SOUTH32 SA COAL HOLDINGS (PTY) LTD

VANDYKSDRIFT CENTRAL: MINING AND INFRASTRUCTURE DEVELOPMENT PROJECT
REHABILITATION, DECOMMISSIONING AND MINE CLOSURE PLAN, ANNUAL REHABILITATION PLAN AND ENVIRONMENTAL RISK ASSESSMENT REPORT

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SYNOPSIS

Background

South32 SA Coal Holdings (Pty) Ltd (South32), is the holder of an amended mining right for coal, granted by the Minister of Mineral Resources, in terms of the Mineral and Petroleum Resources Development Act, 2002 (MPRDA) and notarially executed on the 21st of May 2015 under DMR reference MP30/5/1/2/2/379MR, in respect of its Wolvekrans-Ifalethu Colliery[1] (hereafter referred to as MR379).

This mining right, (MR379), comprises of the following areas:

- Ifalethu Colliery (previously referred to as Wolvekrans North Section[2]) consisting of the Hartbeestfontein, Bankfontein (mining now ceased), Goedehoop, Klipfontein sections and the North Processing Plant; and
- Wolvekrans Colliery (previously referred to as the Wolvekrans South Section) consisting of the Wolvekrans, Vlaklaagte (mining ceased), Driefontein, Boschmanskrans, Vandyksdrift, Albion and Steenkoolspruit sections, as well as the South Processing Plants (Eskom and Export). Some of these areas were previously known as Douglas Colliery. The Vandyksdrift Central (VDDC) area falls within the footprint of historic underground mining operations at the old Douglas Colliery. In 2007, an amendment of the Environmental Management Programme Report (EMPR) for the Douglas Colliery operations was approved, to allow the opencast mining of the remaining No. 5, No. 4, No. 2 and No. 1 seams. The opencast mining operations include the extraction of the remaining pillars, as well as roof and floor extraction (Jaco-K Consulting, 2016(a)). Authorisation of the VDDC mining project included the following:
    - Opencast operation on the farm Kleinkopje 15 IS;
    - Opencast operation on the farm Steenkoolspruit 18 IS;
    - Pillar extraction operation on the farm Vandyksdrift 19 IS;
    - Reclamation of existing slurry ponds; and
    - Rewashing of existing discard dumps (PHD, 2006).

The water uses associated with the opencast mining has been authorised in terms of water use licence number 24084535 dated 10 October 2008.

The No. 2 seam workings are flooded with water and has to be dewatered to enable the open pit development to proceed. A dewatering strategy has therefore been developed and an application for Environmental Authorisation (EA) of the dewatering activities has been submitted to the Department of Mineral Resources and Energy (DMR)[3] (Jaco-K Consulting, 2016a). The water use activities associated with the dewatering strategy have been authorised by WUL number 06/B11F/GCIJ/7943 dated 19 July 2018.

The 2007 EMPR Amendment included limited additional infrastructure in support of the opencast mining operations as it was assumed at that stage that existing infrastructure will be used. The applications for the activities associated with the dewatering strategy, were limited to the infrastructure to facilitate dewatering (i.e. dewatering boreholes, pumps, pipelines, storage tanks, mechanical evaporators, roads and power lines).

[1] Middelburg Mine Services as per mining right

[2] This was previously referred to as Middelburg Colliery

[3] Previously DMR

A pre-feasibility investigation has since been conducted, and the need has been identified to develop additional infrastructure to support the proposed opencast mining. The departure was to use existing facilities as far as possible, since this is a brownfield development. However, the additional infrastructure includes the following:

- Storm water management structures (drains and berms);
- Water management measures for the management of mine impacted water;
- Overburden dumps;
- ROM coal stockpile areas;
- Mixed ROM coal and slurry stockpile areas;
- Topsoil stockpiles following clearance of vegetation;
- Pipelines for the conveyance of water;
- Hard park area and brake test ramp; and
- Haul roads and service roads.

In addition, the proposed VDDC opencast pit boundary as determined through the pre-feasibility investigation differs from the mine lay-out in the 2007 approved EMPR amendment. An area of approximately 196 hectares in the latest mine lay-out was not included in the previous mine lay-out and is therefore not approved to be opencast mined.

This consolidated closure-related report aims to address the Government Notice Regulation (GNR) 1147 requirements as promulgated under the provisions of the National Environmental Management Act, Act 107 of 1998 (as amended) (NEMA) and has been compiled in support of the environmental authorisation application associated with the VDDC infrastructure and mining development project.

Specifically, it provides the identified closure vision, objectives, actions, relinquishment criteria and monitoring objectives against which to assess successful rehabilitation of MR379 as GNR 1147 requires reporting to be undertaken per mining right. It also documents the planned rehabilitation strategy for the open pits and associated infrastructural areas, once mining commences.

Operational Context

The proposed infrastructure development forms part of the VDDC mining project. The construction phase will commence after authorisation for the infrastructure components has been obtained and is expected to commence in July 2020. The construction period is expected to be 18 – 24 months. The operational phase is expected to commence in 2022.

At the end of Life of Operation (LoOP), this disturbed footprint for VDDC will consist, mainly, of product stockpiles, roads, waste rock dumps, and infrastructure (workshops, offices, conveyor belt systems and a processing plant).

Closure Planning Context

Successful closure planning requires an understanding of the current site and regional conditions. The closure knowledge base as documented in this report describes the environmental, social and economic aspects, which will inform the development of the closure state.

The closure state is a detailed description of a sustainable post-closure site, as guided by the closure vision. It is a 'descriptive snapshot' of what the mine site will look like at the point of site relinquishment. All closure planning is aimed at the achievement of this closure state.

The closure vision for VDDC is **"*To achieve a sustainable, entrepreneurial-focused productive farming land use/s across the entire rehabilitated Wolvekrans MRA that: contributes towards the integrity of the local and regional catchment's ongoing fit-for-use surface water and groundwater resources, as well as ecological functionality; limits any health-and-safety risks to people and animals using the land; and creates opportunities for public-private partnerships with other local land users, that can continue to contribute to local job creation, and regional agricultural economic growth*".**

The closure objectives represent the key measurable closure targets for the various closure planning aspects - based on the determined closure state, that are within the operation's control. Ultimately, closure objectives should be contextualised to represent achievement of the closure vision and related closure state.

The closure objectives for VDDC include:

- Land use:
  - To mimic regional geomorphological features by maintaining a free-draining topography across the rehabilitated Mining Right Area (MRA),
  - To maintain a grazing land use, as defined in the Guidelines for the Rehabilitation of Mined Land (2007), over 80% of the rehabilitated portions of the MRA, that can sustain between 2.4 ha/LSU and/or 5t/ha carrying capacity.
  - To maintain a productive vegetation cover that supports a regional pasture-related carrying-capacity of 2.4 ha/LSU and/or 5t/ha of hay, at a vegetal cover of > 75%.
  - To achieve creation of habitats for local fauna expected to occur within the rehabilitated areas on which a grazing land use is taking place.
  - To maintain the visual landform as aligned to the approved surface rehabilitation landform design of the rehabilitated landscape, that blend into the surrounding areas.
- Water:
  - To continue to contribute to an agreed-on, predetermined catchment yield, based on calculated rehabilitated surface drainage densities, aligned to closure state date-specific climatic conditions.
  - To guide appropriate groundwater abstraction within the MRA to an authorised quantity.
  - To have implemented an alternative, agreed-on landowner/user-maintained groundwater supply or source for predefined landowner/user/s who were supplied water during mining operations.
  - To not exceed agreed-on, predefined surface water quality objectives (including PES and EIS), as stipulated in the RWQOs for the following catchments: B11B, B11F and B11G.
  - To limit the impact on the quality of the aquifer adjacent to the rehabilitated open pits by not exceeding the predefined groundwater quality objectives.
- Air quality
  - To maintain local air quality parameters to agreed-on, predefined human health-related standards, in terms of national ambient air quality of the Highveld Priority Area.

- Social
  - To achieve a safe and healthy environment for people and animals, through achievement of the land use, water and air quality closure objectives.
  - To have completed implementation of the closure-related projects agreed-on in the mine's approved Social and Labour Plan, focusing on personal skills development and local economic development.
- Substitute Economics
  - To have developed a plan for care-and-maintenance of remaining mining-related surface infrastructure that has a beneficial re-use, for hand-over to and accountability by the next landowner.
  - To have removed or demolished other infrastructure (non-mining related), except for those facilities that have been identified as having a beneficial post-mining use potential (e.g. powerlines, water pipelines, boreholes etc.)
  - To have identified public-private partnerships accountable for management and maintenance of the rehabilitated landscape as its long-term use/s.
  - To leave behind a rehabilitated landscape that will retain long-term economic value for future landowners.

Relinquishment criteria can be defined as final closure planning performance targets; the measurable component of the closure objectives. They provide standards against which the success of achievement of closure objectives can be measured and are recorded in **Table 1** including the monitoring requirements necessary to demonstrate the achievement of the relinquishment criteria for those objectives where potentially significant risks were assessed.

Risk Assessment

A qualitative risk assessment has been undertaken as a first step in identifying the possible uncertain future events that could influence the achievement of the planned project's identified closure objectives, post-site decommissioning (at the closure state). Most of these closure-related latent risks are linked to achieving long-term water management from mining areas.

Table 1 provides a description of the risks related to each closure objective. Those risks deemed significant have proposed mitigation measures.

Table 1: VDDC closure objectives, relinquishment criteria, closure environmental risks and monitoring requirements.

Closure Planning Aspect	Closure Objectives	Relinquishment Criteria	Closure-related Risk (What will result in not achieving the closure objective?)	Monitoring Requirements
Land use	To maintain a grazing land use, as defined in the Guidelines for the Rehabilitation of Mined Land (2007), over the rehabilitated portions of the Mining Rights Area, that can sustain between 2.4 to 5 ha/LSU and/or 5t/ha carrying capacity	Physical slope conforms to the parameters listed above describing the post-mining topography. Capping is not reduced to ≤250 mm within 50 years. A grazing-specific vegetative cover of ≥ 80% is present at areas destined for a grazing land use. Secondary grass species are persisting on pasture-related rehabilitated areas. Species include *Chloris gayana* (Rhodes grass), *Eragrostis tef* (Teff), and *Cynodon dactylon* (Kweek). No more than 10% loss of productivity on 80% of rehabilitated land, as: • Soil texture is 10 - 30% clay (arable) • Soil pH is between 5.5 - 8.5 • EC is ≤ 150 mS/m Organics are aligned to grazing capability needs	Inability to maintain a grazing land use	Rehabilitation designs and as-built drawings conforming to the relinquishment criteria – Once off Flora assessment – Annually Soils assessment – Annually
Surface water	To continue to contribute to an agreed-on, predetermined catchment yield, based on calculated rehabilitated surface drainage densities, aligned to closure state date-specific climatic conditions	Rehabilitated site contributes to maintaining a natural catchment MARs, as follows: • B11B: 61.30 million m^3/a • B11F: 147.9 million m^3/a • B11G: 164.00 million m^3/a	Reduction in downstream surface water yield to Olifants Catchment	Surface water flow meter monitoring – Quarterly
	To not exceed agreed-on, predefined surface water quality objectives (including PES and EIS), as stipulated in the RWQOsError! Bookmark not defined. for the following catchments: B11B, B11F and B11G	PES & EIS assessments correspond with the identified categories recommended for the delineated wetlands: • PES: C and/or D as determined by a wetland specialist • EIS: C and/or D as determined by a wetland specialist Surface water quality measured is within the water quality range as specified in the relevant WULs:	Deviation / exceedance of RWQ surface water objectives	Surface water monitoring – Quarterly Aquatic ecology monitoring – Bi-annually (dry and wet season) Wetland monitoring– Bi-annually (dry and wet season)
Groundwater	To guide groundwater abstraction within the MRA to an authorised quantity proven to have limited impacts on groundwater use within the rehabilitated MRA.	• Groundwater abstraction corresponds to Groundwater Management Plan (GMP) to avoid excessive abstraction and contaminant plume migration	Deviation / exceedance of authorised groundwater abstraction, resulting in a reduction in the groundwater yield that negatively impacts on groundwater volumes available to authorised borehole users	Groundwater level and quality monitoring – Quarterly
	To not impact on the quality of the aquifer adjacent to the rehabilitated open pits, by not exceeding the predefined groundwater quality objectives	Groundwater monitoring outside the pit boundary indicates no significant increase in chemical parameters within the natural aquifer/s, based on WUL & DWS water quality objectives. Groundwater quality measured is within the water quality range as specified in the relevant WUL:	Deviation / exceedance of the groundwater quality objectives	Groundwater monitoring – Quarterly
Air quality	To maintain local air quality parameters to agreed-on, predefined human health-related standards in terms of national ambient ait quality of the Highveld Priority Area	Air quality monitoring shows that dust and emissions are below air quality requirements for the Highveld Priority Area, as follows: Acceptable dust fallout rates Residential areas – Dust rate < 600 $mg/m^2/day$ (30-day average) Non-residential areas – Dust rate between 600 – 1200 $mg/m^2/day$ (30-day average)	Exceedance of authorised national ambient air standards	Air quality monitoring – Monthly during rehabilitation until no exceedance are recorded for a period of six months.
Social	To achieve a safe and healthy environment for people and animals, through achievement of the land use, water and air quality closure objectives	Land use, water and air quality relinquishment criteria have been met.	See land use, water and air quality	Not applicable
Substitute economics	To have demolished all mining-related infrastructure, except for those facilities that have been identified as having a beneficial	Asset register for infrastructure transfer. Transfer agreements, with signed-off Land Management Plan & Water Management Plan	Failure to demolish mining related infrastructure or to transfer beneficial facilities to the final land owner/user.	Not applicable

Closure Planning Aspect	Closure Objectives	Relinquishment Criteria	Closure-related Risk (What will result in not achieving the closure objective?)	Monitoring Requirements
	post-mining land use potential (e.g. for livestock watering, water management, etc).			

Knowledge Gaps

As the closure knowledge base improves over time, this baseline qualitative risk assessment would need to be refined. Investigations and actions have been identified for implementation during the mine's operational period including:

- Rehabilitation audits confirming the standard and sustainability of the rehabilitation undertaken to date.
- Updated hydrogeological study (including groundwater use outside of MRA).
- Updated approved rehabilitation designs for all areas.
- Wetland assessment of the entire site to determine post-mining PES & EIS.
- Updated social closure plan / social closure assessment.
- Socio-economic land use assessment.
- Development and approval of a long -term water management solution.

It is noted that this research is directly related to any studies that either provide alternative, more feasible closure options, assist in reducing uncertainties around the likelihoods and impacts of identified closure-related risks, and/or support selection of the preferred closure actions, that underpin the defined closure state.

Financial Provision Estimate

The demolition costing for VDDC was undertaken in September 2019 whereby existing information was reviewed, an itemised register was compiled and categorised, rates for demolition activities were determined, items for demolition were measured and quantified, and an itemised cost spreadsheet. The demolition and rehabilitation costing for VDDC is based on a LoM or LoOP scenario (i.e. planned closure scenario based on the mine works programme).

The approach followed for determination of the closure costs is as follows:

- Review of existing information towards gaining an understanding of the closure components and the corresponding activities required in terms of previous work done, regulations, guidelines and standards, as well as civil engineering construction standards and J&W's experience in similar projects.
- Compiling an itemised register of infrastructure/facilities as part of the VDDC infrastructure project to be demolished and/or rehabilitated or mitigated;
- Associating demolition, rehabilitation and mitigation activities with each item in the register and dividing these activities into industry construction-related categories.
- Applying realistic rates to the demolition, rehabilitation and remediation activities;
- Determining the quantities of all related items to be demolished, rehabilitated and/or mitigated; and
- Compiling an itemised cost spreadsheet with a detailed breakdown of the costs.

Table 2 provides the closure cost for the demolition of infrastructure and rehabilitation associated with the proposed VDDC infrastructure project (refer Appendix C1)

Table 2: VDDC infrastructure project demolition and rehabilitation costs

VDDC Infrastructure Project	Immediate Demolition Cost
Contractors laydown area	R 140 930.00
Dirty water drains	R 1 952 992.00
Dirty water pipelines to Vleishaft Dam	R 585 237.00
Dirty water pipeline to Water Treatment Plant	R 1 223 128.00
Drain culverts	R 2 991 796.00
Clean water pipeline (315 diameter)	R 128 163.00
Clean water pipeline (450 diameter)	R 2 072 932.00
EME hard park terrace and brake test ramp	R 1 018 236.00
Evaporators	R 332 975.00
Explosives magazine	R 543 720.00
Haul roads	R 6 169 046.00
Service roads	R940 593.00
Modular water treatment plant	R 54 168.00
Treated water pipeline	R 999 098.00
Stormwater drains and berms	R 554 178.00
Transfer tanks	R 13 325.00
Fencing	R 430 589.00
Opencast rehabilitation	R 296 165 229.00
TOTAL:	**R 316 316 334.00**

The demolition costs associated with the proposed VDDC infrastructure project was calculated based on the same assumptions as the costing for MR379[4]. The LoOP closure cost for the demolition of infrastructure associated with the proposed VDDC infrastructure project is R 20 151 105 (refer **Appendix C1**). These costs exclude VAT, P&Gs and contingencies.

The opencast rehabilitation associated with the proposed VDDC infrastructure project was calculated based on the end of LoOP volumes and rehabilitation designs provided by Golder & Associates (refer Appendix C2) and is R 296 165 229. These costs exclude VAT, P&Gs and contingencies.

The combined financial provision estimate for the proposed VDDC infrastructure mining project is R 316 316 334.00. These costs exclude VAT, P&Gs and contingencies.

Concluding Remark

This plan was compiled in alignment to the NEMA GNR 1147, as amended, and based on information available at the time and specifically incorporate information relating to the VDDC infrastructure development project. Good practice measures widely adopted by the South African and international coal mining industry were incorporated where deemed necessary.

[4] Jones & Wagener (March 2019) Closure Planning: Wolvekrans Colliery Demolition & Rehabilitation Costing Report. Report No. JW082/19/H828 -Rev 1

Specifically, it provides the identified closure vision, objectives, actions, relinquishment criteria and monitoring objectives against which to assess successful rehabilitation of VDDC and provides a cost estimate for demolition and rehabilitation VDDC.

The success of site rehabilitation, towards eventual site relinquishment by South32 to a third party will depend on achievement of the identified post-mining land uses

CONTENTS PAGE

APPENDIXES

LIST OF TABLES

LIST OF FIGURES

TERMS AND DEFINITIONS

The following terms and associated definition have been used as part of this report:

Term	Definition
Care-and-maintenance	Cessation of mining operations – usually for technical or economic reasons – where there is reasonable expectation that operations can be resumed. Actions taken during the period of care-and-maintenance, or suspension of operational activities, that are intended to maintain facilities and structures to enable resumption of production[5].
Cause	Something that will potentially release a hazard and produce an event.
Closure	The point in time when all decommissioning and rehabilitation activities have ceased, monitoring has been completed and the mine applies for a closure certificate.
Closure action	A specific action determined to reduce the risk rating of an identified closure risk to an acceptable level.
	Preventative closure action: An action that reduces the probability of the occurrence of the closure risk event.
	Corrective closure action: An action that reduces the impact of the closure risk event, should the event occur.
Closure certificate	The certificate contemplated in section 43 of the Mineral and Petroleum Resources Development Act, 2002[6].
Closure guiding principle	South32 corporate ideas and concepts that influence the way closure objectives should be conceptualised.
Closure intention	Overarching aim of South32 towards the way closure planning will be undertaken. Should align to the company's core values (care, trust, togetherness, excellence).
Closure knowledge base	Supporting information used to inform a site's closure planning context and the development of the closure state. Documentation of physical, environmental, social and economic closure planning aspects.
Closure objective	Key measurable closure targets for the various closure planning aspects - based on the determined closure state, that are within the operation's control.
Closure planning aspect	Key actions that authorities would want to sign-off on as part of determining feasibility of site relinquishment.
Closure state	Detailed description of a sustainable post-closure site, as guided by the closure vision, at which time a closure certificate can be confidently applied for. All closure planning is aimed at achievement of this closure state.
Closure vision	Description of what an operation would like to achieve or accomplish from the closed operation at the time of site relinquishment – the final, high-level post-operational end state, or goal.
Consequence	The effect, result, or outcome of an event that affected achievement of specified objectives[7]. The effect can be positive or negative. Also referred to as an impact.
Control	Preventive controls are risk control measures that prevent the undesirable event from occurring or, in other words, lower the possibility of occurrence of the undesirable event.
	Corrective controls are risk control measures that reduce the impact of the undesirable event.
Decommissioning	The period directly after cessation of operational activities (i.e. when the last mineral reserve has been extracted). It includes reclamation, rehabilitation and/or

[5] Instituto Brasileiro De Mineração (IBRAM, 2014): Guide for Mine Closure Planning

[6] Department of Environmental Affairs (November 2015). National Environmental Management Act, 1998 (Act No. 107 of 1998) GNR 1147, Government Gazette No. 39425: Regulations pertaining to the financial provision for prospecting, exploration, mining and production operations. Government Printer, Pretoria.

[7] ISO 31000:2009 Risk Management – Principles and Guidelines. Edition1.

Term	Definition
	restoration of any final remaining areas (e.g. backfilling of final ramps and voids, landform shaping, topsoiling and seeding), as well as removal of all operation-related equipment that has no beneficial re-use potential.
Environment	The surroundings within which humans exist and that are made up of – (i) the land, water and atmosphere of the earth; (ii) micro-organisms, plant and animal life; (iii) any part or combination of (i) and (ii) and the interrelationships among and between them; and (iv) the physical. chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being[8].
Environmental management plan	A plan to manage and rehabilitate the environmental impact as a result of prospecting, reconnaissance, exploration or mining operations conducted under the authority of a reconnaissance permission, prospecting right, reconnaissance permit, exploration right or mining permit, as the case may be[9].
Financial provision	The insurance, bank guarantee, trust fund or cash that applicants for or holders of a right or permit must provide in terms of sections 41 and 89 guaranteeing the availability of sufficient funds to undertake the agreed work programmes and to rehabilitate the prospecting, mining, reconnaissance, exploration or production areas, as the case may be[25.]
Functional land use	Functional land use defined as the committed purpose (use) for a piece of land, that utilises a suite of the physical attributes of the area and their related land functions, in a manner that adds economic value within the context of the surrounding environment, and can function independently, or with minimum input, for many generations.
Land use	The purpose for which land is or may be used lawfully in terms of a land use scheme, existing scheme or in terms of any other authorisation, permit or consent issued by a competent authority, and includes any conditions related to such land use purposes[10].
Life-of-mine	The full life cycle of a mining operation, from planning to eventual site relinquishment.
Life-of-operations	The period which includes active mining activities and the production of ore.
Likelihood	The chance of something (an event) happening[23]. Can be expressed as either probability or frequency.
Impact	The effect, result, or outcome of an event that affected achievement of specified objectives[7]. The effect can be positive or negative. Also referred to as a consequence.
Mitigation	The measures that are put in place to prevent or reduce the likelihood and/or severity of a risk event.
Monitoring	Continual checking, supervising, critically observing or determining the status to identify change from the performance level required or expected.
Operations	The period during which operations and infrastructure is developed to extract the mineral resource. It is initiated when the first resource is removed from the ground and ends when the last resource has been extracted.
Post-mining	The period during which any final reclamation, rehabilitation and/or restoration is carried out to achieve the planned closure vision. This include active monitoring of implementation success, as well as application of corrective action, where required.

[8] Department of Environmental Affairs (June 2013). National Environmental Management Act, 1998 (Act No. 107 of 1998). GNR 1273, Gazette No. 23922.

[9] Department of Mineral Resources. (December 2014). Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002). GNR 1273. Government Printer, Pretoria.

[10] Department of Rural Development and Land Reform (August 2013). Spatial Planning and Land Use Management Act, 2013 (Act No. 16 of 2013). GNR 239. Government Printer, Pretoria.

Term	Definition
Probability	A likelihood that an event with a certain impact can occur; expressed as a number between 0 and 1 (or 0% and 100%). 0 indicates an impossible outcome and 1 indicates a certain outcome. Can be used interchangeably with 'likelihood'.
Quantitative risk assessment	Assessment using theoretical and/or calculated data in the form of predictive models to determine the probability of the identified risk event occurring, and the severity of its impact.
Qualitative risk assessment	Assessment that does not analyse the risks mathematically, but rather uses expert judgment to rate the likelihood and consequence of an event in terms of descriptive words like "high", "medium", "low".
Reclamation	Process of converting derelict land to usable land and may include engineering as well as ecological solutions. Restoration and rehabilitation are both aspects of reclamation. However, reclamation focuses on the long-term use of the landscape, and not only its functional capabilities.
Region	In relation to a regional spatial development framework, means a circumscribed geographical area characterised by distinctive economic, social and natural features which may or may not correspond to the administrative boundary of a province or provinces or a municipality or municipalities (SPLUMA, 2013).
Rehabilitation	Transformation of land from its original condition, (such as through mining), to a new and beneficial condition, that does not necessarily match that of its pre-mining condition. Focus is on functional land capabilities.
Relinquishment	Transfer of responsibility for caring for the area to a third party, usually after compliance with legal obligations and relinquishment criteria[11].
Relinquishment criteria	Defined parameters, indicators of conditions that must be met so that closure objectives can be considered as fulfilled. Satisfactory compliance with relinquishment criteria allows for mine closure[11].
Residual risk	A risk that may result or manifest after actions for final rehabilitation, decommissioning and closure have been implemented[12], and that affects achievement of stipulated closure objectives.
Restoration	The artificial acceleration of the processes of natural succession by putting back the original ecosystem's function and form.
Risk (closure)	Uncertain future events that could affect / hinder achievement of the closure objectives, as determined from the likelihood of their occurrence and resultant impacts.
Risk event (closure)	An event that describes the potential or uncertain occurrence of a particular set of circumstances that has a negative impact on the achievement of stipulated closure objectives.
Site relinquishment	When a set of predefined, agreed-on closure objectives have been met through reclamation, rehabilitation and/or restoration that ensures sustainability of the site to acceptable environmental and socio-economic risk levels.
Stakeholder	Person or organisation that can affect, be affected by, or perceive themselves to be affected by a decision or activity[7]. From a closure planning perspective, *relevant* stakeholders are those directly affected by the operational activity.
Sustainable development	The integration of social, economic and environmental factors into planning, implementation and decision making to ensure that mineral and petroleum resources development serves present and future generations[9].
Vegetative cover	All plants, planted or natural, of all sizes and non-invasive species found in an area.

[11] Adapted from IBRAM (2014). Guide for Mine Closure Planning

[12] Department of Environmental Affairs (November 2017). National Environmental Management Act GNR 1228, Government Gazette No. 10778: Proposed regulations pertaining to the financial provision for prospecting, exploration, mining and production operations.

ACRONYMS AND ABBREVIATIONS

Acronym / Abbreviation	Meaning
ARP	Annual Rehabilitation Plan
BCM	Bank Cubic Metres
BoQ	Bills of quantities
CAD	Computer-aided design
DEFF	Department of Environment, Forestry and Fisheries
DME	Department of Energy
DMRE	Department of Mineral Resources
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EIS	Ecological Importance and Sensitivity
EMPr	Environmental Management Programme
EMPR	Environmental Management Programme Report
ERA	Environmental Risk Assessment
ERAR	Environmental Risk Assessment Report
GNR	Government Notice Regulation
ha	Hectares
J&W	Jones & Wagener (Pty) Ltd Engineering & Environmental Consultants
km	Kilometres
LoM	Life-of-mine
LoOP	Life of Operation
LSU	Livestock Unit
m	metres
m^3	cubic metres
m^3/a	cubic metres per annum
mamsl	metres above mean sea level
MAR	Mean Annual Runoff
mm	millimetres
MPRDA	Mineral and Petroleum Resources Development Act, Act 28 of 2002 (as amended)
MRA	Mining Right Area
NEMA	National Environmental Management Act, Act 107 of 1998 (as amended)
NEM:BA	National Environmental Management: Biodiversity Act, Act 10 of 2004 (as amended)

Acronym / Abbreviation	Meaning
NEM:WA	National Environmental Management: Waste Act, Act 59 of 2008 (as amended)
NWA	National Water Act, Act 36 of 1998 (as amended)
P&G	Preliminary & general
PCD	Pollution control dam
PES	Present Ecological State
RA	Risk Assessment
RDCP	Rehabilitation, Decommissioning and Mine Closure Plan
South32	South32 SA Coal Holdings (Pty) Ltd
SP	Significance points
t	Ton
TBA	To be advised
VAT	Value Added Tax
VDDC	Vandyksdrift Central
WML	Waste management licence
WTP	Water treatment plant
WUL	Water use licence
MR379	Wolvekrans Colliery

NATIONAL ENVIRONMENTAL MANAGEMENT ACT – REGULATIONS PERTAINING TO THE FINANCIAL PROVISION FOR PROSPECTING, EXPLORATION, MINING OR PRODUCTION OPERATIONS

The following tables highlight the specific content required as part of NEMA's GNR 1147 "*Regulations pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations*" under the provisions of the NEMA (DEA, September 2016 revision)

GNR 1147 OF GOVERNMENT GAZETTE NO 39425, 20 NOVEMBER 2015

Regulation	Description	Reference in report
ANNUAL REHABILITATION PLAN CHECKLIST		
Appendix 3 3 (a)(i)	Person or persons that prepared the plan	Section 1.3
Appendix 3 3 (a)(ii)	Professional registrations and experience of the person or persons	Section 1.3
Appendix 3 3 (a)(iii)	Timeframes of the implementation of the current, and review of the previous rehabilitation activities	Section 6.4.1.1
Appendix 3 3 (b)	Pertinent environmental and project context relating to the planned rehabilitation and remediation	Section 4 and Appendix B
Appendix 3 3 (c)	Results of monitoring of risks identified in the closure plan with a view of informing rehabilitation and remediation activities	Section 5.3.1
Appendix 3 3 (d)	An identification of the shortcomings experienced in the preceding 12 months	Section 6.4.2.2
Appendix 3 3 (e)	Details of the planned rehabilitation activities for the following 12 months	Section 6.4.3
Appendix 3 3 (e)	A site plan indicating at least the total area disturbed, area available for rehabilitation and area to be rehabilitated per aspect or activity	Section 3.1
Appendix 3 3 (f)	A review of the previous year's annual rehabilitation including a comparison between the planned and actual rehabilitation	Section6.3
Appendix 3 3 (g)(i)	An explanation of the closure cost methodology	Section 5.10
Appendix 3 3 (g)(ii)	Auditable calculation of costs per activity or infrastructure	Section 5.10 & Appendix C
Appendix 3 3 (g)(iii)	Cost assumptions	Section 5.10.1
Appendix 3 3 (g)(iv)	Monitoring and maintenance costs	Section 5.10
REHABILITATION, DECOMMISSIONING AND MINE CLOSURE PLAN CHECKLIST		
Appendix 4 3 (a)(i)	Person or persons that prepared the plan	Section 1.3
Appendix 4 3 (a)(ii)	Professional registrations and experience of the person or persons	Section 1.3
Appendix 4 3 (b)(i) and 3 (b)(ii)	The context of the project including the material project description information and an overview of environmental and social context that may influence closure activities or be influenced by closure activities	Section 3
Appendix 4 3 (b)(iii)	Stakeholder issues and comments	Section 4.1
Appendix 4 3 (b)(iv)	The mine plan and schedule for the full approved life-of-mine	Section 3.6
Appendix 4 3 (c)	Findings of an environmental risk assessment leading to the most appropriate closure strategy	Section 5.3.1
Appendix 4 3 (d)(i)	Design principles including the legal and governance framework and interpretation of these requirements for the closure design principles	Section 2
Appendix 4 3 (d)(ii)	Design principles including closure and vision objectives	Section 4.2 to Section 4.4
Appendix 4 3 (d)(iii)	Design principles including a description and evaluation of alternative closure and post closure options where these exist that are practicable	Section 5.4

GNR 1147 OF GOVERNMENT GAZETTE NO 39425, 20 NOVEMBER 2015

Regulation	Description	Reference in report
	within the socioeconomic and environmental opportunities and constraints in which the operation is located	
Appendix 4 3 (d)(iv)	Design principles including motivation for the preferred closure action within the context of the risks and impacts that are being mitigated	Section 5.6
Appendix 4 3 (d)(v)	Design principles including a definition and motivation of the closure and post closure period, taking cognisance of the probable need to implement post closure monitoring and maintenance for a period sufficient to demonstrate that relinquishment criteria have been achieved	Section 5.6
Appendix 4 3 (d)(vi)	Design principles including details associated with any on-going research on closure options	Section 5.8
Appendix 4 3 (d)(vii)	Design principles including a detailed description of the assumptions made to develop closure actions in the absence of detailed knowledge on site conditions, potential impacts, material availability, stakeholder requirements and other factors for which information is lacking	Section 5.6.1
Appendix 4 3 (e)	Proposed final post-mining land use	Section 4.2
Appendix 4 3 (f)(i)	Closure actions including the development and documenting of a description of specific technical solutions related to infrastructure and facilities for the preferred closure option or options, which must include all areas, infrastructure, activities and aspects both within the mine lease area and off of the mine lease area associated with mining for which the mine has the responsibility to implement closure actions	Section 5.6.1
Appendix 4 3 (f)(ii)	Closure actions including the development and maintenance of a list and assessment of threats and opportunities and any uncertainties associated with the preferred closure option, which list will be used to identify and define any additional work that is needed to reduce the level of uncertainty	Section 5.6.1
Appendix 4 3 (g)	A schedule of actions for final rehabilitation, decommissioning and closure	Section 5.6.1
Appendix 4 3 (h)	An indication of the organisational capacity that will be put in place to implement the plan	Section 5.9.1
Appendix 4 3 (i)	An indication of gaps in the plan, including an auditable action plan and schedule to address the gaps	Section 5.8
Appendix 4 3 (j)	Relinquishment criteria for each activity or infrastructure in relation to environmental aspects with auditable indicators	Section **Error! Reference source not found.**
Appendix 4 3 (k)	Closure cost estimation procedure, which ensures that identified rehabilitation, decommissioning, closure and post-closure costs	Section 5.10
Appendix 4 3 (l)(i)	Monitoring, auditing and reporting requirements which relate to the risk assessment, legal requirements and knowledge gaps and includes a schedule outlining internal, external and legislated audits of the plan for the year	Section 5.11
Appendix 4 3 (l)(ii)	Monitoring, auditing and reporting requirements which relate to the risk assessment, legal requirements and knowledge gaps and includes a schedule of reporting requirements providing an outline of internal and external reporting, including disclosure of updates of the plan to stakeholders	Section 5.11
Appendix 4 3 (l)(iii)	Monitoring, auditing and reporting requirements which relate to the risk assessment, legal requirements and knowledge gaps and includes a monitoring plan	Section 5.11
Appendix 4 3 (m)	Motivations for any amendments made to the final rehabilitation, decommissioning and mine closure plan	Section 5.12

ENVIRONMENTAL RISK ASSESSMENT CHECKLIST		
Appendix 5 3 (a)(i)	Person or persons that prepared the plan	Section 1.3
Appendix 5 3 (a)(ii)	Professional registrations and experience of the person or persons	Section 1.3
Appendix 5 3 (b)(i)	Description of the risk assessment methodology inclusive of risk identification and quantification	Section 5.1
Appendix 5 3 (b)(ii)	Substantiation why each risk is latent, including why the risk was not or could not be mitigated during concurrent rehabilitation and remediation or during the implementation of the final rehabilitation, decommission and closure plan	Section 5.3.1
Appendix 5 3 (b)(iii)	A detailed description of the drivers that could result in the manifestation of the risks	Section 5.3.1
Appendix 5 3 (b)(iv)	A description of the expected timeframe in which the risk is likely to manifest	Section 5.3.1
Appendix 5 3 (b)(v)	A detailed description of the triggers which can be used to identify that the risk is imminent or has manifested, how this will be measured and any cost implications thereof	Section 5.3.1
Appendix 5 3 (b)(vi)	Results and findings of the risk assessment	Section 5.3.1
Appendix 5 3 (b)(vii)	An explanation of changes to the risk assessment results as applicable in annual updates to the plan	Section 5.3.2
Appendix 5 3 (c)(i)	Monitoring of results and findings	Section 5.3.2
Appendix 5 3 (c)(ii)	An assessment of alternatives to mitigate or manage the impacts once the risk has become manifested	Section 5.4
Appendix 5 3 (c)(iii)	Motivation why the selected alternative is the appropriate approach to mitigate the impact	Section 5.4
Appendix 5 3 (c)(iv)	A detailed description of how the alternative will be implemented	Section 5.4
Appendix 5 3 (d)(i)	An explanation of the closure cost methodology	Section 5.10
Appendix 5 3 (d)(ii)	Auditable calculation of costs per activity or infrastructure	Appendix C
Appendix 5 3 (d)(iii)	Cost assumptions	Section 5.10.1
Appendix 5 3 (d)(iv)	Monitoring costs post-closure	Section 5.10
Appendix 5 3 (e)	Monitoring, auditing and reporting requirements	Section 5.11.1

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SOUTH32 SA COAL HOLDINGS (PTY) LTD

VANDYKSDRIFT CENTRAL: MINING AND INFRASTRUCTURE DEVELOPMENT PROJECT REHABILITATION, DECOMMISSIONING AND MINE CLOSURE PLAN, ANNUAL REHABILITATION PLAN AND ENVIRONMENTAL RISK ASSESSMENT REPORT

REPORT NO: JW261/19/G535-08 – Rev 2

1. INTRODUCTION

1.1 Background information

South32 SA Coal Holdings (Pty) Ltd (South32), is the holder of an amended mining right for coal, granted by the Minister of Mineral Resources, in terms of the Mineral and Petroleum Resources Development Act, 2002 (MPRDA) and notarially executed on the 21st of May 2015 under DMR reference MP30/5/1/2/2/379MR, in respect of its Wolvekrans-Ifalethu Colliery[13] (hereafter referred to as MR379).

This mining right, (MR379), comprises of the following areas:

- Ifalethu Colliery (previously referred to as Wolvekrans North Section[14]) consisting of the Hartbeestfontein, Bankfontein (mining now ceased), Goedehoop, Klipfontein sections and the North Processing Plant; and
- Wolvekrans Colliery (previously referred to as the Wolvekrans South Section) consisting of the Wolvekrans, Vlaklaagte (mining ceased), Driefontein, Boschmanskrans, Vandyksdrift, Albion and Steenkoolspruit sections, as well as the South Processing Plants (Eskom and Export). Some of these areas were previously known as Douglas Colliery.

The Vandyksdrift Central (VDDC) area falls within the footprint of historic underground mining operations at the old Douglas Colliery. In 2007, an amendment of the Environmental Management Programme Report (EMPR) for the Douglas Colliery operations was approved, to allow the opencast mining of the remaining No. 5, No. 4, No. 2 and No. 1 seams. The opencast mining operations include the extraction of the remaining pillars, as well as roof and floor extraction (Jaco-K Consulting, 2016(a)). Authorisation of the VDDC mining project included the following:

- Opencast operation on the farm Kleinkopje 15 IS;
- Opencast operation on the farm Steenkoolspruit 18 IS;
- Pillar extraction operation on the farm Vandyksdrift 19 IS;

[13] Middelburg Mine Services as per mining right

[14] This was previously referred to as Middelburg Colliery

- Reclamation of existing slurry ponds; and
- Rewashing of existing discard dumps (PHD, 2006).

The water uses associated with the opencast mining has been authorised in terms of water use licence number 24084535 dated 10 October 2008.

The No. 2 seam underground workings are flooded with water and has to be dewatered to enable the open pit development to proceed. A dewatering strategy has therefore been developed and an application for Environmental Authorisation (EA) of the dewatering activities has been submitted to the Department of Mineral Resources (DMR) (Jaco-K Consulting, 2016a). The water use activities associated with the dewatering strategy have been authorised by WUL number 06/B11F/GCIJ/7943 dated 19 July 2018.

The 2007 EMPR Amendment included limited additional infrastructure in support of the opencast mining operations as it was assumed at that stage that existing infrastructure will be used. The applications for the activities associated with the dewatering strategy, were limited to the infrastructure to facilitate dewatering (i.e. dewatering boreholes, pumps, pipelines, storage tanks, mechanical evaporators, roads and power lines).

A pre-feasibility investigation has since been conducted, and the need has been identified to develop additional infrastructure to support the proposed opencast mining. The departure was to use existing facilities as far as possible since this is a brownfield development. The additional infrastructure includes the following:

- Stormwater management structures (drains and berms);
- Water management measures for the management of mine impacted water, including a modular water treatment plant (WTP) and mechanical evaporators;
- Overburden dumps;
- Run-of-Mine (ROM) coal stockpile areas;
- Mixed ROM coal and slurry stockpile areas;
- Topsoil stockpiles following clearance of vegetation;
- Pipelines for the conveyance of water;
- Hard park area and brake test ramp; and
- Haul roads and service roads.
- .

1.2 Scope and purpose

Jones & Wagener Engineering and Environmental Consultants (J&W) has been appointed by South32 as an independent Environmental Assessment Practitioner (EAP) to undertake an Integrated Regulatory Process (IRP) to obtain the required approvals and authorisations for the required additional infrastructure development to enable South32 to continue with opencast mining at VDDC.

The environmental applications foreseen include:

- Application for Environmental Authorisation through a Scoping and Environmental Impact Reporting (S&EIR) process and the compilation of an Environmental Management Programme (EMPr) in terms of the National Environmental Management Act, 1998 (Act 107 of 1998; NEMA) and its Regulations;

- Waste Management Licence Application (WMLA) in terms of the National Environmental Management: Waste Act, 2008 (Act 59 of 2008; NEM:WA); and
- Integrated Water Use Licence Application (IWULA) in terms of the National Water Act, 1998 (Act 36 of 1998; NWA), including an Integrated Water and Waste Management Plan (IWWMP).

The first two requirements outlined above will be addressed in an Integrated Environmental Authorisation as allowed for in Section 24L of NEMA and Section 25(3) of GNR 326.

A Heritage Impact Assessment in terms of the National Heritage Resources Act, 1999 (Act 25 of 1999, NHRA) was undertaken.

This report was compiled specifically in support of the environmental authorisation application for the VDDC new infrastructure and mining development project (and not the entire mining right) and addresses the requirements of the National Environmental Management Act (Act No. 107 of 1998) Financial Provision Regulations of 2015, as amended.

Figure 1 illustrates the relevance of the above NEMA closure reporting requirements across an operations' life of operations (LoOP) planning. It illustrates the specific timeframes during which each of these reports should be implemented, as well as the key focus of each report. The VDDC infrastructure development project is in the planning phase.

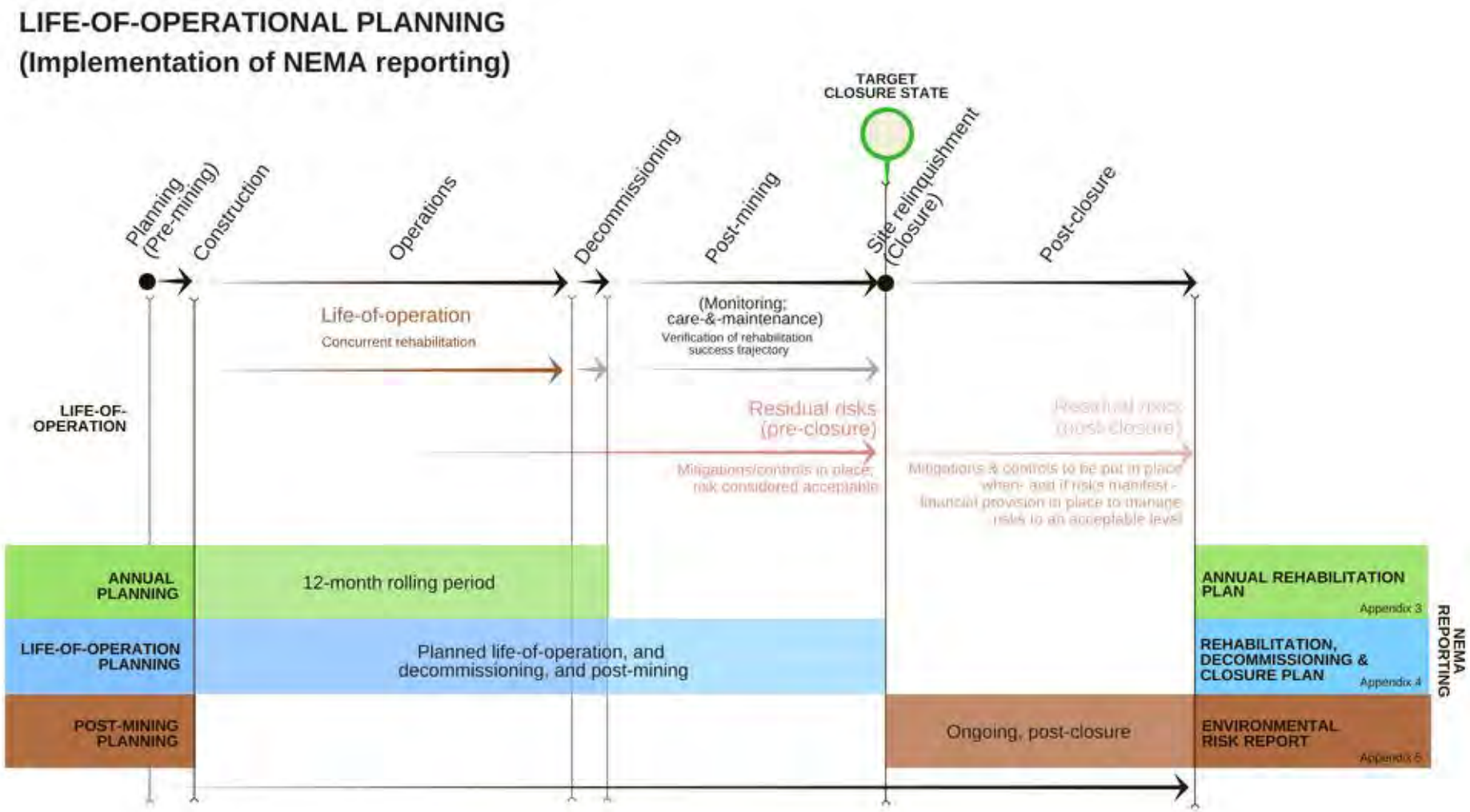


Figure 1: **NEMA closure-related planning relevance for the VDDC infrastructure development project which is currently at the planning phase**

This reporting is underpinned by available, approved information, whether it be for statutory, corporate, and/or operation-specific compliance needs. This predominantly includes the EMPRs, Social and Labour Plans (SLPs) and internal rehabilitation and closure plans for MR379 where applicable. Where more recent specialist studies have been undertaken to determine site-specific, robust, technically-sound information to guide site planning, these have also been used. References to available, supporting information are provided as footnotes, where required.

1.3 Team responsible for plan compilation

South32 appointed Jones & Wagener (Pty) Ltd Engineering & Environmental Consultants (J&W), in terms of the GNR 1147 Regulations, as their independent specialist. The J&W role is to prepare the Final Rehabilitation, Decommissioning and Mine Closure Plan (RDCP), Annual Rehabilitation Plan (ARP), and the Environmental Risk Assessment Report (ERAR), in support of the environmental authorisation for the proposed project.

The contact details of the project team for this closure reporting are provided in **Table 1** below.

Table 1: Jones & Wagener contact details (independent closure planning specialists)

Name:	Jones & Wagener (Pty) Ltd
Company Registration Number:	1993/002655/07
Contact person:	Adriaan Oosthuizen
Postal address:	P.O. Box 1434 Rivonia - 2128
Telephone number:	011 519 0200
Fax:	011 519 0201
E-mail address:	adriaan@jaws.co.za

J&W is a well-established firm of engineering and environmental consultants, operating since 1966. J&W consists of seven specialised departments, namely Structural Engineering, Geotechnical Engineering, Mine Infrastructure, Waste and Tailings, Environmental Engineering, Engineering Hydrology and Environmental Sciences and Management. Together these departments integrate their scientific and engineering expertise to deliver a seamless process, receiving optimal and sustainable designs and solutions, while streamlining the environmental authorisation processes.

Table 2 below summarises the expertise of the main project team members associated with this reporting.

Table 2: J&W project team members and associated qualifications for the mine's rehabilitation- and closure planning

Role on Project	Name	Qualification and professional registrations	**Years'** experience
Mine closure specialist	Renée van Aardt	BSc Hons. (Ecology, Environment and Conservation)	13
Project reviewer	Marius van Zyl	BSc Hons (Biochemistry and Environmental Management)	35
Project approver	Adriaan Oosthuizen	BEng (Civil Engineering) BEng (Hons-Water) Pr. Eng. (20040016)	19

2. CLOSURE PLANNING CONTEXT

The legal and governance documents listed in the following sections are relevant to South32's closure planning process. The lists are not exhaustive but provide key information that could be considered to guide operational closure planning. A comprehensive list of legislation, corporate information, and industry tools and guidance are provided in **Appendix A**.

2.1 Statutory requirements

Alignment to local statutory requirements is considered core to South32's closure planning. Adherence to legislative requirements will result in regulatory compliance, foster a sense of corporate good practice, and limit the company's long-term financial liabilities directly related to site rehabilitation.

In South Africa, the MPRDA came into effect on 1 May 2004. The MPRDA is instituted by the DMR, who is the authorising authority for mining right authorisation and, eventual closure certification.

During 2014, the South African government implemented the One Environmental System. This resulted in a collaborative governance approach between the MPRDA and NEMA, which is responsible for managing the impacts of activities that may have a negative impact on the environment.

In 2015, environmental-related provisions of the MPRDA were superseded and provided for in the amendment to the NEMA, as implemented on 08 December 2014 (National Environmental Management Amendment Act, No. 62 of 2008). The MPRDA Regulations however have not yet been repealed.

In addition, NEMA's Goverment Notice Regulation (GNR) 1147 was promulgated on 20 November 2015, with various amendments that followed. GNR 1147 provides detailed content requirements for operational rehabilitation and closure planning, and requires a prospecting, exploration, mining or production rights holder to, on an annual basis, compile and/or update three distinctive plans:

- Annual rehabilitation plan;
- Final rehabilitation, decommissioning and closure plan; and
- Environmental risk report.

Figure 2 summarises the key closure planning and associated closure costing reporting structure, as adopted by this reporting (GNR 1147).

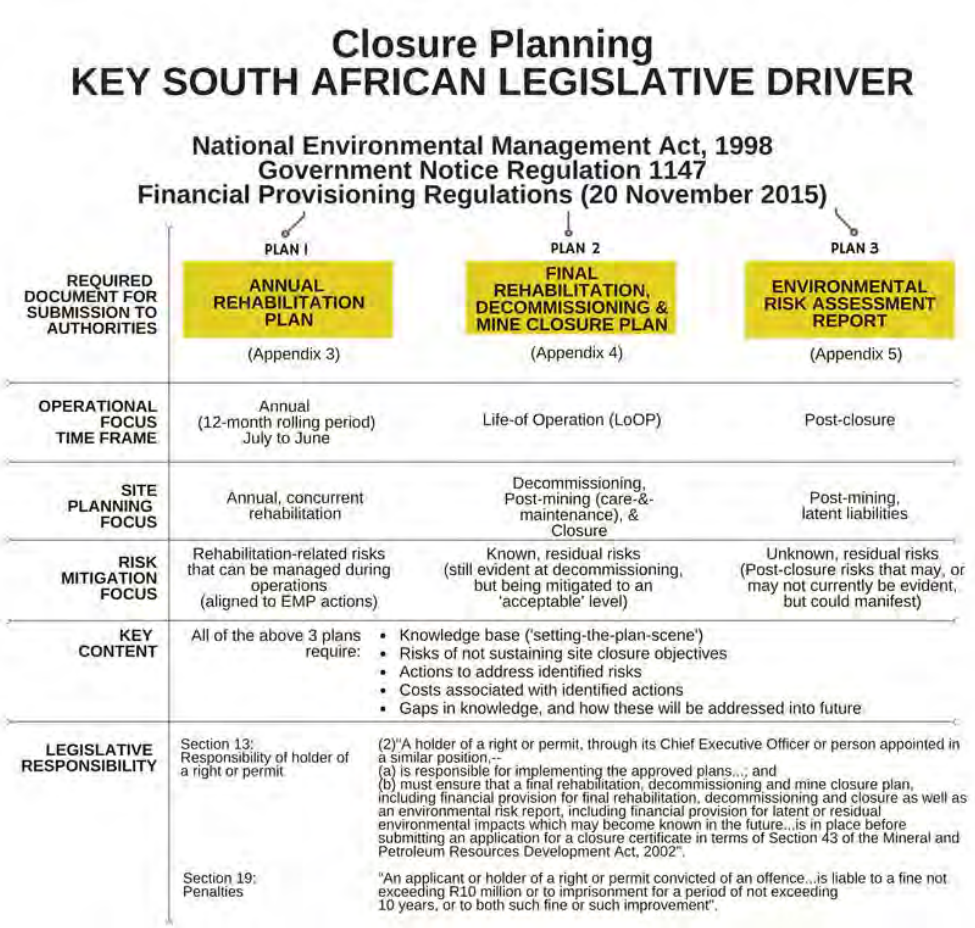


Figure 2: Closure planning requirements of the NEMA GNR 1147

2.2 Industry best practice guidelines and tools

The South African DMR published a Guideline Document for the Evaluation of the Quantum of Closure-Related Financial Provision by a Mine (DMR, 2005) to direct and assist officials of the Department with the assessment of financial provisions made by mines. Although this document was not specifically aimed at establishing an industry standard for the way in which closure costs and associated financial provision should be determined, the broad approach and principles adopted in this document are now generally applied in closure planning and costing.

The above guideline document is the only guidance provided in South Africa specifically relating to the determination of the financial provision for mine closure. However numerous other international best practice guidelines and tools are available, and these can be used to guide risk identification, land use planning and potential closure actions.

A summary of the relevant South African and international best practice guidelines and tools used to inform this report are provided in **Appendix A-1** and **Appendix A-2**, respectively.

2.3 Corporate requirements

During 2017/2018, South32 undertook the development of a draft Closure Planning Standard. The purpose of this Standard was threefold to:

- Standardise the approach to closure planning across the African Region operational and defunct mining operations;

- Ensure alignment of all operations to the requirements of South African rehabilitation and closure-related legislation; and
- Incorporate global good practice closure planning principles within each operation's life-of-mine (LoM) planning to position South32 as a global closure planning leader.

This document[15] provides a stepwise, integrated thinking framework with identified key components for both corporate-level and site-specific planning. This closure reporting has been aligned to the thinking provided in the internal South32 Standard.

The closure intention stated below provides the focus of South32's corporate commitment to company-wide rehabilitation and closure planning across all its African Operations. This closure intention underpins all aspects of VDDC's site-specific closure planning:

South32 commits to undertaking site-specific closure planning that will focus on creating sustainable post-operational land uses that consider climate resilience and generate financial, social and environmental value to remaining landowners. Opportunities for broader closure planning integration with other South32 operations and/or alternative landowners and managers will be sought, towards mitigating residual direct-, indirect- and/or cumulative impacts on the environment.

Implementation of closure plans start on the first day of operations and is achieved through integrating operational and closure planning. This will enable optimised costs of implementation and minimise liability both during operational and post-closure stages.

Closure planning must incorporate local statutory and corporate planning requirements, as a minimum, ensuring responsible land stewardship by a third party / alternative owner so that the post-operational land continues to provide value for future generations.

In addition to the South32 Closure Planning Standard, the following South32-specific corporate guidance documents are also used to inform site-specific closure planning:

- Our Care Strategy (July 2016);
- Sustainability Policy (21 January 2016);
- Environmental Standard (20/21 October 2015);
- Climate Change Strategy Avenue 2 – Climate Resilience (14 March 2016); and
- Sustainability Committee Paper on 3.1 Climate Change Strategy Avenue 2 – Intelligent Land Management (15 March 2016).

A summary of South32 corporate governance documents relevant to closure planning is provided in **Appendix A-3**.

3. OPERATIONAL CONTEXT

As VDDC forms part of MR379 and a detailed description of the VDDC infrastructure development project for which environmental authorisation is being applied for is provided below.

MR379 is located in the Nkangala District Municipality, transgressing into both the Steve Tshwete and eMalahleni Local Municipalities. The VDDC section is located within the jurisdiction of the eMalahleni Local Municipality.

The R575 and R35 provincial roads are situated in close proximity to the western and eastern boundaries of MR379 respectively. The N4 highway is situated north of the

[15] South32 (April 2018). Closure Planning Standard.

property. There are two provincial roads defining the boundaries of this section of the mine (the R547 and R544 roads).

The regional locality plan of VDDC is provided in **Figure 3** and **Table 3** provides the administrative boundaries of VDDC.

Table 3: Administrative boundaries of VDDC

Province	Mpumalanga
District Municipality	Nkangala District Municipality
Local Municipality	Emalahleni Local Municipalities
Water Catchment Zone	B11G, B11F and B11B
Water Management Area	Upper Olifants WMA

The VDDC infrastructure development project is a brownfields project within the greater MR379 mining rights area.

VDDC is located on the western boundary of MR379. The Olifants River determines the southern boundary. The proposed infrastructure development will take place on the farms Kleinkopje 15 IS, VanDyksdrift 19 IS, Wolvekrans 17 IS and Steenkoolspruit 18 IS.

3.1 Project description – VDDC infrastructure development

The infrastructure development forms part of the VDDC mining project. The construction phase will commence after authorisation for the infrastructure components has been obtained and is expected to commence in 2020. The construction period is expected to be 18 – 24 months. The operational phase is expected to commence 2022.

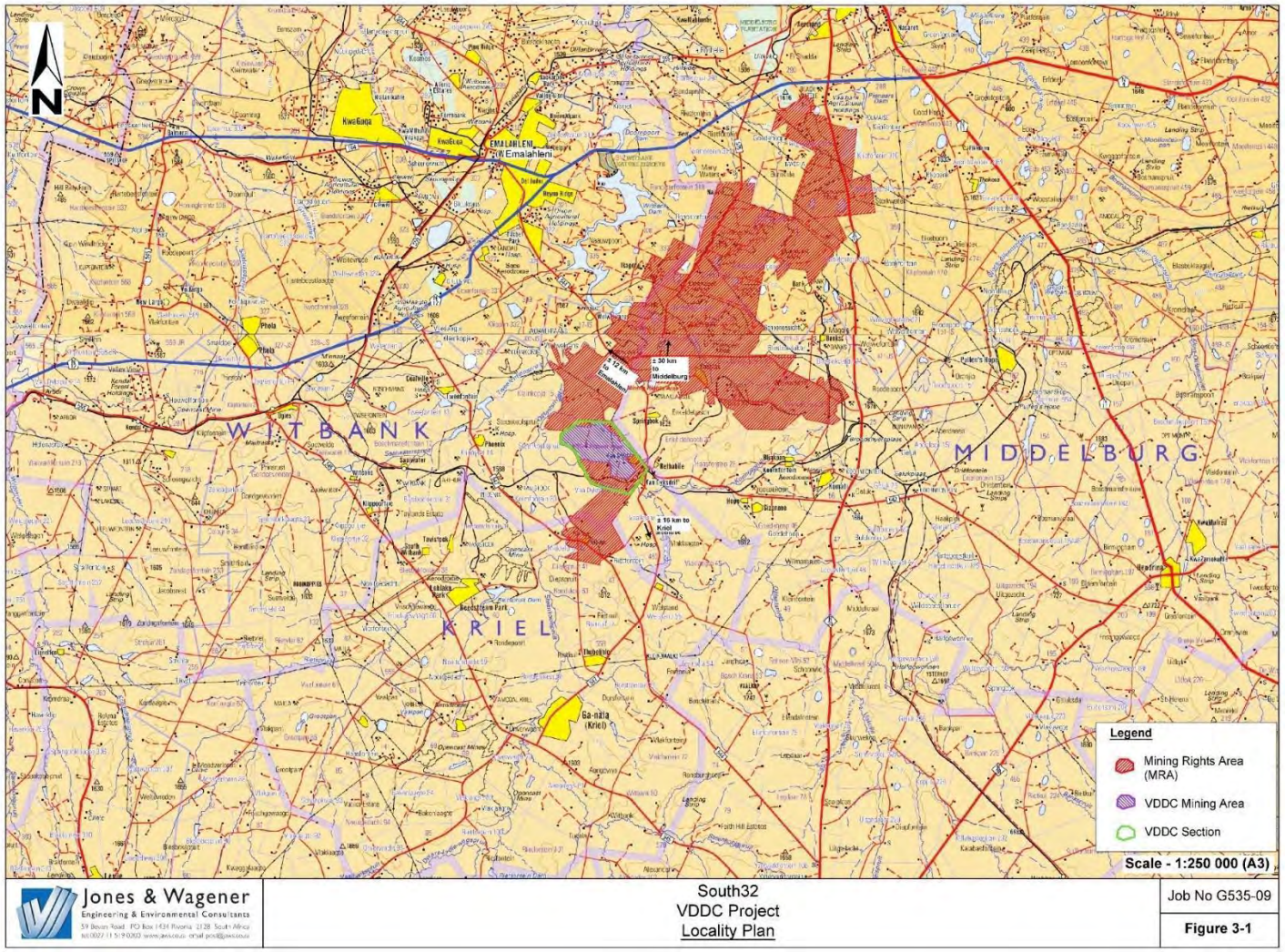


Figure 3: Site Locality

3.2 Coal reserves

The VDDC area has been identified as the most likely coal source to replace the Steenkoolspruit (SKS) operations, and to fulfil the current contracts and market obligations of the mining complex (South32, 2017a).

Coal produced will be mainly exported through the Richards Bay coal terminal.

Limited opencast mining was done before 1990 in the top shallower No. 5 seam. The No. 4L, No. 2, No. 2A and No. 1 coal seams were exploited in the past by means of underground mining. All underground operations were terminated during October 2008. The No. 2 Seam is the principal seam in the project area and its thickness can exceed 9 m, but only the lower select horizon of higher quality 2.5 m – 4.5 m was previously extracted. The targeted mineable seams are the No. 5, No. S4UA, No. S4L, No. S2RP, No. S2A and No. S1 seams respectively (South32, 2017a).

As a result of the previous mining of the No. 2 Seam horizon by bord and pillar means, the following has resulted:

- The majority of the underground No. 2 seam workings are flooded because of water ingress from both surface and underground aquifers. A dewatering programme will be implemented before opencast mining operations commence.
- An area of the No. 2 Seam was historically used for placement of slurry from the processing plant. It is believed to be contained in the southeast portion of the deposit by underground seals and barrier.

3.3 Existing infrastructure

Existing infrastructure in the VDDC area is shown on **Figure 4** and described below.

3.3.1 Access, transport and logistics

Access to the VDDC project area is via one of three existing approaches, depending on the size of the transport, namely:

- Current SKS main entrance;
- Current Wolvekrans main entrance (via BMK workshops); and
- Current VDD main entrance (opposite Springbok village).

All personnel transport and light delivery vehicles will enter the site via the current SKS main entrance. Personal vehicles will park in the existing personnel vehicle parking, whilst busses will drop personnel off at the existing bus turnaround.

Light delivery vehicles and heavy delivery vehicles up to 10 t single body trucks will also enter via the existing SKS main entrance and deliver to the required location, or to the existing store facilities (South32, 2017b).

The heavy delivery vehicles and lowbeds will access the site via either the MR379 main entrance or the VDD main entrance, depending on the destination within the VDDC Project area (South32, 2017b).

A number of existing haul roads have been developed within the mining area (refer to **Figure 4**).

3.3.2 Steenkoolspruit (SKS) facilities

Existing facilities at the SKS operations include the ROM tip and the overland conveyor system to the South Export Plant, the SKS complex offices, warehouse, change houses, workshops, wash bays, laydown areas, a sewage treatment plant and fuelling facilities.

The southern SKS facilities currently in use by the Vandyksdrift North (VDDN) operation include contractors' offices, laydown areas, as well as a fuel, lube, air and coolant (FLAC) station.

3.3.3 Topsoil dump

An existing topsoil dump is located on the north-eastern boundary of the VDDC section.

3.3.4 Surface dumps

Surface discard dumps exist on the southern portion of the VDDC resource area, namely the PSS and LAC dumps. These dumps are in the process of being reclaimed and it is expected that approximately 40% of the material will be recovered. Final rejects from the reclamation process is disposed of on the southern portion of the PSS dump. This Final Rejects Dump will remain in future and the VDDC mining area has been changed to exclude this footprint from the mine plan.

3.3.5 Storm water management measures

A number of clean and dirty water management berms and canals have been constructed to ensure that runoff is managed. This includes a clean water diversion dam which contains clean runoff from the undisturbed areas to the north-east.

A number of dirty water canals drain dirty runoff to dirty water facilities. The Vleishaft Dam is an existing Pollution Control Dam (PCD) with a capacity of 600 000 m^3, that has been authorised for the disposal of mine impacted water in terms of WULs issued to the mine.

Dirty runoff from the discard reclamation and processing plant drains to the Bob Henry dam and silt paddocks.

Existing water management measures at the PSS dump comprises of a clean water canal which collects clean water west of the PSS Dump Extension, as well as a system of canals which collects dirty runoff from the PSS Dump and conveys the water to four PCD's. Excess water from the PCD's is pumped to the underground workings via a borehole. Water is abstracted from the workings via boreholes for re-use in the processing plant.

3.3.6 ROM coal stockpiles

Two Run-of-mine (ROM) coal stockpiles have been developed:

- A ROM coal pad located between the SKS void and the haul road, from where it is taken to the South Export Processing Plant via conveyors from the SKS crushing plant;
- A ROM stockpile area to the south of the Vleishaft Dam, of which a portion is currently used as a hard park area.

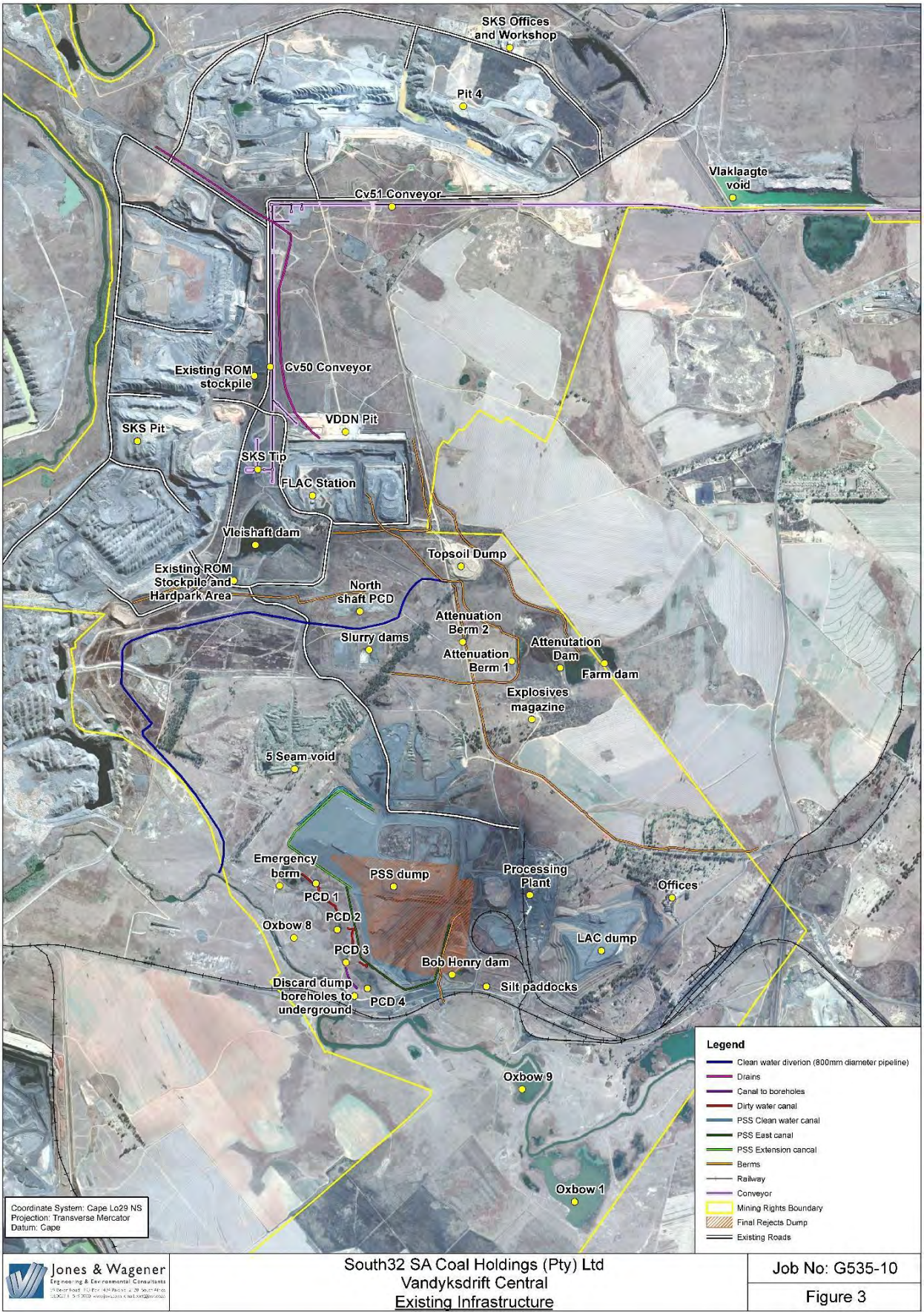


Figure 4: Existing infrastructure

3.3.7 Power supply

The VDDC section is supplied from Eskom's Klein 132 kV Substation, which feeds the DMO Klein Olifant 132 kV Substation. The voltage is stepped down to 22 kV via two 20 MVA power transformers feeding the 22-kV switchgear located in the Klein Olifant Substation (South32, 2017b).

The existing electricity infrastructure is shown on Figure 5.

A section of the Klein-Kromfontein 132 kV powerline must be relocated to allow opencast mining to proceed. This is the subject of a separate application that is undertaken by South32 in terms of a self-build agreement with Eskom. The EA for the powerline will be transferred to Eskom on completion of the construction phase.

3.4 Upfront dewatering infrastructure

In order to mine the VDDC reserve, the water contained in the underground workings must be removed prior to mining. This will be achieved by drilling a number of boreholes into the old underground workings and to abstract the water via these boreholes.

Water will be pumped from the boreholes accessing different underground compartments and will be transferred via borehole connector pipelines to the Vleishaft Dam and/or directly to the evaporation tanks that will be located at the evaporation sites where water will be evaporated using mechanical evaporators. Three evaporators sites have been identified, namely No. 5 Seam void, Vleishaft Dam and Vlaklaagte Void.

In addition, some water will be pumped and stored in the Steenkoolspruit Pit void (Jaco-K Consulting, 2016(b)).

The following evaporators systems have been installed:

- Eight evaporators at Vleishaft Dam (2 Mℓ/day per evaporator);
- Twenty evaporators at Vlaklaagte void (2 Mℓ/day per evaporator); and
- An additional 12 new evaporators (3 Mℓ/day per evaporator) will be installed at the No. 5 Seam void by the end of 2019.

3.5 Project description: Proposed new infrastructure

The new infrastructure to be developed (and which will be the subject of the IRP) is shown on a **Figure 6** and discussed below.

3.5.1 Topsoil dumps

The topsoil excavated from the box cut areas and areas cleared for the development of infrastructure will be relocated to a topsoil stockpile area to be located adjacent to the existing topsoil stockpile in the east of the project area. In addition, provision has been made for a topsoil stockpile area in between the ramps.

The box cut topsoil will be stockpiled due to the lack of direct placement option at the start of the opencast mining operations.

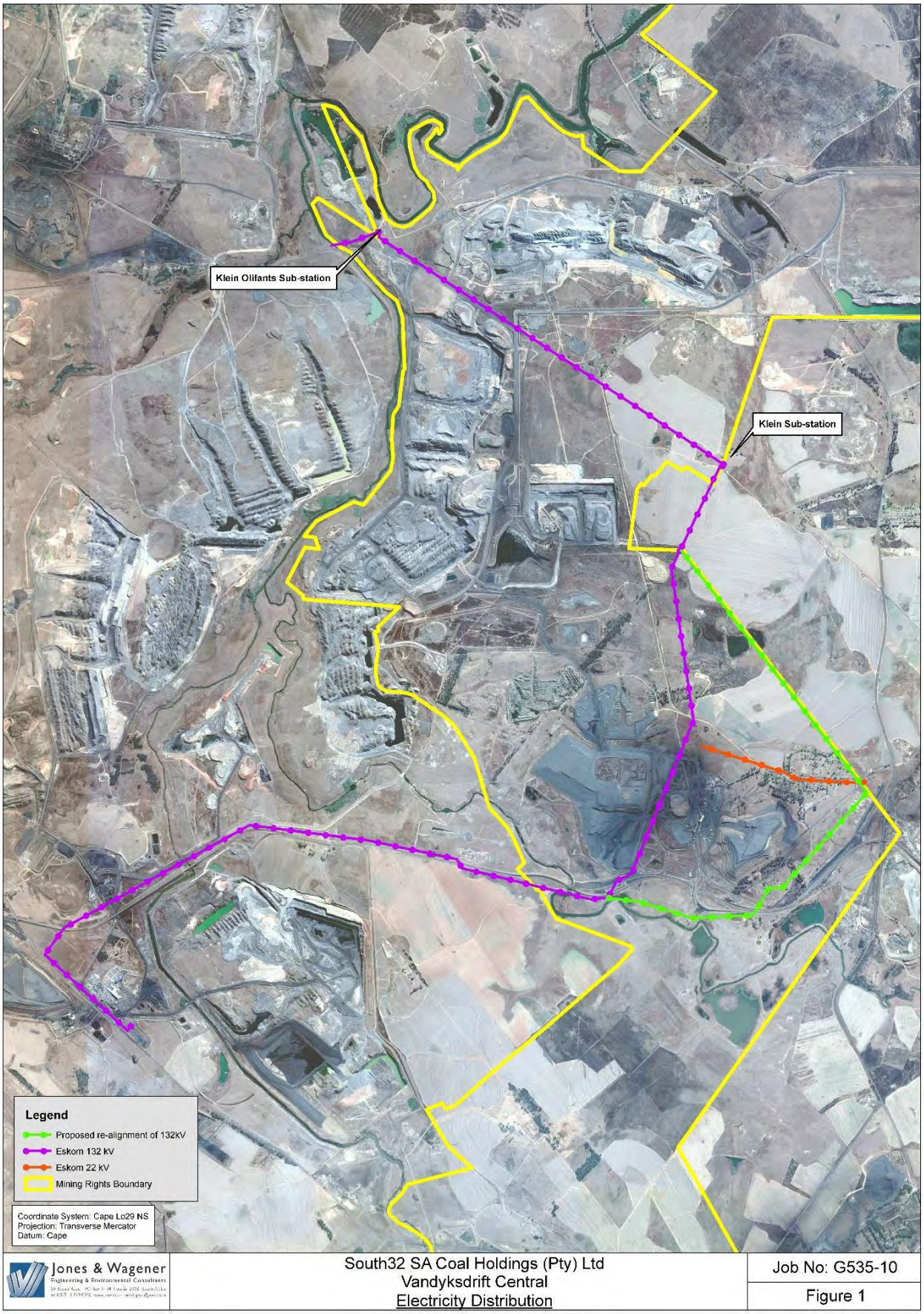


Figure 5: Existing electricity distribution network

3.5.2 Overburden dumps

The boxcut will be done using a combination of dragline and truck and shovel. Overburden from the boxcut will be placed on four overburden dumps located in between the proposed ramps.

In addition, provision has been made for two overburden dumps. A new overburden dump will be developed in the south-east of the project area and the existing overburden dump at the SKS pit will also be used.

Upon steady state mining being achieved, rehabilitation activities can commence safely behind the active dynamic window of operations and the in-pit backfilling of overburden can advance. As the mine pit expand, there will be more opportunity to excavate overburden and apply it directly to re-contoured areas, thus avoiding stockpiling. It has been assumed that overburden stockpiling will be during the initial stages of mining and that direct placement will commence when sufficient placement areas are available (South32, 2017a).

3.5.3 ROM stockpiles and Mixed ROM coal and slurry stockpile areas

An area of the underground No. 2 Seam was historically used for placement of slurry from the processing plant. It is believed to be contained in the southeast portion of the deposit by underground seals and barrier pillars.

Slurry will be mined with the ROM coal and the blended coal and slurry will be transferred to mixed ROM coal and slurry stockpile areas, located to the south of the Vleishaft Dam. The mixed material will be allowed to dewater, before it is removed to the existing SKS tip, from where it will be taken to the South Export Processing Plant[3]. Water will be collected and conveyed via a silt trap to the Vleishaft Dam.

ROM coal from the No. 4 and No. 5 seams will be placed on transfer stockpiles. These stockpiles will be located on a partially reclaimed area of the PSS dump footprint. The stockpile positions will be moved as mining progresses but will remain within the footprint of the existing PSS dump or other previously mined out or disturbed areas.

3.5.4 Water consumption requirements

Potable water and wash water for vehicles and workshops will be supplied from the existing water supply at the SKS complex.

Water for dust suppression will be sourced from mine impacted water.

[3] Processing of the slurry at the existing South Plant may require changes to the processing plant. This, however, falls outside of this application process

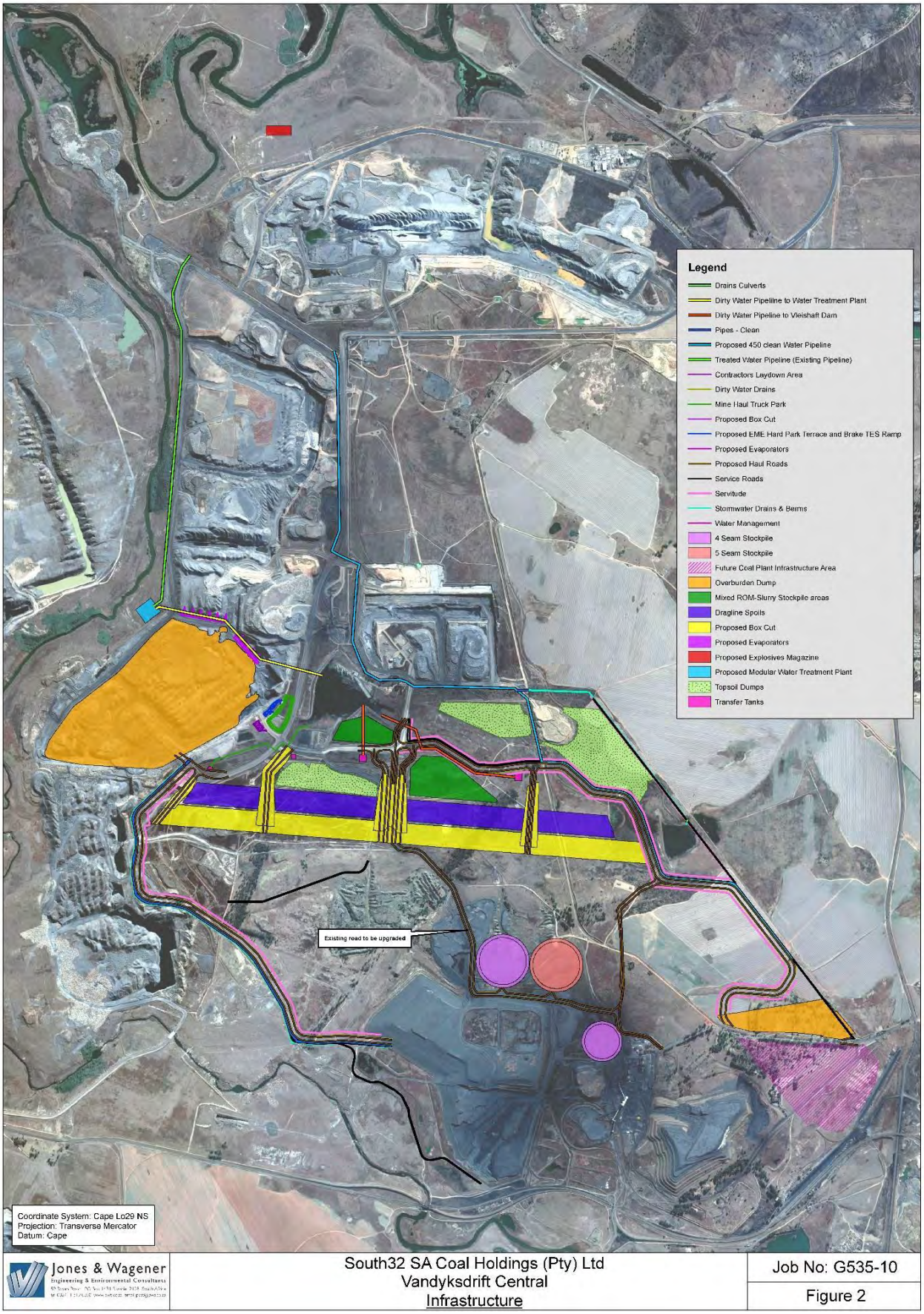


Figure 6: Proposed new infrastructure at VDDC

3.5.5 Management of mine impacted water

The proposed mining operations require the management of mine impacted water. Dirty areas that have been identified and included in the water management strategy are:

- Opencast pit;
- Mixed ROM coal and slurry stockpile areas;
- Overburden dumps;
- ROM stockpiles; and
- Hard park area.

Opencast pit

In order to manage the inflow of water into the mining operations, sumps will be constructed in the pit floor where the water will be collected at the bottom of the pit (at lowest points) and pumped out of the pit. These temporary sumps will be situated at the bottom of each access ramp and the piping routed in a berm servitude on the side of the access ramp, up to transfer tanks situated at the top of the ramp. Once the water reaches the transfer tanks, it will join the polluted water management system. Water will be pumped from the pit with self-priming diesel driven pumps mounted on trailers or skids to allow for easy movement (South32, 2017a). Water will be pumped to the Vleishaft Dam and from there, to one of the evaporator sites, or to the proposed modular water treatment plant (WTP) or to Vlaklaagte void,

Mechanical evaporator sites are as follows:

- Three sites will be established as part of the upfront dewatering strategy (refer to section 1.7):
  - 8 evaporators at Vleishaft Dam (2 Mℓ/day per evaporator);
  - 20 evaporators at Vlaklaagte void (2 Mℓ/day per evaporator); and
  - 12 evaporators (3 Mℓ/day) per evaporator at the No. 5 Seam void.
- As part of the VDDC infrastructure development, eight (8) new evaporators (3 Mℓ/day per evaporator) will be established at the SKS void.
- As mining progresses at VDDC, the 12 evaporators at No. 5 Seam void will move to the SKS void, bringing the number of evaporators at the SKS void to a total of 20.

Surplus water which cannot be handled through the evaporation system, will be conveyed to a mobile, modular WTP with a maximum treatment capacity of 20 Mℓ/day.

Brine from the WTP will be conveyed to the evaporators on the SKS void.

Effluent from the WTP (i.e. treated mine water) will be conveyed via an existing mine water pipeline to the existing northern clean water canal, from where it will discharge via a wetland area into the Olifants River. Water will be treated to comply with Resource Quality Objectives for the Olifants River catchment as published in GN 466 in April 2016.

Mixed ROM coal and slurry stockpile areas

Mine impacted water from the Mixed ROM coal and slurry stockpile areas will be collected and conveyed to the Vleishaft Dam via silt traps.

Overburden dumps

The overburden dump located at the SKS void will drain to the void and no additional measures are foreseen.

Pollution control measures will be required at the new overburden dump located on the south-eastern boundary to collect dirty runoff and seepage. Mine impacted water will be conveyed via suitable diversion structures to the dirty water management infrastructure and re-used in the existing plant for the reprocessing of material from the PSS and LAC dumps, or pumped into the underground via an existing borehole.

3.5.6 Dust Suppression

Dust on haul roads will be controlled using water bowsers. Bowsers will fill up at filling stations that will be located in close proximity to VDDC pit. The use of chemical dust suppressants will also be considered.

3.5.7 Clean water management

Clean run-off water from the area to the east of the VDDC mining area will be diverted away from the mining areas so that it will not become contaminated by the mining operations.

The existing VDDC clean water diversion canal will be diverted around the proposed new topsoil dumps on the eastern boundary of the mining right area.

High wall drains will be installed to divert clean water away from the mining area where practical. These drains will move as mining progresses.

Two 450 mm diameter clean water diversion pipeline will be installed from the existing clean water diversion dam, to the existing northern canal from where water will be discharged via a wetland area into the Olifants River.

3.5.8 Explosives magazine

The existing explosives magazine will be relocated to the north of Pit 4.

3.5.9 New roads

New roads required for the VDDC project include:

- Temporary high wall roads and dragline walkways which will be re-established as mining progresses;
- Earth Moving Equipment (EME) haul roads (40 m width) from the bottom of box cut ramps to the existing haul roads;
- Additional maintenance/service and access roads within the VDDC project area from the existing infrastructure to the box-cut;
- New haul road to the No. 4 seam and No. 5 seam stockpiles.

3.5.10 EME Hard park and Brake Test Ramp

A hard park will be developed between the Vleishaft Dam and the SKS pit. The hard park will include perimeter drains that convey polluted water runoff (primarily polluted with silt) to the SKS void.

A brake test ramp will be provided for EME traffic at the hard park area. The brake test ramp is positioned such that all vehicles will need to traverse the ramp before entering the pit areas. The ramp has been designed to enable the longest expected vehicle entering the mining areas to stop on the inclined sections, with both axles or all wheels. The incline sections are to the steepest recommended grade of these vehicles or to the incline of the ramps to the pits.

In-pit vehicle ramps are of similar construction to the remainder of the haul roads including safety berms.

3.5.11 Access control and security fencing

Access control will be through the existing control measures.

Triple security fencing will be provided at the explosives' magazine. Triple fencing includes a triple barrier of 2.4 m high clear mesh, electric and normal security fencing. Electric fencing is connected to the local security system (South32, 2017b).

3.5.12 Other supporting infrastructure

The remainder of the supporting infrastructure is mostly catered for by the existing SKS complex facilities. Existing change houses, stores facilities, office facilities, tracked vehicle workshops, LDV workshops will be used.

No additional fuel or lube storage area, servicing bays or tyre bays are required.

3.5.13 Future coal plant infrastructure area

As indicated earlier, the PSS and LAC dumps are currently reclaimed and processed within the existing VDD processing plant. As mining progresses, this plant will need to be relocated. An area has been allocated for this purpose and is situated to the south of the proposed new overburden dump in the south-eastern corner of the VDDC area.

3.6 Project description: Changes to opencast mining

The VDDC mine lay-out as determined through the pre-feasibility investigation, as well as the mine-lay-out included in the approved 2007 EMPR Amendment is shown on **Figure 7**. The area where the existing LAC dump is located, as well as a small area further north- east, were not included in the approved 2007 EMPR Amendment, and therefore requires authorisation for opencast mining.

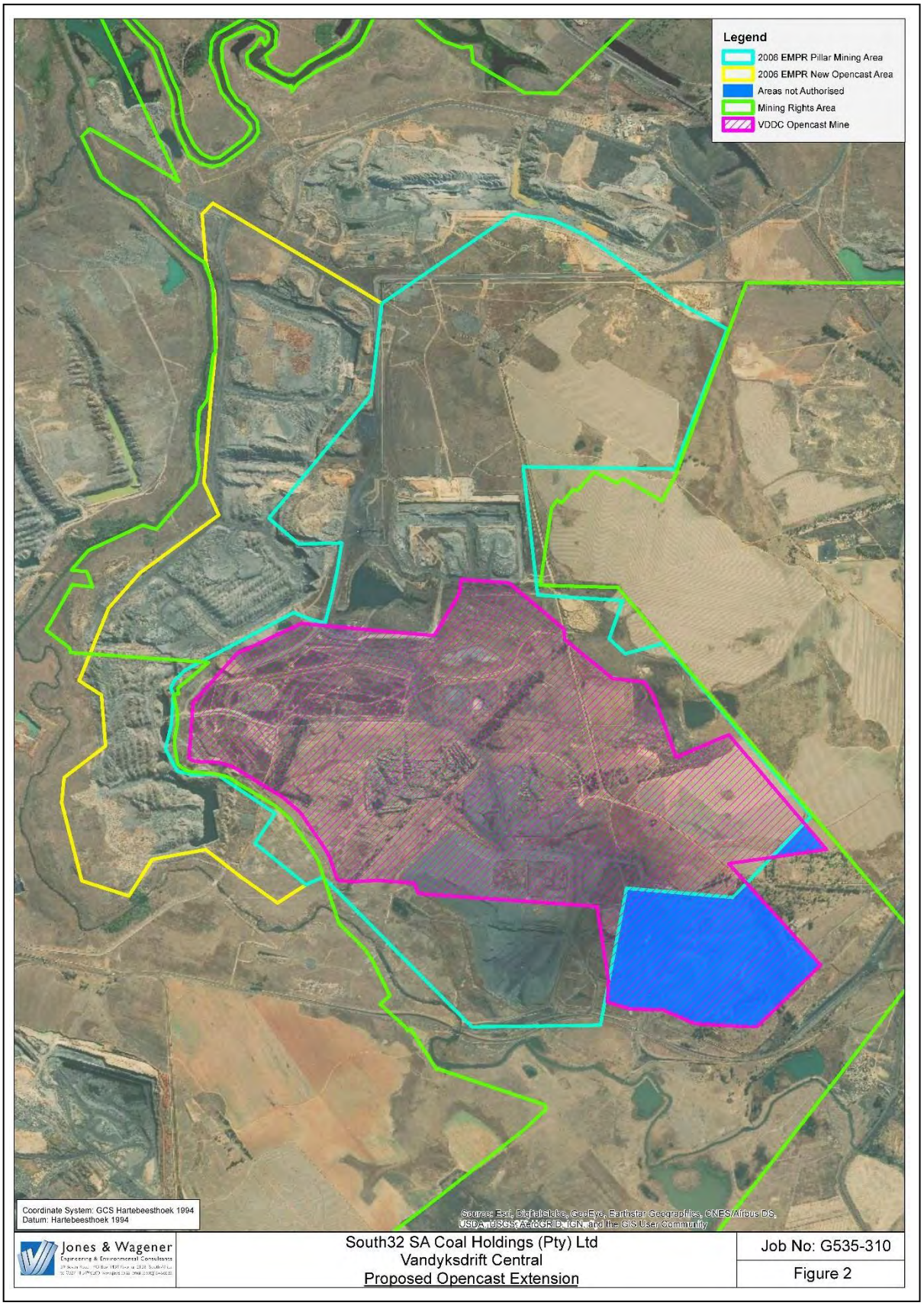


Figure 7: VDDC opencast pit compared to mine layout in 2007

4. CLOSURE KNOWLEDGE BASE

Successful closure planning requires an understanding of the current site and regional conditions. The closure knowledge base is used to document physical, environmental, social and economic aspects, which will inform the development of the closure state. The closure state is a detailed description of a sustainable post-closure site, as guided by the closure vision, at which time a closure certificate can be applied for. All closure planning is aimed at the achievement of this closure state.

To streamline environmental, social and closure-related planning across the operations, the closure knowledge base considers the key planning components, or aspects, of environmental and social reporting structures already in place. This allows for seamless transition of reporting needs between LoM stages, as well as easy identification of commonalities, opportunities, and challenges across the operation's planning domains. For this closure reporting, closure planning aspects are defined as the key planning components, or topics, that guide the subject matter for conceptualisation of the closure knowledge base, objectives and associated actions and the description of the closure state. They are the core subject matter that authorities would want to sign-off on as part of determining feasibility of site relinquishment.

VDDC's closure knowledge base has hence been defined in terms of the key closure planning aspects shown in **Figure 8.**

Figure 8: Closure planning aspects used to define the Wolvekrans Colliery's closure knowledge base.

It is important that the closure knowledge base has been defined using only available, approved information, whether it be for statutory, corporate, and/or operation-specific compliance needs. This information has been supported by site-specific, robust, technically-sound studies, where available, that underpin accurate costing of relevant closure actions. This information should be refined over time, as the operation

approaches decommissioning. This will enable improvement in reliability of supporting information and enhance certainty of the closure planning context.

Figure 9 provides an overview of the VDDC's closure knowledge base.

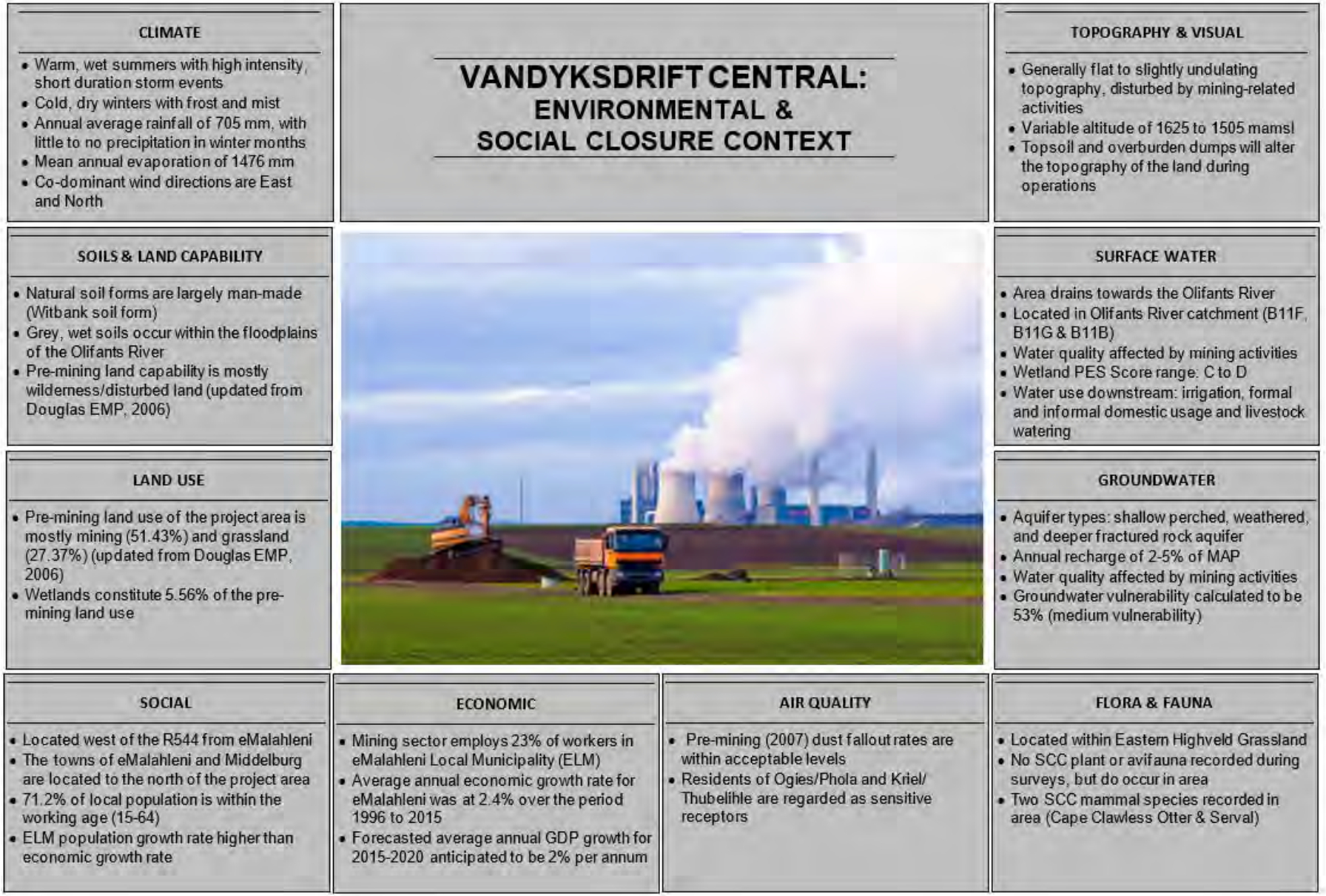


Figure 9: Summary of VDDC's closure knowledge base (environmental and socio-economic)

4.1 Closure-related stakeholder engagement

As part of the IRP, a public participation process has been undertaken. Any issues raised which are relevant to rehabilitation and closure will be noted and addressed as part of the IRP public participation process.

4.2 Closure vision

This section provides the key 'design principles' applied for VDDC's closure planning, building on from the documented environmental and socio-economic closure knowledge base.

A closure vision is the ultimate post-mining state, or goal, envisaged for the site. It is the aspirational endpoint against which closure objectives will be set.

The closure vision for VDDC is as follows (refer **Figure 10):**

Figure 10: VDDC closure vision

4.3 Closure state

The closure state is a detailed description of a sustainable post-closure site, as guided by the closure vision, at which time a closure certificate can be confidently applied for. It is a 'descriptive snapshot' of what the mine site will look like at the point of site relinquishment. All closure planning is aimed at achievement of this closure state.

The specific date for achievement of the closure state can change over time, as the trajectory of successful achievement of closure objectives is refined. However, it should be considered the point at which a steady-state of achievement of relinquishment criteria can be verified or the point at which it is proven that the residual risks that could manifest in future are acceptable.

The Wolvekrans closure state is provided below. It is noted that where there has been a lack of available information, and/or uncertainty regarding information, the most practical 'desired' state has been defined. To separate fact from fiction, any statement underpinned by approved, technical information is represented with a: (tick), and any desired state is represented with a: (lightbulb).

As Wolvekrans closure planning is refined over time, the lightbulbs should all be replaced with ticks, defining a closure state that is technically defendable, based on existing, available supporting information.

4.3.1 Land use

- A total of approximately 551 ha will be available for a functional land use at the proposed VDDC project site. The Mining Right of this entire rehabilitated area would still be owned by South32.

- Although climates may have become hotter and drier, with more chance of drought events and more frequent high-intensity rain events[16], average annual rainfall would still be approximately 680 mm per year[17]. The area will still be a predominantly summer rainfall area, with dry winters. Average midday temperatures will range from 16.6°C in June to 26.2°C in January, coldest in July when temperatures drop to 0.8°C on average during the night.

- The rehabilitated mining areas will be gently undulating, blending into existing surrounding topographies. Where possible, rehabilitated drainage patterns would mimic pre-mining locations. In addition:
  - Most of the rehabilitated areas (in-filled voids and ramps) will be sloped to as per the rehabilitation design (Appendix C) aiming to comply with general standards for grazing, where possible; and
  - The upper surface of all remaining rehabilitated overburden dumps will be free-draining.

- The entire rehabilitated area will be used for a grazing land use, farmed by a local farmer who is leasing the surface rights of the rehabilitated area. The area would have a minimum of 300 – 600 mm[18] soil (growth medium), suitable for this grazing land use [19][17]. A mixture of the following grass species - Rhodes (*Chloris gayana*), Teff (*Eragrostis teff*), Smuts finger (*Digitaria eriantha*)[20] and Eragrostis curvula[21] will be persisting in the pasture-related grass cover, providing a vegetal cover of ≥75%, with a prolific root system.

- The grazing pastures will comprise mixed grassveld of the above species over 80% of the VDDC project site – 441 ha (assuming the remaining (20%) is associated with river systems, infrastructure, etc.). The carrying capacity of the grazing land will be between approximately 2.4 to 5 ha/large stocking unit (ha/LSU).

[16] DEA (October 2017) National Climate Change Adaptation Strategy – Republic of South Africa

[17] AGES (January 2013) EMPR Consolidation Report for Middelburg Mine Complex

[18] Most areas will be covered with 600 mm topsoil in accordance with the 2013 EMPR.

[19] Synergistics (October 2012) EIA and EMPR for The Extension of Mining Operations and the Associated Relocation of Water Management Infrastructure at Boschmanskrans Section of Douglas Colliery

[20] South32 (February 2017) Land and Rehabilitation Management Plan. OL_WVK_PROD_SOP_035

[21] *Pers. comm*. Div De Villiers 7 February 2018

- The rehabilitated area will be surrounded by other grazing, as well as pockets of biologically diverse Eastern Highveld Grassland or Rand Highveld Grassland, allowing for wider regional integration on land use implementation.
- Established, healthy grazing and surrounding land use/s will be providing habitats to a diverse range of birds, small mammals, reptiles, amphibians and invertebrate species.
- A land management plan will be in place and will include guiding specifications for the care-and-maintenance of rehabilitated land, including:
  - Specific facilities on which low-production grazing should be controlled – waste residue facilities (dumps, slimes, etc.), and carefully managed;
  - Fertilisation requirements of pasture grass species to ensure a healthy sward, if needed. Exact fertilisation frequencies, seasonality, and quantities and ratios of LAN fertiliser, and (calcitic or dolomitic) lime if necessary, would be in accordance with specifications generated from land capability assessments;
  - Annual defoliation requirements of pasture grass species, via controlled grazing. In areas where controlled grazing is not possible, the grass will be manually cut and removed every two to three years. (As the rehabilitated area will predominantly be used for grazing uses, no burning regime will be required in support of ecological diversity);
  - Manual control of declared weeds and invader plant species;
  - Livestock stocking rates (carrying capacities) to manage potential for over-grazing;
  - Any activities related to day-to-day farming activities and associated limited maintenance would remain the onus of the new landowner (such as replacement of fencing);
  - Indication of where infrastructure can and cannot be constructed (such as over unconsolidated spoils).
  - The details of the land management plan will be ready for inclusion in the land's Title Deeds, for sale to the new landowner.
- All bio-, air quality-, land capability- and discard facility spontaneous combustion monitoring will be complete, having already served its purpose during the care-and-maintenance period.

4.3.2 Mine-affected water

- Located in the Limpopo-Olifants primary drainage region. The site will be contributing to local surface water catchment yield as follows:
  - Quaternary catchments B11G, B11F and B11B.
- The VDDC project area will drain towards the Olifants River. Downstream of the mine, the river flows to the Witbank Bam, then to the Loskop Dam and through the central part of Kruger National Park to Mozambique. It joins the Limpopo River and discharges into the Indian Ocean on the east African coastline.
- Decant is expected to take place at the Olifants River tributary if the water level exceeds 1530 mamsl.

- At VDDC, the contamination plume is highest concentrations are expected to remain within the boundary of the opencast pit with limited migration downstream (within 100 years post mining).
- A sustainable water management strategy would be in place to manage long-term water make from the site, utilising suitable technology available at the time. Accordingly, water quantities and qualities would be aligned to Resource Water Quality Objectives (RWQOs)**Error! Bookmark not defined.** for the Olifants River.
- A water management plan will have been compiled, for handover to the new landowner as part of the Title Deeds' sale, documenting key land management aspects required to prevent water-related impacts to the new owner / user. This will document at least the following:
  - Exclusion zones where new boreholes cannot be drilled due to the potential draw-down effect they may have on groundwater plumes (both for the new user's information and regulators that will be responsible for the approval and licencing of future groundwater abstraction). (Private boreholes and/or springs that could be affected by plume movement will also be highlighted).
  - Any ongoing commitments including off-take users, pump volumes and rates, maximum allotted quotas, etc.
- Ongoing requirements for dedicated surface- and groundwater monitoring that will need to remain in place to continue to monitor effects of natural groundwater recharge levels and rates, future decant locations, as well as changes in water qualities due to the SO_4 plume movement and decant manifestation. The State, via the DWS, will retain responsibility for catchment water monitoring (surface water), and that any required groundwater monitoring would be provided for, for use by the new landowner.

4.3.3 Social

- All SLP-related actions – local economic development (LED) programmes, human resource development programmes and downscaling and retrenchment initiatives[22] would have been actioned and completed.
- Mining in Mpumalanga will in all likelihood have already started downscaling, as regional coal reserves come to an end. Hence, the Middelburg/eMalahleni surrounding communities would not be predominantly employed within the regional mining sector. There would instead be a higher job-dependency on alternative industries such as alternative energy-generation and agriculture.
- The rehabilitated project area will be fenced to limit unwarranted site access by humans and/or animals, as far as practical and possible.
- The only mining-related surface infrastructure still on surface would be access roads and/or livestock feeding and management facilities (clean water canals and dams[23]) required for farming-related activities. In addition, pumps and pipelines for water management facilities would be in place, as would remaining monitoring boreholes.

[22] BECSA (April 2002) Social and Labour Plan for BHP Billiton Energy Coal South Africa Douglas Middelburg Complex

[23] BECSA (December 2014). Closure Plan for Wolvekrans

4.3.4 Substitute economies

- Within Mpumalanga, and the Steve Tshwete and eMalahleni LM specifically, local economic development would be aligned with the municipal planning objectives of efficient infrastructure and energy supply, sustainable human settlement and social facilities, and education. The rehabilitated Wolvekrans areas would further be aligned to the New Partnerships for Africa's Development (NEPAD) socio-economic principles. Specifically, the rehabilitated areas would be contributing to NEPAD's Investment Programme of Natural Resource Governance and Food Security, through the provision of economic input from pasture-related post-mining land uses.
- Aligned to the above, the rehabilitated landscape will be functioning as part of a larger, regional municipal land use plan. The R575 and R547 would still be key access routes around the site, for integration of MR379's rehabilitated site with adjacent, neighbouring land users.
- Public-private partnerships between the remaining private sector, government agencies, NGOs and communities would form the basis of sustainable economic activities in the area.

4.4 Closure objectives

The closure objectives represent the key measurable closure targets for the various closure planning aspects, based on the determined closure state, that are within the operation's control. Ultimately, closure objectives should be contextualised to represent achievement of the closure vision and related closure state.

Well-conceptualised closure objectives will allow assessment of the risks associated with achieving these objectives, and therefore guide setting of suitable rehabilitation and closure actions to be taken to mitigate these risks at every stage of the operation's life.

Closure objectives should be as specific, measurable, achievable and realistic as possible. They should also define a time period against which they can be measured. This 'SMART' approach to setting the closure objectives and its relevance to the South32 closure planning is defined in Figure 11.

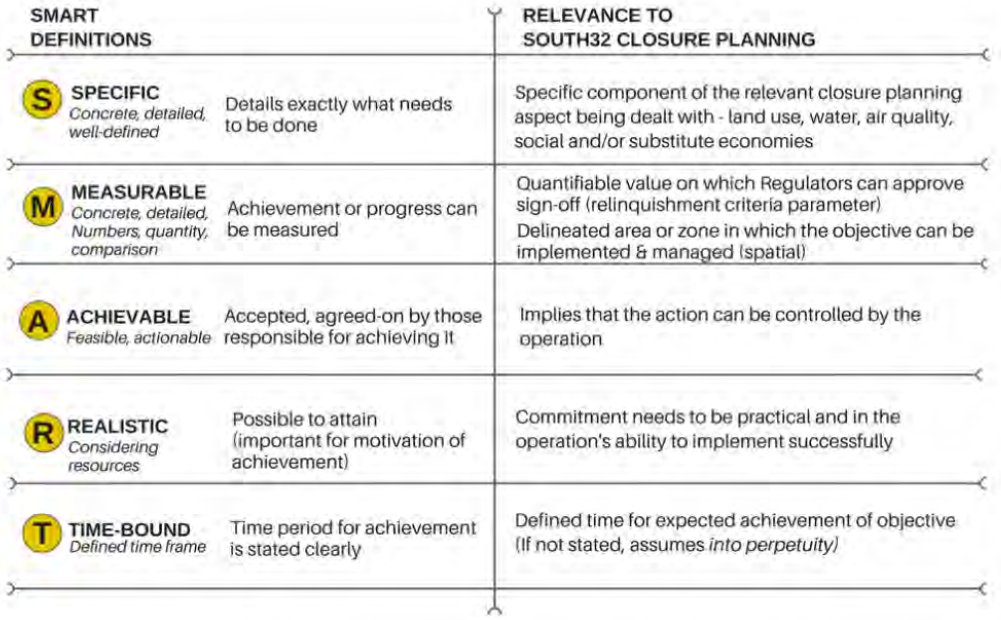


Figure 11: Definition of SMART closure planning objectives

It is noted that unless otherwise specified, T – time will, by default, represent the point in time as defined by the closure state.

The closure objectives for the VDDC infrastructure development project are provided in **Figure 12**.

• To mimic regional geomorphological features, by maintaining a free-draining topography across the rehabilitated MRA	TOPOGRAPHY
• To maintain a grazing land use, as defined in the Guidelines for the Rehabilitation of Mined Land (2007), over 80% of the rehabilitated portions of the MRA, that can sustain at least a 2.4 ha/LSU and/or 5 t/ha carrying capacity	LAND CAPABILITY & SOILS
• To maintain a productive vegetation cover that supports a regional pasture-related carrying capacity of 2.4 ha/LSU and/or 5 t/ha of hay, at a vegetative cover of ≥ 75%	FLORA
• To achieve creation of habitats for local fauna expected to occur within the rehabilitated areas on which a grazing land use is taking place.	FAUNA
• To maintain the visual landform as aligned to the approved surface rehabilitation landform design of the rehabilitated landscape, that blends into the surrounding areas	VISUAL / AESTHETICS

• To continue to contribute to an agreed-on, predetermined catchment yield, based on calculated rehabilitated surface drainage densities, aligned to closure state date-specific climatic conditions	
• To guide groundwater abstraction within the MRA to an authorised quantity proven to not impact on groundwater quality	QUANTITY
• To have implemented an alternative, agreed-on land owner/user-maintained groundwater supply or source for predefined land owner/user/s supplied with water during mining operations	
• To not exceed agreed-on, predefined surface water quality objectives (including PES and EIS), as stipulated in the RWQOs for the following catchments: B11B, B11F and B11G	
• To limit groundwater abstraction to not exceed a predefined radius of influence and/or usage that has been proven to not impact on groundwater quality (induced plume movement)	QUALITY
• To prevent existing groundwater contaminant plumes from migrating further outside of the MRA (natural plume movement)	

• To maintain local air quality parameters of PM10 to agreed-on, predefined human health-related standards, in terms of national ambient air quality of the Highveld Priority Area	DUST & EMISSIONS

• To achieve a safe and healthy environment for people and animals, through achievement of the land use, water and air quality closure objectives	EMPLOYEES & DEPENDANTS
• To have completed implementation of the closure-related projects agreed-on in the mine's approved Social & Labour Plan, focusing on personal skills development and local economic development	COMMUNITIES & LAND OWNERS

• To have developed a plan for care-and-maintenance of remaining mining-related surface infrastructure that has a beneficial re-use, for hand-over to- and accountability by the next land owner	
• To have demolished all mining-related infrastructure, except for those facilities that have been identified as having a beneficial post-mining land use potential (e.g. for livestock watering, water management, etc).	INFRASTRUCTURE
• To have identified public-private partnerships accountable for management and maintenance of the rehabilitated landscape and its long-term use/s	
• To leave behind a rehabilitated landscape that will retain long-term economic value for future land owners.	POST-OPERATIONAL ECONOMIC CONTRIBUTION

Figure 12: VDDC closure objectives

5. RISK ASSESSMENT

The intention of an environmental risk assessment related to closure is to:

- Compile a risk register (list) of events that could influence achievement of closure state;
- Quantify the significance of the identified environmental risks in terms of likelihood of occurrence and associated impact (risk analysis);
- Evaluate the level of acceptability of occurrence and associated impact of the identified risk (risk evaluation); and
- Devise appropriate mitigations or controls (closure actions) to prevent or reduce the impact of the identified risk (risk treatment), that should be implemented.

Figure 13 details the risk assessment process followed for the VDDC's closure-related risk assessments as part of closure planning[24].

A *qualitative environmental risk assessment* was undertaken to inform the site's closure planning, which was used to identify uncertain future events that could influence the achievement of the planned project's identified closure objectives. As the closure knowledge base improves over time, this baseline qualitative risk assessment would need to be refined to a quantitative risk assessment. A *quantitative environmental risk assessment* uses theoretical and/or calculated data to more accurately determine the likelihood of the identified event occurring and the severity of its consequence. This implies the need to refine specialist studies on specific closure-related aspects, aligned to changes in the landscape and/or based on results of ongoing monitoring trend analysis on the concurrent rehabilitation implemented during operations.

Table 4 summarises the key differences between qualitative and quantitative risk assessments (this summary has been adapted from the PMBOK Guide, 5th Edition).

Table 4: Key differences between qualitative and quantitative risk assessments

Qualitative risk assessment	Quantitative risk assessment
Considers all possible risks that could influence closure objectives.	Only considers the risks which are marked for further analysis in the qualitative risk analysis process. These are the risks which have high impact on the closure objectives.
Does not analyse the risks mathematically to identify the probability and distribution. Rather stakeholders' inputs (expert judgment) are used to judge the probability and impact.	Uses the probability distributions to characterise the risk's probability and impact. It also uses project modelling, mathematical and simulation tools to calculate the probability and impact.
Assesses individual risks by assigning numeric ranking of probability and impact.	Predicts likely project outcomes in terms of money or time, based on combined effects of risks. It estimates the likelihood of meeting targets and

[24] To align to best practice, this Closure Planning Standard has adopted the international risk management process as described in the ISO 31000:2009 Risk Management Principles and Guidelines. It has also adopted the South32 Material Risk Standard[24], which is closely aligned with the ISO Guidelines. This enables reporting and accountability of environmental risks to be allocated and addressed appropriately across South32 operations. It also allows for capital expenditure required for implementing operational closure plans to be compared with other business-related capital projects

Qualitative risk assessment	Quantitative risk assessment
	contingency needed to achieve desired level of certainty.

The specific methodology followed for this closure-related qualitative risk assessment (RA) has already been provided in **Section 5.1**.

Once again, it is important to note that the focus of this rehabilitation and closure planning for VDDC is on those key site aspects and/or manifesting risks that could require long-term mitigation and management after mine decommissioning. Accordingly, it is assumed that risks manifesting during the operational period would be managed in terms of EMPR/EMPr commitments. Hence, this environmental RA focuses on the defined closure state situation. An environmental risk report as per Appendix 5 of GNR 1147 has been completed for VDDC and this section provide a summary of the key aspects of that risk assessment.

5.1 Risk methodology

It is important to note that the steps of risk identification, risk analysis, risk evaluation and risk treatment are an iterative process. The outcome of this process will ultimately inform the closure actions required to manage the closure risks and should be updated on a frequent basis as new information becomes available or if there are significant changes to the mine plan.

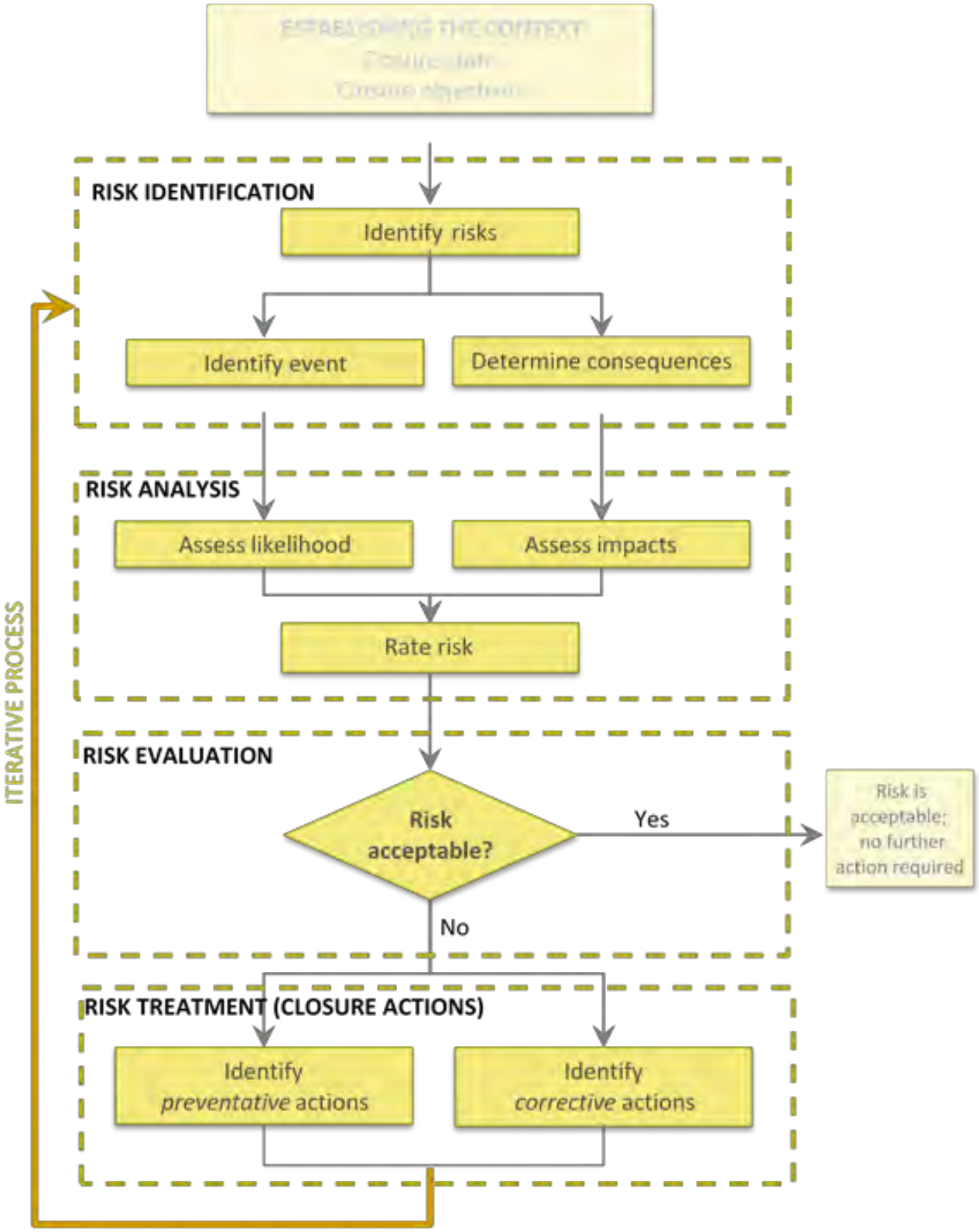
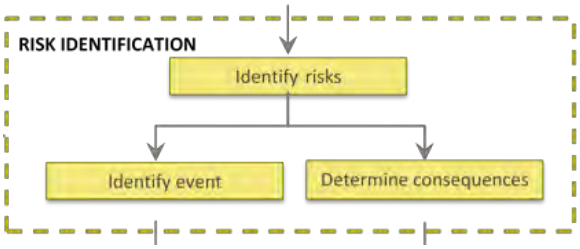


Figure 13: **Closure-related environmental risk assessment process used for Wolvekrans Colliery**

5.2 Risk identification

The risk identification process produced a comprehensive list of closure-related risks and, some site opportunities as well. At this stage, a wide net has been cast to understand all potential risks making up the operation's closure-related risk profile.



The risk events that could influence achievement of VDDC's closure objectives have been identified from:

- MR379's existing 2016 closure risk register[25]; and
- Outcomes from site-specific specialist reports (as determined during compilation of the closure knowledge base).

For each risk event, the following have also been provided:

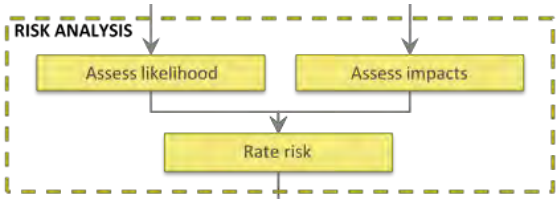
- A description of the *risk drivers* that could result in the manifestation of the risks, if closure actions already have been implemented during the execution of operational concurrent rehabilitation;
- A description of the risk *consequence/s or trigger/s,* which can be used to identify that the risk is imminent or has manifested; and
- Predicted timeframes for risk occurrence (pre-closure, or post-closure).

As the closure knowledge base improves over time, the risk register can be refined, as informed by the most up-to-date supporting studies.

Risk analysis

For VDDC's closure planning, analysis of closure-related risks was undertaken at a qualitative level, due to the level of detail of the available closure knowledge base.

This implies that the risk assessment did not analyse the risks mathematically, but rather used expert judgment to rate the likelihood and consequence of an event in terms of descriptive words like "high", "medium", "low". As the closure knowledge base improves over time, this qualitative risk assessment would need to be refined to a quantitative risk assessment to improve the accuracy of the allocated financial provision. (A quantitative risk assessment uses theoretical and/or calculated data in the form of predictive models to determine the probability of the identified event occurring and the severity of its impact. This implies the need to refine specialist studies on specific closure-related aspects, aligned to changes in the landscape and/or based on results of ongoing monitoring trend analysis).



For each risk event, the likelihood of the event occurring as well as its potential impact were determined.

Likelihood is the chance of something happening[25]. Likelihood can be described using general terms or can be expressed mathematically as either a frequency of event

[25] South32 Material Risk Management Standard (27 November 2015).

occurrence and/or the probability of the event occurring. The South32 risk likelihood table (**Table 5**) describes the likelihood of an event occurring[26].

Table 5: South32 risk likelihood table, including probability rating for risk event occurrence

Uncertainty of event occurrence	Frequency of event occurrence	Likelihood factor	Probability of event occurrence	Likelihood rating
Almost certain	Could be incurred more than once in a year	10	>80 %	L6
Likely	Could be incurred over a 1 – 2-year budget period	3	50 – 80 %	L5
Possible	Could be incurred within a 5-year strategic planning period	1	20 – 50 %	L4
Unlikely	Could be incurred within a 5 – 20-year timeframe	0.3	5 – 20 %	L3
Rare	Could be incurred occur within a 20 – 50-year timeframe	0.1	1 – 5 %	L2
Very rare	For a system failure: no evidence of this in industry within last 50 years / For a natural hazard: predicted return period of 1:100 years	0.03	0 – 1 %	L1

An **impact** is what will happen if the risk occurs or, the outcome of the risk event[25] that affects achievement of a closure objective. The South32 risk severity table provides specific impact types and associated impact criteria for each of these types. The impact types used by South32 are the following:

- Health-and-safety;
- Environment;
- Community;
- Reputation;
- Legal; and
- Financial.

The South32 risk severity table is provided in **Appendix A-3**.

An impact severity scale of 7 to 1 and a related severity factor of 1000 to 1 are assigned to each of the impact types. The impact type, in combination with specific determined impact criteria per impact type, are used to derive a final impact severity scale and factor. All impact types are rated individually for each risk event. The worst impact rating will be used to determine the severity factor.

For closure planning purposes it is assumed that VDDC's EMPr will be implemented. This implies that certain rehabilitation- and/or closure actions are already in place, towards achievement of the closure objectives[27]. Accordingly, for closure planning, all closure-related risks will be deemed as residual risks, where a *residual risk* is a risk that

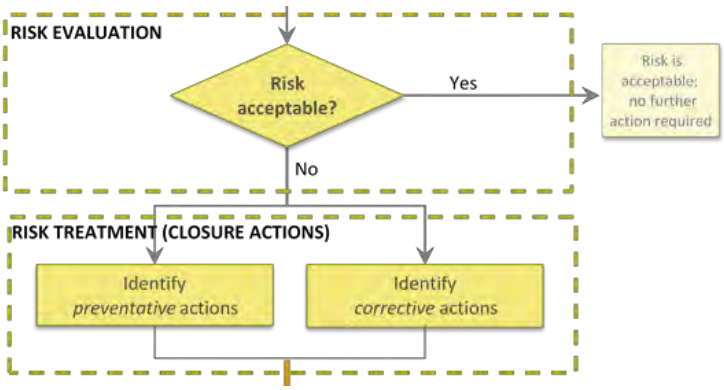
[26] Based on the 'business' likelihood and not 'projects' as provided in the South32 Material Risk Management Standard

[27] An inherent risk is seen as a risk event occurring where no controls nor mitigations are in place - i.e. the risk event occurs, and no form of rehabilitation and closure plan has been implemented. To align with the South32 Risk Management Standard, the maximum foreseeable loss (MFL) is calculated at this point. In other words, this is the worst-case scenario with no rehabilitation and / or closure planning in place. However, operations are legally required to implement rehabilitation, and hence inherent risks will not form part of closure planning.

may result or manifest after actions for final rehabilitation, decommissioning and closure have been implemented[28], where required. Hence, a residual risk is a risk event occurring with closure actions, if required, already in place.

The **risk rating** for a risk event has been derived by multiplying the likelihood factor (L1:0.03 to L6:10) and the severity factor (1:1 to 7:1000) of the impact types (Health and Safety, Environment, etc.) which resulted in the highest impact rating for the risk event. The risks were then shown graphically on a risk matrix by plotting the likelihood factor and severity factor of the impact type which gave the highest impact rating for the risk event (**Figure 14).**

Risk evaluation



The focus of risk evaluation for this closure planning is to identify **unacceptable risks** to achieving a site's closure objectives, towards being able to put suitable measures in place to mitigate these risks. Hence, once the risk has been rated, it needs to be determined whether the risk is at a level that is acceptable for the achievement of the determined closure state, which will need to be signed-off by the relevant authorities. If the risk is deemed acceptable, no further closure actions (mitigation) are required. However, if the risk is deemed unacceptable, a specific closure action would need to be put in place to prevent the occurrence of the risk, or to mitigate its impact should it occur. Any closure actions should reduce the unacceptable risks to an acceptable level.

This 'acceptability level' has been represented by an illustrative 'acceptability line' within the risk matrix. An acceptable risk rating and, hence, the exact location of the acceptability line in the risk matrix has been provided based on previous similar projects undertaken with South32. However, this acceptability line will need to be negotiated with- and agreed on by the relevant authorities responsible for final closure certification approval. **Figure 14** illustrates the South32 closure-related acceptability line for MR379's closure planning.

[28] DEA NEMA GNR1228 (November. 2017): Definitions.

30	100	300	1000	3000	10000	7	1000
9	30	90	300	900	3000	6	300
3	10	30	100	300	1000	5	100
0.9	3	9	30	90	300	4	30
0.3	1	3	10	30	100	3	10
0.09	0.3	0.9	3	9	30	2	3
0.03	0.1	0.3	1	3	10	1	1

L1	L2	L3	L4	L5	L6
0.03	0.1	0.3	1	3	10
Very rare	Rare	Unlikely	Possible	Likely	Almost Certain
The event may occur within the next 50+ years	The event may occur within the next 20-50 years	The event may occur within the next 5-20 years	The event may occur within the next 2-5 years	The event may occur within the next 1-2 years	The event may occur once a year
0% - 1%	1% - 5%	5% - 20%	20% - 50%	50% - 80%	>80%

Figure 14: Risk matrix with 'red acceptability line' showing indicative acceptable levels of risk for Wolvekrans Colliery's closure-related risks.

To prevent a risk event or reduce its impact, various preventative or corrective control or mitigation measures (hereafter referred to as closure actions) can be implemented. The closure actions identified for VDDC's closure-related risks are provided in **Section 5.6**.

A key objective of the approach followed is that, by defining residual closure-related risks as early on as possible, the closure knowledge base can be refined during the operational period towards being able to accurately quantify the long-term liabilities associated with these risks that could potentially remain in the rehabilitated landscape.

5.3 Risk identification and quantification

Based on the approach described above, the key risks that have been identified as having relevance to the VDDC's closure state environment are provided in **Table 6**.

Table 6: Closure-related risks identified for VDDC, including risk type, drivers and triggers.

Closure Planning Aspect		Closure Objectives	Closure-related Risk	Risk Trigger	Risk Driver
Land use	Land capability	To maintain a grazing land use, as defined in the Guidelines for the Rehabilitation of Mined Land (2007), over the rehabilitated portions of the Mining Rights Area, that can sustain between 2.4 to 5 ha/LSU and/or 5t/ha carrying capacity	Inability to maintain a grazing land use	Loss of adequate cover thickness (to <250 mm) over the backfilled spoils for vegetation establishment and growth	Erosion
Mine-affected water	Quantity	To continue to contribute to an agreed-on, predetermined catchment yield, based on calculated rehabilitated surface drainage densities, aligned to closure state date-specific climatic conditions	Reduction in downstream surface water yield to Olifants-Limpopo primary drainage region	Reduction in surface runoff flow to downstream catchment, resulting in ponding	Settlement of backfilled spoils
				Increased infiltration through backfilled spoils	Settlement of backfilled spoils
		To guide groundwater abstraction within the MRA to an authorised quantity proven to not impact on groundwater quality	Deviation / exceedance of authorised groundwater abstraction, resulting in a reduction in the groundwater yield that negatively impacts on groundwater volumes available to authorised borehole users	Reduced groundwater volumes available to other authorised groundwater users within the GMP	Excessive or deviated (unauthorised) groundwater abstraction within the exclusion zone (based on GMP)
	Quality	To not exceed agreed-on, predefined surface water quality objectives (including PES and EIS), as stipulated in the RWQOs for the following catchments: B11B, B11F and B11G.	Deviation / exceedance of RWQ surface water objectives	Surface runoff: Exposure of surface runoff to underlying spoils, thereby increasing volume of contaminated surface runoff reporting to downstream catchment	Rill erosion of cover layer Gully erosion
				Failure of water management solution / technology due to variations in design criteria quantities (i.e. decant management)	Settlement and resultant ponding Increased infiltration through back-filled spoils
		To not impact on the quality of the aquifer adjacent to the rehabilitated open pit, by not exceeding the predefined groundwater quality objectives	Deviation / exceedance of the groundwater quality objectives	Failure of water management solution / technology due to variations in design criteria qualities	Changes to predicted groundwater qualities within the rehabilitated pits due to unexpected inflows (from sources such as increased surface recharge rates, unmitigated inter-mine flows, etc.)
Air Quality	Dust & emissions	To maintain local air quality parameters to agreed-on, predefined human health-related standards in terms of national ambient ait quality of the Highveld Priority Area	Deviation / exceedance of the air quality objectives	Dust generation due to rehabilitation activities.	Erosion of surfaces
Social	Employees & dependants	To achieve a safe and healthy environment for people and animals, through achievement of the land use, water and air quality closure objectives	People or animals being injured due to aspects directly related to the rehabilitated site	People or animals being injured as a result of falling into settled/subsided areas	Settlement of backfilled spoils
				People or animals drowning in ponds formed in settled/subsided areas	
Substitute economics	Infrastructure	To have demolished all mining-related infrastructure, except for those facilities that have been identified as having a beneficial post-mining land use potential (e.g. for livestock watering, water management, etc).	Failure of infrastructure remaining on site	Buildings and/or other infrastructure in a state of disrepair	Lack of proper maintenance

5.3.1 Results and findings of the qualitative environmental risk assessment: moderate or high significance

Table 6 highlights identified closure-related latent risks rated as been significant and specifically related to VDDC. It is noted that some risks could have more than one risk driver, resulting in more than one risk rating and the number of risk events are indicated in brackets. Only those risks (and associated risk drivers) identified as being significant or data deficient are discussed below.

Surface water quality

Following mine closure and rehabilitation of the pit, the backfill will form an artificial aquifer which is likely to discharge. A decant management plan should be developed and should include measures such as the containment of seepage or decant water in appropriate facilities

Groundwater quantity

The closure objective is to guide appropriate groundwater abstraction within the VDDC area to an authorised quantity that has been proven to not impact on groundwater use within the rehabilitated VDDC area. The base case for closure will include the compilation of a Groundwater Management Plan as described in **Section 4.3**. A hydrocensus has however been completed as part of the VDDC mining and infrastructure project. The drawdown cone is not expected to impact on private borehole users as the zone of impact in limited to within the boundaries of VDDC and MR379.

Groundwater quality

The closure objective is to not impact on the quality of the aquifer adjacent to the rehabilitated areas, by not exceeding the predefined groundwater quality objectives. Post closure modelling indicated that 100 years after closure, the pollution concentrations at the majority of the sources start to decrease but the plumes would have migrated further away from the potential sources and affected the Olifants River and its tributaries[29].

5.3.2 Explanation of changes to the risk assessment

Although MR379 has undertaken closure-related risk assessments for in the past, they have not been undertaken based on the above approach nor for the proposed VDDC infrastructure project. Hence, for this closure reporting, 'no changes to risk assessment results' are noted – should these occur in future, they will be documented in subsequent revisions of this reporting.

5.4 Closure and post-closure options – alternatives and preferred option

Various closure and post-closure options are available within the closure planning landscape, based on the site's environmental and socio-economic closure knowledge base. However, not all these options are practical, feasible or suitable to the site's environmental and/or social context. **Table 7** summarises the various alternative closure and post-closure options discussed as part of VDDC's closure planning. This table also

[29] Jones & Wagener (February 2019) Vandyksdrift Central (VDDC) Mining: Infrastructure Development Hydrogeological Investigation. Report No. JW190/18/G535-04.

highlights the preferred closure option used to inform the rest of the closure planning (highlighted in green).

These preferred closure options have been used to inform the site's closure planning context (design principles) (**Section 4.3 above**).

Table 7: Alternative closure and post-closure options for VDDC (green highlighted cell indicates preferred option)

Aspect		Closure options considered		Motivation for selected preferred closure option
		Alternative	**Description**	
Land use	Land capability	Wetland	Wetland conforms to all the following requirements[30]: • a diagnostic organic (O) horizon at the surface; and • a horizon that is gleyed throughout more than 50 percent of its volume and is significantly thick, occurring within 75 cm of the surface.	Arable land will be permanently lost due to mining activities, with limited topsoil available for rehabilitation. A grazing land use is more feasible considering the area available for rehabilitation and has the potential to involve communities in the post-closure land use.
		Grazing land	Grazing land conforms to all the following requirementsError! Bookmark not defined.: • does not qualify as wetland or as arable land; • has soil or soil-like material, permeable to the roots of native plants, that is more than 0.25 m thick and contains less than 50 % by volume of rocks or pedocrete fragments larger than 100 mm diameter; and • supports or is capable of supporting a stand of native or introduced grass species or other forage plants utilisable by domesticated livestock or game animals on a commercial basis.	
		Wilderness	Value and desire for recreation in this area not considered to be sufficiently high.	
		Arable land	Arable land conforms to the following requirementsError! Bookmark not defined.: • does not qualify as wetland; • has soil that is readily permeable to the roots of common cultivated plants throughout a depth of 0.75 m from the surface; • has a soil pH value between 4.0 and 8.4; • has electrical conductivity of the saturation extract less than 400 mS/m at 25 °C and an exchangeable sodium percentage less than 15 through the upper 0.75 m of soil; • has a permeability of at least 1,5 mm per hour in the upper 0.5 m of soil; • has less than 10% volume of rocks or pedocrete fragments larger than 100 mm in diameter in the upper 0.75 m of soil; • has a slope (in percent) and erodibility factor (K) such that their product is less than 2.0;	

[30] Chamber of Mines of South Africa/Coaltech (November 2007). Guidelines for the Rehabilitation of Mined Land.

Aspect		Closure options considered		Motivation for selected preferred closure option
		Alternative	**Description**	
			• occurs under a climate regime which permits, from soils of similar texture and adequate effective depth (0.75 m), the economic attainment of yields of adapted agronomic or horticultural crops that are at least equal to the current national average for those crops; or • is either currently being irrigated successfully or has been scheduled for irrigation by the DWS.	
Mine-affected water	Surface water management	Free draining	The final topography of the rehabilitated areas needs to ensure that clean water is diverted off the site through dedicated stormwater management structures.	Aligned with the requirements of the EMPr and WULs, for MR379, the VDDC site should be made free draining to ensure that stormwater is diverted across the site in control manner minimizing the potential for erosion and the reduction of downstream catchment yield by reducing the likelihood of ponding.
		Non-free draining	The final topography of the rehabilitated areas allows water to pond on site and/or or clean water is allowed to flow across the site in an uncontrolled manner.	
	Decant management	Passive Management	Management systems that do not require ongoing addition of chemical reagents and as a result have low running and maintenance costs, but is currently only effective for low contaminant remediation	Passive management of mine-affected water will be more resilient and requires less maintenance than active management, but if future decant will be more than initially determined, active management will need to be implemented. The most likely scenario would involve a combination of all three water management options.
		Semi-passive Management	Utilises moving parts and chemicals without continuous power and labour required for active systems	
		Active Management	Active water management uses chemicals, energy, labour, and infrastructure. It has the smallest possible footprint for water management but it the most expensive system.	
Substitute economies	Surface infrastructure	Demolish/decommission only mining-related infrastructure within VDDC area	Mining-related infrastructure include stockpiles, dumps, pollution control dams etc.	Non-mining-related infrastructure that may be utilised for the post-mining land use will be more beneficial if retained than if demolished.
		Demolish all infrastructure within the VDDC area	Non-mining-related infrastructure include roads, powerlines, offices, workshops, etc.	
	Post-operational economic contribution	Identify public-private partnerships to manage and maintain rehabilitated land.	A contract between a public-sector institution/municipality and a private party, in which the private party assumes substantial financial, technical and operational risk in the design, financing, building and operation of a project.	The private sector can provide financial support to manage and maintain rehabilitated land, if there is incentive.

Aspect		Closure options considered		Motivation for selected preferred closure option
		Alternative	**Description**	
		Entrust rehabilitated land to the government.	Government will be responsible for the maintenance, management, and utilisation of the rehabilitated land.	

5.5 Closure planning assumptions

Aligned to the above South32 closure intention, as well as taking cognisance of supporting specialist information, the following key assumptions have been made during compilation of VDDC's closure reporting:

- South32's overarching company-wide *closure intention* implies the desire for a walk-away closure state for VDDC. Hence, all closure planning has assumed no long-term, ongoing involvement by South32 in the VDDC's post-closure period.
- When defining VDDC's relinquishment criteria, these target criteria are based on the most recent site knowledge, and the level of detail from the supporting information received. As a basis, regional legislative information is used to inform setting of these targets. However, where the site has specific legislative conditions that it is required to adhere to, it has been assumed that these conditions supersede regional guidance. For example, for VDDC, regional water RQOs are in place; however, the site has WUL-specific water quality and quantity conditions that have been used as the site's closure-related mine-affected water relinquishment criteria.
- The LoOP and post-closure (latent) risks identified as part of this closure reporting have been assessed at a qualitative level based on available information.
- The raw water pipeline and infrastructure related to water supply would not be removed in order to maintain portable water supply future land users.
- All documentation provided by South32 and used to inform the Closure Planning process are assumed to contain correct information. Where ambiguous information arose, clarification was provided by South32.
- The Closure Plan is regarded as a live document and the information used within is relatable to the current situation at VDDC. Therefore, it will be necessary to update the closure plan as mining develops and new information / technologies become available.
- The site's closure planning is underpinned by the guidance provided in a draft South32 Closure Planning Standard. This document aims to take a good practice approach to standardising the way closure planning is undertaken across the African Region operations, as well as ensuring alignment of all operations to the requirements of South African rehabilitation– and closure-related legislation.
- The historical underground mine known as Douglas Colliery does not form part of this closure planning, as this area will be mined out using opencast methods at the Vandyksdrift section.
- Any land claims on South32-owned surface rights would have been settled by the time of closure.
- It is assumed that any mining infrastructure which can be re-purposed in support of the end land use will be retained and transferred to a competent third party.

5.6 Actions for final rehabilitation, decommissioning and closure

5.6.1 Closure actions and implementation schedule

A closure action is a specific action determined to reduce identified closure-related risks rating occuring. These actions will not necessarily completely remove the likelihood of

occurrence of the risk event, nor totally reduce the impact of the event. However, they have to reduce the closure-related risk rating to an acceptable level.

Closure actions can be distinguished based on its effect as being either a preventative or corrective control, or a combination of both, as follows:

- Preventative actions have the effect of, upon implementation, reducing the likelihood of occurrence of a closure-related risk event. The effect would be to reduce the likelihood to the extent that the revised risk rating will be acceptable. If this does not realise, the control would be ineffective for the specific purpose and possibly not worth considering. Certain preventative actions can also reduce the impact of a closure-related risk event.
- Corrective actions reduce the impact of a closure-related risk event. The aim would again be to reduce the impact to the extent that the revised risk rating will be acceptable.

Table 8 provides the closure actions and indicative implementation schedule to either prevent or correct identified closure risks. Implementation of these actions have been highlighted as having to be undertaken either pre-closure, or post-closure (where 'closure' is considered achievement of the closure state i.e. site relinquishment). The key objective is that the closure action should reduce the identified closure risk to an acceptable level.

Table 8: Closure actions for VDDC

Target Area	Closure Actions	Action Type	Implementation Period
D4 (Vandyksdrift includes the proposed VDDC infrastructure development project)	Demolish all buildings, carports, fencing & walls up to 1 m below natural ground level if no beneficial post-closure use is identified. Break up and remove of all roads and parking areas. Rehabilitate infrastructure footprints by placing 300 mm topsoil and establishing indigenous vegetation consisting primarily of three perennial grass species *Digitaria eriantha* (Finger grass), *Chloris gayana* (Rhodes grass), *Eragrostis tef* (Teff) (annual), and *Cynodon dactylon* (Kweek)	Preventative	Pre-closure as areas become available for rehabilitation.
E3 (Vandyksdrift North)	Demolish all structures, including buildings, carports, fencing & walls up to 1 m below natural ground level if no beneficial post-closure use is identified. Break up and remove of all roads and parking areas. Rehabilitate infrastructure footprints by placing 300 mm topsoil and establishing indigenous vegetation consisting primarily of three perennial grass species *Digitaria eriantha* (Finger grass), *Chloris gayana* (Rhodes grass), *Eragrostis tef* (Teff) (annual), and *Cynodon dactylon* (Kweek)	Preventative	Pre-closure as areas become available for rehabilitation.
Across Sites (MR379 including VDDC)			
M – Misc (primarily dams, conveyors, lights and powerlines and railway lines)	Remove, demolish and discard electrical items and conveyors. Break up and remove all roads and parking areas. Rehabilitate wastewater infrastructure and complete earthworks to ensure all areas are safe and free draining. Rehabilitate footprints by placing 300 mm topsoil and establishing indigenous vegetation consisting primarily of three perennial grass species *Digitaria eriantha* (Finger grass), *Chloris gayana* (Rhodes grass), *Eragrostis tef* (Teff) (annual), and *Cynodon dactylon* (Kweek).	Preventative	Pre-closure as areas become available for rehabilitation.
Other – Opencast mining areas	Rehabilitation of opencast mining areas will be completed in line with the standard operating procedure on land and rehabilitation management[31] and rehabilitation designs.	Preventative	Pre-closure as areas become available for rehabilitation.

[31] South32 SA Coal Holdings (Pty) Ltd (February 2017) Land and Rehabilitation Management Plan; Version 1.0. Ref no. OLD_WVK_PROD_SOP_035.

Target Area	Closure Actions	Action Type	Implementation Period
Other – Discard Facilities	Where feasible discard stockpiles may be processed and sold as product. Alternatively discard material may be used a backfill material for the rehabilitation of the opencast mining areas.	Preventative	Pre-closure as areas become available for rehabilitation.

5.7 Relinquishment criteria

The final milestone in the LoOP arrives when decommissioning, final rehabilitation and post-operational care-and-maintenance activities are complete. Ultimately, it is the point at which the desired, authorised closure state has been achieved. At this point, regulatory approval is sought for the relinquishment of the operational lease area.

Relinquishment criteria can be defined as final closure planning performance targets; the measurable component of the closure objectives. They provide standards against which the success of achievement of closure objectives can be measured[32], and enable the operator to determine when its liability for the area ceases[33]. (They can also be referred to as success criteria, completion criteria, closure criteria, and/or release criteria).

The specific relinquishment criteria for the VDDC infrastructure development project, to the level of detail based on current supporting information, are provided in **Table 9**. It is assumed that, as more site information becomes available, these relinquishment criteria will be more quantitative (measurable) - refined over time through a process of adaptive learning, following targeted research and analysis of site-specific data.

[32] Brearley, D. (2003): Developing completion criteria for rehabilitation areas on arid and semi-arid mine sites in Western Australia. Curtin University of Technology.

[33] Australian Department of Industry, Innovation and Science website. https://industry.gov.au/resource/Programs/LPSD/Mine-closure/Development-of-a-closure-plan/Pages/Develop-closure-objectives-and-completion-criteria.aspx. Accessed 20 December 2017.

Table 9: VDDC's closure objectives and associated rehabilitation-related relinquishment criteria (performance targets)

Closure aspects		Closure objective	Relinquishment criteria
Land use	Topography	To mimic regional geomorphological features, by maintaining a free-draining topography across the rehabilitated MRA	• Rehabilitation will be undertaken in accordance with the rehabilitation design (Appendix C).
	Land capability	To maintain a grazing land use, as defined in the Guidelines for the Rehabilitation of Mined Land (2007), over 80% of the rehabilitated portions of the MRA, that can sustain at least a 2.4 ha/LSU and/or 5 t/ha carrying capacity	Physical slope conforms to the parameters listed above describing the post-mining topography. Capping is not reduced to ≤250 mm within 50 years. A grazing-specific vegetative cover of ≥ 80% is present at areas destined for a grazing land use. Secondary grass species are persisting on pasture-related rehabilitated areas. Species include but not limited to *Chloris gayana* (Rhodes grass), *Eragrostis tef* (Teff), and *Cynodon dactylon* (Kweek). No more than 10% loss of productivity on 80% of rehabilitated land, as: • Soil texture is 10 - 30% clay (arable) • Soil pH is between 5.5 - 8.5 • EC is ≤ 150 mS/m • Organics are aligned to grazing capability needs
	Flora	To maintain a productive vegetation cover that supports a regional pasture-related carrying capacity of 2.4 ha/LSU and/or 5t/ha of hay, at a vegetative cover of ≥ 75%	A vegetative cover of ≥ 75% is present. Secondary grass species are persisting on wilderness-related rehabilitated areas (side slops of discard dump and final highwall void).
	Fauna	To achieve creation of habitats for local fauna expected to occur within the rehabilitated areas on which a grazing land use is taking place.	Land capability- and flora relinquishment criteria have been met. Presence of species that indicate a positive trajectory of ecological succession.
	Visual	To maintain the visual landform as aligned to the approved surface rehabilitation landform design of the rehabilitated landscape, that blends into the surrounding areas	Rehabilitation design is successfully implemented with regards to vegetation cover (≥ 75%) and species, slope (≥ 1:5), topsoil depth (≥ 250 mm) and wetland re-establishment delineated in the Wetland Mitigation Strategy.
Mine-affected water	Surface water	To continue to contribute to an agreed-on, predetermined catchment yield, based on calculated rehabilitated surface drainage densities, aligned to closure state date-specific climatic conditions	Rehabilitated site contributes to maintaining natural catchment MARs, as follows: • B11B: 61.30 million m^3/a • B11F: 147.9 million m^3/a • B11G: 164.00 million m^3/a
		To not exceed agreed-on, predefined surface water quality objectives (including PES and EIS), as stipulated in the RWQOs for the following catchments: B11B, B11F and B11G.	PES & EIS assessments correspond with the identified categories recommended for the delineated and/or off-set wetlands: • PES: C and/or D as determined by a wetland specialist • EIS: C and/or D as determined by a wetland specialist
			Surface water quality measured is within the water quality range as specified in the relevant WULs:
		To guide appropriate groundwater abstraction within the MRA to an authorised quantity that has been proven to not impact on groundwater quantity	• Groundwater abstraction corresponds to Groundwater Management Plan (GMP) to avoid excessive abstraction and contaminant plume migration and WUL.
		To limit groundwater abstraction to not exceed a predefined radius of influence and/or usage that has been proven to not impact on groundwater quality (induced plume movement)	Quality objectives as stipulated in the Water Use License (WUL, 2012) or in the absence of specified parameter concentrations, the average pre-mining groundwater qualities as recorded in the Digby Wells Environmental report (DWE, 2015).
		To not impact on the quality of the aquifer adjacent to the rehabilitated open pits, by not exceeding the predefined groundwater quality objectives	Groundwater monitoring outside the pit areas indicates no significant increase in chemical parameters within the natural aquifer/s, based on WUL & DWS water quality objectives.
			Groundwater quality measured is within the water quality range as specified in the relevant WULs:
Air quality	Dust & emissions	To maintain local air quality parameters to agreed-on, predefined human health-related standards, in terms of national ambient air quality of the Highveld Priority Area	• Air quality monitoring shows that dust and emissions are below air quality requirements for the Highveld Priority Area, as follows: <u>Acceptable dust fallout rates</u> • Residential areas – Dust rate < 600 $mg/m^2/day$ (30-day average)

Closure aspects		Closure objective	Relinquishment criteria
			• Non-residential areas – Dust rate between 600 – 1 200 mg/m²/day (30-day average)
Social	Employees & dependents	To achieve a safe and healthy environment for people and animals, through achievement of the land use, water and air quality closure objectives	• Land use, water and air quality relinquishment criteria have been met.
	Communities & landowners	To have completed implementation of the closure-related projects agreed-on in the mine's approved Social & Labour Plan, focusing on personal skills development and local economic development	• SLP closure-related projects, that were agreed upon by stakeholders, have been met.
Substitute economies	Infrastructure	To have developed a plan for care-and-maintenance of remaining mining-related surface infrastructure that has a beneficial re-use, for hand-over to- and accountability by the next landowner	• Asset register for infrastructure transfer. • Transfer agreements, with signed-off Land Management Plan & Water Management Plan.
		To have demolished other infrastructure (non-mining-related), except for those facilities that have been identified as having a beneficial post-mining land use potential (e.g. powerlines, water pipelines, boreholes, etc.)	
	Post-operational economic contribution	To have identified public-private partnerships accountable for management and maintenance of the rehabilitated landscape and its long-term use/s	Public-private partnerships are in consultation with the next landowner.
		To leave behind a rehabilitated landscape that will retain long-term economic value for future landowners	Vegetation yield proves to be sustainable to support cattle grazing (5 t/ha).

5.8 Technical closure knowledge gaps, and implementation schedule

To enhance the feasibility of achieving the closure vision and closure state, the following research, investigations and actions have been identified for implementation during the mine's operational period. It is noted that this research is directly related to any studies that either provide alternative, more feasible closure options, assist in reducing uncertainties around the likelihoods and impacts of identified closure-related risks, and/or support selection of the preferred closure actions, that underpin the defined closure state.

Table 10 provides a dedicated implementation schedule and associated South32 responsible person towards closing the identified closure knowledge base gaps for VDDC. Current studies are those studies which are currently being undertaken by the mine with relevance to rehabilitation and closure.

Table 10: Implementation schedule and associated South32 responsibilities to close identified closure knowledge base gaps

Closure knowledge base gap	Implementation schedule (in order of priority)	Responsibility (South32 designation)
Rehabilitation audits confirming the standard and sustainability of the rehabilitation.	Once mining is commenced	HSE Lead
Updated approved rehabilitation designs for all areas.	2020-2021	HSE Lead / Principal Planning Manager
Updated social closure plan / social closure assessment	5 years before closure	HSE Lead
Socio-economic land use assessment	5 years before closure	HSE Lead / Principal Water and Rehabilitation
Development and approval of a long -term water management solution	TBA	HSE Lead/ Principal Mine Water and Rehabilitation

5.9 Implementation of rehabilitation, decommissioning and closure

The concept of continuous closure planning is not the same as concurrent, or progressive rehabilitation. Continuous closure planning implies an iterative process that extends throughout the life of the operation, which may have an impact on progressive rehabilitation.

With each iteration of this closure reporting, the level and detail of planning should improve, closing gaps in the closure knowledge base, refining closure actions, and improving mitigation of closure-related risks.

It is important to note that implementation of this closure plan is a critical component of VDDC's LoOP planning. Hence, this closure reporting will be integrated within the operation's site-specific business and mine planning, refined in a consolidated manner, on an annual basis (as required in terms of GNR 1147). This focussed integration across business units and management levels will be the only way to ensure optimised financial expenditure during operations towards a sustainable closure state.

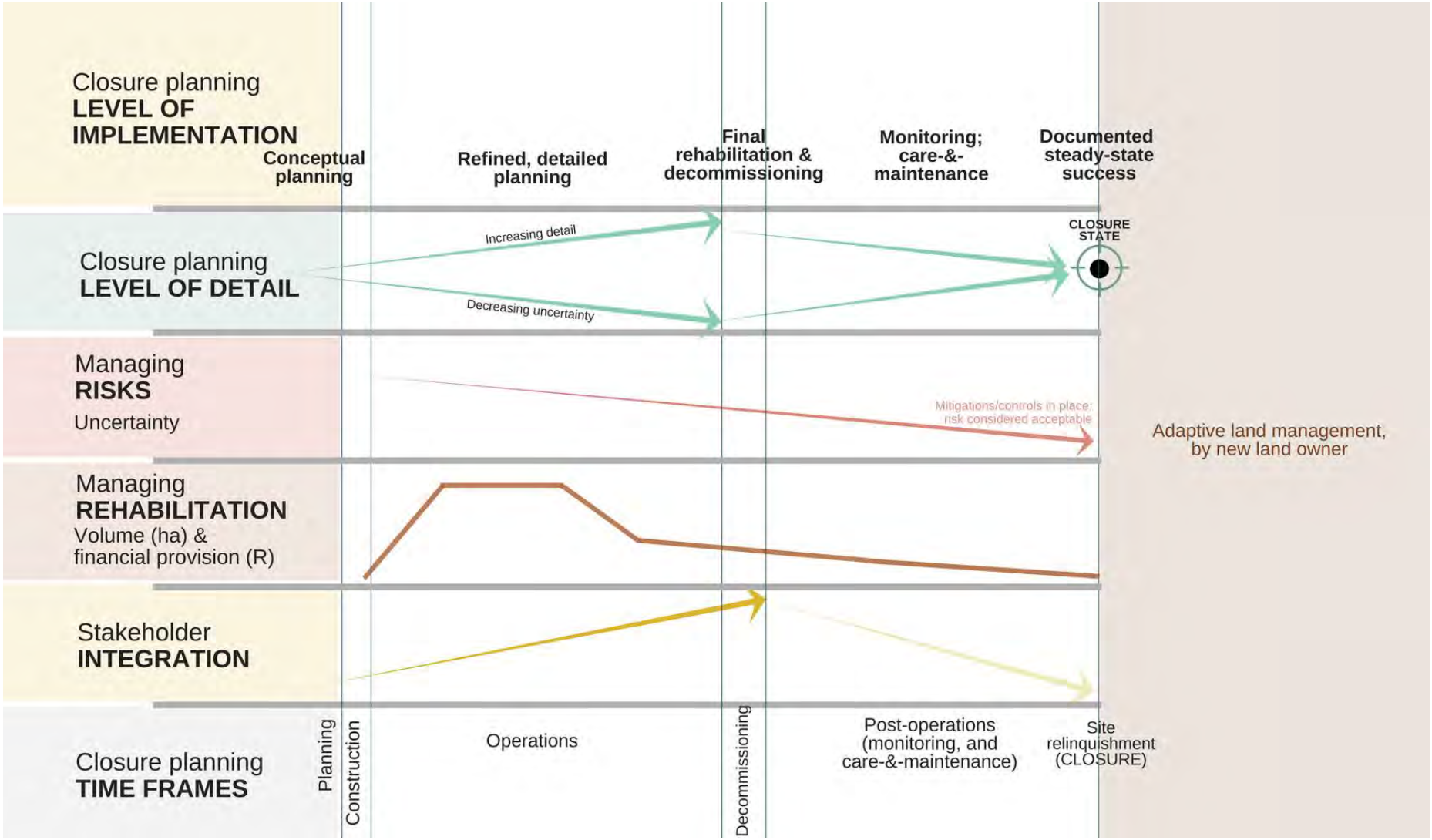


Figure 15: Closure planning implementation schedules during the life of the operation

5.9.1 Organisational structure & responsibilities

This closure plan needs actions in areas as diverse as finance, accounting, personnel management, procurement, production, environmental management, social responsibility, communications, and even sales. It is therefore far from being the sole responsibility of the operation's environmental team.

Hence, to support effective closure planning (developing, management and implementation), it is suggested that a multi-disciplinary mine closure management team be established, usually comprising the following key disciplines: environmental; social; water; financial; metallurgical and tailings; mine planning; other relevant engineering disciplines, community relations and legal.

VDDC should also have a designated person responsible for coordinating closure planning and associated implementation of closure actions – a 'closure champion'. This person is tasked with keeping the planning of mine closure up to date by identifying internal or external events that could have an impact on planning. The closure management team is also expected to inform internal decision-making processes (such as changes in the mine plan and the introduction of technological innovations) with respect to its impact on the closure state

Aligned to the above, the closure planning roles and responsibilities for VDDC's operational team are provided in **Table 11.** To assist the mine to identify a suitable closure champion, those responsibilities relevant to such a closure champion have also been highlighted.

Table 11: Closure planning roles and responsibilities: VDDC Colliery's operational teams

Company role	Closure planning responsibility	Relevance to Closure Champion
Operations Manager	Operational leadership to define and implement long-term operational sustainability, of which closure planning is an integral component Operational leadership to define site-specific closure vision and closure state Identification of closure-related risks, and decision-making of most suitable closure actions for implementation Approval and sign-off of site-specific rehabilitation and closure reporting[17] Providing adequate human and financial resources to implement closure planning Integrating closure planning into overall project and mine management	✓
Mine Planner	Changes in the mine plan to accommodate adjustments in closure objectives, etc.	✓
Rehabilitation Specialist and/or Surveyor	Sign-off and implementation of rehabilitation plans	-

Company role	Closure planning responsibility	Relevance to Closure Champion
Rehabilitation Specialist	Compilation and implementation of rehabilitation- & closure-related EMP and closure planning commitments	-
	Compilation and implementation of annual rehabilitation planning, closure planning and closure-related environmental risk reporting	✓
	Integrating closure planning into overall project and mine management	✓
	Compilation, sourcing and purchasing of rehabilitation-related materials and/or services	-
	Assessment of performance of rehabilitation and closure actions through implementation of monitoring protocols, and analysis of associated monitoring data	✓
Socio-Economic and Community Development Specialist	Establishing an appropriate closure forum for relevant stakeholder identification	✓
	Establishing an appropriate plan for ongoing engagement with the above closure forum stakeholders, and documentation of closure-related issues and opportunities raised	-
	Identify and develop strategies to minimise the impacts of closure on local stakeholders, as well as on regional economic consequences (alignment of SLPs and closure commitments)	-

5.9.2 Closure data management

Having the right information to make the best technical, environmental and socio-economic decisions in closure planning requires the collection, assessment and management of environmental, social and economic data.

A dedicated record of data, as captured in the closure knowledge base, should be used to inform the conceptualisation and refinement of an operation's closure plan.

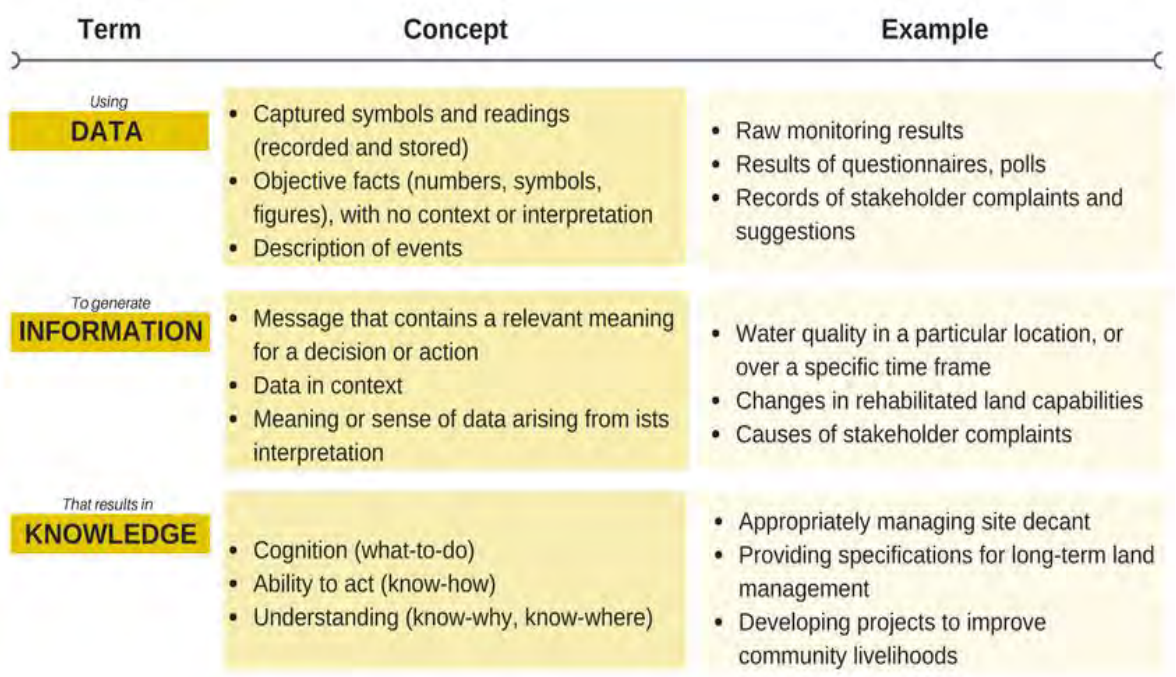


Figure 16: Use of data to generate information that can inform the closure planning knowledge base

Early identification of data and information gaps will help VDDC guide the identification and implementation of research and development programmes required to demonstrate effectiveness and success of currently unproven rehabilitation strategies. A data recording and management system will help the closure planning team to:

- Develop and maintain a consolidated, centralised rehabilitation and closure knowledge base, accessible to the entire South32 team, that includes at least the following:
  - Data presentation in tabular format;
  - Time-series graphs with comparison abilities;
  - Statistical analysis (minimum, maximum, average, percentile values) in tabular format;
  - Graphical presentation of statistics;
  - Linear trend determination;
  - Performance analysis in tabular format;
  - Presentation of data, statistics and performance on diagrams and maps; and
  - Comparison and compliance to relevant guidelines, standards, etc., and any other given objectives.
- Use data and information to analyse performance trends, over time, towards being able to determine the rehabilitation success trajectory; and
- Retain corporate memory to enable repetition of good learnings and avoidance of poor or ineffective learnings.

The mine will need to continually review information gathered as part of the closure knowledge base. As a site's rehabilitation and closure planning is reviewed, updated and refined on an annual basis, new data and information will be captured as part of the operation's data capture and management.

5.9.3 Training and capacity building

South32 have spent considerable effort in developing the detailed company specific Closure Planning Standard (as previously mentioned in this reporting). This Closure Standard is aimed at increasing site-wide knowledge of the closure planning process and the critical environmental and social aspects that would need to inform the planning. The Standard will be rolled-out across the operations, towards developing in-house closure-specific capacity.

Should any further closure-related training requirements be identified in future, these could be included in the subsequent versions of this reporting.

5.10 Closure costing

The closure cost estimation procedure for VDDC consists of two distinct components namely:

- Determination of the immediate demolition closure costs – As determined by Jones and Wagener based on the infrastructure layout provided by Worsley Parsons; and
- Determination of rehabilitation costs – As determined by Jones and Wagener based on rehabilitation designs provided by Golder & Associates (refer Appendix C2).

The assumptions and costs associated with each component are described below

5.10.1 Costing assumptions

5.10.1.1. General

The following general assumptions were made during compilation of these demolition-related closure costs:

- The demolition cost estimate was based on the measurements provided by Worley Parsons[34].
- All costs have been determined in South African Rand, with a base date of April 2018, however, CPI of 4.7% has been applied to the rates to obtain the March 2019 rates.
- As VDDC will close within the next 20 years, Appendix 6, regulation 2(k)(i) and Appendix 7, regulation 2(d)(iii) of GNR1228 stipulate that closure provisions for operations 30 years or less (but more than ten years) from closure will be prepared within an accuracy of +/- 70 percent. This cost accuracy was achieved for the demolition costing only.
- No cost is allowed in the estimate for specialist studies or other special costs (i.e. professional fees) required under future environmental authorisation requirements since these will only be certain at the time of closure. These include, amongst others, permits, appointment of specialists, design fees, etc.
- VAT and the contractor's P&Gs costs have been excluded from the cost estimates. At the time of publishing this report, a clarification of the afore mentioned was not yet officially provided by the authorities. Once this has been clarified, the costs reflected herein will need to be updated accordingly.

[34] Excel spreadsheet Copy of G535_rD_Inventory Input Measurements_20190626_TH received via email dated 29 July 2019.

- GNR1147 also stipulated that any salvage values must be excluded.

5.10.1.2. Site-specific

The following site-specific assumptions were made during compilation of these demolition-related closure costs:

- The costing includes the cost of removal of infrastructure within the VDDC project area as well as the cost of rehabilitation and maintenance of these disturbed areas. This cost excludes opencast rehabilitation.
- Demolition of infrastructure has been assumed to be up to 1 m below original ground level (OGL).
- The general site rehabilitation allowance consists of ripping of previously compacted areas (where applicable), topsoiling, vegetating and fertilising the areas, as well as maintenance. The depth of topsoil is assumed to be 300 mm (demolition costing items only).
- Aligned to the above, various areas within the MRA were identified in terms of their suitability as being either borrow areas for topsoil or disposal sites for demolition-related debris. The overhaul costs of obtaining topsoil and disposal of debris for the various sites have been included.
- A period of 5-years has been allowed for monitoring, care-and-maintenance, post-rehabilitation, where necessary.
- The total cost excludes any possible salvage value, P&Gs, VAT, contingencies and/or professional fees required to execute rehabilitation activities.

Table 12 provides the closure cost for the demolition of infrastructure associated with the proposed VDDC infrastructure project (refer Appendix C1).

Table 12: VDDC infrastructure project demolition costs

VDDC Infrastructure Project	Immediate Demolition Cost
Contractors laydown area	R 140 930.00
Dirty water drains	R 1 952 992.00
Dirty water pipelines to Vleishaft Dam	R 585 237.00
Dirty water pipeline to Water Treatment Plant	R 1 223 128.00
Drain culverts	R 2 991 796.00
Clean water pipeline (315 diameter)	R 128 163.00
Clean water pipeline (450 diameter)	R 2 072 932.00
EME hard park terrace and brake test ramp	R 1 018 236.00
Evaporators	R 332 975.00
Explosives magazine	R 543 720.00
Haul roads	R 6 169 046.00
Service roads	R940 593.00
Modular water treatment plant	R 54 168.00
Treated water pipeline	R 999 098.00
Stormwater drains and berms	R 554 178.00
Transfer tanks	R 13 325.00
Fencing	R 430 589.00
Opencast rehabilitation	R 296 165 229.00
TOTAL:	R 316 316 334.00

The LoOP closure cost for the demolition of infrastructure associated with the proposed VDDC infrastructure project is R 20 151 105 (refer **Appendix C1**). These costs exclude VAT, P&Gs and contingencies.

The opencast rehabilitation associated with the proposed VDDC infrastructure project was calculated based on the end of LoOP volumes and rehabilitation designs provided by Golder & Associates (refer Appendix C2) and is R 296 165 229. These costs exclude VAT, P&Gs and contingencies.

The combined financial provision estimate for the proposed VDDC infrastructure mining project is R 316 316 334.00. These costs exclude VAT, P&Gs and contingencies.

5.11 Monitoring, auditing and reporting

5.11.1 Monitoring plan

The role of ongoing measurement and monitoring as part of closure planning should not be underestimated. A detailed, relevant and comprehensive monitoring plan will illustrate that the relinquishment criteria, as defined in the closure plan, are being met.

The key objectives of closure-related monitoring for VDDC are as follows:

- To assess the performance of implemented closure actions towards achievement of the relinquishment criteria; and
- To verify the effectiveness of implemented closure actions over time, as well as adjustments that may be required.

In addition, the monitoring programme is focused on at least the following:

- Based on the relinquishment criteria, defined key aspects to be monitored, the measurements that must be taken and the results that are required;
- Guidance on the processing and analysis of the monitoring measurements;
- Use of recognised or acceptable monitoring methodologies and standards;
- Monitoring that considers the wider receiving environments, receptors and exposure pathways;
- Use of appropriate quality control systems and procedures in sampling, analysis and reporting of results;
- Referencing trends against expected or predicted performance based on agreed relinquishment criteria;
- Contingency strategies if monitoring data indicates key environmental indicators move outside agreed relinquishment criteria; and
- Timeline for implementation of the monitoring programme.

The monitoring plan for the rehabilitation and closure of VDDC, aligned to the closure vision and objectives is provided in **Table 13.**

Table 13: The closure-related monitoring plan for rehabilitation and closure of VDDC

Aspect		Closure objective	Relinquishment criteria	Monitoring Requirement
Land use	Topography	To mimic regional geomorphological features, by maintaining a free-draining topography across the rehabilitated portions MRA	Rehabilitation will be undertaken in accordance with the rehabilitation design.	• Rehabilitation designs and as-built drawings conforming to the relinquishment criteria for land use – Once off • Erosion monitoring – Visual inspection for gully formation – Annually • Erosion monitoring – Rill erosion monitoring – Continuously for a minimum period of 5 year after completing rehabilitation
	Land capability	To maintain a grazing land use, as defined in the Guidelines for the Rehabilitation of Mined Land (2007), over 80% of the rehabilitated portions of the MRA, that can sustain at least a 1.7ha/LSU and/or 5t/ha carrying capacity	Physical slope conforms to the parameters listed above describing the post-mining topography. Capping is not reduced to ≤250 mm within 50 years. A grazing-specific vegetative cover of ≥ 80% is present at areas destined for a grazing land use. Secondary grass species are persisting on pasture-related rehabilitated areas. Species include *Chloris gayana* (Rhodes grass), *Eragrostis tef* (Teff), and *Cynodon dactylon* (Kweek). No more than 10% loss of productivity on 80% of rehabilitated land, as: • Soil texture is 10 - 30% clay (arable) • Soil pH is between 5.5 - 8.5 • EC is ≤ 150 mS/m • Organics are aligned to grazing capability needs	• Rehabilitation designs and as-built drawings conforming to the relinquishment criteria – Once off • Flora assessment – Annually • Soils assessment – Annually

Aspect		Closure objective	Relinquishment criteria	Monitoring Requirement
	Flora	To maintain a productive vegetation cover that supports a regional pasture-related carrying capacity of 2.4 ha/LSU and/or 5t/ha of hay, at a vegetal cover of ≥ 75%	A vegetative cover of ≥ 75% is present. Secondary grass species are persisting on wilderness-related rehabilitated areas (side slops of discard dump and final highwall void).	• Flora assessment – Annually • Soils assessment – Annually • Alien invasive monitoring – Annually
	Fauna	To achieve creation of habitats for local fauna expected to occur within the rehabilitated areas on which a grazing land use is taking place.	Land capability- and flora relinquishment criteria in this table have been met. Presence of species that indicate a positive trajectory of ecological succession.	• Flora assessment – Annually • Fauna assessment – Annually
	Visual	To maintain the visual landform as aligned to the approved surface rehabilitation landform design of the rehabilitated landscape, that blends into the surrounding areas	Rehabilitation design is successfully implemented with regards to vegetation cover (≥ 75%) and species, slope (≥1:5), topsoil depth (≥250 mm) .	• Visual assessment – Once off before application for closure certificate
Mine-affected water	Surface water	To continue to contribute to an agreed-on, predetermined catchment yield, based on calculated rehabilitated surface drainage densities, aligned to closure state date-specific climatic conditions	Rehabilitated site contributes to maintaining a natural catchment MARs, as follows: • B11B: 61.30 million m^3/a • B11F: 147.9 million m^3/a • B11G: 164.00 million m^3/a	• Surface water flow meter monitoring – Quarterly
		To not exceed agreed-on, predefined surface water quality objectives (including PES and EIS), as stipulated in the	PES & EIS assessments correspond with the identified categories recommended for the delineated wetlands: • PES: C and/or D as determined by a wetland specialist	• Surface water monitoring – Quarterly

Aspect		Closure objective	Relinquishment criteria	Monitoring Requirement
		RWQOs for the following catchments: B11B, B11F and B11G.	• EIS: C and/or D as determined by a wetland specialist Surface water quality measured is within the water quality range as specified in the relevant WULs:	• Aquatic ecology monitoring – Bi-annually (dry and wet season)
			Surface water quality measured is within the water quality range as specified in the relevant WULs:	• Wetland monitoring– Bi-annually (dry and wet season)
		To have implemented an alternative landowner/user-maintained groundwater supply or source affected by mining operations and currently supplied with water by South32.	• The water management plan will include any ongoing water use commitments including off-take users, pump volumes and rates, maximum allotted quotas, etc.	N/A
	Groundwater	To guide appropriate groundwater abstraction within the MRA to an authorised quantity that has been proven to not impact on groundwater quality	• Groundwater abstraction corresponds to Groundwater Management Plan (GMP) to avoid excessive abstraction and contaminant plume migration and WUL.	• Groundwater level monitoring – Quarterly
		To limit groundwater abstraction to not exceed a predefined radius of influence and/or usage that has been proven to not impact on groundwater quality (induced plume movement)	• Register of groundwater users in the area. • Indication via monitoring results that at least one monitoring site is representative of the required aquifer parameters	• Groundwater monitoring – Quarterly
		To have limited impacts on the quality of the aquifer adjacent to the	Groundwater monitoring outside the pit areas indicates no significant increase in chemical parameters within the natural aquifer/s, based on WUL & DWS water quality objectives.	• Groundwater monitoring – Quarterly

Aspect		Closure objective	Relinquishment criteria	Monitoring Requirement
		rehabilitated open pits, by not exceeding the predefined groundwater quality objectives	Groundwater quality measured is within the water quality range as specified in the relevant WUL:	
Air quality	Dust & Emissions	To maintain local air quality parameters to agreed-on, predefined human health-related standards, in terms of national ambient air quality the Highveld Priority Area	• Air quality monitoring shows that dust and emissions are below air quality requirements for the Highveld Priority Area, as follows: <u>Acceptable dust fallout rates</u> • Residential areas – Dust rate < 600 mg/m^2/day (30-day average) • Non-residential areas – Dust rate between 600 – 1200 mg/m^2/day (30-day average)	• Air quality monitoring – Monthly during rehabilitation until no exceedance are recorded for a period of six months.
Social	Employees & Dependents	To achieve a safe and healthy environment for people and animals, through achievement of the land use, water and air quality closure objectives.	• Land use, water and air quality relinquishment criteria have been met.	NA
	Communities & Landowners	To have completed implementation of the closure-related projects agreed-on in the mine's approved SLP, focusing on personal skills development and local economic development.	• SLP closure-related projects, that were agreed upon by stakeholders, have been completed.	NA
Substitute economies	Infrastructure	To have developed a plan for care-and-maintenance of remaining mining-related surface infrastructure that has a beneficial re-use, for hand-over to- and	• Asset register for infrastructure transfer. • Transfer agreements, with signed-off Land Management Plan & Water Management Plan	NA

Aspect		Closure objective	Relinquishment criteria	Monitoring Requirement
		accountability by the next landowner.		
		To have removed or demolished other infrastructure (non-mining-related), except for those facilities that have been identified as having a beneficial post-mining land use potential (e.g. powerlines, water pipelines, boreholes, etc.).		NA
	Post-operational economic contribution	To have identified public-private partnerships accountable for management and maintenance of the rehabilitated landscape and its long-term use/s.	Public-private partnerships are in consultation with the next landowner	NA
		To leave behind a rehabilitated landscape that will retain long-term economic value for future landowners.	Vegetation yield proves to be sustainable to support cattle grazing (5 t/ha)	NA

5.11.2 External and legislated audits

Auditing / review of the closure-related aspects will be undertaken on an annual basis. This is aligned to performance assessment audit intervals in terms of NEMA reporting requirements.

Table 14 provides a summary of the legislated audits required by NEMA which will be supplemented by additional internal and external audits.

Table 14: Environmental Auditing Schedule for VDDC

Audit Description	Audit type	Planned Date of Audit / Audit Frequency	Responsible person
Environmental Management Plan performance assessment	Legislated audit	Biennial	External third party
Rehabilitation audit	External audit	Annually	External third party
Integrated Water Use Licence audit	Internal audit External audit	Annually	Environmental Manager External third party
Financial Provision audit	Internal audit External audit	Annually Every 5 years	Environmental Manager External third party
External third party to be appointed by Environmental Manager			

Should audit findings on closure-related aspects be identified, these would need to be documented, dated and a corrective action schedule defined.

As required in terms of GNR 1147, this plan, together with the associated closure costs, will be updated on an annual basis.

This plan, as well as subsequent versions thereof, will be provided to stakeholders for comment as part of mine-specific EA process throughout the LoM.

5.12 Motivation for amendments made to the final closure plan

As this is the first report addressing the requirements of GNR 1147, this section will be populated in the subsequent annual review period, if necessary.

5.13 Concluding remarks

This plan was compiled in alignment to the NEMA GNR 1147 and based on information available at the time of compilation. Good practice measures widely adopted by the South African and international coal mining industry were incorporated where deemed necessary.

Specifically, it provides the identified closure vision, objectives, actions, relinquishment criteria and monitoring objectives against which to assess successful rehabilitation of the VDDC infrastructure project. It also documents the planned rehabilitation strategy for the open pits and associated infrastructural areas, once mining commences.

The success of site rehabilitation, towards eventual site relinquishment by South32 to a third party will depend on achievement of the identified post-mining land uses.

6. ANNUAL REHABILITATION PLAN FOR VDDC (GNR1147 – APPENDIX 3)

This section details the Annual Rehabilitation Plan (ARP) for the VDDC as per the requirements of GNR 1147, Appendix 3. As this report forms part of an integrated report, references have been made to earlier sections to avoid repetition.

This plan considers a 12-month rolling period, aligned to South32's annual financial reporting period, as highlighted below in **Figure 17.** Specifically, it provides the details of the 12-month annual rehabilitation activities for the proposed project. Dedicated LoOP rehabilitation-related strategies and associated closure costs are provided in the RDCP (**Section 5.6**).

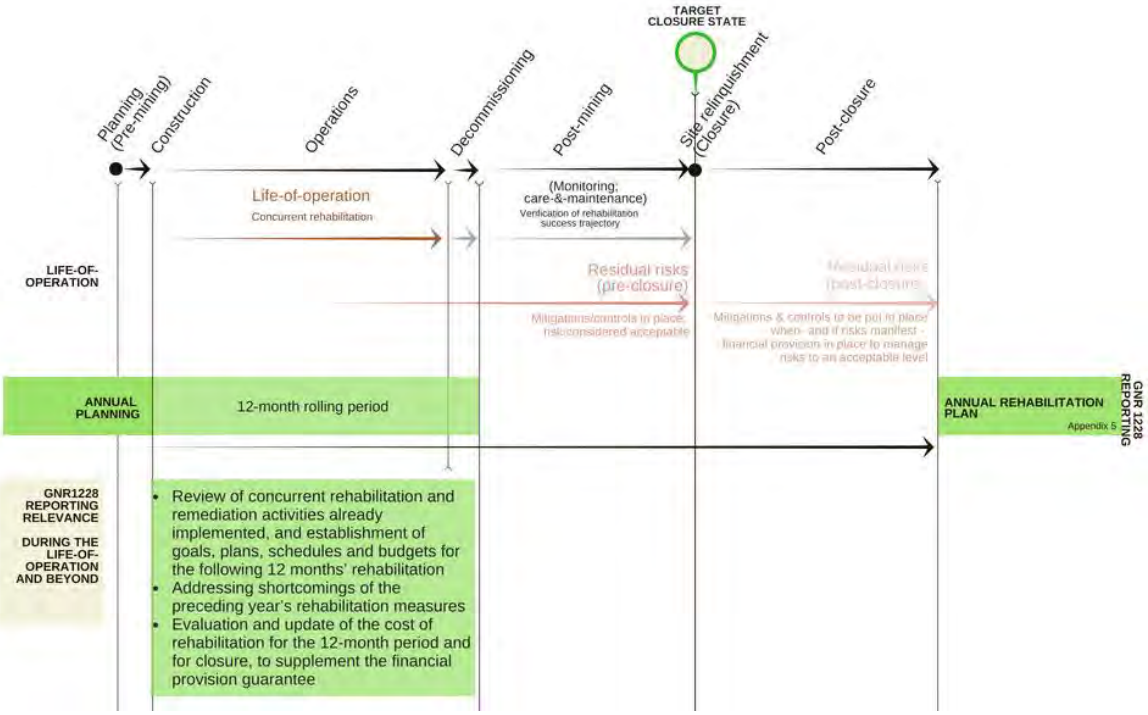


Figure 17: Reporting focus of the VDDC's Annual Rehabilitation Plan

In addition, it is important to note that this ARP focuses specifically on aspects of the mining site directly related to achieving the closure vision (closure state). Hence, it is assumed that any operational-related aspects needing implementation, monitoring and/or corrective action, are addressed as part of the mine's EMPr/EMPR.

6.1 Environmental context

Please refer to Section 4 and Figure 9.

6.2 Socio-economic context

Please refer to Section 4 and Figure 9

6.3 Plan review

This section has been written with a view of informing rehabilitation activities within the mining operations of VDDC, for the first 12-month period once mining activities commenced at the VDDC project area.

6.3.1 Risk monitoring programmes

As closure planning-related risks could influence achievement of the identified closure vision, monitoring of risks has been incorporated as part of site-wide rehabilitation monitoring (**Section 5.3**).

6.3.2 Auditing and reporting on monitoring results

As for the above, auditing and reporting on monitoring results will be undertaken aligned to agreed-on authorisation conditions obtained as part of the EA Process.

6.4 Current, previous and planned rehabilitation

As the VDDC Project is only in its planning stage, there are no current or previous rehabilitation activities on-site. This section therefore documents the planned rehabilitation measures for implementation when the project has been authorised. As mining commences, this rehabilitation plan will be updated at the required legislative intervals, and will include documentation of current and previous rehabilitation activities, where applicable

6.4.1 Current rehabilitation activities

6.4.1.1. Timeframes

Not applicable at the time of compilation of this plan, to be updated on initiation of mining activities.

6.4.1.2. Implementation

Not applicable at the time of compilation of this plan, to be updated on initiation of mining activities.

6.4.2 Review of previous rehabilitation activities

Not applicable at the time of compilation of this plan.

6.4.2.1. Rehabilitation activities undertaken

Not applicable at the time of compilation of this plan.

6.4.2.2. Identification of shortcomings

Not applicable at the time of compilation of this plan.

6.4.3 Planned rehabilitation activities

Once mining has commenced, this section should document a rolling 12-month period of rehabilitation activities, aligned to the South32 annual financial reporting period of July to June. This should include highlighting site-specific rehabilitation measures aligned to the

mine plan, as well as how to address any shortcomings and related corrective actions/mitigations that may have been identified in Section 6.4.2.2

However, as the mine is only in the planning stage, this section provides the overarching rehabilitation strategy proposed for the planned rehabilitation activities, specifically relevant to the first 12-months of the proposed project.

6.4.3.1. Nature/type of current activity

Open pit mining will take place using a combination of dragline and conventional truck-and-shovel roll-over mining method. The opencast area will be backfilled with reject material (from the tip at the processing plant) and overburden material and levelled concurrently with mining operations.

Once backfilled to a predefined surface level and profile (final rehabilitation landform design refer Appendix C), topsoil will be replaced and the area re-vegetated.

6.4.3.2. Planned remaining life of activity under consideration

The VDDC infrastructure development is required to ensure the life of mine of the Wolvekrans Colliery to continue until 2046 and to ensure that the contractual obligations are met.

6.4.3.3. Area already disturbed or planned to be disturbed in the period under review

The cumulative area to be disturbed throughout the operations is approximately 551 ha. Within the first 12-months of the project, no rehabilitation will be possible, as the box-cuts are being initiated. It is envisaged that the time from box-cut creation to initiation of rehabilitation activities could be between 1 – 2 years.

6.4.3.4. Percent of the disturbed area available for rehab, and percent of this area to be rehabilitated

Not applicable at the time of compilation of this plan.

6.4.4 Details of rehabilitation activity planned

Once initiated, rehabilitation activities for the open pit will be undertaken as follows:

- Year 1: Infilling, shaping and levelling, and topsoiling; and
- Year 2: Seeding, according to specified seedmix (related to identified post-mining land use/s).

The above assumes that Year 1 is the year in which concurrent rehabilitation activities will take place for a pre-defined, completed mining strip. Year 2 is the year immediately following Year 1. In addition, during Year 2 it is assumed that equipment will be available for seeding, and that seeding could only take place within the growing/rainy season of October to March. (Should this not be possible, seeding would only be able to take place the following year, namely in 'Year 3').

Aligned to the above, provided the project commences as planned (2021), rehabilitation activities (infilling, levelling and shaping) could commence.

LOM rehabilitated surfaces

A conceptual predictive post-mining rehabilitation plan has been compiled as part of the mine planning by Golder and Associates (refer Appendix C).

6.4.5 Closure objectives and performance targets that will be addressed

The closure objectives for VDDC and related rehabilitation performance targets including design criteria are defined in Table 9.

6.5 Closure Costing

6.5.1 Closure cost methodology

Refer to **Section 5.10**

6.5.2 Calculations of cost per activity/infrastructure

Refer to **Section 5.10**

6.5.3 Cost assumptions

Refer to **Section 5.10**

6.5.4 Monitoring and maintenance costs

As monitoring and maintenance costs are likely to be incurred during the operational period, as part of concurrent rehabilitation activities, the relevant monitoring and maintenance costs provided in the EMPr have been used to inform this section (Table 13).

6.6 Concluding remarks

Aligned to the above, as mining continues, this annual rehabilitation plan will be updated at the required legislative intervals and will include documentation of current and previous rehabilitation activities, where applicable include activities associated with VDDC.

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Project Director
for Jones & Wagener

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APPENDIX A

LEGAL AND POLICY FRAMEWORK

Appendix 1- 1: Key relevant South African legislation requiring compliance for site-specific closure planning.

MPRDA (No. 28 of 2002)	NEMA (No. 107 of 1998)				
	GNR 982 (4 December 2014), Section 19 - (5) A closure plan is required where the application for an environmental authorisation relates to the decommissioning or closure of a facility; (7) The content of a closure plan may be combined with the content of an EMPr on condition that the requirements of both Appendices 5 and 4, respectively, are met		**GNR 1147 (14 November 2015)**		
	Appendix 4 (Content of environmental management programme)	**Appendix 5 (Content of closure plan)**	**Annual Rehabilitation Plan (Appendix 3)**	**Final Rehabilitation, Decommissioning & Mine Closure Plan (Appendix 4)**	**Environmental Risk Report (Appendix 5)**
Section 43(3)(d) - The holder of a prospecting right, mining right, retention permit or mining permit or the person contemplated in subsection (2), as the case may be, must apply for a closure certificate upon - completion of the prescribed closing plan to which a right, permit or permission relate. **Regulations 527 (23 April, 2004)** A closure plan contemplated in section 43(3)(d) of the Act, forms part of the environmental management programme or environmental management plan, as the case may be, and must include -	1. (1) An EMPr must comply with section 24N of the Act and include- (a) details of (i) the EAP who prepared the EMPr; (ii) the expertise of that EAP to prepare an EMPr, including a curriculum vitae.	1. (1) A closure plan must include- (a) details of - (i) the EAP who prepared the closure plan; (ii) the expertise of that EAP.	3. The annual rehabilitation plan must contain information that defines concurrent rehabilitation and remediation activities for the forthcoming 12 months and how these relate to the operations' closure vision, as detailed in the final rehabilitation, decommissioning and mine closure plan, must indicate what closure objectives and criteria are being achieved through the implementation of the plan, must be measurable and auditable and must include— a) details of the— (i) person or persons that prepared the plan; (ii) professional registrations and experience of the person or persons; (iii) timeframes of implementation of the current, and review of the previous rehabilitation activities;		
(a) a description of the **closure objectives** and how these relate to the prospecting or mine operation and its environmental and social setting;		(b) closure objectives;	3. The annual rehabilitation plan must contain information that defines concurrent rehabilitation and remediation activities for the forthcoming 12 months and how these relate to the operations' closure vision, as detailed in the final rehabilitation, decommissioning and mine closure plan, must indicate what closure objectives and criteria are being achieved through the implementation of the plan,	(d) design principles, including— (ii) closure vision, objectives and targets, which objectives and targets must reflect the local environmental and socio-economic context and reflect regulatory and corporate requirements and stakeholder expectations;	
	(b) a detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description;		(b) the context of the project, including— (i) material information and issues that have guided the development of the plan; (ii) an overview of—		

MPRDA (No. 28 of 2002)	NEMA (No. 107 of 1998)				
	GNR 982 (4 December 2014), Section 19 - (5) A closure plan is required where the application for an environmental authorisation relates to the decommissioning or closure of a facility; (7) The content of a closure plan may be combined with the content of an EMPr on condition that the requirements of both Appendices 5 and 4, respectively, are met		**GNR 1147 (14 November 2015)**		
	Appendix 4 (Content of environmental management programme)	**Appendix 5 (Content of closure plan)**	**Annual Rehabilitation Plan (Appendix 3)**	**Final Rehabilitation, Decommissioning & Mine Closure Plan (Appendix 4)**	**Environmental Risk Report (Appendix 5)**
			(aa) the environmental context, including but not limited to air quality, quantity and quality of surface and groundwater, land, soils and biodiversity; and (bb) the social context that may influence closure activities and post-mining land use or be influenced by closure activities and post-mining land use; (iii) stakeholder issues and comments that have informed the plan; (iv) the mine plan and schedule for the full approved operations, and must include— (aa) appropriate description of the mine plan; (bb) drawings and figures to indicate how the mine develops; (cc) what areas are disturbed; (dd) how infrastructure and structures (including ponds, residue stockpiles etc.) develops during operations;		
(b) a **plan** contemplated in regulation 2(2), showing the land or area under closure;	(c) a map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that any areas that should be avoided, including buffers;	-	(iv) the mine plan and schedule for the full approved operations, and must include— (aa) appropriate description of the mine plan; (bb) drawings and figures to indicate how the mine develops; (cc) what areas are disturbed; (dd) how infrastructure and structures (including ponds, residue stockpiles etc.) develops during operations;	(e) a proposed final post-mining land use which is appropriate, feasible and possible of implementation, including— (ii) a map of the proposed final post-mining land use;	
(c) a summary of the **regulatory requirements** and conditions for closure negotiated and documented in the environmental management programme or environmental management plan, as the case may be;	-	-		(k) closure cost estimation procedure, which ensures that identified rehabilitation, decommissioning, closure and post-closure costs, whether on-going or once-off, are realistically estimated and incorporated into the estimate, on condition that—	

MPRDA (No. 28 of 2002)	NEMA (No. 107 of 1998)				
	GNR 982 (4 December 2014), Section 19 - (5) A closure plan is required where the application for an environmental authorisation relates to the decommissioning or closure of a facility; (7) The content of a closure plan may be combined with the content of an EMPr on condition that the requirements of both Appendices 5 and 4, respectively, are met		GNR 1147 (14 November 2015)		
	Appendix 4 (Content of environmental management programme)	**Appendix 5 (Content of closure plan)**	**Annual Rehabilitation Plan (Appendix 3)**	**Final Rehabilitation, Decommissioning & Mine Closure Plan (Appendix 4)**	**Environmental Risk Report (Appendix 5)**
				(iii) the closure cost estimate must be updated annually during the operation's life to reflect known developments, including changes from the annual review of the closure strategy assumptions and inputs, scope changes, the effect of a further year's inflation, new regulatory requirements and any other material developments;	
(d) a summary of the **results of the environmental risk report** and details of **identified residual and latent impacts** (Section 60 provides detailed environmental risk assessment content);	(d) a description of the impact management objectives, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development including- (i) planning and design; (ii) pre-construction activities; (iii) construction activities; (iv) rehabilitation of the environment after construction and where applicable post-closure; (v) where relevant, operation activities.			(c) findings of an environmental risk assessment leading to the most appropriate closure strategy, including— (i) a description of the risk assessment methodology including risk identification and quantification, to be undertaken for all areas of infrastructure or activity or aspects for which a holder of a right or permit has a responsibility to mitigate an impact or risk at closure; (ii) an identification of indicators that are most sensitive to potential risks and the monitoring of such risks with a view to informing rehabilitation and remediation activities; (iii) an identification of conceptual closure strategies to avoid, manage and mitigate the impacts and risks; (iv) a reassessment of the risks to determine whether, after the implementation of the closure strategy, the residual risk has been avoided and / or how it has resulted in avoidance, rehabilitation and management of impacts and whether this is acceptable to the mining operation and stakeholders; and (v) an explanation of changes to the risk assessment results, as	

MPRDA (No. 28 of 2002)	NEMA (No. 107 of 1998)				
	GNR 982 (4 December 2014), Section 19 - (5) A closure plan is required where the application for an environmental authorisation relates to the decommissioning or closure of a facility; (7) The content of a closure plan may be combined with the content of an EMPr on condition that the requirements of both Appendices 5 and 4, respectively, are met		**GNR 1147 (14 November 2015)**		
	Appendix 4 (Content of environmental management programme)	**Appendix 5 (Content of closure plan)**	**Annual Rehabilitation Plan (Appendix 3)**	**Final Rehabilitation, Decommissioning & Mine Closure Plan (Appendix 4)**	**Environmental Risk Report (Appendix 5)**
				applicable in annual updates to the plan;	
	(e) a description and identification of impact management outcomes required for the aspects contemplated in paragraph (d);	-			
	-	-			
(e) a summary of the **results of progressive rehabilitation undertaken**;	-	-	(f) a review of the previous year's annual rehabilitation and remediation activities, indicating a comparison between activities planned in the previous year's annual rehabilitation and remediation plan and actual rehabilitation and remediation implemented, which should be tabulated and as a minimum contain— (aa) area planned to be rehabilitated and remediated during the plan under review; (bb) actual area rehabilitation or remediated; (cc) if the variance between planned and actual exceeds 15%, motivation indicating reasons for the inability to rehabilitate or remediate the full area; (f) a review of the previous year's annual rehabilitation and remediation activities, indicating a comparison between activities planned in the previous year's annual rehabilitation and remediation plan and actual rehabilitation and remediation implemented, which should be tabulated and as a minimum contain— (aa) area planned to be rehabilitated and remediated during the plan under review; (bb) actual area rehabilitation or remediated; and		

MPRDA (No. 28 of 2002)	NEMA (No. 107 of 1998)				
	GNR 982 (4 December 2014), Section 19 - (5) A closure plan is required where the application for an environmental authorisation relates to the decommissioning or closure of a facility; (7) The content of a closure plan may be combined with the content of an EMPr on condition that the requirements of both Appendices 5 and 4, respectively, are met		**GNR 1147 (14 November 2015)**		
	Appendix 4 (Content of environmental management programme)	**Appendix 5 (Content of closure plan)**	**Annual Rehabilitation Plan (Appendix 3)**	**Final Rehabilitation, Decommissioning & Mine Closure Plan (Appendix 4)**	**Environmental Risk Report (Appendix 5)**
			(cc) if the variance between planned and actual exceeds 15%, motivation indicating reasons for the inability to rehabilitate or remediate the full area;		
(f) a description of the **methods to decommission** each prospecting or mining component **and the mitigation or management strategy** proposed to avoid, minimize and manage residual or latent impacts;	(f) a description of proposed impact management actions, identifying the manner in which the impact management objectives and outcomes contemplated in paragraphs (d) (e) will be achieved, and must, where applicable, include actions to – (i) avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; (ii) comply with any prescribed environmental management standards or practices; (iii) comply with any applicable provisions of the Act regarding closure, where applicable; (iv) comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable;	(d) measures to rehabilitate the environment affected by the undertaking of any listed activity or specified activity and associated closure to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development, including a handover report, where applicable; (e) information on any proposed avoidance, management and mitigation measures that will be taken to address the environmental impacts resulting from the undertaking of the closure activity; (f) a description of the manner in which it intends to- (i) modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation during closure; (ii) remedy the cause of pollution or degradation and migration of pollutants during closure; (iii) comply with any prescribed environmental management standards or practices; (iv) comply with any applicable provisions of the Act regarding closure;	c) results of monitoring of risks identified in the final rehabilitation, decommissioning and mine closure plan with a view to informing rehabilitation and remediation activities;	(c) findings of an environmental risk assessment leading to the most appropriate closure strategy, including— (i) a description of the risk assessment methodology including risk identification and quantification, to be undertaken for all areas of infrastructure or activity or aspects for which a holder of a right or permit has a responsibility to mitigate an impact or risk at closure; (ii) an identification of indicators that are most sensitive to potential risks and the monitoring of such risks with a view to informing rehabilitation and remediation activities; (iii) an identification of conceptual closure strategies to avoid, manage and mitigate the impacts and risks; (iv) a reassessment of the risks to determine whether, after the implementation of the closure strategy, the residual risk has been avoided and / or how it has resulted in avoidance, rehabilitation and management of impacts and whether this is acceptable to the mining operation and stakeholders; (v) an explanation of changes to the risk assessment results, as applicable in annual updates to the plan;	(b) details of the assessment process used to identify and quantify the latent risks, including– (i) a description of the risk assessment methodology inclusive of risk identification and quantification; (ii) substantiation why each risk is latent, including why the risk was not or could not be mitigated during concurrent rehabilitation and remediation or during the implementation of the final rehabilitation, decommission and closure plan; (iii) a detailed description of the drivers that could result in the manifestation of the risks, to be presented within the context of closure actions already having been implemented during the execution of concurrent rehabilitation or during the implementation of the final rehabilitation, decommission and closure plan; (iv) a description of the expected timeframe in which the risk is likely to manifest, typically as expected years after closure, and the duration of the impact, including motivation to support these timeframes; (v) a detailed description of the triggers which can be used to identify that the risk is imminent or has manifested, how this will be measured and any cost implications thereof;

MPRDA (No. 28 of 2002)	NEMA (No. 107 of 1998)				
	GNR 982 (4 December 2014), Section 19 - (5) A closure plan is required where the application for an environmental authorisation relates to the decommissioning or closure of a facility; (7) The content of a closure plan may be combined with the content of an EMPr on condition that the requirements of both Appendices 5 and 4, respectively, are met		**GNR 1147 (14 November 2015)**		
	Appendix 4 (Content of environmental management programme)	**Appendix 5 (Content of closure plan)**	**Annual Rehabilitation Plan (Appendix 3)**	**Final Rehabilitation, Decommissioning & Mine Closure Plan (Appendix 4)**	**Environmental Risk Report (Appendix 5)**
					(vi) results and findings of the risk assessment; (vii) an explanation of changes to the risk assessment results as applicable in annual updates to the plan;
(g) details of any **long-term management and maintenance** expected;	(g) the method of monitoring the implementation of the impact management actions contemplated in paragraph (f);	(c) proposed mechanisms for monitoring compliance with and performance assessment against the closure plan and reporting thereon;		(iii) a monitoring plan which outlines— (aa) parameters to be monitored, frequency of monitoring and period of monitoring; (bb) an explanation of the approach that will be taken to analyse monitoring results and how these results will be used to inform adaptive or corrective management and/or risk reduction activities;	
	(h) the frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f);			(iii) a monitoring plan which outlines— (aa) parameters to be monitored, frequency of monitoring and period of monitoring;	
	(i) an indication of the persons who will be responsible for the implementation of the impact management actions;	-			(iii) the persons who will be responsible for the implementation of the care and maintenance plan;
	(j) the time periods within which the impact management actions contemplated in paragraph (f) must be implemented;	(g) time periods within which the measures contemplated in the closure plan must be implemented;			(iv) a description of the expected timeframe in which the risk is likely to manifest, typically as expected years after closure, and the duration of the impact, including motivation to support these timeframes;
	(k) the mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f);	(h) the process for managing any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of closure;		(g) a schedule of actions for final rehabilitation, decommissioning and closure which will ensure avoidance, rehabilitation, management of impacts including pumping and treatment of extraneous water	
	(l) a program for reporting on compliance, taking into account the requirements as prescribed by the Regulations;	-			

MPRDA (No. 28 of 2002)	NEMA (No. 107 of 1998)				
	GNR 982 (4 December 2014), Section 19 - (5) A closure plan is required where the application for an environmental authorisation relates to the decommissioning or closure of a facility; (7) The content of a closure plan may be combined with the content of an EMPr on condition that the requirements of both Appendices 5 and 4, respectively, are met		**GNR 1147 (14 November 2015)**		
	Appendix 4 (Content of environmental management programme)	**Appendix 5 (Content of closure plan)**	**Annual Rehabilitation Plan (Appendix 3)**	**Final Rehabilitation, Decommissioning & Mine Closure Plan (Appendix 4)**	**Environmental Risk Report (Appendix 5)**
	(m) an environmental awareness plan describing the manner in which- (i) the applicant intends to inform his or her employees of any environmental risk which may result from their work; (ii) risks must be dealt with in order to avoid pollution or the degradation of the environment;				
(h) details of a **proposed closure cost and financial provision** for monitoring, maintenance and post-closure management;	-	(j) where applicable, details of any financial provisions for the rehabilitation, closure and on-going post decommissioning management of negative environmental impacts;	(g) costing, including— (iv) monitoring and maintenance costs likely to be incurred both during the period of the annual rehabilitation plan and those that will extend past the period of the final rehabilitation, decommissioning and mine closure plan, on condition that the monitoring and maintenance costs included in previous annual rehabilitation plans must be accumulated into subsequent versions of the annual rehabilitation plan until such time as the monitoring and maintenance obligation is discharged.		(d) costing, calculated using the current value of money and no discounting or net present value calculations included in the determination of the quantum of the liability
(i) a **sketch plan** drawn on an appropriate scale describing the **final and future land use** proposal and arrangements for the site;	-			(e) a proposed final post-mining land use which is appropriate, feasible and possible of implementation, including— (i) descriptions of appropriate and feasible final post-mining land use for the overall project and per infrastructure or activity and a description of the methodology used to identify final post-mining land use, including the requirements of the operations stakeholders; (ii) a map of the proposed final post-mining land use;	
(j) a record of **interested and affected persons** consulted;	-	(i) details of all public participation processes conducted in terms of regulation 41 of the Regulations, including-		(b) the context of the project, including—	

MPRDA (No. 28 of 2002)	NEMA (No. 107 of 1998)				
	GNR 982 (4 December 2014), Section 19 - (5) A closure plan is required where the application for an environmental authorisation relates to the decommissioning or closure of a facility; (7) The content of a closure plan may be combined with the content of an EMPr on condition that the requirements of both Appendices 5 and 4, respectively, are met		**GNR 1147 (14 November 2015)**		
	Appendix 4 (Content of environmental management programme)	**Appendix 5 (Content of closure plan)**	**Annual Rehabilitation Plan (Appendix 3)**	**Final Rehabilitation, Decommissioning & Mine Closure Plan (Appendix 4)**	**Environmental Risk Report (Appendix 5)**
		(i) copies of any representations and comments received from registered interested and affected parties; (ii) a summary of comments received from, and a summary of issues raised by registered interested and affected parties, the date of receipt of these comments and the response of the EAP to those comments; (iii) the minutes of any meetings held by the EAP with interested and affected parties and other role players which record the views of the participants; (iv) where applicable, an indication of the amendments made to the plan as a result of public participation processes conducted in terms of regulation 41 of these Regulations:		(iii) stakeholder issues and comments that have informed the plan;	
(k) **technical appendices**, if any.	(n) any specific information that may be required by the competent authority.	-		(b) the context of the project, including— (ii) an overview of— (aa) the environmental context, including but not limited to air quality, quantity and quality of surface and groundwater, land, soils and biodiversity; (bb) the social context that may influence closure activities and post-mining land use or be influenced by closure activities and post-mining land use;	

Appendix 1- 2: Key relevant South African legislation requiring compliance for site-specific closure planning.

South African legislation	Sections relevant to closure planning
Constitution of the Republic of South Africa (Act 108 of 1996)	***S24*** Everyone has the right to: • An environment that is not harmful to their health or wellbeing • Have an environment protected through legislative and other means for present and future generations.
MPRDA (Act 28 of 2002) as amended	***S41*** Financial provision for mine rehabilitation, management and remediation of negative environmental impacts • Assess annually and adapt as required • Maintain and retain until closure certificate is issued. ***S43*** Application for closure • S43(1) The owner of a prospecting/mining right remains responsible for any environmental liability, pollution, ecological degradation, pumping and treatment of extraneous water, compliance to the conditions of the environmental authorization and management & sustainable closure thereof. • S43(3)(d) The holder of a prospecting right, mining right, retention permit or mining permit or the person contemplated in subsection (2), as the case may be, must apply for a closure certificate upon - completion of the prescribed closing plan to which a right, permit or permission relate. • S43(4) An application for a closure certificate must be made to the Regional Manager within 180 days of the completion of the prescribed closure plan (or lapsing, abandonment, cancellation, cessation, relinquishment or completion of the right, permit, application or operation)
	GNR 527 (April 2004) • ***R53*** Methods for financial provision • ***R54*** Quantum of financial provision • ***R56*** Principles for mine closure. o The closure of a prospecting/mining operation incorporates a process which must start at the commencement of the operation and continue throughout the life of the operation – while gathering relevant information throughout. o Land must be rehabilitated to its natural state or a predetermined and agreed standard or land use, which conforms to the concept of sustainable development. • ***R58 & R59*** Transfer of liabilities and responsibilities

South African legislation	Sections relevant to closure planning
	• ***R61*** Closure objectives must: o Identify key objectives for mine closure to guide the project design, development and management of environmental impacts o Provide broad future land use objective(s) for the site o Provide proposed closure costs.
NEMA (Act 107 of 1998) as amended	***S2*** Principles of sustainable development ***S24(5)(b)(viii)*** Laying down the procedure to be followed in respect of: • Mine closure requirements and procedures; apportionment of liability for mine closure; and sustainable closure of mines resulting in a cumulative impact. ***S24N*** Environmental management program must contain: • Information on proposed management, mitigation, protection or remedial measures undertaken to address environmental impacts of mine closure. ***S24P*** Financial provision for remediation of environmental damage. • Comply with prescribed financial provision for the rehabilitation, closure and ongoing post-decommissioning management of negative environmental impacts. ***S24R*** Mine closure on environmental authorization. • Every holder remains responsible for any environmental liability, pollution and ecological degradation, the pumping and treatment of polluted or extraneous water, and the management and sustainable closure thereof. • Minister for MR issues may retain some financial provision for any latent, residual or any other environmental impact i.e. pumping of polluted or extraneous water. ***S28*** Duty of care and remediation of environmental damage
	GNR 326 S19 Contents of a BAR, Closure Plan and EMPr.
	GNR 327Listed Activity 22 (Requiring a BA) The decommissioning of any activity requiring – (i) a closure certificate in terms of section 43 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002); or (ii) a prospecting right, mining right, mining permit, production right or exploration right, where the throughput of the activity has reduced by 90% or more over a period of 5 years excluding where the competent authority has in writing agreed that such reduction in throughput does not constitute closure.

South African legislation	Sections relevant to closure planning
	GNR 1147 *(November 2015)* Regulations pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations. Annual deliverables: • Annual Closure Plan • Rehabilitation, Decommissioning and Closure Plan • Environmental Risk Assessment Report
SEMAs	**NEM:WA (Act 59 of 2008)** ***S17*** Reduction, re-use, recycling, recovery, treatment and disposal of waste. ***S18*** Extended producer responsibility: • The Minister may identify a product (or class of products) in respect of which extended producer responsibility applies; and specify extended producer responsibility measure that must be taken in respect of that product of class.
	NEM:AQA (Act 39 of 2004) ***S33*** Rehabilitation when mining operations cease. • If a mine is likely to cease operations within a 5-year period, owner must notify Minister of likely cessation and of any plans in place or in contemplation for rehabilitation and pollution prevention. ***GNR 827*** *(November 2013)* National Dust Control Regulations applicable with regard to fugitive dust associated with closure measures
	NEM:BA (Act 10 of 2004) ***S75, R16 of GNR 598, GNR 599*** Restriction on spreading and release of listed invasive species
Mine Health & Safety (Act 29 of 1996) as amended	***S2*** Health and Safety at Mines (2). • The owner of a mine not being worked, but in respect of which a closure certificate in terms of the Minerals Act has not been issued, must take reasonable steps to continuously prevent injuries, ill-health, loss of life or damage of any kind from occurring at or because of the mine.
NWA (Act 36 of 1998)	• A duty is imposed on the owner of land, a person in control of land or a person who occupies or uses the land to take all reasonable measures to prevent the pollution of a water resource from occurring, continuing or recurring. • Regulations on the Use of Water for Mining and Related Activities Aimed at the Protection of Water Resources, GNR R704 • Any person in control of an existing mine must notify the DWA 14 days before the temporary or permanent cessation of the operation of the mine;

South African legislation	Sections relevant to closure planning
	• Any person in control of a mine must at temporary or permanent cessation of mining operations, ensure that - - Any person in control of a mine or activity must at temporary or permanent cessation of operations ensure that all pollution control measures have been designed, modified, constructed and maintained in accordance with GNR 704; and - Any person in control of a mine or activity must ensure that the in-stream and riparian habitat of any water resource, which may be affected or altered by the mine or activity, is remedied so as to comply with GNR 704. • Provision is made for, inter alia - - Regulation 4: Restrictions on locality regarding infrastructure; - Regulation 5: Restrictions on use of material; - Regulation 6: Capacity requirements of clean and dirty water systems; and - Regulation 7: Protection of water resources.
	S19 Prevention and remedying effects of pollution. • An owner of land, on which an activity has caused or is likely to cause pollution of a water resource, must take all reasonable measures to prevent any such pollution from occurring, continuing or recurring.
NWA Regulation 7 of GNR 704	Every person in control of a mine or activity must take reasonable measures to - • Prevent water containing waste or any substance which causes or is likely to cause pollution of a water resource from entering any water resource and must retain or collect such substance or water for use, re-use, evaporation or for purification and disposal in terms of the Act; • Cause effective measures to minimise the flow of any surface water or floodwater into mine workings, opencast workings, other workings or subterranean caverns, through cracked or fissured formations, subsided ground, sinkholes, outcrop excavations, adits, entrances or any other openings; and • Prevent the erosion or leaching of materials from any residue deposit or stockpile from any area and contain such material or substances so eroded and leached in such area by providing effective suitable barrier dams, evaporative dams or any other effective measures to prevent this material or substance from entering and polluting any water resources.

South African legislation	Sections relevant to closure planning
	GNR R704 *(June 1999)* Regulations on Use of Water for Mining and Related Activities aimed at the Protection of Water Resources • ***R2(2)(b)*** Notify Department of Water Affairs of temporary or permanent cessation of operation of a mine • ***R7*** Protection of water resources • ***R7(c)*** Minimise flow of surface water or floodwater into mine workings ... through cracked or fissured formations, subsided ground, sinkholes etc. • ***R9*** Temporary or permanent cessation of mine or activity. A mine or activity must, at either temporary or permanent cessation of operations, ensure that all pollution control measures have been designed, modified, constructed and maintained so as to comply with these regulations.
SPLUMA (Act 16 of 2013)	***S3*** Objectives of the Act • provide for a uniform, effective and comprehensive system of spatial planning and land use management for the Republic; • ensure that the system of spatial planning and land use management promotes social and economic inclusion; • provide for development principles and norms and standards; • provide for the sustainable and efficient use of land; • provide for cooperative government and intergovernmental relations amongst the national, provincial and local spheres of government; and • redress the imbalances of the past and to ensure that there is equity in the application of spatial development planning and land use management systems. ***S7*** Development principles. ***S28*** Amendment of land use and rezoning. ***S30*** Alignment of authorisations. ***S45*** Parties to land development applications.
NHRA (Act 25 of 1999)	***S34(1)*** No person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority. In terms of the MPRDA Amendment Bill, the minister of mineral resources may also instruct that buildings may not be demolished.

South African legislation	Sections relevant to closure planning
CARA (Act 43 of 1983)	***S6(m)*** and ***R13, R14, R15*** of ***GNR 1048*** • Restoration/reclamation of eroded land or land which is otherwise disturbed or denuded • Land user must control weeds and Category 1 – 3 invader plants
Other	• Application for change in land use (if required) in terms of planning/land use legislation

Appendix 1- 3: Key relevant South African best practice guidelines (BPG) and tools to support site-specific closure planning.

Relevance	Name	Date
MPRDA (Act 28 of 2002)	Guideline Document for the Evaluation of the Quantum of Closure-Related Financial Provision Provided by a Mine (2005)	2005
NWA (Act	DWAF, Best Practice Guidelines (2006-2008) • Best Practice Guideline G1 – Stormwater management • Best Practice Guideline G3 – Water Monitoring Systems • Best Practice Guideline A2 – Waste Management for Mine Residue Deposits • Best Practice Guideline A4 – Pollution Control Dams • Best Practice Guideline A5 – Water Management for Surface Mines • Best Practice Guideline A5 – Water Management for Underground Mines • Best Practice Guideline G4 – Impact Prediction • Best Practice Guideline G5 – Water Management Aspects for Mine Closure • Best Practice Guideline H2 – Pollution Prevention and Minimisation of Impacts • Best Practice Guideline H3 – Water Reuse and Reclamation • Best Practice Guideline H4 – Water Treatment	2006 - 2008
	DWAF, Environmental Best Practice Guidelines: Decommissioning Planning (2005)	2005
Coaltech / Chamber of Mines South Africa	Guidelines for the Rehabilitation of Mined Land	2007
Department of Mineral Resources	The National Strategy for the Management of Derelict and Ownerless Mines in South Africa	2009
South African National Biodiversity Institute (SANBI)	Biodiversity GIS (BGIS) (www.bgis.sanbi.org) Central hub for the management and distribution of biodiversity planning and related information. Provides data such as interactive maps, accessible via free tools to view and analyse available spatial data.	-

Relevance	Name	Date
South African National Biodiversity Institute (SANBI)	Land Use Decision Support (LUDS) tool (http://bgis.sanbi.org/LUDS/Home) Extracts the most important biodiversity planning information for an area from national and regional spatial datasets.	-
Department of Environmental Affairs' (DEA)	Environmental GIS (EGIS) (www.egis.environment.gov.za) Access to baseline environmental geospatial data and services, including a register of South African protected areas and national land cover data sets.	-
Department of Agriculture, Forestry and Fisheries' (DAFF)	Agricultural geo-referenced information system (AGIS) (www.agis.agric.za) Spatial information (maps), industry-specific information and decision-support tools for the agricultural sector.	-
Water Research Commission (WRC)	South African mine water atlas (www.wrc.org.za) Maps the threat of mining to South Africa's water resources, providing existing data on mineralogy, water quality, flow, present ecological state, hydrogeological information	-

Appendix 1- 4: Key relevant literature, policies, standards and/or toolkits available to support site-specific closure planning.

Guideline/Tool	International / South African	Date	Author	Regulator / Industry / Academia / Other	Policy / Standard / Guideline / Toolkit	Mining / Other	Mine Closure / Rehabilitation
Mine Rehabilitation: Leading Practice Sustainable Development Program for the Mining Industry	International	2016	Australian Government	Regulator	Toolkit	Mining	Rehabilitation
Guidelines for Preparing Mine Closure Plans	International	2015	Government of Western Australia: Department of Mines and Petroleum - Environmental Protection Authority	Regulator	Guideline	Mining	Mine Closure
Rehabilitation requirements for mining resource activities	International	2014	Queensland Government: Department of Environment and Heritage Protection	Regulator	Policy	Mining	Rehabilitation
Monitoring criteria for mining assets in the post-closure period	International	2014	Bureau de Projetos e Consultoria, Brazil Vale S.A., Brazil	Industry	Guideline: Research	Mining	Mine Closure
Partnerships and early planning with good science: The key to long-term ecological and socio-economic success	International	2014	Anglo American, Brazil	Industry	Guideline: Research	Mining	Mine Closure
Guide for Mine Closure Planning	International	2014	Brazilian Mining Association	Industry	Guideline	Mining	Mine Closure
Anglo American Mine Closure Toolbox, Version 2	South African	2013	Anglo American	Industry	Toolkit	Mining	Mine Closure
The Equator Principles III	International	2013	The Equator Principles Association	Other	Guideline	Other	Rehabilitation
Case Studies and Decision-Making Process for the Relinquishment of Closed Mine Sites	International	2013	Cowan Minerals Ltd NOAMI	Industry	Guideline: Case Studies	Mining	Mine Closure
Mining and Biodiversity Guideline: Mainstreaming biodiversity into the mining sector	South African	2013	Department of Environmental Affairs, Department of Mineral Resources, Chamber of Mines, South African Mining	Regulator	Guideline	Mining	Rehabilitation

Guideline/Tool	International / South African	Date	Author	Regulator / Industry / Academia / Other	Policy / Standard / Guideline / Toolkit	Mining / Other	Mine Closure / Rehabilitation
			and Biodiversity Forum, and South African National Biodiversity Institute				
Anglo American Socio-Economic Assessment Toolbox (SEAT), Version 3	International	2012	Anglo American	Industry	Toolkit	Mining	Mine Closure
Ecological Restoration for Protected Areas: Principles, Guidelines and Best Practices	International	2012	IUCN	Other	Guideline	Other	Rehabilitation
Spatial Planning and Land Use Management Bill	South African	2012	Department of Rural Development and Land Reform	Regulator	Policy	Other	Rehabilitation
A Guide to Leading Practice Sustainable Development in Mining: Leading Practice Sustainable Development Program for the Mining Industry	International	2011	Australian Government: Department of Industry, Tourism and Resources	Regulator	Guideline	Mining	Rehabilitation
Guidelines for land use mapping in Australia: principles, procedures and definitions	International	2011	Australian Government: Australian Bureau of Agricultural and Resource Economics and Sciences	Regulator	Guideline	Other	Rehabilitation
The role of mining and metals in land use and adaptation	International	2011	International Council on Mining and Metals	Industry	Guideline: Research	Mining	Mine Closure
Coaltech - The Socio-Economic Aspects of Mine Closure and Sustainable Development: Literature Overview and Lessons for the Socio-Economic Aspects of Closure, Report 1 of 2	South African	2010	Centre for Sustainability in Mining and Industry	Industry	Guideline	Mining	Mine Closure

Guideline/Tool	International / South African	Date	Author	Regulator / Industry / Academia / Other	Policy / Standard / Guideline / Toolkit	Mining / Other	Mine Closure / Rehabilitation
Coaltech - The Socio-Economic Aspects of Mine Closure and Sustainable Development: Guideline for the Socio-Economic Aspects of Closure, Report 2 of 2	South African	2010	Centre for Sustainability in Mining and Industry	Industry	Guideline	Mining	Mine Closure
Coaltech - Sustainable Development of the Waterberg Coalfields: Scenarios for Optimal Settlement Patterns	South African	2010	Centre for Sustainability in Mining and Industry	Industry	Guideline: Case Studies	Mining	Mine Closure
The National Strategy for the Management of Derelict and Ownerless Mines in South Africa	South African	2009	Department of Mineral Resources	Regulator	Standard	Mining	Rehabilitation
Planning for Integrated Mine Closure: Toolkit	International	2008	International Council on Mining and Metals	Industry	Toolkit	Mining	Mine Closure
Guidelines for the Rehabilitation of Mined Land	South African	2007	Chamber of Mines of South Africa / Coaltech	Industry	Guideline	Mining	Rehabilitation
Environmental, Health, and Safety Guidelines for Mining	International	2007	World Bank / International Finance Corporation	Other	Guideline	Mining	Mine Closure
Mine Closure and Completion: Leading Practice Sustainable Development Program for the Mining Industry	International	2006	Australian Government: Department of Industry, Tourism and Resources	Regulator	Guideline	Mining	Mine Closure
Mine Rehabilitation: Leading Practice Sustainable Development Program for the Mining Industry	International	2006	Australian Government: Department of Industry, Tourism and Resources	Regulator	Guideline	Mining	Rehabilitation
Guidelines to the Mining, Rehabilitation and Environmental Management Process	International	2006	NSW Department of Primary Industries - Mineral Resources	Regulator	Guideline	Mining	Rehabilitation
Post-Mining Rehabilitation, Land Use and Pollution at Collieries in South Africa	South African	2005	Centre for Sustainability in Mining and Industry Anglo Coal BHP Billiton	Industry	Guideline: Research and Case Studies	Mining	Rehabilitation

Guideline/Tool	International / South African	Date	Author	Regulator / Industry / Academia / Other	Policy / Standard / Guideline / Toolkit	Mining / Other	Mine Closure / Rehabilitation
Mining for Closure: Policies and Guidelines for Sustainable Mining Practice and Closure of Mines	International	2005	Environment Security (ENVSEC) initiative UNEP, UNDP, OSCE, NATO	Other	Guideline	Mining	Mine Closure
Land Use Planning Handbook	International	2005	United States: Department of the Interior Bureau of Land Management	Regulator	Toolkit	Other	Rehabilitation
It's Not Over When It's Over: Mine Closure Around the World	International	2002	World Bank International Finance Corporation	Other	Guideline: Case Studies	Mining	Mine Closure
Guidelines Mine Closure Planning in Queensland	International	2001	Queensland Mining Council	Industry	Guideline	Mining	Mine Closure
Strategic Framework for Mine Closure	International	2000	Australian and New Zealand Minerals and Energy Council Minerals Council of Australia	Regulator Industry	Guideline	Mining	Mine Closure
Assessing mine site rehabilitation design for erosion impact	International	2000	KG Evans	Academia	Guideline: Research	Mining	Rehabilitation
Mine Rehabilitation for Environment and Health Protection	International	1998	United Nations Environment Programme World Health Organisation	Other	Toolkit	Mining	Rehabilitation
Infomine E-Book: Mine Closure	International	-	Dr A Robertson and S Shaw	Academia	Guideline	Mining	Mine Closure
Mine Closure in Latin America: A Review of Recent Developments in Argentina, Bolivia, Chile and Peru	International	-	Elisabeth Bastida and Tony Sanford	Academia	Guideline: Research and Case Studies	Mining	Mine Closure

Appendix 1- 5: South32 corporate governance (policies, standards, guidance) relevant to site-specific closure planning.

Document	Intent
Sustainability Policy, Dated 20/21 October 2015	South32 affirms our commitment to Sustainable Development, defined as supporting the needs of the present without compromising the ability of future generations to meet their own needs. 1. We monitor the external environment for opportunities to invest and develop natural resources that deliver shared value for society. 2. We work to achieve positive social, environmental and economic outcomes as a result of our decisions. 3. We commit to respecting internationally recognised human rights relevant to our operations, in line with the International Council for Mining and Metals Sustainable Development Framework, the United Nations Guiding Principles on Business and Human Rights and the Voluntary Principles on Security and Human Rights. 4. We support employment and community practises which empower people to make choices and have control over their process of development as it affects their lives, beliefs, institutions, well-being and the lands they occupy or otherwise use. 5. We continually improve safety, health, environmental practise, management systems and controls to ensure we avoid, mitigate and manage impact. 6. We practise responsible stewardship for the commodities we extract as well as the natural resources we consume. 7. We actively initiate and partake in conservation and rehabilitation activities to ensure ecosystems continue providing value to future generations. 8. To meet the challenge of climate change, we work to reduce our greenhouse gas emissions. We monitor our impact to ensure we do not compromise the ecosystems which provide resilience against climate change for our host communities. 9. We uphold stringent health, safety, environment and governance standards in all jurisdictions in which we operate. 10. We publicly report our progress and encourage high standards of transparency and accountability in our business governance, risk and government interactions.
Environment Standard, dated 21 January 2016	Environmental commitments: South32's environmental commitments protect the environment in a way that demonstrates our values and are aligned with the ICMM commitments for mining and protected areas. • Exploration and extraction of resources must not occur: o within the boundaries of World Heritage listed properties. o adjacent to World Heritage listed properties unless internal (Appendix 1) and external approvals are obtained.

Document	Intent
	o within or adjacent to the boundaries of International Union for Conservation of Nature (IUCN) Protected Areas Categories I to IV unless internal approvals (Appendix 1) and o within or adjacent to the boundaries of any protected area defined under legislation unless internal (Appendix 1) and external approvals are obtained. o where there is a risk of direct impacts to ecosystems which could result in the extinction of an IUCN Red List Threatened Species in the wild. • Mined waste rock or tailings must not be disposed of in a river or marine environment.
	• Establish target environmental outcomes in accordance with Appendix 2 that: o contribute to enduring environment benefits; o are developed on a two-yearly cycle; and o are authorised in accordance with Appendix 1.
	• Identify and implement abatement projects that: o are aligned with the South32 Climate Change Strategy; o take into account the internal carbon pricing; and o are approved through the business planning process. • Maintain a GHG emissions forecast for the life of operation that: o is inclusive of Scope 1 and Scope 2 emissions; o includes all approved GHG abatement projects; o is authorised (Appendix 1) annually; and o is incorporated into the business planning process. • Evaluate and implement GHG emissions reduction opportunities in project design and equipment selection.
	Area of influence

Document	Intent
	The boundary that takes into account South32's business activities, and their potential direct, indirect and/or cumulative impacts on the environment. The area of influence may vary depending on the type and severity of environmental impact being considered (e.g. air shed, water catchment, bio-region).
Climate Change Strategy Avenue 2 – Climate Resilience, Dated 14 March 2016	The South32 Board endorsed the Climate Change Strategy, 3 February 2016. Avenue 2 of the strategy works towards climate resilience for South32 operations, including resilience against: • Environmental impacts such as extreme weather events and drying trends leading to water scarcity; • Societal impacts such as conflict over shared natural resources including land and water use; and • Economic impacts such as increasingly stringent environmental regulation. The Intelligent Land Management (ILM) objective is to transform South32 land holdings*, which are otherwise unused or that are currently a liability, into land holdings that increase climate resilience and generate financial, social and environmental value. (*Available South32 land: land owned or leased by South32 that has already been mined/disturbed or is undisturbed and is found to contain no ore (sterilised)). Projects selected against four sub-criteria to ensure that the ILM objective is achieved: • Protecting biodiversity Protecting and linking significant conservation areas, which means a greater diversity of species can survive. This results in a higher likelihood that ecosystems can adapt to change. • Preserves an ecosystem service Well-functioning ecosystems provide services in an operational context to South32 (water extraction and discharge) and in a broader context to society (food, freshwater, carbon sequestration). Taking a role in conserving an ecosystem service in our area of need, means that South32 can work towards continued access to a critical ecosystem service over the long-term. Being visible and pro-active in this regard also reduces potential for conflict with communities over these services. For example, ensuring that a water catchment in the South32 area of influence is functioning so we and the community (including competing industry) can continue to draw water. • Community legacy Responsibly stewarding land so that it continues to provide value for future generations is a core tenant of the South32 values and Sustainability Policy. Linking South32 land holdings with surrounding National Parks thereby expanding the area under conservation or, generating alternative land use projects like biofuels is an example of the legacy South32 can leave for current communities and future generations at low cost. • Financial contribution

Document	Intent
	Funding to manage ILM projects will be generated in the design of the projects themselves, creating a neutral to positive financial impact to South32. ILM projects may generate direct revenue to support their own operation through bio-banking, carbon credits or various other government incentive mechanisms. ILM projects may also generate a positive financial contribution for South32 where they meet the future need to generate biodiversity offsets and/or offset mandatory community obligation
Sustainability Committee Paper on 3.1 Climate Change Strategy Avenue 2 – Intelligent Land Management Dated 15 March 2016	The South32 Board endorsed the Climate Change Strategy, 2 February 2016. Avenue 2 of the strategy works towards climate resilience for South32 operations, including resilience against: • Environmental impacts such as extreme weather events and drying trends leading to water scarcity; • Societal impacts such as conflict over shared natural resources including land and water use; and • Economic impacts such as increasingly stringent environmental regulation. Under Avenue 2, climate resilience will be achieved through two pathways of action: 1. Identification and execution of projects which deliver on the objective of ILM; and 2. Expanding current business planning to include accurate weather projections, improved water modelling and long-term rehabilitation planning. (References same four sub-criteria and related projects as above document).

Appendix 2-1: South 32 risk severity table

Severity Level	Impact types						Severity Factor
	Health and safety	Environment[33]	Community	Reputation	Legal	Financial	
7	>50 fatalities. Permanent impairment >30% of body to more than 500 persons.	Permanent severe impact/s to land, biodiversity, ecosystem services, water resources or air on a provincial or national scale	Severe, widespread community health, safety or security impacts (>1000 households) or human rights violations; complete destruction of >1000 houses or community infrastructure; complete irreversible desecration of multiple structures/objects/places of global significance.	Crisis event or publication of highly confidential material information resulting in international media, government, regulator, NGO campaigning and employee condemnation of the company (>6 months). Long term damage to company reputation.	Bankruptcy, closure / nationalisation of operations on multiple sites.	≥ US$1 billion	1000
6	>20 fatalities. Permanent impairment >30% of body to more than100 persons.	Severe impact/s (>20years) to land, biodiversity, ecosystem services, water resources or air on a provincial or national scale.	Extensive community health, safety or security impacts (>200 households) or human rights violations; extended serious disruption to people's lives (>1000 households); extensive damage to >1000 houses or community infrastructure or structures/ objects/places of global cultural significance.	Crisis event or publication of confidential material information resulting in international media, government, regulator, NGO campaigning and employee condemnation of the company (< 6 months). Ongoing condemnation results in damage of the reputation of the company.	Lack of valid operating title, forced closure of an operation, competition, anti-corruption, international trade law or tax breach; Major personal injury class actions. Nationalisation of Operation by host government.	≥ US$250 million to <US$1 billion	300
5	2-20 fatalities Permanent impairment >30% of body more than 10 persons.	Serious or extensive impact/s (<20 years) to land, biodiversity, ecosystem services, water resources or air on a regional scale.	Serious community health, safety or security impacts (>50 households) or human rights violations; extended disruption to people's lives (>200 households), extensive damage to >200 houses or structures/ objects/places of national cultural significance.	Serious national and international negative media attention. General public and NGO adverse reaction with interest from regulators (< 3 months). Structured campaigning from employees, NGOs or communities having a major impact on the Region / Operations reputation.	Prosecutions for criminal breaches resulting in jail terms for employees or agents or defendant to major civil litigation.	≥ US$100 million to < US$250 million	100
4	Single Fatality. Permanent impairment >30% of body to one or more persons.	Major impact/s (<5 years) to land, biodiversity, ecosystem services, water resources or air on a local scale	Serious community health, safety or security impacts (<50 households). Multiple allegations of human rights violations; extended disruption to people's lives (>50 households); extensive damage to >50 houses; moderate irreversible damage to structures/objects/places of national cultural significance	Adverse national media attention. General public and NGO adverse reaction with interest from regulators with no material outcome. Structured campaigning from employees, NGOs or communities having a major impact on the Region / Operations reputation	Significant civil litigation.	≥ US$25 million to <US$100 million	30
3	Permanent impairment <30% of body to one or more persons. Restricted or lost days due to injury or illness.	Moderate impact/s (<1 year) to land, biodiversity, ecosystem services, water resources or air on a local scale.	Moderate community health, safety or security impacts (<50 households). Single allegation of human rights violations; moderate disruption to people's lives (<50 households); extensive damage to <50 houses; moderate reversible damage to structures/objects/ places of national cultural significance.	Attention from regional media and/or heightened concern by local community. Criticism by community, NGOs or activists. Operations reputation adversely affected.	Breach of regulation. Lack of valid exploration title.	≥ US$5 million to < US$25 million	10
2	Objective but reversible impairment. Medical treatment injury or illness.	Minor impact/s (<3 months) to land, biodiversity, ecosystem services, water resources or air on a local scale.	Minor community health, safety or security impacts (<10 households) or human rights infringements; inconvenience to livelihoods <6 months; moderate damage to <50 houses or community infrastructure; minor, reversible damage to structures/ objects/places of regional cultural significance.	Adverse local public or media attention and complaints. Heightened scrutiny from regulator. Operations reputation is adversely affected with a small number of people.	Minor legal issues and non-compliances with commitments.	≥US$500,000 to <US$5 million	3
1	Low-level short-term subjective symptoms or inconvenience. No medical treatment.	Low-level impact/s to land, biodiversity, ecosystem services, water resources or air on a local scale.	Single low level community health, safety or security impact; low-level inconvenience <2 weeks; minor, reversible, low-level disturbance or minor damage to a single house or structure/object/place of regional cultural significance.	Public concern restricted to local complaints. Low-level interest from local media and/or regulator.	Low-level legal issue.	<US$500,000	1

[33] Provincial = Impact extent to District Municipality/Provincial boundaries; Regional = Impact will affect an area up to 50 km offset from the site boundary; Local = Impact will affect an area up to a 5 km offset from the site boundary