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DEPARTMENT OF MINERAL RESOURCES AND ENERGY

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PUBLICATION OF THE DRAFT NATIONAL MINE CLOSURE STRATEGY 2021 FOR PUBLIC COMMENTS

I, **SAMSON GWEDE MANTASHE, MP**, Minister of Mineral Resources and Energy, hereby publish the Draft National Mine Closure Strategy 2021 for public comment.

Interested and affected parties are hereby invited to submit written representations on the Draft National Mine Closure Strategy 2021. The aforesaid representations must be marked for the attention of **Mr Reuben Masenya** and hand delivered, emailed or sent by post, on or before the 23rd of July **2021** to the following addresses:

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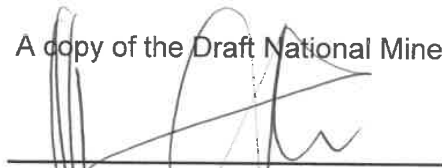
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A copy of the Draft National Mine Closure Strategy 2021 is attached hereto.



Mr Samson Gwede Mantashe, MP

Department of Mineral Resources and Energy

Date: 21 / 04 / 2021



mineral resources & energy

Department: Mineral Resources &
Energy
REPUBLIC OF SOUTH AFRICA

NATIONAL MINE CLOSURE STRATEGY

2020

EXECUTIVE SUMMARY

Mining can have profound adverse impacts on the biophysical and socio-economic environments. The closure of mines typically results in often irreversible environmental degradation and economic hardship in mining-dependent communities, most visibly in the areas local to the mining activity. The closure of mines further results in the externalisation of environmental degradation to the social and economic detriment of those communities local to the mining site. To mitigate these impacts, South African mining legislation requires of mining companies to submit Environmental Management Plans (EMPs) to define their responsibility to manage impacts during the process of mining.

The key problem area is where mines are interconnected or their safety, health, social or environmental impacts are integrated which results in a cumulative impact and the socio-economic impacts post mine closure. The closure of a mine will often impact on the remaining mines in that region i.e., environmentally, economically, and socially. Because different mines in a specific area will cease their operations at different times, an overarching integrated framework needs to be developed for each mining region/cluster within which individual mines will be able to plan for mine closure. This has led the Department to take a pro-active approach to the sustainable closure of mines. Taking note that mine closure is redefined in the current global mining industry to embrace the concept of handing over predetermined and defined post-mining land use with concurrent economic diversification rather than just closure when the operational stage of a mine ceases and decommissioning is complete. Concurrent economic diversification on the scale of a mine site or mining cluster can utilise the relative prosperity generated by mining to create sustainable environments and economies, which will endure beyond the life of the mining project(s).

The concept of concurrent economic diversification embraces the principle that every mine has the potential for some form of economic diversification during the currency of mining operations as well as beyond the closure of the mines. While the exploitation of non-renewable resources is not in itself sustainable, the vertical and lateral economies that are catalysed can be. Non-mining utilisation of mining lands for economic programmes must be planned for as an integral element of a mine's life cycle. The adoption of the strategy in areas where there are clusters of mines, either operating or already closed is regarded as a national priority. There are consequent similarities in environmental impacts and post-mining end land use alternatives therefore, these must be exploited and optimised in the mining regions of South Africa post closure.

GLOSSARY OF TERMS

Closure - A whole of mine life process that typically culminates in the issue of a closure certificate in terms of Section 43 of the MPRDA. It includes decommissioning and rehabilitation.

Closure Planning - A process that begins during the pre-feasibility phase of a project and continues throughout the operations to closure certification. It sets clear objectives and guidelines, makes financial provision and establishes effective stakeholder engagement leading to closure.

Decommissioning - An intense part of the closure process which begins near, or at, the cessation of mineral production and incorporates removal of unwanted infrastructure, development of final landforms, and the construction of specific closure components.

Environment - Defined in Section 1 of the MPRDA as meaning the environment as defined in the National Environmental Management Act, 1998 (Act 107 of 1998), which characterises environment as follows:

'Environment' means 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.

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 reconnaissance permission, prospecting right or reconnaissance permit, as contemplated in Section 39 of the MPRDA.

Environmental Management Programme - A legal document capturing the current state of the mine, mine progress as to the agreed state and the interim arrangements made during the course of each year of the mine's operation, as contemplated in Section 39 of the MPRDA.

Environmental Risk Assessment (ERA) - A process of gathering data and making assumptions to estimate short- and long-term harmful effects on human health and the environment from exposure to hazards associated with the use of a particular product or technology; or establishing the probability of an event occurring, the factors that could bring about that event, likely exposure levels and the acceptability of the impact resulting from exposure.

Financial Provision - Section 1 of the MPRDA defines financial provision as meaning 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.

Goldfield - The economic geology term goldfield describes a geologically distinct area/ unit where gold occurs.

Life of Mine - An assessment of realistically assumed geological, mining, metallurgical, economic, marketing, legal, environmental, social, governmental, engineering, operational and all other modifying factors, which are considered in order to derive the years for which a mine can still operate economically.

Planned Closure - Planned closures occur when the mining and processing ceases due to economic or operational requirements or when the ore reserve is exhausted. In this scenario a detailed closure plan will have been prepared and submitted to the authorities for approval prior to closure (preferably 5 years prior to closure) and decommissioning activities will be systematically implemented after cessation of operations.

Post-Closure - Post-closure defines the point at which decommissioning activities have ceased and post-closure management activities have commenced. This usually signifies that there is no intention to mine or process minerals at the site in the foreseeable future.

Resource - A concentration or occurrence of material of economic interest in or on the earth's crust in such form, quality and quantity that there are reasonable and realistic prospects for eventual economic extraction (SAMREC, 2007).

Reserve - The economically mineable material derived from a Measured and/or Indicated Resource (SAMREC, 2007).

Risk - The probability that a substance, an activity or an event will produce an adverse health, safety or environmental effect under a given set of circumstances.

Social and Labour Plan - As contemplated in Regulation 40 and 46 of the MPRDA, a plan to ensure that mine right holders contribute to the socio-economic development of the areas in which they are operating. The social and labour plan aims to promote employment and advance the socioeconomic welfare of all South Africans and contribute to the transformation of the mining industry to benefit the previously disadvantaged communities.

Sustainable Development - Section 1 of the MPRDA defines sustainable development as meaning the integration of social, economic and environmental factors into planning, implementation and decision making so as to ensure that mineral and petroleum resources development serve present and future generations.

Temporary Closure - The phase following temporary cessation of operations when infrastructure remains intact and the site continues to be managed. Care and maintenance is often required for operations that have temporarily ceased operations. In this situation a

caretaker generally manages the site and the operation may recommence when more positive circumstances prevail.

Unplanned Closure - Unplanned closures occur when mining and processing suddenly cease due to financial constraints (or similar economic imperatives) or if the operations are instructed to close due to non-conformances with regulatory requirements. Planning for this outcome would involve determining the cost of decommissioning if the operation were to close at any given point in the life of the closure plan (nominally 1 year).

ACRONYMS

CGS	Council for Geoscience
CSIR	Council for Scientific and Industrial Research
DMRE	Department of Mineral Resources and Energy
DWS	Department of Water and Sanitation
EIA	Environmental impact assessment
ICMM	International Council on Mining and Metals
KOSH	Klerksdorp–Orkney–Stilfontein–Hartebeesfontein
MPRDA	Mineral and Petroleum Resources Development Act
NDP	National Development Plan
NEMA	National Environmental Management Act
NWA	National Water Act
RMCS	Regional Mine Closure Strategies
SDG	Sustainable development goal

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1. BACKGROUND

Following the World Summit on Sustainable Development (WSSD), the Department instituted a broad initiative to develop a strategic framework for sustainable development in the minerals sector in South Africa. The Council for Geoscience (CGS), in conjunction with the Department, developed a series of Regional Mine Closure Strategies (RMCS) in 2008 covering the Witwatersrand goldfields (Central Rand, East Rand, KOSH, West Rand and Far West Rand). These strategies were developed in response to cumulative mining related impacts (environmental and socio-economic) experienced in the goldfields. The extent of cumulative mining-related impacts has led the Department to take a pro-active approach to the sustainable closure of mines. The reason that different mines in a specific area will cease their respective operations at different times, has made it important to develop a strategic framework for each mining region within which individual mines will be able to plan for mine closure.

The Regional Gold-mining Closure Strategy for the Witwatersrand was the overarching one supported by 5 goldfield-specific regional mine closure strategies for the five goldfields within the Witwatersrand Goldfield i.e., East Rand, Central Rand, West Rand, Far West Rand, Klerksdorp, Orkney, Stilfontein and Haartebeesfontein (KOSH). The Department furthermore requested the Council for Geoscience (CGS) to carry out a high-level gap analysis of the approved regional closure strategies. Given the background and considering the challenges around individual RMCS, the Department requested CGS to develop a comprehensive National Mine Closure Strategy to address the extent of cumulative mining related impact across the country including economic succession planning during and post mine closure.

1.1 PROBLEM STATEMENT

The closure of a mine within a region will often impact on the remaining mines in that region. The implication of a single mining operation's decision to cease operation, taken in isolation from its neighbouring mines, may consequently result in a risk that is transferred to the remaining mines in that region. The unintended consequence of the unilateral decision of a single mine to cease operations could thus negatively affect the safe operation of neighbouring mines and potentially result in the cessation of their operations.

The key problem area is surface water contamination, suspected groundwater contamination on a regional scale. The socio-economic impacts of mine closure, other environmental impacts, such as air pollution by windblown dust, radioactivity arising from the uraniferous nature of the ores and the waste products arising from their processing, land degradation and land instability due to undermining and seismicity; apportionment of these impacts; seismicity

due to increase mining activity, the amount of damage done to local biodiversity during mining is substantial.

The cumulative impact resulting from all the mines in a region could potentially be imposed upon the last operating mine in the region which will be held responsible and liable for the cumulative impact of all the mines with which it is interconnected. This translates to financial risk, which can become a driver of disinvestment in the mining industry with a resultant potential loss of jobs and associated economic activity.

Temporary closure, or care and maintenance, is provided for in the MPRDA, for circumstances where a mine is unable to operate for economic or other reasons but has a reasonable prospect of resuming operations should these factors change. Unfortunately, this provision can be cynically used as a loophole for avoiding expensive closure programmes.

The endemic invasion of derelict and abandoned mines by illegal miners has become a major social, safety, economic and legal problem for the country. Under current legislation, this practice is primarily illegal mining by the so-called Zama-Zamas, who are frequently associated with highly organised criminal syndicates. These illegal mining operations themselves are typically chaotic and characterised by violence, damage to public and private infrastructure, vandalism, and unsafe mining practices. The cost of security measures to prevent the practice are high. From an economic perspective, estimates of Zama-Zama outputs of gold production exceed R14 billion a year, making South Africa one of the largest sources of illicit gold in Africa. The practice is not restricted to the gold industry and is rife in the Platinum Group Metal (PGM) sector and around the plethora of abandoned coal mines in the country.

While this issue must be considered in the present strategy, it is a broader-ranging problem that must be addressed by several government departments and statutes. The facilitation and control of legal secondary mining of waste deposits by small-scale and artisanal miners are a key aspect of mine closure for which the former owners of the mines undergoing secondary mining cannot be held responsible. This responsibility consequently devolves to the State and must be clearly dealt with in the mine closure policy that will emanate from this strategy.

These identified gaps that manifested the stated problems led the Department to take a proactive approach to the sustainable closure of mines. Because different mines in a specific area will cease their operations at different times, an overarching framework needs to be developed for each mining region within which individual mines will be able to plan for mine closure.

2. LEGAL FRAMEWORK GOVERNING MINE CLOSURE

South Africa has a 150 year history of modern commercial mining and is in a phase of structural contraction as a result of depletion of known and easily accessible mineral reserves and a lack of new investment to replace these reserves. However, the potential to access more difficult mineral deposits using innovative mining and mineral processing methods and changing demand patterns for new minerals, has altered conventional mining methods and economics. The rapid growth of digitization and lightweight, high strength materials technologies has fundamentally changed both the nature of mining methodologies and the construction and function of mining equipment and by implication, the future of work in the industry. Formal mine closure legislation was only promulgated for the first time with section 43 the Mineral and Petroleum Resources Development Act (Act 28 of 2002) as amended and Mine Health and Safety Act (Act 29 of 1996).

This Act introduced a developmental approach to mining in South Africa in line with the country's ambition to become a developmental state and to give effect to Section 24 of the Constitution which enshrines environmental rights in South Africa. The Constitution of South Africa (Act 108 of 1996) guarantees a healthy environment to every person and mandates the government to ensure compliance with this right. The State is itself prohibited from infringing on the right to environmental protection and is required to provide protection against any harmful conduct towards the environment. Other relevant legislation includes the various Acts covered by the National Environmental Management Act (107 of 1998) and its regulations as amended, the National Water Act (Act No. 36 of 1998) and all other Acts and regulations which govern mining in South Africa. These statutes and their current regulations are comprehensive regarding rehabilitation and remediation of mining land but are largely disparate and are not sufficiently cohesive in dealing specifically with the social, economic, and environmental impacts of mine closure and the development of a post-mining economy. In particular, the National Water Act only addresses the management of water permitting and water quality during mining operations and water quality after mine closure. Like the MPRDA and NEMA, there are no proactive provisions for the post-mining economic use of water in the Water Act.

3. THE CONCEPT OF NATIONAL MINE CLOSURE STRATEGY (NMCS)

For a long part of the mining history legislation endorsing appropriate rehabilitation and recovery of mine-impacted land and natural resources had been lacking. The initial requirements for mine closure entailed the concept of "safe-making of the surface of mining land" and the submission of a basic "rehabilitation plan". This only became a legal obligation in 1956 with the Regulations to the Mines and Works Act. The Minerals Act, 1991 (Act No. 50

of 1991) was the first act that paid appropriate attention to mine environmental management. Subsequent to the implementation of the Minerals Act the “Departmental Policy on Mine Closure” was developed.

The “planning for closure” concept emerged as a major objective of this policy. However, the Departmental Policy never had any legal status. The concepts of the policy were incorporated into the Regulations published in support of the Mineral and Petroleum Resources Development Act, 2002 (MPRDA) in 2004 after wide consultation with other role-players. The introduction of the MPRDA, in 2004, marked a shift in the perception of the impact of mines and the current concept of mine closure. These changes included not only a sophisticated legal and technical process but also a new focus on the social and economic impacts of mine closure. South Africa now has a legal framework that instructs the mining industry on “what” to do to minimise environmental and socio-economic impacts with guidelines on “how” to achieve compliance with the laws concerned with mining activities.

3.1 AIM

The aim of regional mine closure is to prevent or minimize adverse long-term environmental and socio-economic impacts, and to create a self-sustaining natural ecosystem or alternate land use. The Regional Closure Strategy will therefore set specific standards for all mines and promote the alignment of individual mine closure plans and regional mine closure plans, including the requirements for application for closure, requirements for Environment Management Programme/ Plans and financial provision. A Regional Mine Closure Strategy (RMCS) is different to a Mine Closure Plan. The regional mine closure strategy considers the various issues that are relevant to mine closure on a broader integrated level and develops a strategic framework within which individual mine-closure plans will fit. RMCS therefore do not replace a mine closure plan.

3.2 OBJECTIVES

The objectives of National Mine Closure Strategy are:

- To manage the closure of mines in a demarcated area in an integrated and sustainable manner, hence ensuring that these mines work together to achieve self-sustaining ecosystem after closure.
- To ensure that mines do not impact negatively on the livelihood of adjacent/interconnected mines in a demarcated area.
- To promote a strategic approach to managing water at mining and mineral processing sites so that water is more efficiently managed and valued and to develop a post closure mine water strategy for an area.

- To make provision for post-closure stewardship and socio-economic sustainability, to continue monitoring the implementation of individual and regional mine closure plans.
- Integrate environmental management and related closure activities with socio-economic interventions and aligning these with development of a post-closure economy, by rationalising current wasteful spending on Environmental Management Programme (EMPr), Social and Labour Plan (SLP) and Corporate Social Investment (CSI) by reducing duplication of efforts and spending and aggregating available funding for coordinated regional projects.

4. KEY FOCUS AREAS OF THE NATION MINE CLOSURE STRATEGY

4.1 Planning for closure beyond environmental rehabilitation

An important departure from the historical practice of attempting to rehabilitate land to a pristine, pre-mining condition is the concept of rehabilitation of land to a *fit-for-purpose* condition. This changes the focus of rehabilitation from one that is of restoration to socio-economic sustainability. Current legislation requires preparation of land for the agreed post-mining land use but does not require any specific detail. This provides for integration of the proposed concurrent economic diversification process with concurrent rehabilitation. This affords greater integration regarding prescribed land management and rehabilitation programmes and the sustainable development of the mine site within its regional context.

Experience has also shown that attempts at land restoration are often unsuccessful in the medium to long term, owing to inappropriate land use choices and a lack of buy-in to the underlying objectives of mine closure by the implementing companies. Regenerative practices may provide better results in the long term but must be aligned with a sustainable post-mining land use. As most mines are in rural areas with a largely rural local skills base, agricultural projects will likely form the core of the post-mining economy, with processing and beneficiation of agricultural produce potential areas for economic development. Both food and non-food (fibre, biomass energy, etc.) crops may form part of the economic diversification programme. Given the current crisis on energy supply, self-generation of energy by mining companies is a critically important aspect of a post-mining economy. Suites of biomass and other renewable energy sources. The recent developments where operating mines generate their own power will create a generation base that can be used to provide energy to post-mining developments, as well as providing sustainable energy where long-term pumping and treatment of water are required. Rural land may also provide opportunities for the development of enterprises in the tourism sector.

4.2 Closure planning throughout the mining lifecycle

The primary purpose of the strategy is to mitigate the risks inherent in the termination of the mining operations from the earliest phases of the mining lifecycle with clear objectives to be achieved at each phase of the mine's development. Submission of the mine closure plan should therefore become a precondition to the granting of a mining licence, as part of a mine EMP or Environmental Impact Assessment (EIA). It will evolve through the stages of the development of a mining project. The mine closure plan should clearly highlight the aims, objectives and regulatory requirements that are necessary throughout the process. Engagement with stakeholders constitutes a critical component of the closure planning and implementation processes. The end-use scenarios for each mine site will obviously be site specific. Post-mining economic alternatives must be identified and interrogated for sustainability, affordability and feasibility during the pre-feasibility and feasibility planning of the mine itself. These scenarios can then be assessed alongside the mining plans, to ensure that decisions taken throughout the mine lifecycle are consistent with the closure plan, if they do not compromise the economics, functionality or safety of mining operations.

4.3 Regional approach to mine closure

The closure of a mine within a region will often impact on the remaining mines in that region. The implication of a single mining operation's decision to cease operation, taken in isolation from its neighbouring mines, may consequently result in a risk that is transferred to the remaining mines in that region. The unintended consequence of the unilateral decision of a single mine to cease operations could thus negatively affect the safe operation of neighbouring mines and potentially result in the cessation of their operations. The adoption of regional strategies for areas where there are clusters of mines, either operating or already closed is regarded as a priority in this strategy. Regional classification must be based on: single isolated mines, geographic clusters of mines, clusters mining similar commodities as opposed to geographic clusters of mines producing different commodities, mine clusters that straddle administrative/biophysical boundaries, clusters comprising mines at different points in their lifecycles.

As a result of geological formations and associated primary and secondary structural controls, mines tend to occur in clusters. There are consequent similarities in environmental impacts and post-mining economic alternatives. These must be exploited and optimised in regional post closure planning for mining clusters within which the constituent mine plans and programmes must be located. Recognising that mining has this regional coherence, provision for the identification of the closure regions is made in Section 43 (9 and 10) of the MPRDA. Furthermore, provisions for enforcement are made in Section 43 (11) of the same Act. Section

43 (9) states that a Minister, in consultation with the Minister of Environmental Affairs and Tourism, may identify areas by notice in the Gazette, where mines are interconnected or their safety, health, social or environmental impacts are integrated, resulting in cumulative impacts. Section 43 (10) of the Act further states that the Minister may, in consultation with the Minister of Environmental Affairs and Tourism, publish by a notice in the Gazette, strategies to facilitate mine closure where mines are interconnected, have an integrated impact or pose a cumulative impact. Currently, large amounts of money are being spent by mining companies in these clusters on SLP, CSI and EMPr projects in efforts that are often duplicated and uncoordinated.

This practice is wasteful with little tangible current or sustainable economic benefit. There is consequently a dire need to optimise this expenditure in jointly managed regional economic and social development programmes in areas where there are synergistic clusters of mines. This coordinated regional development must encompass: Integrated economic development, Infrastructure rationalization, social development, cross-sectoral collaboration, robust institutional capacity for mine closure management; and optimisation of funding through: • pooling of CSI, SLP and EMPr funding at a cluster level, coordination of CSI, SLP and EMPr funding; and recruitment of third-party collateral funding.

4.3.1 Collaborative Regional Development

Regional planning for clusters of mines must be implemented within the constructs of collaborative regional development programmes. These should be cross-sectoral imperatives between mining companies, other sectors such as agriculture, energy, water, manufacturing and tourism undertaken in collaboration with provincial and local government. The most structured example of collaborative regional development is the Impact Catalyst imperative in the Limpopo Province. This is a development imperative between Anglo American, Exarro, the Limpopo Provincial Government, the CSIR, the University of Cape Town and NGOs such as World Vision.

4.3.2 The identification of Mine Closure Regions

The identification of closure regions is a multi-contextual process and requires consideration of social, environmental, and economic impacts geared towards sustainable post closure support for dependent communities. The initiative requires the identification of closure regions suitable for integrated development strategies. The identification of these closure regions should be made within the existing provisions of the MPRDA. The selection of logical mine closure regions will enable the aggregation of development and rehabilitation funds into common regional economic development programmes underpinned by substantial financial capacity. This, in turn, provides the basis for collaborative regional development between

mining companies, local government and other sectors. Examples of these regions are shown in Figure 1.

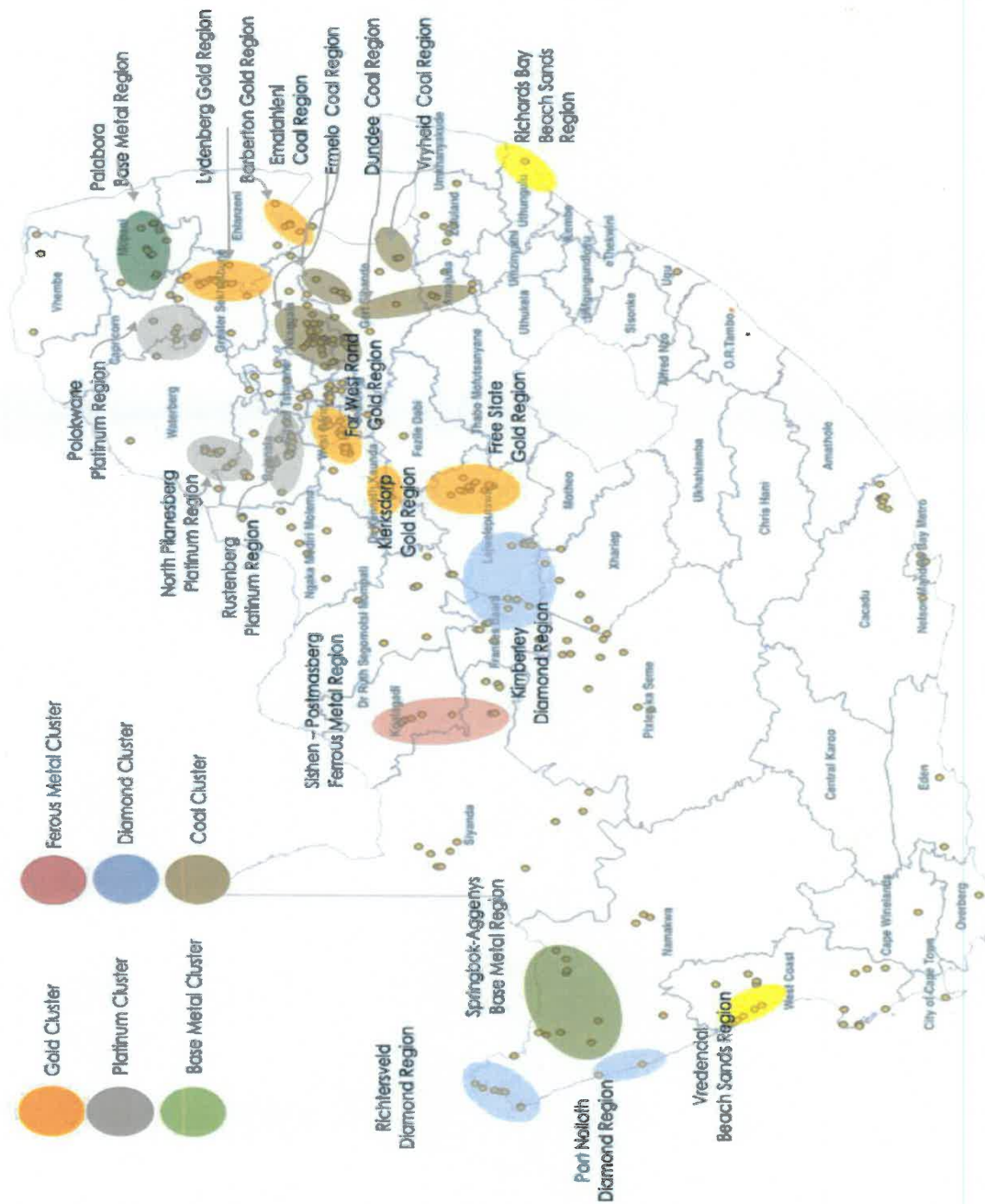


Figure 1: Regional Mining Cluster

5. PROPOSED IMPLEMENTATION PLAN

5.1 Economic Succession Planning and the Development of a Sustainable Post-mining Economy

The National Mine Closure Strategy adopts the concept of economic succession planning. This embraces the principle that every mine has the potential for some form of economic diversification during the currency of mining operations as well as beyond the closure of the mines. While the exploitation of non-renewable resources is not in itself sustainable, the vertical and lateral economies that are catalysed can be. Non-mining utilisation of mining lands for economic programmes must be planned for as an integral element of a mine's life cycle. The positive environmental and social legacies of mining may not be reversed on mine closure and the negative legacy impacts need to be mitigated. This transitional economy must ultimately metamorphose into the substitutive economy once the nonrenewable mineral resources are depleted and the mine is closed. The methodology enables existing mining activity to leverage greater economic benefit and labour absorption than is currently the case and enhances sustainability around mining by planning for transitional and post-mining substitutive economies.

5.2 Economic Benchmarking

Economic benchmarking provides an analytical framework and methodology that will enable mining companies and government to map, assess, visualise and understand the full economic impact of mining activity on both local and remote mining-dependent and mining-affected communities. Thereafter, the data and their derived factors will be used to construct a model with which to predict the economic, social, environmental and political impact of mine downscaling and closure, which will form the baseline against which the new economic succession plan will be benchmarked. A critical aspect of this process is the identification of those communities that are most affected by the mining activity in question. These communities should be assessed with respect to the nature and extent of economic dependence on a mine or cluster of mines. Local communities as well as remote communities in labour sending areas and communities in dependent industrial areas must be considered.

A deep understanding of the socio-economic equation through a structured research, monitoring evaluation and modelling programme must inform the planning. This will apprise the relevant departments at all levels of government as to the vulnerability of these communities to mine closure and equip them to put strategies in place to mitigate these impacts. The mining companies must, in turn, formulate their own, synergistic strategies for the management of land, resources and the post-mining economic needs of communities

affected by mine closure. Economic Succession Planning is specifically designed to provide a logical, highly structured approach to land use and infrastructure diversification of mine properties that is premised on this benchmark and can be measured and evaluated against it.

5.3 Planning a Diverse Post-Mining Economy.

Diversification planning must be directed towards producing comprehensive business plans and a project prospectus for each project. Once approved, these will be used for recruiting business partners into the various ventures embarked upon as well as to solicit and secure collateral funding for projects. These will be included in the terms of reference for projects. In the interests of all stakeholders, in particular government and the mining company, the establishment of an economic baseline is a necessary part of the planning process. The baseline economic analysis will qualify the extent to which mining companies currently contribute economically to communities and the various levels of the economy. The baseline will also be used to assess the extent to which the economic succession plans may offset the loss of this economy to current beneficiaries. This ultimately forms the basis on which programmes are affordable and beneficial to mining company management and shareholders, or by government as being acceptable contributors to SLP and EMPr commitments while allowing additional support via the integration of CSI spending.

5.4 The integration of socio-economic activities with mine environmental management and closure

Existing EMPr formats primarily address the biophysical impacts of mining and their mitigation and/or rehabilitation. This strategy integrates the mitigation of the biophysical impacts of mining with the development of a post-mining economy by planning for closure throughout the mining life-cycle, with a closure plan which integrates impacts on the physical environment with socio-economic impacts and economic succession planning. Since economic activities have been identified and their feasibility established early in the mining life-cycle, mines' EMPrs and closure plans can be tailored to rehabilitate land to a fit-for-use criterion, in the place of restoration to a pre-mining, pristine condition. This can also impact on mine planning, while avoiding environmental impacts which will be detrimental to the long-term value of land in mining properties. Concurrent diversification of mining properties, natural resources, infrastructure and institutional capacity during mining plays a key role on the programme.

5.5 Tailoring closure programmes to various categories of mines

The full closure programme envisaged in this strategy is applicable to mines in planning, new mines and mines early in their lifecycle. For operating mines and mines nearing (within ten years) closure, a more limited implementation of concurrent diversification and post-closure economic development must still be adopted. Where rehabilitation of legacy mines is

pragmatically and economically possible, consideration should be given to applicable land use options such as the planting and establishment of regenerative revegetation for carbon sequestration and viable agriculture.

5.6 Peer review, monitoring and evaluation.

The technical aspects of planning and performance relative to the closure plan will, from time to time, require independent expert peer review, to ensure that the plan and its implementation contribute to sustainability after closure. Independent professional peer review, as required by NEMA regulations, is mandatory to ensure that the closure plan is credible and realistic. Furthermore, reviewers need to be involved in the monitoring of the implementation of review recommendations. The involvement of regulators and affected communities in the peer-review process will ensure that their concerns are adequately addressed. Mining companies should put measures in place to monitor and evaluate the progress made on the closure plans on a regular basis and inform the DMRE on the outcomes.

6. Recommendations

The following are recommended:

- 6.1 Alignment of EMPs to manage the interconnectedness in an integrated and sustainable manner.
- 6.2 Align closure plans to achieve self-sustaining ecosystem after closure and ensure that mines do not impact negatively on adjacent mines.
- 6.3 Integration of EMPs, SLP and CSI objectives to reducing duplication of efforts and spending and aggregating available funding for coordinated regional projects
- 6.4 Contribute towards regional mine closure fund and ensure funds are available for post closure monitoring.
- 6.5 Development of mine closure policy.
- 6.6 Applications to place operations under care and maintenance should be critically assessed on a regular basis regarding:
 - a. An auditable business plan, justifying the partial closure, and detailing the circumstances which will allow operations to resume;
 - b. Contingency plans and provision for full closure of the conditions if the resumption of operations does not occur within a reasonable time. A period of five years is proposed, after which care, and maintenance can only continue based on an approved comprehensive motivation to the Minister of Mineral Resources and Energy;
 - c. Operations placed under care and maintenance must be maintained in a way that:
 - i. All critical mining infrastructure is kept in an operable condition or that future resumption of operations is not sterilised through the destruction or removal of critical mining infrastructure;
 - ii. Non-critical infrastructure and equipment must be deployed where possible to economic diversification projects and used in the implementation of the closure plan; and
 - iii. Adequate security must be provided to protect infrastructure and equipment and prevent illegal mining.

Appendix 1: Environmental Impacts that need to be addressed in mine closure plans for selected regions.

		Water pollution & water usage	Disturbance of watercourses/aquifers	Soil contamination/disturbance	Air pollution	Radioactivity	Reduction of biodiversity	Landscape change/sense of place	Climate change impacts
Commodities/mineral provinces	Gold (Witwatersrand, including uranium)	Sulfidic ores and residues will generate AMD, except where sufficient buffer capacity is present (dolomitic areas, but will need to be determined on a site by site basis)	Localised impact on watercourses Localised impact on aquifers Potential regional impact on dolomitic aquifers, where present (East Rand, Far West Rand, West Rand, KOSH) Downstream water and sediment pollution by metals and radionuclides	Mine residues cover large areas. Waterborne and windblown material entering the environment can contaminate soil Pipeline bursts contaminate surrounding soils	Windblown dust is a source of metal contamination Windblown "nuisance" and irritant dust Radon from decay of radium	Must be considered for all waste streams, contaminant pathways Uranium-series disequilibrium needs to be considered	Mines have the potential to pollute areas of local conservation importance (e.g. Marievale Bird Sanctuary, Free State pans) Discharges of water from mines may support local ecosystems	Recent open-pit operations disrupt the continuity of urban areas	Closure should aim to be at least carbon neutral Carbon- negative plans via sequestration or offsetting should be considered
	Gold (greenstone and other)	Sulfidic ores and residues will generate AMD, except where sufficient buffer capacity is present (gold associated with dolomite in Sabie-Pilgrims' Rest). Arsenic is present in many sulfidic gold ores (e.g. greenstone belts such as Barberton)	Localised impact on watercourses. Localised impact on aquifers	Mine residues cover large areas waterborne and windblown material entering the environment can contaminate soil Pipeline bursts contaminate surrounding soils	Windblown dust is a source of metal contamination Windblown "nuisance" and irritant dust		Some gold deposits in Mpumalanga coincide with areas of high biodiversity importance — closure should aim to enhance biodiversity potential Some gold deposits in Mpumalanga lie in strategic water source areas	Mines are located in scenic areas with established tourism industry Closure should enhance these characteristics	
	Coal	Sulfides in coal, discard and surrounding rock can lead to the generation of AMD Mining has been shown to have a catchment-scale impact	Opencast mining can impact watercourses Both underground and opencast (Huisamen 2017) mining intersect local aquifers, leading to disturbance and contamination Impacts can occur on both local and regional scale Large scale of opencast operations needs to be addressed	Opencast mining replaces a complete soil profile with a mix of horizons, including rock. This is often not addressed in operational mines, leading to problems at and after closure Acid and saline mine drainage contaminates soils Spontaneous combustion can "bake" soils	Spontaneous combustion — smoke, SO _x , NO _x , particulates, products of incomplete combustion Methane emissions Dust from mining, waste disposal and poorly vegetated rehabilitated mine sites	Some coal deposits (e.g. Springbok Flats) contain elevated uranium concentrations	Some coal deposits coincide with areas of high biodiversity importance. Closure should aim to enhance biodiversity potential Change of ecosystem Some coal deposits lie in strategic water source areas	Loss of valuable land area and soil due to opencast mining and deposition of coal mine wastes. Damage & vast voids by opencast mines, subsidence from Upper Group mines, spontaneous combustions, etc. Unnatural landscapes with negative aesthetics	Spontaneous combustion of remaining coal Methane emissions from disturbed coal seams Closure should aim to be at least carbon neutral Carbon-negative plans via sequestration or offsetting should be considered

		Water pollution & water usage	Disturbance of watercourses/aquifers	Soil contamination/disturbance	Air pollution	Radioactivity	Reduction of biodiversity	Landscape change/sense of place	Climate change impacts
	Asbestos	Transport of asbestos in rivers	Mining operations may divert/interfere with rivers Siltation Erosion	Asbestos in soils due to airborne transport and mining operations	Windblown asbestos dust from residues, stockpiles, contaminated areas etc.		Localised because of the scale of mining	Former asbestos mines may leave land uninhabitable, even after rehabilitation	Closure should aim to be at least carbon neutral Carbon- negative plans via sequestration or offsetting should be considered
	Uranium (Karoo)	Effect of redox state change with mining – uranium soluble under oxidising conditions (Coetzee <i>et al.</i> 2008b; Tarras-Wahlberg <i>et al.</i> 2008)							
	Shale gas (potential areas)	Water use Water contamination – due to fracturing fluid, drilling fluid (all chemicals are toxic to some extent, although some are much more hazardous than others) and associated with flowback water	yes	yes	Greenhouse gas (GHG) emissions and related climate change impact	Resulting from fracturing fluid as it contains dissolved materials such as naturally occurring radionuclides and bromide	Waste water (not fully treated, which, if discharged into rivers, could affect toxicity and nutrient levels in aquatic & terrestrial ecosystems)	The Karoo is well known for wide open spaces and “Die Niks” (Seeliger <i>et al.</i> 2016) Land use, terrestrial eco-toxicity (e.g. due to the disposal of drilling waste) earthquakes	Fugitive emissions from closed wells. Closure should aim to be at least carbon neutral. Carbon-negative plans via sequestration or offsetting should be considered
	Marine mining	Mining can contribute to the contamination of seawater		Seafloor mining can be extremely disruptive of the benthic environment, including fish spawning			Marine mining poses potential threats to marine biodiversity, with possible effects on commercial and subsistence fisheries		Closure should aim to be at least carbon neutral Carbon- negative plans via sequestration or offsetting should be considered
	Sand (construction)		Sand mining in rivers and on riverbanks can lead to downstream erosion and/or silting up						

Pillar	Tenets	Category	Sub-category	
Post-Mining Economy	Economic Alternatives	Assesment of the full economic potential of the operating assets (Concurrent and Post Mining)	Natural Resources	
			Infrastructure	
			Institutional Capacity	
		Agricultural Potential	Agronomy	
			Livestock	
			Agro-Industry	
			Institutional Support	
		Tourism Potential	Application of the Mining Factors of Production to a concurrent	
		Energy Potential	Support for business, leisure or recreational tourism in and around	
		Circular Economy	Grid infrastructure	
Renewables				
Waste generated buy mining operations				
Environmental Remediation and Rehabilitation	Environmental Compliance	Tailings	Construction integrity	
		Infrastructure	Residual economic potential	
		Residual Emissions	Residual land use potential	
			Demolition vs Retention	
	Energy	Energy Management	Applicable to diversified economic activity	
			Grid Electricity	
	Water	Water Management	Renewable Energy Options	
		Water infrastructure	The use of mine water supply or pumped mine water for catalysing	
	Biodiversity	Biodiversity Management	The use of mine water supply or pumped mine water for catalysing	
			Post-mining responsibility for funding of retained mine water	
	Emissions	Carbon sequestration	Post-mining Operation of Mine Water Treatment utilities	
			Carbon Tax	Using biodiversity for alternative economies
	Effluents and Waste	Zero Waste to Landfill	Restoring Biodiversity on impacted land	
				Agriculture
	Social Impact	Labour/Management Relations	Preparation for mine closure	Creation of new biomes
				Alternative occupations
Community Health and Safety			Airborne Pollutants/Inhalable Hazards	Carbon tax offsets
				Community Safety
			Post-employment health care and Supplementation of NHI services for retrenched mine workers on mine closure	Domestic Waste
				Preparation of Retrenched Workers and Dependent Communities for Post-mining livelihoods
Creating employment outside of mining			Vocational preparation	
Diversity and Equal Opportunity			Gender Equity in Post Mining Economic Arrangements	Mine dependent local communities
		Ownership Models for of Post-mining enterprises and		Labour Sending Areas
Society		Human Rights Assessment	Human Rights Assessment for the post-mining care of dependent communities	Industrial areas
				Just transition for communities
		Local Communities	Illegal mining activities	Health and safety issues for survival miners
				Pragmatic, implementable plans for post-mining economy
			Land Access and Resettlement	Community-led Projects
				Women and youth
		Remote Communities	Labour Sending Areas	Business support
	Industrial Areas: Secondary and Tertiary sectors			Mining Land

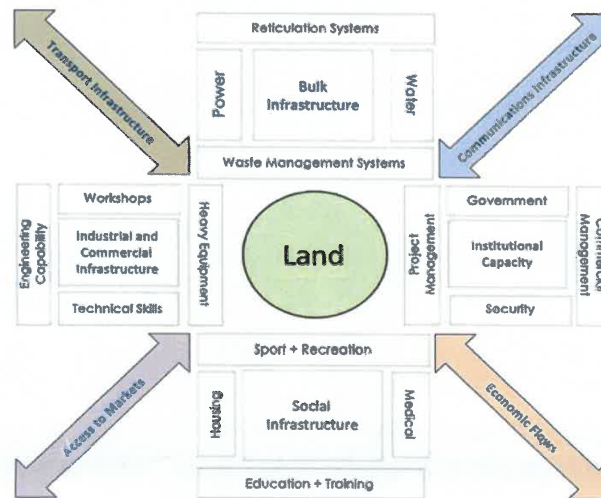
Appendix 3: Economic transition and substitution economic phasing

Mine-specific strategies and plans must be clearly located within a defined project framework for the concurrent and post-mining development of the mine site concerned. Every aspect of the diversification planning and the concomitant rehabilitation interventions must be accommodated in these plans. They must then be mapped into the integrated architecture and assessed with respect to optimising overall economic impact. This entails:

1. The mapping of land, infrastructure and water reticulation;
2. Scoping appropriate usage for each asset, ensuring that linkages are properly mapped and commercially related;
3. Identifying premium market offtakers for each agricultural or industrial enterprise, identifying and qualifying strategic, business and operating partnerships; and
4. Scoping secondary and tertiary enterprises in the SME support ecosystem.

The concept is graphically presented in 2.

The chronology of mine closure and the need for establishing the diversified transition economy well in advance of mine closure is best depicted in 3. This scheme demonstrates the timing of the decline of the mine relative to the development of the new substitutive economy being developed. A similar figure will be developed for each site whereby the progress of the economic succession plan can be tracked.



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Figure 2. Common factors of production between mines and farms.

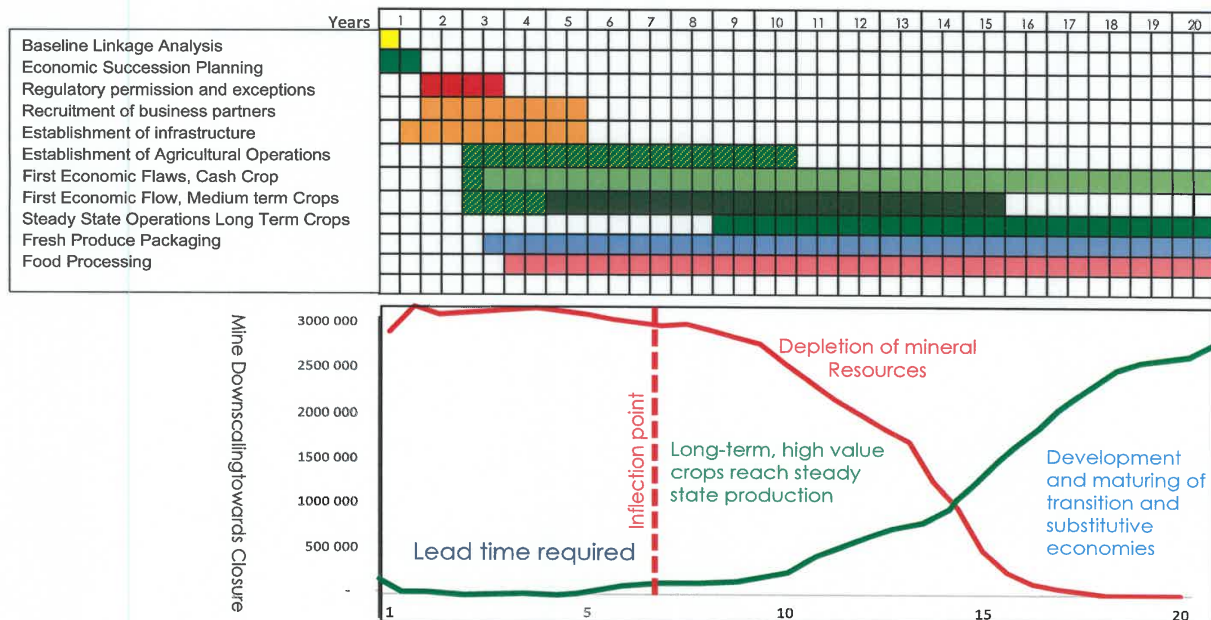


Figure 3: Economic transition and substitution economic phasing.