic baseline situation

Aspect	Overview
Geology	The world's largest land-based sedimentary manganese deposit is contained in the Kalahari Manganese Field (KMF), situated 47 km north-west of Kuruman in the Northern Cape. The MMT is located on the south-western outer rim of the KMF. The MMT lies within the Hotazel Formation (Transvaal Supergroup) towards the southern end of the Kalahari Basin and is underlain by basaltic lava of the Ongeluk Formation (Transvaal Supergroup) and directly overlain by dolomite of the Mooidraai Formation (Transvaal Supergroup). The Transvaal Supergroup is overlain unconformably by the Olifantshoek Supergroup, which consists of arenaceous sediments, typically interbedded shale, quartzite and lavas overlain by coarser quartzite and shale. The Olifantshoek Supergroup is overlain by Dwyka Formation, which forms the basal part of the Karoo Supergroup. The whole Supergroup has been deformed into a succession with an east-verging dip consisting of tillite (diamictite), which is covered by sands, claystone and calcrete of the Kalahari Group. MMT is exploiting the manganese from the banded iron stones of the Hotazel Formation. The ore is contained within a 30 to 45 m thick mineralised zone which occurs along the entire extent of MMT and is made up of three manganese-rich zones, namely the Upper Manganese Ore Body (UMO), the Middle Manganese Ore Body (MMO) and the Lower Manganese Ore Body (LMO). The UMO is 10 cm to 15 cm thick and comprises moderate deposits of manganese. The poorly mineralised MMO is approximately 1 m thick and not economically viable. The LMO is highly mineralised and makes up the bulk of the ore body. Various intrusive structures are close to and around MMT. These include doleritic dykes. It is expected that vertical displacement of the Hotazel Formation and the sill that intrudes it has occurred along the trend of many of these structures. It is further noted that many of the permeable voids that developed in response to faulting would have been filled during a later magmatic phase (SLR, 2021).
Climate	MMT falls within the Northern Steppe Climatic Zone. It is a semi-arid region characterised by seasonal rainfall, hot temperatures in summer, and colder temperatures in winter. The area is associated with a mean annual precipitation ranging between 201 – 400 mm per annum. Dominant winds are from the north, north-east direction.
Topography	The area surrounding the MMT is relatively flat with a gentle slope towards the north-west. The elevation varies from 1 087 m to 1 107 m above mean sea level (mamsl). The Vlermuisleegte River is located approximately 3 km west and the Witleegte River is located approximately 6 km north-east of the proposed project site. The natural topography of the area surrounding the MMT has been influenced largely through mining activities such as the Tshipi Borwa Mine, the old Middelplaats Mine, the United Manganese of Kalahari Mine and the Adams Solar Farm. The natural topography at the MMT has been altered as a result of the establishment of the NE topsoil stockpile area. Prior to the establishment of the NE topsoil stockpile the topography of the project site would have resembled similar characteristics to that of the surrounding general area (i.e. relatively flat areas with gentle slopes). Given that was mined out by 1980, the natural topography was already altered prior to the use of for the disposal of general waste (including rubble and used conveyor belts) and the storage of sinter de-dust.

Aspect	Overview
Soils and land capability	The soil forms associated with the project areas include a combination of Cullinan, Ermelo, Hutton and Witbank. The Cullinan soil form is often characterised by little or no soil material present. The Ermelo soil form is an oxidic soil and is characterised by a thick Orthic/ Yellow-Brown Apedal horizon and has strong pigmenting effects of iron (Fe) in the form of hematite. These soils are generally freely drained and well aerated. These attributes (i.e. good drainage and well aeration) make these soils ideal for tillage. The Hutton soil form is an oxidic soil and is characterized by a thick Orthic/Red Apedal horizon and has strong pigmenting effects of iron (Fe) in the form of hematite and goethite. These soils are generally considered freely drained and well aerated. These attributes make these soils ideal for tillage. The Witbank soil form is characterised as soil that has been physically altered and extensively disturbed by human intervention such that no recognizable diagnostic soil morphological characteristics could be identified. The land capability of the proposed development sites is Arable Class I with a Moderate land potential.
Biodiversity (Flora)	The MMT falls within the Kathu Bushveld vegetation type, which is considered a Least Threatened vegetation type, per the National Biodiversity Assessment (2020). The Kathu Bushveld is characterised by a medium-tall tree layer with *Vachellia erioloba* (Camel Thorn trees) in places, but mostly open and including *Boscia albitrunca* (Shepherd's Tree) as the prominent trees. The shrub layer is generally most important with, for example, A. mellifera, *Diospyros lycioides* and *Lycium hirsutum.* The grass layer is variable in cover. The habitat units associated with the project areas include the Kathu Bushveld habitat unit, the Transformed habitat unit and the Degraded habitat unit. The Kathu Bushveld habitat unit is considered an open savanna and has well-developed tree/shrub layers. with dominant trees such as *Senegalia (Acacia) mellifera*, scattered *Terminalia sericea* and *Acacia haematoxylon*. The shrub layer is developed and is dominated by species such as *Senegalia mellifera*, *Tarchonanthus camphoratus, Grewia flava*, and *A. hebeclada*. The grass layer is variable in cover, with bare soil patches notable throughout the habitat unit. In some areas, denser bush clumps occur either consisting of the Protected Tree Acacia (*Vachellia erioloba*) or dense stands of Acacia mellifera. The Transformed Habitat Unit refers to areas that have been transformed as a result of historic and ongoing mining activities and infrastructure. These areas contain very little to no vegetation and where present it consists mainly of alien invasive species. The Degraded Bushveld Habitat Unit refers to areas that have been partially or largely transformed. The Degraded Bushveld was severely altered from the reference Kathu Bushveld as a result of mining activities and infrastructure. These areas contain very little natural vegetation and consist mainly of alien invasive species. A number of protected floral species are present in the project area, particularly in the Kathu Bushveld Habitat and include the National Forest Act, (Act 84 of 1998) (NFA) (amended in September 2011) protected trees *Vachellia erioloba* and *Vachellia haematoxylon*. A lso observed were a number of Northern Cape Nature Conservation Act (Act 9 of 2009) (NCNCA) protected species, namely *Boophone disticha, Harpagophytum procumbens*, and *Tridentea sp. H. procumbens* is also considered a protected species in terms of NEM: BA Threatened or Protected Species (TOPS). It was observed that individuals of the V. *erioloba* and *V. haematoxylon*, as well as a single individual of the *B. disticha* were observed in the degraded Bushveld habitat unit.
Biodiversity (Fauna)	One listed Species of Conservation Concern (SCC), *Orycteropus afer* (Aardvark), was observed within the proposed project area and its immediate surroundings. The Kathu Bushveld habitat unit is expected to support a number of faunal SCC. The following faunal SCC may occur within

Aspect	Overview
	the study area, namely *Atelerix frontalis* (Southern African Hedgehog), *Felis nigripes* (Black-footed Cat), *Otocyon megalotis* (Bat-eared Fox), *Vulpes chama* (Cape Fox), *Mellivora capensis* (Honey Badger), Aquila verreauxii (Verreaux's eagle), *Anthus crenatus* (African Rock Pipit), *Ardeotis kori* (Kori Bustard) and *Sagittarius serpentarius* (Secretary bird. Three burrowing Scorpions (*Opistophthalmus ater* (CR), *Opistophthalmus carinatus* (NYBA) and *Opistophthalmus wahlbergii* (NYBA)) all have suitable habitat located within the proposed project area and have distributions which overlap the study area. Suitable habitat for *Chamaeleo dilepis* (Common flap-neck chameleon) and *Python sebae* (African rock python) was observed and these species could occur within the proposed project area. Due to the highly degraded nature of the Transformed Habitat Unit resulting from mining activities, sufficient suitable habitat is not available to support faunal SCC.
Surface water	The MMT is located within the Lower Vaal Water Management Area. The MMT falls within the quaternary catchment D41K which has a gross total catchment area of 4 216 km^2, with a net mean annual runoff of 6.53 million cubic meters. There are no watercourses within the project areas and natural drainage across the project area is via sheet flow. The nearest watercourses are the ephemeral Vlermuisleegte River (approximately 3 km west) and the ephemeral Witleegte River (approximately 6 km north-east). There is no third-party reliance on surface water. No wetlands were identified in the proposed project area.
Groundwater	Two aquifers are present beneath the project area. These include a shallow aquifer comprising the Kalahari sands and calcrete, and a deeper fractured aquifer comprising Dwyka clay and Mooidraai dolomite formation. Groundwater flows across the mine area in accordance with the topography from the south-east to north-west. Natural groundwater levels and flows are influenced (although limited to the low permeability and storage characteristics of the aquifer) by open pit mining activities. Most of the groundwater is used to supply drinking water for cattle and in some instances to supply water for domestic use. Groundwater qualities have been influenced locally by existing mining activities.
Air quality	Ambient air quality is influenced by mines, household fuel combustion, vehicle tailpipe emissions and agricultural activities. Monitoring results indicate that dust fallout rates are within limits set out in the National Dust Control Regulations. Potential receptors include the isolated residences and farmhouses on the surrounding farms, ranging between 3 and 6 km from the mine. These are owned and/or occupied by farmers and farm workers.
Visual	The landscape character of the MMT is characterised by mining infrastructure and activities. The landscape character of the undisturbed areas within the MMT have been fundamentally altered due to the existing mining infrastructure and activities.
Socio-economic	There are mines, private landowners and farm occupants surrounding the MMT. Unemployment and education levels in the area are higher than the provincial and municipal average. Basic services infrastructure appears to be far less formalised when considering the province and municipalities.
Land use	Agriculture (ad hoc livestock grazing), isolated farmsteads, small towns (e.g. Hotazel), dormant and active mines, roads, powerlines, a solar farm, a railway line and the Vaal-Gamagara pipeline are the predominant land uses surrounding MMT. The land uses within the MMT Mining Right area are limited to mining activities.

3.4 STAKEHOLDER ISSUES AND COMMENTS

As part of the Integrated Regulatory Process, a public participation process was undertaken for the proposed project. To date, no closure-related issues and concerns around rehabilitation and closure objectives has been raised.

4. MINE PLAN AND SCHEDULE

Information in this section was sourced from the EIA report (SLR, 2020) for the proposed project. A summary of the key project components is provided in the section below.

This report is an addendum to the existing South32 financial provision for MMT (South32, 2019), and only incorporates the proposed layout/activity changes at MMT that will contribute to the overall financial provision for closure. Layout/activity changes that have already taken place (and are not part of the approved EMPr) have been previously included in the existing South32 financial provision for MMT (see Table 3-1 for more details).

4.1.1 Establishment of a top-cut stockpile and associated mobile crushing and screening plant

Additional storage space is required to stockpile top-cut material prior to processing at the sinter plant. The top-cut material will need to be subjected to crushing and screening (via a mobile crushing and screening plant) prior to the material being sent to the sinter plant. To develop this area, indigenous vegetation needs to be cleared.

[The top-cut stockpile area and mobile crushing and screening plant are costed in this report].

4.1.2 Establishment of stormwater management infrastructure

The proposed project will include the upgrade of the existing stormwater management system to accommodate dirty water runoff within the mine area, to flow across the site as surface flow before discharging into lined storage facilities (in accordance with GN 704 requirements (GN 704, 1999), These upgrades include the optimization of pollution control dams, conveyance and earth cut-off channel infrastructure.

[The dirty water concrete lined channels, silt trap and PCD are costed in this report].

4.1.3 Changes to waste rock dump height

MMT is proposing to increase the approved 2005 EMPr height of the waste rock dumps from 50 m to 80 m.

[This aspect is not expected to increase the existing financial provision for MMT provided the slopes of the waste rock dumps are reduced to 1V:5H – as planned].

4.1.4 Establishment of a pipeline to transport abstracted water from Middelplaats Mine to MMT

MMT is proposing to abstract water from the old Middelplaats Mine as and when needed when water is not available from the open pit dewatering or from the Vaal-Gamagara Water Pipeline. Water will be abstracted via two proposed boreholes (yet to be drilled). A pipeline to transfer the water from the Middelplaats Mine to the MMT will need to be established. Water will be pumped to existing infrastructure – the water will be pumped to the (existing) Aqua Dam/Tank and then to the (existing) Catchment Dam/Tank. The new pipeline has been costed in this report.

4.1.5 Upgrading the railway and railway loadout station

Transnet Freight Rail (TFR) plans to increase the capacity of the Manganese rail line. In order to meet the TFR expansion requirements the loading rate of trains at the MMT needs to be increased. This will be achieved by upgrading the existing loadout station and related railway.

[The railway loop, loadout station and product stockpile area has been costed in this report].

4.1.6 Sale of waste rock as aggregate

MMT is proposing to sell some of the waste rock that would have remained on surface in perpetuity as aggregate to third parties.

[This aspect is not expected to increase the existing financial provision for MMT].

4.1.7 Re-processing of material located in Adams Pit.

As part of rehabilitation, MMT is proposing to re-process material located within Adams Pit, for sale to third parties. This material includes the tailings, DMS grit, sinter de-dust and plant spillages. This material will be screened using mobile screens prior to sale to third parties. Screened waste (conveyors and metal) will be removed from Adams Pit and deposited at the designated waste disposal area at the MMT.

[This aspect is not expected to increase the existing financial provision for MMT].

5. ENVIRONMENTAL RISK ASSESSMENT

5.1 RISK ASSESSMENT METHODOLOGY

The methodology applied to assess the significance of risks is provided in Table 5-1 below.

Note: Part A provides the definition for determining impact consequence (combining intensity, spatial scale and duration) and impact significance (the overall rating of the impact). Impact consequence and significance are determined from Part B and C. The interpretation of the impact significance is given in Part D.

Table 5-1: Impact Assessment Methodology

PART A: DEFINITIONS AND CRITERIA*		
Definition of SIGNIFICANCE		**Significance = consequence x probability**
Definition of CONSEQUENCE		**Consequence is a function of intensity, spatial extent and duration**
Criteria for ranking of the INTENSITY of environmental impacts	**VH**	Severe change, disturbance or degradation. Associated with severe consequences. May result in severe illness, injury or death. Targets, limits and thresholds of concern continually exceeded. Substantial intervention will be required. Vigorous/widespread community mobilization against project can be expected. May result in legal action if impact occurs.
	H	Prominent change, disturbance or degradation. Associated with real and substantial consequences. May result in illness or injury. Targets, limits and thresholds of concern regularly exceeded. Will definitely require intervention. Threats of community action. Regular complaints can be expected when the impact takes place.
	M	Moderate change, disturbance or discomfort. Associated with real but not substantial consequences. Targets, limits and thresholds of concern may occasionally be exceeded. Likely to require some intervention. Occasional complaints can be expected.
	L	Minor (Slight) change, disturbance or nuisance. Associated with minor consequences or deterioration. Targets, limits and thresholds of concern rarely exceeded. Require only minor interventions or clean-up actions. Sporadic complaints could be expected.
	VL	Negligible change, disturbance or nuisance. Associated with very minor consequences or deterioration. Targets, limits and thresholds of concern never exceeded. No interventions or clean-up actions required. No complaints anticipated.
	VL+	Negligible change or improvement. Almost no benefits. Change not measurable/will remain in the current range.
	L+	Minor change or improvement. Minor benefits. Change not measurable/will remain in the current range. Few people will experience benefits.
	M+	Moderate change or improvement. Real but not substantial benefits. Will be within or marginally better than the current conditions. Small number of people will experience benefits.
	H+	Prominent change or improvement. Real and substantial benefits. Will be better than current conditions. Many people will experience benefits. General community support.
	VH+	Substantial, large-scale change or improvement. Considerable and widespread benefit. Will be much better than the current conditions. Favourable publicity and/or widespread support expected.
Criteria for ranking the	**VL**	Very short, always less than a year. Quickly reversible
	L	Short-term, occurs for more than 1 but less than 5 years. Reversible over time.

PART A: DEFINITIONS AND CRITERIA*		
DURATION of impacts	**M**	Medium-term, 5 to 10 years.
	H	Long term, between 10 and 20 years. (Likely to cease at the end of the operational life of the activity)
	VH	Very long, permanent, +20 years (Irreversible. Beyond closure)
Criteria for ranking the EXTENT of impacts	**VL**	A part of the site/property.
	L	Whole site.
	M	Beyond the site boundary, affecting immediate neighbours
	H	Local area, extending far beyond site boundary.
	VH	Regional/National

PART B: DETERMINING CONSEQUENCE							
INTENSITY = VL							
DURATION	Very long	**VH**	**Low**	**Low**	**Medium**	**Medium**	**High**
	Long term	**H**	**Low**	**Low**	**Low**	**Medium**	**Medium**
	Medium term	**M**	**Very Low**	**Low**	**Low**	**Low**	**Medium**
	Short term	**L**	**Very low**	**Very Low**	**Low**	**Low**	**Low**
	Very short	**VL**	**Very low**	**Very Low**	**Very Low**	**Low**	**Low**
INTENSITY = L							
DURATION	Very long	**VH**	**Medium**	**Medium**	**Medium**	**High**	**High**
	Long term	**H**	**Low**	**Medium**	**Medium**	**Medium**	**High**
	Medium term	**M**	**Low**	**Low**	**Medium**	**Medium**	**Medium**
	Short term	**L**	**Low**	**Low**	**Low**	**Medium**	**Medium**
	Very short	**VL**	**Very low**	**Low**	**Low**	**Low**	**Medium**
INTENSITY = M							
DURATION	**Very long**	**VH**	**Medium**	**High**	**High**	**High**	**Very High**
	Long term	**H**	**Medium**	**Medium**	**Medium**	**High**	**High**
	Medium term	**M**	**Medium**	**Medium**	**Medium**	**High**	**High**
	Short term	**L**	**Low**	**Medium**	**Medium**	**Medium**	**High**
	Very short	**VL**	**Low**	**Low**	**Low**	**Medium**	**Medium**
INTENSITY = H							
DURATION	**Very long**	**VH**	**High**	**High**	**High**	**Very High**	**Very High**
	Long term	**H**	**Medium**	**High**	**High**	**High**	**Very High**
	Medium term	**M**	**Medium**	**Medium**	**High**	**High**	**High**
	Short term	**L**	**Medium**	**Medium**	**Medium**	**High**	**High**
	Very short	**VL**	**Low**	**Medium**	**Medium**	**Medium**	**High**

PART A: DEFINITIONS AND CRITERIA*							
INTENSITY = VH							
DURATION	**Very long**	**VH**	**High**	**High**	**Very High**	**Very High**	**Very High**
	Long term	**H**	**High**	**High**	**High**	**Very High**	**Very High**
	Medium term	**M**	**Medium**	**High**	**High**	**High**	**Very High**
	Short term	**L**	**Medium**	**Medium**	**High**	**High**	**High**
	Very short	**VL**	**Low**	**Medium**	**Medium**	**High**	**High**
			VL	**L**	**M**	**H**	**VH**
			A part of the site/ property	Whole site	Beyond the site, affecting neighbours	Extending far beyond site but localised	Regional/ National
			EXTENT				

PART C: DETERMINING SIGNIFICANCE							
PROBABILITY (Of exposure to impacts)	**Definite/ Continuous**	**VH**	**Very Low**	**Low**	**Medium**	**High**	**Very High**
	Probable	**H**	**Very Low**	**Low**	**Medium**	**High**	**Very High**
	Possible/ frequent	**M**	**Very Low**	**Very Low**	**Low**	**Medium**	**High**
	Conceivable	**L**	**Insignificant**	**Very Low**	**Low**	**Medium**	**High**
	Unlikely/ improbable	**VL**	**Insignificant**	**Insignificant**	**Very Low**	**Low**	**Medium**
			VL	**L**	**M**	**H**	**VVH**
			CONSEQUENCE				

PART D: INTERPRETATION OF SIGNIFICANCE	
Significance	**Decision guideline**
Very High	Potential fatal flaw unless mitigated to lower significance.
High	It must have an influence on the decision. Substantial mitigation will be required.
Medium	It should have an influence on the decision. Mitigation will be required.
Low	Unlikely that it will have a real influence on the decision. Limited mitigation is likely required.
Very Low	It will not have an influence on the decision. Does not require any mitigation
Insignificant	Inconsequential, not requiring any consideration.

**VH = very high, H = high, M= medium, L= low and VL= very low and + denotes a positive impact.*

5.2 IDENTIFICATION OF STRATEGIES TO MANAGE AND MITIGATE THE IMPACTS AND RISKS

Impacts and risks identified for the proposed project that are likely to extend post-closure are included in Table 5-2 below. Strategies to manage and mitigate impacts and risks have been identified, considering, the findings of specialist studies (where relevant), input from stakeholders and consideration of the project plan. These management and mitigation strategies are aimed at controlling the project activities and processes that have the potential to result in environmental degradation.

Table 5-2: Impacts and risks identified for the proposed project

Activity	Potential impact	Aspects affected	Phase	Significance (Unmitigated)	Management actions type	Significance (Mitigated)	Extent to which the impact can be reversed, avoided or cause irreplaceable loss and the degree to which the impact and risk can be mitigated
N/A	Loss and sterilisation of mineral resources	Geology	N/A	**INSIGNIFICANT**			
Site preparation Civil works Earthworks Rehabilitation Maintenance and aftercare	Altering topography	Topography	Construction Decommissioning Closure	**Insignificant**	Minimise the area of disturbance by designing and constructing the most compact infrastructure practically possible; and Rehabilitate in accordance with the approved mine closure plan that ensure a suitable post-closure land use is achieved.	**INSIGNIFICANT**	
Site preparation Civil works Earthworks	Hazardous excavations and infrastructure resulting in safety risks to third parties and animals		Construction	**Medium**	The project area will be fenced off to prevent inadvertent access by third parties and animals; Access control will be implemented to ensure access is only granted to those who have authorisation; Barriers will be erected around all hazardous excavations; Warning signage will be erected at all hazardous excavations; and Where the proposed project has caused injury to third parties or animals, appropriate compensation will be provided; Care must be taken to ensure that third-party infrastructure, such as telephone lines, etc. are not damaged during the construction phase.	**Low**	Highly likely to be mitigated. Highly unlikely to be reversed in the case of injury or death. Highly likely to be avoided with mitigation. Highly likely to cause irreplaceable loss in the case of injury or death.
Site preparation Civil works Earthworks Transport systems General site management Demolition Rehabilitation	Soil erosion	Soil and Land Capability	Construction Operation Decommissioning Closure	**Medium**	Implement the soil conservation procedure as per the EMPR. Establish short term perennial vegetation that will stabilise the site but allow the indigenous vegetation to establish over the site; Use existing established roads; Ensure vegetation clearing is undertaken in phases; Limit vegetation clearance to only the areas where the infrastructure will be constructed;	**Low**	Highly likely to be mitigated. Unlikely to be reversed where vegetation has been removed, highly likely to

Activity	Potential impact	Aspects affected	Phase	Significance (Unmitigated)	Management actions type	Significance (Mitigated)	Extent to which the impact can be reversed, avoided or cause irreplaceable loss and the degree to which the impact and risk can be mitigated
Maintenance and aftercare					Avoid parking of vehicles and equipment outside of designated parking areas; Plan vegetation clearance for dry seasons (late autumn, winter and early spring); and Re-establish vegetation along the railway infrastructure to reduce the impact of run-off from the compacted surface of the railway area.		be reversed beyond the project footprint. Unlikely to be avoided where vegetation has been removed, highly likely to be avoided beyond the project footprint. Highly unlikely to result in irreplaceable loss.
Site preparation Civil works Earthworks Transport systems General site management Demolition Rehabilitation Maintenance and aftercare	Disturbance of original soil profiles		Construction Operation Decommissioning Closure	**Medium**	Land clearance must only be undertaken immediately prior to construction activities within the development footprint; and Level any remaining topsoil that was removed from the railway area and that remained on the surface instead of allowing small stockpiled of soil to remain on the surface.	**Low**	Highly likely to be mitigated. Unlikely to be reversed where vegetation has been removed, highly likely to be reversed beyond the project footprint. Unlikely to be avoided where vegetation has been removed, highly likely to be avoided beyond the project footprint. Highly unlikely to result in

Activity	Potential impact	Aspects affected	Phase	Significance (Unmitigated)	Management actions type	Significance (Mitigated)	Extent to which the impact can be reversed, avoided or cause irreplaceable loss and the degree to which the impact and risk can be mitigated
							irreplaceable loss.
Site preparation Civil works Earthworks Transport systems General site management Demolition Rehabilitation Maintenance and aftercare	Chemical pollution of soil		Construction Operation Decommissioning Closure	**Medium**	Conduct potentially polluting activities (i.e., loading, hauling, tipping, transportation, handling and storage) in a manner that pollutants are contained at source and do not pollute soils. In this regard: Service all vehicles and mobile equipment regularly in workshops, service bays and wash bays with contained impermeable, floors, dirty water collection facilities and oil traps; Design and operate all new and used chemical, fuel and oil storage and handling facilities in a manner that all spillages are contained in impermeable areas and cannot be released into the environment; Report ad hoc spills of potentially polluting substances (whether in dirty areas or in the environment) to the environmental manager immediately and clean up and/or remediate immediately; Implement and maintain a dirty water management system; Implement the waste management practices, as per the IWWMP and EMPR. Educate and train all employees (temporary and permanent) and contractors in pollution prevention; and Implement formalised action plans to enable fast and efficient reaction to contain and remediate pollution incidents. Consider the requirements for long term soil pollution prevention, land function and confirmatory monitoring in the design of any permanent and potentially polluting structures; and Implement the emergency response procedure in the event any major spillage incident.	**Low**	Highly likely to be mitigated. Highly likely to be reversed with remediation. Highly likely to be avoided with mitigation. Highly unlikely to cause irreplaceable loss.
Site preparation Civil works Earthworks Transport systems	Physical destruction and disturbance of floral species	Biodiversity	Construction Operation Decommissioning	**Medium**	A biodiversity specialist shall do a walkdown of the project footprint prior to land clearing activities to identify protected floral species and floral SCC that may have been lying dormant during initial field observations;	**LOW**	Very highly likely to be mitigated. Medium likeliness to be reversed.

Activity	Potential impact	Aspects affected	Phase	Significance (Unmitigated)	Management actions type	Significance (Mitigated)	Extent to which the impact can be reversed, avoided or cause irreplaceable loss and the degree to which the impact and risk can be mitigated
General site management Demolition Rehabilitation Maintenance and aftercare			Closure		Should any protected floral species and floral SCC be located on site, the necessary permits need to be obtained from DENC and/or DFFE prior to removal. They are to be relocated and the relocation success of such species should be monitored for three years post-construction. Immediate actions are to be taken if it becomes evident that relocation is not successful; Ensure the removal of indigenous vegetation is restricted to what is absolutely necessary; No collection of floral species and floral SCC is allowed; Limit edge effects to the surrounding environment by: Demarcating all footprint areas during construction; Preventing construction rubble or cleared alien vegetation and invasive species to be disposed outside of demarcated areas; Ensuring that construction rubble and cleared alien and invasive species are taken to a registered waste disposal facility; and Managing the spread of alien and invasive species. Provide appropriate sanitary facilities and ensure the disposal thereof at a registered licenced facility; Ensure no temporary dump sites are created on site; No fires are allowed on site; Compile an alien invasive species management or control plan for implementation with the following recommendations: A buffer area of 30 m surrounding the railway balloon should be regularly checked for alien invasive species; Remove alien invasive species throughout the construction, operation and maintenance phases; Ensure alien vegetation is removed prior to the removal of indigenous vegetation; Ensure only trained personnel are involved in the chemical control of alien invasive species;		Medium likeliness to be avoided with mitigation. Unlikely to cause irreplaceable loss.

Activity	Potential impact	Aspects affected	Phase	Significance (Unmitigated)	Management actions type	Significance (Mitigated)	Extent to which the impact can be reversed, avoided or cause irreplaceable loss and the degree to which the impact and risk can be mitigated
					Edge effects arising from the proposed project which may affect adjacent areas must be strictly managed; Ongoing alien invasive species monitoring must be undertaken throughout all phases; and Removed alien invasive species must not be placed on unprotected ground as seeds may disperse upon it. All cleared alien invasive species must be disposed of at a licenced waste facility.		
Site preparation Civil works Earthworks Transport systems General site management Demolition Rehabilitation Maintenance and aftercare	Physical destruction and disturbance of faunal species	Biodiversity	Construction Operation Decommissioning Closure	**High**	A biodiversity specialist shall do a walkdown of the project footprint prior to land clearing activities to identify faunal species on site and to assist with the relocation thereof; It is recommended that culverts of sufficient size be places beneath the railway line so as to allow for the movement of small faunal species between the remaining habitat inside the railway loop and that of the larger habitat outside. Culverts must be regularly inspected for infilling and blockages, ensuring they are kept clear of debris; No collection, trapping and harming of faunal species and faunal SCC is allowed; Construction personnel are to undergo environmental awareness training pertaining to the potential faunal species located on site; While no protected faunal species were identified on site, if any species are encountered on site, the necessary permits need to be obtained from DENC and/or DFFE prior to removal/relocation; Perimeter fencing installed as part of the proposed project must allow for the movement of small animals (e.g., palisade fencing or cattle fencing). Should impermeable fencing be installed, small openings must be created to allow for the continuous movement of small animals. Such openings must be continuously monitored and cleared of debris; and Smaller species that are not readily able to move out of an area ahead of vegetation and ground clearing activities (such as	**Medium**	Very highly likely to be mitigated. Medium likeliness to be reversed. Medium likeliness to be avoided with mitigation. Unlikely to cause irreplaceable loss.

Activity	Potential impact	Aspects affected	Phase	Significance (Unmitigated)	Management actions type	Significance (Mitigated)	Extent to which the impact can be reversed, avoided or cause irreplaceable loss and the degree to which the impact and risk can be mitigated
					scorpions and reptiles), will be less mobile during rainfall events and cold days. As such, care must be taken to look for these species prior to these activities and should these species be encountered, they are to be carefully and safely moved to an area of similar habitat outside of the project footprint. A suitably trained specialist shall be instructed to carry out the removal of venomous snake species.		
Site preparation Civil works Earthworks General site management Rehabilitation	Alteration of natural drainage patterns	Surface water resources	Construction Operation Decommissioning Closure	**Medium**	Stormwater management plan has been designed to channel runoff and separate dirty water from clean water, aligning with the GN704.	**Low**	Very highly likely to be mitigated. Medium likeliness to be reversed. Medium likeliness to be avoided with mitigation. Unlikely to cause irreplaceable loss.
Site preparation Civil works Earthworks General site management Rehabilitation	Contamination of surface water resources			**Medium**	Drip trays to be placed under all standing machinery and equipment. Water quality monitoring plan and implementation. Stormwater management plan to minimise the potential to contaminate surface water and separates dirty and clean water. Optimise the reuse of mine water to minimise disposal / treatment / storage of dirty water.	**Low**	Very highly likely to be mitigated. Medium likeliness to be reversed. Medium likeliness to be avoided with mitigation. Unlikely to cause irreplaceable loss.
Site preparation Civil works Earthworks Transport systems General site management Demolition	Contamination of groundwater resources	Groundwater resources	Construction Operation Decommissioning Closure	**Medium**	Implement approved management actions pertaining to the containment of dirty water in accordance with Regulation 704 (June 1999); Any sheet runoff from compacted areas must be slowed down by the strategic placement of berms; and Control stormwater through the implementation of HMM's existing Stormwater Management Plan.	**Low**	

Activity	Potential impact	Aspects affected	Phase	Significance (Unmitigated)	Management actions type	Significance (Mitigated)	Extent to which the impact can be reversed, avoided or cause irreplaceable loss and the degree to which the impact and risk can be mitigated
Rehabilitation Maintenance and aftercare							
Site preparation Civil works Earthworks Demolition	Air pollution	Air Quality	Construction Decommissioning	**Low**	Continue the implementation of HMM's dust fallout monitoring programme; Reduce vehicle exhaust emissions through the use of better-quality diesel; Implement inspection and maintenance programmes; Implement dust suppression measures (wet and dry) to limit dust impacts.	**Very Low**	Very highly likely to be mitigated. Low likeliness to be reversed. High likeliness to be avoided with mitigation. Very unlikely to cause irreplaceable loss.
Site preparation Civil works Earthworks	Increase in disturbing noise levels	Noise	Construction	**Low**	Use noise barriers and low noise equipment and vehicles. Investigate use of alternatives to audible reversing alarms and maximise forward movements of mobile plant and vehicles. Staff training and awareness of noise control plan. Avoid clustering of mobile equipment near receptors. Noise generating activities to be limited to daytime hours. Maintenance of vehicles and equipment.	**Very Low**	Very highly likely to be mitigated. Low likeliness to be reversed. High likeliness to be avoided with mitigation. Very unlikely to cause irreplaceable loss.
N/A	Negative visual views	Visual	N/A	**INSIGNIFICANT**			
NA	Road disturbance and traffic safety	Traffic	N/A	**INSIGNIFICANT**			
Site preparation	Loss of cultural/heritage	Cultural/heritage and	Construction	**Insignificant**	Implement the chance find procedure in the event of the discovery of cultural/heritage and/or palaeontological resources on site.	**INSIGNIFICANT**	

Activity	Potential impact	Aspects affected	Phase	Significance (Unmitigated)	Management actions type	Significance (Mitigated)	Extent to which the impact can be reversed, avoided or cause irreplaceable loss and the degree to which the impact and risk can be mitigated
Civil works Earthworks	and paleontological resources	paleontological resources					
Site preparation Civil works EarthworkS	Inward migration and economic impact	Socio-economic		**Medium**	Communication with local communities to identify and manage inward migration. Indicate the extent to which additional employment may be available for the construction phase.	**Low**	Moderately likely to be mitigated. Moderate likeliness to be reversed. Moderate likeliness to be avoided with mitigation. Very unlikely to cause irreplaceable loss.
N/A	Change in land use		N/A	**INSIGNIFICANT**			

5.3 IDENTIFICATION OF INDICATORS

Two key indicators have been defined which will facilitate evaluation of the ongoing environmental impacts and associated risk to closure (risk triggers). These two key indicators can be evaluated through analysis of ongoing monitoring results. The two key indicators are:

- groundwater quality; and
- vegetative cover.

Surface water quality has not been selected as a key indicator given the lack of surface water anticipated post-closure. The closest watercourses are located approximately 3 km (Vlermuisleegte) and 6 km (Witleegte) from the MMT. They are ephemeral in nature and highly seasonal.

The first indicator – groundwater quality – is an important measure of the effectiveness of mitigation activities (for final landforms) and for protecting the health and safety of neighbouring and/or down gradient land users, livestock, and wildlife.

The second indicator – vegetative cover – is highly correlated with all the other major environmental parameters of the area, including erosion, dust, physical stability, chemical stability, soil quality and hydrology. Good vegetative cover results in a reduction in the volume of surface runoff, increases soil and slope stability, and leads to the formation of an organic layer. In addition, vegetative growth is visually correlated with successful rehabilitation (and/or protection of the surrounding environment). This is an extremely important indicator because it provides a simple, very effective and relevant measure of the land's current (and/or future) capability.

5.4 REASSESSMENT OF RISKS

An environmental monitoring programme has been established at the MMT to provide early warning systems necessary to avoid environmental emergencies, and for informing continual improvement of the mine-closure plan. The monitoring programme includes:

- surface water resource quality;
- groundwater resource quality;
- air quality; and
- disturbance of biodiversity.

The environmental manager will conduct internal management audits against the commitments in the EMPr in accordance with an annual audit plan. The audit findings will be documented for both record-keeping purposes and for informing continual improvement of the mine-closure plan. In addition, an independent qualified professional will conduct an EMPr performance assessment in accordance with the relevant NEMA Regulations (GNR 982, 2014).

5.5 FINANCIAL PROVISION FOR LATENT ENVIRONMENTAL IMPACTS

The costs associated with the post-closure management and monitoring of environmental impacts has been estimated and included in the overall closure cost liability calculations (see Section 13). Groundwater quality is not expected to change as a result of the proposed layout/activity changes at MMT. No specific residual or latent environmental impacts have been costed at this stage. Additional remediation activities (i.e. remediation activities not currently anticipated which may later be required) will be identified during the on-going operation of the mine through the various monitoring programmes, environmental audits and/or updated risk assessment and pollution potential studies.

6. CLOSURE AND DESIGN PRINCIPLES

6.1 LEGAL AND GOVERNANCE FRAMEWORK

This report has been drafted in accordance with the Financial Provisioning Regulations, 2015 (GNR 1147, 2015), for inclusion into the EIA for the project. The financial provision was calculated as per the methodology used by South32 for the calculation of existing closure liabilities at MMT (South32, 2019) that uses site-specific decommissioning and rehabilitation rates.

It is a requirement of the Environmental Impact Assessment Regulations, 2014 (GNR 982, 2014) that a closure plan must contain the information set out in Appendix 4 of these Regulations, and, where the application for an environmental authorisation is for prospecting, mining, exploration, extraction and primary processing of a mineral or petroleum resource or activities directly related thereto, the closure plan must address the requirements as set in the Financial Provisioning Regulations, 2015 (GNR 1147, 2015).

It is a requirement of the Mineral and Petroleum Resources Development Amendment Bill, 2013 (Bill 15 of 2013) that the holder of a mining right must make the prescribed financial provision for the rehabilitation and management of any negative environmental impacts due to mining activities.

This project also includes the authorisation of specific water uses in terms of Section 21 of the National Water Act (NWA) (No. 36 of 1998) – Procedural Requirements for Water Use Licence (WUL) applications (GNR 267, 2017). These regulations outlined the minimum content (Appendix 7 of GNR 267) required for a mine-closure and/or rehabilitation report. This report therefore also takes cognisance of these requirements.

6.2 VISION, OBJECTIVES AND TARGETS FOR CLOSURE

The vision, objectives and targets for closure have been developed against the local environmental and socio-economic context of the proposed project, as well as regulatory requirements and stakeholder issues and concerns.

Stakeholders will continuously be involved in the closure planning process throughout the mine life. This project forms part of the overall closure for the MMT. The MMT will strive to maintain a good working relationship with stakeholders and the local communities in which they operate. Agreements and final approval will be sought from authorities as closure approaches.

6.2.1 Vision for closure

The overall vision for closure of the MMT mine is to minimise the impacts associated with the closure and decommissioning of the mine, and to restore the land to a functioning post-mining land use of grazing.

6.2.2 Objectives for closure

The preliminary closure plan objectives and principles have been developed for the proposed project against the background of the mine location in the Kuruman region of the Northern Cape, and include the following:

- that environmental damage is minimised to the extent that it is acceptable to all parties involved;
- that contamination beyond the mine site by surface run-off, groundwater movement and wind will be prevented;
- that mine closure is achieved efficiently, cost effectively and in compliance with the law;
- that the social and economic impacts resulting from mine closure are managed in such a way that negative socio-economic impacts are minimised; and
- rehabilitate the land to achieve an end use of grazing to the extent reasonably possible.

Additional and more specific closure objectives may be tied to the final land use for the entire MMT mining right area, and these will be determined in collaboration with local communities and other stakeholders during the ongoing operations of the MMT.

6.2.3 Targets for closure

The closure target outcomes for the MMT site are therefore assumed to be as follows:

- to achieve chemical, physical and biological stability for an indefinite, extended time period over all disturbed landscapes and residual mining infrastructure;
- to protect groundwater, soils and other natural resources from loss of current utility value or environmental functioning;
- to limit the rate of emissions into the atmosphere of particulate matter to the extent that degradation of the surrounding areas' land capability or environmental functioning does not occur;
- to maximise visual 'harmony' with the surrounding landscape; and
- to create a final land use that has economic, environmental and social benefits for future generations that outweigh the long-term aftercare costs associated with the mine.

6.3 ALTERNATIVE CLOSURE OPTION

No alternative closure and post-closure options have been considered at this stage. Any alternative and practical closure and post-closure options will be investigated during the ongoing operations of the proposed mine.

6.4 MOTIVATION FOR PREFERRED CLOSURE OPTION

The preferred closure option for the disturbed areas associated with the proposed layout/activities changes is grazing. The approved EMPr (JAWS, 2005), indicates that the MMT site had a land use of grazing prior to the mining operations.

6.5 MOTIVATION FOR CLOSURE AND POST-CLOSURE PERIOD

A 2 to 3-year period for maintenance and aftercare is considered reasonable for the disturbed areas associated with the proposed layout/activities changes given that this is the time required for revegetation to re-establish (provided there is sufficient rainfall).

6.6 ON-GOING RESEARCH FOR PROPOSED CLOSURE OPTIONS

Further research regarding the proposed and/or alternative closure options will be ongoing during the remaining life of mine. In this regard, there needs to be monitoring of trial revegetation programmes to evaluate the effectiveness and sustainability of revegetation efforts; methods to further improve and/or optimise; as well as inform the post-closure maintenance and aftercare period.

Trials comparing two slope options (1V:5H versus 1V:7H), as well as trials comparing drainage options (1V:5H free draining slope versus 1V:5H benched slope) have already been undertaken (JAWS, 2018).

6.7 CLOSURE PLAN ASSUMPTIONS

The following assumptions are made for the development of the preliminary closure plan at this stage of the proposed project:

- MMT will follow and adhere to the commitments made in the EMPr;
- MMT will follow the mine layout to minimise the potential for additional disturbed areas;
- runoff water quality from rehabilitated areas will be acceptable and will not require any further treatment;
- no consideration of the social closure costs has been included in this report;
- no assessment of any socio-economic/shared value/ community-based programmes being implemented and whether these would continue post-closure of the operation;

- all costs associated with pre-closure monitoring, auditing and reporting are presumed to be covered under the operations expenditure of the mine, and have not been included in this preliminary closure plan; and
- this preliminary closure plan focuses on the objectives for closure of the disturbed areas associated with the proposed layout/activities changes. MMT has a separate preliminary closure plan that caters for the overall MMT mine operations (JAWS, 2018).

These assumptions will be reviewed during the ongoing operations of the mine and any required technical work conducted in order to reduce information gaps and uncertainty prior to mine closure.

7. POST-CLOSURE LAND USE

With reference to Section 6.4, post-closure land use for the disturbed areas associated with the proposed layout/activities changes is grazing.

8. CLOSURE ACTIONS

The preliminary closure actions are currently as follows:

- dismantle and remove the mobile screening and crushing plant;
- dismantle and remove the pipeline from Middelplaats Mine to MMT;
- demolish and remove rail loadout station and associated substation;
- demolish and remove concrete channels for dirty stormwater management;
- dismantle and remove railway channels, ballast and sleepers; and
- revegetate the disturbed areas associated with the top-cut stockpile area, product stockpile area, contractor laydown areas, site access and temporary roads, and railway loop.

Generally accepted closure methods have been used as the basis for determining the closure cost liability. Further detail is provided below.

8.1 MOBILE SCREENING AND CRUSHING PLANT

- Plant infrastructure will all be dismantled, and salvageable elements will be decontaminated, sold and removed from site.
- Inert non-salvageable elements including concrete, plastic liners, brickwork, conveyor belting or other such items will be dismantled or broken up and disposed of at the designated waste disposal area at the MMT.
- Concrete foundations, hardstand areas and underground services (e.g. electrical, water and sewer) will all be removed or buried at least 1 m below natural ground surface.
- Contaminated soil from the decommissioned areas that can be remediated (i.e. hydrocarbons associated with diesel, oil, grease) will be excavated for on-site bioremediation at a designated area.
- Decommissioned plant infrastructure areas will be landscaped and levelled so that the areas are free-draining and that there is no ponding of water.
- Decommissioned plant infrastructure areas will be ripped and revegetated with indigenous species to align to the surrounding natural environment as far as practical.

8.2 THE PIPELINE FROM MIDDELPLAATS MINE TO MMT

- The pipeline will be dismantled, decontaminated and recycled for scrap, resale or donation to local communities.
- Inert material such as concrete foundations will be disposed of at the designated waste disposal area at the MMT.
- In areas where the servitude of the pipeline has been cleared of vegetation, these areas should be ripped to promote the re-establishment of indigenous vegetation.

8.3 RAIL LOADOUT STATION AND ASSOCIATED SUBSTATION

- Rail loadout station and associated Infrastructure (e.g. substation) will all be dismantled, and salvageable elements will be decontaminated, sold and removed from site.
- Inert non-salvageable elements including concrete, brickwork or other such items will be dismantled or broken up and disposed of at the designated waste disposal area at the MMT.
- Concrete foundations, hardstand areas and underground services (e.g. electrical, water and sewer) will all be removed or buried at least 1 m below natural ground surface.
- Contaminated soil from the decommissioned areas that can be remediated (i.e. hydrocarbons associated with diesel, oil, grease) will be excavated for on-site bioremediation at a designated area.

- Decommissioned plant infrastructure areas will be landscaped and levelled so that the areas are free-draining and that there is no ponding of water.
- Decommissioned plant infrastructure areas will be ripped and revegetated with indigenous species to align to the surrounding natural environment as far as practical.

8.4 STORMWATER MANAGEMENT INFRASTRUCTURE

- Lined concrete channels and silt trap (to the pollution control dam (PCD)) will all be broken up and disposed of at the designated waste disposal area at the MMT.
- Channel, silt trap and PCD areas will be landscaped and levelled so that the areas are free-draining and that there is no ponding of water.
- Channel, silt trap and PCD areas will be ripped and revegetated with indigenous species to align to the surrounding natural environment as far as practical.

8.5 RAILWAY CHANNELS, BALLAST AND SLEEPERS

- Railway infrastructure will all be dismantled, and salvageable elements (e.g. railway channels) will be decontaminated, sold and removed from site.
- Inert non-salvageable elements including ballast and concrete sleepers will be disposed of at the designated waste disposal area at the MMT.
- Contaminated soil from the railway loop area that can be remediated (i.e. hydrocarbons associated with diesel, oil, grease) will be excavated for on-site bioremediation at a designated area.
- Decommissioned railway loop areas will be landscaped and levelled so that the areas are free-draining and that there is no ponding of water.
- Decommissioned railway loop areas will be ripped and revegetated with indigenous species to align to the surrounding natural environment as far as practical.

8.6 CONTRACTOR AREAS

- Decommissioned contractor areas (including laydown areas, site offices, access roads and site entrance point/security check) will be landscaped and levelled so that the areas are free-draining and that there is no ponding of water.
- Decommissioned contractor areas will be ripped and revegetated with indigenous species to align to the surrounding natural environment as far as practical.

8.7 REVEGETATION

Revegetation of disturbed areas will be undertaken by replacing the previously stockpiled topsoil and growth medium materials (typically a 300 mm layer), ameliorate (where required) and planting with indigenous grasses (i.e. dry seeding) and deep rooted species such as trees/shrubs (i.e. hand planting of seedlings).

Grass and tree species to be used for revegetation will need to be carefully selected based upon their soil-building capabilities, erosion-protection characteristics, natural occurrence in the area, social/commercial value, and wildlife habitat value. It is recommended that field trials be undertaken during the mining operations to best determine the plant species and methodology for re-establishing vegetation. Revegetation activities also need to be carefully undertaken so as not to unnecessarily introduce any alien and/or invasive plant species into the area.

It is recommended that seed and plant harvesting be undertaken using vegetation from the surrounding area. Seed collection should be done preferably from April to May. Grass seeds in particular should be harvested as well as pods (from deeper-rooted species). A suitable seed store should be established on site. Also, an on-site

nursery to germinate tree and shrub species should also be established to provide sufficient stock for revegetation.

Field trials should be undertaken to determine the most successful methods of revegetation and will include the evaluation of the use of plugs (seedlings), local seed harvesting, commercially available seed mixes, planting aids (e.g. hydrogel, fertilizer), wet (hydroseeding) or dry seeding techniques, water requirements, maintenance and aftercare requirements, and the time taken to meet the criteria for revegetation success.

Key revegetation challenges include:

- reducing sand movement (burial) and erosion to allow seedling establishment to take place;
- low soil nutrient content (that can be further aggravated by incorrect storage);
- low (and unpredictable/erratic) rainfall in an arid environment i.e. all planting activities should be undertaken at the end of the dry season, although there may still be insufficient summer rainfall to ensure sufficient growth; and
- establishing key stone (deep-rooted) species that assist to promote biodiversity (i.e. shallow-rooted species) through hydraulic lift and soil stabilisation.

8.8 GROUNDWATER MANAGEMENT

No groundwater management is currently anticipated. This will however be investigated and confirmed in subsequent closure plan updates and through ongoing groundwater monitoring for the MMT. The following recommendations should be addressed as part of this work:

- An audit on the monitoring network should be undertaken to identify where improvements to infrastructure is required to prevent possible anthropogenic contamination and to aid the integrity of the water quality monitoring exercise.
- The cumulative impact on groundwater levels due to other surrounding mining operations such as at United Manganese of the Kalahari, Middelplaats and Tshipi Borwa Mine should be determined to understand the regional effect on groundwater levels.

8.9 MAINTENANCE AND AFTERCARE

The rehabilitated areas will require some form of aftercare and maintenance to ensure closure success. Activities will typically include erosion control and filling of erosion gullies on slopes; fertilising of struggling rehabilitated areas; monitoring of groundwater quality; monitoring of vegetation composition and diversity; control and eradication of alien plants; monitoring slope stability of waste rock dumps, monitoring of dust fallout and creating firebreaks .

9. SCHEDULE OF CLOSURE ACTIONS

The decommissioning activities (as identified in Section 8 previously) will occur simultaneously with the decommissioning of the existing MMT plant at mine closure. Similarly, the rehabilitation of the disturbed areas will occur simultaneously with the rehabilitation of the existing MMT plant and stockpile areas at mine closure.

10. ORGANISATIONAL CAPACITY

The key personnel who ensure compliance with the EMPr commitments are the project's environmental specialists and superintendent. As a minimum, these roles as they relate to the implementation of monitoring programmes and management activities include:

- minimising the areas of possible disturbance by mining activities;
- informing and committing to follow the annual rehabilitation plan;
- ensuring that the monitoring programmes, audits, and plan updates/reviews are scoped and included in the annual mine budget;
- identifying and appointing appropriately qualified specialists/engineers to undertake the monitoring, auditing and planning work;
- integrating closure planning into the overall mine operations and mine planning work;
- appointing specialists in a timeously manner to ensure work can be carried out to acceptable standards;
- liaising with the relevant structures in terms of the commitments in the Closure Plan;
- ensuring that commitments in the Closure Plan are undertaken and implemented;
- establishing and maintaining good working relations with surrounding communities and landowners; and
- facilitating stakeholder communication, information sharing and grievance mechanisms.

11. GAP IDENTIFICATION

Current gaps (and/or known unknowns) associated with the closure plan that will be addressed during the ongoing operations of the mine and will be part of the overall MMT closure plan include:

- identifying what species of grasses, shrubs and trees will best support the post closure land use of grazing on the various rehabilitated sites;
- assessing the likelihood and/or presence of any Category 1 alien invasive plant species on site;
- investigating what work activities of the closure plan can be undertaken during operations as part of the annual rehabilitation planning;
- establishing a closure plan committee that will meet on a regular basis to inform the closure-planning process;
- undertaking a detailed environmental and closure risk assessment to fully evaluate the potential environmental and closure risks and possible mitigation/control strategies; and
- initiating trials of seed collection and germination (i.e. on-site nursery) to inform: (i) the revegetation plan (i.e. suitable plant species and methodology for re-establishing vegetation) and (ii) to provide sufficient plant stock for revegetation purposes.

12. RELINQUISHMENT CRITERIA

Relinquishment criteria will be developed in communication with the regulatory authorities and project stakeholders to define specific end-points that demonstrate the closure objectives have been met. Two key indicators have been defined which will facilitate evaluation of closure objectives for the merged WRD having been met at the MMT. These two key indicators can be evaluated through analysis of ongoing monitoring results. The two key indicators are:

- groundwater quality, and
- vegetative cover.

Surface water quality has not been selected as a key indicator given the lack of surface water anticipated post-closure. The closest watercourses are located approximately 3 km (Vlermuisleegte) and 6 km (Witleegte) from the MMT. They are ephemeral in nature and highly seasonal.

The first indicator – groundwater quality – is an important measure of the effectiveness of mitigation activities (particularly for the latent environmental impact of groundwater associated with the open pit and remaining waste rock facilities) and for protecting the health and safety of post-closure land users, neighbouring and/or down gradient land users, livestock, and wildlife.

The second indicator – vegetative cover – is highly correlated with all the other major environmental parameters of the area, including erosion, dust/air quality, physical stability, chemical stability, soil quality and hydrology. Good vegetative cover results in a reduction in the volume of surface runoff, increases soil and slope stability, and leads to the formation of an organic layer. In addition, vegetative growth is visually correlated with successful rehabilitation (and/or protection of the surrounding environment). This is an extremely important indicator because it provides a simple, very effective and relevant measure of the land's current (and/or future) capability.

An additional key indicator covering landscape function analysis (LFA) may need to be incorporated in future. The stability of a rehabilitated area (or cover) can be determined by LFA which evaluates the area for a number of parameters and then lists three indices that can be tracked over time to see if the system is improving. If the LFA scores have been calibrated for the area, using indicative reference scores, a final score for each parameter index can be set to use as the target (relinquishment) state.

13. CLOSURE COST ESTIMATION

13.1 CLOSURE COST ASSUMPTIONS

The closure plan and cost estimate assumptions are outlined in Section 6.7.

13.2 CLOSURE COST METHODOLOGY

13.2.1 Quantities

The quantities have been calculated from the site layout plan (

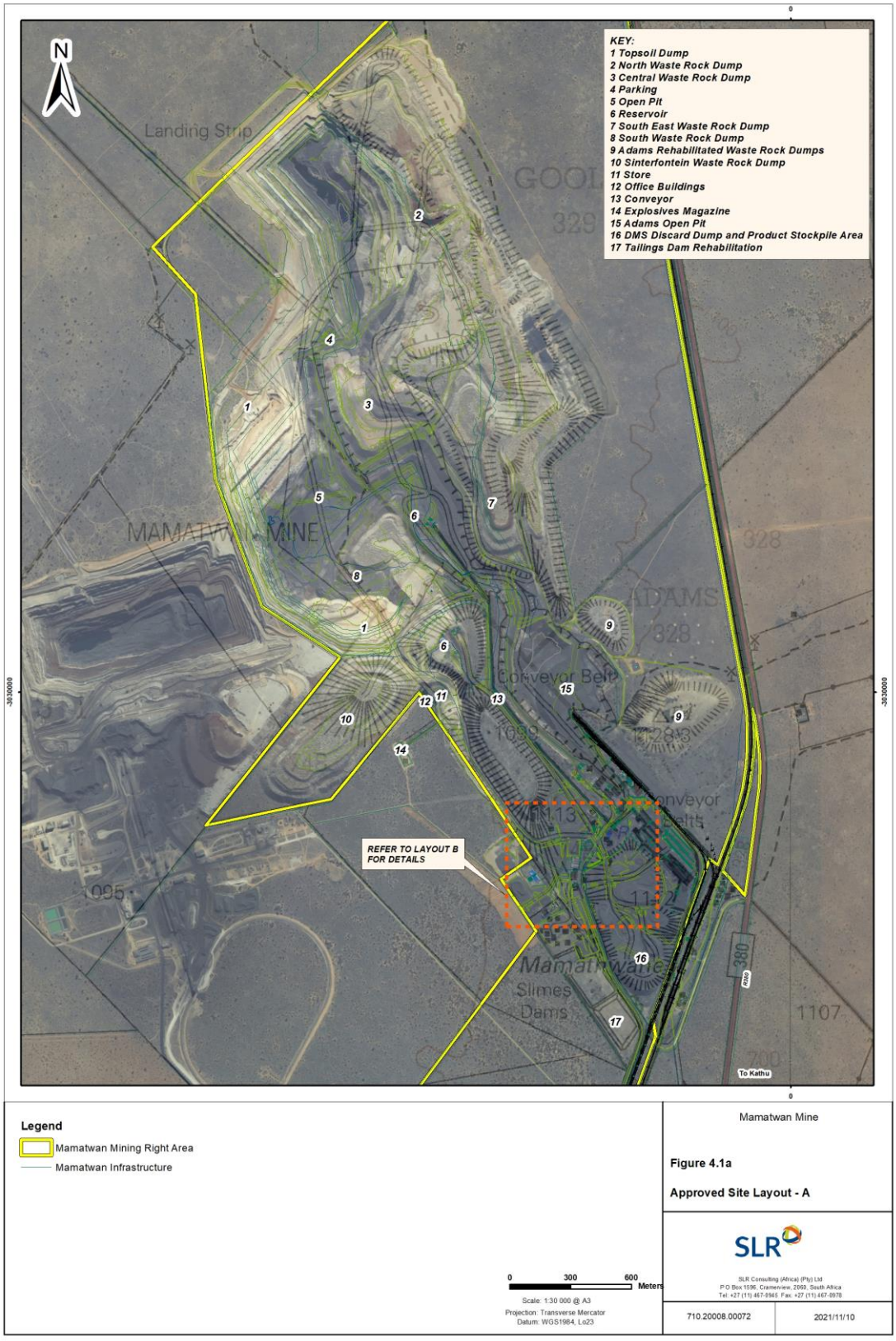

Figure 2) and project plan.

13.2.2 Unit rates

The unit (Master) rates for each closure component are taken from the existing South32 financial provision for MMT (South32, 2019), and inflated by 8.4 [1] to 9.4% [2] to account for escalation up to August 2021.

Table 13-1: Unit (master) rates

Activity	Unit	South32 Rate (December 2019)	Escalated Rate (August 2021)
Decommissioning and revegetation			
Demolishing of structures	m^2	R 683.20	R 747.47
Scrap steel removal	t	R 1,882.47	R 2,059.55
Dismantle and remove small diameter pipeline (above ground)	m	n/a	R 54.92
Demolish concrete slabs	m^2	R 200.92	R 219.82
Remove railway channels	m	R 190.34	R 208.24
Remove ballast and sleepers	m^3	n/a	R 47.02
Ripping and scarifying compacted areas	m^2	R 8.98	R 9.82
Topsoil	m^3	R 38.03	R 41.61
Ameliorate and vegetation	ha	R 43,600.00	R 47,248.20
Maintenance and Aftercare			
Care and maintenance	ha	R 13,609.53	R 14,748.30
Engineering and Management			
Development of Closure Plan (to incorporate project into current closure plan)	hr	R 1,633.14	R 1,769.79
Detailed design closure requirements (to incorporate project into current closure plan)	hr	R 1,633.14	R 1,769.79
Supervision costs	hr	R 1,360.95	R 1,474.83
Management costs	hr	R 2,041.43	R 2,212.25
P&G and Contingency			
Preliminary and general (P&G) costs	%	6	6
Contingency	%	0	0

The escalated rates (as of August 2021) were utilised in the closure cost calculation.

13.3 CLOSURE COST CALCULATION

The closure cost calculation for the proposed layout/activity changes at MMT amounts to **R 13,900,305 (excluding VAT).** The detailed calculations are included in Appendix B.

[1] Equipment rates escalated using appropriate CPAP diesel, material and plant indices since June 2019.
[2] Labour rates escalated using CPI index since June 2019.

14. ANNUAL REHABILITATION PLAN

According to the Financial Provisioning Regulations, 2015 (GNR 1147, 2015), the objectives of the annual rehabilitation plan are to:

- Review concurrent rehabilitation and remediation activities already implemented;
- establish rehabilitation and remediation goals and outcomes for the forthcoming 12 months, which contribute to the gradual achievement of the post-mining land use, closure vision and objectives identified in the holder's final rehabilitation, decommissioning and mine-closure plan;
- establish a plan, schedule and budget for rehabilitation for the forthcoming 12 months;
- identify and address shortcomings experienced in the preceding 12 months of rehabilitation; and
- evaluate and update the cost of rehabilitation for the 12-month period and for closure, for the purposes of supplementing the financial provision guarantee or other financial provision instrument.

Rehabilitation will be undertaken concurrently with mining operations, based on the rehabilitation plan developed for the mine. The mining plan/schedule will be optimised to facilitate continuous rehabilitation. The strategy for continuous rehabilitation is as follows:

- Waste rock will be placed back into the pits to 25 m below original ground level.
- The full depth of available soils and subsoils will be placed on to the hard rock spoils, as far as is practical, so as to limit ingress.
- The calcrete material will be placed over the hard rock spoils in order to facilitate the development of an aquiclude over the spoils.
- Vegetation that is local to the area will be established to limit the risk of erosion.
- The mining plan/schedule will ensure optimal placement of waste rock to facilitate concurrent rehabilitation.
- The mining plan/schedule will be updated on an annual basis.
- Rehabilitation monitoring and auditing will be implemented to ensure conformance to this objective and the rehabilitation plan.

15. MONITORING, AUDITING AND REPORTING

15.1 PRE-CLOSURE MONITORING, AUDITING AND REPORTING

The environmental specialist will conduct internal audits against the commitments in the EMPr. Pre-closure monitoring will be done in line with the proposed monitoring programme outlined in the EMPr.

In accordance with Regulation 55 of the Mining Regulation 527 (23/04/2004), and Regulation 982 of the National Environmental Management Act (107 of 1998) (NEMA) (4/12/2014), an independent professional will conduct a performance assessment every 2 years. The site's compliance with the provisions of the EMPr and the adequacy of the EMPr is assessed in the performance assessment.

In accordance with the Financial Provisioning Regulations, 2015 (GNR 1147, 2015), financial provision for closure, as well as unforeseen premature closure will be updated on an annual basis. This update will be carried out by external and independent environmental consultants.

All costs associated with pre-closure monitoring, auditing and reporting are assumed to be covered under the operational expenditure of the mining operations and have not been included in this report.

15.2 POST-CLOSURE MONITORING, AUDITING AND REPORTING

Post-closure care and maintenance, auditing and reporting will comprise:

- Post-closure care and maintenance activities for a 2 to 3-year period as outlined below;
- the continuation of external EMPr performance assessments by an independent professional until such time as a closure application is applied for; and
- the continuation of annual financial provision updates by external and independent environmental consultants until such time as a closure application is applied for.

Table 15-1: Post-closure aftercare and maintenance programme

Rehabilitation targets	Method of monitoring	Frequency of monitoring	Aftercare and maintenance period	Actions to be taken if target is not reached
Vegetation cover	Visual biodiversity inspections by a qualified person to ensure that vegetation cover has re-established	Annual monitoring	Aftercare and maintenance will take place for 2 to 3 years.	If a reasonable assessment indicates that the re-establishment of vegetation is unacceptably slow, the soil will need to be analysed, fertilised/ameliorated and the area seeded with a seed mix of indigenous species
Erosion control	Visual inspections to ensure that erosion gullies have not developed	Annual monitoring	Aftercare and maintenance will take place for 2 to 3 years.	Erosion management measures and/or mitigation measures to be confirmed through ongoing field trials.
Removal of alien and invasive species	Visual biodiversity inspections by a qualified person to ensure that alien invasive species have not established	Annual monitoring	Aftercare and maintenance will take place for 2 to 3 years.	All illegal invader plants and weeds shall be dealt with as required in terms of the relevant legislation.

The vegetative cover monitoring programme is designed to verify that rehabilitated areas are successfully developing a productive, self-sustaining ecosystem, which facilitates the post-closure land use. The success of the vegetative cover is an important aspect in rehabilitation because of its impact on other parameters such as the extent of soil development, soil chemistry and surface erosion (by water and wind).

The major potential concerns with vegetative cover on rehabilitated areas are related to the adequacy of ground cover, the overall density of tree/shrub (woody) species and species composition (promote the growth of indigenous species and limit the spread of alien invasive species). The vegetative cover monitoring programme has been designed to evaluate these parameters where appropriate to ensure long-term environmental protection and the suitability of rehabilitated areas for post-closure land use.

Further detail pertaining to the vegetation monitoring programme is provided below. The success of the monitoring programme will be evaluated considering the vegetation cover indicators outlined in Section 12.

15.2.1 Vegetation cover analysis

The adequacy of vegetative ground cover in providing effective erosion control, habitat establishment and soil building for post-closure land uses is related to the percentage of ground surface covered by vegetation and its products. Analysis of the percentage of vegetative cover involves determining the percentage of ground surface that falls under the live parts of plants (the crown cover) or the aerial parts plus the mulch (the basal cover). The Notched Boot Method can be utilised for determination of the percentage of vegetative cover on rehabilitated areas; however, the latest developed methods must also be considered in order to ensure the best procedure is used.

15.2.2 Tree/shrub density analysis

The density of tree and shrub (woody) species on rehabilitated areas provides an indication of the success of efforts in re-establishing a diverse forest/bush environment for post-closure land use. A direct count of woody species within belt transects is utilised to determine the density of woody species on rehabilitated areas. Selected transects used in the rehabilitated areas for analysis of vegetative cover percentage will be utilised for determining woody species density. A 2 m wide by 100 m long rectangular plot centred on each transect line selected will be demarcated and the number of plants of woody species that are rooted in each plot will be counted, even if not all of an individual plant's aerial canopy is within the plot. Likewise, plants whose aerial canopy overlap the plot but are not rooted within the plot will not be counted. This method is effective in determining woody species density in areas of low to semi-dense stands of vegetation.

15.2.3 Species composition analysis

The composition of indigenous species (and/or common commercial species due to previous farming activity) within rehabilitated areas also provides an indication of the success of revegetation efforts in re-establishing a diverse bush environment which is similar to that found in nearby undisturbed areas, thereby ensuring similar productive capability of the rehabilitated area for post-closure land use. A direct count of vegetative species composition is undertaken on portions of selected belt transects utilised for analysis of woody species density in order to determine the percentage of indigenous species (and/or common commercial species due to previous farming activity) growing on rehabilitated areas.

All vegetation rooted within a representative 5 m long section of each belt transect selected will be identified and classified as either indigenous/common commercial or alien.

15.2.4 Historic reference sampling in reference areas

Representative vegetation reference plots (with similar/identical land uses as per the proposed post-closure land use of rehabilitated mine areas) will be demarcated areas near rehabilitated mine areas for determining the

degree of achievement of rehabilitation success criteria for vegetative cover. This procedure, known as historic record sampling, provides an indication of the percentage of ground cover, woody species density and percentage of indigenous species found in undisturbed areas. Vegetative growth on reference plots will be compared with the vegetation on rehabilitated areas. These reference areas will be at least 2500 m^2 in size. Analysis of vegetative cover percentage, tree/shrub density, and percentage of indigenous species will be undertaken on each reference plot.

The results of these analyses will be compared with the results of similar analyses on rehabilitated areas as described in Sections 15.2.1, 15.2.2 and 15.2.3 to determine the degree of achievement of rehabilitation success for vegetative cover.

15.2.5 Vegetation monitoring schedule

Vegetative cover monitoring will begin one year after completion of revegetation activities and continue annually until rehabilitation success for vegetative cover is achieved. Assessments will be done by trained staff under the supervision of a qualified professional. Vegetative cover monitoring will be completed each year during the seasonal period of peak standing biomass.

Should vegetative cover monitoring after the first year of the aftercare period on any rehabilitated area indicate that the vegetation in that area is not developing in a manner that will lead to achieving vegetative cover success criteria, then necessary remedial measures will be undertaken to enhance vegetative growth in that area to the extent that required standards can be expected to be met.

Rehabilitation success for the vegetative cover will be demonstrated when the following criteria are met:

- The percentage of basal cover on rehabilitated areas is greater than or equal to 8%.
- The density of tree/shrub species (expressed as woody plants per ha) on rehabilitated areas is greater than or equal to 80% of the density of tree/shrub species found on corresponding reference plots with a similar land use.
- Species composition is similar to the species composition of nearby reference plots.
- No Category 1 alien invasive plant species occur on site.
- Achievement of the rehabilitation success criteria for vegetative cover will ensure that a productive, self-sustaining vegetative community has been established which facilitates a sustainable post-closure land use.

16. CONCLUSION

This preliminary closure plan has been prepared in accordance with the National Environmental Management Act (NEMA) (107/1998) - Financial Provisioning Regulations, 2015 (GNR 1147, 2015).

The proposed layout/activity changes at MMT that have been costed as part of the financial provision of this report include: the top-cut stockpile area, the mobile crushing and screening plant, and the new pipeline from Middelplaats Mine to MMT. The closure cost calculation for the proposed layout/activity changes at MMT amounts to **R 13,900,305 (excluding VAT)**. This amount will be incorporated into the overall MMT mine-closure plan and the annual financial provision updates. Layout/activity changes that have already taken place (and are not part of the approved EMPr) have been previously included in the South32 financial provision.

Stephen van Niekerk
(Project Manager / author)

Sharon Meyer
(Reviewer)

17. REFERENCES

GNR 267, 2017. GNR 267 of the National Water Act (36/1998) – *Regulations regarding the Procedural Requirements for Water Use Licence Applications and Appeals*. 24 March 2017.

GNR 982, 2014. GNR 982 of the National Environmental Management Act (107/1998) - *Environmental Impact Assessment Regulations, 2014*. 4 December 2014.

GNR 1147, 2015. GNR 1147 of the National Environmental Management Act (107/1998) - *Regulations pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations*. 20 November 2015 (Financial Provisioning Regulations, 2015).

JAWS, 2005. *Environmental Management Programme – Mamatwan Mine*. Jones and Wagener Consulting Civil Engineers. Report No: 64/05/A095. June 2005.

JAWS, 2018. *Mamatwan Manganese Mine – Conceptual Rehabilitation Design Report.* Jones and Wagener Consulting Civil Engineers. Report No: JW078/17/F986 – Rev 1. March 2018.

SLR, 2019. *Financial Provision for the Merging of the Mamatwan Sinterfontein and Tshipi Eastern Waste Rock Dumps. SLR Consulting*. April 2019. (Specialist report as part of Basic Assessment Report and Environmental Management Programme Report for the Merging of the Mamatwan Sinterfontein Waste Rock Dump and the Tshipi Eastern Waste Rock Dump, April 2019).

South32, 2019. *Mamatwan mine (NC252MR) DMR financial provision FY19*. South32. 6 December 2019.

Appendix A: Curricula Vitae

Appendix B: Detailed Closure Cost Calculation

CLOSURE COST ASSESSMENT
(COST AT AUGUST 2021)

Item	Description	Project component	Works	P&G	Total
				6%	
1	Sealing of Shafts	-	R0	R0	R0
2	Demolition of Plant	Mobile crusher, Abstraction pipeline and Loadout station	R1 144 454.26	R68 667.26	R1 213 121.52
3	Demolition of Buildings and Structures	Stormwater infrastructure	R1 063 489.16	R63 809.35	R1 127 298.51
5	Demolition of Roads, Railways and Platforms	Railway loop	R790 022.04	R47 401.32	R837 423.36
7	Opencast Rehabilitation	-	R0	R0	R0
8	Rehabilitation of Pits and Dumps	-	R0	R0	R0
10	Fencing	-	R0	R0	R0
11	General Surface Rehabilitation	All newly disturbed areas	R8 881 945.28	R532 916.72	R9 414 861.99
12	Stormwater Management	-	R0	R0	R0
14	Maintenance and Aftercare	All newly disturbed areas	R716 214.32	R42 972.86	R759 187.18
15	Engineering and Management Cost	All newly disturbed areas	R517 370.06	R31 042.20	R548 412.26
		TOTAL	**R13 113 495.11**	**R786 809.71**	**R13 900 304.82**

Demolition of Plant
Cost @ August 2021

Area Description	Closure Activities	Quantum Costing

Mobile crusher and screen		Quantity	Unit	Rate ZAR	Total ZAR
	Area (footprint of structure)	180	m^2		
	Demolishing of Structures	180	m^2	747.47	R134 544.60
	Scrap Steel Removal	25	t	2 059.55	R51 488.75
HDPE abstraction pipeline		**Quantity**	**Unit**	**Rate ZAR**	**Total ZAR**
	Dismantle and remove above ground pipeline	9 805	m	54.92	R538 490.60
Rail loadout station		**Quantity**	**Unit**	**Rate ZAR**	**Total ZAR**
	Area (footprint of structure)	278	m^2		
	Demolishing of Structures	278	m^2	747.47	R207 796.66
	Scrap Steel Removal	103	t	2 059.55	R212 133.65

Summary - Demolition of Plant

TOTAL - Cost for demolishing, removal of scrap	**R1 144 454.26**

Demolition of Buildings and Structures
Cost @ August 2021

Area Description	Closure Activities	Quantum Costing

Stormwater infrastructure	Quantity	Unit	Rate ZAR	Total ZAR
Concrete channels	3 338	m^2	219.82	R733 759.16
Silt trap	1 500	m^2	219.82	R329 730.00

Summary - Demolition of Buildings and Structures

TOTAL - Cost for demolishing, removal of scrap	**R1 063 489.16**

Demolition of Roads, Railways and Platforms
Cost @ August 2021

Area Description	Closure Activities	Quantum Costing

Railway loop		Quantity	Unit	Rate ZAR	Total ZAR
	Remove railway channels	2 985	m	208.24	R621 596.40
	Remove ballast & sleepers, and dispose	3 582	m³	47.02	R168 425.64

Summary - Demolition of Roads, Railways and Platforms

TOTAL - Cost for demolishing, removal of scrap	**R790 022.04**

General Surface Rehabilitation
Cost @ August 2021

Area Description	Closure Activities	Quantum Costing

Topsoil = 0.3

Rehabilitation of Disturbed land		Quantity	Unit	Rate ZAR	Total ZAR
	Top cut stockpile area	340 000			
	Product stockpile area	41 900			
	Contractor laydown area	14 700			
	Road to laydown area	22 250			
	Railway loop	44 775			
	Pollution control dam (PCD)	14 000			
	Contractor site entrance/security check	8 000			
	TOTAL	485 625			
	Ripping and scarifying compacted areas	485 625.00	m^2	9.82	R4 768 837.50
	Topsoil	145 687.50	m^3	41.61	R1 818 617.06
	Ameliorate and Vegetation	48.56	ha	47 248.20	R2 294 490.71

Summary - General Surface Rehabilitation

TOTAL - General Surface Rehabilitation (Profiling, Topsoiling, Ripping & Vegetation)	**R8 881 945.28**

Engineering, Care and Maintenance Costs
Cost @ August 2021

Area Description	Closure Activities	Quantum Costing

	Quantity	Unit	Rate ZAR	Total ZAR
Development of Closure Plan (to incorporate project into current closure plan)	40	hrs	1 769.79	R70 792
Detailed design closure requirements (to incorporate project into current closure plan)	64	hrs	1 769.79	R113 267
Supervision costs	130	hrs	1 474.83	R191 728
Management costs	64	hrs	2 212.25	R141 584
Care and Maintenance	48.56	ha	14 748.30	R716 214

Summary - Engineering, Care and Maintenance Costs

Engineering and Management costs	R517 370
Maintenance and Aftercare	R716 214
TOTAL - General Surface Rehabilitation (Profiling, Topsoiling, Ripping & Vegetation)	**R1 233 584**

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