Series G: General Guidelines



G5

BEST PRACTICE GUIDELINE

Water Management Aspects for Mine Closure

Best Practice Guidelines for Water Resource Protection in the South African Mining Industry

DIRECTORATE: RESOURCE PROTECTION & WASTE

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DOCUMENT INDEX

This document is the fifth in a series of the following general aspects Best Practice Guideline documents:

BPG G1: Storm Water Management

BPG G2: Water and Salt Balances

BPG G3: Water Monitoring Systems

BPG G4: Impact Prediction

BPG G5: Water Management Aspects for Mine Closure

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Since 1999 a number of steering committee meetings and stakeholder workshops were held at various stages of the development and drafting of this series of Best Practice Guidelines for Water Resource Protection in the South African Mining Industry.

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APPROVALS

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PREFACE

Water is typically the prime environmental medium (besides air) that is affected by mining activities. Mining adversely affects water quality and poses a significant risk to South Africa's water resources. Mining operations can further substantially alter the hydrological and topographical characteristics of the mining areas and subsequently affect the surface runoff, soil moisture, evapo-transpiration and groundwater behaviour. Failure to manage impacts on water resources (surface and groundwater) in an acceptable manner throughout the life-of-mine and post-closure, on both a local and regional scale, will result in the mining industry finding it increasingly difficult to obtain community and government support for existing and future projects. Consequently, sound management practices to prevent or minimise water pollution are fundamental for mining operations to be sustainable.

Pro-active management of environmental impacts is required from the outset of mining activities. Internationally, principles of sustainable environmental management have developed rapidly in the past few years. Locally the Department of Water Affairs and Forestry (DWAF) and the mining industry have made major strides together in developing principles and approaches for the effective management of water within the industry. This has largely been achieved through the establishment of joint structures where problems have been discussed and addressed through co-operation.

The Bill of Rights in the Constitution of the Republic of South Africa, 1996 (Act 108 of 1996) enshrines the concept of sustainability; specifying rights regarding the environment, water, access to information and just administrative action. These rights and other requirements are further legislated through the National Water Act (NWA), 1998 (Act 36 of 1998). The latter is the primary statute providing the legal basis for water management in South Africa and has to ensure ecological integrity, economic growth and social equity when managing and using water. Use of water for mining and related activities is also regulated through regulations that were updated after the promulgation of the NWA (Government Notice No. GN704 dated 4 June 1999).

The NWA introduced the concept of Integrated Water Resource Management (IWRM), comprising all aspects of the water resource, including water quality, water quantity and the aquatic ecosystem quality (quality of the aquatic biota and in-stream and riparian habitat). The IWRM approach provides for both resource directed and source directed measures. Resource directed measures aim to protect and manage the receiving environment. Examples of resource directed actions are the formulation of resource quality objectives and the development of associated strategies to ensure ongoing attainment of these objectives; catchment management strategies and the establishment of catchment management agencies (CMAs) to implement these strategies.

On the other hand, source directed measures aim to control the impacts at source through the identification and implementation of pollution prevention, water reuse and water treatment mechanisms.

The integration of resource and source directed measures forms the basis of the ***hierarchy of decision-taking*** aimed at protecting the resource from waste impacts. This hierarchy is based on a *precautionary approach* and the following order of priority for mine water and waste management decisions and/or actions is applicable:

RESOURCE PROTECTION AND WASTE MANAGEMENT HIERARCHY

Step 1: Pollution Prevention

↓

Step 2: Minimisation of Impacts
Water reuse & reclamation
Water treatment

↓

Step 3: Discharge or disposal of waste and/or waste water
Site specific risk based approach
Polluter pays principle

The documentation describing **Water Resource Protection and Waste Management** in South Africa is being developed at a number of different levels, as described and illustrated in the schematic diagram below.

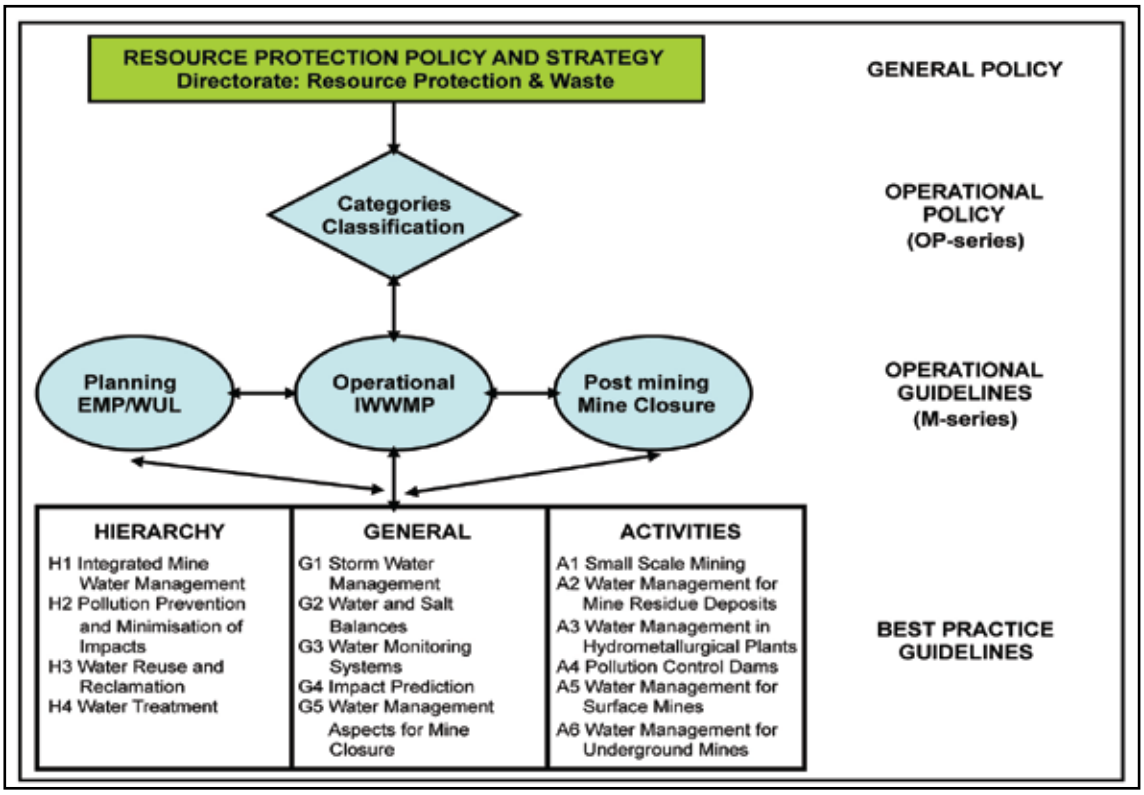
The overall Resource Protection and Waste Management Policy sets out the interpretation of policy and legal principles as well as functional and organisational arrangements for resource protection and waste management in South Africa.

Operational policies describe the rules applicable to different categories and aspects relating to waste discharge and disposal activities. Such activities from the mining sector is categorised and classified based on their potential risks to the water environment.

Operational Guidelines contain the requirements for specific documents e.g. licence application reports.

Best Practice Guidelines (BPG's) define and document best practices for water and waste management.

Schematic Diagram of the Mining Sector Resource Protection and Waste Management Strategy



The DWAF has developed a series of **Best Practice Guidelines** (BPGs) for mines in line with International Principles and Approaches towards sustainability. The series of BPGs have been grouped as outlined below:

BEST PRACTICE GUIDELINES dealing with aspects of DWAF's water management **HIERARCHY** are prefaced with the letter **H**. The topics that are covered in these guidelines include:

- H1. Integrated Mine Water Management
- H2. Pollution Prevention and Minimisation of Impacts
- H3. Water Reuse and Reclamation
- H4. Water Treatment

BEST PRACTICE GUIDELINES dealing with **GENERAL** water management strategies, techniques and tools, which could be applied cross-sectoral and always prefaced by the letter **G**. The topics that are covered in these guidelines include:

- G1. Storm Water Management
- G2. Water and Salt Balances
- G3. Water Monitoring Systems
- G4. Impact Prediction
- G5. Water Management Aspects for Mine Closure

BEST PRACTICE GUIDELINES dealing with specific mining **ACTIVITIES** or **ASPECTS** and always prefaced by the letter **A**. These guidelines address the prevention and management of impacts from:

- A1. Small-Scale Mining
- A2. Water Management for Mine Residue Deposits
- A3. Water Management in Hydro-metallurgical Plants
- A4. Pollution Control Dams
- A5. Water Management for Surface Mines
- A6. Water Management for Underground Mines

The development of the guidelines is an inclusive consultative process that incorporates the input from a wide range of experts, including specialists within and outside the mining industry and government. The process of identifying which BPGs to prepare, who should participate in the preparation and consultative processes, and the approval of the BPGs was managed by a Project Steering Committee (PSC) with representation by key role-players.

The BPGs will perform the following functions within the hierarchy of decision making:

- Utilisation by the mining sector as input for compiling water use licence applications (and other legally required documents such as EMPs, EIAs, closure plans, etc.) and for drafting licence conditions.
- Serve as a uniform basis for negotiations through the licensing process prescribed by the NWA.
- Used specifically by DWAF personnel as a basis for negotiation with the mining industry, and likewise by the mining industry as a guideline as to what the DWAF considers as best practice in resource protection and waste management.
- Inform Interested and Affected Parties on good practice at mines.

The information contained in the BPGs will be transferred through a structured knowledge transfer process, which includes the following steps:

- Workshops in key mining regions open to all interested parties, including representatives from the mining industry, government and the public.
- Provision of material to mining industry training groups for inclusion into standard employee training programmes.
- Provision of material to tertiary education institutions for inclusion into existing training programmes.
- Provision of electronic BPGs on the DWAF Internet web page.

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FIGURES

ABBREVIATIONS

ABBREVIATIONS

ABA	Acid Base Accounting
AP	Acid Potential
ARD	Acid Rock Drainage
ASTM	American Society for Testing and Materials
BPG	Best Practice Guideline (documents in this series)
CANMET	Canada Centre for Mineral and Energy Technology
DTM	Digital Terrain Model
DWAF	Department of Water Affairs and Forestry
EC	Electrical Conductivity
ECA	Environmental Conservation Act, 1989 (Act 73 of 1989)
EIA	Environmental Impact Assessment
EMP	Environmental Management Programme
EPMA	Electron Probe Microanalysis
EPRI	Electrical Power Research Institute
ERA	Environmental Risk Assessment
GIS	Geographic Information System
GN704	Government Notice 704 promulgated in terms of NWA on 4 June 1999
GPS	Global Positioning System
ICPMS	Inductively Coupled Plasma Mass Spectroscopy
IWM	Integrated water management
IWMP	Integrated water management plan
MPRDA	Minerals and Petroleum Resources Development Act (Act 28 of 2002)
NEMA	National Environmental Management Act, 1998 (Act 107 of 1998)
NP	Neutralising Potential
NNP	Net Neutralising Potential = NP – AP
NPR	Neutralising Potential Ratio = NP/AP
NWA	National Water Act, 1998 (Act 36 of 1998)
PAG	Potentially ARD Generating
OCM	Oxygen Consumption Method
QA/QC	Quality Assurance / Quality Control
RDF	Reside Disposal Facility
SEM	Scanning Electron Microscopy
TDF	Tailings Disposal Facility
TDS	Total Dissolved Solids
UNEP	United Nations Environment Programme
USEPA	United States Environmental Protection Agency
WASP	Waste Aquifer Separation Principle
WRC	Water Research Commission
WULA	Water Use Licence Application
XRD	X-Ray Diffraction
XRF	X-Ray Fluorescence

GLOSSARY

In assessing the definitions given below, it must be understood that the definitions as provided in the NWA and Government Notice 704 (GN704) are primary.

Active management system: A management system that may require external energy inputs (such as electrical power) or continuous operator attention for its continued successful operation.

Aquifer: a geological formation which has structures or textures that hold water or permit appreciable water movement through them

Audit: A systematic, documented, periodic and objective evaluation of how well management systems and equipment are performing, with the aim of facilitating management control of practices and to assess compliance with relevant policies and objectives, which include meeting regulatory requirements.

Care and maintenance: Period following temporary cessation of operations when infrastructure remains largely intact and the site continues to be managed.

Catchment: In relation to a watercourse or watercourses or part of a watercourse, means the area from which any rainfall will drain into the watercourse or watercourses or part of a watercourse, through surface flow to a common point or common points. (National Water Act, 1998 (Act 36 of 1998)).

Category A Mines: Those mines that exploit ore bodies that are associated with sulphide minerals or any other reactive minerals, either in the ore, overburden or waste material.

Clean water: Water that has not been affected by pollution.

Closure planning: A process that extends through the whole life of a mine and that typically culminates in site relinquishment. It includes decommissioning and rehabilitation.

Closure: indicates the point at which the mine obtains a mine closure certificate and separates the decommissioning and post-closure phases.

Decommissioning: The process that begins near or at the cessation of mineral production and ends with the removal of all unwanted infrastructure and services.

Deterministic estimates: Estimates of value (cost or benefit) of the outcome of an event occurring, expressed as a single mean or mode value and a range of single values (e.g., minimum, maximum).

Dirty water: Water that contains waste.

Environmental water balance: The broad-scale water balance that incorporates consideration of the full hydrological cycle and the state of the groundwater and how these are affected in the long-term by mining actions, e.g. consideration of the effect of replacing well-structured geological formations which accommodates a functioning water-bearing aquifer with a backfilled pit which acts as a sponge that will release water wherever it can.

Groundwater: Water that occurs in the voids of saturated rock and soil material beneath the ground surface is referred to as groundwater and the body within which the groundwater is found is referred to as an aquifer.

Life cycle costing: Life-cycle costing refers to the process whereby all costs associated with the system (e.g. capital cost, operational cost, maintenance costs, closure and rehabilitation

cost, impact mitigation costs, etc.) as applied to the defined life cycle are considered

Life of mine: The life of mine includes all the phases of the mine's existence from the conceptual and planning phases, through design, construction, operation and decommissioning to the post-closure and aftercare phases.

Mitigation: Measures taken to reduce adverse impacts on the environment.

Passive management system: A management system that does not require external energy inputs (such as electrical power) or continuous operator attention for its continued successful operation.

Pollution: Pollution means the direct or indirect alteration of physical, chemical or biological properties of a water resource so as to make it –

(a) less fit for any beneficial purpose for which it may reasonably be expected to be used; or

(b) harmful or potentially harmful –

  (aa) to the welfare, health or safety of human beings;

  (bb) to any aquatic or non-aquatic organisms;

  (cc) to the resource quality; or

  (dd) to property.

(National Water Act, 1998 (Act 36 of 1998))

Precautionary principle: This refers to the principle that in the absence of actual data to demonstrate an alternative conclusion, the most conservative assumption will be made and precautionary management measures will need to be applied.

Prediction Specialist: a person with the requisite training, skill and expertise to participate in an impact prediction exercise and who is capable of signing a declaration of his expertise and ability to undertake the work in question and his/her willingness to subject him/herself to independent specialist review.

Prevention: Measures taken to minimize the release of contaminants to the environment.

Probabilistic estimates: Estimates of value (cost or benefit) that account for the likelihood of occurrence and the range of values of the outcomes. Values are expressed through a statistical analysis (e.g., Monte Carlo simulation) using a statistical distribution over the range of possible values accounting for the probability and timing of the event occurring.

Reclamation: Treatment of previously degraded land to achieve a useful purpose.

Rehabilitation: Return of disturbed land to a stable, productive and self-sustaining condition after taking into account beneficial uses of the site and surrounding land.

Relinquishment: Formal approval by the relevant regulating authority indicating that the completion criteria for the mine have been met to the satisfaction of the authority.

Residue: Residue includes any debris, discard, tailings, slimes, screenings, slurry, waste rock, foundry sand, beneficiation plant waste, ash and other waste product derived from or incidental to the operation of a mine or activity and which is stockpiled, stored or accumulated for potential reuse or recycling or which is disposed of. (Government Notice 704 of 4 June 1999.)

Residue deposits: Residue deposits include any dump, tailings dams, slimes dams, ash dump, waste rock dump, in-pit deposit and any other heap, pile or accumulation of residue. (Government Notice 704 of 4 June 1999.)

Resource quality: means the quality of all the aspects of a water resource including (National Water Act, 1998 (Act 36 of 1998))-

(a) the quantity, pattern, timing, water level and assurance of instream flow;

(b) the water quality, including the physical, chemical and biological characteristics of the water;

(c) the character and condition of the instream and riparian habitat; and

(d) the characteristics, condition and distribution of the aquatic biota

Risk assessment: The qualitative and quantitative evaluation performed in an effort to define the risk posed to human health or the environment by the presence or potential presence and use of specific pollutants.

Seepage: The act or process involving the slow movement of water or another fluid through a porous material like soil, slimes or discard.

Siting: The process of choosing a location for a facility.

Slope: Slope is a dimensionless number and is defined by the vertical distance (drop) divided by the horizontal distance.

Stakeholder: A person, group or organization with the potential to affect or be affected by the process or outcome of mine closure.

Suitably qualified and experienced person: Suitably qualified means a person having a level of training and experience with the type of work to be done and recognised skills in the type of work to be done.

Surface water: All water naturally open to the atmosphere (rivers, lakes, reservoirs, streams, impoundments, seas, estuaries, etc.); also refers to springs, wells, or other collectors that are directly influenced by surface water.

Watercourse: Watercourse means –

(a) a river or spring;

(b) a natural channel in which water flows regularly or intermittently;

(c) a wetland, lake or dam into which, or from which, water flows; and

any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its beds and banks. (National Water Act, 1998 (Act 36 of 1998)).

Water resource: Includes a watercourse, surface water, estuary, or aquifer. (National Water Act, 1998 (Act 36 of 1998))

Water system: Water system includes any dam, any other form of impoundment, canal, works, pipeline and any other structure or facility constructed for the retention or conveyance of water. (Government Notice 704 of 4 June 1999.)

1 INTRODUCTION AND OBJECTIVES OF THIS BEST PRACTICE GUIDELINE

1.1 INTRODUCTION

While mine closure is an action that is regulated by the Department of Minerals & Energy (DME) in terms of the Mineral and Petroleum Resources Development Act (MPRDA), 2002 (Act 28 of 2002), the post-closure impacts associated with mining operations very often include significant impacts on the water resource and hence DWAF has a particular interest in the water management aspects associated with mine closure. Legacies of historic mining activities abound in South Africa and DWAF is faced with legal and financial responsibility to address the water-related impacts of many of the abandoned and ownerless mines. The key to ensuring that current mining operations do not become tomorrow's water management legacies is to ensure that the correct attention is paid to all water management aspects of a mine's closure planning process and this is the focus of this Best Practice Guideline.

Mine closure planning and liability assessment is a critical process that could have significant financial impacts for both the mines and the State, given that the approval of a mine closure application effectively entails transfer of environmental and financial risk from the mine to the State and the citizens of South Africa.

In a recent review of mine closure policy (MMSD, 2002), it was noted that many mine closures have been stalled due to the inability of mines to provide adequate levels of assurance to government departments (specifically DWAF) that possible residual risks have been identified, quantified and that sufficient financial provision and/or technical measures are in place to manage them, should they manifest.

The current situation of a lack of decision-making / approval by government is not desirable and is not in the interest of any parties, be it the mine, DWAF or the communities adjacent to the mining operation. On the one hand, the mining industry often levels criticism at DWAF and other relevant government departments that they do not approve mine closure applications and that there is, therefore, no value in even attempting to get approval for mine closure, especially if the provisions of Section 19 of the National Water Act (NWA), 1998 (Act 36 of 1998) are taken into account. DWAF counters with the criticism that the reason closure applications are not approved is that they do not provide DWAF with the necessary information and confidence to support such decision-making and the associated acceptance of residual risk.

This BPG is aimed at providing a logical and clear process that can be applied by the mines and by DWAF to enable proper mine closure planning in a manner that meets DWAF's requirements and that will ultimately enable DWAF to support the approval of a mine closure application made by a mine to DME. As the granting of mine closure transfers residual environmental and financial risk to the State and the citizens of South Africa, a rigorous process has been developed that will give DWAF the confidence to make decisions relating to mine closure.

1.2 OBJECTIVES OF THIS BPG

This BPG is intended to be a practical document that provides a procedure on the very important topic of mine closure planning, with specific emphasis on the identification and management of water-related closure risks and liabilities. This BPG aims to ensure that, at the end of mining, the mine has a plan that can be implemented to sustain, protect and preserve the water quality and quantity upstream and downstream of the mine after mine closure and that water users are identified and protected. It further aims to ensure that the procedure is scientifically valid and equitable to the mining sector, government and citizens of the country and meets the relevant legal requirements.

A complicating factor at mine closure is that there are numerous stakeholders who may each have different objectives such as listed below (Pulles et al, 2004):

- **The mine** which most probably has the objectives of wanting to close the mine in accordance with good practice but with minimum decommissioning expenditure, minimise or prevent financial provisions for post-closure maintenance and operation of water treatment works and to obtain a walk-away closure certificate approved by all relevant authorities.
- **The authorities** whose most probable objective is to minimise exposure to short and long-term risk and ensure that there are no latent or residual impacts leading to remediation measures that require financing from the State and that a sustainable post-closure land use plan is implemented.
- **Labour & employees** whose objective is probably to prevent or delay mine closure and prevent job losses.
- **Communities** who logically have a primary objective to preserve a viable socio-economic structure after mine closure, and to minimise the environmental impacts including aspects such as aesthetic appearance, dust generation, and the pollution of water resources.

Bearing the above factors in mind, successful mine closure planning and liability assessment require a structured and methodical approach that accommodates the various uncertainties and different objectives.

The purpose of the process set out in this guideline is to provide technical guidance on the sequence, extent and nature of investigations that should be undertaken in order to develop a mine closure plan, as required in terms of section 43 of the MPRDA that specifically addresses water management issues. This guideline is to be used as a planning tool to enable mines to implement a logical, step-wise approach to mine closure planning that can be progressively refined and to ensure that they address all water-related mine closure aspects. As such it is not to be used as a prescriptive tool but rather to be adapted to meet specific circumstances as required.

Furthermore, this BPG provides a logical decision support system that enables DWAF to assess the risk of impacts on the country's water resources, in the case of mine closure. It also aims to ensure consistency in the approach of DWAF from mine to mine, and region to region, and thus encourages uniformity in decision-making with respect to water management aspects of mine closure.

In light of the requirements of the MPRDA, a risk-based approach is followed during the mine closure process. The objectives set out below do not relate only to water issues, although water would be a key issue in most of the objectives.

The objectives of this BPG are as follows:

1) To ensure that all stakeholders have their water resource-related interests considered during the mine closure process.
2) To ensure that the closure planning process, from a water management perspective, is undertaken in a logical, orderly, defensible, cost-effective and timely manner throughout the mine life cycle.
3) To ensure that appropriate tools and specialists have been utilised to make long-term post-closure predictions of water management risks, that these predictions have been validated and verified.
4) To ensure that clear water resource-related closure objectives are defined and agreed upon and that these consider sustainable land use and environmental water balance issues and that the mine has provided clear accountability and adequate resources for the implementation of its closure plan to meet the agreed closure objectives. The defined closure objectives must have built in conservatism to allow for uncertainties and to allow for continuous improvement and future use and development.
5) To ensure that the costs associated with water management actions, both for decommissioning and post-closure, are adequately and correctly represented in the mine's financial provisions and that the community / DWAF / taxpayer is not left with a residual water management liability.
6) To ensure that a set of indicators are established which will demonstrate the successful completion of the closure process and attainment of the agreed closure objectives in a sustainable manner and that will enable approval of the mine closure application process.
7) To provide guidance on information that DWAF needs to have access to in order to be able to review and assess a mine closure application.

It must be emphasized that the mine closure planning and approval process needs to consider many different issues and these are stipulated in the MPRDA. This BPG only addresses the aspects that

relate to water management and additional guidance should be sought from the DME's MEM-Series Guideline on Mine Closure and other legislative requirements on the other mine closure issues.

1.3 APPLICABILITY, STRUCTURE AND FOCUS OF THIS BPG

This BPG is applicable to all mines at all different stages of the mine life cycle as sustainable mine closure requires that the mine closure planning process commence at the earliest possible stage in the mine life cycle. In this way, mining activities can be undertaken in a manner that minimizes long-term post-closure risks and maximizes the sustainability of mine closure. It is therefore considered imperative that this BPG not only be used at the time that the mine intends to implement final mine decommissioning and closure actions and apply for mine closure. This BPG is aimed at the different user groups as follows:

- **DWAF officials** who are involved in reviewing and approving mine closure objectives, plans and applications, in order to assist them in understanding the process and which water resource management aspects must be addressed and what criteria must be used in order to ensure consistency in decision-making.
- **Mining companies and their consultants** in order to clearly define the procedures that need to be followed in developing a mine closure plan and the questions that DWAF officials will be asking when reviewing a mine closure plan and considering a mine closure application.

This BPG is structured as follows:

- Chapter 2 covers the general principles and key considerations that relate to water management aspects for mine closure.
- Chapter 3 describes some of the typical water management issues that present problems at mine closure
- Chapter 4 briefly describes the legal framework for mine closure planning.
- Chapter 5 describes the closure planning and implementation actions that should be undertaken at different stages in the mine life cycle.
- Chapter 6 briefly describes the mine closure planning process that should happen and presents key milestones that DWAF officials need to sign off on.
- Chapter 7 describes the environmental risk assessment (ERA) process that should be used to develop a mine closure plan, specifically from a water management aspect viewpoint.
- Chapter 8 provides guidance on aspects relating to financial provisions for water management actions associated with mine decommissioning and post-closure.
- Chapter 9 presents the key issues and information requirements that DWAF will consider when reviewing and assessing a mine closure plan.
- Appendix A presents a more expanded discussion on the legal framework for mine closure.

2 GENERAL PRINCIPLES RELATING TO WATER MANAGEMENT ASPECTS FOR MINE CLOSURE

In order to successfully implement integrated mine water management (refer to ***BPG H1: Integrated Mine Water Management***), including post-closure, long-term water management, in a manner that complies with all legislation, certain key principles must be taken into account. All the principles listed in BPG H1 will also apply to mine closure and must be taken into account. For the purpose of this BPG, the applicable principles are divided into two sections as follows:

- Principles that relate to the technical process
- Principles that relate to the DWAF decision-making process

2.1 PRINCIPLES RELATING TO THE TECHNICAL PROCESS

Legal compliance and Best Practice

The closure planning process and management actions must be developed such that:

- It complies with all relevant legislation.
- It complies with the DWAF hierarchy of water quality management.
- It is in line with the DWAF Integrated Water Resource Management process.

Risk-based approach

This implies consideration of several issues, including:

- Demonstrable conservatism must be built into any assumptions that need to be made in lieu of appropriate data sets (precautionary principle). These assumptions should be clearly documented and motivated.
- A risk-based assessment should be undertaken by a suitably qualified person(s) with the necessary qualifications and experience to ensure the results are credible and unbiased.
- Wherever quantitative environmental risk assessments or impact predictions are made, the mine should, through prior consultation with the authorities, obtain agreement on the modelling techniques and tools to be used. This will ensure that such techniques are acceptable to the authorities, and that the results will be acceptable – see ***BPG G4: Impact Prediction***.
- The surface residue deposits that remain after mine closure can never be maintained in a completely reducing environment and must be considered to pose a potential water related risk until shown otherwise by way of a suitable semi-quantitative or fully quantitative geochemical assessment – see ***BPG A2: Water Management for Mine Residue Deposits***.
- Underground and opencast mine workings will fill up either partially or completely with water over time (slow or fast depending on geohydrological setting) and this water will be contaminated (either for a limited time or in perpetuity). A key element influencing the risk that these processes pose to the water resource is whether or not this contaminated water will decant into the underground aquifers or into the surface water resource and to what extent the natural water resource can assimilate this contamination. The mine workings must, therefore, be considered to pose a potential water related risk until shown otherwise by way of a suitable semi-quantitative or fully quantitative geohydrological and geochemical assessment – see ***BPG A5: Water Management for Surface Mines*** and ***BPG A6: Water Management for Underground Mines***.

- In certain mining regions (e.g. near dolomitic compartments), mine dewatering activities and placement of surface residue deposits pose a long-term risk with regard to formation of sinkholes, which in turn pose safety, water resource and land use risks that need to be assessed.
- An understanding is required that mine closure is not about greening, but rather long-term pollution control and risk/hazard management. This involves consideration of a range of issues, and a range of possible management strategies.
- A risk-based approach includes a cradle to grave assessment on waste or waste streams, that is, from the point where they are generated, to their final disposal or reuse.
- Lastly, a risk-based approach will include the risk of failure of systems or management strategies. The consequences of such failure should be taken into account and the necessary contingency and/or emergency measures should be addressed either in the management measures and/or in the financial provisions.

Sustainability

- The mine closure plan must be sustainable over the mine life-cycle.
- One of the primary focus issues throughout all phases of the mine life-cycle should be pollution prevention, as this will minimise the closure liabilities.
- Management measures at closure should primarily be of a passive nature with minimal long-term maintenance and operating costs. If this is not possible, the appropriate financial provision will be required to motivate the State to accept an active system.
- For mines that exploit ore bodies containing reactive minerals (such as sulphides), the closure planning and liability assessment should pay particular attention to long-term water quality issues – see ***BPG G4: Impact Prediction***.

Consideration of regional context

- Due to the fact that most mines are hydrologically interconnected with the adjacent mines, the closure of one mine within a region will often have impacts on the remaining mines. There is also a risk that the cumulative impact from all the mines in a region could be imposed upon the last mine in the region to cease operations. This poses a secondary risk that this last mine could be held responsible and liable for the cumulative impact of all the mines or, as a minimum, that it would be difficult, if not impossible, to apportion liability to the contributing mines within a region. It must also be recognised that different mines within a region will cease operations at different times and some framework must be established within which these mines can plan for mine closure, e.g. regional mine closure strategy.
- The closure plan must take into account the objectives and parameters set for a particular catchment in terms of regional strategies, such as regional mine closure strategies, catchment management strategies, Reserve determinations, water resources strategies, resource quality objectives, etc. This will identify current and potential water management issues within a catchment and/or mining region, and place the mine into context within that catchment and/or mining region, ensuring that the cumulative effects of mining are addressed adequately.

Consideration of social aspects

While most of the closure planning will relate to technical or engineering issues and the associated financial planning, the social aspects should not be forgotten. This includes aspects such as:

- The effective training of staff and their roles and responsibilities in terms of the implementation and management of the mine closure plan is key to the success or failure of the plan.
- Communities will be affected by mine closure, and while they may not be directly affected by the water management strategies, health and safety issues and possible employment opportunities related to the proposed strategies should be considered.
- The closure plan must be in line with the requirements of the mine's Social and Labour Plan, developed in terms of section 25 of the MPRDA.
- Effective implementation of the closure plan requires company and management commitment.
- Closure should not have a negative impact on other water users.

Communication and public participation

- The mine closure plan must incorporate the constitutional rights of the environment and other users of the water resource. The expectations and concerns of interested and affected parties (IAPs) must be considered and addressed. Effective communication must be maintained throughout the process.

- The mine closure process must also include effective liaison with the decision-making authorities, in particular DME and DWAF, to amongst others, ensure that the statutory and legal requirements are met.
- All interested and affected parties (IAPs) should be involved in the development of the risk-based strategy. While the timing and extent of this will vary from site to site, it is a key aspect that a risk communication component is included.
- Inherent in a risk based approach is that a clear paper trail is required so that others can understand the method whereby risks have been quantified. As indicated previously, all relevant assumptions should be documented.
- A transparent, consistent and reasonable flow of information on the mine closure plan and its performance between the mine and all relevant IAPs (including decision-making authorities) must be maintained throughout the mine life-cycle.

Consideration of timeframe

Timescale involves several aspects to be considered, including:

- Mine closure planning should begin at the earliest stage of a mining operation.
- The full lifecycle of the mine has to be considered, both with a view to possible closure at different times in the life of the mine, as well as the planning, operational, decommissioning and post closure phases of the mine.
- Wherever required, specialist investigations and prediction of long-term pollution from mines should be finalised no later than 5 years before planned cessation of mining activities in order to allow a monitoring and verification period concurrent with the last years of mining – see ***BPG G4: Impact Prediction***.

Continual improvement

- Finalisation of the mine closure plan should be followed by implementation, monitoring and auditing. It is for this reason that the mine closure plan must include quantifiable closure objectives, and relevant performance indicators need to be identified and implemented.
- Ongoing verification and improvement of the closure liabilities and management plan is required as more data becomes available.
- An annual review of the closure liabilities and financial provision (section 40(3) of the MPRDA) is recommended.
- Effort should be correctly focused on the priority issues and a phased reduction in uncertainties is desirable. This is in line with the principles associated with most quality control systems implemented on many mines in this country.
- Some statement or assessment of monitoring post closure is required. This should be based on a reasonable time frame required to validate the sustainability of the measures put in place, or the assumptions made.

Concurrent rehabilitation and reduction of desertification

- The final post-closure land use must be sustainable, based on consideration of the environmental water balance which aims to ensure that the macro-scale long-term effects of the mine on the environmental water balance are considered in defining the land use – see ***BPG H1: Integrated Mine Water Management.***
- The final landform must be sustainable, must be free-draining, must minimise erosion and avoid ponding.
- Concurrent rehabilitation must be undertaken in a manner that supports the final closure landform in order to ensure that rehabilitation does not need to be redone at a later stage
- Design final closure slopes of mine residue deposits (e.g. tailings residue facilities) and build and operate these facilities at the correct post-closure slopes in order that these slopes can be successfully concurrently rehabilitated and all runoff and seepage control facilities are then located in the correct place.
- Minimise the disturbed area and footprint of the mine's operations and ensure that undisturbed land is properly managed in accordance with its intended final land use.

2.2 PRINCIPLES RELATING TO THE DWAF DECISION-MAKING PROCESS

The very nature of risk-based management actions and strategies is that there is always a risk that some unforeseen long-term pollution problem develops. The primary departure point that DWAF will be bearing in mind when undertaking or reviewing a closure application for a

mine site where water pollution is believed to be a potential risk element, is that approval and granting of closure poses an increased risk to the State (and therefore the citizens of South Africa) of attracting liabilities previously only attributable to the mine. It is the responsibility of the State (DWAF and DME) to ensure that the risk of unforeseen long-term water pollution problems arising after closure has been granted, is absolutely minimized, taking into account financial realities and practicalities and sustainability of water management measures.

In order to ensure that this risk is minimized to an acceptably low level, DWAF will review a closure plan or closure application in terms of its compliance with the principles set out below.

1) There must have been consultation and agreement with DWAF (see authorisation levels in DWAF operational guidelines) and other Stakeholders on closure objectives for the mine and the mine closure plan must have demonstrated that it complies with these agreed closure objectives.
2) There must be full disclosure by the mine of all the data, facts, assumptions and any other relevant information that will or could potentially have a bearing on the decision to approve or to reject the closure application. Failure to fully disclose such information could result in the automatic rejection of the closure application. Discovery of such failure to fully disclose after closure has been approved could result in DWAF applying corrective measures in terms of Section 19 of the NWA.
3) The risk assessment and impact predictions (see ***BPG G4: Impact Prediction***) must be fully documented in a comprehensive technical report that sets out the detailed methodology that must, as a minimum, include the following information:
    - Detailed description of the objectives of the assessment and the technical questions that were set to be answered in the assessment
    - Detailed conceptual model for the individual components (source terms) and the integrated facility for which closure is being applied and the manner in which it interacts with the environment (i.e. all relevant impact pathways and critical receptors);
    - Full disclosure and documentation of all data and assumptions used, with all assumptions to be motivated and properly referenced – such references to be made available to the State upon request;
    - Statement on the statistical representivity of the dataset and its suitability for addressing the issues that pertain to the particular closure application;
    - Detailed description of sampling techniques applied, analytical techniques used, data assessment techniques used and mathematical models used;
    - Discussion on how the issue of uncertainty in data and assessment techniques has been accounted for in the predictions on future environmental impact and what confidence can be placed in the predictions;
    - Detailed definition of verification monitoring programme to collect data for future (typically 3-5 years after prediction was made) validation of predictions and, in the case of an actual closure application, the results of the validation exercise confirming the accuracy and reliability of the predictions of future impact.
    - Findings of all peer reviews done as part of the process (see ***BPG G4: Impact Prediction*** on the precise role and input required from an independent reviewer), as well as how the findings were addressed;
    - Detailed documentation of all IAP consultations and how these consultations have been incorporated into the closure process to demonstrate real commitment to IAP involvement;
    - Details of all post-closure impacts and management and maintenance measures that have been proposed to mitigate and manage such impacts to the point where they are within the limits set and agreed for the critical receptor(s);
    - Financial provision for construction, operation and maintenance of post-closure water management measures where required and for as long as predicted to be required; and
    - third party involvement (if any) in post-closure and contractual agreements.
4) The study must be undertaken by suitably qualified persons using appropriate public-domain mathematical models and assessment techniques that are generally accepted in the scientific

community as being suitable for the assessment being undertaken. While proprietary models can, with suitable motivation, be used for assessments undertaken by mines for non mine-closure situations, this is not the case where mine closure is being sought. The requirement for public domain models is to ensure that the performance of the model in undertaking the assessment at hand can be independently validated and that a suitably qualified third party could review the input files used and recreate the predictions independently, if deemed necessary. The procedures set out in ***BPG G4: Impact Prediction*** should be applied.

In all cases, the closure application must be evaluated taking into account the site-specific circumstances and the sustainability of the management measures put in place to address the long-term (post closure) environmental impacts.

2.3 KEY QUESTIONS IN THE DWAF DECISION-MAKING PROCESS

From DWAF's perspective, based on the realistic assumption that DWAF will not have the in-house expertise to properly review a detailed and integrated impact prediction assessment that incorporates integration of numerous hydrological, geohydrological and especially geochemical modelling exercises, the key questions that must be answered when considering a mine closure plan and/or mine closure application, are the following:

1) Does the assessment fully comply with **all** aspects of the independent review process as set out in ***BPG G4: Impact Prediction***?
2) Does the closure plan consider all the relevant principles described in Section 2.1 and does it present the information requested in Section 2.2 above in a clear written report and has all such information been verified by the appointed reviewer?
3) Has the assessment included clear evidence, supported by the independent reviewer, that all impact prediction assessments and models have been fully calibrated and validated using information collected from a verification monitoring programme?
4) Does DWAF have written confirmation from the appointed reviewer that his/her review was undertaken independently, objectively, scientifically, without bias or favour to any party, that he/she was given full access to all information required to undertake the review and that he/she deems him/herself competent to have undertaken the review?
5) Does DWAF have written confirmation, from a duly appointed representative of the mine's Board of Directors, that the mine closure application is based on full and complete disclosure of all information that could in any way be pertinent to the consideration of the mine closure application and that no potentially damaging information has been withheld?
6) Does DWAF have confirmation, through an independent assessment by suitably qualified persons, that all the stipulated and agreed water management actions and measures (including any water treatment plants that may be required) have been properly implemented and that sufficient/ adequate financial provisions (see Chapter 8) have been made and that suitable contractual arrangements have been entered into with approved third parties to ensure that all the required operational, maintenance and financial measures will be implemented and audited for as long as has been predicted to be necessary to ensure that the agreed closure objectives are met?

Provided that a clear YES answer can be given to the abovementioned six questions, then DWAF will be in a position to consider the mine closure plan and/or mine closure application and to make an informed and motivated decision that can be forwarded to the mining proponent and can then prepare a record of decision.

Importantly too, provided the above 6 questions have been answered with an unambiguous YES and provided that no future information comes to light that shows that the above questions were not truthfully answered, the approval of mine closure by DWAF, will constitute an acceptance by DWAF that it accepts any future risks associated with the closed mine and that it will not utilise the NWA to seek redress from the mining company. This undertaking falls away in the event that it comes to light that any of the 6 questions were not answered truthfully.

The risk that DWAF is prepared to accept in approving a mine closure application is the risk of the genuinely unforeseen events. The principles and procedures set out above and in the remainder of this document are aimed at ensuring that the technically correct process is followed, that suitably qualified persons are engaged, that appropriate independent review procedures are followed and that there is full disclosure of all pertinent information. This process will then culminate in the development of appropriate management actions to address predicted post-closure impacts and the provision of appropriate financial resources to implement these actions (i.e. polluter pays principle). **However, it is accepted that, despite following the abovementioned procedures, the possibility exists that some unforeseen event could occur which results in a greater post-closure impact than that which was predicted. In such a case, provided the procedures in this BPG have been followed and there was full disclosure of all relevant information by the mine at the time of the closure application, then DWAF accepts the risk and responsibility of managing such unforeseen impact.**

3 TYPICAL WATER-RELATED MINE CLOSURE ISSUES

While each mining site has its site specific issues and risks with regard to mine closure, there are a number of commonly encountered issues that will occur at most mine sites and where a conservative approach would be to assume that the problem does exist until it can be proven otherwise.

From a technical assessment perspective, the primary technical factors that need to be considered when planning mine closure and post-closure water management, and which DWAF would typically want to see are being addressed within a mine closure plan are, amongst others:

- surface hydrology;
- geohydrology and geochemistry;
- mine voids and interconnections between adjacent mines;
- receiving water environment assimilative capacity;
- reserve requirements and resource quality objectives;
- desertification and consideration of the environmental water balance (see ***BPG H1: Integrated Mine Water Management***)
- water control measures such as pumping or collecting of decant; and
- water usage/disposal including possible uses and associated treatment technologies.
- monitoring and validation of impact predictions

The primary technical factors that need to be considered when planning mine closure and post-closure in the broader environmental context are, amongst others:

- **Land use plan** which is directly interlinked with water management issues insofar as water is required to support the intended land use and the land use itself may have an impact on the water resource;
- **Biodiversity plan** will address issues that are interrelated with the mine water management plan, particularly with regard to the environmental water balance and the effects that mining may have thereon;
- **Surface subsidence** may have significant impacts on the mine water balance, either through promotion of ponding on surface that leads to increased infiltration into the mine workings, through damage to overlying aquifers leading to dewatering of aquifers into mine workings, or through propagation of subsidence cracks to surface or across watercourses leading to direct inflow of surface water into the mine workings. These subsidence features may only occur at some future time and knowledge of the future risks of subsidence must be incorporated into the future water resource impacts considered in the mine closure plan;
- **Spontaneous combustion** and associated air pollution issues have an effect on the water management plan insofar as combustion of coal residues converts sulphides to oxidized air pollutants. While this process reduces the sulphide source term at the site of combustion, it transports contaminants over a wide area where they may precipitate, thereby entering the hydrological cycle and impacting on the water resource. Spontaneous combustion also hinders the effectiveness of the rehabilitation of the source term that has combusted;
- **Sustainable rehabilitation of surface residue deposits** requires that these residue deposits are constructed with the end landform in mind in order that they can be concurrently rehabilitated without needing to reshape them at mine closure, thereby spending unnecessary funds, exposing fresh minerals for oxidation and potential ARD and pushing the footprint of the dump over the existing seepage control systems;

- **Social and labour plan** issues may have a bearing on water management insofar as there may be a requirement for water in implementation of these plans, e.g. use of rehabilitated mine land for agriculture;
- **Regional interconnections** and need for regional closure strategies is a key consideration in many of the country's large mining regions for the coal, gold and platinum industries in particular and where such interactions exist, mine closure plans must be consistent with an overarching regional closure strategy;
- **Cumulative impacts** from a number of sources within the same zone of impact could be an important consideration within a single mine where it refers to multiple source terms, or alternatively it could apply to the consideration of the cumulative effects of different mines;
- **Sustainable development** issues are fundamental to mine closure and apply to land use plans, social and labour plans and integrated water management plans insofar as these plans must all be sustainable over the long term beyond mine closure;
- **Public participation and consultation** issues are also fundamental to mine closure and there is a need for full involvement of stakeholders in the development of final mine closure plans and in the agreement on final mine closure objectives;
- **Sterilisation of mineral reserves** is a factor that is always considered by DME and this is an issue that must be addressed in a final mine closure plan;
- **Financial provision for post-closure management actions** is a critical precondition for mine closure, also from a water management perspective and DWAF will require independent confirmation that the financial provisions are adequate and that appropriate systems and contracts have been put in place to ensure that the necessary post-closure management actions are implemented.

Although the precise solution to these variable factors will differ for each site-specific situation, there are generic procedures and a generic framework that should be followed in order to reach the site-specific solution and to enable approval of a mine closure plan. It should also be noted that the mine closure framework, as described in this document, is applicable to new and operational mines, as well as mines that are in the process of closure.

While each mine site is unique, the **following mining features (amongst others) do typically have a long-term impact potential and the default assumption that would be applied is that they are deemed to have a potential significant impact on the water resource until it is proven otherwise**:

- Decant from opencast pits (see Figure 3.1)
- Accumulation and evaporation of water in final voids (see Figure 3.2)
- Decant from underground mines (see Figure 3.3)
- Seepage from all waste residue deposits – coarse and fine-grained (see Figure 3.4)
- Long-term seepage from areas where soils have been heavily contaminated, e.g. beneath waste rock dumps that have been reclaimed, from beneficiation plant footprints, from unlined pollution control dams, etc. where long-term pump and treat options may need to be implemented.

Figure 3.1: Typical water management considerations for closed opencast pit

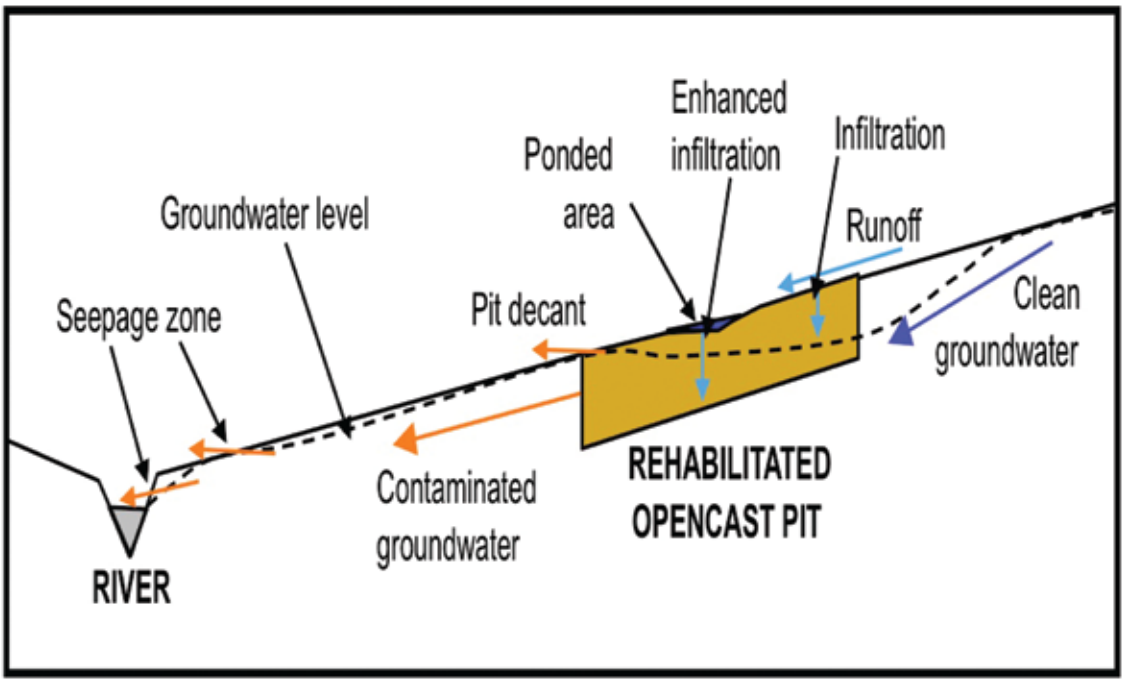


Figure 3.2: Typical water management considerations for closed final void

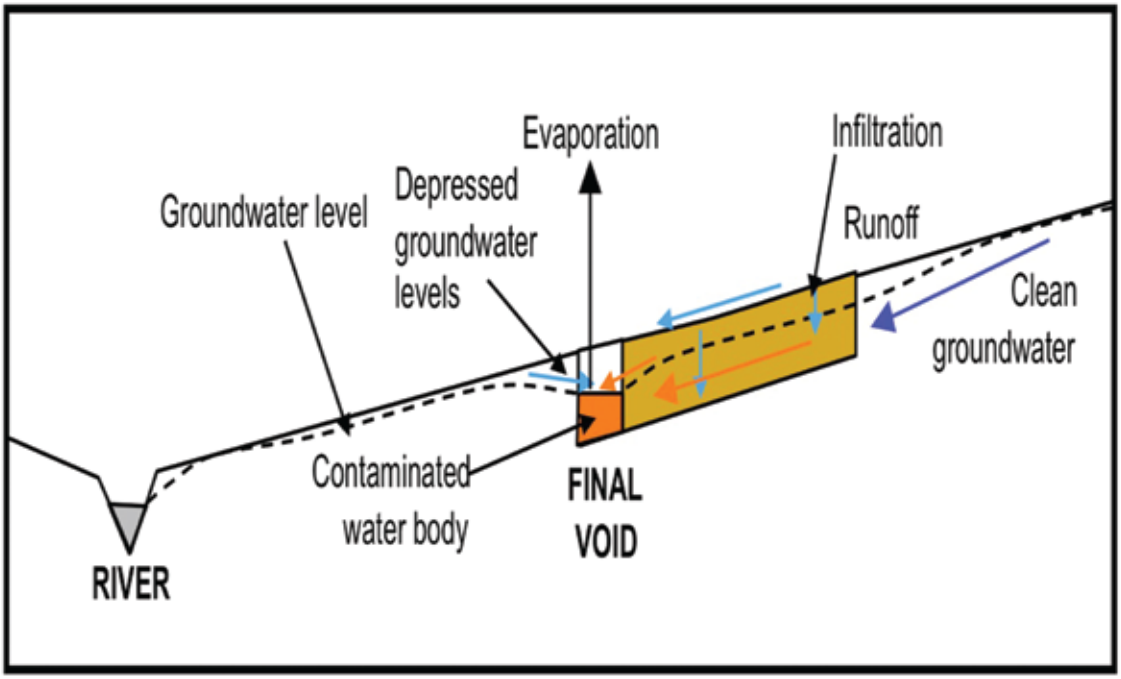


Figure 3.3: Typical water management considerations for closed underground mine

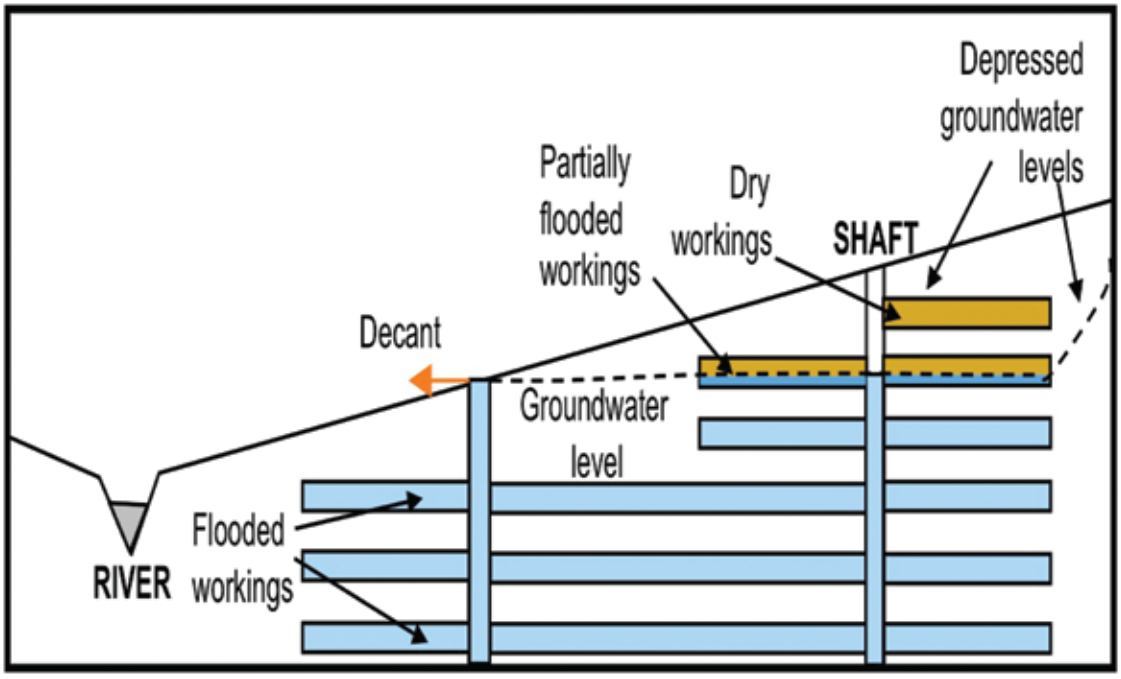
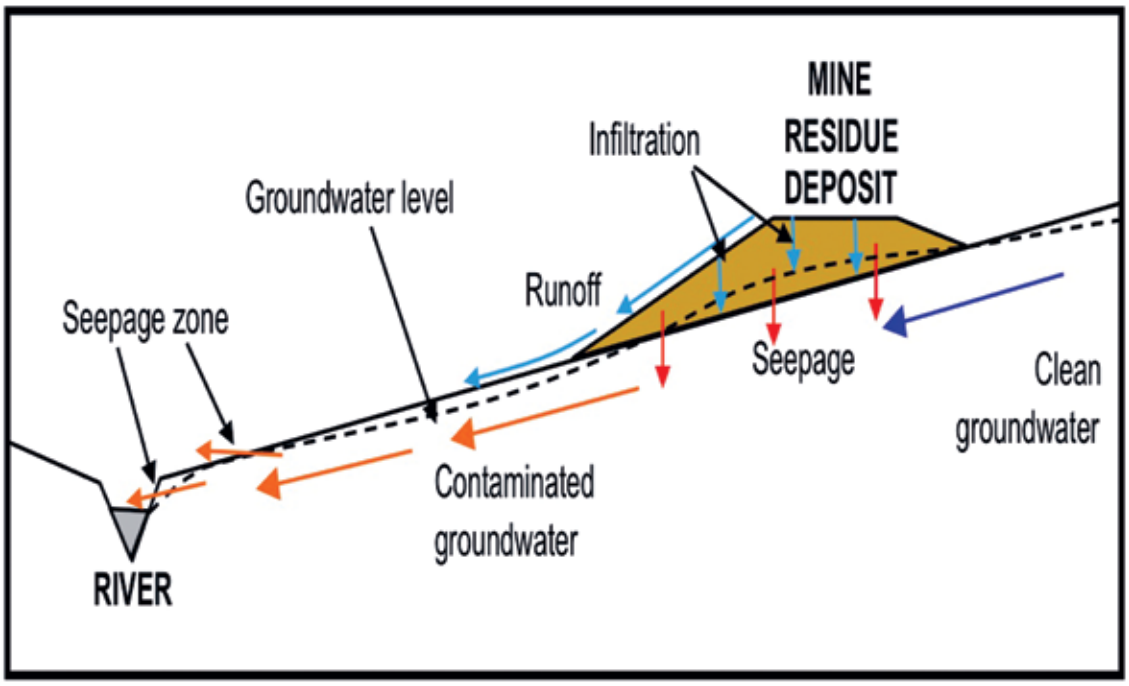


Figure 3.4: Typical water management considerations for closed mine residue deposits



4

LEGAL FRAMEWORK FOR MINE CLOSURE PLANNING

This chapter describes the legal framework for mine closure planning, as prescribed in the MPRDA. A detailed legal review of all relevant environmental legislation regarding financial provision, environmental rehabilitation and mine closure and international best practice is provided in Appendix A and readers are also referred to the MEM Series Guideline on Mine Closure being prepared by the DME.

4.1 MINERALS AND PETROLEUM RESOURCES DEVELOPMENT ACT 2002 (Act 28 of 2002) (MPRDA)

Legislation in South Africa governing mining has been in existence for many years. The MPRDA and the regulations published under the MPRDA (GN No. 527) stipulate very specific requirements for mine closure. In terms of section 43 of the MPRDA, the holder of a mining right or authorisation must apply for a closure certificate upon cessation of the mining operation and remains responsible for any environmental liability, pollution or ecological degradation, and the management thereof, until a closure certificate is issued.

Although the pursuit and eventual acquisition of a closure certificate is indispensable for the purpose of both environmental and legal risk management, a closure certificate per se cannot serve, and should not in itself be viewed as adequate for the purpose of managing Environmental-Legal Risks during decommissioning, closure and post closure. Many legal factors and risks may exist in relation to a particular mine which are likely to be overlooked during an Environmental Risk Assessment process unless a concerted effort is made to identify such issues and risks. This document therefore incorporates a stand-alone procedure for Environmental-Legal Risk Assessment and management as an integral part of the closure process, with a specific focus on the water-related aspects thereof. An experienced Environmental-Legal Risk Assessment and Management specialist should be incorporated in the closure project team for this purpose. Specific reference should also be made to ***BPG G4: Impact Prediction*** as it addresses many of the issues that directly relate to mine closure.

In terms of section 57 of MPRDA Regulations GN No. 527, the application for a closure plan must be accompanied by an environmental risk assessment (ERA), describing the potential residual and latent environmental risks and the agreed management thereof, as well as the financial provision provided for long-term management and monitoring programmes. This is mainly to provide assurance to the Department of Minerals and Energy (DME), the Department of Water Affairs and Forestry (DWAF) and other relevant decision-making authorities that no significant risks remain, and that should any latent risks manifest, these will be adequately covered in a closure fund.

The MPRDA further stipulates that the closure process must start at the commencement of a mining operation and continue throughout the life of the operation, within the framework of sustainable development (section 42(1)(a)). Closure (and future land use) objectives and how these relate to the mining operation and its environmental and social setting must be included in the environmental management programme (EMP) developed during the planning stages of the mining operation (section 48(1)(a)). Further, in line with section 24(a) of the Constitution, 1996 (Act 108 of 1996), any environmental damage or residual impacts identified during the environmental risk assessment (ERA) process must be acceptable to all involved Interested and Affected Parties (IAPs) (section 42(1)(d)). It is therefore essential that any decisions on closure requirements and whether proper closure has taken place, be done co-operatively with government representatives who have the responsibility for the protection of the environment (water, soil, air, etc.) and social issues, as well as any other IAPs.

In light of the above legal requirements, the main objective of mine closure is therefore to provide long-term stabilisation of the geochemical and geo-technical conditions of the disturbed mining areas, to protect public health, and minimise and prevent any additional or ongoing environmental degradation (Nazari, 1999). Stakeholder participation is also vital for successful closure of each mine and to ensure social and economic activities are maintained (MMSD, 2002). The principles of mine closure are set out in Section 56 of GN 527.

It is now legally required that proper planning for closure be incorporated into the feasibility, design and permitting phases of a mine and be reviewed and improved during the operational phase (MPRDA, 2002). Until recently, mine closure was typically only addressed at a time when the operation is no longer economically viable, when cash flow is severely restricted or negative, or when the value of assets is below the expenditures required to achieve the environmental objectives for mine closure. Securing mine closure funding at an early stage and including closure procedures at the onset and during operations will ensure that sufficient funds are available for mine closure activities and that options to mitigate against risks that an enterprise may pose to the environment and the sustainable post-mining land use are not limited.

In terms of section 43(1) of the MPRDA, the holder of a prospecting right, mining right, retention permit or mining permit remains responsible for any environmental liability, pollution or ecological degradation, and the management thereof, until the Minister has issued a closure certificate to the holder concerned.

An application for a closure certificate must be made to the Regional Manager in whose region the land in question is situated within 180 days of the occurrence of the lapsing, abandonment, cancellation, cessation, relinquishment or completion contemplated in section 43(3) and must be accompanied by the prescribed environmental risk report. The ERA process to be followed during the development of the mine closure report is prescribed in Section 60 of the regulations published under the MPRDA (GN No. R527, 23 April 2004). Refer to box below.

Section 43(5) also stipulates that no closure certificate may be issued unless the Chief Inspector and the DWAF have confirmed in writing that the provisions pertaining to health and safety and management of potential pollution to water resources have been addressed.

Environmental Risk Report

An application for a closure certificate in terms of section 43(3) of the Act must be accompanied by an environmental risk report which must include-

(a) the undertaking of a screening level environmental risk assessment where-
  (i) all possible environmental risks are identified, including those which appear to be insignificant;
  (ii) the process is based on the input from existing date;
  (iii) the issues that are considered are qualitatively ranked as -
    (aa) a potential significant risk; and/or
    (bb) an uncertain risk; and/or
    (cc) an insignificant risk.

(b) the undertaking of a second level risk assessment on issues classified as potential significant risks where-
  (i) appropriate sampling, data collection and monitoring be carried out;
  (ii) more realistic assumptions and actual measurements be made; and
  (iii) a more quantitative risk assessment is undertaken, again classifying issues as posing a potential significant risk or insignificant risk.

(c) assessing whether issues classified as posing potential significant risks are acceptable without further mitigation;

(d) issues classified as uncertain risks be re-evaluated and re-classified as either posing potential significant risks or insignificant risks;

(e) documenting the status of insignificant risks and agree with interested and affected persons;

(f) identifying alternative risk prevention or management strategies for potential significant risks which have been identified, quantified and qualified in the second level risk assessment;

(g) agreeing on management measures to be implemented for the potential significant risks which must include-
  (i) a description of the management measures to be applied;
  (ii) a predicted long-term result of the applied management measures;
  (iii) the residual and latent impact after successful implementation of the management measures;
  (iv) time frames and schedule for the implementation of the management measures;
  (v) responsibilities for implementation and long-term maintenance of the management measures;
  (vi) financial provision for long-term maintenance; and
  (vii) monitoring programmes to be implemented.

See MPRDA

4.2 NATIONAL WATER ACT 1998 (Act 36 of 1998) (NWA)

The licencing process and water use authorisations all consider the progression of the mine life cycle towards closure and aim to ensure that water management issues and impacts are defined and managed before mine closure occurs. This series of BPGs (see Preface) also repeatedly addresses water management aspects at all phases of the mine life cycle, including mine closure.

Section 19 of the National Water Act (NWA) stipulates the general duty of care on persons who own, control, use or occupy land on which any activity or process is or was performed or undertaken, or any other situation exists which causes, has caused or is likely to cause pollution of a water resource, to take all reasonable measures to prevent any

such pollution from occurring, continuing or recurring. As discussed in Section 2.3 of this BPG, if the mine closure plan meets certain well-defined criteria, then DWAF undertakes not to utilise Section 19 to address post-closure impacts. Conversely, however, if it later transpires that the six questions in Section 2.3 were not truthfully answered, then Section 19 can be invoked to seek redress.

Government Notice No. 704 (GN704), regulations on use of water for mining and related activities aimed at the protection of water resources, was promulgated in terms of section 26 of the NWA on 4 June 1999. The following regulations have direct relation to rehabilitation and mine closure:

- Regulation 2(2)(b) requires that the DWAF be notified (in writing) 14 days before the temporary or permanent cessation, or resumption, of a mining or related activity.
- Regulation 9 deals with the temporary or permanent cessation of a mine or activity, and stipulates that:
  - All pollution control measures must be designed, modified, constructed and maintained so as to comply with the requirements of GN704 at the time of cessation of operations.
  - The in-stream and riparian habitat of any water resource, which may have been affected by the mine or activity, is remedied so as to comply with the requirements of GN704.
  - The Minister may request a copy of any surface or underground plans as contemplated in the Minerals Act, 1991.
- Regulation 11 requires that all coal residue deposits are compacted and rehabilitated concurrent with the mining operations.
- Regulation 12 allows the DWAF to request any additional information or direct a person in control of a mining or related activity to conduct a detailed study, should this information not be available in any other reports or documents and be necessary to evaluate and manage certain aspects related to the specific mine or activity, which could include rehabilitation and/or closure aspects.
- Regulation 13 states that the person in control of a mine or activity must provide the manager with the means and afford him or her every facility required to enable the manager to comply with the provisions of GN704, and includes making available the necessary financial and human resources, training and education, management structures, contact with expertise for necessary investigations, etc.

5

CLOSURE PLANNING AND THE MINE LIFE CYCLE

Planning for mine closure is fundamental to the responsible operation of a mine. The mine closure process begins during the planning and feasibility phase and concludes with mine decommissioning and then mine closure.

The mine closure plan is most effective when integrated into day-to-day operations and implemented throughout the life of the mine. Mine closure plans should therefore be developed at the feasibility stage for new projects and implemented on commencement of mining operations. For existing operations, mine closure plans should be developed and implemented without delay (QMC, 2001). While the level of detail and accuracy of the investigations can be refined and improved upon at a later stage, the early development of a closure plan will ensure that the identification and application of pollution prevention measures can be optimised (Pulles et al, 2004).

The closure plan is a dynamic document and as such requires frequent review to remain current and cost effective. A strategy for ongoing review and improvement should therefore be established at an early stage of the mining operations. It is recommended that the closure plan be broadly reviewed on an annual basis and that it be fundamentally reviewed no less frequently than once every 5 years. Ongoing review will further ensure that a mining company is adequately prepared and resourced for mine closure at any given time.

Although most mining operations may plan the exact timing of mine closure, there is always a risk associated with early or unplanned closure as a result of changes in economic markets, company finances, technical or structural failure, etc. Closure in these cases may be temporary or permanent. A range of closure scenarios must therefore be considered at the preparation of the closure plan, namely planned, unplanned and temporary closure.

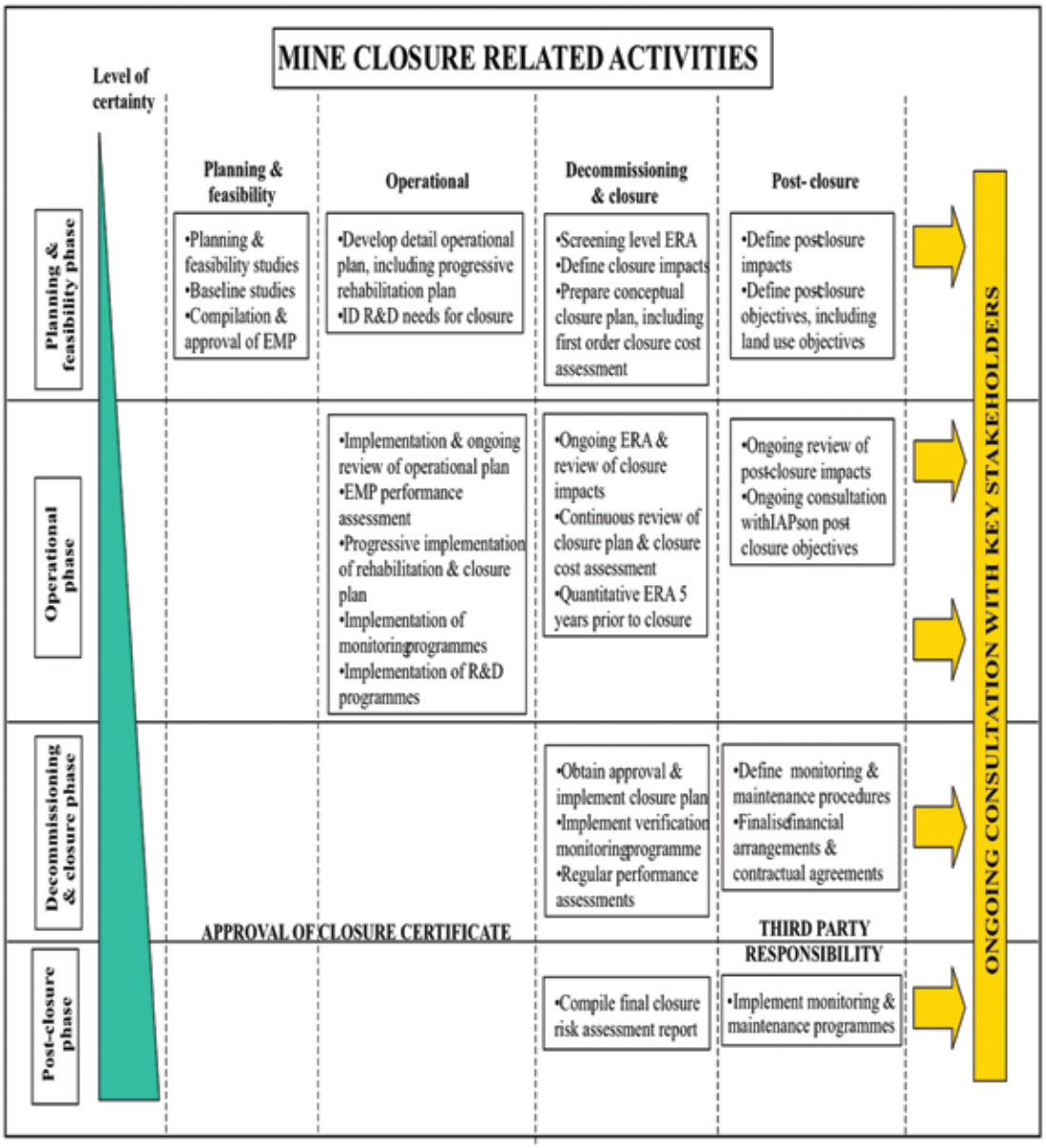
The development and application of mine closure related activities over the mine life-cycle, as well as the progressive improvement in the level of detail of the mine closure plan is illustrated in Figure 5.1 (Pulles et al, 2004 amended).

This figure can be interpreted as follows:

The figure has both vertical and horizontal axes. The horizontal axis presents the mine closure related activities while the vertical axis shows the actual life-cycle phases of the mine. For the purpose of this document four life-cycle phases are distinguished, namely:

1) Planning & feasibility phase
2) Operational phase
3) Decommissioning & closure phase
4) Post-closure phase

Figure 5.1: Mine closure related activities over the life-cycle of a mine



During the **planning & feasibility phase,** the mine will undertake the following closure related activities:

1) Planning & feasibility activities:

- Undertake detailed planning and feasibility studies, including environmental baseline investigations.
- Develop and compile Environmental Management Programme (EMP) report.

2) Operational activities:

- Prepare detailed operational plan, including progressive rehabilitation plan.
- Identify research and development (R&D) needs to achieve closure.

3) Decommissioning & closure activities:

- Perform screening level risk assessment.
- Define closure impacts (social, environmental and financial impacts).
- Prepare a conceptual closure plan, including first-order closure cost assessment.

4) Post-closure activities:

- Define post-closure (residual, latent) impacts.
- Define post-closure objectives, including long-term land use objectives.

During the **operational phase,** the mine will undertake the following closure related activities:

1) Operational activities:

- Implementation and continuous review and improvement of operational plan.
- Perform regular EMP performance assessments and revise EMP if required.
- Progressive implementation of rehabilitation and closure plan.
- Implementation of monitoring system to verify long-term impacts.
- Implementation of R&D programmes.

2) Decommissioning & closure activities:

- Ongoing risk assessments and review of closure impacts as more information becomes available.
- Continuous review and update of closure plan and closure cost assessment throughout operational phase – preferably annual review in conjunction with budget review.
- Perform detailed quantitative level 2 risk assessment and compile detailed closure plan for submission to authorities 5 years prior to closure of mine.

3) Post-closure activities:

- Ongoing review of post-closure (residual, latent) impacts as more information becomes available.
- Ongoing consultation with IAPs on post-closure objectives.

During the **decommissioning & closure phase,** the mine will undertake the following closure related activities:

1) Decommissioning & closure activities:

- Obtain final approval for closure plan.
- Implementation of closure plan.
- Validate progress against closure objectives & targets.
- Verification of latent/residual impacts through monitoring systems and performance assessments.
- Get final agreement on closure from IAPs and obtain closure certificate from authorities.

2) Post-closure activities:

- Define post-closure monitoring and maintenance procedures.
- Finalise financial arrangements for post-closure management and maintenance.
- Finalise contractual agreements with future landowners and/or responsible parties.

During the **post-closure phase** of the mine, the mine no longer has any formal responsibilities and the appointed third parties will be responsible to implement the post-closure monitoring and maintenance programmes. This phase will continue until the residual impact of the mine has reached acceptable levels (see Figure 8.1) and no further ongoing maintenance work is required. The potential regional interconnections and cumulative impacts will also need to be considered within the framework of a regional mine closure strategy.

6

MINE CLOSURE PLANNING PROCESS

Mine closure planning is undertaken within the framework and regulations developed by the MPRDA and a mine closure plan will be submitted to the DME, who will, in turn, ensure that inputs are obtained from various Stakeholders, particularly DWAF, as they are legally required to sign off on any closure certificate that the DME wants to issue. In addition, in many mining regions, the mine closure plan and the planning and implementation process will need to be undertaken within the framework of a regional mine closure strategy. The broader mine closure planning process as managed by the DME is discussed and presented in the following document:

Department of Minerals and Energy, 2008. MEM Series Guideline on Mine Closure

and this document should be studied and used by all parties involved in the development of a mine closure plan within South Africa. However, because DWAF is required to legally sign off on any closure certificate and because DWAF could ultimately become responsible for managing post-closure water resource risks, there are a number of key points within the closure planning process that DWAF will require very specific information and performance from the mine that is planning closure as shown in Figure 6.1. Figure 6.1 also indicates the specific involvement of DWAF throughout the mine closure planning and implementation process. Important inputs from DWAF within the mine closure planning process, specifically relate to the setting of and agreement on water resource-based mine closure objectives. In this context, two different scenarios are envisaged as follows:

1) **Closure objectives for a conceptual mine closure plan**: this applies to all mine closure plans for mining operations where intended closure is 5 years or longer into the future. Due to the fact that there is an ever-increasing demand on water as an increasingly scarce resource to supply future populations and development with water, the approach that DWAF will take with regard to setting mine closure objectives for a timeframe greater than 5 years into the future, is to stipulate zero residual impact. This implies that all future point and diffuse pollution sources will need to be managed such that zero residual impact is achieved and that all off-site impacts and migration of contaminants that occurred during the mine's operational phase will need to be fully remediated in line with DWAF's water management hierarchy – see ***BPG H1: Integrated Mine Water Management.***
2) **Closure objectives for a final mine closure plan**: this applies to all mines that intend to close within the next 5 years. It is also explicitly implied that mines that do not submit a final mine closure application within 5 years of obtaining agreement on the water resource-based mine closure objectives, may need to renegotiate these objectives and they may become more stringent. In setting and agreeing on these final water resource-based mine closure objectives, DWAF will refer to and make use of catchment management strategies, Reserve determinations, water resources strategies, resource quality objectives, etc., and will also consider regional issues as well as make provision for future developments and new water users.

Figure 6.1: Mine closure planning process from water resource management perspective

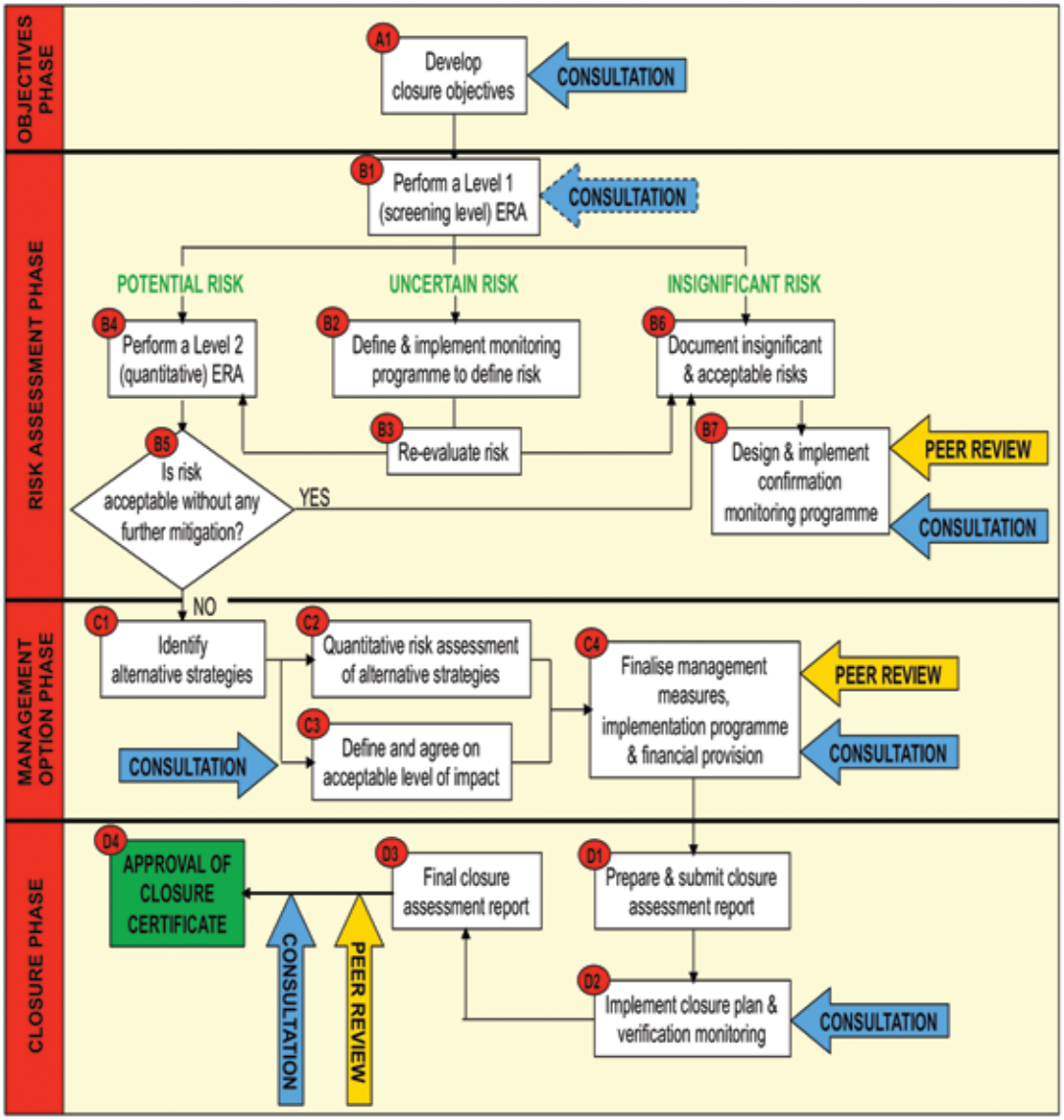
MINE PHASE	DOCUMENTARY REQUIREMENT	PROCEDURAL / METHODOLOGY REQUIREMENT	DWAF INPUT
Feasibility & mine planning phase	Prepare conceptual mine closure plan within EMP	1. Develop conceptual water-resource based mine closure objectives & consider regional closure strategies 2. Consider alternative mine design options from perspective of long-term impact / risk to water resource see ***BPG A5: Water Management for Surface Mines*** and ***BPG A6: Water Management for Underground Mines*** 3. Demonstrate that pollution prevention options & opportunities have been maximised – see ***BPG H2: Pollution Prevention and Minimization of Impacts*** 4. Develop a detailed monitoring programme to collect data that will specifically support the eventual detailed impact predictions required for a detailed mine closure plan – see ***BPG G3: Water Monitoring Systems***	DWAF to agree on water resource-based mine closure objectives (will be based on zero residual impact). DWAF to review conceptual mine closure plan as part of EMP review process
Operational phase	Update conceptual mine closure plan annually	1. Ensure that concurrent rehabilitation is up to date 2. Ensure that the mining plan and the conceptual closure plan are still mutually valid from a water resource perspective and update if not 3. Review/update the water management financial provisions 4. Review and update the closure data monitoring programme to ensure that the correct data is collected	DWAF to review updated conceptual mine closure plan as part of annual review process: • ensure plan is still valid • check financial provisions for water management • ensure monitoring is ongoing
	5 YEARS BEFORE CLOSURE		
	Prepare detailed mine closure plan	1. Undertake a detailed site risk assessment 2. Engage in detailed stakeholder consultation to develop and agree on final water resource based closure objectives 3. Undertake detailed water resource impact predictions with full independent review as set out in ***BPG G4: Impact Prediction*** 4. Identify alternatives to manage / mitigate impact and risk and undertake detailed quantitative assessment thereof in terms of long term impact on the water resource 5. Determine the detailed financial provisions for decommissioning and post-closure water management actions 6. Develop and implement a monitoring programme aimed at collecting data to validate the impact predictions 7. Calibrate and validate all impact predictions 8. Confirm that water resource closure objectives will be met with the final mine closure plan 9. Ensure fit with regional mine closure strategy	DWAF to agree on final water resource-based mine closure objectives (will be based on consideration of prevalent regulatory measures). Interaction with DWAF during final closure planning and impact prediction process to be in accordance with ***BPG G4: Impact Prediction*** specifications DWAF to review detailed mine closure plan as part of EMP review process and in accordance with Chapter 2.2 and 2.3 of this BPG
Decommissioning phase	Implement mine closure plan	1. Implement all mine closure actions 2. Monitor and confirm that implemented actions do meet the agreed water resource closure objectives and/or that future predictions are reliable 3. Confirm all the post-closure water management actions that will need to be implemented and prepare detailed financial provisions for these actions 4. Define and agree with stakeholders on the post-closure responsibilities and schedules and put necessary contractual arrangements in place	DWAF to review monitoring programme and confirm that closure objectives agreed to in detailed mine closure plan are being complied with and/or predictions of future impact are valid. DWAF to agree on post-closure actions and financial provisions
	Apply for mine closure certificate	1. Prepare a final closure assessment report 2. Present the final closure assessment to stakeholders and agree on contents and conclusions 3. Apply for mine closure certificate	DWAF to participate in stakeholder consultations
	Approve mine closure certificate	1. Review final closure assessment report & financial provisions 2. Obtain written confirmation from mine on full disclosure and from reviewer 3. Make decision on mine closure	DWAF to review mine closure application in accordance with Chapter 2.2 and 2.3 of this BPG

7 ENVIRONMENTAL RISK ASSESSMENT FOR MINE CLOSURE

The mine closure risk assessment process presented in this chapter was originally developed during a WRC project dealing with mine closure planning procedures for gold mines (Pulles et al, 2004). During the course of developing this guideline, the process was refined further and the final process is shown in Figure 7.1. The process is in line with the legal requirements stipulated in the MPRDA and GN No. 1520, as summarised in Chapter 4, and is subscribed to by all the decision-making authorities.

In addition to the technical requirements, public participation forms an essential part of the ERA process, and the process therefore includes a strong risk communication component to allow the Interested and Affected Parties (IAPs) the opportunity to voice their opinions on the assessment process and its results. Agreement must be reached with IAPs on the results of the risk assessments and the long-term management strategy to be implemented to address the significant risks.

Figure 7.1: Mine closure ERA process



The mine closure risk assessment process shown in Figure 7.1 has been subdivided into four distinct phases, each with a specific communication and peer review component, which must be documented. In addition, each phase has been broken down into a number of steps, as illustrated in Figure 7.1. Each phase has been broken down into its technical, peer review and consultation components, and is detailed in the sections below.

The closure planning process from a water management perspective is inextricably linked to the process of impact prediction as set out in detail in ***BPG G4: Impact Prediction***. The closure planning process **must**, therefore, make use of BPG G4 and must be based on the risk assessment procedure and impact prediction procedure as set out in BPG G4. In particular, it is deemed essential that the independent review mechanisms described in BPG G4 for the mine closure situation must be strictly adhered to, in order for DWAF to be able to consider the closure application.

7.1 OBJECTIVE SETTING PHASE

Although not provided for in the process set out in the MPRDA and its regulations, given that the role of DWAF is to ensure that the water resource is protected (and other resources as far as other regulators are concerned), the agreement on closure objectives is one of the primary functions that DWAF performs in the mine closure planning process. The closure objectives that are set must be comprehensive, unambiguous and measurable and these objectives will then also set the benchmark against which the risk assessment is undertaken – see Chapter 6.

In order to sensibly propose, discuss, review and agree on closure objectives, it is first necessary to have access to the following information:

1) A land use plan that is in harmony with the relevant integrated development plan for the area and that presents agreed end land uses for the mine area. This land use plan must have been discussed and agreed with authorities and IAPs.
2) An approved social and labour plan as contemplated in the MPRDA.
3) A reserve determination (preliminary or detailed), resource quality objectives and any applicable in-stream water quality objectives for the catchments potentially impacted upon by the mine (see Chapter 6).
4) An independent assessment of the remaining mineral reserves that may be affected by the planned closure of the mine.
5) Any known or suspected regional interactions with other mines, particularly with regard to the movement of underground water between mines and any applicable regional mine closure strategies.

The mine should prepare a written set of detailed and specific (concise, sustainable, measurable, and practical) mine closure objectives that can be presented to regulators and IAPs for thorough discussion and agreement at a meeting.

7.2 RISK ASSESSMENT PHASE

7.2.1 Technical component

Step B1: Undertake a screening level (Level 1) environmental risk assessment

The screening level assessment, which is relatively quick and inexpensive, is characterised by the following elements:

- all possible environmental risks are identified, including those which appear at the outset to be insignificant;
- the process is based on the input from existing data, credible and recognised specialists and persons with a detailed long-standing knowledge of the mine's operations and history;
- in the absence of actual data, consciously conservative assumptions are made and documented; and
- IAPs (including the authorities) may be involved.

The adoption of consciously conservative assumptions in the absence of data is an essential component of the process. The reason for this is that during the screening level assessment, the issues that are considered are qualitatively ranked as follows:

- potential significant risk (rating 3)
- uncertain risk (rating 2)
- insignificant risk (rating 1)

It is important to realise that those issues that are identified as posing potential significant risk during the conservative screening level assessment process, may not in fact, be significant risks. As conservative assumptions are

replaced with more realistic assumptions (Step B4) and measured data, both the level of conservatism, and the estimated risk, decrease.

Step B2: Define and implement data collection programme on uncertain risks

Those issues that are classified as posing an uncertain risk would typically require that a simple data-gathering programme be defined and undertaken to provide key data to enable a re-assessment of risk to be made – see Step B3.

Step B3: Re-evaluate uncertain risks

Once additional data have been collected in Step B2, the issues earlier characterised as uncertain risks will be re-evaluated and reclassified as either potential significant or insignificant risks. This means that these issues will either join Step B4 or Step B6 of the process.

Step B4: Undertake a quantitative (Level 2) risk assessment on potential significant risks

Those issues, which are classified as potential significant risks are taken forward into the next phase of the assessment process where the following activities are undertaken:

- based on the specific identified risks, an appropriate data collection / sampling / monitoring programme is defined and carried out;
- conservative assumptions are replaced with more realistic assumptions and actual measurements; and
- a more quantitative risk assessment is undertaken, again classifying issues as posing potential significant or insignificant risks.

The residual risks identified as being potentially significant are then subjected to detailed, fully quantitative risk assessments that have a high degree of certainty and are typically supported by extensive site-specific data – see Step C2. However, the number of issues subjected to a detailed fully quantitative risk assessment is typically a small fraction of the total range of issues that were initially evaluated in the screening-level assessment. It is possible that a number of issues previously assessed as posing a potential risk will be downgraded to insignificant (or acceptable) risk once the additional data has been collected and a quantitative assessment process has been initiated.

Within the context of water management, the risk assessment will invariably entail making predictions of future impact and in this case, the risk assessment and impact prediction methodology defined in ***BPG G4: Impact Prediction*** should be followed.

Step B5: Assess whether potential significant risks are acceptable without further mitigation

After the quantitative risk assessments undertaken in Step B4, it may be found that issues identified in Step B1 as potential significant risks are no longer assessed as such and they can therefore move forward to Step B6. It is also possible that certain issues may be identified (and agreed by the IAPs) as posing a potential residual risk but that the risk is either acceptable without any mitigation being applied or that current mitigating measures are considered appropriate and adequate. In this case, it will not be necessary to subject such issues to a more detailed risk assessment, provided this is agreed upon by the IAPs during the consultation component.

Within the context of water management, the risk assessment will invariably entail making predictions of future impact and in this case, the risk assessment and impact prediction methodology defined in ***BPG G4: Impact Prediction*** should be followed.

Step B6: Document insignificant / acceptable risks

As the issues that have been classified as insignificant risks could have been classified as such with little concrete data, the adoption and motivation of demonstrable conservative assumptions will ensure that any errors in the assessment will be in favour of the environment. This means that a more detailed assessment based on actual collected data will, by definition, result in an assessment of reduced risk. This will ensure that there is full confidence that these issues indeed do constitute insignificant risk and do not warrant any further attention. This assessment of insignificant risks (including those identified during Step B5 as being acceptable without any further mitigation) should be agreed with all IAPs concerned. The outcome of the risk assessment phase should be documented, including all risks identified with a detailed description and substantiation of their status (insignificant, acceptable or potentially significant). In order to ensure transparency, the Risk Assessment Report must be structured such that the assessment trail can clearly and easily be followed by all stakeholders (both the lay person and specialist reader).

Step B7: Design and implement confirmation monitoring programme

In order to confirm that those issues assessed as posing insignificant or acceptable risk have been correctly assessed, it will be necessary to develop and implement an appropriate confirmation monitoring programme, in consultation with the IAPs. For the purpose of this report, this type of monitoring is termed confirmation monitoring, as its intent is to confirm the level of assessed risk. This monitoring programme should be included in the Risk Assessment Report referred to in Step B6.

7.2.2 Peer review component

After completion of Step B7 it is recommended that the Risk Assessment Report undergo a peer review, to verify the process followed during the risk assessment, as well as the outcome(s) thereof. This will ensure that the accepted level of risk assessment has been performed (refer to definitions of Level 1 and Level 2 assessments) and that the ratings have been determined in an unbiased manner. The peer review has a dual purpose; on the one hand it assures the mine that an adequate, accurate assessment was performed and that the process followed is fully compliant with legal requirements, which will prevent future come-backs, while on the other hand it assures the IAPs (including the authorities) that the assessment is unbiased and reflects the true impacts associated with the activity.

The peer review must be performed by a suitably qualified and independent person (independent of both the mine and the consultants undertaking the specialist studies to be reviewed).

Where quantitative risk assessments and impact predictions are undertaken, the detailed independent peer review process defined in ***BPG G4: Impact Prediction*** should be followed.

7.2.3 Consultation component

Depending on the complexity of the mining activity, it may be considered to have a workshop during Step B1 to perform a screening ERA. It is advisable that key stakeholders, who are familiar with the mining activity and the surrounding area, are invited to this workshop. This is however not compulsory and will be very dependent on the site-specific situation.

After completion of Step B7, the outcome of the risk assessment phase as presented in the Risk Assessment Report must be communicated to the IAPs to obtain their input and agreement on the outcome and monitoring programme to verify the assessment (Step B7). This could either be done by means of notification through an appropriate document or a formal stakeholder forum meeting.

7.3 MANAGEMENT OPTION PHASE

7.3.1 Technical component

Step C1: Identify alternative risk prevention / management strategies

For those issues which have passed through Step B5 as still posing potentially significant or unacceptable risks, additional detailed studies will be required (see Steps C1 to C4). As a first step in this exercise, it is necessary to identify alternative management strategies that can be applied to mitigate against the risks.

As stated earlier in the report, management measures at closure should be sustainable and therefore primarily be of a *passive* nature with minimal long-term maintenance and operating costs. If this is not possible, the appropriate financial provision will be required to motivate the State to accept an active system.

Thus, in identifying alternative strategies, it is important to consider options in the following order of priority:

1) Strategies that can prevent or minimise the risk and its impacts (see ***BPG H2: Pollution Prevention and Minimisation of Impacts***)
2) Strategies and measures that can manage the risk or impact with minimal long-term maintenance requirements
3) Strategies and measures that can manage the risk or impact but that require active, regular and long-term maintenance and management

The alternative strategies that are to be considered in Step C1 must be clearly defined and agreement must be obtained from the IAPs that all the appropriate strategies have been included amongst the alternatives.

Step C2: Undertake quantitative assessment of risks and management alternatives

The next step in the mine closure risk assessment process is to quantify the long-term impacts associated with the different alternative management strategies.

As the objective with this step is to predict the future consequences of current or historical actions, it is unavoidable that predictive models will have to be used. Depending on the issue to be addressed, different assessment tools will be required. For example, the prediction of long-term subsidence/sinkhole risks will require specific expertise and modelling techniques. The assessment of long-term water quality from mines containing sulphide minerals will require a combination of kinetic and equilibrium geochemical models (***BPG G4: Impact Prediction***).

It is strongly recommended that, wherever appropriate, use be made of probabilistic modelling techniques and sensitivity analyses. This is to ensure that the level of uncertainty within the model results is defined as well as to ensure that the most critical data inputs and variables are identified and included in the monitoring programme defined in Step D2.

This part of the risk assessment process is typically the most difficult and costly to undertake and it is, therefore, important to ensure that it is done correctly. Important and costly decisions will need to be made on the basis of the results of these assessments. Refer to DWAF ***BPG H4: Water Treatment*** and ***BPG G4: Impact Prediction*** for water treatment and pollution prediction techniques.

Step C3: Define and agree on acceptable impacts with IAPs

In order to be ultimately able to evaluate the acceptability of alternative management strategies, it is necessary to define and agree what level of impact is acceptable. This is often a difficult process as it is necessary to obtain agreement with IAPs as to what is acceptable at the specific location of the mine seeking closure. Although the acceptable impact may be generically defined for certain environmental aspects, others, such as water quality, are very site specific and will need to be defined and agreed separately for each site, taking into account factors such as downstream users, the class of river, sensitive ecology, etc. and other applicable legislation.

Step C4: Finalisation of management measures and implementation programme

On the basis of an iterative and simultaneous consideration of the results of Steps C2 and C3, the acceptable management strategies that will be implemented on mine closure can be identified. The hierarchy and prioritisation of strategies set out in Step C1 will be considered here, i.e. pollution prevention measures should be applied wherever possible, and low maintenance and sustainable mitigation measures are preferred above those that require active and ongoing management. In addition, the implementation programme for mine closure should be developed and based on the management measures chosen. The following need to be finalised and agreed upon (refer to 7.2.3) during this step:

1) Precise specification of the management measures to be applied.
2) The predicted long-term result of the applied management measures.
3) The residual impact after successful implementation of the management measures.
4) Time frame and schedule for implementation of the management measures.
5) Responsibilities for implementation and long-term maintenance of the management measures.
6) Financial provisions for long-term maintenance.
7) Closure objectives and performance indicators.
8) Monitoring programmes that should be implemented to verify long-term impact assessments and compliance.

7.3.2 Peer review component

After completion of Step C4 and prior to the consultation component associated with this step (refer to 7.3.3. below), it is proposed that the mining organisation again put the results of the technical investigations through a peer review for verification. This will prevent any unnecessary expenditure and capital layout for management measures that may in the end not be appropriate to mitigate the impacts/risks to an acceptable manner. It will also serve as an endorsement of the outcome of the investigations, which will expedite the final decision-making and agreement process.

The peer review must be performed by a suitably qualified and independent person (independent of both the mine and the consultants undertaking the specialist studies to be reviewed).

7.3.3 Consultation component

Before undertaking the quantitative assessments (Step C2), it is advised that the mine submit a detailed assessment plan for discussion and agreement with the regulatory authorities and the reviewer (and also IAPs if it is for a final closure plan). Such an assessment plan should, inter alia, present the proposed methodology,

data collection and monitoring programmes, assessment tools and models to be used and the capabilities of the specialists who will undertake the assessments. This process is important in order to ensure that the IAPs agree with the assessment methodology and that they will therefore have confidence in the results of the assessment and to ensure that the mine does not waste time and money on assessments that are later rejected as being inappropriate. Use should be made of the procedures set out in ***BPG G4: Impact Prediction***.

In addition to this, it is desirable to reach agreement with the IAPs at an early stage on acceptable levels of impact (Step C3), as well as the factors and techniques that will be considered in making the decision as to what level of impact is considered acceptable. For example, use could be made of cost-benefit assessments, coupled with consideration of socio-economic and environmental impacts and rights.

As the consultation process associated with Steps C2 and C3 would be iterative in nature, it is proposed that the consultation components associated with these steps be combined. As these steps could involve complex techniques and decisions, it is proposed that this consultation be done via a public form or workshop, and if required, one-on-one consultation with IAPs. Depending on the complexity of the situation, this IAP consultation can be combined with the consultation component performed after completion of Step B7.

After completion of Step C4 and the peer review component, agreement will need to be reached between the mine and IAPs and authorities, as appropriate, on what the acceptable management strategies are that will be implemented at mine closure, as well as on the implementation programme (refer to list under Step C4). Again, depending on the complexity of the mining activity and risk assessment followed, this could either be done by means of notification through an appropriate document or a formal stakeholder forum meeting.

7.4 CLOSURE PHASE

7.4.1 Technical component

Step D1: Prepare and submit closure assessment report

Based on the agreement(s) reached during Step C4, a detailed closure plan / Risk Assessment Report should be prepared and submitted to the authorities for approval. This report should be written in such a manner that it is understandable by both laypersons and specialists. The report should clearly document all the work undertaken in the mine closure risk assessment process and should clearly document all decisions and agreements that were reached. The agreed quantitative closure objectives (including performance indicators) in terms of all significant risks should be listed, together with the monitoring programme that will be implemented to verify compliance with these objectives. A detailed closure cost assessment and financial provision statement should also be included. The report must be formally approved by the authorities, with the proviso that there will be a final update after completion of Step D2.

Step D2: Implement of mine closure plan and verification monitoring programme

During this step the closure plan, as per the implementation programme developed (and agreed upon in Step C4), must be implemented. An appropriate monitoring programme must be defined and implemented with the primary objective of verifying that the long-term impact assessment (Step C2) was in fact accurate and that the management measures agreed on during Step C4 is appropriate to mitigate the impacts to an acceptable level. This type of monitoring is quite different from compliance monitoring as, in addition to monitoring the predicted end-result (e.g. decant water quality), it is also necessary to obtain data to confirm that the data inputs into the model are correct. For example, with regard to long-term trends in water quality from sulphide-containing materials, simple trend analysis of water quality will most probably not give a reliable indication of future changes in water quality – changes in the geochemical driving forces will affect the long-term water quality and these should be monitored as well.

The monitoring programme must therefore clearly specify factors such as the objectives of the monitoring programme, the monitoring points, the parameters to be monitored and measured, responsibilities, reporting requirements, etc. The duration of the monitoring programme will be determined by the complexity of the situation and the amount of data required to verify/ calibrate the long-term models. This is normally agreed to between the mining organisation and the authorities during Step D1.

Step D3: Final closure assessment report

Once the monitoring programme defined in Step D2 has been implemented and the stated (agreed) objectives of

the monitoring programme have been met, the closure assessment report (Step D1) must be updated and submitted to the authorities for final approval and issuing of a mine closure certificate. The final closure report should as a minimum describe the following issues:

- Post-closure (residual, latent) impacts.
- Post-closure monitoring and maintenance procedures.
- Financial arrangements for post-closure management and maintenance.
- Contractual agreements with future landowners and/ or responsible parties.

Step D4: Approval of closure certificate

Provided that the mine has properly followed all the above steps, and has obtained prior approval from the authorities and IAPs regarding the quantitative assessment tools (as set out in Step C2 above) used, and provided the agreement reached in Step C3 has been successfully implemented and verified (Step D2), and the issues and questions set out in Chapters 2.2 and 2.3 of this BPG have been addressed, mine closure should be approved for the mine.

7.4.2 Peer review component

After completion of Steps D2 & D3 and before final closure is granted to the mine (Step D4), it is recommended that the authorities perform a peer review to ensure that the implementation programme has been implemented successfully, and that the verification programme indicates that the measures implemented is sufficient and appropriate to mitigate the impacts to an acceptable level, in the current time and in the future. This will ensure that the authorities make an informed, accurate decision and that no latent, unidentified risks would emerge after the closure certificate has been issued.

7.4.3 Consultation component

Regular feedback on the implementation and results of the implementation programme and verification monitoring programme (Step D2) must, apart from being reported formally to the authorities as per the requirements of the closure plan, be communicated to the IAPs. This could be done by means of annual forum meetings, regular environmental reports or annual performance assessment statements.

In addition, all IAPs must be given the opportunity to comment on the final closure document (Step D3). This does not necessarily imply that a formal forum meeting needs to be held; the final closure plan could be made available in a more informal manner, allowing the IAPs a sufficient time period for commenting.

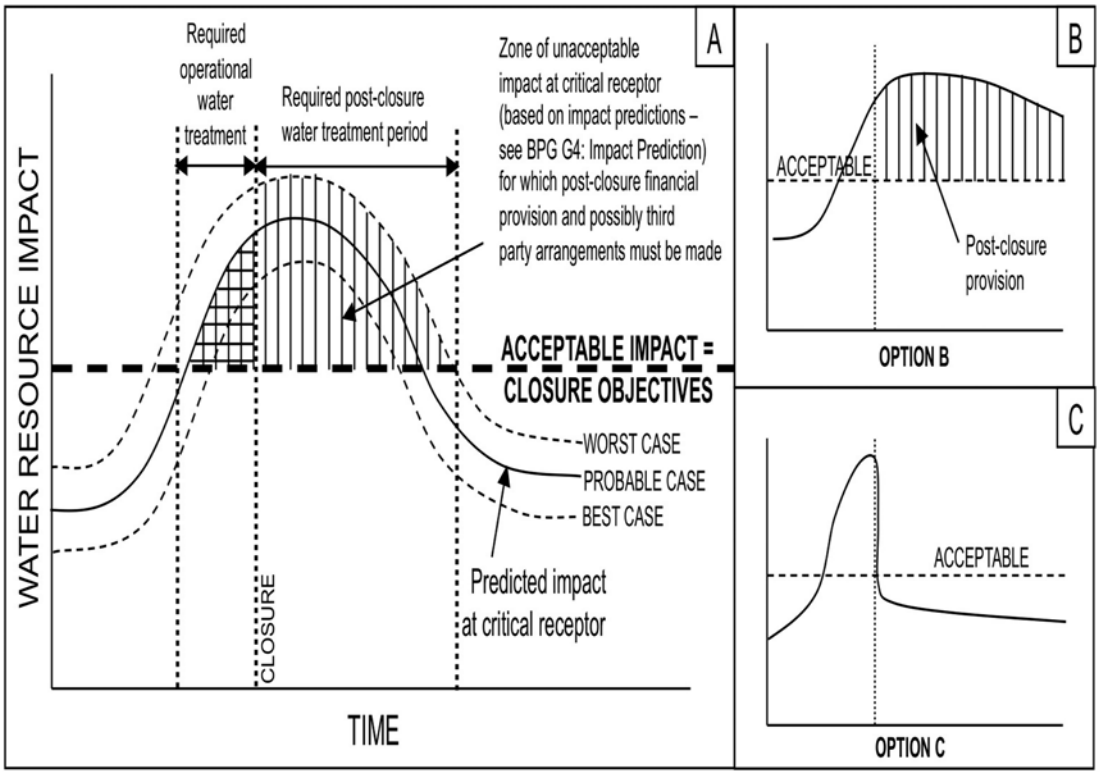
8 FINANCIAL PROVISIONS FOR POST-CLOSURE WATER MANAGEMENT

In many mine closure situations, there is a risk of an unacceptable post-closure risk to the water resource, as determined by an appropriate risk assessment and impact prediction (see ***BPG G4: Impact Prediction***). In such situations, there will be a need to determine the financial provisions required to fund both the capital cost of appropriate water management measures and the operating costs associated therewith. In cases where the water management measures are required for a number of decades, provision may also be required to reconstruct the appropriate measures after their design life has been exceeded.

While the DME has prepared a guideline for determining financial provisions, there is no standardized formula or factor that can be applied to determining what the financial provisions for water management should be, as each mine site will have very site specific requirements. The generic approach that would underpin the determination of the water management financial provisions is as follows:

1) Determine objectives for the water resource (i.e. set acceptable levels of impact or risk to the identified critical receptor) that the mine would need to meet on closure.
2) Undertake a quantitative risk assessment and impact prediction exercise (see ***BPG G4: Impact Prediction***) for the base case situation (application of standard minimum best practice measures) and determine whether or not the water management closure objectives would be met.
3) If not, undertake a second round of quantitative assessments (see ***BPG G4: Impact Prediction***) for a range of defined and agreed alternative management measures (give preference to pollution prevention and passive measures with minimum long-term maintenance requirements – see ***BPG H2: Pollution Prevention and Minimisation of Impacts***) and determine whether any of these options meet the agreed water management closure objectives. If an option can be identified that meets the closure objectives, determine the capital and operating costs for that management option and include it into the mine's financial provisions.
4) If, even after application of an appropriate water management option, the agreed water management closure objectives are not met, then provision must be made for interception of the source of water contamination (diffuse and point sources) and treatment of the intercepted water in order that the closure objectives can be met – see ***BPG H4: Water Treatment***.
5) The duration of the required water treatment measures will depend on the outcome of the quantitative impact assessment that is undertaken and will need to coincide with the duration over which the closure objectives will not be met. An example is shown in Figure 8.1.
6) Determine the capital and operating costs for the full period over which the water treatment needs to be applied and incorporate this into the closure financial provisions.

Figure 8.1: Post-closure water treatment financial provision



The assessments that need to be undertaken to determine the need for water management and/or water treatment measures would need to be undertaken in full compliance with the procedures set out in ***BPG G4: Impact Prediction***. In particular, it will be necessary to ensure that the peer review process specified for mine closure-related assessments is complied with and that the specialist team undertaking the assessments incorporate persons with the appropriate skills and expertise in water management and treatment options.

With the scarcity of water in South Africa and the future implementation of the Waste Discharge Charge System, mine closure management options that result in the interception and evaporation of contaminated water are not acceptable, and management measures should be implemented to eliminate this water use. The worst case scenario is that the intercepted water will need to be pumped to a water treatment plant and treated and provision for this eventuality must then be incorporated into the mine closure financial provisions. In cases where there are regional interconnections between mines, or there is a combined impact or use of a combined water treatment plant an apportionment of financial liability for any cumulative or combined water treatment need must be made to the satisfaction of the regulatory authorities.

Where the need for water management and treatment actions is envisaged after mine closure, appropriate arrangements must be made for financing and managing the water management / water treatment operations for the designated period of time (in terms of the MPRDA and various regulations defined in R527) after mine closure. In this scenario, and as shown schematically in Figure 8.1 A above, the financial provision must cater for the possibility that the worst case scenario (as determined by probabilistic modelling – see ***BPG G4: Impact Prediction***) may develop. It may also be necessary to enter into contractual arrangements with approved third parties (as provided for in the MPRDA). Other examples of impact predictions are shown in Figure 8.1 B and 8.1 C where perpetual and no post-closure water treatment requirements are shown as examples.

9

INFORMATION REQUIREMENTS FOR A MINE CLOSURE PLAN

Requirements for a mine closure plan are set out in the following document:

Department of Minerals and Energy, 2008. MEM Series Guideline on Mine Closure

and, in order to prevent confusion, this BPG also refers the user to this document for guidance on the structure and contents of a mine closure plan.

It must be made clear, however, that Sections 2.2 and 2.3 in this BPG give a very clear description of the information that DWAF will be seeking and the questions that it will want answered before supporting a mine closure application. The mine must therefore ensure that this information is explicitly provided in a separate section in the mine closure plan or else DWAF will not be in a position to consider or process the mine closure application.

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APPENDIX A: LEGAL REVIEW FOR MINE CLOSURE PLANNING

This legal review provides an outline of the requirements of the Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002) regarding financial provision, environmental rehabilitation and mine closure. It also places the issue of financial provision and mine closure within the context of certain constitutional considerations and the broader environmental legal and policy framework currently prevailing in South Africa. Additional and most recent information on legal requirements relating to mine closure should be sought from the following document:

Department of Minerals and Energy, 2008. MEM Series Guideline on Mine Closure

A.1 MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002 (ACT 28 OF 2002)

A.1.1 Rehabilitation and Closure

Section 5(4)(a) of the MPRDA stipulates that no person may prospect for or remove, mine, conduct technical co-operation operations, reconnaissance operations, explore for and produce any mineral or petroleum or commence with any work incidental thereto on any area without *inter alia* an approved environmental management programme or approved environmental management plan, as the case may be. This requirement is further supported in the MPRDA and in Government Notice No. R.527 (R527), dealing with the mineral and petroleum resources development regulations published in the Government Gazette of 23 April 2004 (GG No. 26275, Volume 466):

Prospecting rights – if the application for a prospecting right is accepted by the Regional Manager, the Regional Manager must within 14 days from the date of acceptance notify the applicant in writing to *inter alia* submit an environmental management plan (section 16(4)(a)). The granting of a prospecting right only becomes effective on the date on which the environmental management plan is approved in terms of section 39 of the MPRDA (section 17(5)). The application for renewal of a prospecting right must *inter alia* be accompanied by a report reflecting the extent of compliance with the requirements of the environmental management plan, the rehabilitation completed and the estimated cost thereof (section 18(2)(c)) and the Minister must grant the renewal of a prospecting right if the application complies with sections 18(1) and 18(2) and the holder of the prospecting right has *inter alia* complied with the requirements of the approved environmental management plan (section 18(3)(c)). The holder of a prospecting right must comply with the requirements of the approved environmental management plan in terms of section 19(2)(c). In the case of a retention permit, the environmental management plan approved in respect of the prospecting right remains in force as if the prospecting right had not lapsed in terms of section 32(2) (section 32(3)) and the holder of the retention permit must give effect to the approved environmental management plan (section 35(2)(a)). The specific requirements for environmental management plans are further dealt with in section 39 of the MPRDA and regulation 52 of R527. Monitoring and performance assessment requirements for environmental management plans are dealt with in regulation 55.

Mining rights – if the application for a mining right is accepted, the Regional Manager must within 14 days from the date of acceptance notify the applicant in writing to *inter alia* conduct an environmental impact assessment and submit an environmental management programme for approval in terms of section 39 (section 22(4)). A mining right granted in terms of section 23(1) comes into effect on the date on which the environmental management programme is approved in terms of section 39(4) (section 23(5)). An application for renewal of a mining right must *inter alia* be accompanied by a report reflecting the extent of compliance with the requirements of the approved environmental management programme, the rehabilitation to be completed and the estimated cost thereof (section 24(2)(b)) and the Minister must grant the renewal of a mining right

if the application complies with sections 24(1) and 24(2) and the holder of the mining right has *inter alia* complied with the requirements of the approved environmental management programme (section 24(3)(c)). The holder of a mining right must comply with the requirements of the approved environmental management programme in terms of section 25(2)(e). The specific requirements for environmental management programmes are further dealt with in section 39 of the MPRDA and regulation 51 of R527. Monitoring and performance assessment requirements for environmental management programmes are dealt with in regulation 55.

Mining Permits – if the Regional Manager accepts the application for a mining permit, the Regional Manager must, within 14 days from the date of acceptance, notify the applicant in writing to *inter alia* submit an environmental management plan (section 27(5)(a)). The Minister must issue a mining permit if *inter alia* the applicant has submitted the environmental management plan (section 27(6)(b)). The specific requirements for environmental management plans are further dealt with in section 39 of the MPRDA and regulation 52 of R527. Monitoring and performance assessment requirements for environmental management plans are dealt with in regulation 55.

Section 38(1) requires that the holder of a reconnaissance permission, prospecting right, mining right, mining permit or retention permit:

- must at all times give effect to the general objectives of integrated environmental management laid down in Chapter 5 of the National Environmental Management Act 107 of 1998;
- must consider, investigate, assess and communicate the impact of his or her prospecting or mining on the environment as contemplated in section 24(7) of the National Environmental Management Act 107 of 1998;
- must manage all environmental impacts:
  - in accordance with his or her environmental management plan or approved environmental management programme, where appropriate; and
  - as an integral part of the reconnaissance, prospecting or mining operation, unless the Minister directs otherwise;
- must as far as it is reasonably practicable, rehabilitate the environment affected by the prospecting or mining operations to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development; and
- is responsible for any environmental damage, pollution or ecological degradation as a result of his or her reconnaissance prospecting or mining operations and which may occur inside and outside the boundaries of the area to which such right, permit or permission relates.

In terms of section 43(1), the holder of a prospecting right, mining right, retention permit or mining permit remains responsible for any environmental liability, pollution or ecological degradation, and the management thereof, until the Minister has issued a closure certificate to the holder concerned.

In terms of section 43(3), the holder of a prospecting right, mining right, retention permit or mining permit or the person to whom environmental liabilities and responsibilities are transferred in terms of section 43(2), as the case may be, must apply for a closure certificate upon:

- the lapsing, abandonment or cancellation of the right or permit in question;
- cessation of the prospecting or mining operation;
- the relinquishment of any portion of the prospecting of the land to which a right, permit or permission relate; or
- completion of the prescribed closing plan to which a right, permit or permission relate.

An application for a closure certificate must be made to the Regional Manager in whose region the land in question is situated within 180 days of the occurrence of the lapsing, abandonment, cancellation, cessation, relinquishment or completion contemplated in section 43(3) and must be accompanied by the prescribed environmental risk report. The environmental risk assessment (ERA) process to be followed during the development of the said report is prescribed in regulation 60 of R527.

Section 43(5) stipulates that no closure certificate may be issued unless the Chief Inspector and the Department of Water Affairs and Forestry have confirmed in writing that the provisions pertaining to health and safety and management of potential pollution to water resources have been addressed. As indicated previously, in terms of section 43(6), when the Minister issues a certificate he or she must return such portion of the financial provision contemplated in section 41 as the Minister may deem

appropriate to the holder of the prospecting right, mining right, retention permit or mining permit in question, but may retain any portion of such financial provision for latent and or residual environmental impact which may become known in the future.

Further regulations (R527) on mine closure, which also deal specifically with financial provision, includes:

Regulation 57(2)(b) requires that an application for a closure certificate in terms of section 43(3) of the MPRDA must be accompanied by an environmental risk report, which must include the financial provision for long-term maintenance (regulation 60(g)(v)).

Regulation 62 requires that a closure plan in terms of section 43(3)(d) of the MPRDA, forms part of the environmental management programme or environmental management plan, as the case may be, and must include details of financial provision for monitoring, maintenance and post closure management, if required (regulation 62(h)).

Regulation 73(8)(a)(iv) stipulates that the decommissioning, closure and post closure management of residue deposits must be addressed in the closure plan, which must contain cost estimates and financial provision for closure and post-closure management.

Further specific rehabilitation and closure requirements are contained in the MPRDA and R527, including the principles for mine closure in regulation 56; the application for the closure certificate (regulation 57); the transfer of liabilities to a competent person in section 43(2) and regulation 58 and the qualifications of that person in regulation 59; the requirements for an environmental risk report in regulation 60; closure objectives in regulation 61; and the content of a closure plan in regulation 62.

A.1.2 Financial Provision

Section 41(1) requires that an applicant for a prospecting right, mining right or mining permit must, before the Minister approves the environmental management plan or environmental management programme in terms of section 39(4), make the prescribed financial provision for the rehabilitation or management of negative environmental impacts.

R527 deals further with the issue of financial provision. Regulations 51 and 52, dealing primarily with the contents of the environmental management programme/ plan, require that the environmental management programme or plan, as the case may be, must include the financial provision required for the execution of the environmental management programme or plan, including the determination of the quantum and details of the method of provision and revision thereof.

Regulation 53 stipulates that one or more of the following methods must provide for the financial provision:

- approved contributions to a trust fund as required in section 10(1)(cH) of the Income Tax Act, 1962 (Act 58 of 1962)
- a financial guarantee from a South African registered or any other bank or financial institution approved by the Director-General
- financial deposits into the account specified by the Director-General
- any other methodology the Director-General may determine.

Regulation 54(1) requires that the quantum of the financial provision must be based on the requirements of the environmental management programme or plan and shall include a detailed itemisation of all actual costs required for:

- pre-mature closure regarding the:
  - rehabilitation of the surface of the area;
  - prevention and management of pollution from the atmosphere;
  - prevention and management of pollution of water and the soil; and
  - prevention of leakage of water and minerals between subsurface formations and the surface.
- decommissioning and final closure of the operation; and
- post-closure management of residual and latent environmental impacts.

Sections 18(2)(c) and 24(2)(b) of the MPRDA require that an application for renewal of a prospecting right and mining right respectively must be accompanied by a report reflecting the extent of compliance with the requirements of the approved environmental management programme, the rehabilitation to be completed and the estimated cost thereof. Further to this, section 41(2) provides that, if the holder of a prospecting right, mining right or mining permit fails to rehabilitate or manage, or is unable to undertake such rehabilitation or to manage any negative impact on the environment, the Minister may, upon written notice

to such holder, use all or part of the financial provision to rehabilitate or manage the negative environmental impact in question.

Section 41(3) requires the holder of a prospecting right, mining right or mining permit to annually assess his or her environmental liability and increase his or her financial provision to the satisfaction of the Minister. In line with this regulation 54(2) also requires that the holder of a prospecting right, mining right or mining permit must annually update and review the quantum of the financial provision:

- in consultation with a competent person;
- as required in terms of the approved environmental management programme or plan; or
- as requested by the Minister.

Any inadequacies with regard to the financial provision must in terms of regulation 54(3) be rectified by the holder of a prospecting right, mining right or mining permit:

- in an amendment of the environmental management programme or plan, as the case may be;
- within the timeframe provided for; or
- as determined by the Minister.

In terms of section 41(4), if the Minister is not satisfied with the assessment and financial provision contemplated in this section, the Minister may appoint an independent assessor to conduct the assessment and determine the financial provision. Section 41(5) stipulates that the requirement to maintain and retain this financial provision remains in force until the Minister issues such holder with a closure certificate contemplated in section 43. However, the Minister may retain such portion of the financial provision as may be required to rehabilitate the closed mining or prospecting operation in respect of latent or residual environmental impacts. Furthermore, section 43(6) requires that, when a closure certificate is issued, the Minister must return to the holder in question such portion of the financial provision as the Minister may deem appropriate, but may retain any portion of such financial provision for latent or residual environmental impacts which may become known in the future.

A.2 PROVISIONS OF OTHER LEGISLATION

Certain other items of legislation of general application that are relevant to mine rehabilitation and closure include:

A.2.1 Constitution of the Republic of South Africa Act, 1996 (Act 108 of 1996)

Certain of the fundamental rights contained in Chapter 2 of the Constitution are closely associated with financial provision, rehabilitation and closure and the Department's functions regarding these matters. These include in particular section 24 ("Environment") and section 33 ("Just Administrative Action"). Section 24 of the Constitution provides that "*everyone has the right … to an environment that is not harmful to their health or well-being; and … to have the environment protected for the benefit of present and future generations through reasonable legislative and other measures that - (i) prevent pollution and ecological degradation; (ii) promote conservation; and (iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development*". Section 33 of the Constitution entitles everyone to administrative action that is lawful, reasonable and procedurally fair and, if one's rights have been adversely affected by administrative action, to be given written reasons for the decision.

A.2.2 National Environmental Management Act, 1998 (Act 107 of 1998)

The National Environmental Management Act (NEMA) contains certain principles in section 2. These principles apply throughout the country to the actions of all organs of state (as defined in the Constitution) that may significantly affect the environment and:

- shall apply alongside all other appropriate and relevant considerations, including the State's responsibility to respect, protect, promote and fulfil the social and economic rights in Chapter 2 of the Constitution and in particular the basic needs of categories of persons disadvantaged by unfair discrimination;
- serve as the general framework within which environmental management and implementation plans (referred to in section 11 of NEMA) must be formulated;
- serve as guidelines by reference to which any organ of state must exercise any function when taking any decision in terms of NEMA or any statutory provision concerning the protection of the environment;
- serve as principles by reference to which a conciliator appointed under NEMA must make recommendations; and

- guide the interpretation, administration and implementation of NEMA, and any other law concerned with the protection or management of the environment.

In the context of mining, these principles are given further effect through section 37 of the MPRDA, which stipulates that the principles set out in section 2 of NEMA:

- apply to all prospecting and mining operations, as the case may be, and any matter relating to such operation; and
- serve as guidelines for the interpretation, administration and implementation of the environmental requirements of the MPRDA.

Furthermore, section 37(2) of the MPRDA requires that any prospecting or mining operation must be conducted in accordance with generally accepted principles of sustainable development by integrating social, economic and environmental factors into the planning and implementation of prospecting and mining projects in order to ensure that exploitation of mineral resources serves present and future generations.

Section 28 of NEMA further establishes a general duty of care on every person who causes, has caused or may cause significant pollution or degradation of the environment to take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment.

A.2.3 National Water Act, 1998 (Act 36 of 1998)

Section 19 of the National Water Act (NWA) further iterates the general duty of care on persons who own, control, use or occupy land on which any activity or process is or was performed or undertaken, or any other situation exists which causes, has caused or is likely to cause pollution of a water resource, to take all reasonable measures to prevent any such pollution from occurring, continuing or recurring.

Government Notice No. 704 (GN704), regulations on use of water for mining and related activities aimed at the protection of water resources, was promulgated in terms of section 26 of the NWA on 4 June 1999. The following regulations have direct relation to rehabilitation and mine closure:

- Regulation 2(2)(b) requires that the DWAF be notified (in writing) 14 days before the temporary or permanent cessation, or resumption, of a mining or related activity.
- Regulation 9 deals with the temporary or permanent cessation of a mine or activity, and stipulates that:
  - All pollution control measures must be designed, modified, constructed and maintained so as to comply with the requirements of GN704 at the time of cessation of operations.
  - The in-stream and riparian habitat of any water resource, which may have been affected by the mine or activity, is remedied so as to comply with the requirements of GN704.
  - The Minister may request a copy of any surface or underground plans as contemplated in the Minerals Act, 1991.
- Regulation 11 requires that all coal residue deposits are compacted and rehabilitated concurrent with the mining operations.
- Regulation 12 allows the DWAF to request any additional information or direct a person in control of a mining or related activity to conduct a detailed study, should this information not be available in any other reports or documents and be necessary to evaluate and manage certain aspects related to the specific mine or activity, which could include rehabilitation and/or closure aspects.
- Regulation 13 states that the person in control of a mine or activity must provide the manager with the means and afford him or her every facility required to enable the manager to comply with the provisions of GN704, and includes making available the necessary financial and human resources, training and education, management structures, contact with expertise for necessary investigations, etc.

A.2.4 Mine Health and Safety Act, 1996 (Act 29 of 1996)

Sections 2(2) and 49 stipulates that the employer (owner) of a mine that is not being worked, but in respect of which a closure certificate has not been issued, must take reasonable steps to prevent injuries, ill-health, loss of life or damage of any kind from occurring at or because of the mine. The Chief Inspector of Mines has the power to monitor and control those environmental aspects at

mines that affect, or may affect, the health or safety of employees or other persons and is required to consult with the Director: Mineral Development concerning the exercise of those powers.

A.2.5 Atmospheric Pollution Prevention Act, 1965 (Act 45 of 1965)

Section 32 of the Atmospheric Pollution Prevention Act (APPA) stipulates that a certificate is required under certain circumstances before the sale of any assets, indicating that adequate steps have been taken to prevent dust pollution from the mine.

A.2.6 National Heritage Resources Act, 1999 (Act 25 of 1999)

Section 34 stipulates that a permit is required to alter or demolish any structure or part of a structure which is older than 60 years from the relevant provincial heritage resources authority. Various other forms of protection may also apply.